or cut out certain portions of color, causing red or blue to predominate as the case may be, and thereby in their various gradations cause a harmonious and pleasing intermingling of colors, photographically recorded, which reproduces an image in the natural colors of nature.

One of our engravings shows another modified form more simple, non-stereoscopic, which gives a smaller though equally as perfect a color reproduction of the step-Kromskop, and is called the miniature Kromskop.

In this case the kromogram is made up of the three color record pictures on one plate, as will be seen at the right end of the picture, where one end of the transparency projects upward.

To avoid distortion in viewing these images at an angle of 45°, Mr. Ives devised a special correcting combination, consisting of a prismatic lens and a prism, observed in the center of the diagonally placed board, and just below the view aperture. One side of the instrument forms a hinged door, so that access can be had to the interior.

R, *B*, *G*, are the three color screens respectively red, blue and green, in front of which the kromogram is placed. The light passes through the kromogram images and the color screens in the direction of the dotted lines, *R*, *B*, *G*, the green being reflected by the silvered mirror, marked *P*, and the other colors by the transparent colored glass mirrors, *G* and *B*, along one line, through the prismatic lens on diagonal board, and the prism fixed just below the eye aperture.

From a personal examination of these color record transparencies in the two viewing instruments just described, we have been more than satisfied with the remarkable natural blending of colors that were produced and were particularly interested in the quick, simple, yet scientific way in which all the adjustments and results are obtained.

Mr. Ives has constructed a color-projecting attachment for lanterns which is very effective and accurate in its adjustments. This we shall hope to describe at another time.

In the correct optical rendering of photographic pictures in the colors of nature, the Kromskop certainly can be compared in its effectiveness and importance to the phonograph as a reproducer of sound, or to the kinetoscope in the reproduction of motion.

A commercial use suggested for this instrument is that colored articles such as rugs, carpeting, and china, and other kinds of merchandise, can be presented in their original coloring to the prospective purchaser, and thus save the expense of transportation and display of actual samples by the manufacturer.

We are informed that Mr. Ives is regarded as being the first to invent and protect by patents the only practical photo-chromoscopic apparatus that has been placed on public sale, and that several medals have been awarded to him by important scientific societies at home and abroad.

THE UPBUILDING OF THE AMERICAN MERCHANT MARINE.

The public has heard a great deal recently about the revival of American shipbuilding, particularly as regards that branch of it which is devoted to deep-sea navigation, and we now take pleasure in presenting illustrations of a fleet of a dozen American freight and passenger steamers which are being constructed on the Delaware and the Clyde. Eight of these vessels are upon the stocks at the yard of the William Cramp & Sons Ship and Engine Building Co., Philadelphia, while the other four are building at the shipyard of the Clydebank Engineering and Shipbuilding Co., Glasgow. By far the most important of these boats are four large steamers of 12,000 tons measurement and 17 knots speed which are being constructed for the Red Star Line service between New York and Antwerp; two of which, the "Vaterland" and "Zeeland," are being built by the Cramps, and the other pair by the Glasgow firm above mentioned. The boats will take rank among the largest afloat. They are 560 feet long, 60 feet wide, and 42 feet deep. They are, of course, fitted with twin screws, and the twin engines in the case of the "Vaterland" and "Zeeland" will be of the quadruple expansion type, and in the case of the other two boats, of the triple expansion type. The maximum indicated horse power will be 10,000. There will be accommodations for 300 first cabin, 250 second cabin and 750 steerage passengers. The cabin passengers, both of the first class and second class, will be carried in the bridge deck house amidships, and the majority of the rooms will be deck cabins. There will be a certain number of first cabin suites, each of which will include a sitting-room, a bedroom, and a bathroom. On the promenade deck, which will be of the generous proportions which are found on recent ships of this type, will be a large library and a smoking-room, while the first-class dining salon, which is situated amidships on the upper deck, will be large enough to accommodate all the passengers at one sitting.

