

Francisco—the leading shipbuilding plant on the Pacific coast—has borne fruit; and the firm is to build a craft for the imperial Japanese government in substantial token of the impression made in the East by the Charleston and the Olympia, the fabrications of that yard. An order for a duplicate vessel was placed at the same time with William Cramp & Sons, of Philadelphia.

The new vessel, designated by the Japanese as a second class, unarmored, protected cruiser, is unlike any vessel in our service; and is modeled after several swift cruisers of English build constructed for other nations, the best of which boats is the Japanese Yoshino, which took a very active part in the late Chino-Japanese war, and during her wide service proved herself an exceptionally effective craft.

The cruiser to be built by the Union Iron Works is an enlarged and bettered Yoshino; and it is no small credit to the Pacific yard that it is willing to trust its standing upon the development of lines peculiarly English and to start afresh where the patient practice of its rival has halted.

The new ship will have a load water line length of 396 feet; an extreme beam of 49 feet; and upon a normal displacement of 4,760 tons will draw 17 feet 7½ inches of water.

There will be twin screws, each screw being driven by a triple expansion engine. These engines, which are in separate compartments, are of the four cylinder type; and each will have a high pressure cylinder of 40 inches, an intermediate pressure cylinder of 60 inches, and two low pressure cylinders of 66 inches in diameter. The common stroke is three feet, and when they work at their maximum power the engines will develop 15,000 indicated horse power, and will induce a speed of quite 22½ knots an hour. The probability is that this speed will be exceeded.

Steam will be supplied by four double-ended and four single-ended boilers, in four separate watertight compartments; and forced draught will be induced by large blowers exhausting directly into the closed fire rooms. The normal coal supply will be 350 tons, but the bunker capacity will be for 1,000 tons; and upon this liberal allowance the vessel will have an exceptionally wide radius of action. The coal will be stowed abreast the boilers and the engines for the sake of added protection; and to lessen the tax of handling, it will be arranged to fall right in upon the fire room floors.

There is a double bottom from stem to stern, and a cellular form of structure prevails along the water line region. This arrangement, in conjunction with the disposition of coal, and a protective deck, 4½ inches thick on the slopes and 1¾ inches thick on the flat portion, extending from bow to stern and generally about the level of the water line, offers excellent protection against high explosive shell fire, and guarantees shelter for the vitals and the preservation of stability.

The Japanese know only too well the danger of conflagration in action and its vital menace to efficiency, and with a view to protection, every bit of woodwork will be fireproofed. The ship will be lighted by electricity and ventilated by natural and artificial means; and comfortable and healthful accommodations are planned for the complement of 405 persons.

The armament will consist, in the main battery, of two 8 inch quick-firing rifles and ten 4.7 inch quick-firing rifles, and, in the secondary battery, of twelve 12 pounders and six 2½ pounders. The 8 inch guns are mounted one on the forecabin and one on the poop deck, and each will have an arc of fire of 270°. These guns are protected by steel shields, and, in their rapid-fire mechanisms, are beautiful evidences of skill. Each projectile weighs 210 pounds, and a speed of fire of four aimed shots in sixty-four seconds has been attained by a well trained crew. While our own 8 inch guns fire a shell of 250 pounds, our best practice has been one shot in a minute and a half. The 4.7 inch guns are mounted on the main deck, in 3 inch armored sponsons, and are further protected by shields. The forward and aft 4.7 inch guns fire dead ahead and dead astern, respectively, and have a total arc of fire, each, of 130°. The rest of these guns, in broadside, have a radius of fire of about 100°.

The 12 pounder guns are mounted on the main deck amidships and one at the bow and one at the stern, on each side, in sponsons. These guns likewise have effective arcs of fire. The 2½ pounders are carried on the hammock berthing and in the military tops.

The whole armament is capable of great rapidity of fire, and all the guns will be manufactured by the celebrated Armstrong firm, of Newcastle, England. The ammunition for the heavier guns is raised by electrical hoists, while that for the secondary battery will be raised by hand. There are five torpedo tubes, one in the stem and two on each broadside, for the discharge of 14 inch Whitehead torpedoes.

