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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 rate.

THE CANADIAN ROUTE FROM THE GREAT LAKES.

At a time when the interests of the Erie Canal seem to be the mere sport of politics, and this greatly needed improvement is apparently as far from realization as ever, it is as well that the people of the State should realize that the Canadian government is pushing forward the interests of the rival route by the way of the St. Lawrence River Canal with the greatest activity. In an address delivered last week to the business men of Montreal, by Mr. Tarte, Minister of Public Works in the Dominion government, he assured them that by the time the improvements of the St. Lawrence were completed Montreal would contain as many grain elevators as the city of Buffalo. He stated that the Port Colborne works, at the Lake Erie end of the Welland Canal, would be completed in two seasons, and that the government was about to undertake important works at Georgian Bay and the French River. The Minister also said that, at the next session of Parliament, he would ask for money to complete a public drydock at Montreal, and that with a view to encouraging a large share of the trade of the Great Lakes to come to that city, he favored a free canal, and a free port at Montreal. Direct evidence of the wisdom of the great St. Lawrence enterprise was shown in the recent sailings of the new vessels of the Northwestern Steamship Company. These ships, the first of which is known as the "Northwestern," have been built specially for the canal route; they are 256 feet in length, 42 feet in beam, 26½ feet in depth and they can carry between 3,200 and 3,500 tons at a speed of 13 knots an hour. On her first trip the "Northwestern" took a large consignment of machines from the McCormick Harvesting Machine Company, Chicago, direct to Hamburg. The vessel cleared Chicago on April 24, and two days later another consignment of 144 carloads of agricultural machinery left for Europe by a sister ship, the "Northman." The fact that vessels are sailing at an interval of only two days, carrying American machinery direct from Chicago to European ports, should bring home to the people of New York State the present reality and the prospective strength of Canadian competition. We have said before, and we repeat it, that the most effective answer to this competition would be the construction of a canal of equal capacity and convenience from Buffalo to the Hudson River; for unless we present some rival water route, New York will see the city of Montreal added to the number of Eastern ports that are taking away the trade which formerly sought its natural shipping point at this port.

HYDRAULIC SYSTEM OF AIR COMPRESSION.

It sometimes happens that an early invention, which anticipated the period of its practical application because of the undeveloped state of the mechanical arts, will, in the course of years, be reinvented, or to speak more correctly, reapplied, with surprisingly favorable results. Of this class is the hydraulic air compressor, which, during the last few years, has been showing results that compare favorably with those attained by other forms of air compressor. The new type traces its ancestry to the venerable trompé, or water-blast, used centuries ago in working the Catalan furnace, in which a moderate air pressure was obtained by means of falling water, the air being drawn in with the water, at the top of a wooden pipe, carried down with the same and collected in a chamber from which it issued to the furnace. The apparatus was crude and the principles but poorly applied; consequently the blast was too weak to be of any service except in the antiquated methods of the middle ages. As the art of iron-making advanced, the steam-driven compressor and the centrifugal blower were developed to meet the demand for a strong air blast; and no one seems to have imagined that the fundamental principles of the old trompé could be developed to meet the demand for great volumes of air at high pressure.

In the Journal of Franklin Institute of September, 1880, J. P. Frizell enunciated the principles of the hydraulic air compressor, and in 1895 it was put into practical form by the patentee, C. H. Taylor, of Montreal, and several installations are now working in various parts of the country with highly economical results. At the Milwaukee meeting of the American Society of Mechanical Engineers W. O. Weber gave the results of a series of tests of the hydraulic compressor at Magog, Quebec, a plant that was fully described and illustrated in the SCIENTIFIC AMERICAN of April 28, 1900. The compressor consists of a downflow pipe which delivers the water and air from a large tank at the top to a separating tank at the bottom of the pipe; the pipe and the lower tank being placed in a deep excavated shaft. A number of small air-inlet pipes lead into the mouth of the downflow pipe, and as the water flows by them, it draws in a proportionate number of jets of air with it. The air is carried down with the falling water and subjected to a pressure proportionate to the head of the water. Within the lower tank is arranged a series of deflecter plates, which decrease the velocity of the water and facilitate the escape of the air; the latter collecting above the water, and being drawn off for use as required. Three series of tests were made, one with thirty-four 2-inch air-inlet pipes, another in which the number of air tubes was increased by fifteen ¾-inch pipes, and a third series of tests in which the number was increased by thirty ¾-inch pipes. The tests were carried out by Prof. C. H. McLeod, of McGill University, Mr. W. O. Weber, of Boston, Mass., the author of the paper above referred to, and others. In the Magog plant the supply penstock is 60 inches in diameter, the downtube 44 inches in diameter; the total depth of the shaft below normal level of head of water is 150 feet and the normal head and fall is about 22 feet. It should be explained that after the separation of the air and water in the lower tank, the surplus water passes out under the edge of the tank, and rising through the shaft escapes by the tailrace. The tests showed that, with the original number of compressor head air-inlets, and a flow of 3,772 cubic feet of water per minute, the pressure of the air at the compressor was 51.9 pounds per square inch, and that the percentage of efficiency of the compressor was 56.8 per cent. When the inlets were increased by thirty ¾-inch pipes the efficiency rose to 64.5. With a flow of water of 4,200 cubic feet per minute, the economy was highest when only fifteen extra air tubes were employed, the efficiency increasing from 60.3 per cent for the original setting to 70.7 per cent as modified. When the flow of water was further increased to 4,600 cubic feet per minute, it was found that there was no economical advantage by increasing the air-inlet area. In addition to the fact that an efficiency of 70.7 per cent was realized under the most economical rate of flow of water, it was proved that the air is compressed at the temperature of the water; a most important result, as the costly cooling plant, necessary with other systems, is thereby dispensed with. Using an old Corliss engine, 81 horse power was recovered; a result which would represent a total efficiency of work, recovered from the falling water, of 52.2 per cent. In a test in which the compressed air was preheated to 267 deg. F. before being used in the engine, 111 horse power was recovered when using 115 pounds of coke per hour, which latter, it was estimated, would equal about 25 horse power. The efficiency of work recovered from the falling water and the fuel burned would, therefore, be about 61½ per cent. On the basis of 425 cubic feet of air per brake horsepower per hour, when preheated to 300 deg. F. and used in a hot-air jacketed cylinder, it is estimated by the author of the paper that the total efficiency secured would have been about 87½ per cent.