The second cabin accommodations will be amidships, chiefly in the deck house, so that most of these rooms, also, will be deck cabins. The dining salon will have the added attraction that comes from being placed near the center instead of, as is usually the case, at the stern of the vessel. A feature of these ships which is worthy of particular note is the successful attempt which has been made to render life in the steerage more comfortable. The accommodations consist largely of two, four and six-berth rooms, all of which are well lighted and ventilated, while ample lavatory accommodations have been provided. A distinctly modern innovation is the provision of a large social hall.

From the above description it will be seen that these fine ships hold a position midway between the modern ocean greyhound and the modern cargo and passenger ship of 14 and 15 knots speed. They will make the trip from New York to Antwerp in eight days, steaming about 17 knots an hour. The International Navigation Company, or the American Line, as it is more popularly known, for whom these ships have been built, is also having two steamers of similar design and speed, but of 10,000-ton measurement, constructed at Glasgow for the Philadelphia-Liverpool service.

The New York and Cuba Mail Steamship Company has under construction at the Cramp's yard three freight and passenger steamships which are to carry cattle, fruit and merchandise between New York and Cuba. They will be ranked as second-class vessels under the Subsidy Act of March, 1891. The vessels, whose general appearance is shown in the drawing on the front page of this issue, will contain three decks, in addition to hurricane and shelter decks. They will be built of steel with the usual cellular bottom and watertight compartments, and will be provided with bilge keels to give steadiness in a sea-way. It will be noticed from the illustration, they will have a high freeboard, a feature which will conduce greatly to good sea-going qualities and general comfort. One of these vessels, the "Morro Castle," will be of 6,000 tons measurements, 400 feet in length, 50 feet in width and 36½ feet in depth. On a draught of 20 feet she will have a deadweight capacity of 3,400 tons of freight and 800 tons of bunker coal. She will be driven by two four-cylinder triple-expansion surface-condensing engines with a combined horse power of 8,000. With this maximum indication the engines will run at 100 revolutions per minute, when the boiler pressure is 170 pounds to the square inch. The sea speed will be about 18 knots per hour. Two others are being built which will be of 4,500 tons gross measurement. They will be 341 feet long, 47½ feet wide, with a depth of hold of 36 feet. The draught will be 30 feet on a deadweight carrying capacity of 3,000 tons of freight, and 360 tons of bunker cool. The twin three-cylinder triple-expansion engines will indicate 5,000 horse power at 97 revolutions per minute, when the boiler pressure is 160 pounds to the square inch. The largest of these three ships will accommodate 150 first, 85 second and 100 steerage passengers, while the two sister ships of 4,000 tons measurement will accommodate 125 first, 85 second and 100 steerage passengers. The speed of these three vessels will be about 17 knots per hour, as against a speed of 18 knots per hour for the "Morro Castle."

The Oceanic Steamship Company, which, for many years has maintained a service between San Francisco and Sydney, N.S.W., calling at Honolulu, at our newly acquired island of Tutuela and at Auckland, New Zealand, is having three handsome vessels constructed at the Cramp's yard, and these, like those above mentioned, are steel veseels, of first-class construction with double bottom, bilge keels and extensive subdivision by watertight bulkheads. The new boats are 400 feet in length, 50 feet in width and on a draught of 23 feet have a gross measurement of 6,000 tons. The twin-screw, triple-expansion engine will indicate 7,500 horse power and drive the vessels at an average sea speed of 17 knots an hour. The ships are specially designed for the requirements of the long trip across the Pacific Ocean, the larger part of which lies within the tropics. They are distinguished by the large port-holes and abundant means of ventilation which have earned for the old "Alameda" and "Mariposa," of this company, a well-deserved reputation. Because of the great distance between coaling stations on this run, the ships are to be provided with the liberal bunker capacity of 2,000 tons.

Although the American merchant marine has a long road to travel before it reaches the proud position which it once held, the fine fleet of vessels depicted in our front-page engraving is cause for justifiable pride, and without indulging in over-sanguine expectations we may look upon it as an earnest of a great revival of deep-sea shipbuilding in this country.

The Latest Work of the Palestine Exploration Fund.