The new ship will have the characteristic handiness of maneuvering common to the Yoshino and her type, and will form, with her sister ship, a valuable addition to the new Japanese navy.

We are indebted to the Union Iron Works, of San Francisco, for plans and particulars.

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PROPOSED BRIDGE ACROSS THE ST. LAWRENCE AT QUEBEC.

We have received from Mr. Charles Baillairge a sketch of a design which was made by him some forty years ago, for a proposed trussed railway suspension bridge across the St. Lawrence River, opposite Quebec. Our correspondent points out that the question of a bridge of this kind at Quebec is by no means a new one, and that this design, which we now have before us, was submitted as being the best solution of the problem of conveying the railroad and highway traffic across the river. Attention is called to the fact that this sketch of over forty years ago embodies the best features of modern practice for long span railway bridges. The distance across the river, opposite Dufferin Terrace, from cliff to cliff, is 4,800 feet, and this was to be spanned by three 1,200 foot river spans and two 600 foot shore spans. The bridge was to have been built on the trussed suspension system and was to have a double deck, the lower deck being used for railroad traffic and the upper deck for highway and pedestrian traffic. The foundations were to have been carried down more than 150 feet below high water, the piers being built of solid first-class masonry up to the level of the lower floor or deck of the bridge.

The plan view shows an arrangement of five cables. The center cable was to hang in a vertical plane, the four outer cables being considerably "cradled." Mr. Baillairge points out that this old design is quite applicable in its broad features to the conditions of modern bridge building, and that it would merely be necessary to make such changes in the details as would be called for by modern developments in the manufacture of steel and general bridge material. It is pointed out that the deep foundations could be constructed on the principle of the Hawkesbury River piers erected a few years ago in Australia by the Union Bridge Company, of New York, in which some of the piers were carried down through mud and sand to a depth of 180 feet.

THE NEW RULES OF PRACTICE OF THE PATENT OFFICE ABROGATED.

The revised rules of practice of the Patent Office, which were promulgated by the late Commissioner of Patents, were abrogated Saturday, June 19, by Secretary Bliss on the recommendation of Commissioner Butterworth, and the original rules of practice, which were in force April 1, 1892, have been reinstated. The original rules referred to numbered in all two hundred and twenty-nine, and they were condensed by the late Commissioner to eighty-eight.

In abrogating the revised rules of his predecessor, Mr. Butterworth has incorporated several amendments bearing upon the practice of the Patent Office. Of these, rule 17 reads as follows:

"An applicant or assignee of an entire interest may prosecute his own case, but he is advised, unless familiar with such matters, to employ a patent attorney, as the value of a patent depends largely upon the skillful preparation of the specification or claims.

"An applicant may be represented by

"(a) Any person who, at the date of approval of this rule, is in good standing as a practitioner before the Patent Office.

"(b) Any attorney-at-law in good standing in any court of record in the United States or in any of the States or Territories thereof.

"(c) Any person of good moral character who shall show to the satisfaction of the Commissioner of Patents that he is duly qualified to act as attorney in the prosecution of cases before the office."

THE FATIGUE OF METALS.

An investigation of the fracture of a steel rail on the Great Northern Railway, in England, has brought out some interesting facts bearing upon the question of the fatigue of metals. On the occasion in question a Bessemer steel rail, which had been in use for about twenty-two years, broke into nearly a score of pieces beneath the wheels of a Great Northern express train, causing a serious wreck. An examination was carried out by Mr. Thomas Andrews, M. Inst. C.E., and in a paper on microscopic observation on the deterioration by fatigue in steel rails, he gives some very interesting particulars regarding the appearance of the broken fragments of the rail. The composition of the rail was as follows: Carbon 0.53 per cent, silicon 0.12 per cent, phosphorus 0.08 per cent, sulphur 0.09 per cent. The microscopic examination revealed a large number of fine hair cracks, and Mr. Andrews concludes that the continual hammering of the wheels had developed these minute fractures throughout the body of the metal and produced the remarkable simultaneous failure which occurred at many points of the rail. The occurrence of such hair-like cracks in manufactured steel is not uncommon, and just what it is that causes them is an open question. It is possible they occur in the process of rolling, and that in the case of steel rails they are to be traced to this origin more than to the severe concussion of the traffic which passes over them. This supposition is borne out by the fact that such cracks are to be found in the newly finished output of the mills,

and if they are to be prevented, the cure will have to be found in the process of manufacture. The fatigue of metal is a pretty theory, and one which was largely accepted a few years ago. To-day, however, it is believed that such fatigue does not take place, except, perhaps, in cases where the metal is subjected to very violent and long-continued strains.

