SCIENTIFIC AMERICAN

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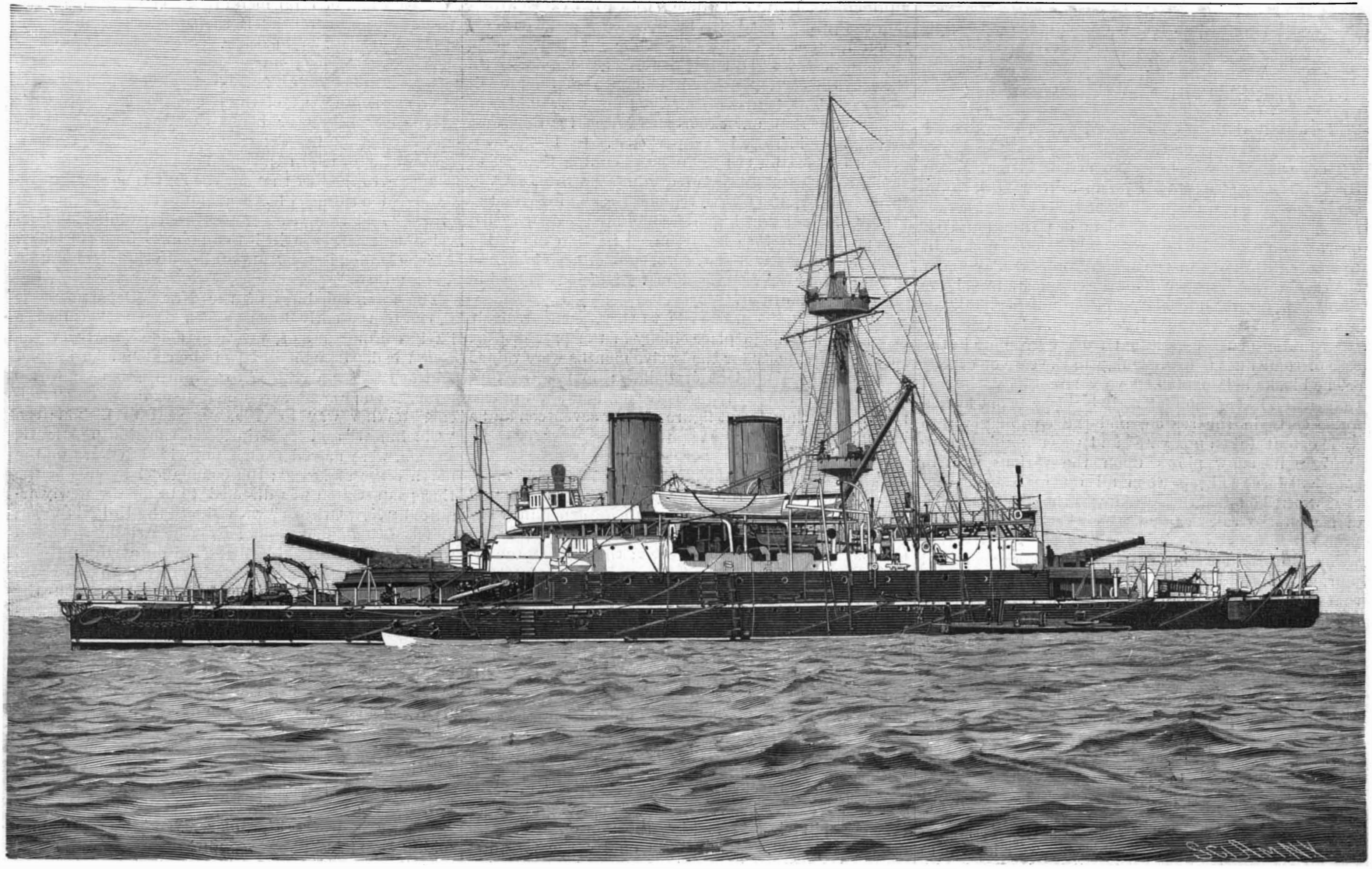
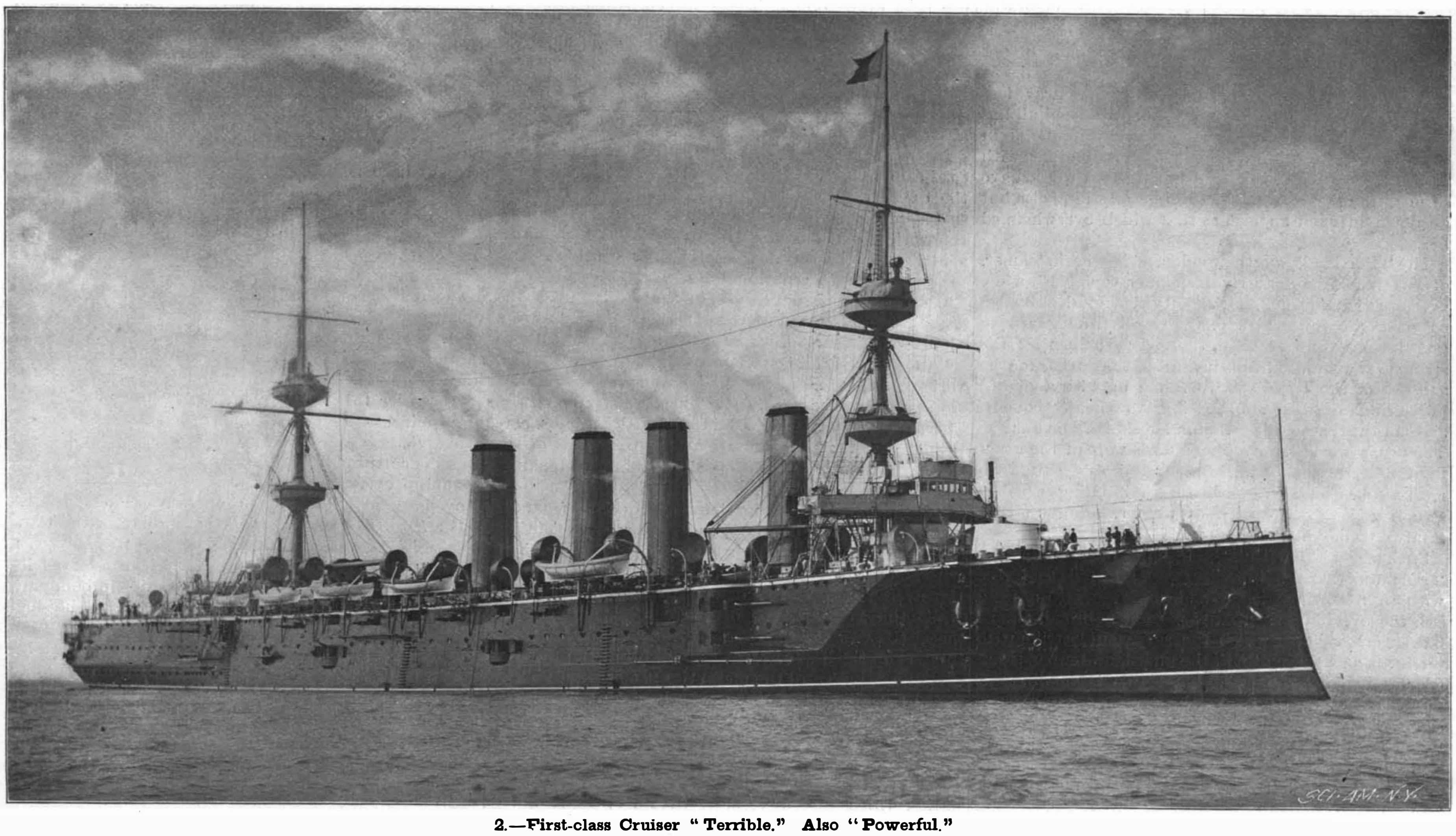
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXIX.—No. 24. ESTABLISHED 1845. NEW YORK, DECEMBER 10, 1898. [$3.00 A YEAR. WEEKLY.



1.—First-class Battleship "Benbow." "Admiral" Class of Six Ships.

Displacement, 10,600 tons. **Speed,** 16·75 knots. **Bunker Capacity,** 1,200 tons. **Armor:** Belt, 18 inches; bulkheads, 16 inches; barbettes, 14 inches; deck, 2½ to 3 inches. **Armament,** two 16¼-inch 110-ton B. L. guns, ten 6-inch rapid-fire guns, ten 3-pounders, seven machine guns, two boat guns. **Torpedo Tubes,** 5. **Complement,** 509. **Date,** 1888.



2.—First-class Cruiser "Terrible." Also "Powerful."

Displacement, 14,200 tons. **Length,** 538 feet. **Speed,** 22·4 knots. **Bunker Capacity,** 3,000 tons. **Armor:** Deck, 3 inches on flat, 6 inches on slopes; casemates and shields, 6 inches. **Armament,** two 9·2-inch B. L. rifles, twelve 6-inch rapid-fire guns, eighteen 3-inch rapid-fire guns, twelve 3-pounders, nine machine guns, two 3-inch boat guns. **Torpedo Tubes,** 4. **Complement,** 840. **Date,** 1895.

From photographs by Symonds & Co., Portsmouth, England.

NAVIES OF THE WORLD—I. GREAT BRITAIN.—[See page 376.]

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Scientific American.

ESTABLISHED 1845.

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) .... $3.00 a year.
Scientific American Supplement (Established 1876) .... 5.00 "
Scientific American Building Edition (Established 1885) .... 2.50 "
Scientific American Export Edition (Established 1878) .... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, DECEMBER 10, 1898.

THE UNDERGROUND TROLLEY IN THE RECENT SNOWSTORM.

The severe snowstorm of November 26 and 27 put the Underground Trolley System in New York to the severest test that it has undergone since it was inaugurated, and although the complete or partial paralysis of traffic on some of the lines would seem at first sight to suggest a failure of the underground trolley under such conditions, a review of all the circumstances shows that the new system lived up to its promises and did as well as could be reasonably expected. The delay in the running of the cars lasted from four hours in the case of some lines to a whole day in the case of others.

The blockade is explained very largely by the fact that such a heavy snowfall as 12 inches was not looked for so early in the season, and the company was to some extent taken unawares and was not able to concentrate its snow plows upon the various lines in sufficient force to keep them all open. Another fact that worked against the system was that the formation of ice on the rails caused the wheels to slip and brought the cars to a standstill. In this connection we are surprised to note that a New York electrical journal falls into the extraordinary error of stating that the ice on the rails prevented contact between them and the wheels, "thus preventing the establishment of a circuit." It is one of the chief merits of the underground trolley that both the feeder and return lines are placed in the conduit, and the current does not have to pass through the track and the wheels. Slipping of the wheels is a contingency to which every form of motor, whether steam, compressed air, or electric, is liable, and a blockade due to this cause does not reflect in any way upon the underground system as such.

THE LOSS OF THE "PORTLAND."

Out of over one hundred souls that were known to have sailed out of Boston on the ill-fated "Portland," on the eve of the disastrous storm of November 26, not one has escaped to tell of the loss of the vessel. All that is known is that she was sighted later that night making a futile attempt to breast the northerly storm, and that a few hours later scattered fragments of her wreckage were cast ashore at Cape Cod, many miles to the southeast of the point at which she was last sighted. The fact that no large portion of the hull has been found indicates that the vessel foundered in deep water; and to any one who is familiar with the type of vessel to which she belonged, it would have seemed a miracle if she had done anything else but go down in such a storm as that which overwhelmed her.

The "Portland" was a wooden, side-wheel steamer, of the true American river steamer type, with wide, overhanging guards, and a lofty tier of deckhouses covering the full width of the vessel from guard to guard. She differed from the river type in that the struts that extended from the hull to the guards for the support of the latter were planked in, with a view to preventing, or rather mitigating, the heavy concussions of the seas against the under side of the guards. The upper works above the guards were of the usual light construction, and, while admirably suited to river work, would be smashed into kindling wood if struck by heavy seas, such as were running on that fatal Saturday night.

Such a boat, particularly if built of wood, as the "Portland" was, is in every way unfitted to battle with an Atlantic gale. When plunging into a head sea, the overhanging guards present a broad, almost flat surface against which the seas would strike with terrific force, tending to lift the guards and superstructure bodily from the hull. That this is possible was proved a few years ago on the Pacific coast, when a side-wheeler of the same type as the "Portland" foundered during a trip from the Columbia River to San Francisco. On this occasion the guards and superincumbent deck were lifted bodily from the hull, allowing the water to rush into the hold, and causing the vessel to go down with great rapidity. We think it is more than probable that like causes led to a like result in the case of the "Portland."

The wooden side-wheel steamer is altogether out of place on a coastwise or deep sea service. The paddle wheel and its cumbrous "box" are an element of danger in themselves; and when to these are added the broad flaring surface of the guards, and a towering pile of flimsy deckhouses, it is simply courting destruction to expose such a vessel to the fury of an Atlantic gale.

INCREASE OF OUR EXPORT TRADE TO AFRICA.

The rapid expansion of our export trade to Africa is the subject of a good deal of attention in the European nations which have hitherto supplied most of the articles imported into that country. A recent issue of a prominent European trade publication called attention to the fact that British exports to South Africa for the nine months ending September 30, 1898, show a decrease of $3,600,000 or 12½ per cent as compared with those of the corresponding nine months of the preceding year. The figures of our Treasury Bureau of Statistics show that our exports to Africa for the same period have increased 13½ per cent. In 1894 our exports to Africa for the ten months ending October 31 amounted to $4,380,425 and our imports to $3,852,701. In 1898 our exports for the ten months had increased to $14,986,476 and our imports amounted to $7,267,317. The greatest increase has occurred in the exportation of such products as wheat, corn, canned beef, lard, and tobacco, and even American butter is being shipped in increasing quantities.

The growth of our exports to these comparatively new fields has taken place chiefly in the past decade. In 1868 the exports for the twelve months were valued at about three millions of dollars; in 1878, at four millions; in 1888 they fell to three millions; and in 1898 they rose to the present figure of over seventeen and a half millions.

THE PROPOSED ADDITIONS TO THE NAVY.

The additions to the navy proposed by the Naval Board on Construction contemplate an expenditure of $36,100,000 distributed as follows: Three 13,500-ton battleships to cost $3,600,000 each; three 12,000-ton armored cruisers to cost $4,000,000 each; three 6,000-ton protected cruisers to cost $2,150,000 each; and six 2,500-ton protected cruisers to cost $1,141,000 apiece. Each of these vessels is to carry "the heaviest armor and most powerful ordnance for vessels of their class, to have the highest practicable speed, and great radius of action."

If the nation has any conception of the vast responsibilities which the acquisition of the Philippines has placed upon it, there will be no difficulty in securing the necessary appropriation for making this addition to our navy. In view of the fact that two or three years must elapse before the ships are completed, no time should be lost in making the appropriation; indeed, the question should form one of the very first subjects of deliberation at the forthcoming reopening of Congress.

The Naval Board shows great wisdom in recommending that every one of these fifteen ships be wood sheathed and coppered. We shall have no docking facilities in the Philippines for some time to come, and the ability to keep the sea afforded by coppering will be invaluable.

METAL RAILROAD TIES CHEAPER THAN WOOD TIES.

In view of the enormous demand made by the railroad companies for timber suitable for railroad ties, the question of providing a suitable metallic tie assumes increasing importance as the railroad systems of the world are extended. One of the most valuable contributions on the subject is that recently communicated to the International Railway Congress by M. Ch. Renson, and published in the Bulletin of the Association. It recounts the experience gained during some twenty years of experimental work carried out by the Liége-Limburg Railway, Belgium, on which various kinds of metal ties have been tested on different sections of the road. For purposes of comparison a section of the road was laid with oak sleepers, care being taken that the conditions as to nature of the roadbed, drainage, weight of rail, care in maintenance, etc., should be identical.

The metal ties varied in shape and quality from the crude forms of the earliest ties to the more scientifically designed later ties, in which the experience gained with the earlier ties was embodied. It was found that the average life of the oak ties was thirteen years, while the average type of the earliest and crudest metal ties was eighteen years. Allowing four per cent interest on the first cost, it was found that the oak ties cost 41 centimes and the metal ties 19·5 centimes. The metal ties showed, on the other hand, a greater cost for maintenance, and correcting the figures accordingly it was found that the metal ties showed a yearly economy of 10 centimes.

