ENGINEERING.

The new British battleship-cruiser "Invincible" showed remarkable speed on a full-speed run from Queen's Ferry to Portsmouth, averaging over 28 knots and for a part of the run attaining very nearly 29 knots.

Seven bids have been received for the foundation work of the municipal building to be erected in New York city near the Manhattan end of the Brooklyn Bridge. As the building will be twenty-five stories high, and the foundations must be carried to bedrock, the latter work will be costly, the lowest bid received being nearly one and one-half million dollars, and the highest upward of two and one-quarter millions.

The city of London has increased from an area of 0.3 square mile in the year 1200 to 117 square miles in 1908. At present the annual supply of water is about 82,125,000,000 gallons. Liverpool, which had an area of 0.1 square mile in the year 1300, covered 27.8 square miles in 1905. Its present population is 793,000, while the corporation water works provide a supply of 10,801,000,000 gallons to a population of 907,000 people.

The jubilee of the Suez Canal, work on which commenced in 1859, took place on the 25th of April. The canal was opened for traffic in 1869, and at that date the depth of water was 26 feet. The present depth is about 32½ feet, and improvements are now going on which will bring it to 34 feet. The original width was 71 feet on the bottom, and this has been gradually increased, until at present the bottom width is 97½ feet. In 1870 there passed through the canal 486 ships, whose gross tonnage was 654,914. Last year 3,795 ships used the canal, and their total tonnage was over 19,000,000 tons.

The first tests of the McClean-Lissak automatic gun, said to be the largest automatic gun in the world, have recently been made over Lake Erie near Cleveland. The gun has been contracted for by the British government for use in guarding the English Channel. It is mounted on an automobile truck, said to be capable of conveying a supply of ammunition and a crew of ten men at the rate of 25 miles an hour on ordinary roads, and of wheeling into position and shooting before ordinary artillery could be unlimbered. In the trials three-pound shells were thrown three and one-half miles at the rate of 250 per minute.

A new railway bridge has just been completed by the Spokane-Portland Railroad Company, which spans the Willamette River just below Portland. The total length of this new bridge from opposite bank abutments is 1,762 feet. The total cost of the structure exceeded $500,000, and more than a year was required in which to complete the work. The superstructure, composed of structural steel, rests on five massive reinforced-concrete piers faced with granite. The drawspan of this new bridge is 521 feet long from center to center of the end pins, and engineers claim that it is the longest drawspan in the world. The shipping of Portland is very extensive, and an immense drawbridge is required to accommodate the many vessels.

The dimensions of the power plant now being built for the construction of the Gatun locks, Panama, are characteristic of the great scale of the work on the canal. The building, 150 feet long, 77 feet wide, and 48 feet high, will contain six water-tube boilers and three 1,500-kilowatt vertical steam turbines. During construction, it will furnish power for running cableways for the material wharves and for the cement rock and sand storage pile; for operating the concrete mixers; for running the cars which carry the concrete to the cableways; and for operating three 20-inch centrifugal pumps for the hydraulic construction of Gatun dam. When the canal is in service, the plant will be held in reserve to operate the locks and towing machinery, in case of failure of the hydraulic power plant.

Work is being rapidly pushed on the Manhattan Bridge, the fourth of New York city's bridges spanning the East River and the third largest suspension bridge in the world, in the hope of its completion before the beginning of next year. The first foundation caisson for the Brooklyn pier was sunk in February, 1902, and that for the Manhattan pier eighteen months later, the foundations being completed in March, 1904. The first wire across the river was placed in June, 1908, and the four big suspension cables were shown complete in the Engineering number of the SCIENTIFIC AMERICAN at the end of last year. The stiffening truss, which incloses the roadway, was commenced in March last, the lower deck meeting in midstream a month later. Since that time the work has progressed so rapidly that the upper deck has been completed, and the approaches are expected to be ready by November. About 37,000 tons of material has been used, 3,000 tons for the towers, 8,000 for the cables, 18,000 for the suspended span, and 8,000 for the approaches.

