ENGINEERING.

The ferry bridge continues to find favor in Europe. One of this type, with a span of 910 feet, is planned for erection across the Rhine at Koblenz, Germany. The floor with its double tracks will be carried by a steel arch. Another ferry bridge of even greater length is to be built at Bordeaux, France, over the Garonne, which at the point of crossing has a width of over 1,500 feet.

The submarine is advancing steadily in size and capacity. France has recently launched the "Archimedes," whose displacement of 800 tons constitutes her the largest submersible boat afloat. She is 229 feet 8 inches in length, and is driven by twin-screw engines at a speed of 15 knots on the surface, and 10 submerged. Her steaming radius is 2,500 miles.

In view of the sudden rapid decrease in the freight-car surplus during the latter part of July and the first half of August, the American Railway Association considers that within a few weeks there may be a shortage of cars. In the second week of August there was a surplus of 207,173 cars, which represented a decrease of about 36,000 cars during the preceding two weeks.

During the year 1908, there were 470 boiler explosions in the United States, as compared with 471, 431, and 450 respectively in 1907, 1906, and 1905. The number of persons killed by boiler explosions in 1908 was 281; in 1907, 300; in 1906, 235; and 383 in 1905. During the intervening period since October 1st, 1867, the total number of boiler explosions was 10,051, in which 15,634 people were injured, and 10,884 were killed.

One of the most severely used portions of a city street is the row of headers which line the inside edge of car rails, for they are continually exposed to a particularly severe grinding effect from the wheels of drays and other heavy horse-drawn traffic. A test of iron-slag block paving is being made in the Borough of Richmond, New York, where a line of such blocks has been laid along the inside of the rails of streets paved with asphalt blocks. They are reported as showing excellent wearing qualities.

We have recently referred to the plan by which the United States government is now purchasing its coal on the basis of its heating value, which is ascertained by analyses of samples. The new system of purchase applies to forty buildings in Washington, over three hundred public buildings throughout the United States, the navy yards and arsenals, and the Panama Canal. Already the government has effected a saving of $200,000 on its annual fuel bill of $10,000,000.

Improvements in rolling-mill plants make it possible to roll in one section I-beams of a weight and size which were beyond the capacity of the mills of the last decade. Formerly, when an I-beam or other rectangular shape exceeded a certain size, it had to be built up of plate and angles riveted together. The Bethlehem Steel Works, which has been rolling unusually large shapes, has met with such success that Mr. Schwab is about to expend $5,000,000 in the erection of new furnaces and mills.

At last those two famous single-screw liners, the "Umbria" and "Etruria," holders of the transatlantic record in the 80's of the last century, have been withdrawn from service; not because they are by any means worn out, but because they cannot compete in economy with twin, triple, and quadruple screw engines of multiple-expansion and turbine type. These two vessels contain the largest single-screw marine engines ever built; they marked the close of what might be called the single-screw, compound engine period in the history of transatlantic travel.

Work is actively in progress on the construction of another mountain railroad across the Andes, this time from La Paz, Bolivia, to Aricas, Chili. The railroad, which is about 33 miles long, reaches an extreme height of 13,000 feet above the sea, and it will serve the important purpose of giving the commerce of Bolivia a port of exit. Sir John Jackson, of London, who has contracted to build the road for $15,000,000, on his way home from Chili, by way of New York, made a private inspection of the Panama Canal. He expressed his conviction that the work would be completed in six and possibly in five years from the present time.

The new Pennsylvania terminal station in New York is rapidly approaching completion, and the last piece of stone in the exterior finish of the station was recently put in place. The dimensions of this work are unusually large. The exterior walls are nearly half a mile in length, and they contain 490,000 cubic feet of granite. Adding to this 60,000 cubic feet of stone used inside the concourse, we get a total of 550,000 cubic feet of granite, weighing 47,000 tons, which required 1,140 freight cars to transport it from the quarries at Milford, Mass. Into the construction of the building there have also entered 27,000 tons of steel and 15,000,000 bricks, weighing 48,000 tons.

ELECTRICITY.