This, it must be remembered, was for the early form of ties, which were little more than a straight rolled channel. The later ties have their width decreased and their vertical flanges deepened at the center, thus providing a maximum bearing surface immediately beneath the rails, and increased girder depth at the center. By the use of round drilled holes for the fastenings and the insertion of wearing plates between the rail and the tie, the life of the ties has been greatly lengthened. M. Renson states that the Liége-Limburg experiments have proved that, not only on the score of economy, but on every point of comparison, the metal ties are superior to those of wood.

If any one in this city wishes to test the comparative riding qualities of wood and steel ties, he can do so in passing over the stretch of the New York Central tracks lying between the north end of the Park Avenue tunnel and the new steel viaduct. The first stretch of this piece of road is laid on wood ties, and the latter half of it on metal ties. The portion of the track laid on metal ties is the smoothest riding; but it is not so silent as the other.

SECRETARY LONG'S REPORT.

The recent report of the Secretary of the Navy is of special interest as being the final official statement regarding the extensive and complicated operations of the war. In the opening paragraph attention is drawn to the fact that for the first time since its rehabilitation the navy has been put to the "supreme test of war," and that years of persistent training and development had brought it to a point of high efficiency, which resulted in the "unparalleled victories of Manila and Santiago."

The forehandedness of the Navy Department is shown by the early date at which preparations for the likely contingency of war were made. Early in the year the department directed the commander-in-chief of the European station to retain those men whose terms of enlistment were about to expire. The "Helena," on her way to Asia, was sent to Lisbon; the "Cincinnati" and "Castine," on the South Atlantic station, were moved from Montevideo to Para on the north coast of Brazil; the commander-in-chief of the European station was directed to bring the newly acquired "New Orleans" with him to the United States; and the commander-in-chief of the Asiatic squadron was ordered to assemble his squadron at Hong Kong. The "Olympia," under orders to proceed to San Francisco, was retained on the Asiatic station, and the "Oregon" was ordered from the dry-dock at Bremerton, Wash., to San Francisco to prepare for her voyage to the Atlantic. Meanwhile orders were given to husband ammunition and keep all vessels filled with the best coal obtainable; the North Atlantic fleet was stationed at Key West, and the flying squadron, organized for the protection of our coast line, was stationed at Fortress Monroe. On March 9 the emergency appropriation of $50,000,000 was made, and three days later a board was appointed for the purchase of auxiliary vessels.

"The squadrons, ships, officers, and crews," we are told, "were in admirable condition and training," and "the bureaus of the department had, by wise forethought, prepared them with every facility in the way of men, supplies, ammunition, information, and drills, and as early as April 15, four weeks before Admiral Cervera's fleet reached Cuban waters, the navy of the United States was ready for the outbreak of hostilities. The North Atlantic fleet at Key West covered Cuba; the flying squadron at Hampton Roads stood ready to defend our own coast or threaten that of Spain, and the Asiatic squadron at Hong-Kong only awaited information of the outbreak of hostilities." On April 20 the northern patrol squadron was organized for the protection of the Atlantic coast between the capes of the Delaware and Bar Harbor, Maine.

War was declared April 21. On April 24 the following telegram was sent to Commodore Dewey: "War has commenced between the United States and Spain. Proceed at once to the Philippine Islands. Commence operations at once, particularly against the Spanish fleet. You must capture vessels or destroy. Use utmost endeavor." On the 27th the squadron set sail, and on May 1 it had not only followed out the Secretary's order to the letter, but held the capital of the Philippines at its mercy. This "brilliant and electrifying victory at the very outset of the war infused confidence throughout the country and into the personnel of every branch of the service," and "it removed at once all apprehension for the Pacific coast."

On April 29 Cervera's fleet set sail from the Cape Verde Islands. Sampson at once sailed east with a part of his fleet for observation, having received instructions not to risk the loss of his ships in bombardments. Returning from San Juan (which he had reached May 12) without finding Cervera, Sampson was informed that Cervera was at Curacoa, West Indies, and was himself ordered back with all speed to Key West. On May 19 the flying squadron under Schley was ordered to Cienfuegos under the impression that Cervera had entered that harbor. On May 20 the department thought Cervera was at Santiago, and told Sampson to order Schley to proceed thither. This order was sent by the "Marblehead" on the 21st. On the 23d Sampson sailed east to occupy the Nicholas Channel. On the 26th Sampson received a dispatch from Schley stating that "he was by no means satisfied that the Spanish squadron was not at Cienfuegos,

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and that he would, therefore, remain off that port with his squadron." On the 27th Sampson again directed Schley to "proceed with all possible dispatch to Santiago." At this time two telegrams reached Sampson from Schley dated Cienfuegos, May 24, saying that he had ascertained that Cervera was not at Cienfuegos and that he would go eastward the next day, the 25th, but that being short of coal he "could not blockade if the squadron was in Santiago, but would proceed to Nicholas Mole and communicate."

Thereupon Sampson decided to go to Key West for coal and go in person, if authorized by the department, to Santiago. The "New Orleans" was sent with all haste to Schley, "with orders to Commodore Schley to remain on the blockade at Santiago at all hazards." Sampson reached Key West May 28 and cabled Schley that the "New Orleans" would meet him at Santiago May 29 with important dispatches. Schley left Cienfuegos May 24 and was 20 miles southeast of Santiago at 5:30 P. M. May 26. Here he signaled to his fleet, "Destination Key West via south side of Cuba and Yucatan Channel as soon as colliers are repaired." On the morning of the 27th the "Harvard" showed Schley a dispatch from the department, ordering him to "ascertain facts" and "if the enemy is 'in Santiago' not to leave without decisive action." Schley then signaled to his fleet, "Can you fetch into Key West with the coal remaining?" and sent a dispatch by the "Harvard" saying he "could not remain off Santiago, present state of squadron, on account of shortness of coal." The squadron moved to the westward until it was 40 miles southwest of Santiago, where it remained until 1:12 P. M. of the following day, May 28, when it returned to within 10 miles of Santiago Harbor. On May 29 part of the Spanish fleet was seen at the mouth of the harbor. "On July 1," says the report, "Admiral Sampson arrived off Santiago and found Commodore Schley's squadron in column to the westward of the mouth of the harbor." The forces were now concentrated and a close blockade established.

The report throws considerable light upon the combined naval and military operations at Santiago. On the arrival of the convoy Sampson explained to Shafter that in order to enable the vessels of the navy to enter it was necessary that the positions occupied by the eastern and western batteries should be carried, in order to insure the destruction of the mines. "To this plan General Shafter gave cordial assent." On July 1 and 2 the forts at Aguadores and at the mouth of the harbor were heavily bombarded and a report of this bombardment was sent to Shafter, in which Sampson stated again the impossibility of entering the harbor until the forts were taken and the mines removed. Shafter replied that "it was not possible to say when he could take the batteries and urged that an effort be immediately made by the navy to force an entrance," to which Sampson answered by saying that such an attempt would result in sinking one or more of his vessels and closing the harbor entrance.

The controversy was cut short by Cervera himself, who came out to be destroyed piecemeal by our fleet. Sampson at the time was on his way, in the "New York," to a personal interview with Shafter. The losses on the Spanish side were 1,600 prisoners, 350 killed or drowned and 160 wounded. On our side only one man was killed.

On July 5, the President issued the following order: "General Shafter and Admiral Sampson should confer at once for co-operation in taking Santiago;" as the result of which it was arranged for the fleet to bombard Santiago on the 9th, and if this was not sufficient, an assault was to be made by the marines and Cubans on the batteries and some of the smaller ships were to force the harbor. A bombardment was carried on on the 10th and 11th, and Shafter signaled that the fire was very accurate and that unconditional surrender had been demanded. Sampson then signaled that he expected to be represented in the conference to arrange surrender, which was agreed to. On July 16, Shafter telegraphed, "Enemy has surrendered. Will you send some one to represent navy in the matter?" Admiral Sampson's chief of staff went to the front and stated that it was Sampson's expectation that, in view of the fact that Santiago had surrendered in face of the joint operations of the army and navy, he be one of the signatories to the agreement of capitulation. This General Shafter declined to permit.

A high tribute is paid to the auxiliary naval force, "the personnel of which was almost entirely contributed by the naval militia organizations of the various States." We shall take up the work of the auxiliary navy at fuller length in the following issue of this journal.

THE REPORT OF THE SECRETARY OF AGRICULTURE.

The Hon. James Wilson, Secretary of Agriculture, has just made public his Annual Report, in which, in addition to the discussion of domestic problems, he reviews agricultural relations in foreign fields. He asks for an emergency appropriation of a lump sum for future requirements which cannot be specifically anticipated, such as the exploration by scientists of new territorial acquisitions and the sudden appearance of pests.

In discussing the agricultural resources of our new island acquisitions, Mr. Wilson says: "In the territories recently brought under the control of the United States government, the agricultural interests urgently call for attention by this department. Hawaii and the West India islands depend almost exclusively for their prosperity upon their agricultural productions. It behooves this department, therefore, to place itself at the earliest possible moment in a position to extend to the agriculturists of those territories which have or may come under the United States flag the services and benefits which it renders to the farmers of the United States. The increased trade relations which may be looked for between the United States and its insular dependencies, moreover, render the conditions of agriculture in the latter and the character and extent of their productions matters of benefit to the people of the United States."

The trade in the China seas in American farm products is growing, and in order that markets may be obtained in Japan, China, and other foreign countries, an agent is now in that region establishing agencies to which the department will make shipments and gather all information possible for the American producer.

The Secretary recommends the extension and adoption of the provisions of the law regarding inspection and certification of meat and all meat products for export, so as to make them apply to butter and cheese. The Secretary enlarges on the need of nature teaching in the common schools. He says there is a growing interest in education that relates to production and all classes of intelligent people favor it. More knowledge by the farmer would enable him to control conditions, produce more from an acre and contribute more to the general welfare. He also describes the good work which the Bureau of Animal Industry has been doing in the way of perfecting dips for cattle, experimenting on anti-toxine serum, etc.

Good work has been done by hybridizing the orange and other citrus plants and in the crossing of pineapples, increasing the size and vigor and greatly improving the flavor. Observation and forecast weather stations have been extended around the Caribbean Sea and increased through the interior of this country, especially in the mountain States. The natural life zones of the United States are being surveyed and the areas best adapted to various crops determined. Four scientific explorers of the department are abroad getting seeds and plants in Russia, the Mediterranean, the China Sea, and South America. Great attention is being paid to perfect crop statistics. The Alaskan interior will be explored next summer to learn of its capacity to support population. Steel rails are said to be the coming material for good roads if hard rock is not convenient. Forest species adapted to wild regions are now being introduced. Better methods of handling forest fires are advocated and private ownership is being introduced by government agents and fire prevention and fire fighting are being studied.

The report also refers to the value and popularity of the official farmers' bulletins and to soil and tobacco researches. The Department of Agriculture carries on some of the most useful work of any branch of the government service and it is very satisfactory to know that each year the untiring efforts of the various bureaus and divisions included in the department are better appreciated.

A SCHOOL OF HOUSEKEEPING.

A school of housekeeping has been established in Boston, and its aim is to provide a school where employers and employés may together learn the business of housekeeping. An institution of this kind will certainly tend to do away with a large part of one of the most serious problems which confront us. The ordinary cooking school takes up the subject in a greater or lesser degree, but it does not provide for the study of the subject in detail. Lectures will be given on "How to Build a House," by C. F. Wingate, the sanitary engineer, and C. Howard Walker, an architect of marked ability. The "Equipment of a House" is described by Miss Mary Ware and by a practical housekeeper, Maria Parloa. Among other lectures will be "Food in the Relation of True Economics," "Economic Buying," and "Domestic Housekeeping;" "The House as a Unit of Health," "Division of Income in Household Expenditure," "Domestic Service: Its Past, Present, and Future," and "Domestic Service as a Trade."

In addition to this there will be demonstrations on "Dust and its Dangers," "Practical Study of the Cellar and Yard," "Heating and Lighting," "Ventilation, Drainage, and Plumbing," "The Laundry," "The Kitchen," "The Storeroom," "Interior Woodwork: Its Preparation and Preservation," "The Hygiene of the Bedroom," etc. From what has already been said it will be seen that the school is a radical departure from the ordinary methods in vogue. It is an acknowledgment that housekeeping is a science and housework a trade—an important distinction.

The plan proposed for the development of this idea comprises a home, a family, and classes in theory and practice for housekeeping, for employers, and a course of practical training in housework for employés. The school is carried on in two connecting houses, well arranged for this experiment. One house is occupied by boarders constituting the "family." The other is used for classes and demonstration work for employers and employés. These employés receive the training; they carry on the work of the house under the direction of a skilled housekeeper and a cooking teacher. A special course of training and housekeeping has been arranged, so that a limited number of employers may, during a six weeks' résidence in the school, learn "to keep house" by practice and observation. This seems the only Utopian phase of the school, but it is an interesting problem to see what this section of the work will amount to. On the whole, the school will tend to assist in the solution of the domestic problem. The use of the laboratory method in this connection is a very interesting one, and it has succeeded elsewhere, so many times, we see no reason why the school of housekeeping should not be a success.

HINTS FOR EXPORTERS TO CHINA.

The following is a copy of a letter written by Consul-General Goodnow, at Shanghai, July 16, 1898, in answer to an inquiry from a cotton firm in New Orleans:

American firms handling cotton goods (I speak from memory) here are the American Trading Company, Frazar & Company, China and Japan Trading Company, Cary & Sandford, and Fobes & Company. Most of the business with Shanghai from the United States is carried on by drawing on the purchasers in China, with documents attached. The principal banks doing business with the United States here are the Hong-Kong and Shanghai Banking Corporation and the Charter Bank of India, Australia, and China. The rate of exchange is always the rate on the day on which the draft is presented for payment.

I find there are two great obstacles in the way of business with America. In the first place, American firms do not take care to fill the orders exactly. There is somewhat of a feeling at home, "Oh, anything will do for the Chinese." As a matter of fact, there are no people more particular than the Chinese. Their customs and their superstitions must be considered, as well as the things which come into account in other countries. It is a great thing to have a lucky trademark. It is above all necessary to handle the goods through a man on the ground, in whom the Chinese have confidence. They do not think anything about the firm at home; they think of the man directly with whom they deal. This man, if he is wise, knows the demand of the trade and caters to it; and, however eccentric some of his directions may seem in ordering, they should be followed to the letter. In the next place, almost all English and German firms have an arrangement by which all claims for damages through faulty packing, etc., are settled very promptly through the arbitration of their consul at the place where the goods are delivered. Most American shipments are made without any such agreement, and the consequence is that should the goods be damaged through faulty packing, etc., the parties interested are so far apart that the local dealer here is forced to stand the loss, rather than to go to the expense of suit or arbitration in America; and the consequence is that on even terms or at some difference in price he buys his goods from England or Germany. He is willing to pay the higher price for a certainty of a speedy, just, and inexpensive settlement of any damage there may be.

THE LATE JOSHUA ROSE.

We regret to learn of the death of Joshua Rose, who was for many years a contributor to the SCIENTIFIC AMERICAN. He was a well known mechanical engineer and had lived in England for a number of years. He was an Englishman by birth and obtained an extensive knowledge of mechanics in England. He came to this country and worked at his trade, obtaining valuable information regarding American practice. He was an accomplished writer and contributed many articles to technical papers. He was one of the editors of Appleton's "Cyclopedia of Applied Mechanics," and was the author of "Complete Practical Machinist," "The Slide Valve Practically Explained," "Modern Steam Engines," "Steam Boilers," "The Pattern Maker's Assistant" and "Modern Machine Shop Practice," besides other less important works. He will undoubtedly be best remembered by the last book we have mentioned, as it was an encyclopedic work of great value. An extensive series of articles by Mr. Rose appeared in the SCIENTIFIC AMERICAN in 1875 and in the SUPPLEMENT in 1876 and 1877.