**MUNICIPAL GOVERNMENT WITHOUT TAXATION.**

The city of Glasgow, Scotland, is in the fortunate position of being able to pay all the expenses of the city government out of the revenue derived from its public improvements—a state of things which has earned for this city the title to be called the most advanced and best governed city in the world. The details regarding the system employed by the municipal authorities are given in a letter from Mr. Joseph Asbury Johnson, in the Morning Call, of San Francisco, from which it appears that the progress of improvement of the city dates from the year 1854, when a number of philanthropic citizens formed an association for the improvement of the condition of the slum population. This was practically the beginning of a reform movement which ultimately resulted in an act of Parliament empowering the city corporation to carry out the work which philanthropy and private effort had failed to accomplish. It is claimed that at this time the condition of the poor in the city was worse than in any other of the cities of Great Britain. On June 11 occurred the thirty-first anniversary of the passage by the British Parliament of the Glasgow Improvement Trust Act. The measure has worked so well that to-day the slum districts are practically eradicated. The city condemned the wretched tenements and erected in their place the very best form of modern sanitary buildings, containing one, two, three, four, or five room apartments, which the city rents to the tenants at from \$3 to \$17 a month. The water and gas rates which are paid to the city are merely nominal and reduce the cost of living to a minimum. There are altogether over one thousand of these suites of rooms or flats owned by the city and rented at the prices named above, and at the average rate of six persons to the flat, there are over six thousand people accommodated in this way. The scheme has been so well managed that the income derived by the city not only covers the interest of the investment, cost of maintenance, and all incidental expenses, but there has actually accumulated a sinking fund which is gradually wiping out the debt incurred in the purchase of the condemned property and constructing the new tenements.

Encouraged by the success of this experiment, the city organized a system of relief and benefit for widows and widowers with small families who are obliged to go to their daily labor and have no one in whose care they can leave the children. A large building was erected, containing one hundred and seventy-five bedrooms and a number of nurseries, bathrooms, kitchens, and playrooms for the children, and a staff of nurses was engaged to look after the little ones during the entire day. The charges are extremely low, including as they do light, heat, washing and care of the children, etc. The prices paid are as follows: For a mother and child, 79 cents per week; a mother and two children, 95½ cents; with three children, \$1, and 12½ cents for each additional child. For a father and one child, \$1.04 a week; father with two children, \$1.21 per week; with three children, \$1.38 per week, with a charge of 16 cents extra for each additional child. In addition to this, board is provided for adults at 5 cents for breakfast, 8 cents for dinner, and 6 cents for supper, or 19 cents per day. Summing up these items, we find that a widow with three children can live very comfortably for \$3.38 per week, and a man with three children for \$3.75.

A further extension of the operations of this laudable system of government is now being carried out, by which the city will be given parliamentary power to expropriate property to provide sanitary dwellings for all the working classes. So excellent is the credit of the city that it is able to borrow all the money it needs at 2½ per cent, a rate of interest which will go far to make the venture a financial success; and it is reasonably expected that the social and sanitary results will fully compensate the city for the outlay. It may be mentioned here that many years ago the city established public wash houses where, for 4 cents an hour, a woman is allowed the use of hot and cold water wash-tubs, and may have the washed clothes machine-dried and mangled all within the hour. It is claimed that of all the vast number of operations of this kind undertaken by the city none has proved a failure, and what this means can be understood when it is said that the authorities have under their care city farms, city markets, dairies, libraries, scientific schools, and many other things of like character. Indeed, the city has realized in fifty different ways the reduction of the cost of service to the public which comes from the public ownership of lighting plants, street cars, waterworks, markets, and other public utilities. In conclusion it may be said that no clearer tribute to the success of the system can be paid than by the fact that the entire revenue of the city is derived from its public works and institu-

tions, and that the hours of service of the public employes have been shortened and their daily wage increased.