The British government is about to lay a telephone cable under the English Channel, to be connected with the present land lines at Dover and Calais. It will be equipped with Pupin coils, and is expected to materially improve communication between London and Paris.

The entire machine shop of the International Harvester Company at Sterling, Ill., is to be operated by electricity, for the generation of which turbines are now being installed. The substitution of motors at all the individual machines for shafting and belting is expected to reduce the power cost by one-half.

Many of the railways are arranging to employ telephones for train dispatching, the Northern Pacific having already 470 miles of telephone in service and 250 more projected, while the New York Central will have its whole route to Chicago under telephone control when 200 miles of equipment, in addition to the present 250 upon the Michigan Central, is complete.

A dressmaking establishment in Boston almost entirely operated by electricity has an electric cutter capable of cutting out 250 thicknesses of cloth at once, a button-sewing machine which puts on 3,000 buttons a day, a buttonhole machine making 400 per hour, sleeve sewers, tucking machines, waist and skirt machines making 1,800 to 3,500 stitches a minute.

A new hydro-electric power station has been completed on the Reedy River in South Carolina. It uses the entire flow of the river of 110 cubic feet per second, but has a storage reservoir of 1,600,000 cubic feet capacity retained by a masonry dam. Three turbines drive direct-connected generators, one of 300 and two of 600-kilowatt capacity, delivering 60-cycle three-phase alternating current at 2,300 volts pressure.

Prof. Gale of the University of Chicago is slowly recovering from his accident last March at the solar observatory at Pasadena, Cal., when he received a shock of 15,000 volts. He appears to have suffered less from the actual shock than from burns from a hot rheostat, upon which he was thrown by the shock and lay for a long time unconscious, but his recovery at all is remarkable and cause for congratulation.

The valuable work of the United States Forest Service has called attention, among many other matters, to the fact that damage to wooden telegraph, telephone, and electric-light poles by woodpeckers and similar birds may be prevented by creosoting. The value of this process for the preservation of wood both from decay and from fungous growth and wood-boring insects is well known. It has now been found that of poles of identical wood those which have been impregnated with creosote are immune from attack by birds of the woodpecker family in districts where untreated poles are severely injured.

The American Mono-rail Company announces that it will commence the construction of a mono-rail road through Pelham Park to City Island early this autumn. Engineers of the Public Service Commission, who saw the system in operation at the Jamestown Exhibition, say that a speed of 135 miles an hour may be expected over parts of the route where right of way has been granted away from highways, so that the train headway may be unrestricted. If this line meets with the approval of the public, application will be made for permission to operate mono-rail express trains on an upper deck over the present elevated railways in New York.

The destruction by fire of the long-distance wireless telegraph station at Glace Bay, Nova Scotia, just as it was completed and ready for service, is not merely a serious blow to the Marconi Company, but very much to be regretted by all interested in the advancement of radio-telegraphy. The towers and aerials were not damaged, fortunately, and the boiler room and manager's house also escaped; but all the valuable machines had been specially made and cannot be duplicated, while quantities of spare parts for them, stored in the burnt-out condenser room, were ruined. The loss amounts to thousands of dollars, apart from the loss of business due to the station having to stand idle until new machines can be sent from Europe.

The latest machine in which electricity has been substituted for steam power is the steam shovel, which from its cumbrous parts, rough usage, and irregular loads did not seem a likely appliance to be electrically driven. Two 110-ton machines are used in limestone quarrying by the Dolese & Shepard Company of Chicago, in which the hoisting and the digging movement are controlled by separate motors of 200 and 80 horsepower respectively. Each motor is separately controlled by an automatic magnetic switch controller, securing the greatest nicety of operation and protecting the motor from overload due to rock encountered while digging. A feed cable is carried on a reel in the cab connecting at a convenient point with fixed conductor, and the shovel moves under its own power. It has been found very simple and economical in operation, requiring fewer operators than a steam shovel and eliminating the carrying of coal and water.

SCIENCE.

