Engineering Notes.

The contract for building the largest cantilever bridge in the world has been awarded by the Wabash Railroad. The new structure will span the Monongahela River from the foot of Ferry Street to the south side and will permit the Wabash to enter Pittsburg.

The project of draining the Zuider Zee has been withdrawn from the States-General by the new ministry, thus being disposed of probably for a long period. The state of the Dutch budget renders such an undertaking at this time unadvisable; besides, the fall in the price of land has diminished the demand for new agricultural holdings.

A new ingenious contrivance for consuming smoke is being utilized in Berlin. When applied to a furnace it saves coal and consumes all the smoke. It has already been applied to several large engineering works in Germany with complete success. The German Naval Department has been submitting the device to severe tests upon a torpedo boat, and the results have been so satisfactory that it is proposed to adopt the system throughout the service.

A small experimental smelter has just been erected at San Diego, Cal. This will use as an experiment oil as a fuel in the reduction of copper and all other smelting ores. Mr. Trapp, the inventor, has perfect confidence in its success. In the ordinary smelter coke has been considered a necessity in smelting, as it generates great heat and has a chemical action on the ore. Shipments of iron and copper ore have been made to the new smelter and experiments will be started at once.

Under date of July 8, 1901, Consul-General Holloway writes from St. Petersburg: The city of St. Petersburg has decided to invite bids for a bridge over the Neva River, near the Winter Palace, to replace the pontoon bridge so long in use at that point. Its length is 847 feet and width 91 feet; the cost is limited to 3,500,000 rubles ($1,802,500). The specifications will be ready September 1, 1901, and the bridge must be completed in one year from that date. There are now two prominent bridges over the Neva—one stone and one iron—about completed.

The American Bridge Company, of Philadelphia, has obtained a contract for the construction of twenty steel bridges along the line of the Uganda Railroad in East Africa. The amount of the contract is about a million dollars. Several English and continental firms offered bids, but the Philadelphia company's bid was not only the lowest, but guaranteed the completion of the work in a shorter space of time than its foreign competitors. The new bridges will replace wooden structures which were built several months ago and were found to be inadequate for the service.

An interesting paper on "Comparison of Recent Battleship Designs" was read on November 15 before the Society of Naval Architects and Marine Engineers, which held a meeting in New York, by Naval Constructor H. G. Gillmor, U. S. N. As the most approved examples of battleship construction he named the United States battleship "Virginia," the British "Duncan," the German "Wittelsbach," the Russian "Borodino," the Italian "Vittorio Emanuele" and the Japanese "Mikasa." By a system of percentage values, the speaker reduced them all to a status of relative naval merit which placed the Italian at the head of the list, the American second and the German following.

The Department of State has received from Minister Merry, of Managua, under date of September 27, 1901, translation of a note from the Nicaraguan Minister for Foreign Affairs, giving notice that in accordance with Article XX. of the treaty of amity, commerce, and navigation, and Article VII. of the convention of extradition concluded between Nicaragua and the United States, the former treaty will expire at the close of twelve months and the second six months from the date of receipt of this notice. This denunciation, it is stated, in nowise affects the friendly relations existing between the two countries, and the Nicaraguan government desires the conclusion of new treaties.

In the opinion of Prof. Thurston the gas engine is a formidable rival of the steam engine, and is capable of further development. Each has given a horse power for about one pound of coal and the efficiency of both, between the coal pile and the point of delivery, is about 20 per cent. The steam engine, he says, has so nearly reached its limit that further progress under commercial conditions would seem to be very slow, but its range may be increased by employing very high pressures and superheating combined with them. In Sibley College work, 1,000 pounds per square inch have been used, and Prof. Thurston expresses the view that twice that pressure may be successfully used eventually, or with sufficient experience in its management. These factors would raise the efficiencies nearly 50 per cent, and reduce the coal per horse power hour to about three-fourths of one pound.

Science Notes.

The Manufacturers' Club of Philadelphia has passed a resolution indorsing the metric system, and a memorial will be sent to Congress urging its general adoption by the government.