THE Swiss Society Rambertia has laid out an Alpine garden at Montreux, at an elevation of 6,000 feet, where the characteristic trees and flowers of the country are to be cultivated.

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THE NEW CENTURY CALIGRAPH.

One of the chief causes of our pre-eminence in the design and manufacture of labor-saving devices, big and little, is the close attention paid to the improvement of details. In the development of an invention there seldom comes a time when the American mechanic is willing to admit that improvement is impossible, and there are many notable devices of which it may truly be said that far more ingenuity has been shown in the subsequent improvements than was embodied in the first practical machine.

The typewriter is a notable instance of the infinite thought, patience, and labor that have been expended to bring some of the most useful and necessary inventions of the present age to their present state of perfection. From among the many excellent types of this machine that have been developed from the first crude instrument we have selected the "New Century" Caligraph, manufactured by the American Writing Machine Company, 237 Broadway, New York, as affording an excellent example of the improvement of details that is being made in this valuable adjunct of modern commercial life.

Commencing with the keyboard and the key and type-bar mechanism, this machine embodies an ingenious and successful solution of the problem of presenting a perfectly even "touch" to the operator. This is secured by the system of compound levers shown in Fig. 1.

The key levers are pivoted on a rod at the back of the machine and are attached by short connecting rods to a series of bars which have a parallel motion in a vertical plane. This motion is secured by pivoting the bars, *B*, at each end to rocking links, *F*, which latter rotate upon the fixed horizontal rods, *G*. Connecting wires, *D*, provided with adjustable turnbuckles are attached to the parallel bars, *B*, and connect them with the type-bars, *C*. The weight of the type-bars in connection with the springs at end of parallel bars holds the keys in the raised or normal position. As there are seven banks of keys in the machine, it follows that the levers carrying the lowest banks are several inches longer than those carrying the upper banks, and consequently, on the principle of the lever, the pressure exerted on the keys of the top bank to raise the type-bars would have to be greater than that on the lowest bank, unless some compensation were made. The matter is adjusted by attaching the connecting rods, *E*, at seven different points, or mid-length of the key levers, *A*, thus insuring that the pressure on the keys and the amount of their vertical movement shall be uniform. The type-bars are provided with longer pivots than are commonly used. This increased length gives great lateral rigidity and conduces to accurate alignment. The pivots rest in cone bearings formed in the hangers, which consist of pieces of finely tempered gun-barrel steel bent round to shape, with the bearing drilled into the opposing sides. A small screw, which passes through the hanger, just behind the pivot, serves to draw the sides of the hanger together to take up the wear. The design is very neat, simple, and effective. In order to secure as short a type-bar as possible, the hangers were placed in two superimposed circles, as shown, one above the other. By this arrangement, moreover, a very long pivot is obtainable and the stiffness of the whole mechanism is greatly increased, as explained above. Our sketch, Fig. 2, shows the method of bringing the type-bars to a common printing point. In order that the type shall strike the platen normal to its surface when the hangers are arranged in superimposed planes, it is necessary to drill the pivot holes in the hangers in the upper plane at a slight angle with those in the lower.

The carriage may be removed by turning two small bushings, *A*, Fig. 3, one at each end of the hinge bar of the carriage, until the openings in their jaws correspond with similar openings in two brackets that hold the bar in place. The bar and its attached carriage can then be removed. It will of course be understood that a carriage is inserted by placing its hinge bar in the jaws of the brackets and bushings and then giving the latter a half turn to lock the bar in place. The removal of the carriage provides easy access to all parts of the carriage mechanism.

The movement of the carriage is effected by means of a mainspring and a steel draw-band connecting the main spring with the carriage. It is operated by a wheel escapement in connection with a bell-crank provided with dogs which alternately engage with the teeth of the wheel, *D*, Fig. 4, thus securing a quick, accurate, and almost noiseless escapement. On the same shaft of the escapement wheel is a small pinion, *E*, which engages a rack, *C*, at the back of the carriage carrier. The carriage is released by pressing down

THE NEW CENTURY CALIGRAPH.

upon the lever, *A*, which in turn acts upon the lever, *B*, and forces down the escapement pinion clear of the rack. This leaves the carriage free to be moved forward for the commencement of another line or to any desired position on the machine.

It is worthy of notice that this release lever is effective, no matter in what position the carriage may be.

Before passing on to a description of the ribbon movement, which is perhaps the most ingenious and meritorious mechanical feature of the machine, it will be well to describe two interesting features of this typewriter which render it very convenient for special classes of work. Every operator is aware of the loss of time involved in having to unpin and remove the ribbon before setting to work on the cutting of a mimeograph stencil. In the New Century it is only necessary to move a small and readily accessible lever, which throws off the pawl connecting the mainspring with the ribbon movement, which is then at rest, and, the ribbon being stationary, it can be pushed aside with a pencil at the center of the guide plate sufficiently to clear the striking point of the type.

Another simple but very effectual device is an adjustable front rail carrying the wheel supporting the front of the carriage, which enables one to regulate the height of the platen at the printing point. By this arrangement compensation may be made for the increased diameter of the platen, due to the number of the sheets used in manifolding. If the platen is not raised to a position just equal to the thickness of the extra sheets, the impressions that are made by the type striking from opposite sides of the machine will not be in alignment, some being too high and others too low. The adjustable front rail eliminates the faulty alignment, and the improvement commends itself at once to any one who has experienced the difficulty of keeping good alignment in heavy manifold work.

In Fig. 5 we show the very ingenious automatic mechanism of the ribbon movement. It is designed to secure the two valuable features of a complete use of all the surface of the ribbon from edge to edge and an automatic reversal of the travel of the ribbon as soon as it has been entirely wound onto another spool. This mechanism is so arranged that the ribbon has two motions: first, it is continuously unwound from one spool onto the other, and, secondly, it is moved bodily, with its spools, back and forth, the result being that the points of contact of the type with the ribbon describe a continuous zigzag line upon the latter, no two impressions being made on the same spot, thereby securing uniform work. The reciprocating motion of the ribbon is secured by means of a heart cam, *A*, attached to and turning with the mainspring drum, which, by means of a connecting rod, *P*, gives a rocking motion to the double bell crank lever, *T*. The vertical arm of *T* engages with the ribbon spool carrier frame, and as the latter is free to slide upon its shaft, *X*, the spool is moved to and fro accordingly. The right hand arm of lever, *T*, gives a vertical rocking motion to another lever, *O*. To *O* is attached a connecting rod, *P*, which is forked at its upper end. This fork carries two gravity pawls, one acting above and the other below a ratchet wheel, *K*, which revolves loosely on the shaft, *X*, on which the mainspring and the ribbon spool are keyed. The circular motion of the wheel, *K*, is transmitted to the shaft, *X*, by means of a pawl, *C*, which is carried on a sliding sleeve which is also keyed on the shaft. The vertical reciprocal motion of the connecting rod, *P*, acting through its own gravity pawls on the outer rack, and through the inner rack and pawl, *C*, upon the sliding sleeve, serves to rotate the shaft, *X*, and wind up the ribbon on the spool.

When the ribbon is unwound from the other spool, the tang, *C*, Fig. 6, drops out from the drum and in the forward lateral movement strikes the switch arm, *B*, which is connected with the loose sleeve at that end and pushes it into gear. At the same time, by the action of the switch, *D*, the corresponding pawl, *C*, is released at this end of the ribbon. The action is thus automatic and continuous, the ribbon being moved with a compound lateral and transverse motion without any attention on the part of the operator.

Our cut, Fig. 6, *B*, shows the ball bearing of the ribbon spools. To facilitate the sliding of the spools on the shaft, *X*, grooves are cut longitudinally on the outside of the shaft and on the inside of the spool. The balls fill the space thus provided and act as a key, causing the spools to rotate with their respective shafts.

Between the platen finger wheel at the right and the carriage frame is another finger wheel which serves to compress a spring by which the platen head and the platen are held together. The line space pawl and platen head remain in constant relationship to each other, while the platen revolves without any hindrance. In working on ruled lines the frictional release enables one to get just the exact spot desired, and when engagement is made between the platen and platen head, as the latter has a constant relationship to the line space pawl as indicated above, the spacing is always exact. A favorable feature of this machine is the reduction of the noise of operation to a minimum, this being due to the action being so nicely balanced throughout. The lessening of noise is a desideratum both to the operator and to the business community in general.

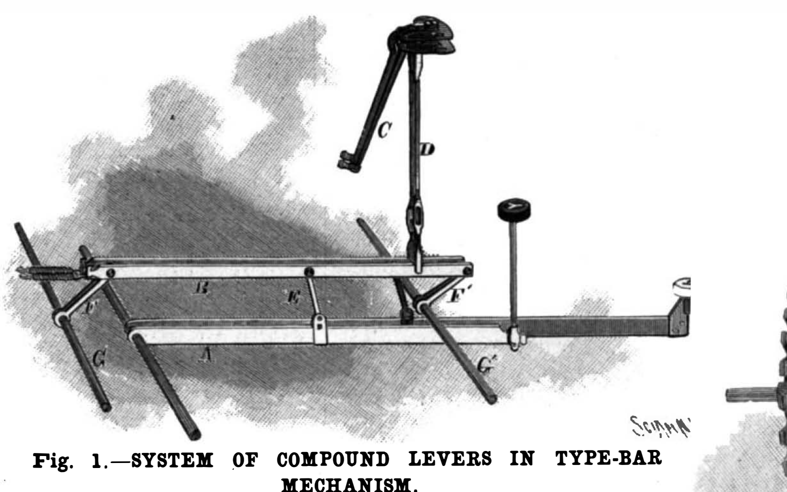

Fig. 1.—SYSTEM OF COMPOUND LEVERS IN TYPE-BAR MECHANISM.

Fig. 2.—METHOD OF CENTERING TYPE ON THE PLATEN.

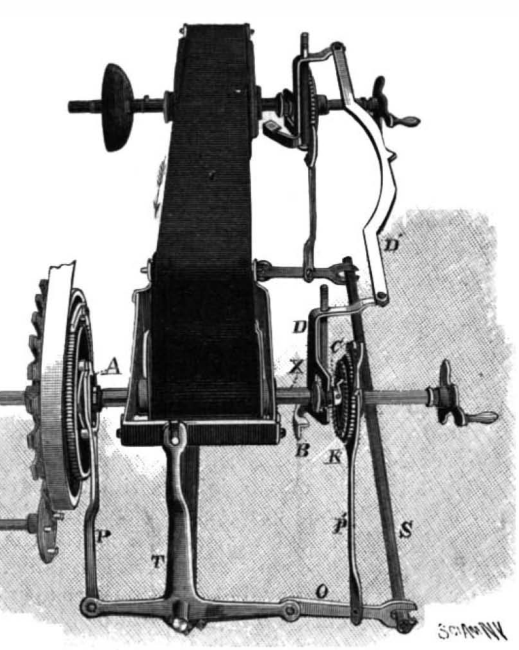

Fig. 5.—RIBBON MOVEMENT.

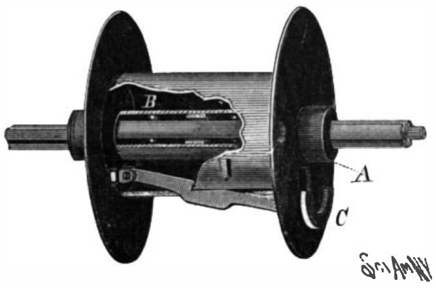

Fig. 6.—RIBBON SPOOL.

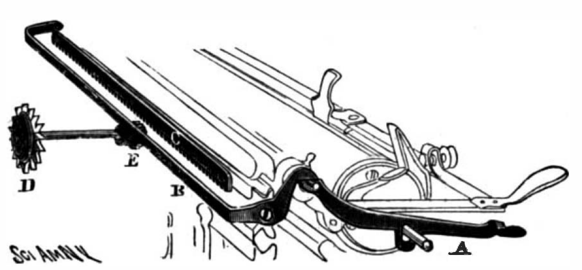

Fig. 4.—ESCAPEMENT MECHANISM OF CARRIAGE MOVEMENT.

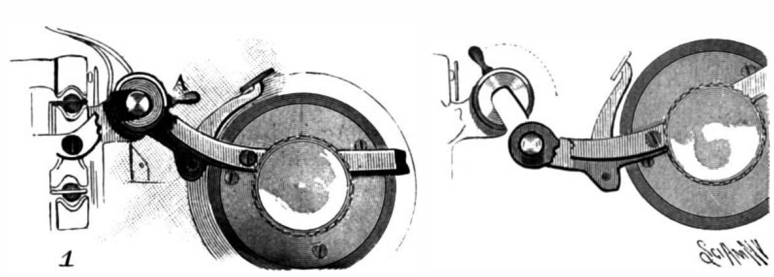

Fig. 3.—METHOD OF REMOVING CARRIAGE.

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THE NEW 2,500 HORSE POWER TURBINES AT NIAGARA.

In our issues of March 6, 1897, and June 18 of this year, we give illustrated descriptions of the celebrated power house at Niagara. In the present issue we show a pair of Greyelin Jonval horizontal axis turbines which have lately been installed at the works of the Niagara Power and Manufacturing Company, by R. D. Wood & Co. of Philadelphia.

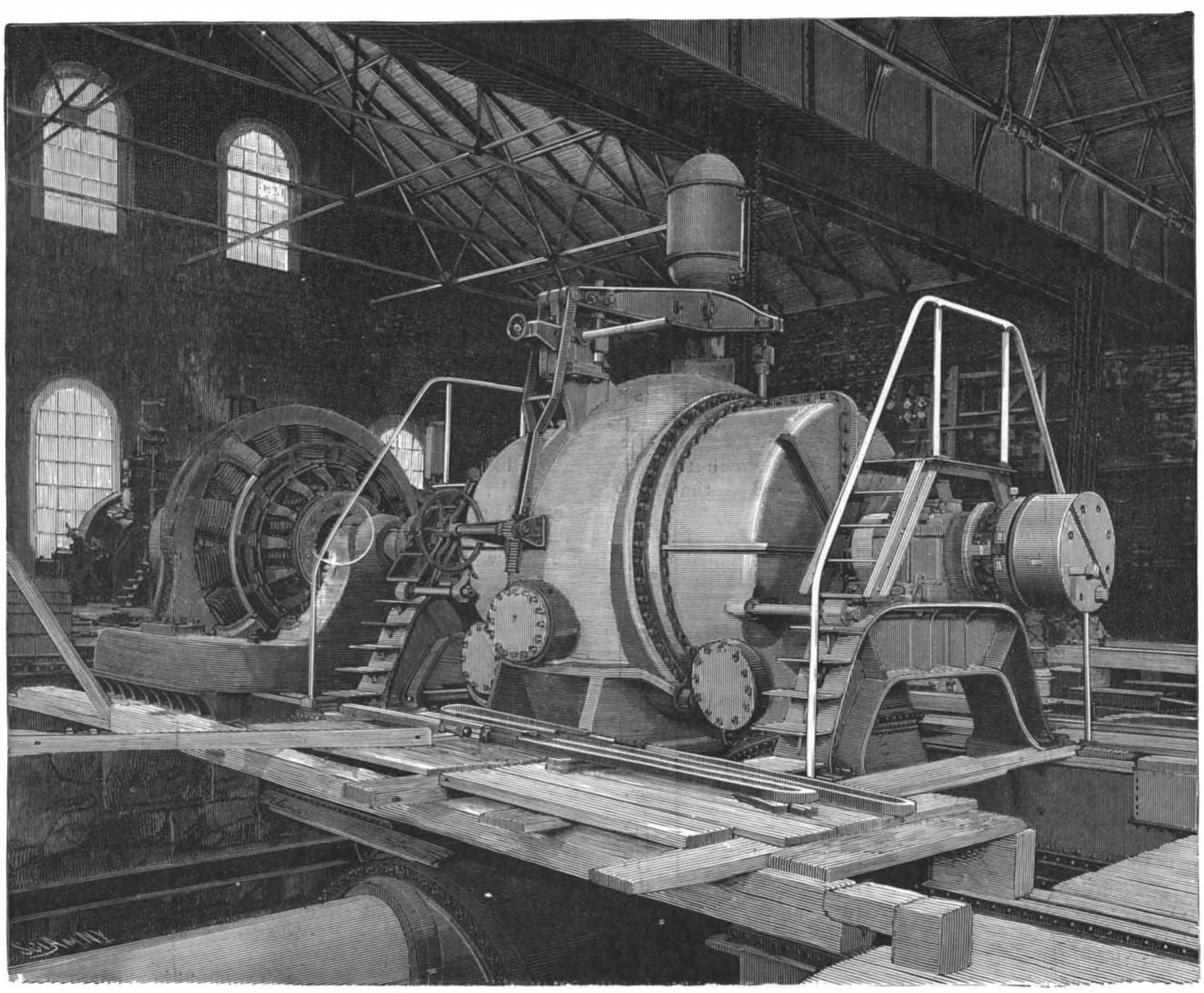
This pair of turbines forms part of a series of turbines composed of five pairs, each pair to be 2,500 horse power. They will be attached to a 13-foot diameter inlet tube, which tube directs the water from the top of the upper level of the fall to within 20 feet of the bottom of the fall, at which elevation a horizontal tube runs over the whole length of the wheel pit into which the spent waters are to be discharged. On the upper part of this horizontal tube are provided five openings on which slide gates of 60 inches diameter are attached. Each of these gates is acted upon by a hydraulic plunger operated by the pressure of the water.

