ENGINEERING.

The vast scale of operations at Panama is shown by the fact that during the fiscal year ended June 30, the value of material received by the Division of Materials and Supplies was over eleven and a half million dollars; and the value of material disbursed exceeded that sum by seventy-eight thousand dollars.

It is reported that the mammoth vessel "Olympic," to be built for the White Star Line, will be of 50,000 tons displacement and 840 feet long. We accept the displacement, but seriously doubt the length. The ship would overlap our longest New York piers by 40 feet. The extra 5,000 tons over the 45,000 tons of the "Lusitania" could easily be obtained by a greater fullness in the lines.

The accident report of the Public Service Commission of New York State for last year shows that out of 104,113,466 passengers carried by the steam railroads, 24.2 were killed in each million carried, and 246.2 were injured. The electric railroads carried 416,279,788 passengers, the ratio of killed to each million being 5.98, and of injured 104.9. The high rate of injuries and fatalities on steam railroads was due to the disastrous wrecks at Woodlawn and Lansingburg.

It is a curious anomaly that the most powerful "Dreadnought" afloat should belong to a South American republic; but it cannot be denied that the "Minas Geraes" is entitled to this distinction. She is the only warship mounting twelve 12-inch guns; and they are so placed that she can concentrate eight ahead and astern and ten on either broadside, as against four ahead and astern and ten on either broadside, which can be done by our new "North Dakota" and "Delaware."

The most serious fact developed by the cruise of the Pacific fleet was our shortage of colliers. It was all very well to carry coal in foreign bottoms during a peaceful maneuver; in time of war these ships would not be available. Hence there is some satisfaction to be derived from the recent awarding to the Maryland Steel Company of the contract for three large colliers. Congress should appropriate for others, until we have a fleet sufficient for the greatest possible needs of the navy.

According to cable dispatches, the French people are urging Wilbur Wright to make a flight across the English Channel. As to his ability to do this, there can be little doubt; as to the expediency of doing it, there is no doubt whatever; for it would be the most foolish thing that he could attempt at the present time. A slight mishap to the motor would mean a descent into the sea and a probable catastrophe. The work already done by Wright should prove sufficiently spectacular to satisfy even the excitement-loving people of France.

The neglect to provide approaches, and connect the various surface and elevated roads with the great bridges across the East River, New York, has been one of the scandals of city administration. Recently, the existing connections with the Brooklyn Bridge have been improved by the construction of inclines and the widening of the roadways. The Williamsburg Bridge, also, is coming into its own; for at last the elevated structure, built into the bridge at the time of its opening, has been connected with a subway terminal on Manhattan, and with the existing elevated lines in Brooklyn. Nothing, however, has been done in the way of connections for the great Blackwell's Island cantilever structure.

The British Home Office recently published a report of the Inspector of Mines on the fatal colliery accident at Durham. The explosion was caused by firing a shot of "permitted explosives," bellite No. 1. The conditions were not abnormal, but were such as often arise in dry and dusty collieries. The shot was fired "without watering," which is a violation of the Coal Mines Regulation Act. It seems that the locality of a blast is not usually watered when permitted explosives are used, on the ground that the latter are not of such a nature as would inflame gas or dust. But the fact that within sixteen months four explosions have occurred under these conditions proves that precautions are as necessary as when gunpowder was the explosive.

The marvel of to-day becomes the matter of fact of to-morrow. It does not seem to some of us so very long ago since we wondered at the audacious flights of imagination of Jules Verne, when he pictured a trip around the world in eighty days. Yet it is a fact that the passenger may now take forty days' vacation, and accomplish the Jules Verne feat with plenty of stopping time on the route. The statistics of this trip come from London, and the compiler of them asks merely that the Cunard steamships shall make their call at an English Channel port. He figures out the run as follows: Leave New York Saturday by the "Lusitania"; land at Plymouth the following Thursday, reaching London in time to catch the evening train for Berlin. Leaving Berlin Friday evening, the traveler reaches Moscow Sunday morning. He would be at Vladivostock, on the Pacific, the following Thursday week; and, leaving there on the next Saturday evening, would be landed at Tsuraga, Japan, on the Monday following. Taking train across to Yokohama, he would catch the Canadian Pacific steamer, sailing the same day, and reach Vancouver twelve days later. Then taking the Great Northern Limited to St. Paul, the Northwest Limited to Chicago, and the Twentieth Century Limited for New York, he would reach his starting point at 9:30 on Thursday morning, having takes less than forty days for this 20,000-mile journey.

ELECTRICITY.