ELECTRICITY.

A bill has been introduced in Congress providing that all steamships carrying over 50 passengers, and making trips of over 200 miles, shall be equipped with wireless telegraph apparatus. A fine of $2,000 shall be imposed in case of a violation of this measure.

The American Railway Association has voted to appoint a committee on electric working, which will be chosen by the president, F. A. Delano. The object of the committee will be to study the use of electricity in the operation of railways. This movement is significant of the progress of electricity in displacing the steam locomotive.

One of the largest steel companies in Germany, namely, the August Thyssen Company, has decided to install electric furnaces of the Héroult type. Two of these will be set up at Deutscher Kaiser Works, and the other at Mülheim. The furnaces will be used in making rails for steel from Thomas converters. After these furnaces have been tried out, others will be installed.

A system of wireless telephony was recently tested by the French navy between the armored cruiser "Condé" and shore stations. It is reported that conversation was carried on over a distance of 100 miles. The inventors of this system are Lieutenants Jeance and Colin of the French navy. Their work is quite remarkable in view of the fact that in our own navy we have had difficulty in maintaining wireless telephone communication over a distance of 20 miles.

Despite the favorable report of C. H. Merz to the Victorian Railway Commission, the latter has decided not to electrify the suburban steam railways of Melbourne, Australia. Mr. Merz was prominently connected with the electrification of the first steam railway in Great Britain, and it was his opinion that there would be no financial difficulties in the way of electrifying the Melbourne railway. However, the Commission has decided that better results would be obtained by overhauling and reorganizing the present equipment of the road, without making so sweeping a change as that of displacing steam with electricity.

A new system of wireless telegraphy, known as the Lepel system, uses a very small spark gap but a very large current. The spark gap consists of two broad electrodes, which are separated by two pieces of paper, in the center of which a hole is punched. A succession of sparks pass across the gap, and gradually burn away the paper. The action of the paper appears to keep the sparking points constantly moving, so that no arc is formed. It is suggested that the products of combustion of the paper produce a gaseous atmosphere about the electrodes, which is similar in many respects to the hydrogen atmosphere of the Poulsen system.

A new system has been developed for the fixation of nitrogen from the atmosphere in which a very long and absolutely quiet arc is used. The air is brought into contact with the arc not at right angles, as heretofore, but in a spiral direction. The arc is formed in a long tube. An iron electrode is used at the bottom of the tube, while the upper end of the tube serves as the other electrode. This part of the tube is water-cooled. At the upper end the arc rotates or gyrates about the tube, owing to the spiral flow of air. There is not the slightest danger of its coming in contact with the sides of the tube below the upper end. The air is warmed before being brought into contact with the arc by passing it through a series of co-axial tubes. The arc is started by means of a small electrode, which is brought in contact with the iron electrode. As the small electrode is withdrawn, the arc forms between the iron electrode and the tube, and gradually works its way up to the top. In use the iron electrode oxidizes and very slowly burns away, but this is the only loss involved in the furnace.

Some time ago mention was made in this column of a mercury-vapor arc in which a quartz tube was used in place of a glass tube. This lamp possesses the advantage that the temperature may be raised to a much higher degree than would be possible with an ordinary tube, and thus the candle-power efficiency is much higher. The quartz tube in which the arc is formed is provided with a cylindrical quartz vessel at each end, in which the mercury is contained. The lamp is started by tilting this tube, so that a stream of mercury will flow from one cylinder to the other, making a path for current, after which the tube is tilted back. The tilting of the tube is accomplished automatically by means of a magnet, and when the current flows through the tube, a solenoid opens the circuit of the magnet, causing the tube to tilt back to normal position. If there is any air in the quartz tube, the arc will be extinguished when the tube is restored to normal position, and the tilting operation will then be repeated automatically until the mercury has been sufficiently heated to provide a mercury atmosphere of a density necessary for maintaining the arc.

SCIENCE.

