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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

made in manufacturing tinfoil and in applying it to manifold commercial uses. New machines have been made to work it up into handsome ornamental forms, and considerable capital has been invested to extend its usefulness. There is very little export trade in tinfoil, as the foil is also made extensively in England, France and Germany, but the home trade is adequately supplied by the four tinfoil factories in this country—two in New York, one in Philadelphia, and another in St. Louis. After the expiration of the original patents these four factories started almost simultaneously, and they have controlled the output of the material ever since.

New machinery and processes for improving the tinfoil are being invented nearly every year, and the quality of the material produced to-day is infinitely better than that of a dozen years ago. A good deal of the new machinery is made to enhance the ornamental effects of the foil, but not a little of it is made to increase the strength and wearing quality of the material. In the druggist and confectionery trades the demand for very highly ornamental tinfoil effects is especially urgent, and artists of considerable ability are engaged to produce fancy patterns. The silvery surface of the tinfoil is made more effective by fancy patterns of stars, figures and fine lines, which are stamped or embossed in the sheets by special machinery. Recently machinery was made to print the patterns on the sheets of foil in colors. In order to do this the sheets of foil are put through regular printing cylinder presses, which not only color the patterns but stamp in the "dead" effects of various figures and lines. The machinery required for this delicate work is quite elaborate and represents part of the invested capital of the plant.

The tinfoil is also lacquered handsomely with gold, which, in connection with the embossing and printing in colors, produces remarkably artistic effects. Many large firms employ these fancy effects as trade marks which are stamped or printed on all the foil they use as wrapping for their articles. Tinfoil is growing rapidly in use for wrapping purposes where food and other articles must be kept from the air as much as possible. Its first use was for tobacco wrapping, and the demand in this trade stands first to-day. Fine cigars, plug tobacco and cigarettes have the fine aroma of the tobacco and the natural moisture retained indefinitely by this process. Most prepared foods are wrapped in tinfoil, and now that the manufacture of these has grown tremendously the demand for tinfoil has increased also to remarkable proportions. Cheese, yeast cakes, and other products of the delicatessen order require annually tons of pure tinfoil. Confectioners have also resorted to the use of tinfoil for wrapping their choice candies in preference to tissue paper. The drug trade has found infinite uses for the foil because of its air-tight qualities, which keep the goods from direct contact with the atmosphere.

Perishable goods shipped to warm, tropical countries are frequently wrapped in tinfoil to exclude the air and to retain the natural moisture. A combination of thin paper and tinfoil is considered better for food products than the foil alone. It was considered better not to have the foil come in direct contact with the food, and consequently a machine was made by which the sheets of tinfoil and paper were firmly adhered together. These double sheets are used so that the paper alone comes in contact with the food, while the tin serves all the purposes of excluding the air. There is considerable labor of folding saved by this process, and only one instead of two foldings is required for each separate article.

Some foil is brought into direct contact with certain classes of food, which by its nature could not well absorb any poison from the foil, but the factories make all such foil wrapping from pure rolled tin. There is no lead mixed with this foil to give occasion for reports of poisoning from goods wrapped in tinfoil. This foil is more expensive to make, and the combination of tinfoil and thin paper is becoming more popular.

Bottle caps are manufactured largely out of tinfoil, but they are of a different quality and manufacture from that of the ordinary foil. The sheets for this work are spun on a lathe from a mixture of lead and tin. There is more lead in this foil than in the finer quality for general use. The foil is thicker and coarser, and as it never comes in contact with the contents of the bottle the amount of lead in it is immaterial from the consumer's point of view. The thickness of the tinfoil in common use runs from one-half of one-thousandth of an inch up to almost any thickness required by special trades. The thinner the foil is rolled or spun the more expensive it is. The foil is rolled usually in sheets fifty feet in length and in varying widths. Some machines are made to roll it twelve inches wide, but most of them have only half this width, as trade demands favor the narrower widths After the sheets are rolled they are stamped, printed, and embossed in suitable sizes and patterns, and then cut up in lengths desired. Millions of pounds are required for the trade in this country, and the market price runs from 75 cents per pound for the handsome embossed and lacquered foil down to a few cents a pound for the cheaper grades. G. E. W.