**SETTLEMENT OF THE VACANT PUBLIC LANDS OF THE UNITED STATES.**

The settlement of the middle and far West of the United States presents the most striking example in history of the rapid subjugation of a virgin country by an enterprising race. The records of ancient or medieval times fail to show a single instance in which a people has taken possession of the land so swiftly and covered it as if by magic with the evidences of an up-to-date civilization. Nor is it likely that such a development as that of the past thirty years will be repeated in any other quarter of the world. The great railroad which is under construction by the Russian government across Siberia is not likely to produce any such a transformation as followed the completion of our own transcontinental lines to the Pacific coast; and judging from what has already been accomplished in the civilization of Africa, it is likely that its development will be slow in comparison with that of our Western territories.

If we wish to trace the history of legislation on the subject of the disposal and settlement of public lands in the United States, we must go back to the earliest days of the republic. An ordinance was passed in 1787 which provided for the organization of the territory lying to the northwest of the Ohio, and declared that the new States should never interfere with the disposal of the soil by the United States. In an interesting article in the National Geographic Magazine, by Mr. Emory F. Best, assistant commissioner of the General Land Office, we are told that in all subsequent admissions of new States into the Union the absolute proprietary power and primary right of disposal of the soil has been uniformly reserved by solemn compact in conformity therewith. Cessions of territory to the United States were made upon the condition that the land should be held in trust for all the States, the original purpose being to create a fund for the redemption of the public debt.

The basis of the public land system is found in the plan submitted to Congress in 1790 by Mr. Hamilton, in which it was sought to raise revenue from the sale of the land. It provided for the disposal of the public domain at public offering, by private cash sales, and by the allowance of the preference right of purchase to actual settlers under the several pre-emption laws. These laws were at first temporary, being limited in their operation, until the general law of 1841, which continued in force until its repeal by the act of March 3, 1891.

The general policy of sales for revenue remained unchanged until the question of free homes for the people came to be agitated, and resulted in the homestead law of 1862. The homestead law provided that any citizen who is the head of a family, or who has arrived at the age of 21 years, may acquire title to 160 acres of land by residing upon, cultivating, and improving the tract for five years immediately preceding his final proof, free from all cost except the Land Office fees.

The homestead law was one of the most beneficent ever recorded in the statute books of a nation. Coming about the same time as the extensive grants of land in aid of the construction of the Pacific railroads, it proved to be a powerful factor in the building upon of the vast extent of country lying to the west of the Mississippi River. Thirty-five years ago the Indian roved over this country, much of which was known as the Great American Desert, and dwellers in the Eastern States only caught an occasional glimpse of its natural riches, when observant travelers returned with stories of its rich grass lands and endless ranges of forest-clad hills. How largely the settlers have availed themselves of the law is shown by the fact that up to the last fiscal year 508,936 homestead entries have been allowed, embracing an area of 67,618,451 acres.

Altogether, during the period under review, 247,000,000 acres have been sold for cash. In this total are included the homestead entries, which have realized about \$250,000,000. This item, with the grants to railroads and donations to States for educational purposes and internal improvements, includes the greatest portion of the public lands already disposed of by the government.

There remains some 600,000,000 acres of vacant public land, exclusive of Alaska, of which 100,000,000 acres only are favored with sufficient rainfall for the successful cultivation of crops. The title to the soil is in the United States, but the control of the water rests with the State. Mr. Best is of the opinion that unless these two elements are combined, the land is valueless, and he asks the question: "Are the laws which have operated so favorably in the disposal of the well watered and fertile lands of the Mississippi Valley adequate to the conditions that confront us in the arid West?" The act of March 3, 1877, authorizing the entry of 640 acres of desert land upon the condition of paying \$1.25 per acre and reclaiming the land by irrigation, which was designed to meet these conditions, has failed

to yield any commensurate results of the kind intended; for while the lands lying along the borders of the streams, which are capable of easy irrigation, have been taken up, the arid lands proper, or those that cannot be reclaimed by the individual efforts of the settler, are still lying neglected.