The Victorian State Railway, Australia, has been studying the electrified steam railways of England with a view to adopting electric traction on the Melbourne suburban railways. It is proposed to electrify 40 miles of track.

Electricity is slowly but surely making its way into the household. The latest is the electrical fireless cooker. The cooker is provided with steatite radiators that are electrically heated, and the food is then slowly cooked by the stored heat. In this connection electricity can compete with gas, coal, or oil because practically all the heat generated by the current is absorbed by the radiator.

The Electrical Engineer of London describes an interesting interpole motor adapted particularly for tramway systems or for use in any circumstances where the duty is more than ordinarily heavy. In order to provide an especially good ventilation of the armature, the connections between the armature coils and the commutator bars are made of flat copper strips, which act as fan vanes to draw a current of air through the motor when the armature rotates. It is claimed that this artificially-produced draft cools the motor fully 25 per cent.

To handle the telephone business of the twin Hudson Terminal buildings, 750 miles of telephone wire are necessary. When the Metropolitan Life building is completed, it will have in its installation 680 miles of telephone wire. The City Investment building is provided with 450 miles of telephone wire, while the Broad Exchange and the Singer buildings are installed with 250 and 230 miles of wire respectively. In these five buildings alone the telephone wires total a length of 2,360 miles, and would stretch from New York nearly to San Francisco.

The ideal wire for transmission purposes is one which will combine the tensile strength of steel with the non-corrosive qualities and conductivity of copper. Efforts to make a wire of this sort by coating a steel wire with a layer of copper have not been very satisfactory, owing to the impossibility of preventing air from entering between the copper and steel, causing the latter to rust and the former to flake off. A recent invention provides a new process for combining the metals, so that a perfect union between the two is obtained. This consists in applying a heavy coat of copper to a billet of steel while both are heated to a high temperature. The air between the two metals is driven out by the heat, and the copper and steel are virtually welded together. The billet after being cooled is heated again and rolled into a wire ⅜ of an inch in diameter, and is then drawn down to any size desired. So perfect is the union between the two metals that it is impossible to hammer off a piece of the copper, even when it is notched so as to leave a tongue of copper projecting from the steel.

Some time ago Carl Hering, when investigating the action of conductors in an electric furnace, discovered that after the metal had been reduced to a liquid state, at a certain temperature there is set up in the metal an attraction toward its axis, producing what he called a "pinched" effect. That is, the liquid seems to be reduced at the center, as if it had been pinched by the fingers, while at the ends it is piled up, producing a hydrostatic pressure between the axis and the circumference of the conductor. This peculiar effect has been utilized by Dr. E. F. Northrup in an ammeter for measuring very large alternating currents. Heretofore, we have had no instrument of simple form that would accurately measure any alternating current of over 1,000 amperes. In Dr. Northrup's instrument two mercury cells are used, which are 1/64 of an inch in length. Over the mercury a quantity of colored oil is placed, and the hydrostatic pressure produced when passing a current through this mercury causes the oil to rise in a glass tube, and the strength of the current is measured by the height to which the oil rises.

Electric apparatus for ozonizing water is now used in three of the German cities, namely, Berlin, Wiesbaden, and Paderborn. These plants serve to purify drinking water. The ozonizer is a modification of the Berthelot apparatus, and consists of a boiler or iron tank which is filled with water and contains three vertical glass tubes. These tubes project below the bottom of the tank through tight joints, and the lower ends are in contact with the air. Each of the tubes contains an aluminium cylinder. The air penetrates into the space between the cylinder and the tube and thus enters the tank at the upper part which is designed to contain the ozonized air. The aluminium forms the positive pole and the tank the negative pole of the current, which has a tension of 8,000 volts. The water in the tank becomes the outer coating of the condenser. An electric discharge takes place between the aluminium and the glass, which is of a silent nature. The iron tanks are connected to the ground by hollow iron columns which serve as supports. Placed together in a dark part of the plant, the boxes are mounted so that the operator can see the discharge through an opening. The air is first dried and filtered, and the water is also filtered. The ozone which is thus formed is led into the sterilizing towers, which are filled with gravel, and the water trickles down through this and comes in contact with the ozone. It is noticed that the ozonized water has a special taste and odor at first, but it loses this when passed in a masonry conduit. From 14 to 27 grammes of ozone per horse-power are obtained. Such water is very pure and almost free from bacteria, as has been determined. What germs may be left are of a harmless character, and cholera or typhoid bacteria are removed.

SCIENCE.

It is said that Ekeberg, the Swedish discoverer of tantalum, gave that name to the metal because of the tantalizing difficulties that he encountered while investigating it. It is only recently that tantalum has been obtained in a state of purity. A single pound of tantalum suffices to furnish 23,000 lamps, each of 25 candle-power.