The jubilee of the fiftieth anniversary of the scientific debut of M. Pierre Marcelin Berthelot, which took place on November 24, almost reached the proportions of a national affair. The ceremony took place at the University of the Sorbonne, and among those present were the President of the Republic and a number of the members of the diplomatic corps.

The gathering of cigar butts is to be suppressed, according to an ordinance recently passed in the Council in the city of Chicago, Ill. The penalty for violation of this ordinance has been fixed at a fine of not less than $10 nor more that $100 for each offense. The law covers the manufacture of cigars, etc., from tobacco thus collected, and no one shall buy or receive such material. There is a movement on foot in New York and other cities to prohibit this nefarious practice.

The Italian government has purchased the celebrated Ludovisi Boncompagni Museum, the most important private collection of antiques existing in Rome, at a cost of $280,000. The purchase price represents about one-third of the value of the museum, which is now open to the public, in the baths of Diocletian, in Piazza Termini. It is intended to gather the many interesting museums of Rome in the Villa Borghese, converted into a National Museum of Italy.

A site has been secured in Washington, D. C., for the building of the Bureau of Standardization. It is what is known as the Children's Home site on Pierce Mill Road west of Connecticut Avenue. Twenty-five thousand dollars, which is the entire amount of the appropriation available, was spent for the site. The latter is said to be particularly adapted for the purpose, being entirely free from mechanical and electrical disturbances, and at a sufficient elevation to meet the requirements of atmospheric conditions. Two buildings, to be erected at a cost of $250,000, have been authorized, and will be begun at once.

The English Antarctic exploration vessel "Discovery" is proving unsatisfactory. Her journey from London to Cape Town proved that she is not a very good sailer. She consumes a great deal of coal, and makes little progress in a head wind. She also leaked badly on the voyage out, and it became necessary to shift all her cargo for repairs. This work proved a severe task to the crew in a tropical sun, but fortunately fine weather prevailed, so that the repairs were effected satisfactorily. A relief ship is going to be sent out to the "Discovery" at the end of her first winter in the Antarctic, and for this purpose a Norwegian whaling vessel has been purchased and is now being fitted up.

Some consternation has been caused among the passengers of the Central London Electric Railroad by the assertion of the Lancet that the air in the tube contains carbonic acid gas of nearly double the amount fixed as the limit of impurity. According to the Medical Officer for Marylebone, Dr. Wynter Blythe, who has analyzed the air at several stations, has found that the carbonic acid gas was not less than 10.3 parts per 10,000, while in the tunnel itself it reached 11.9. These figures have occasioned considerable surprise among the officials of the railroad and steps will be taken to purify the atmosphere. Passengers, it is remarked, persistently complain that the air is oppressive, when, as a matter of fact, the change they notice is really due to the temperature, which is much higher in the tube than it is, at this season, in the open air.

Although the plague and the practical failure of the monsoon have exerted a depressing influence upon both the export and import trade of British India during 1900, the value of the imports was in excess of that of either of the two preceding years; while the exports, though smaller than the two preceding years, were greater than any year previous to 1898. The most important decreases were in metals, machinery and railway material. The trade in matches has greatly increased, but the British article has almost disappeared from the market owing to the spirited competition of the enterprising Japanese. The Japanese matches are cheap, which is a vital consideration to the Hindoo. Great Britain is the principal market for India with 63.8 of the total trade. But whereas Great Britain's share is less than it was in 1899, so also is that of the United States and France, while all other countries have slightly improved their position. With regard to the tea industry, which constitutes the principal export of the country, the Indian growers are establishing markets in other colonies beyond Great Britain, which is still, however, its greatest customer for this commodity. The success of this enterprise is adequately demonstrated by the fact that the increased consumption of Indian tea outside British markets between 1896 and 1900 was over 14,000,000 pounds.

GIANT SAND WHEEL FOR THE CALUMET AND HECLA MINING COMPANY.