METHODS PROPOSED FOR DEALING WITH LONDON'S CONGESTED TRAFFIC.

Elaborate projects are being framed by the London County Council for dealing with the crowded thoroughfares of the English metropolis, and to inaugurate a system of intercommunication similar to that already existent in the most modern cities. The tramways are to be immediately converted to electric roads; the river is to be supplied with an efficient and rapid service of steamers; while it is also mooted that an attempt is to be made to relieve the congested condition of the Strand and Fleet Street by the construction of street subways similar to those of Boston.

With regard to the tramway systems, for some time past the County Council have been carrying out experiments to determine what method of supplying the current to the car motors is best adapted to the exigencies of the case. It has been decided to employ both the overhead trolley and the conduit systems, the former to be more generally employed in the less crowded thoroughfares of the suburbs. At the present time there are 115 miles of street tramways in London, and the carrying capacity averages 350,000,000 passengers per annum. With the present system of horse traction a profit of $1,250,000 is earned annually. If electric traction were employed it is computed that this profit would be increased to $3,300,000. A comprehensive idea of the earning capacity of the tramways may be realized from the first year's working by the County Council of the tramways south of the Thames. This service was purchased by the municipal authorities for $4,375,000, and the surplus upon the year's working amounted to $65,000. The mileage in this instance is 24 miles, with an earning capacity of $7,835.

One of the most perplexing difficulties with which the Council have had to contend in connection with their proposed inauguration of electric traction is the fact that the roads in the various districts through which the tramways extend are controlled by the local authorities, the majority of which are bitterly opposed to the change. There are no less than fifty of these small local authorities possessing the power of veto over the roads. The objections in many instances have been successfully surmounted, but negotiations are still being carried on with those authorities who remain obdurate, and it is anticipated that the installation of the electric plant will be commenced almost immediately.

With regard to the river traffic the Council considers that the development of a fast and frequent service upon the waterway is an efficient means of relieving the streets. The service at present in vogue is distinctly inadequate, and is only for summer use. The boats are slow and antiquated, and the service too infrequent to commend its more widespread utilization. According to the scheme of the Council, it is intended to supply a three minutes' service; to provide a fleet of fast, comfortable, and modern river steamers; and, if possible, to secure the entire control of the river piers, which at present are under the auspices of the Thames Conservancy. The enterprise will cost $2,500,000 to carry through. The boats will cost $37,500 each. The piers will be transferred from the sides of the river to the center round the pillars of the various bridges, approaches to which will be provided. It is estimated that the cost of maintaining the service will amount to $700,000 per annum.

The suggestion of supplying underground tramways to the principal arteries of traffic, though generally favored, is beset with innumerable difficulties. For the most part, the streets of London are intersected in all directions by electric cables, gas, water, and pneumatic pipes, etc. Under these circumstances if such a tramway were constructed it would have to be at a great depth, which would have the effect of preventing its being used for the very purpose for which it was intended. If the descent of about a dozen steps from the street level were only necessary to give access to the subway, then it would doubtless prove a great success. To insure this, the network of obstructions would have to be removed, and this could only be accomplished at a great outlay. The general idea is to lay all pipes and wires in a long tunnel, running parallel to the tramway, so that access could easily be gained thereto for carrying out repairs, or for the laying of new material, without disturbing the surface of the street, and causing great inconvenience to the vehicular traffic. At the present time the principal thoroughfares in the metropolis are up for the laying of the government telephone cables, which are to extend over a mileage of 640 miles, causing widespread inconvenience. Many of the streets of London are provided with a duplicate thoroughfare below, in which are the gas, water, and other pipes, wires, etc., but the idea is not general throughout the city. The Council are carefully studying this scheme, and since the chairman of the Highways Committee, who have the subject in hand, has investigated the system in vogue in Boston, and is convinced of its practicability in London, there appears every symptom of its adaptation to the English metropolis within the near future.

