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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 rates.

GROWTH OF AMERICAN MERCHANT MARINE.

The growth of our merchant marine is slow, and is in no sense commensurate with our phenomenal advancement in manufactures and commerce. At the same time, it is a fact worthy of note that the documented tonnage of the United States on June 30, 1903, for the first time in our history, exceeded 6,000,000 gross tons register, comprising 24,425 vessels of 6,087,345 gross tons. These figures do not include 1,828 yachts of 74,990 gross tons. The total shipping of the United Kingdom for 1902 was 20,258 vessels of 15,357,052 gross tons (vessels of British colonies number 15,533 of 512,268 net tons). On January 1, 1902, the total shipping of the German Empire was 6,024 vessels of 3,503,551 gross tons. The shipping of the United Kingdom and Germany is largely employed in developing foreign trade. The shipping of the United States is almost wholly a part of our domestic transportation system. On June 30, 1903, 5,141,037 gross tons were engaged in transportation and coastwise trade, 879,264 gross tons were devoted to foreign trade, and 67,044 to fisheries. The distribution of our tonnage on June 30, 1903, was: Atlantic Ocean, 3,157,373 gross tons; Pacific Ocean, 812,179 gross tons; the Great Lakes, 1,902,698 gross tons; Mississippi system, 215,095 gross tons. Our shipping on the Pacific has increased more rapidly than on the Atlantic. In regard to motive power, 3,408,088 gross tons were propelled by steam and 1,965,924 gross tons were sailing vessels, and 713,333 gross tons of canal boats and barges were variously propelled. As regards the materials of construction, 2,440,247 gross tons were of iron and steel construction, and 3,647,098 gross tons were of wood.

During the years 1902 and 1903, nearly 100,000 tons of large ocean-going steamers have been added to our registered fleet.

The subject of the losses of vessels from various causes is a most important one. During the year ending June 30, 1903, 487 vessels of 107,084 gross tons were reported.

The very heavy percentage of loss of steamers by fire discloses unsatisfactory attention to duty in the hold or insufficient fire apparatus, or both. For comparison of the relative losses of the merchant shipping of the United States and foreign nations, the most complete figures are those of the Bureau Veritas. They cover only sea-going steamers of over 100 gross tons and sea-going sail vessels of over 50 net tons. The proportion of foreign vessels on the ocean is so great and of American vessels so small that the figures do not clearly disclose the relative security of navigation under various flags and laws. Figures show that American sea-going vessels from 1896 to 1903 have been less liable to accident but more liable to total loss than foreign steamers, while American sea-going sail vessels have been more liable both to accident and loss than foreign sea-going sail vessels.

The losses of both steamers and sail vessels of all nations are due, of course, more to stranding than to any other cause, as it accounts for 47 per cent of the losses of American sea-going steamers and 53 per cent of the losses of American sea-going sail vessels. The losses of foreign steamers are 44 per cent, and the losses of foreign sail vessels 56 per cent. There is a special reason why American vessels are more liable to stranding than the vessels of other nations which conduct the world's deep-sea trade. American vessels are seldom found in mid-ocean on long voyages. Their course is usually along our own coasts in the domestic trade, or in trade with nearby countries. The excellent lighthouse system of the American coast and care in navigation have thus overcome liability to accident from the nature of our trade along the coasts. Collision differs totally from stranding in that, for its prevention, one must look to the navigating officers. The figures show that superior care and intelligence are possessed by the navigating officers of American steamers.

ELECTRICITY IN KOREA AND JAPAN.

Particular attention is called to the development of the electrical industry in Asia by the present war between Russia and Japan, and especially to that part of it which Americans have established. American engineers and capitalists were the pioneers in Korea and Japan in introducing electrical plants for lighting and power production, and even throughout southern Manchuria—the disputed territory that brought on the present war—more American electrical machinery is found than that of any other nation. The effect of the war upon Korea must inevitably prove momentous, and far Eastern representatives of American electrical concerns are anxiously watching the progress of events.

