Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845)........................$3.00 a year
Scientific American Supplement (Established 1876) .... 5.00 "
Scientific American Building Edition (Established 1885). .... 2.50 "
Scientific American Export Edition (Established 1878)......... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
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MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, MAY 11, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

CHICAGO DRAINAGE CANAL COMPLICATIONS.

In response to the request of the shipping interests of Chicago, the Secretary of War has given an order that the flow in the Chicago Drainage Canal must be reduced to 200,000 cubic feet per minute, which is about a third less than the discharge for which the canal was designed. When the construction of the canal was authorized by the Legislature, it was distinctly laid down that, when the sewage of Chicago was turned into the canal, it should be diluted at the rate of 20,000 cubic feet per minute for each 100,000 population, and that the total flow must not fall below 300,000 cubic feet per minute. These stipulations were made in agreement with the laws, and in response to the urgent representations of the residents of the valleys through which the sewage-laden waters of the canal would be carried to the sea, and it would surely seem as though the provision for a flow of 300,000 cubic feet per minute is surely none too ample in view of the unsavory burden that the canal waters carry. Unfortunately, the discharge of this volume of water produces a current which, it is claimed by the shipowners, is dangerous to navigation in the Chicago River. Moreover, the authorities of the city of Chicago are disposed to make much trouble over the question of canal bridges. Thus this magnificent enterprise would seem to be just now placed "between the devil and the deep sea."

It is not likely that any of these opposing interests would seriously deny that the drainage canal is a necessity, and that its completion and execution is one of the greatest sanitary works of this or any other age. That a large city like Chicago should continue to pour its refuse into Lake Michigan, with the prospect of ultimately bringing it into the absolutely disgusting condition which obtains to-day in Havana Harbor, is a proposition that neither the inhabitants of the Illinois and Desplaines valleys, nor even the city of St. Louis, would justify for a moment. Since the canal is there, and there to stay, it is surely possible, in such a reasonable age as this, for the contending interests to meet and consider the matter in a practical and broad-minded spirit, and make a compromise which shall do justice to every interest affected.

LIQUID AIR AS A BLASTING AGENT.

The problem of the exact field of usefulness of liquid air has been simplified by the elimination, for the present at least, of one class of work for which it was claimed that the new liquid would prove highly efficient. We refer to its use as a blasting agent. A paper recently read before the British Institution of Mining Engineers by Mr. A. Larsen described some tests recently made in the Simplon tunnel with cartridges, which consisted of a wrapper filled with a carbonaceous material, and placed bodily in liquid air until it was completely saturated. The cartridges were kept in the liquid, at the working face of the rock, until they were required for use, when they were lifted out, quickly placed in the shot-holes and detonated with a small guncotton primer and detonator. It was found that, owing to the rapid evaporation, the useful life of the charges was very short. The cartridges, which were 3 inches in diameter by 8 inches in length, had to be fired within fifteen minutes after being taken out of the liquid air; otherwise there was danger of a misfire. It was chiefly on this account that the tests were discontinued. The disruptive effects, however, were said to be comparable to those of dynamite.

TRAIN BRAKE RESULTS OF HIGH SPEED.

In our issue of April 27 we gave a synopsis of Behr's description of his high-speed monorail system, which it is proposed to build between Manchester and Liverpool, and on which it is expected that speeds of over one hundred miles an hour will be realized. It was mentioned that the important question of braking was to be solved by the use both of an electric and Westinghouse brake, and that calculations were based upon an estimate that the Westinghouse brake alone would enable the speed of the train to be reduced at the rate of three miles per second. Sir F. Bramwell, in a communication to the Journal of the Society of Arts, corroborates Mr. Behr's figures, and gives the results of tests carried out by himself and the late Mr. Cowper on the Midland Railway, in which it was proved that the speed of a train could be reduced at exactly the rate named, a train running at a rate of thirty miles a hour being brought to rest during these experiments without shock in ten seconds. Bramwell further suggests that it might be possible to utilize in high-speed trains a method of braking which is not dependent upon the weight of the train, and suggests the use of the "clip" brake, which, as the name implies, grips the sides of the rails in the same manner as the safety clutches used on many of the modern elevators grip the vertical guide-rails. The suggestion is a good one, for it would certainly seem that some form of clip brake would be necessary, at these high speeds, to secure an absolutely reliable and certain braking effect, whose power could be multiplied to any extent desired.