The pair of turbines lately started is placed 24 feet above the lower level of the fall. The water, after acting on the blades of the turbine, is directed to two draught tubes, the extremities of which plunge into the tailrace water. This application of draught tubes in this case is specially desirable, as it enables the dynamos, which are directly attached to the extension of the turbine shaft, to be removed far above the tailrace water, thus escaping dampness.

The water is admitted to the central chamber, in which is placed a register gate controlled either by hand motion or by a governor for regular work. The water from the gates, which are placed opposite to each other, is admitted to the guide blades, which direct the water to the blades of the two revolving bronze wheels. These blades, with a view to high efficiency, are carefully designed and highly polished so as to reduce friction. The water leaving the two revolving wheels discharges into two draught tubes, the lower extremity of which plunges into the tailrace water. The whole structure rests on a framing of steel beams, secured by the side walls forming the tailrace. To prevent leakage of water, hydraulic grooves are provided both in the movable part and the stationary part.

The turbines are 70 inches mean diameter, of 36 blades, and each one has 142 square inches. They are secured on a horizontal axis of 11½ inches diameter in the middle, tapering down to 8 inches. The turbines make 250 revolutions per minute, and they are supported on self-oiling bearings of 30 inches length by 8 inches diameter, supported on stout stands resting on the steel framing above mentioned. Each end of the shaft is provided with thrust bearings, so as to neutralize any end pressure that may be caused by a temporary obstruction in one or the other of the turbines. The prolongations of both shafts are provided with couplings to which dynamos are directly connected. To-day, however, but one dynamo is in position, absorbing about 1,100 horse power.

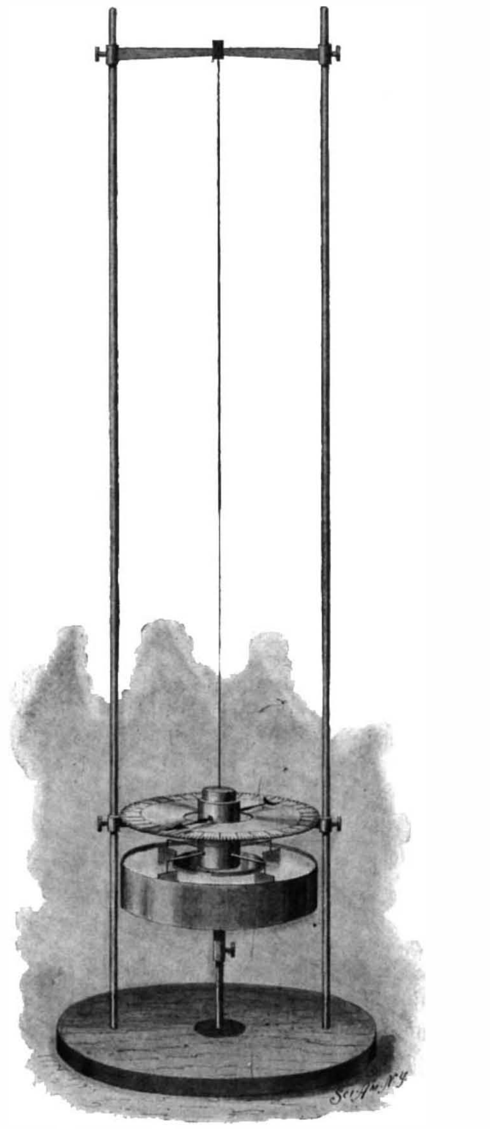
The placing of turbines in pairs on horizontal axes has within the last ten or fifteen years become a favorite mode of using water power, as, by placing the turbine shaft above the tailrace water, every part is made accessible. This mode of absorbing the power of hydraulic motors has become specially desirable, since the generators may be in many cases direct connected with the turbine shaft, thus saving any loss by the use of belting. Mr. E. Greyelin informs us that when, forty-four years ago, he placed two pairs of turbines on a horizontal axis, he little realized the advantages in the way of neutralizing the end pressure that would be secured by this method.



2,500 HORSE POWER TURBINES—NIAGARA POWER AND MANUFACTURING COMPANY.

A NEW VISCOSIMETER.

All who have given time to the subject of oil testing must have felt that many of the so-called standard tests were very unsatisfactory as compared with chemical tests in use in other fields to-day. This is no doubt due to the fact that it is almost impossible to duplicate many of these tests, especially those that come more under the domain of physical investigation rather than chemical.



A NEW TYPE OF VISCOSIMETER.

Foremost among this class of tests, and probably of more practical value than any other, is the determination of the viscosity of lubricating oils. But the value of this test has always been limited by the gross nature of the results obtained, and more especially since the recent investigations of Meyer and Slotte have shown that the apparatus which was formerly so much used and is still in somewhat extended use to-day, namely, the pipette, does not measure the viscosity at all, but that the result of all tests made with this instrument are influenced by the specific gravity of the sample.

Considering the nature of a correct test for viscosity, it should be kept in mind that viscosity has been defined as the resistance to flowing that any liquid or gas may possess. The frictional resistance which a fluid offers to change of shape or distortion of shape has been proved to be directly proportional to the length of time required to produce the change, or, in technical language, to the shearing per unit of time. Since shearing is the relative sliding of parallel planes without changing their mutual distances, and the tangential force per unit area of one of these planes is the measure of the frictional resistance of the fluid at the actual rate of shearing, then the quotient

$$\frac{\text{tangential force per unit area}}{\text{shear per unit time}}$$

is the measure of the quality of the fluid in virtue of which it resists distortion. It may correctly be called the coefficient of viscosity, or simply viscosity. The dimensions of this as given in the absolute system would be $\frac{M}{LT}$ and would determine the number of dynes per square centimeter necessary to produce unit shear per second.

The accompanying sketch shows a machine of the author's design for practically determining the viscosity of any liquid. The weight, including the pointers and paddles, of which latter there are four together with the wire, is exactly one kilogramme. Each paddle has an area of one square centimeter and is one millimeter thick. An adjustable scale graduated in degrees is shown just below the pointers. The pan is so arranged that it is adjustable in height, as shown by the pillar and screw. The wire from which the weight is suspended is one-tenth of a millimeter in diameter for light liquids and one millimeter in diameter for liquids of heavy viscosity, and in all cases one meter long. This wire is soldered into the standard at the top and into the center of the weight at the other extremity. The paddles stand at right angles to their adjacent neighbors as shown.

When ready for a test, the apparatus is in the position shown. The portion of the pan in which the paddles move is filled with the liquid to be tested and the pan raised until the liquid just covers the paddles. The weight is then brought to rest, thus showing that the wire is not subjected to any torsional strain. The weight is then moved until the pointers stand 180° from their original positions, and after being brought to rest are suddenly released. The elasticity of the wire now sets the weight in motion, and the number of degrees cut off in the first complete vibration is noted. This is then compared with the same angle determined with water at the same temperature. The subjoined table will give the actual viscosity for water at the several temperatures most commonly used.

The superiority of this method over the pipette procedure will be seen when it is known that with the pipette no difference in viscosity could be detected between water at 20° C. and petroleum naphtha at the same temperature. By this method, the following results were obtained:

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Water, 0·0102, and benzine, 0·0064. It will be seen that a difference of 0·0038 of a dyne per square centimeter was detected.

TABLE OF VISCOSITIES OF WATER.

0° C.	0·0181
10° "	0·0133
20° "	0·0102
30° "	0·0081
40° "	0·0067
50° "	0·0056

Meyer adopts the formula $\frac{0·0183}{0·0369\ A}$ as approximately representing his results, A being the temperature C.

S. S. KNIGHT.

Buying and Selling Steam Boilers.

BY EGBERT P. WATSON.

It is an axiom in trade to never argue with a buyer. Let him express his views and expound the laws of all things connected with the goods to his heart's content, but do not gainsay or dispute with him, upon any consideration. Business is not carried on to prove the correctness of theories, establish personal views, or to convert persons of opposite faith. It is prosecuted to transfer the ownership of merchandise, and, when arguments threaten, skillful salesmen have very elastic views. Anything which seems likely to interfere with making sales is a diversion from the principal issue. This is particularly true in selling boilers, for there are but few steam users who have not some stock objections to make as regards details of boilers. The writer was once taken aback by a steam user asserting that he would not have a dome on a boiler upon any consideration, for a dome was nothing but a condenser. This he had established to his entire satisfaction. Of two boilers in his works, one had a dome and the other had none. He went into the boiler room one Sunday when there was steam on, and proved the fact mentioned. The boilers were used for evaporating by steam coils, and when he opened the valve on the dome boiler the coil was full of condensed water, while the domeless boiler gave forth dry steam. "Now where did that water come from, if not out of the dome?" was his inquiry; but to it no rejoinder was made. It is with such absurdities as this that salesmen are often confronted, and it is a hard matter, sometimes, to show steam users that their premises and conclusions are both wrong, without giving offense and losing a sale.

It would seem that, where so much depends upon efficiency and economy in the use of steam boilers, the buyer should obtain the best advice before purchasing one; and this he can readily get by consulting firms of eminence in the business, and paying for what he needs; but there are some thrifty persons in this world who seem averse to such a very safe and simple plan, and go about the buying of a boiler as if they were buying a box of matches, and with as little consideration apparently. An old lady upon a witness stand was asked by counsel if she knew all about the case at issue, whereupon she replied, "Why, no sir. How can I know all about a thing I know nothing about?" And this view should be taken by outsiders when they undertake to buy boilers. A steam boiler is an expensive apparatus, and cannot be said to be cheap from any aspect. It is only relatively cheap when all the conditions are summed up. It seems obvious, therefore, that the best way to get a boiler suited to the work in hand is to get some one to buy it who knows what he is getting for his money. Externally all boilers look pretty much alike. No one but an expert can tell good work from poor, or whether the boiler is fitted for the service intended. Economy in the purchase of a boiler is a mistake, for the difference in first cost between a good boiler and a poor one is very little in comparison to the expense of repairing and keeping the poor one in order. There is always a demand for poor boilers, or they would not be made; but the man who expects to buy the best at the price of the worst will be mistaken. A horse weighing 1,000 pounds cannot do the same amount of work that a horse which weighs 1,500 pounds can do, and the average steam user would not think of substituting one for the other when it came to hauling loads. The case is exactly the same with the relative capacity of steam boilers. If the steam user knew nothing about horses, he would go to some one whom he could rely upon to get a good one, but when he wants a boiler he buys one himself. It is not a wise proceeding.

CURIOUS EXPERIENCES.

In selling boilers there are many curious situations and experiences which to an engineer expert are ludicrous in their several aspects, and give him new ideas as to the ability of non-experts to get hold of technicalities by the wrong end and to coin new terms for familiar details, so that he is at a loss to understand what is meant. For example, a boiler maker sells a boiler to a party who is evidently not at all acquainted with his needs. The boiler man makes boilers to sell, and it is not within his province to tell buyers what they shall have and what they shall not have, unless he knows that he will suffer in reputation by the transaction. So in this case the boiler is sold, and that is supposed to be the end of the matter. In a sale under consideration this was not the case, and, in a few days, the boiler maker received information that the boiler would not work up to its stated power. Where this happens, sometimes a salesman is sent and sometimes the foreman of the shop. The former is the best from a business aspect, for he has tact and lets the steam user down easy if he is in the wrong—as he always is. The foreman is the best man if anything is wrong with the management of the boiler, but he has about as much tact as a steel trap, and is prone to sarcasm and accusations of ignorance, than which nothing is more disagreeable to men who are ignorant. The foreman was sent, and his account of his experience was so amusing that it is given in his own words.

"I got up there all right, and when I went into the place, I asked the party what the trouble was. He said the only trouble was that the boiler wasn't good for anything, made no steam at all, and wouldn't drive a coffee mill, let alone a ten-horse engine.

"I found he was trying to run the boiler himself. So I said, 'Let me see it,' and went over to it. He had about twenty-five pounds of steam on, a water-glass chock-a-block with water, and a grate barely covered with a dull fire.

"'Say, my friend,' says I, 'what do you think you are trying to do? Frying fish-balls! Give me that shovel.'

"I took off my coat, blew out about two barrels of water from the boiler, hauled out his dirty cinders, and started a new fire. As soon as it got going, the steam went up to eighty pounds, and kept going up."

"'Now start your coffee-mill,' says I, and he did. Then I put in a good fire and let her go. After half an hour had passed and the coffee-mill was going all right, I says:

"'What's the matter with that boiler?'

"'You put in an awful lot of coal,' he says. 'It must be a very expensive boiler if it takes all that coal to run it. I had plenty in myself.'

"'All what coal?' I says to him. 'That fire-box hasn't got a bushel of coal in it, for it won't hold it. With what fire there is in now it will run an hour. That will be one hundred pounds of coal an hour. Since there are only four square feet of grate surface in the boiler, that is only burning twenty-five pounds per square foot of grate per hour, which is no coal at all for a small boiler. There ain't nothing the matter with that boiler but you;' and I came away first train."

It is not so much trouble to sell a boiler as it is, in case of dissatisfaction, to show the buyer that the fault is not in the boiler, but in his engine. Now, if you tell a man his engine is an expensive one to run, and is not up to the times, he resents it as quickly as he would derogatory personal remarks. Faulty engines are much more common than one would suppose; there are plenty which are made to sell only—"trade engines," so called, and require fifty to sixty pounds of steam per horse power per hour, when half of that should suffice. There are also engines which have been tampered with by alleged engineers, and even by the steam user himself, upon the belief that he can improve them. In one case the writer knows of, the boiler clearly would not drive the engine. So an engineer-expert was sent to see where the difficulty lay. He ran the boiler by evaporation for two hours, and found that it was well over its rating, and then he accused the engine of bad faith in the premises. Of course, the proprietor resented this promptly; but, all the same, the expert proposed to satisfy himself. As a short cut to one end of the solution, he took off the upper cylinder-head to ascertain the clearances, and found just what he expected to—that some one had turned off the cylinder-head so that there was fully three-quarters of an inch clearance. After gazing at it for a moment, he turned to the proprietor and said, "Who did that?"

"Did what?" was the reply.

"Who cut that cylinder-head off like that?"

"You mean that lid over the hole," said the man. "I did. The steam had no chance to get in the barrel, or whatever it is; so I cut off the nearest piece—the lid—that stopped the hole up. Now it works much better."

The engineer made no reply to this, but looked into the steam chest, where he saw that the proprietor, or some one for him, had been tinkering with the eccentric, so that not only the valve was adrift (washers and wires bent up like hair-pins had been inserted to cure this), but the times of the valve were a kind of go-as-you-please arrangement, where, by good luck, some steam occasionally got to the piston.