The Peary Arctic Club has received word that Commander Peary's vessel "Roosevelt" struck an iceberg with serious damage. Commander Peary states that he is proceeding along shore and that the prospects are good, despite the collision. A previous communication stated that Cape York was reached on July 31, that the "Roosevelt" was overhauled and trimmed for the ice at Etah, and that dogs were secured. The season is unusually stormy, with much snow and no ice as yet. Thirty-five walrus were killed, which means that the expedition has much good fresh meat.

Madam Curie's announcement that she has been unable to obtain experimental verification of Sir William Ramsay's discovery of the transmutation of copper to sodium, potassium, and lithium naturally makes one wonder if the late Lord Kelvin was not justified in doubting the accuracy of Sir William's investigation. On the other hand, Ramsay is so careful a chemist that he is not likely to draw rash conclusions. That even the most cautious of chemists may err is proven by Prof. Onnes's first announcement of the liquefaction of helium. Madam Curie carefully purified her materials. So did Ramsay. Yet we have contradictory results. We must wait now for a third verification or refutation before we can be quite sure.

The recent development of aeronautics has given importance to the production of hydrogen, illuminating gas having gone out of fashion as completely as Montgolfier's hot air, and for the same reason—because it is too heavy. In a new American method of producing hydrogen, water gas is first made in the usual way, by passing steam over live coal. The resulting water gas, which is a mixture of hydrogen and carbon monoxide, is then passed over hot pulverized calcium carbide. The carbon monoxide is decomposed, the carbon remaining behind in the form of graphite and the oxygen combining with the carbide to form calcium carbonate, leaving the hydrogen almost pure (97 per cent). It is claimed that hydrogen can be produced very cheaply by this process.

Paper money is popularly supposed to be a carrier of infectious diseases. No doubt microbes do find a resting place on many of the bills now in circulation, but investigations which have been conducted at the research laboratory of the New York Board of Health indicate that although paper money is by no means free from bacteria, it is, nevertheless, not quite so prolific a breeding ground as may be supposed. On clean bank bills an average of 2,350 bacteria were discovered. On soiled bills the average was 73,000. This investigation was made some years ago. Its results have now been checked by Warren W. Hilditch of the Sheffield laboratory of bacteriology and research at Yale. The dirtiest bills which banks and railways could place at his disposal showed an average of only 142,000 bacteria for each bill. The lowest was 14,000; the highest, 586,000. Curiously enough, the cleanest-looking note was charged with 405,000 bacteria, and the dirtiest with 38,000, which seems to prove that there is no necessary connection between dirt and bacteria. Mr. Hilditch finds that guinea pigs inoculated with these bacteria contracted no disease, which would mean that money bacteria are not necessarily virulent.

A large quantity of combined nitrogen is lost in distillery wastes. Methods of recovering this nitrogen in the form of ammonia have been devised, but they have proved impracticable, for the following reasons: By dry distillation only 50 or 60 per cent of the nitrogen can be recovered, and half of this is in the form of amides; the sulphate of ammonia produced is difficult to crystallize and is hygroscopic, and the apparatus required is so expensive that no profit is left after operating, interest, and maintenance charges are met. Effront conceived the idea of treating distillery wastes by biological methods and endeavored to find a diastase by the action of which the nitrogen contained in those wastes could be converted into ammonia under conditions obtainable in practice and with some hope of profit. His researches have led to the following results: 1. Beer yeast contains a diastase, which Effront has named "amidase," and which converts amido-acids completely into ammonia and volatile fatty acids. 2. Amidase is found also in butyric acid ferments and in various species of bacteria and molds. 3. The organic nitrogen contained in distillery wastes derived from grain, beets or molasses, can be converted into ammonia by the action of beer yeast in its "autophagous," or self-consuming phase, or by that of other ferments which have been brought into a special condition by aeration or the addition of alkalies or antiseptics. 4. The wastes obtained from one ton of molasses thus yield, by fermentation and distillation, about 150 pounds of ammonium sulphate and more than 200 pounds of acetic, propionic, and butyric acids. It is not necessary to employ pure cultures of yeast or mold. Ordinary garden soil contains the germs required to set up the ammoniacal fermentation. Effront recommends sterilizing a mixture of earth and distillery waste by heating for an hour to 160 to 175 deg. F., a treatment which does not kill the ammoniacal ferments. The sterilized mixture may then be used as a leaven to start the fermentation in other quantities of waste, but it must be renewed frequently.