In the event of Japan proving victorious, Korea will undoubtedly become a fertile field for the exploitation of American electrical machinery. Japan, instead of discouraging American manufactures in Korea, would distinctly favor their introduction. It may not be generally known that the largest single electrical plant in Asia was built by an American firm, and that the consulting engineer was a Japanese graduated from the Massachusetts Institute of Technology. This plant is known as the Seoul Electric Company, a Korean organization which holds the property under mortgage. The plant furnishes arc and incandescent lights for the city of Seoul, and operates over twelve miles of overhead trolley railway. Seoul since the establishment of this plant has assumed quite a metropolitan appearance, and in some respects it is a city more progressive than most of the Asian towns. Altogether, some 1,500 incandescent lamps are used to light it, and half as many more arc lights in the streets. The public buildings and private houses and offices have gradually adopted the electric light, and one sees electricity everywhere in the evening. At first the opposition to railways and electric lights was so pronounced that few natives would patronize them, but conditions have rapidly changed for the better under Japanese influences. Certainly in this respect the Japanese have helped the Americans to open Korea in a most satisfactory way. The machinery and equipments of the railway and lighting apparatus are all of American pattern. There are two double-current generators made by a Pittsburg firm and the boilers are of the water-tube type. High-voltage alternating current is used. A direct current of 550 volts is produced by the generators for operating the railway, and the alternating current is employed for the city lighting. The extension of the plant in the past year has been proposed, and but for the war it would have been nearly doubled in capacity. American and Japanese engineers were drawing plans for extending the railway, and for introducing the electric lighting to the suburbs; but nothing will probably be done now until after the war.

Should Japan defeat Russia and hold Korea, the peninsula empire would become one of the most fertile fields for electrical development in the Far East. At Chemulpo there is a smaller electrical plant for lighting and power purposes, and, as the seaport of the capital of the country, this would prove an important field for introducing American electrical machinery. On the southern coast of Korea, Fusan has one or two American electrical plants, and electric railways running from there to Masampo and Tongi along the coast have been proposed. Masampo is the nearest good port that the Japanese can reach, and every effort will be made to develop it and establish direct connections with the lower end of the proposed steam railroad running from Fusan to Seoul.

Telephones are also largely being used in Korea. In the foreign quarters of Seoul a city telephone system has been inaugurated recently, and the natives are gradually making use of it. The Japanese army of occupation, according to recent reports, are extending the service so as to connect all parts of the army with headquarters. In China telephones have been introduced by the German, French, and English residents, and in Korea the American telephone apparatus is almost exclusively used.

Japan is an excellent market for American electrical machinery and instruments, as shown by consular and other reports. Electrical instruments last year were exported to Japan to the value of $26,781, and electrical machinery sent to the little island empire reached a total valuation of $70,592. These amounts may not seem large, but considering the condition of the country last year, and its gradual opening to the influences of American ideas, the exports of electrical goods showed gratifying encouragement. Boilers and machinery that had more or less direct connection with the electrical trade were exported to Japan from this country to something like $175,000 more than that of exclusive electrical apparatus. Orders for American electrical goods for the current year had been placed in this country, dependent upon the outbreak of hostilities.

Japan is a field that will show increasing demand in the next decade for American machinery and electrical apparatus. The Japanese engineers and electrical experts educated in this country are opening the way for a steady demand for our products. If the present war should prove favorable to Japan, an unexampled trade demand for American electrical machinery will follow. Electrical railways will be projected in a dozen different centers of the island empire, and with their special predilection for American goods the Japanese will undoubtedly place most of their orders in this country. We have even built up a good trade in automobiles in that distant land, and a number of American electrical automobiles were shipped to Japan just prior to the war. Copper wire for electrical construction work has become a considerable item of export to Japan, and the figures furnished by our consuls indicate that nearly every line of electrical equipment will receive a new impetus when the war ends. Meanwhile, agents of the large electrical companies are watching the development of events, ready with accustomed American vigor to open a trade campaign in Korea and Japan that will mark a new era in our exports to the Far East.