WATERWAYS AND CANALS OF CANADA.

The rivers and lakes of Canada, to say nothing of the splendid systems of canals by which they have been linked together, form a continuous inland water route which is unmatched in any other quarter of the globe. From the mouth of the St. Lawrence to the most westerly Canadian port on Lake Superior, a vessel may steam continuously in Canadian waters for a distance of 2,260 statute miles; while from Belle Isle to Montreal the St. Lawrence River offers a channel, large enough for the accommodation of ocean steamers, for a distance of nearly a thousand miles. The difference in level between Lake Superior and tidewater on the St. Lawrence near Montreal is 600 feet, and a vessel, in ascending from Montreal to Port Arthur, has to be lifted through this great vertical distance. Of this total 551 feet is covered by means of locks, and 49 feet of it are overcome by steaming against the stream, which, in some stretches of the river, is so strong that the vessels have to be assisted by tugs. According to figures furnished by J. L. Bittinger, consul-general, there are between Montreal and Kingston seven canals, with a total length of 50$\frac{1}{4}$ miles, and a total lift at the locks of 207$\frac{1}{2}$ feet. The width of these locks is 45 feet, and the depth of water on the sills 14 feet. Steamers on the run down from Kingston make no use of several of these canals, for the reason that the rapids may be run with safety. From Kingston the westward course is through Lake Ontario to Port Dalhousie, where the Welland Canal commences. This structure is 26$\frac{3}{4}$ miles in length, and the total lift of 326$\frac{3}{4}$ feet is effected by twenty-seven locks, each 270 feet by 45 feet, with a depth of 14 feet. From Port Colborne, at the Lake Erie end of the canal, there is deep water for a distance of 394 miles to the Sault Canal, which is 5,967 feet in length, and contains a lock 900 feet by 60 feet, with a depth of 20 feet 3 inches, the total lift being 18 feet. Once through the Sault Canal the last natural obstruction is passed, and there is deep water to Port Arthur.

In addition to this magnificent system, Canada has another watercourse, which runs from Montreal to Ottawa, and then down to Kingston, a total distance of 245 miles. On this route there are four canals and locks: Lachine, St. Anne's, Carillon and Grenville. In the distance from Ottawa to Kingston, 126$\frac{1}{4}$ miles, there are thirty-five locks. In addition to these main-line canals, moreover, there are other canals on the line of the Richelieu River, in Ontario, and through the Peterborough district in Cape Breton; and there are a number of branches connecting with the Rideau and Welland systems. The total traffic through the several canals in the Dominion, in 1889, amounted to 6,225,924 tons. The total quantity of through freight passed through the Welland and St. Lawrence Canals from Lake Erie to Montreal was, in 1890, 231,746 tons eastward and only 13,951 tons westward. In 1899 354,933 tons were passed eastward and only 5,991 tons westward. The total expenditure for the fiscal year ending June 30, 1900, was $3,351,164, and the total net revenue was $322,642. Commenting on this, the consul-general says that if it is judged by the net revenue received, as compared to the outlay, the Canadian canal system would be found wanting; but that the Canadians do not take so narrow a view of the question, and recognize that waterways and roadways are essential to the commercial life of the country.

TRANSPORTATION OF TRAINS ON LAKE BAIKAL.