COMPARATIVE EFFICIENCY OF KRUPP AND OTHER HIGH-POWER GUNS.

It seems that our comments upon an article published in the German scientific journal Prometheus on the comparative efficiency of the Krupp, Armstrong and Schneider-Canet guns have been misunderstood by some of our readers. A recent issue of our German contemporary states that, in our criticism, the efficiency of the German gun is "acknowledged in very appreciative words," and Prometheus is correct in stating that it is our opinion that the "superiority of the German gun results from the great weight of the projectile used;" but when it proceeds to credit us with the statement that heavy projectiles are not always the best, and that it is "doubtful whether the Krupp gun will still show so enormous an efficiency if fired with the lighter projectiles used in England and France," it is in error and must be confusing the opinions of the SCIENTIFIC AMERICAN with Continental criticisms which "have been re-echoed by the English press and apparently accepted with a certain satisfaction." As a matter of fact, we did not touch upon the question of the efficiency of the gun under other conditions than those for which it was designed. What we did say was that the greater weight of the shell will reduce the total number of rounds that can be carried for each gun; a consideration which is of the greatest importance, where every ton of displacement of a ship is valuable, when it comes to the question of distribution among the contending claims of armor, engines, stores and ammunition. We said furthermore that the increased weight must tell somewhat against the rapidity of handling, and that if the ammunition is to be handled at the same speed, it becomes necessary to install heavier machinery for operating the hoists.

As a matter of fact, we consider that the German artillerists have shown considerable shrewdness in increasing the weight of their projectiles and thereby securing greater effectiveness at long ranges. The wisdom of this policy will be seen, we think, whenever the next naval campaign shall be fought; for we entirely agree with our contemporary in the prediction that there will be a tendency to carry out naval engagements of the future at ever-increasing ranges, and this because of conditions similar to those which have so vastly increased the fighting range on land in recent wars. It is likely that the battle of the future will begin at unusually long ranges which will gradually decrease as the engagement proceeds, the ships approaching each other as the battle reaches the decisive step.

It is evident from the comments of Prometheus that some of its European contemporaries have been questioning the suitability of the Krupp gun to fire lighter projectiles at higher velocities; probably assuming that the Krupp gun is unable to withstand the higher pressures that will be necessary. In reply to this Prometheus gives some graphical comparisons of the 12-inch and 6-inch guns of the Krupp, Vickers and Armstrong makes, which show that when the same weight of shell is used in each, the highest ballistic results are still achieved by the Krupp weapons. Thus, for instance, in a comparison of the 12-inch 40-caliber gun, it is shown that the Krupp weapon has an initial velocity of 816 meters, as against 791 and 786 meters, respectively, for the Vickers and Armstrong guns, the equivalent muzzle energies being 13,100 meter-tons for Krupp, 12,340 meter-tons for Vickers, and 12,515 meter-tons for Armstrong. At a range of 3,000 meters the remaining velocities and energies are as follows: Krupp, 681 meters and 9,110 meter-tons; Vickers, 659 meters and 8,540 meter-tons; and Armstrong, 655 meters and 8,440 meter-tons. Although these results are very gratifying as compared with other European weapons, it is satisfactory to note that they are surpassed by the new United States naval 12-inch gun, which with a muzzle velocity of 870 meters has developed a muzzle energy of 14,865 meter-tons, or 1,765 meter-tons more than the Krupp gun. The remaining velocities and energies at the various ranges are, of course, proportionately greater than those of the latter gun. At the same time, it is but just to point out that, judged on the basis of energy per weight of gun, the Krupp weapon is superior; our new gun showing 272 meter-kilogrammes per kilogramme of weight of gun, whereas the German weapon shows 288 meter-kilogrammes. Prometheus points out that the light weight of the German weapons compared with their high efficiency argues particularly excellent quality both in gun steel and the construction of the gun itself; a point which is certainly well made.

GROWTH OF THE TINFOIL INDUSTRY.

Recent ornamental novelties made of pure tinfoil, lacquered with gold and embossed in various forms, manufactured for the drug, confectioners' and tobacconists' trades, serve to call attention to an invention and industry that are purely of American origin and growth. Before the inventor of tinfoil hit upon the idea of rolling tin upon sheets of lead, the two metals being previously welded together, the only tinfoil known to the world was that of pure tin beaten by a process similar to that followed by gold-leaf beaters. This beaten tin was made in England, and only small quantities were imported into this country. Its use was limited because of its expense and its liability to tear.

The first tinfoil rolling mill was established in New York city about half a century ago, and it was started on such a modest scale that the rollers were obtained as second-hand iron. The English-beaten tinfoil was found to be so expensive in this country that a cheaper method of making it was tried, and proved successful. The business of this early, but now extinct, tinfoil factory was thus announced: "Foil Rolling Mill and Metallic Cap Works; tobacconists' foil, plain or embossed, tin sheet-foil for druggists and bottlers, superior to the imported article."

In the half century which has followed this modest beginning of an industry great strides have been