THE POLAR REGIONS.

National emulation, more particularly since the great success of Nansen, seems to have played the chief rôle in all the recent researches undertaken in the vicinity of the poles.

No fewer than three expeditions were organized in 1902 for the main purpose of reaching the North Pole. Otto Sverdrup, the Norwegian, with Nansen's old ship, the "Fram," started in through Smith Sound; Lieut. Robert E. Peary, of the United States navy, pursued a like course; while Mr. E. B. Baldwin, also an American, selected Franz Josef Land as his point of departure, although Prince Luigi, of Savoy, had only just vainly attempted it.

The expedition led by Capt. Sverdrup was incontestably the most successful, says Dr. Herman Haack in his Geographen Kalender. As early as 1898 his expedition was already under way. He spent the first winter north of Cape Sabine, where, by means of extended sledge journeys, he explored the fiords of Hayes Sound, in the following spring even advancing as far as the west coast of Ellesmereland. Finding the ice conditions no more favorable in 1899 than in the previous summer, he abandoned forthwith his former plan and fixed upon Jones Sound as the starting point for his investigations, in the hope of finding on the west coast of Ellesmereland a better and freer water course to the north than the narrow neck of Smith Sound can afford, which is so easily obstructed by the pack ice from the Pole. Sverdrup met with difficulties also in Jones Sound, for he could push no farther forward than Inglefeld had reached in 1852, and so he took up his second winter quarters at the point where the coast of Ellesmereland seemed to bend northward, under north latitude 76 deg. 29 min. and west longitude 84 deg. 24 min.

The sledge journeys of the fall of that year established the fact that Ellesmereland extended much farther westward than was supposed, and was separated from North Kent only by the Belcher Channel, a small arm of the sea. In the spring of 1900 Sverdrup continued the exploration of the west coast of Ellesmereland, where he discovered a deep fiord, while his assistant, Isachsen, examined a large body of land lying to the west of it. The "Fram" being free from ice in August, the passage through Jones Sound was continued, but the ship was soon fast again in the Belcher Channel near the westernmost point of Ellesmereland, and Sverdrup established his third winter quarters under latitude 76 deg. 48 min. and longitude 89 deg. The fall of 1900 and the spring of 1901 were devoted to sledge journeys.

Sverdrup himself continued his exploration of Ellesmereland, examining anew and more thoroughly the fiord which he discovered the year before, after which he turned northward and succeeded in reaching the most westerly point occupied by him in the spring of 1899 to which he had then proceeded from Smith Sound.

Isachsen proceeded westward and discovered north of North Cornwall two larger islands, exploring their southern coasts till they turned toward the north. Under latitude 79 deg. 30 min. and longitude 106 deg., he reached his farthest western limit, from which point neither to the west nor to the north was any land visible, and from the character of the floating ice it was not probable that any land existed in either direction. In July of that year the north coast of North Devon was explored in boats.

All attempts to get the "Fram" out of the ice having failed, Sverdrup was compelled to pass a fourth winter in 1901-2 in this region, during which other extended sledge journeys were undertaken. Following the west coast of Ellesmereland, Sverdrup attempted to reach 80 deg. 16 min. N., 85 deg. 33 min. W., the farthest point attained by Lieut. Aldrich, of the English Polar Expedition of 1875-76 on the west coast of Grinnell Land coming down from the north. He was not successful, however, though he penetrated as far north as 80 deg. 37 min., which was but a short distance from the goal. Sledge journeys undertaken by other participants in the expedition resulted in the exploration of the west coast of North Devon. In the beginning of August, 1902, when the "Fram" was again free from ice, Sverdrup started immediately upon his homeward way, reaching Stavanger on the 19th of September. The chief result of this expedition was the discovery of large land areas west of Ellesmereland; and since the discovery of Franz Josef Land no such extension of our knowledge of these regions has been signalized.