The Duke of the Abruzzi, at the end of April, climbed Mount Zozila (India) to a height of 10,500 feet during a fatiguing march of four days in a snowstorm. Zozila is famous for its avalanches, one of which in 1908 buried a caravan of forty natives.

Syzygium jambolanum (the jambul tree) is very plentiful on the island of Madura but is also found in Java. Its height is about 50 feet. The fruits are very much like cherries. They have the same color, the same size and about the same taste, but are a little astringent. The seeds are used in treating diabetes.

India rubber under tensile stress contracts strongly when its temperature is raised. Work is done by its contraction at the expense of the energy of the heat. Hence, accordiing to Prof. S. P. Thompson, it would be possible to construct a thermal engine in which the working substance is India rubber, instead of steam or hot air, and operating by contraction, instead of expansion, of the working substance.

A curious property of neon is recorded by Prof. J. Norman Collie, F. R. S. Perfectly pure neon, when inclosed in a glass tube with mercury and shaken, glows with a bright orange-red color. As neon does this at ordinary pressures it appears to be different from other gases. When a silica tube is used and the mercury boiled in it, even at pressures of neon almost as high as atmospheric pressures, the mercury vapor glows bright green.

A German medical journal describes five recent cases of injury inflicted upon the eyes by the rays of mercury vapor lamps. These cases, in connection with others previously reported, leave no room for doubt that the light of the mercury vapor lamps employed in therapeutics and for the illumination of factories and other buildings may injure the eyes, not only by causing conjunctivitis (inflammation of the lining membrane of the eyeball) but also by producing paralysis of the retina.

The severity and sudden changes of temperature of the past winter proved very destructive to the inmates of zoological gardens. Animals in captivity require a fairly uniform temperature. The zoological collections of Antwerp and Hamburg were decimated by the cold, and of 5,748 animals kept at Regent's Park, London, 1,737 perished. The reptiles, especially the smaller specimens, suffered most, although their quarters were heated with great care. The most important losses were those of two great snakes, a boa and a python, which died of pneumonia. Two giant tortoises from the Galapagos islands, one of which was two hundred years old, succumbed to the same disease.

In a German village an underground lead water pipe was found greatly corroded and perforated. Investigation showed that the soil in which the pipe had lain was permeated by very impure water and consequently contained large quantities of ammonia, ammonium nitrate, and other compounds, which had attacked the lead pipe, forming lead carbonate, nitrate, nitrite, and chloride. All of these lead salts, except the carbonate, are more or less soluble in water. The carbonate is insoluble in pure water, but soluble in water containing carbon dioxide. Iron pipes coated with asphalt should be employed for underground conduits. If lead pipes are used, they should be imbedded in asphalt.

Hellriegel discovered, many years ago, that nitrogen is absorbed directly from the air by certain nodules, which are found especially in leguminous plants. An English scientist, Jamieson, has discovered another method of direct fixation of atmospheric nitrogen. He finds that numerous plants are covered with hairs which absorb nitrogen, convert it into albumen, and then wither and become absorbed into the body of the plant. By examining with a microscope series of sections which had been treated with reagents which stain albumen, the migration of the absorbed nitrogen could be approximately traced. The phenomenon is of very general occurrence among plants. Jamieson's results have been completely confirmed by experiments recently made in Hungary with various species of trees.

The waste waters of cellulose factories contain organic matter which is not in itself a source of pollution to streams into which it is thrown, but which may become noxious through fermentation. The best method of preventing fermentation, according to Vogel, consists in diluting the wastes very freely. This may be accomplished by mixing together the ordinary wash water and the alkaline baths in which the raw materials have been boiled for the purpose of freeing the cellulose from other substances. The mixture is then thrown into the stream with violence in order to insure its rapid dissemination through the water. It is not necessary to neutralize wastes laden with sulphurous acid if sufficient dilution is secured, but it must be remembered that fish are killed by one part (by weight) of sulphurous acid in two million parts of water.