The Turkish government has granted the Palestine Exploration Fund a firman to excavate over an area of ten square kilometers, and the region marked out for the operations is on the borders of Shephelah, or old country. It was found that three promising sites for excavation, viz.: Tell Judeideh, Tell Zakariya, and Tell-es-Safi, could be brought within the limits of the permit. On October 26, 1898, work was begun at Tell Zakariya by Dr. Bliss and Mr. Macalister. It is a hill rising abruptly 350 feet above the Vale of Elah, and is 1,050 feet long and 450 feet broad. Dr. Bliss found on the top of the hill the walls of a fortress, to which six towers had been added at a later date. A large part of the area enclosed by the walls has been excavated down to the rock. It has been proved that the fortress has been built after a considerable amount of débris had accumulated on the mound, possibly in the Jewish period. The fortress was simply an enclosure for protecting houses within, and the datable objects range from pre-Israelite to late Jewish times, with a small proportion of later objects. It appears to be probable that the place was inhabited when Joshua conquered the land; that it was fortified in Jewish times; that it was occupied until a later Jewish period, and that during the Roman period there was a brief occupation, after which it appears to have been deserted. Interesting potsherds have been discovered. Tell-es-Safi gives great promise and it is likely that it represents the Biblical Gath.

Automobile News.

It has been suggested that automobiles be named in the same way as a yacht.

An exhibition of motor carriages under the auspices of the Austrian Automobile Club will open at Vienna on May 31 and will continue until June 10.

There seems to be an excellent opening for the sale of motor cars in Spain. In many of the provinces there is not a very extensive railroad communication and there seems to be an excellent prospect for the introduction of motor car, passenger and goods services between many places in the provinces of Spain.

In a new automobile which has been designed for doctors' use, the doctor is his own driver. He sits inside and obtains an uninterrupted view through large glass windows on all sides, the steering and manipulating devices being readily accessible from his seat. Inside the body is also a space for instrument cases and other necessary articles carried by a doctor. There is a headlight, reading light and side lights. The vehicle is an electric one.

Gottlieb Daimler, the inventor of the Daimler motor, died in Germany a short time ago. He became associated with Dr. Otto some thirty years ago, and in their little workshop at Deutz, the Otto gas engine was constructed. Herr Daimler finally started in business for himself and undertook the production of an engine using gas made from petroleum. According to The Automobile the first attempt to construct an automobile at the Daimler works was about fourteen years ago.

A series of eighteen questions has been prepared for the examination of Chicago automobile operatives. Regular examinations are required and the police are instructed to see that the ordinance is inforced. Good eyesight, sound hearing and a stable nervous system are required. The questions relate largely to the special type of vehicle which is to be used, also questions relating to the responsibility of operating a vehicle on the public streets, whether the operator has ever had any accidents or not, etc. The rules and regulations seem to be thoroughly common-sense and ought not to be objected to by anyone. Nothing will hurt the automobile industry more than a series of accidents.

At the recent German military maneuvers, four-wheeled automobiles containing an officer and driver were used, for the most part, for the speedy conveyance of the elderly staff officers, and some of them ran at a speed as great as 30 or 40 miles an hour. In the Franco-Prussian war a hard day's march of twenty-four hours for transport wagons was 50 miles. At the end of each march, the horses were useless. In the recent maneuvers motor wagons traveled at the rate of 7 miles an hour, and a day's work of ten hours was 70 miles. War authorities consider that the day is not far distant when train horses will be replaced to a considerable extent by petroleum motors. The Kaiser takes the greatest interest in this new development, and a number of officers have been set apart to study motors and impart instructions to their subordinates.

A bill was passed by the Wisconsin State Legislature on March 5, 1875, which virtually offers a prize of $10,000 for an invention. The Motor Vehicle Review recently investigated the law, which was found on the statute books. The first section of the law enacts that the sum of $10,000 shall be paid to any citizen of Wisconsin who shall invent and, after five years continuous trial and use, shall produce a machine propelled by steam or other motive agent which shall be a cheap and practical substitute for use in place of horses and other animals on the highway and farm. Any machine entering for the prize must perform a journey of at least 200 miles on the common roads of the State, on the continuous line north and south, propelled by its own power at an average rate of at least 5 miles per hour working time. The other sections provide that the vehicle must be of such construction and width as to conform with or run in the ordinary track of the common wagon or buggy and be able to run backward or turn out to accommodate other vehicles. It must also be able to ascend and descend a grade of 200 feet for a mile.