Lieut. Robert N. Peary, U. S. N., conceived a plan of reaching the North Pole by sledge journeys, accompanied by no one but Esquimaux and his black servant Henson. For this purpose it became necessary to establish, well to the south, a point of departure that could be reached every year by a ship, which should supply fresh provisions and new outfittings, that were to be pushed toward the north and deposited in caches along the coast. The weak point of the scheme lay in the fact that the advance to the farthest points already reached required so much time for so small a sledge crew, that further penetration into the unknown must be undertaken at an advanced season of the year, when the stability of the ice made such a movement questionable. The winter of 1898-99 Peary passed at Etah on the eastern shore of Smith Sound, in order to interest the aborigines in his plan, buy dogs, and perfect other preparations. After his ship, the "Windward," reached him with fresh supplies in the fall of 1899, he was transported to Cape Sabine, which he had fixed upon as the starting point and base of the expedition. Here he passed the winter of 1899-1900. In the spring of 1900 he undertook a sledge journey straight across Ellesmereland, and in the fall of that year established a line of depots toward the north. In the spring of 1901 he made the first energetic move toward the Pole, which led him from Grant Land in the direction of Greenland. He passed the most northern point, 83 deg. 24 min., reached by Lockwood in the Greely expedition of 1882, and fixed, under latitude 83 deg. 39 min., the northern extremity of Greenland. He followed the coast toward the east until it began to bend decidedly to the southeast in the direction of Independence Bay, thus establishing the insular nature of Greenland.

On his return he made a dash for the north and reached 83 deg. 50 min., the highest point thus far attained on the American side of the polar archipelago. During the spring of 1902, Peary even exceeded this. Starting from Cape Hekla, the northernmost point of Grant Land, he proceeded over the ice as far as 84 deg. 17 min., while Capt. Markham in 1876 succeeded only in reaching 83 deg. 20 min. from this side. From the European side, however, Capt. Cagni, of the Italian expedition, starting from Franz Josef Land, attained the advanced position of 86 deg. 34 min.

Peary was obliged to make his dash in April, and, as was the case with Markham, he found the ice in a very unsatisfactory condition; the immense hummocks of compressed drift-ice increased the difficulties of travel for both dogs and men. There were no traces, however, of the unchangeable paleocrystic ice mentioned by Markham, for on the return Peary met with numerous open places and channels which caused serious delays. No land was visible to the north of either Greenland or Grant Land. In spite of the unsuccessful termination of his expedition, Peary is still convinced that the best point of departure is from the American side of the archipelago, and, moreover, that, with an early start from Grant Land, the Pole may be reached by sledge. Though Sverdrup and Peary added to our knowledge of the Polar regions, the third expedition fitted out by Mr. Ziegler, an American, and under the direction of Mr. Baldwin, who started from Franz Josef Land for the Pole, was closed without definite results. Several small islands were discovered; the hut in which Nansen and Johansen lived in 1895-6 was again found; some scientific events were noted; meteorological sketches and photographs of the Northern Lights were made; and yet the finality of the expedition was a fiasco. No earnest attempt to reach the Pole was made. Serious friction between Baldwin and Fridtjof, the sailing master of the expedition, is responsible for the unsuccessful termination.

Among the most important of the Polar expeditions is that led by Baron Toll, a Russian, for the discovery and exploration of the island either existing or supposed to exist to the north of the New Siberian Islands. Having twice before, in 1886 and 1894, visited the northernmost of these islands, Toll left Europe again in 1900 in the steamship "Sarja" upon a similar quest. Upon entering the Sea of Kara, he did not pick up the ship which was bringing him coal, and since both the condition of the ice and the open sea were favorable to his designs, he preferred not to wait for it. Cape Tscheljuskin, the extreme northern point of Asia, and the intended termination of the first summer's journey, was not reached, but the condition of the ice compelled him to put into Colin-Archer haven at the entrance to the Taimyr Straits on September 26, where he passed the winter.