At this melancholy spectacle he gazed in wonderment for a time, then he turned to the proprietor and asked him what he would think of him if he went into his mill and proceeded to change the action of his machines without the least idea of what he was doing, and added, "If you get some one who knows his business to come here and put that engine in half-way decent condition, you will have steam to burn;" but nothing was ever after heard from the man, and he may be improving his engine still.

Marine engines are quite as bad as stationary engines, especially those fitted with that pestilential device known as a "keel condenser," that is, a pipe running around the exterior of the boat U-shaped, into which the engine exhausts, and makes a pretense of creating a vacuum.

Keel condensers are usually too small, there is not enough surface in them, and if oil is used in the cylinder, it quickly coats the interior of the pipe, and there is no way of getting it out without hauling the boat out of the water. The result is that the grease acts as a non-conductor, and the steam does not condense, so that only half a vacuum is obtained. If the engine is run above its normal speed for any cause, trouble begins at once, for the condenser is gagged, and cannot get away with the steam; so that there is at least seven pounds back pressure against the piston constantly.

A person applied for a boiler to drive an auxiliary yacht with an engine of a certain size. The price was satisfactory and the proposal accepted, but the contract was not signed. A few days after, the buyer called to complete it, and casually mentioned "two pumps" as part of the outfit.

"How large are the pumps?" he was asked.

When the size was given, he was told that the pumps would require as much steam as the engine. The gentleman then said that he had an electric light plant, which he also expected to drive from the boiler.

"Is there any more load on the boiler besides the engine, electric light, and two pumps?" he was asked. He said:

"No; nothing of any moment, only to heat the ship in cold weather."

The salesman was full to bursting with emotions he did not like to express; but he told the gentleman, in effect, that it was impolite in trade to keep things up one's sleeve in buying boilers, and that he (the salesman) had a narrow escape from making a serious blunder, and the yachtsman would have had a lot of bother which would have been his own fault; he had not stated his exact needs, and the boiler would not have been half large enough for the work. Then it would have been discarded, and the mourners would have gone about the streets, crying that Blank's boiler had been put out of the "Dugout" because it was no good.

There is any quantity of persons like this yachtsman, who fancy that a boiler is an unfailing source of steam, and that all one has to do is to open a valve, and it gushes forth, as the water gushed forth when Moses smote the rock aforetime. The only safe course for sellers is to make the contract specific as to the work the boiler has to do. If, afterward, the buyer hitches on a steam hogshead, and expects to fill and empty it twenty times an hour while the ship is in full route, he does it upon his own risk.

These are only a few instances out of a long experience, but they serve to show that a boiler maker's lot is not undiluted bliss. His failures are shouted from the housetops, but his successes are not told in Gath, neither are they published in Askelon.

A New Canal Project.

An effort is to be made by the persons interested in lake transportation to have the Anglo-American Commission take up the project of a canal joining the Great Lakes and the Atlantic. This subject has been favorably reported upon by a deep waterway commission authorized by Congress and appointed by the President. While this established the practicability of the canal, the present movement contemplates the devising by the commission of a plan of joint action by which the work will be actually commenced. It is suggested that the proper route will be by way of the St. Lawrence River and Lake Champlain, a cut of twenty-nine miles being sufficient, it is said, for that length of canal. Another cut of twenty-four miles would carry the canal to the Hudson River, thus connecting the shipping of Chicago and New York by way of the lakes, the Welland Canal, the St. Lawrence River, Lake Champlain, and the Hudson River. The projectors claim that the cut between the St. Lawrence and Lake Champlain can be made for three or four millions, the topography being particularly favorable to canal digging. They are proceeding on the idea of having the two governments do the work, each doing the construction of its own side, thus making it a government rather than a private enterprise.

Death of Professor Allman.

Professor George James Allman, the well known biologist, died in London, November 27. He was born in Cork, Ireland, 1812, and graduated from Dublin University 1844, and was immediately appointed Professor of Botany. In 1854 he went to Edinburgh University and was keeper of its natural history museum. His chief scientific labors were among the lower organisms of the animal kingdom, to the study of whose structure and development he specially devoted himself.

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Correspondence.

The Bicycle Frame Again.

To the Editor of the SCIENTIFIC AMERICAN:

I have been reading, with much interest, your recent articles on lighter weight bicycles, and particularly your suggestions as to the use of a third transverse tube from seat cluster to the bottom angle of the head.

I can say, to start with, that the idea is not a new one, nor is it, as some of your correspondents claim, a "wild-eyed" one.

In 1893 the writer conceived this idea, studied over it a while, and then made a machine on that line in 1894. Previous to that time a certain well known machine was made and marketed in large numbers, with a tube running from the top of the head to the crank hanger bracket. It occurred to me that the strain of successive shocks transmitted through front forks was not provided for in any way whatever, under that form of construction; that, in fact, the extra tube was entirely superfluous.

On the other hand, I had observed in every case of a head-on collision, of undue shock from running against an obstacle or in a deep depression in the road, that the lower main tube of the front diamond was invariably buckled and bent upward. I thought a tube placed exactly opposite from the one in the machine referred to would obviate this and provide against shocks of the character mentioned, distribute them through the length of the auxiliary tube by vibration, and, meeting with a solid point of resistance at the seat cluster, become absorbed and their destructive qualities eliminated.

So in the machine I made I used 26 gage seamless tube throughout, except on the chain side of the rear frame, where I used 18 gage to provide against chain pull.

I mentioned my idea to a number of bicycle workmen, who all admitted the tube would perform what I aimed at, but that it would be impractical mechanically, some under one claim and some under another.

But being confident the idea was practical and mechanical, I built my machine. The result surprised even myself. I found I had a thoroughly practical road wheel, at a weight, with road tires, of about 23 pounds. The rigidity and freedom from shocks in riding over rough roads was very apparent and much commented upon by all who tried it.

I rode this machine all of one season, for something like 700 miles. Gave it particularly hard usage, met with more than the ordinary number of accidents, on one occasion taking a "header" into a blind ditch, with which an ordinary built machine would, I am confident, have been a complete wreck. In short, the idea proved practical from every point of view except one—that of marketing same. Many people in the trade, whose opinion was valuable, claimed it would not prove a "seller," and my experience in one of our leading cities obliged me to adopt the same view. For instance, I have had the irrepressible street gamin yell after me, "See the guy with his freak wheel," etc.; many times in terms less complimentary than those. Personally, after becoming used to the outlines and appearance of the machine, I rather liked it, but perhaps I was prejudiced, it being my own child, you know. Finally, I laid it by as a thing ahead of its time. It is still stored in a certain place, awaiting the time when it may seem proper to attempt its introduction as a thing to make and to sell with success. I will only say in conclusion that all your claims as to the feasibility of the idea were fully proved in my experience. W. C. JOHNSON.

Springfield, O., November 12, 1898.

Death in the Milk Jug.

The omnipotent bacillus is everywhere. At the Sanitary Congress, says Humanitarian, some very unpleasant revelations were made concerning the milk supply of our large cities. Dr. Scurfield testified that not only was the milk poor in quality as regards the proportion of fat and non-fatty solids in it, but it was often contaminated by dirt or disease germs on its way to the consumer. Mr. Niven, the Medical Officer of Health for Manchester, also gave some unsavory facts about that city. Out of ninety-three samples of milk taken at random, 18 per cent were found to contain tubercular infective matter. Medical authorities declare that one of the most fruitful causes of diarrhea is the boracic acid used to adulterate the milk; and that the existing Adulteration Acts are inadequate and not strictly enforced. These are not small things, for milk is one of the necessaries of life. They constitute a great scandal and a grave danger, which should be dealt with firmly and promptly.

A Medal for the "Phantascope."

The Elliott Cresson medal has been awarded to C. Francis Jenkins, for the invention of the phantascope, on the recommendation of the Franklin Institute, after a searching examination of this instrument. We have already fully illustrated the Jenkins apparatus.

Miscellaneous Notes and Receipts.

Picric acid excited popular interest for some time when this substance was employed in France for the production of the melinite bombs. Now the acid formerly used for an explosive assumes the rôle of a peaceful remedy against the so-called eczema, a cutaneous eruption which is sometimes quite malicious. According to the Paris Bulletin Médicale, a solution of 1 part picric acid in 86 parts pure water, applied with a brush on the diseased portions of the skin, is said to allay the painful itching at once. It forms a sort of protective covering over the sore spot, under which the healing and cicatrization progress quickly.

A New Whooping Cough Bacillus.—An Italian investigator, Prof. Livio Vincenzi, at Sassari, claims to have discovered the above. He found it, as stated in the Deutsche Medizinische Wochenschrift, in the expectorations of children suffering with whooping cough, in some cases it being present in a very large quantity, while it was absent in other processes of sickness. Prof. Vincenzi ascertained by a series of researches the peculiar qualities of the little organism, but he did not succeed in causing by inoculation on animals the same disease as in human beings. It is, however, a well-known fact that whooping cough never occurs in animals.

Preserved Lemon Juice.—The expressed juice is poured through a cloth and then mixed with about one-fourth of its volume of powdered talc, whereupon it is shaken about one-quarter hour; next, it is placed aside for one-half hour, shaken again, allowed to stand, and filtered. Filter through paper, add to the filtrate 10 per cent of sugar and bring to a boil. During this time place the bottles to receive the juice in a kettle of water, fill them with water and boil them in the kettle. Empty the bottles, pour in the boiling lemon juice as quickly as possible and close up at once with a good cork previously dipped into paraffine. Juice prepared and bottled in this manner is said to possess unlimited keeping qualities.—Neueste Erfindungen und Erfahrungen.

Soluble Mercury.—According to Lottermann colloidal quicksilver can be produced by using stannous nitrate as a reducing agent and proceeding as follows: The strongly diluted mercurous nitrate solution is, with stirring, poured into the likewise diluted solution of the stannous nitrate, both solutions containing only so much free acid as is necessary for preventing the separation of basic salts. A deep brown liquid is formed. The liquid is then mixed with a concentrated solution of ammonium nitrate, whereby the colloidal mercury is eliminated. The brown color of the liquid passes into black, and a very fine black precipitate is distinguished. Then neutralize with ammonia, stirring the while and avoiding strong heating. After the precipitate has settled the supernatant solution is taken off with a siphon, further liquid being sucked up by means of a porous clay filter, and the paste, still rather thinly liquid, is dried in the vacuum exsiccator over sulphuric acid. Thus silvery pieces are obtained which dissolve in water, with a deep brown color.—Journal für praktische Chemie.

Preparation of Gold Water (Dantzic Brandy).—Some of the most reliable and tried recipes for the preparation of Dantzic brandy are the following:

I.

Rose leaves	125	grammes.
Cinnamon bark	15	"
Cloves	7½	"
Cardamoms	2½	"
Nutmeg	5	"
Lavender blossoms	7½	"

Pour 1½ liters of spirit of wine and 1 liter of water over the comminuted spices, and subject to distillation. After 1½ liters have been distilled, add 750 grammes of sugar and water, so as to obtain 3 liters. Mix with gold leaf reduced to small pieces.

II.

Rose leaves	15	grammes.
Lavender blossoms	15	"
Balm	15	"
Marjoram	7½	"
Caraway	7½	"
Camomile (Roman)	7½	"
Sassafras wood	4	"
Cloves	4	"
Nutmeg	4	"
Lemon peel	6	"
Orris root	6	"
Guinea grains	6	"
Bay berries	4	"
Juniper berries	4	"

Directions same as in first recipe.

III.

French recipe:

Rose leaves	250	grammes.
Orange flowers	250	"
Cinnamon bark	30	"
Cloves	7½	"
Lavender flowers	15	"
Spirit	3	liters.
Water	2	"

Distill 4 liters of this and add ½ liter of rose water and ¼ liter of orange flower water, as well as 1 kilogramme of sugar, and mix with gold leaf.—Apotheker Zeitung.

Science Notes.

A writer in a recent number of Medicin Moderne, after expressing his sympathy with the pharmacists whose difficult task it is to decipher illegible prescriptions, adds that the matter has attracted the attention of the Dean of the Medical Faculty of Paris. The execrable handwriting of many French physicians is thought to be a menace to the public, and the Dean is reported to have said that he would take the earliest opportunity of bringing the matter to the notice of the faculty. The pharmacists of America will doubtless sympathize with this movement.

Capt. Spelterini a few weeks ago ascended in the balloon Vega, but was foiled in his attempt to cross the Alps by the wind, which drove the balloon to the northwest of the Diablerets instead of northward. The balloon descended safely at Dijon in France, having reached an altitude of 20,670 feet. Prof. Heim, Dr. Mauer, and Dr. Biederman accompanied Capt. Spelterini. The balloon was specially constructed for this ascent. It contained 3,268 cubic meters of gas, was nearly 200 feet in height, and was capable of carrying a weight of 110,000 kilos, or about 100 tons. The weight of the car was one ton, and two tons of ballast were carried. A "trial," or unoccupied, balloon was also sent up by the International Aerostatic Society. It was fitted with recording instruments. Quite a gale was blowing at the time, and the balloon was driven at high speed in a northeasterly direction, finally disappearing amid the clouds at a height of 4,500 meters (14,764 feet). The automatic ballast was lost at the start when the balloon was crossing the promenade.

On the suggestion of C. Witter, of the Hamburg metallurgical laboratory, R. Hase, of Hanover, has constructed a new type of chemical balance, which at once marks the approximate weight of the substance. This is done by an additional pointer, which occupies an inclined position and plays over a special graduated arc. This pointer and the additional device are put in gear by means of a button on the top of the glass case of the balance. The substance is put in one pan, a number of weights in the other; the pointer then marks how many grammes are still wanting, to within a few centigrammes. The rest of the weighing can easily be performed with the help of the rider only in the usual fashion. The method is particularly convenient for weighing predetermined quantities. The platinum dish can, for instance, be filled while standing on the pan without arresting the balance, until the additional pointer indicates that the weight is almost correct. The addition is said not to complicate the construction much, and to make little difference in the price. If that be so, the novelty will be welcome.

Prof. Zickler, of Brünn, has conducted an elaborate series of experiments, which show that a telegraphic instrument can be actuated at considerable distances by a beam of ultra-violet light. He employs a powerful arc lamp as his transmitter, using a screen of glass to produce intermittent flashes of the ultra-violet beam, which embody themselves as dot and dash signals on his receiver. The receiver is an air gap in a circuit containing an induction coil regulated to an electromotive force just below the sparking point at the air gap. As Hertz long ago has shown, a beam of ultra-violet light falling on the cathode of a strained air gap, near its breaking-down point, will immediately provoke a discharge. Zickler started by producing this effect over a distance of 2 meters. Then, by improving the shape and material of his electrodes and inclosing them in a chamber of compressed air, he was able to increase this distance to 200 meters, says The Electrical Review. This is a remarkable result, and it is extremely interesting to physicists to learn that the short and easily absorbed ultra-violet light can influence a spark discharge at so great a distance.

F. C. Harrison, of Guelph, Ontario, has examined hailstones bacteriologically on two separate occasions. The stones were washed in mercuric chloride solution (1 in 500), rinsed several times in sterilized cold water, and each stone thus treated was dropped into a tube of melted nutrient gelatin, the mixture thoroughly shaken, and plates were made in the usual way. Four days after the plates were counted, all the bacteria and a number of moulds were isolated, and their cultural characteristics determined. Among those present were Penicillium glaucum, Mucor sp., Aspergillus sp., B. fluorescens liquefaciens, B. fluorescens nonliquefaciens, a protean form of Proteus vulgaris, and two micro-organisms, a bacillus and a coccus, which do not agree with any published descriptions, and for which the author suggests the names B. flavus grandinis and M. melleus grandinis. Detailed descriptions of the two latter are given in the monograph. The repeated presence of the fluorescing germs lends support to Bujwid's surmise that surface water is carried up by storms and frozen, producing hailstones. Bujwid, who probably was the first bacteriologist to investigate hailstones, arrived at this conclusion in the first place from consideration of the large number of germs found in the hail.—Botanical Gazette.

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NAVIES OF THE WORLD.