Science Notes.

The scientific results of the Norwegian Polar expedition will soon be published. It will edited by Dr. Nansen.

Miss Catherine Wolfe Bruce who gave most generously for the advancement of astronomical science, died a short time ago.

The Glasgow International Exhibition opens May, 1901, and application for space must be made not later than June 1, of the present year.

Prof. Alphonse Milne-Edwards, the distinguished French naturalist and Director of the Museum of Natural History of Paris, died suddenly April 21, in his sixty-fifth year.

Color photography will, doubtless, in time be of great use for reproducing the medical and surgical aspects of disease. Mr. Ives has experimented upon this subject with his "Kromskop." It is easy to see its usefulness for lecturing and teaching purposes.

The American Geographical Society will no longer hold its public meetings in Chickering Hall, New York, as the building is soon to be removed to give room for another structure. For nearly a quarter of a century the society has had the most celebrated explorers and traveler in the world to address them. The society will soon begin the erection of a fine building on Eighty-first Street, near the Museum of Natural History.

A volcanic eruption has occurred at the southeastern extremity of the island of Luzon. There are several extinct volcanoes in this province, but Mayon has always been more or less active. The eruption took place on March 1 about 2:30 in the afternoon. Large stones were hurled up, and finally streams of red hot lava could be seen coursing down the mountain side, and one of them apparently reached the sea some 6 miles away. On March 4 the eruption seemed to be practically over, but steam was still rising from the hot lava and the mountain was obscured with smoke.

San Francisco has had quite an epidemic of fish poisoning. Oysters have been a frequent cause of ptomaine poisoning. Most of the oysters consumed are obtained from beds situated in or about San Francisco Bay, the waters of which, says The Pacific Medical Journal, are never thoroughly changed. There is considerable tide, but the stagnant water from the sewage of surrounding towns flows into bay. The oyster, as well as the lobster, crab and shrimp, are natural scavengers, and they should be raised or gathered only in waters having no sewage pollution, and waters having free access to the ocean.

The engineers and workmen on the Jungfrau Railway, who are obliged to remain a considerable time at an altitude of about 10,000 feet above the sea level, are apt to develop a disagreeable complaint. After eight or ten days they are seized with violent pains in several teeth on one side of the jaw, the gums and cheek on the same side becoming swollen. The teeth are very sensitive to pressure, so that it is painful to eat. These symptoms increase in severity for three days and then gradually disappear. All newcomers appear to suffer from the same complaint and they do not have any recurrence of the trouble.

The London County Council has passed some by-laws which are interesting. One of them forbids the use of flash or searchlights for advertising purposes. By flashlight is meant a light used for the purpose of illuminating or exhibiting words, signs, etc., which alters suddenly in intensity, color or direction, and by searchlight is meant every light exceeding 500 candle power, whether in one lamp or lantern, or a series of lamps or lanterns used together and projected as one concentrated light, altering either in intensity, color or direction. The fine for every such offense is not to exceed five pounds sterling. Recommendations have also been passed requiring a sufficient support for every person standing on window-sills for the purpose of cleaning windows at all heights above 6 feet from the ground. Another by-law stops street shouting, and in a short time London will probably be the best regulated city in the world as regards street nuisances.

At the meeting of the Department of Superintendents of the National Educational Association, at Chattanooga, Tennessee, in 1898, a committee was appointed to propose a plan for prosecuting a scientific inquiry for the determination of the factors involved in the proper seating, lighting and ventilating of school buildings. This committee made a report and the council appointed a committee and $2,100 was appropriated for prizes. For the best essays submitted on each of the following topics a prize of $200 will be given: The seating, lighting, heating and ventilating of school buildings, and for the second best essay submitted on each topic, $100 will be offered. Each essay will be limited to 10,000 words, and must be printed or typewritten, must not be signed, but the name of the author must be enclosed with it in a sealed envelope, and not mailed later than February 1, 1901, to A. R. Taylor, Chairman of the Committee, **Emporia, Kansas.**

Engineering Notes.