Failing in two attempts to gain the mouth of the Jenissei by crossing the land, Lieut. Kolomeizoff finally reached it by following the coast. During the spring of 1901, the extent of Taimyr Bay was carefully explored upon sleds, and through the discovery of the hut in which Lapten spent the winter of 1840-1, as well as by reaching the most northern station of the Middendorf expedition of 1843, the mouth of the Taimyr River was definitely fixed. The "Sarja" could not proceed till August 25. Cape Tscheljuskin was safely rounded and the course set for the location where, according to Toll's observation in 1886, the distant Polarland, seen as early as 1811 by Sannikow, to the north of Kotelny, ought to be. This point was passed without sighting the supposed land, and a few miles before reaching Cape Emma, the southernmost point on Bennett Island, discovered by the "Jeannette" expedition, the ice became so packed that further progress northward was impossible. On the return voyage the ship cruised again in the vicinity of the supposed Sannikow land, but without sighting it. On September 24, 1901, the "Sarja" froze in at the island of Kotelny in Nerpitscha Bay, where the expedition passed the winter. Whether or not Sannikow and Toll were deceived as to what they saw cannot yet be determined. It is quite possible that they may have miscalculated the distance and that the island may lie farther north in a section not touched even by Nansen's drift in the "Fram" during the long winter night of 1893-4.

Unable to get coal from the Lena River, the "Sarja" became unfit for long journeys; accordingly Toll resolved upon sledge journeys to the north, similar to those undertaken from the "Fram" by Nansen. The geologist Birula began such a journey May 11, intending to explore the largest of the New Siberian Islands. On June 5 Toll followed him, accompanied by the astronomer Seeberg and two Jakuts, but touched only at the northernmost point, Cape Wyssoki, which he left on July 13, crossing the ice for Bennett Island. Toll left Lieut. F. Mattheissen in charge of the "Sarja," but August 21 arrived before any earnest effort could be made to proceed to New Siberia and Bennett Land to bring back the sledge parties. About Kotelny and Faddejew the ice was so thick that these islands could be passed neither to the north nor the south; and since the open season was fast drawing to a close, Mattheissen brought the "Sarja" back to the Lena, where he anchored in the bay of Tiksi September 8. Being too deep of draft to steam up the river, the "Sarja" was abandoned, and the crew, together with the scientific collection and instruments, were transferred to Jakutsk on the small steamer "Lena."

It was expected that Toll and Birula would return to the mainland at the beginning of winter, but Birula returned in 1903, in good health, without having seen Toll. Perhaps the condition of the ice between Bennett Land and New Siberia prevented Toll's return, and it was held that he would attempt it again in the spring of 1903.

CALCIUM CARBIDE AND ITS COMMERCIAL DEVELOPMENT.

The wonderful simplicity of the reaction of water on calcium carbide to produce acetylene gas has doubtless struck almost every student who has had occasion to generate the gas. The important effect which Willson's discovery of electrically producing calcium carbide in commercial quantities will have upon the gas industry of the civilized world, an effect which is due in part at least to this very simplicity of producing the gas, may well be shown by tracing the development of the carbide and acetylene industries in Germany.

There are about eight thousand acetylene installations, of all capacities, in active operation at the present time in that country.

Acetylene is coming into use for driving gas engines; 5.65 cubic feet develop 1 horse-power, for the development of which 21.19 cubic feet of coal-gas are required. The small weight of carbide needed for the production of a given illumination gives acetylene an advantage over other illuminants for colonial and military uses, where the cost of transport forms an important item. The high temperature of 2,700 degrees of the acetylene Bunsen flame renders it valuable for soldering purposes. For miners' and other portable lamps a portable acetylene generator is now largely used. Acetylene is also adopted in factories and other places where colors have to be distinguished and compared by artificial light. Investigations on the Elbe have shown that acetylene is very suitable for lighthouse illumination and for signaling at sea. Carbide containing a high percentage of phosphorus is useful for destroying parasites on vines.

SCIENCE NOTES.