I. GREAT BRITAIN—SECOND ARTICLE.

In the first chapter of this series (see issue of November 26) we discussed the armored ships of the British navy, under which head were included the battleships, coast defense vessels, and armored cruisers. We found that, after omitting the obsolete ships, Great Britain possesses or is building 54 battleships, 25 coast defense vessels, and 17 armored cruisers. In like manner, by applying a test of speed and omitting all protected cruisers whose speed falls below 15 knots, and all gunboats below 12 knots, we arrived at a total of 194 unarmored vessels, made up of 97 protected cruisers, ranging in size from small cruisers of 2,000 tons displacement and less up to great vessels like the "Powerful" and "Terrible," of 14,200 tons displacement, and 97 cruisers and gunboats below 2,000 tons displacement.

The distinction between an armored and an unarmored but protected vessel is very simple. Any vessel, be she battleship or cruiser, that carries a belt of vertical side armor at the water line is "armored." Any vessel that has a continuous protective deck of steel extending from stem to stern, but no vertical side armor, is "protected." The vessel that has neither steel deck nor side armor is "unprotected."

The imposition of a speed limit of 15 knots reduces the total number of protected cruisers from 226 to 194. The 32 vessels thus omitted are made up of cruisers of from 2,000 to 3,000 tons displacement and from 12½ to 14½ knots speed and a number of gunboats. They were built in the early eighties, and while they might be of some value in convoying merchant vessels, they would be as helpless against modern cruisers as were Montojo's vessels at Manila. They are therefore omitted from the present estimate of fighting strength. Dividing the 194 cruisers and gunboats into classes according to their size, we get 10 ships of from 11,000 to 14,200 tons; 11 ships of from 7,350 to 9,000 tons; 30 ships of from 4,050 to 5,800 tons; 46 ships of from 2,135 to 3,600 tons; and 97 cruisers and gunboats below 2,000 tons.

Broadly speaking, the British cruisers exhibit the same distinguishing characteristics as the battleships. They are essentially sea-keeping ships, standing well up out of the water, and having good speed, a liberal coal supply, and generous berthing accommodation for the crew; but it must be confessed that in the main the vessels appear to be under-gunned, the armament in many of the vessels being light in proportion to the displacement. Whether the British cruisers be compared with our own or those turned out by private English firms, such as the Armstrong Company, the weight of metal thrown compared with the displacement is light for all but a very few of the Admiralty designs. As an instance of this we present a comparison of the British protected cruiser "Edgar," of 7,350 tons, with the armored cruiser "Esmeralda," of 7,020 tons, designed and built by Armstrong for the Chilean government.

Now, at first sight, on comparing these vessels, one wonders what has been done with the extra 330 tons of displacement in the "Edgar." It is true the sloping deck is 3 inches thicker; but this is more than offset by the 6-inch belt of the "Esmeralda." The guns are better protected in the "Edgar," being contained in closed 6-inch casemates or sheltered behind 6-inch shields, whereas the "Esmeralda's" guns are mounted in the open and the crew are lightly protected by shields; but against this must be set off the fact that the two 8-inch and sixteen 6-inch guns, all rapid-firers, give the Armstrong vessel a great preponderance of offensive power. The larger coal supply of the "Edgar" may be set down to the larger displacement. Finally, the smaller vessel has an excess of 2½ knots of speed. There is one point of comparison on which we do not possess the figures, namely, the supply of ammunition—a feature of prime importance. In this regard it is likely that the government vessel is better provided.

	"Edgar."	"Esmeralda."
Displacement	7,350 tons.	7,020 tons.
Speed ...	20·5 knots.	23 knots.
Coal supply (normal)....	850 tons.	550 tons.
Armor: Deck..........	5-inch.	2-inch.
Belt....	none.	6-inch.
Gun position...	6-inch.	Light shields.
Armament:	Two 9·2-inch Ten 6-inch rapid-fire. Twelve 6-pounders. Five 3-pounders. Seven machine guns. Four torpedo tubes.	Two 8-inch rapid-fire. Sixteen 6-inch rapid fire. Eight 3-inch rapid fire. Two 3-pounders. Four machine guns. Three torpedo tubes.

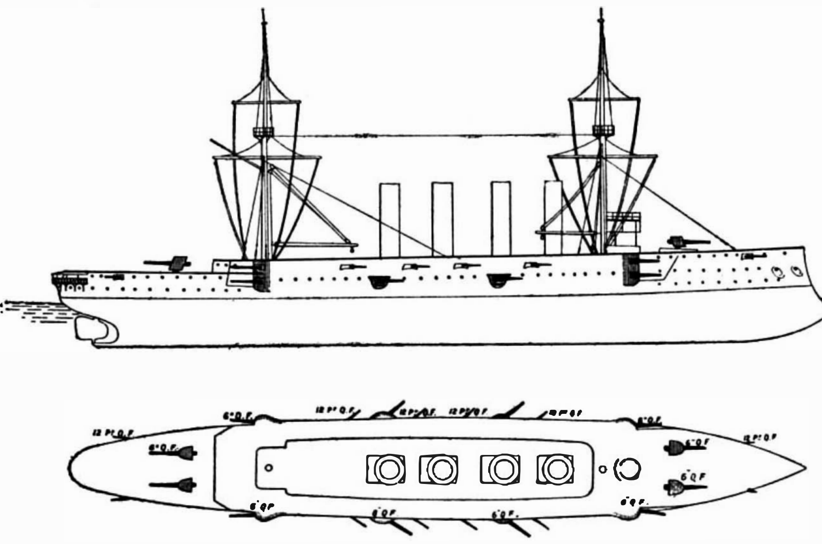
It is the policy of Sir W. White, who has designed practically the whole of the modern British navy, as distinct from that of Mr. Watts, who designs the Armstrong ships, to provide a vessel with a moderate number of guns, thoroughly protected and well supplied with ammunition, rather than with an excessive number of guns, poorly protected and carrying a limited supply of ammunition. Which system is better, the supreme test of war alone can tell. If the past is any guide, we know that victory rests with the ship that can bring an overwhelming preponderance of fire to bear at the outset of the fight. It was thus we triumphed in the naval duels of the war of 1812, and the probability is that "Providence" will be found to be "on the side of big" batteries.

In keeping with the policy of mounting fewer guns but giving them thorough protection is the great pains that is taken to encourage good marksmanship in the British navy. It is not generally known, but is nevertheless a fact, that, as a result of the prizes that are offered for the best target practice, a high state of efficiency has been reached by the British gunners, as the subjoined results of recent prize shooting in the Channel Squadron will show:

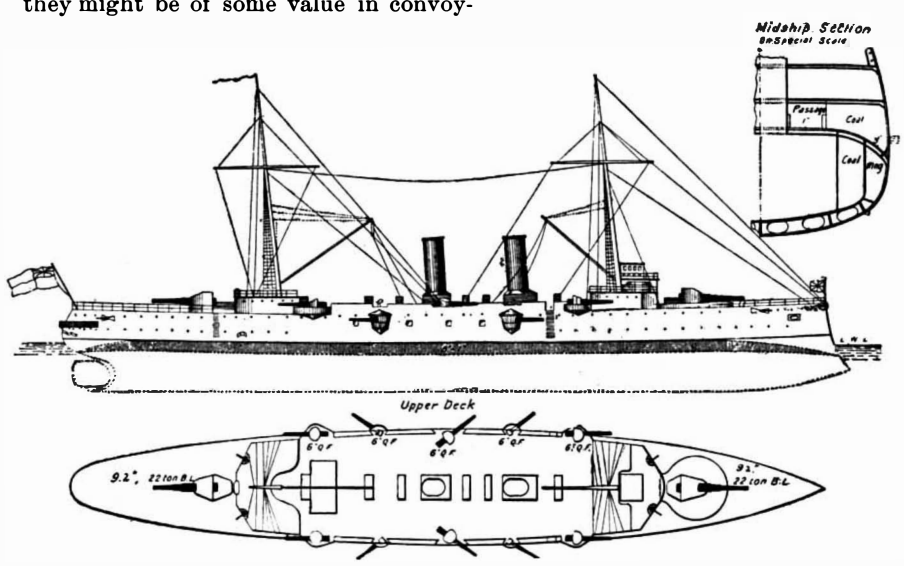
"Repulse"	23 rounds	with	13·5-inch	guns	scored	9 hits.
"Magnificent"..	17 "	"	12-inch	"	"	3 "
"Repulse"......	86 "	"	6-inch R. F.	"	"	18 "
"Magnificent"..	97 "	"	6-inch "	"	"	14 "
"Pelorus"......	89 "	"	4-inch "	"	"	25 "

These results were obtained in "dirty" weather when the ships were under way, and only direct hits were counted.

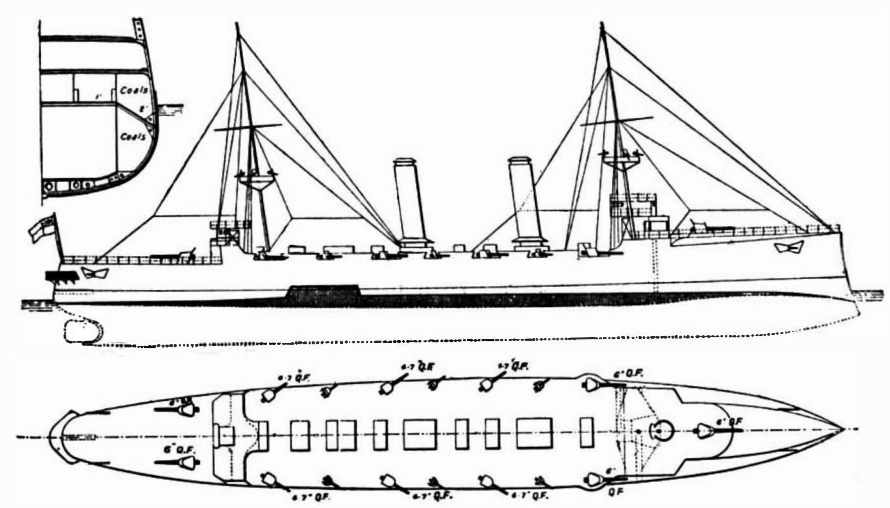
As will be seen by studying the cross section of the "Edgar" (see accompanying diagrams), the protection to the vitals of an unarmored cruiser consists of a steel deck which is flat in the center, but slopes to below the waterline at either side. The coal bunkers are



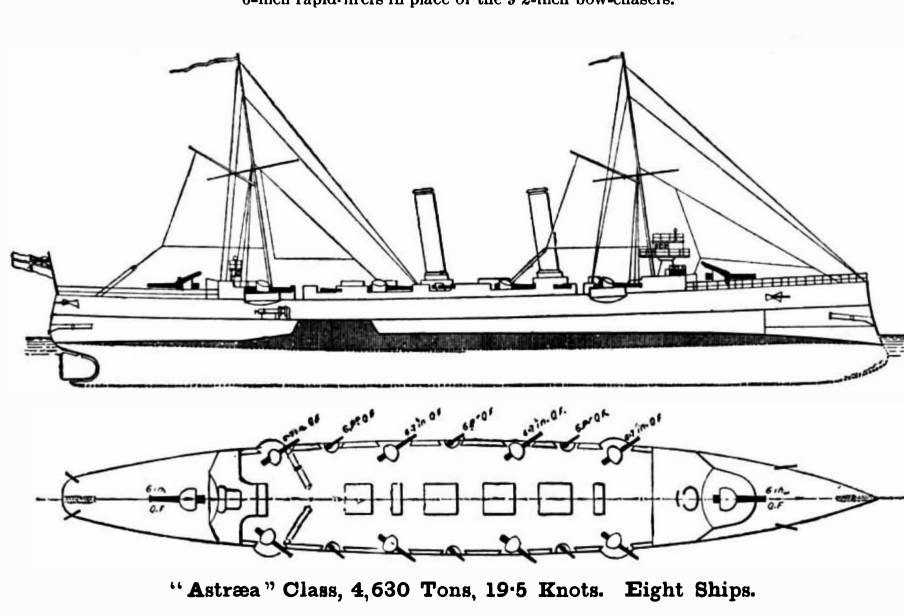
"Diadem" Class, 11,000 Tons. 20·5 Knots. Eight Ships.
Also "Powerful" and "Terrible," 14,200 tons, 22·4 knots, with flush upper deck, and a 9·2-inch rifle substituted for the two 6-inch guns at bow and stern.



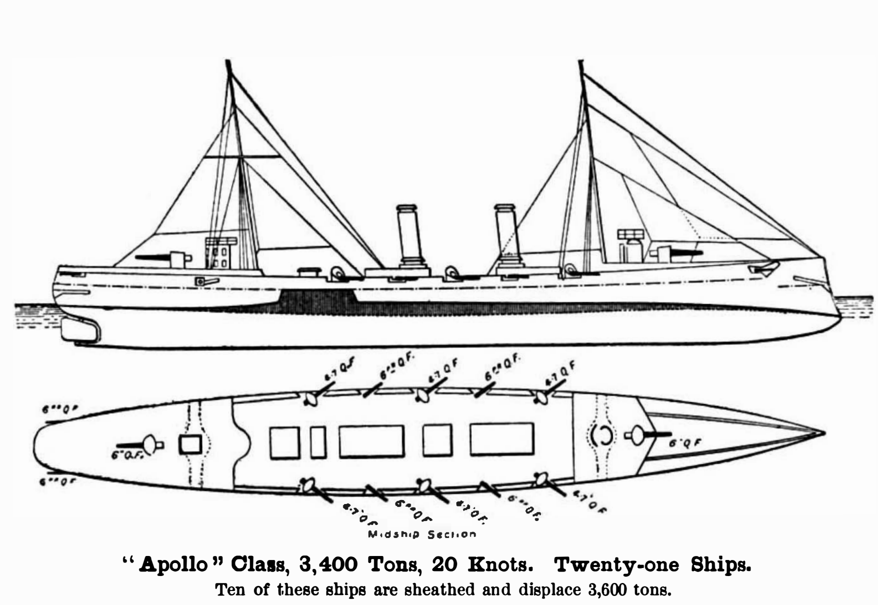
"Edgar" Class, 7,350 Tons, 20 Knots. Nine Ships.
Four ships of this class ("Royal Arthur" type, 7,700 tons, 19¾ knots) have a raised forecastle deck with two 6-inch rapid-firers in place of the 9·2-inch bow-chasers.



"Eclipse" Class, 5,600 Tons, 20 Knots. Sixteen Ships.
Four ships of this class ("Arrogant" type, 5,800 tons, with three smokestacks) are strengthened for ramming and carry four 6-inch and six 4·7-inch guns. Three of the "Eclipse" class carry eleven 6-inch rapid-firers in place of five 6-inch and six 4·7-inch.



"Astræa" Class, 4,630 Tons, 19·5 Knots. Eight Ships.



"Apollo" Class, 3,400 Tons, 20 Knots. Twenty-one Ships.
Ten of these ships are sheathed and displace 3,600 tons.