The Pennsylvania Railroad Company is experimenting with nickel steel rails.

On a branch of the Northern Pacific Railway submerged water tanks are used, means being provided for forcing the water out of the well with the aid of steam from the boiler.

There are thirty-three jute mills in India, employing 94,540 persons. The mills contain 13,371 looms and over 278,000 spindles. Nearly all of the mills are in the neighborhood of Calcutta.

A British steamer is now being loaded at Sparrow's Point to sail for Vladivostock and will carry the largest cargo of steel rails ever taken from an American port by one vessel. The shipment will amount to 8,700 tons.

The importation of calcium carbide into Servia has been forbidden on the ground that acetylene would diminish the value of the government petroleum monopoly. It seems as though the same result could have been obtained by levying a heavy import duty.

The largest smokestacks which have ever been manufactured in the United States are now being built by the St. Louis Transport Company. They will be 70 feet in circumference at the base and gradually taper to 40 feet in circumference at the top. They will be 200 feet high and will cost about $20,000 apiece.

The French authorities have recently built a new armored train. The locomotive is encased by a conical hood which developes into the cylindrical envelope with which the cars are covered. At the ends of the cars the armor overlaps so as to give a rather serpentine appearance to the train as it winds around a curve.

There is to be a cordite factory built in India. Electricity will be used for motive and lighting purposes. The bulk of the cordite used in India has been heretofore imported, and the government factory at Waltham Abbey in England cannot supply it in sufficient quantities, so that orders have to be placed with private firms.

The question of the right to use a bicycle on railway tracks has just come up for decision. A Minnesota man devised an adaptation of a bicycle enabling its use after the manner of the regular railroad tricycle. The question of the right of the railway company to prohibit the use of such machines is involved. In making answer to the inquiry the Commission took the ground that the use of such a machine was in the nature of placing an obstruction upon the tracks of the railroad company and, therefore, says The Railway Review, is expressly prohibited by law.

The Fountaine Marchand in Paris is to be demolished in a short time. There are now no fewer than eleven fountains in Paris at which water is sold by the bucketful, the price being one centime, In 1860 the amount received from this source was 700,000 francs, says The British Architect, but in 1882 it shrunk to 40,000 francs. Now, however, the guardians of the fountains probably sell a bucketful of water a month each. Their office, however, is maintained as a comfortable sinecure for superannuated servants of the water company who receive $100 a year and gratuitous lodgings.

The problem of transportation across crowded waterways is modified by local conditions, among which one of the most important is the amount of rise and fall of the tide. Methods that are practicable for a small range of tide, are impracticable when the variation is extreme. Thus, the ferry floating pontoon landing system universally in use at New Yorkis impracticable in such a place as St. Malo, France, where the daily variation of 40 feet is overcome by an elevated platform traveling on rails laid at the bottom of the harbor. Again, the medium rise and fall of 14 feet at Glasgow was overcome by Wm. Simons & Company, of Renfrew, by the construction of the curious elevating platform ferry, illustrations of which were given in the SCIENTIFIC AMERICAN of April 7, 1900.

It is ordinarily rather difficult to sample pig iron, but a simple and effective device for doing this work has been presented at a meeting of the American Institute of Mining Engineers. It consists of an ordinary plumber's gas T, over the leg of which is snugly fitted a small tin cup to catch the drillings which are made by a breast drill with a ¼-inch twist-bit working in the arm of the T. The forward arm of the T is filed down to a blunt edge, over which is stretched a short piece of rubber tubing projecting a little beyond the end. The bottom of the inside of the front arm of the T is filed down at an angle to facilitate the passage of drillings into the cup. The rear arm of the T is fitted with a tin ring, which holds in place a stiff spiral spring which presses the tool firmly against the metal being drilled. The other end of the spring is supported against a shoulder of the breast drill. The projecting rubber prevents the loss of any drillings and prevents the filling in of sand. A number of pigs can be sampled by making small holes; thus the average can be obtained.