The Central London Electric Railway has had the effect of considerably relieving the congestion of the streets, and has proved such a success that application is to be sought for Parliamentary powers to extend the railway at the city terminus at the Bank to Liverpool Street, the terminus of the Great Eastern Railroad, and which supplies the densely populated districts of Walthamstow, Stratford, Bow, Stepney, etc.; and also at the southern terminus at Shepherd's Bush. It is also stated that another similar railway is projected by an American syndicate to connect Victoria with Putney, a remote southwestern suburb.

WIRELESS TELEGRAPHY FOR THE PREVENTION OF SHIPPING DISASTERS.

For some time past numerous experiments have been carried out with Marconi's wireless telegraphy with a view to employing the system on lighthouses, etc., as a means of preventing maritime disasters. But the endeavors have only been attended with such mediocre success that it has not been considered advisable to develop the matter. But a novel device has now been invented by Mr. J. Gardner, of Manchester (England), which, so far as the present experiments are concerned, has been highly successful. It is termed an automatic signaler, from which it will be gathered that its mechanism is automatic in its action. The inventor claims that by this means an adequate warning is supplied to vessels of impending danger, within a zone, the radius of which has been previously determined. It may be either applied from ship to shore, or from ship to ship while at sea, with equal success and reliability.

The apparatus is somewhat similar to that utilized by Marconi. At the shore station a mast is set up, to the top of which is attached a metallic conductor. This conductor is connected to the transmitting apparatus, which is accommodated in a building in close proximity. The transmitter consists of an induction coil, and the accumulators for the provision of the current. The automatic portion of the instrument consists of a specially cut wheel, bearing the name of the danger spot to which the mast is attached. This wheel controls a Morse key. This wheel is maintained in constant rotation, the periphery being regulated to any desired time, so that one revolution may be completed in one, two, three or more minutes.

Vessels are supplied with a receiver, and directly a ship enters the danger zone the instruments print off on the tape machine in the Morse code the name of the danger spot it is approaching, at the same time setting a bell in motion; both bell and receiver continuing to operate until the ship has once more passed beyond the influence of the transmitting apparatus. All vessels that happen to enter the danger zone receive the warning simultaneously, as with Marconi's system the apparatus is not affected by any climatic conditions.

The preliminary experiments for demonstrating the efficacy of the scheme were conducted at the mouth of the Thames. The shore station was established at Shoeburyness. A steam launch put off from Southend provided with a receiving instrument, the invention of Colonel Hozier—the secretary to Lloyd's—and Mr. Nevill Maskelyne. A stiff breeze was blowing and a thick fog hung over the water. The launch stood about eight miles out to sea, and then the automatic apparatus at the shore station was set in motion, the zone of influence in this instance extending to seven miles. The launch then put about and wended her way shoreward. Suddenly the bell commenced ringing violently, and simultaneously the word "Southend," the name of the danger spot, was printed upon the tape machine. The vessel then put out to sea again, and entered the zone from another quarter, but the moment it entered the range of influence of the shore station the warning was received. For two hours these trials were continued, but with always the same result. The instrument never once failed in its working, thus conclusively testifying to its efficiency and reliability.

There were several well-known shipping men present at the trials, including the representatives of the Cunard, White Star, the American, the P. & O., and other leading steamship lines, and the secretary of Trinity House. In connection with its adaptation for vessels the receivers on two respective ships approaching one another would receive the name and course of the other. In view of the practicability of this automatic signaler and the possibility of reducing the number of maritime disasters by its utilization, the installation of the apparatus at several points of the British coast within the near future is probable.

The American losses of troops in the Philippines since August 6, 1898, are as follows, says The Medical Record: Killed, 741; died of wounds or accidents, 472; died of disease, 2,295; total deaths, 3,508; wounded, 2,638; grand total, 6,146.