One of the mines of the Calumet and Hecla Mining Company on Lake Superior is to be equipped with a sand or refuse wheel which will be the largest of its kind in the world. The wheel, which is now being constructed at the plant of the Robert Poole & Son Company, of Baltimore, has a capacity for carrying 550 sand buckets on the inner surface of its rim, and as the wheel will make ten revolutions in a minute, it will remove 5,500 buckets of refuse in that time, the contents of each receptacle being dumped into a trough to be located at the top of the wheel, in which it will be carried off by sluice water. The wheel measures 65 feet at its greatest diameter, and its estimated weight, exclusive of bearings and supports, is 50 tons. The axle or shaft, which was forged at Krupp's Essen factory, is 27 feet long, 32 inches in diameter, with a 26-inch hole through the center, and weighs 42,000 pounds. All of the finishing work on it was done in Baltimore.

One of the first requisites for building such a structure was a pit in which the completed portion of the wheel might be sunk as it was put together; and it was found that the Poole Company had one suited to the purpose, the pit being 100 feet long, 12 feet wide and 30 feet deep, while the building over the pit is so high that it easily accommodates the completed wheel.

The wheel was built in twenty segments. The rim is box-shaped in cross-section, with the toothed rim cast separate, in segments, and bolted to the wheel by inwardly-projecting flanges.

The structure is built on the same principle as the early bicycle wheels, which were commonly known as "spider" wheels. Toward each end of the shaft are two massive cast-steel hubs, and from these radiate forty steel arms or rods. The rods are arranged in pairs, and at the rim each pair connects to a pair of plate-steel lugs, which are riveted to the inner face of the rim, the outer ends of the arms being formed with an eye and secured to the lugs by means of an eye-bolt. The adjustment of the tension of the rods and the truing-up of the rim are accomplished, as in the old spider-wheel bicycle, by means of threads, nuts and lock-nuts on the ends of the arms where they engage the hubs. A good feature in the design of the wheel is that the stresses are all accurately determined, the arms, for instance, simply being subjected to a tensional stress and not having to resist the tangential stresses due to the load of sand in the buckets at the periphery. These tangential stresses are taken up by means of a system of tangent spokes and tie-rods which extend from the lugs on the rim, already referred to, to the periphery of a tangent-hub, which is keyed at the center of the shaft within the wheel. These tangential rods are arranged in pairs and in opposite directions, so that whether the tangential load at the periphery be right-handed or left-handed, there will be no transverse bending stresses on the main spokes or arms of the wheel. There are turnbuckles in the center of each tangential tie-rod, to enable the tension to be accurately adjusted.

One of the most interesting parts of the work on this wheel is the cutting of the teeth on the outside rim. For this purpose a special milling machine has been constructed, which is set up facing the teeth in the position shown in our illustration. When it is in position at the mine, the wheel will be driven by an electric motor of about 700 horse power.

The Charleston Exposition.

S. C. Mead, president of the New York State Commission which has just returned from a visit to the South Carolina Interstate and West Indian Exposition, said to-day: "We were very much surprised at the extensive plan and scope of the Charleston Exposition. It exceeds Atlanta and Nashville. As far as the beauty of architecture and of the surroundings are concerned, it will be one of the grandest expositions since the World's Fair.

"Charleston is certainly to be congratulated upon its courage in undertaking an exposition of this magnitude. Out of the city's population of 60,000, only 25,000 are whites. This means that there are only 5,000 or 6,000 men upon whose shoulders must fall the burden of financing and carrying through the Exposition. Yet this they are doing successfully.

"As far as we can ascertain, the New York merchants and manufacturers do not seem to be properly represented among the exhibitors. It would seem as though an opportunity of this sort to bring before the people of the South the products of New York ought not to be lost by our New York merchants and manufacturers.

"The New York State Building is just about completed. It is undoubtedly, next to the Art Gallery, the most beautiful building on the grounds, from an architectural standpoint. It is the purpose of the commission to make this building a center of social attraction, thereby appealing to one of the dominant characteristics of the South, namely, hospitality."

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GIANT SAND WHEEL FOR THE CALUMET AND HECLA MINING COMPANY.—DIAMETER, 65 FEET; WEIGHT, 50 TONS; NUMBER OF BUCKETS, 550.—[See page 411.]