Electrical Notes.

The Chicago Electric Traction Company will possibly abandon the storage battery system for the overhead trolley. The former system has proved successful on single lines.

A similar system could undoubtedly be used to great advantage in libraries and in many places where light weights have to be transported a long distance at a high rate of speed.

The Manhattan Elevated Railway Company, of New York, is considering a plan for providing its stations with inclined stairways. Such elevating means would have a capacity of 3,000 persons per hour. The stairways will be run on the endless chain principle, and will be actuated by electricity.

The Street Railway Company, in Norfolk, has complied with an act recently passed by the Legislature to provide separate cars for colored people. The company which has done this is the first street railway company to observe the law. By this arrangement the colored people are carried in trolley cars.

An electrically-driven saw has been found to be of great use in surgery. The shaft upon which it runs is connected with a motor by a flexible spiral coil enclosed in a braided sheath. The machine has been extensively used in the larger hospitals, and operations that have been usually fatal with the old hand-saw, have been very successful with the new ones.

Nearly all of the jute mills in India are now lighted with electric lights. It was found that the working people could work overtime under much better conditions with increased pay in the electric-lighted mill; the consequence was that the workmen flocked to the well-lighted mills so that those mills, which opposed the introduction of electric light were forced to provide it.

An electrical telpherage system has been used with satisfaction in the offices of a German insurance company. A box for the purpose of carrying papers is suspended from the car and the whole affair is driven by a one-tenth horse power motor. The current is taken off from a bare copper wire by a trolley wheel, and the return current goes through the wheels and rails. A car can be ran from 3 to 5 feet per second, and as the ends of the track do not form a part of the circuit, the speed of the car is decreased when it reaches the end.

The International Tramways and Light Railways Exhibition which will be held in London, June 2 to July 4 of the present year, offers two prizes; one of $125 for the best device for securing a dry seat on the top of tram cars and omnibuses in all conditions of weather, and the other a prize of $125 for the most practical and efficient life-saving guard or fender for street railway cars. The competitors must offer a full-sized model and pay a nominal fee. Applications are to be sent to The Tramway and Railway World, London, not later than June 1.

Liebenow considers that no attempts in the direction of making dry secondary cells are likely to be successful. Investigations into the action of the secondary cells have shown that there are electrical concentration currents set up, which tend to convey the acid in the pores of the plates from points of maximum to points of minimum concentration. These currents are necessary to equalize the strength of the acid, and effect this far more rapidly than would be done by diffusion acting alone. When a gelatinous electrolyte, or a dry non-conducting powder is introduced between the plates, this equalization is prevented and the cell is soon exhausted.

The Shawinigan Falls will be utilized for the purpose of generating electricity, which will be transmitted to Montreal for use. The works consists of a canal, flumes, etc., which will develop 30,000 horse power, and this amount can be increased if necessary. The current will be delivered to manufacturing establishments at Shawinigan Falls during the coming summer. The power will not be transmitted to Montreal until the spring of 1901. The transmission line will be a little less than 80 miles in length and will run along the Great Northern Railway, which is now being completed. At first 5,000 horse power will be delivered in Montreal and this amount will be increased to meet the demand.

M. Marcel Delmas, 10 Boulevard Emile Augier, Paris-Passy, has charge of the report of the "Congres de Mecanique de l'Exposition Universelle," in the department of applications of electricity to the various apparatus of haulage, hoisting, etc. (including cranes, elevators, winches, swing-bridges, pumps and other such mechanisms), and particularly desires information regarding the economic side of the matter. He requests that all, whether intending exhibitors or others, who are willing to assist in the collection of this data, send him, at the address given above, statements of costs of installations, of exploitation and incidental expenses; especially where a comparison can be made with costs of the older systems under similar circumstances. All publications, and illustrations will be welcome, if authentic and exact in statements of facts and **data.**