The Bulletin of the Société des Ingenieurs Civils contains an account by M. Platon Yankowsky of the method of transporting the trains of the Trans-Siberian Railroad across Lake Baikal. The railroad is now in operation from Tcheliabinsk on the eastern frontier of Siberia, to Stretiensk, on the river Chilka, an affluent of the Amour, on the frontier of Manchuria, making a total distance of 2,650 miles. The route is interrupted over a length of 40 miles by Lake Baikal, and the trains are ferried across the lake, in order to avoid going around it, which would increase the distance by 82 miles. It is expected that the route will ultimately follow the shore of the lake, but its exact position has not yet been decided. The piers for the ferry system have been built at a considerable distance from shore to assure a sufficient depth of water; the piers are united to the bank by causeways which have 1,800 and 1,100 feet length respectively. These piers are formed of wood caissons filled with stone, and each has the form of a fork, whose branches are of unequal dimensions, that next the lake measuring 486 feet long by 32 feet wide, and that next the shore 220 feet by 20 and 25 feet. The ice-breaking ferryboat "Baikal," used to transport the trains, enters the free space between the two branches, where it is protected from the waves. Upon the deck is let down a gang-plank which establishes communication between the rails of the piers and those of the boat, and the train passes upon the latter. The "Baikal," whose shell is of soft steel, measures 285 feet long by 56 feet maximum width, and the height from keel to the center of the main deck is 12 feet. When fully loaded, it has a draught of 19 feet forward and 17 feet aft; its displacement is 4,200 tons, including 580 tons water ballast and 250 tons of coal. It is driven by three screws, of which two are in the rear and one forward; the latter serves at the same time to disperse the ice which has been broken. These screws have four blades, the forward screw being of phosphor-bronze and the rear pair of steel. The former has a diameter of 12 feet and the latter 10 feet. The three triple-expansion engines give a total of 3,750 indicated horse power, and the steam is furnished by fifteen cylindrical boilers. With its three engines, the "Baikal" passes easily through compact ice two feet thick and more at a constant speed of about three knots an hour. Upon the deck are three tracks, which can receive 25 freight cars of a gross weight of 500 tons. Above the deck have been constructed cabins of three classes, which permit the transport of 200 passengers. Another ice-breaking boat, the "Angara," is used as an auxiliary for the transfer of passengers and for freight unloaded from the cars; she is also built of soft steel, and measures 197 by 34 feet, with 24 feet height at the center. Its draught at full load is 14 feet, and its displacement 1,200 tons. This boat, which has a capacity of 150 passengers, is driven by a single rear screw, and has a triple-expansion engine of 1,250 horse power. In smooth water each of these boats makes a speed of about 12.5 knots an hour. It is estimated that the total cost of the Lake Baikal transportation system reaches more than $3,400,000.

THORIUM COMPOUNDS.

In a paper lately read before the Académie des Sciences, Messrs. Matignon and Delépine give an account of a series of experiments which they have made upon two imperfectly known bodies, the hydride and the nitride of thorium. The nitride appears to have been discovered by Chydenius in 1863; he formed it by reacting upon the chloride with ammonia. M. Moissan obtained the same compound by the action of ammonia upon the carbonate. It has since been found that the metal will combine directly with nitrogen. As to the hydride of thorium, its existence has been demonstrated by Winkler. The experimenters purpose to make a further study of these two compounds, and to form them from the metal. To obtain thorium from its chloride by the method of Chydenius, the chloride was prepared by two methods; first by the action of well-dried oxide of carbon and chlorine upon the oxide of the metal heated in a porcelain tube, and second by the action of tetrachloride of carbon upon the oxide heated to redness in a glass tube. The first process gives a very pure product, but its action is slow, and the second is preferred, as it gives large quantities of the chloride, which, however, are less pure, and contain thoria in the form of oxychloride. The metal is prepared from the latter chloride by acting upon it with sodium; it contains a large proportion of thoria, being only 74 per cent pure. To form the hydride of thorium, the metal is heated to low redness, when it combines with hydrogen with incandescence, and forms a compound which is not decomposed by water. Hydrochloric acid attacks it, giving off hydrogen, which has double the volume of that given by the metal. By determining the proportion of hydrogen the formula for the hydride of thorium was found to be ThH_4. This body