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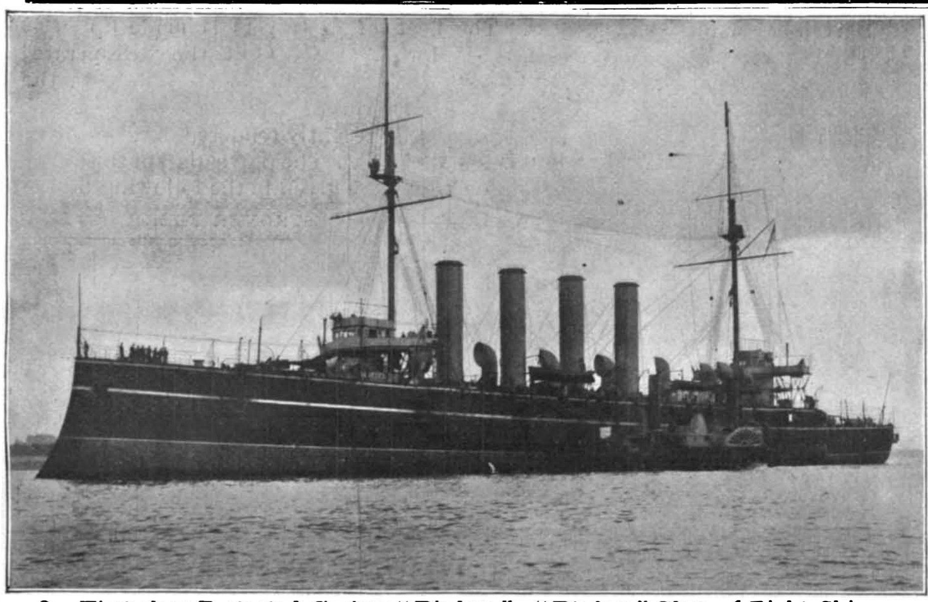
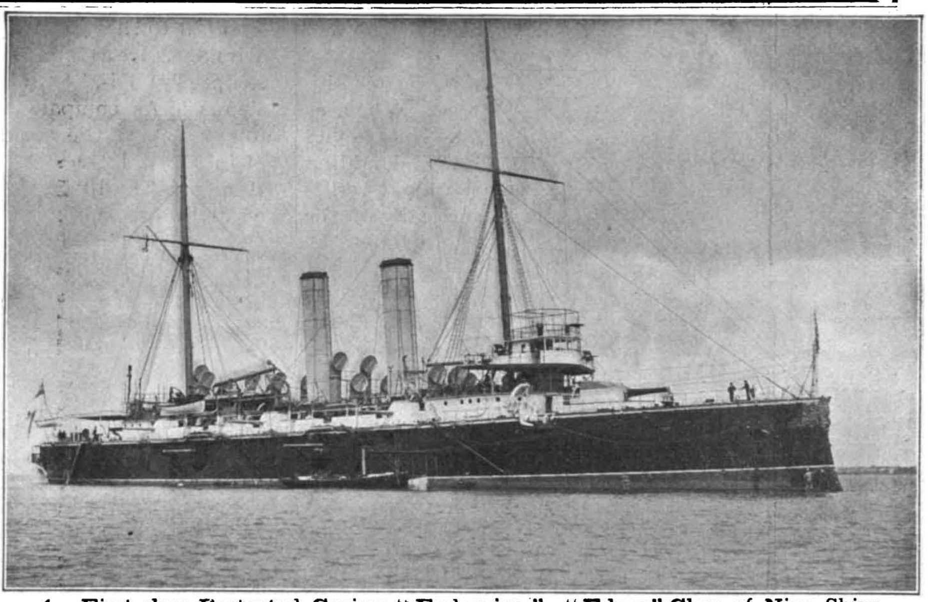


3.—First-class Protected Cruiser "Diadem." "Diadem" Class of Eight Ships.

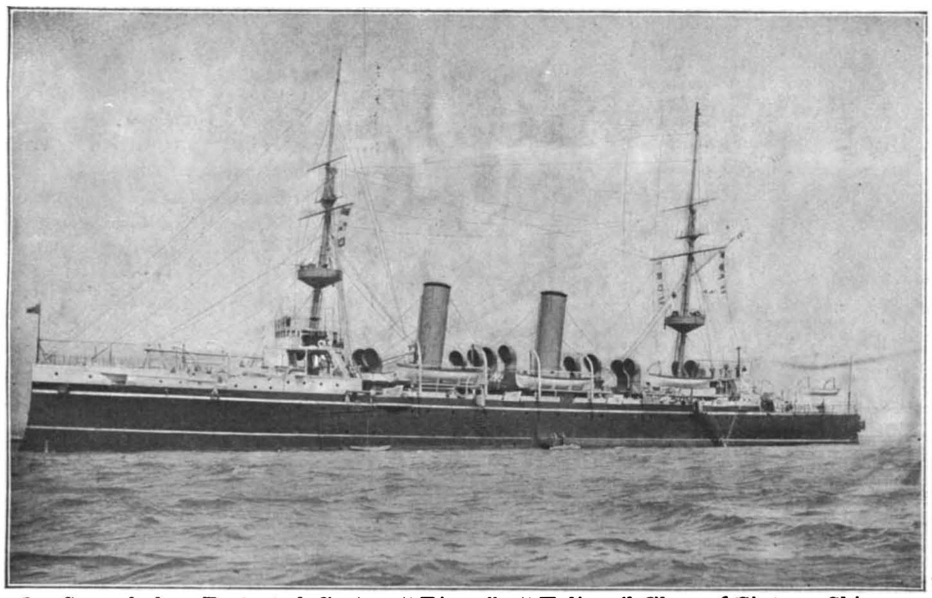
Displacement, 11,000 tons. **Speed,** 20·5 knots. **Bunker Capacity,** 1,900 tons. **Armor:** Deck, 2½ inches on flats, 4 inches on slopes; shields and casemates, 6 inches. **Armament,** sixteen 6-inch and fourteen 3-inch rapid-fire guns, twelve 3-pounders, two 3-inch boat guns. **Torpedo Tubes** 5 (two submerged). **Complement,** 677. **Date,** 1897.



4.—First-class Protected Cruiser "Endymion." "Edgar" Class of Nine Ships.

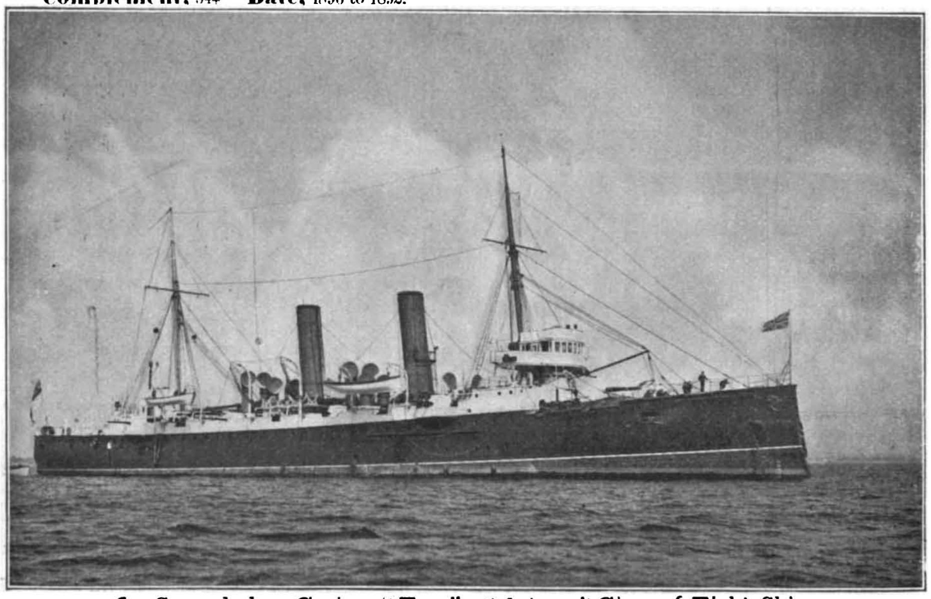
Also the "Blake" and "Blenheim" of 9,000 tons and 21·5 knots.

Displacement, 7,350 tons. **Speed,** 20 knots. **Normal Coal Supply,** 850 tons. **Armor:** 1 inch on flats, 5 inches on slopes; gun positions, 6 inches. **Armament,** two 9·2-inch, ten 6-inch rapid-fire, twelve 6-pounders, five 3-pounders, seven machine guns, two boat guns. **Torpedo Tubes,** 4 (two submerged). **Complement,** 544 **Date,** 1890 to 1892.



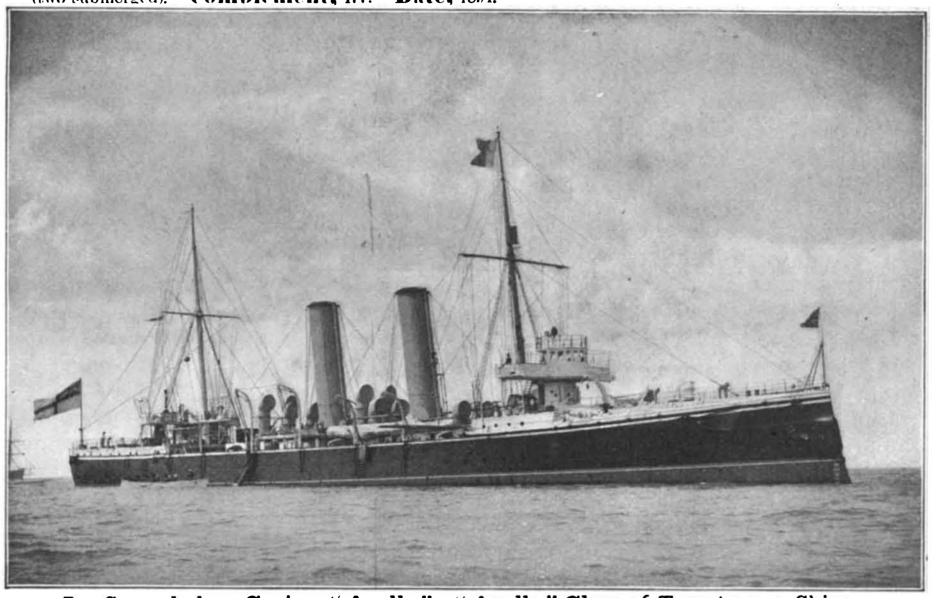
5.—Second-class Protected Cruiser "Diana." "Eclipse" Class of Sixteen Ships.

Displacement, 5,600 tons. **Speed,** 20 knots. **Normal Coal Supply,** 550 tons. **Armor:** Deck, 1½ inches on flats, 3 inches on slopes; gun positions. 4½ inches. **Armament,** five 6-inch, six 4·7-inch, and nine 3-inch rapid-fire guns, one 3-pounder, four machine guns, one 3-inch boat gun. **Torpedo Tubes,** 3 (two submerged). **Complement,** 477. **Date,** 1894.



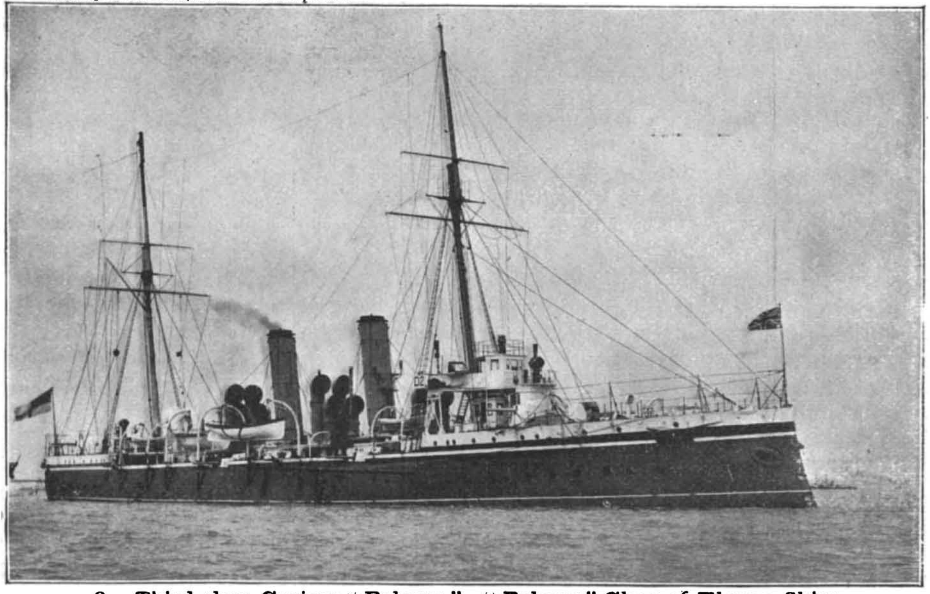
6.—Second-class Cruiser "Fox." "Astræa" Class of Eight Ships.

Displacement, 4,360 tons. **Speed,** 19·5 knots. **Normal Coal Supply,** 400 tons. **Armor:** Deck, 1 inch on flats, 2 inches on slopes; gun positions, 4½ inches. **Armament,** two 6-inch and eight 4·7-inch rapid-fire guns, eight 6-pounders, one 3-pounder, four machine guns, one boat gun. **Torpedo Tubes,** 4. **Complement,** 312. **Date,** 1893.



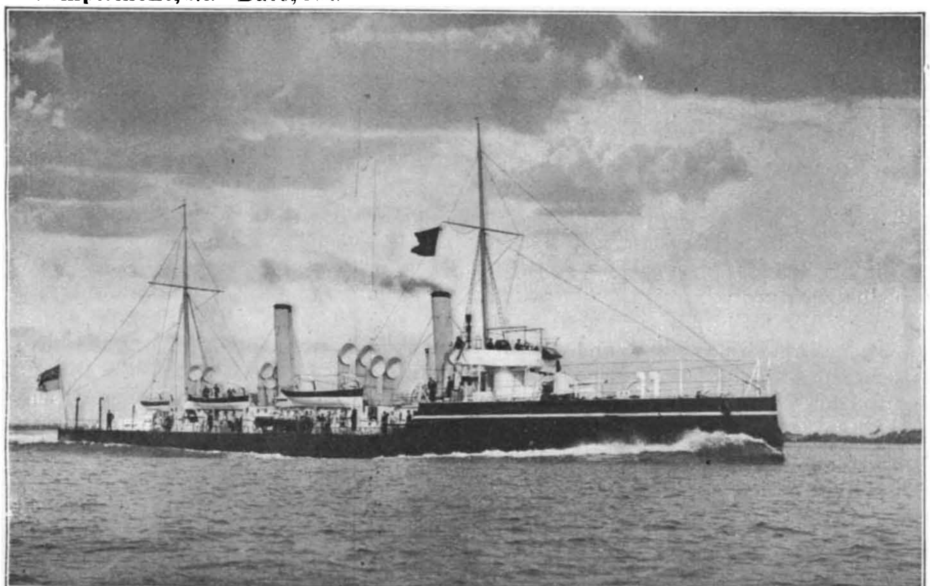
7.—Second-class Cruiser "Apollo." "Apollo" Class of Twenty-one Ships.

Displacement, 3,400 tons. **Speed,** 20 knots. **Normal Coal Supply,** 400 tons. **Armor:** Deck, 1 inch on flats, 2 inches on slopes; gun positions, 4½ inches. **Armament,** two 6-inch and six 4·7-inch rapid-fire guns, eight 6-pounders, one 3-pounder, four machine guns, one boat gun. **Torpedo Tubes,** 4. **Complement,** 273. **Date,** 1892.



8.—Third-class Cruiser "Pelorus." "Pelorus" Class of Eleven Ships.

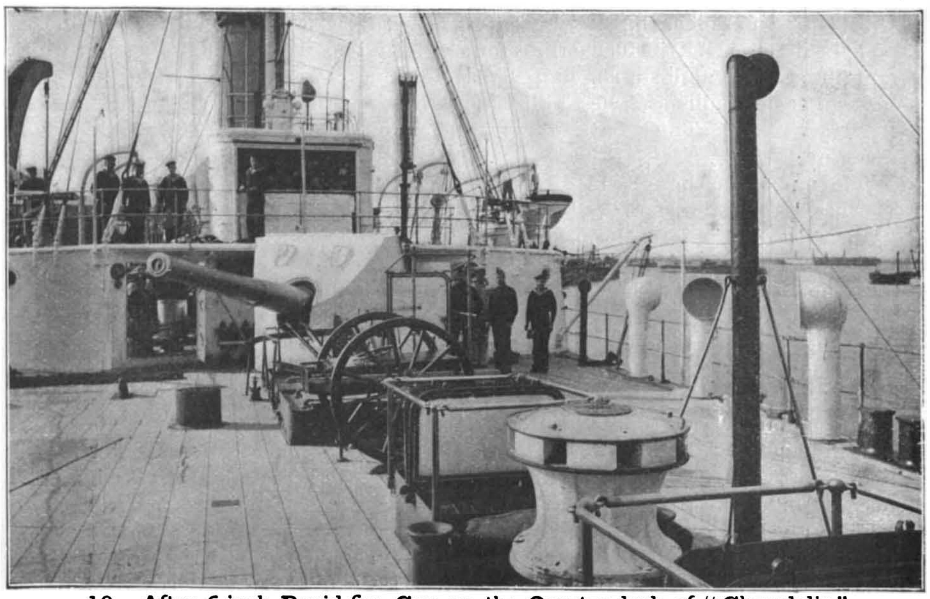
Displacement, 2,135 tons. **Speed,** 20·7 knots. **Normal Coal Supply,** 250 tons. **Armor:** Deck, 2 inches: gun positions, 4½ inches. **Armament,** eight 4-inch rapid-fire guns, eight 3-pounders. two boat guns. **Torpedo Tubes,** 2. **Complement,** 224. **Date,** 1898.