It is estimated that of the 500,000,000 acres of vacant lands within the arid region only 20 per cent can be brought under cultivation, and that this can only be done by good engineering treatment of the problem, and a careful use of the water that is brought in. The special committee appointed by the United States Senate in 1889 to investigate this subject, says: "The irrigable lands are limited in extent. The area of the arid region which can be irrigated is a small fraction of the entire region. This arises from the fact that all the waters that can be used are insufficient to serve all the possible irrigable lands. It therefore becomes necessary to select the lands to be redeemed. On the wisdom of this selection vast interests depend. It is possible to irrigate lands on the mountains and on the high plateaus, but if the water is used there it cannot be used below, and these elevated lands will not make the best homes for the people. The climate there is rigorous, and the variety of agricultural products that can be raised is limited, being chiefly hay and vegetables. To use the water on such lands is largely to waste it, and to drive agriculture into the mountains is to doom the people engaged therein to a dreary life in a subarctic climate. It is therefore manifestly to the interest of the greatest number of people that the agriculture of the arid lands should not be established in the mountain regions. The valleys and plains below are warm, salubrious, and rich, the variety of agricultural products is great, and if the waters are used on these lands, they will give support to a prosperous people."

It is argued from the above report that the vacant public lands should not be disposed of until they have been brought into an agricultural condition by irrigation, and it is suggested that the best way to accomplish this result would be to let the States control the waters within their respective borders. The right to use the water being under the absolute control of the State, it would, if it also controlled the land, be in a position to secure, by a judicious choice of the land to be irrigated, an economical and profitable use of the water. At present 76 per cent of the arid land is in the hands of the government. In Nevada 95 per cent of the area is vacant, and these lands contribute nothing to the revenues of the State, and therefore it is impossible for the State to undertake a system of irrigation itself. It would surely be good policy for the government to dispose of them to the State, so that they may become an available source of revenue. It is true the Carey act of August 19, 1894, authorizes the Secretary of the Interior to contract with any of the desert land States to donate to the States such lands as the States may cause to be irrigated, reclaimed, occupied, and cultivated by actual settlers; but it fails to give the State sufficient control over the lands to enable it to pledge them as security for their reclamation, and hence it cannot contract for the construction of works on the most favorable terms. The assistant commissioner argues with much reason that if the Carey law were so amended as to provide for the granting of the lands to the State upon application, leaving the State free to contract for their reclamation and to pledge the lands as security therefor, it would be of practical benefit, and under its provisions the State might be enabled to secure the reclamation of all the lands within its limits that could be utilized.

**INTERESTING MARINE STATISTICS.**

The merchant marine of the United States on June 30, 1896, comprised 22,908 vessels of 4,703,850 gross tons—a decrease of 330 vessels, but an increase of 68,000 tons over the previous year. Wooden sailing vessels numbered 16,244, of 2,310,819 gross tons. Iron and steel steamers numbered 880, of 1,004,113 gross tons. Vessels documented at the Atlantic and Gulf ports numbered 16,786, of 2,667,313 gross tons; at Pacific coast ports, 1,560, of 437,972 tons; on the great lakes, 2,333, of 1,324,068 tons; and on the Western rivers, 1,229 vessels, of 274,527 tons. Vessels registered for the foreign trade numbered 1,257, of 844,954 tons, of which 244 are steamers. Vessels built and documented during the year number 723, of 227,096 gross tons, or more than double the construction of the previous year. On the great lakes 117 vessels, of 108,782 tons, were built.—Report of Bureau of Navigation.

**DEATH OF PROF. FRESSENIUS.**

Prof. Carl Remigius Fresenius, the great chemist, died June 10, from a stroke of apoplexy. He was born in 1818, at Frankfort-on-the-Main, and was made professor of chemistry at the Institute of Wiesbaden. He founded a laboratory at Wiesbaden, which resulted in great developments, particularly of an industrial and agricultural nature. He was the author of several works on chemistry, the most famous being probably his "Qualitative Analysis" and his "Quantitative Analysis." These works have a world-wide reputation.