The symbol of the two-headed eagle is considered by some heralds to be merely the result of the heraldic practice of "dimidiation," which crept into English heraldry during the reign of Edward I. Dimidiation was simply a child's way of impaling two coats-of-arms on the same shield by the primitive method of cutting each in half and taking the dexter half of one and the sinister half of the other and placing them back to back, as it were. Strange two-headed beasts naturally resulted, as, for instance, when a lion and an eagle were halved and joined together, and the griffin is supposed to have been evolved from two lions rampant by dimidiation. It robs the two-headed eagle of half its terrors to know that it owes its origin to this sort of child's play. The gryphon and mock turtle that went out to sea with the whiting are far more serious creations.

Dr. Jules Rehns, of Paris, has been carrying out several experiments to ascertain the precise effects of radium burning upon the skin. If the rays of one-sixteen-hundredth part of an ounce of radium bromide are applied no pain is experienced, nor is there any mark left at the time of application, but twenty-four hours later a red mark appears, remains for a fortnight, fades, and leaves behind a scar similar to that of a burn. If the application be continued for ten minutes instead of five, the mark becomes visible in eighteen hours. Ulceration does not occur unless the radium has been applied for at least an hour. If the spot thus caused is treated medically, suppuration may be prevented and the wound cured in six weeks or two months. But if it is not attended to, it gathers, becomes painful, and lasts an indefinite period. Some of these wounds or burns, caused three months ago by one hour's application of radium, still show no signs of healing. Moles can be destroyed by applying the radium for ten minutes.

Glass is known to be blackened under the influence of radium rays, the same phenomenon being observed in the case of quartz. The coloration produced by radium will disappear, not only under the influence of heat, but at ordinary temperatures as well. N. Georgiewski, in a paper recently presented to the Russian Physico-Chemical Society, has investigated by a photometric method the absorption of glasses and of quartz colored by radium rays, as well as its diminution in coloration with time, this diminution being represented by a logarithmic curve. The author describes his experiments made on quartz, mica, gypsum, and other bodies, showing the alteration of the optical properties of these materials, as occurring under the influence of radium rays. Mica, being placed between crossed Nicol prisms, shows an alteration in the chromatic polarization in the portion which formerly was exposed to the action of radium rays, this alteration disappearing as soon as the specimen is heated. Gypsum and fluorspar, while showing the same alterations of the optical properties, are not blackened under the influence of radium rays.

In order to show the diffusion of the emanation from radium bromide, a long tube was used, the internal surface of which was coated with a layer of sidoblende (zinc sulphide). On connecting the apparatus with a test tube containing a solution of radium bromide, a luminescence was found to appear and to be propagated throughout the tube. On repeating Ramsay's experiments, Th. Indricson (see paper read before the Russian Physico-Chem. Society) found the yellow helium line not to coincide with the yellow line of the spectrum given by the emanation, but to lie between the two yellow lines of the emanation. If the coil of pipe communicating with the tube was dipped into liquefied air, a strengthening of the lines corresponding to the helium line was noted in the spectrum of the emanation; while between the two yellow lines above referred to, a third line coinciding with the yellow line of helium would appear. The lines of helium do not exist in the spectrum given by the emanation of a freshly-prepared tube, but appear only afterward. On observing the gases set free on the dissolution of radium bromide, it was observed that the helium lines did not appear as long as the spectrum tube preserved its phosphorescence in the dark. After four days, this phosphorescence would disappear, while the lines of helium were noted in the spectrum.

A pipe line 280 miles long, built for the purpose of conveying oil from the Kern River district to a shipping point on San Francisco Bay, was recently completed and opened for service, when a very unexpected difficulty was encountered. The oil is so heavy that it moved through the pipe at a sluggish rate of speed, which makes this method of transporting the oil impracticable unless some improvement in the process can be devised. The oil was five days traveling the first thirty-seven miles, when it was decided to abandon the work. It has been decided to make the experiment of heating the oil to a point of about 120 degrees, and at the same time the number of pumping stations will be greatly increased.