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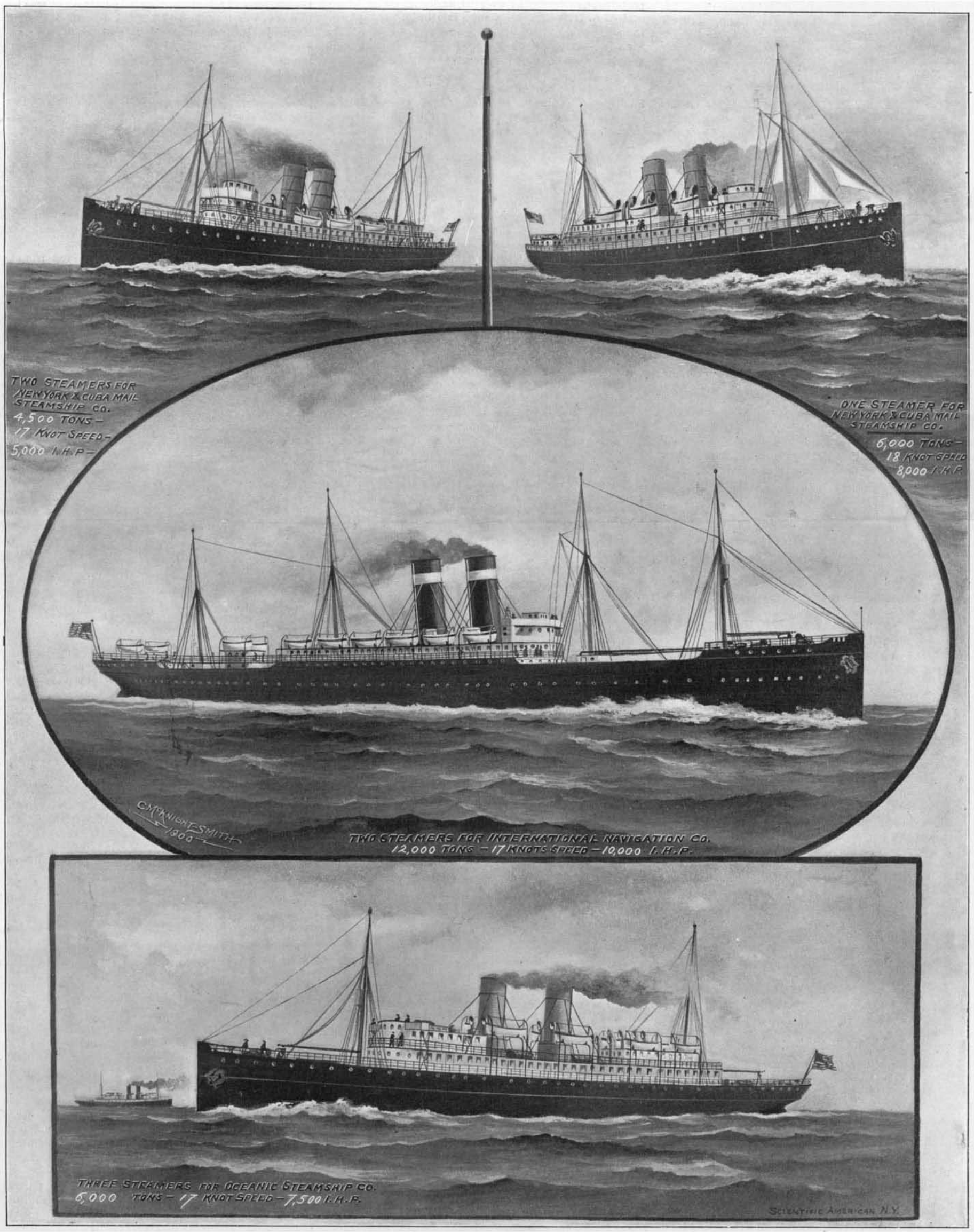

REVIVAL OF THE AMERICAN MERCHANT MARINE—GROUP OF VESSELS NOW UNDER CONSTRUCTION AT THE CRAMP'S SHIPYARD, PHILADELPHIA.—[See p. 278.]