The seventy-fifth meeting of the British Association for the Advancement of Science was opened on August 25th in Winnipeg with six hundred delegates present from the United Kingdom, the United States, and Canada. The twelve sections of the Association remained in session for a week. One of the principal addresses was delivered by Sir J. J. Thomson, the president of the Association, and is published in the SCIENTIFIC AMERICAN SUPPLEMENT.

Capt. Rowland V. Webster F.R.G.S., is to head an expedition of the Royal Geographic Society to the South Pole. He expects to employ an aeroplane or some form of flying machine in making the final dash, and to follow the route taken by the German expedition a few years ago.

An effort is to be made to stock the Hudson River as well as other northern rivers of the United States with sturgeon, a fish that once swarmed in their waters, but which has since been exterminated. The proposal comes from Mr. Horace G. Knowles, formerly American Minister to the Balkan States. Through Mr. Knowles's efforts the Roumanian government has promised a carload of sturgeon fry, some cans of young sterlet, and smaller food fish to populate our waters. The first consignment of several hundred thousand fry will probably be planted in the Delaware River. The native sturgeon have been all but exterminated by wastefulness.

The ancient Romans excelled in making pottery. They possessed regular muffle ovens and even a sort of producer-gas oven. Attempts to produce the beautiful soft gloss peculiar to old Roman pottery have not yet attained complete success. The best result is obtained by Fischer's mechanical process, in which the ware, before it is fired, is coated with a paste of clay and pigment, and is then polished. Fine imitations of ancient pottery are thus produced, but the study of defective portions of the genuine *terra sigillata* ware shows that it was made by a different process, the gloss having evidently been produced by the application of a superficial glaze, without mechanical polishing.

Stoklaga has published the results of experiments in inoculating soil with nitrogen-fixing bacteria, which possess great power of assimilating free nitrogen and are retarded in development by nitrates in the soil. The radio-bacteria, on the other hand, decompose nitrates, and liberate nitrogen, which is voraciously consumed by the azotobacteria. The results of the experiments show that inoculation with nitrogen-fixing bacteria increases the crop and improves its quality, provided that care is taken to supply the carbohydrates, potash, and phosphoric acid which these bacteria require for their growth, and to neutralize the free acids of the soil by applying lime in liberal quantities.

Ozone is the best agent for purifying water, because it adds nothing except oxygen, which assists in aeration. An ozonizing plant has recently been installed at Saint Maur, near Paris, where the water of the Marne River was found to contain many disease germs, even after it had passed through sedimentation basins and sand filters. The ozone generators are of the Siemens type and are operated by a high-tension alternating circuit obtained by transforming the current of a 110-volt alternator, which is driven by a 44-horse-power steam engine. The total consumption of energy is 1 kilowatt hour for each 1,200 cubic feet of water, and more than half of the energy is employed in working the compressing pumps. The cost of sterilization is less than 5 cents per thousand cubic feet. The temperature of the water is lowered by the operation, and not a trace of nitrous oxide, chlorine compounds, hydrogen dioxide, or metallic salts due to corrosion of the apparatus can be detected in the sterilized water. Of the ozone absorbed, 73 per cent is consumed immediately in sterilization, 7 per cent remains diffused through the water and exerts a subsequent sterilizing effect, and 20 per cent escapes into the atmosphere.

Walter Wellman's second attempt to sail over the North Pole in a dirigible airship was made on August 15th, and proved a failure. The airship met with a mishap about thirty-two miles from the starting point. The leather guide rope, to which was attached a thousand pounds of provisions and stores, broke away. Relieved of this great weight, the airship shot up to a great height, but the pilot succeeded in bringing it down to earth, and in turning it homeward against a strong wind. No one was injured. The airship has been described in these columns in detail, for which reason it is hardly necessary to discuss its construction at length. Although the attempt was a failure, it must be admitted that while aloft the craft was maneuvered with ease. That it was brought to earth after its swift upward rush, and safely landed, speaks well for the power of its engines. Mr. Wellman has been working for four years to carry out his idea of reaching the North Pole by an airship. His aeronautical idea is the result of two expeditions by sledge and boat into the polar regions.