9.—Torpedo Gunboat "Speedy." "Speedy" Class of Eleven Vessels.

Also four "Halcyon" type, 1,070 tons and 19 knots, and thirteen of "Gleaner" type, 735 tons and 20 knots.

Displacement, 810 tons. **Speed,** 20·2 knots. **Normal Coal Supply,** 100 tons. **Armor:** Gun positions, 4½ inches. **Armament,** two 4·7-inch rapid-fire guns, four 3-pounders. **Torpedo Tubes,** 3. **Complement,** 91. **Date,** 1893.



10.—After 6-inch Rapid-fire Gun on the Quarter-deck of "Charybdis." "Astræa" Class.

Weight of gun, 6¼ tons. Weight of shell, 100 pounds. Length of bore, 40 calibers. Number of shots per minute, 6.

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From photographs by Symonds & Co., Portsmouth, England.

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ranged along the sides in the wake of the engines and boilers and fill up the space between sloping deck and outside shell plating, and also the spaces between inside of slopes and engine and boiler rooms. When, as in the case of the "Edgar," the slope is 5 inches thick, this equals about 7½ inches vertical, and, adding the resistance of the coal, we get the equivalent resistance of about 12 inches of steel placed vertically on the sides of the ship. It is better, however, to burst the shells outside than inside the shell plating, and hence the armored cruiser is coming increasingly into favor in the present day.

The duties of the cruisers of the British navy will lie chiefly in the direction of protecting her enormous maritime commerce. They will be disposed at important points on the great trade routes, which they will patrol as long as any cruisers of the enemy are at sea. Undoubtedly at the outbreak of the war an effort will be made to watch the hostile cruisers, and keep them shut up in their own ports; but should they escape, it will be the work of this big fleet of close upon two hundred vessels to capture or sink them as quickly as possible. The enemy's commerce destroyers of over 21 knots will be open to attack only by such fast vessels as the "Powerful" and "Terrible," of 21½ to 22½ knots speed. In view of the terrible havoc that a 23-knot commerce destroyer could work on British commerce, it is strange that the government does not build a few powerful vessels capable of overtaking a craft of this kind. Two 15,000 ton armored cruisers of 23 knots are to be laid down shortly.

It is a remarkable fact that nearly the whole of this large fleet of protected cruisers has been built during the past ten years. The start was made when the alarm of the British public over the defenseless condition of their maritime commerce led to the passage of the Naval Defense Act of 1889, when $100,000,000 was voted for the construction of seventy new vessels. Previous to the passage of the act, the protected cruiser classes were represented by the "Blake" and "Blenheim," 9,000 tons, 21½ knots; eight ships of the "Forth" and "Leander" types, of 4,000 and 4,300 tons and 17 and 16½ knots; five ships of the "Magicienne" and "Medusa" types, 2,950 and 2,800 tons and 19 knots; the "Calliope," and "Calypso" (the former famous for its escape from Apia during the fatal hurricane), 2,770 tons and 14·6 knots; fifteen gunboats of the "Archer" and "Barracouta" classes, of 1,830 and 1,580 tons and 18·6 and 16·5 knots; besides some forty or fifty smaller and slower gunboats. Of these only the "Blake" and the "Blenheim" can be considered thoroughly up-to-date vessels.

THE SIPHON OF THE CLAM.

The Naval Defense Act, in addition to 10 battleships, called for 29 second-class cruisers of the "Apollo" class, of 3,400 tons and 20 knots, and 9 first-class cruisers of the "Edgar" type, of 7,350 tons and 20 knots. Of these 29 second-class cruisers, 11 were built according to the original design, as follows: Displacement, 3,400 tons; speed, 20 knots; armament, 2 6-inch, 6 4·7-inch rapid-fire guns, and 14 smaller guns. Ten others were built of identical dimensions, etc., but were sheathed and coppered to fit them for tropical waters, the displacement being thereby raised to 3,600 tons. The names of the 21 vessels are as follows: "Æolus," "Andromeda," "Apollo," "Brilliant," "Indefatigable," "Intrepid," "Iphigenia," "Latona," "Melampus," "Naiad," "Pique," "Rainbow," "Retribution," "Sappho," "Scylla," "Sirius," "Spartan," "Sybille," "Terpsichore," "Thetis," and "Tribune."

To give them better sea-going qualities and a more powerful battery, the other 8 ships were built with 20 feet more length, the whole battery was placed on a flush main deck (instead of on a forecastle and poop and in a well amidships), and two additional 4·7-inch guns were added. These ships were known as the "Astræa" class. Their particulars will be found under Plate No. 6.

The names of these 8 ships are "Astræa," "Bonaventure," "Cambrian," "Charybdis," "Flora," "Forte," "Fox," and "Hermione."

The 9 first-class cruisers of the Naval Defense Act are known as the "Edgar" class. They are smaller editions of the "Blake," with the same battery, but 1½ knots less speed and a smaller coal supply. The dimensions, etc., of the "Edgar" are given under Plate 4. Five of the ships of this class: the "Edgar," "Endymion," "Grafton," "Hawke," and "Theseus," are similar to the diagram shown on page 376.

To improve their seagoing qualities, a raised forecastle deck was added to the other four ships, the "Crescent," "Gibraltar," "Royal Arthur," and "St. George," and the 9·2-inch bow-chaser was replaced by 2 6-inch rapid-firers. They were also sheathed and coppered, the displacement being raised to 7,700 tons.

The next addition to the navy included 11 second-class cruisers of the "Eclipse" class. Nine of these were built to the dimensions, etc., given below Plate 5. Their names are as follows: "Diana," "Dido," "Doris," "Eclipse," "Isis," "Juno," "Minerva," "Talbot," "Venus." As compared with the ships of similar size in other navies, the armament was manifestly light, and in three later ships of the class: "Hermès," "Hyacinth," and "Highflyer," eleven 6-inch guns were mounted in place of five 6-inch and six 4·7-inch.

The next important addition to the fleet cruisers consisted of two huge vessels, the "Powerful" and "Terrible," of 14,200 tons and 22½ knots speed. They were the first warships to have the length of an Atlantic liner, being 536 feet long by 71 feet beam. As will be seen from the front page engraving, they are imposing vessels, of handsome design. They have a flush upper deck throughout the whole length whose average height above the water line is about 32 feet. The main battery of two 9·2-inch guns is carried on this deck, the axis of the forward guns being about 38 feet above the sea. The battery of twelve 6-inch guns is disposed on the gun deck and berth deck below, four of the guns being in superimposed 6-inch armored casemates forward and four aft, the other four guns being in armored casemates amidships on the berth deck. The battery of sixteen 3-inch guns is disposed on the gun and berth decks, eight amidships, four in the bow, and four in the stern. The fire dead ahead or dead astern is one 9·2-inch, four 6-inch, and four 3-inch.

Apart from their size, these ships are remarkable as having been the first large ships in the navy to be furnished with a complete installation of watertube boilers. They are sheathed and coppered and carry the enormous supply of 3,000 tons of coal—more than they require, in view of the frequency of British coaling stations.

The next lot of first-class cruisers, known as the "Diadem" class, were smaller editions of the "Terrible." The poop is cut away (see diagram), thereby sacrificing gun command and officers' accommodations in favor of a saving of 300 tons of weight, the coal supply is reduced to 1,900 tons, and the speed is reduced from 22½ to 20½ knots, with a consequent reduction of the displacement from 14,200 to 11,000 tons. The two 9·2-inch guns are replaced by four 6-inch rapid firers, with the result that these vessels carry sixteen of these effective weapons, besides fourteen 3-inch rapid-firers and fourteen smaller guns. The vessels are all sheathed and coppered. The vessels in this class are as follows: "Andromeda," "Diadem," "Europa," "Niobe," "Amphitrite," "Ariadne," "Argonaut," and "Spartiate."

In Plate 8 we give an illustration of the "Pelorus," which is a good representation of the latest third-class cruisers of this navy. They are trim little craft similar to our "Marblehead," which is greatly superior to them in battery but inferior in speed and protection. The battery of eight 4-inch and eight 3-pounders is mounted on a raised forecastle and on the gundeck amidships. There are 11 ships of this class, and, including these, there are 44 vessels of the so-called third-class cruiser type. They vary from 1,600 to 3,000 tons in displacement and from 16½ to 20 knots in speed.

Plate 9 shows one of the latest gunboats of the "Speedy" class, in which are 11 identical vessels of 810 tons and 20 knots speed. The 13 vessels of the "Gleaner" type are somewhat smaller, 735 tons, but have the same speed and armament. The four gunboats of the "Halcyon" type have a raised poop and displace 1,070 tons, the speed being 19 knots.

The torpedo flotilla of the British navy differs from that of the other Continental navies in the large number of torpedo boat destroyers that it includes in proportion to the number of torpedo boats proper. The official lists show 109 of the former built or building, against 187 of the latter; whereas the French navy has about a score of destroyers to 232 torpedo boats. Great Britain has practically given up the construction of torpedo boats, and has been content to increase her force of destroyers, for the reason that the destroyer is capable of running down and sinking torpedo boats, while at the same time it is capable of taking the offensive against battleships and cruisers, with at least as much prospect of success as the smaller, but slower, torpedo boat.

The torpedo flotilla is made up of 97 torpedo boats of the first class, which vary in speed from 19 to 23 knots, and 90 of the second class, with speeds of from 16 to 23 knots. The fleet of destroyers is made up of 42 boats of the "Hornet" type, 48 of the "Desperate" type, 5 of the "Albatross" type; a 33-knot boat, the "Express;" a 35-knot propelled by the Parsons turbine; and 12 vessels recently tendered for, of an improved "Desperate" type. The particulars of the different types of destroyer are given in the following table:

TORPEDO BOAT DESTROYER FLEET.

Name of Type.	No. of boats.	Length.	Displacement in tons.	Horse power.	Speed in knots.	Armament. 12-pounders.	6-pounders.	Torpedo tubes	Complement.	Coal.
Hornet	42	180	240	4,000	27·3	1	3	3	43	57
Desperate	48	210	300	5,400	30	1	5	2	58	80
Albatross	5	227·6	300	7,500	32	1	5	2	60	80
Express	1	227·6	300	10,000	33	1	5	2	60	80
Improved Turbinia	1	....	....	....	35	....		....	....	....
Improved Desperate	12	....	....	..	30	...	...	....	...	....

Of all the elements of a modern navy, the torpedo flotilla is the most uncertain and undetermined as to its value; but there is no doubt that, for the duties of such a navy as Great Britain's, the sea-going destroyer is preferable to the smaller and unseaworthy torpedo boat.

Summing up our review of the British navy, we consider that, in addition to the advantage that comes from numbers, the best features are the excellent sea-going qualities of the ships; the large supplies of coal, ammunition, and stores carried; the uniformity in the types due to building the ships in classes; the small number of patterns of guns, thereby avoiding confusion and complication in ammunition; and lastly, and perhaps most important of all, the excellent personnel and the undoubted esprit de corps of the navy.

The defects are, in the battleships, the unarmored ends, the fact that the breeches of many of the large guns are unprotected, and in the later cruisers the total absence of side armor at the water line. Most serious defect of all, however, and one that cannot be too soon remedied in future ships, is the fact that the ships, both battleships and cruisers, do not carry as powerful armaments relatively to their great displacement as are found in ships of other navies of the world. Ship for ship, the "Majestics" would probably be a match for any French or Russian battleships they might encounter, but, with their excess of 2,000 to 3,000 tons displacement, they should carry an overwhelming preponderance of armament.

THE SIPHON OF THE CLAM.

BY C. F. HOLDER.

The interesting clam with elongated siphon shown in the accompanying illustration was taken at Long Beach, where the art of clamming is conducted in an interesting manner at times. Instead of the single clammer on the beach at low tide, often a picturesque object from the dunes, we see a man plowing a long furrow in the sands, hoping in this way to throw up hundreds of the succulent bivalves.

To those who frequent muddy shores at low tide, the hole of the clam is a familiar sight. Sometimes the latter is discovered near the surface, ejecting a spurt of water; and strange clicking, sucking sounds, the dulcet voice of the clam, have been heard by those who, out of curiosity, frequent its haunts.

In the accompanying illustration one of the most interesting features of bivalves is seen at its best, namely, the siphon, a singular continuation of the mantle, a fleshy chimney, so to speak, which enables the clam to rest at the bottom in security, and throw up this extension, and breathe and eat through it. The siphon in the cooked clam is a black, small, and retracted object, projecting but slightly from the shell; it is known as the head, a misnomer, as it is really at the posterior opening of the shell, and opposite the place where the head, if there were one, should be.

The siphon is a long, muscular, and exceedingly tough tube, really an extension of the mantle which incloses the clam, and, in this instance, divided into two tubes. To fully understand its office a glance at the internal economy of the animal is necessary. Opening a clam, we find next to the shells a delicate gray mantle that encompasses the animal, so that it appears to be a bag holding the body of the clam and protecting it. At the posterior end the mantle is developed into the siphon, which contains two tubes. Opening the shell wider, we have the various parts before us. On the lower side is a muscular organ called the foot, that in some shells, as the razor clam, is an extraordinary member. This foot in some species, as the mussel, bears a remarkable gland which secretes a fluid that,

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when produced and exposed to the water, becomes a mass of dark, horny fibers that serve as anchor chains by which the animal attaches itself to the rocks. We find the mouth directly opposite the so-called siphon, provided with a pair of peculiar lips, leaf-like, which have the faculty of aiding in sending currents of water bearing food to the mouth. We see the long coiled intestine, the stomach, and liver, and in a bag or sac a marvelous rod, clear as crystal, seemingly distinct from the body and without purpose, a backbone unattached as it were, known as the crystalline style; an organ that is well known, but which is still a zoological mystery.

The heart is an interesting object, the blood pouring from the gills into the two auricles, then passing into the median ventricle, which pumps it into all parts of the body. The gills are prominent objects, apparently hanging on either side, and made up of a marvelously complicated series of tubes. If in imagination we could follow the blood current of the clam, we should see it collecting in a large tube at the base of the gills, from which it passes into the tubes and so to the heart. During the passage through the tubes which make up the gills the process of breathing is accomplished, which brings us to the consideration of the long siphon of the clam.

This singular organ has various offices. It is like the trunk of an elephant, inasmuch as it can be elongated to obtain food at a distance from the body, illustrated by the clam at the bottom of its burrow, while the tip of the pseudo trunk or siphon is at the opening receiving food. The siphon has two tubes; the one furthest from the hinge, or the lower, may be called the mouth proper, as it sucks in a continual current of water. The other performs an opposite work, rejecting the accumulation, and can be compared to a chimney, out of which passes the rejectamenta after consumption. In this one act of drawing water through its long siphon the clam eats and breathes. The water, laden with food and oxygen, is brought into the clam in a remarkable manner, which is readily observed. The gills and other parts of the clam are covered with minute, hair-like organs, which may be compared to oars, which all wave or work in a given direction, always away from the incurrent siphon opening, thus creating a current through it, the water from without rushing in to fill its place, and so powerfully do the cilia work that a few in a small section of the gills removed for the purpose have been known to move six millimeters in a minute. The water from the incurrent siphon, laden with food particles and charged with oxygen, is then wafted by millions of paddles over every portion of the gills, when the blood in the tubes takes up the oxygen and ejects the carbonic acid. On it passes, the cilia or paddles sweeping it on in the direction of the mouth, which, as it passes, seizes the atoms of food, the rejected portions, the impure water now laden with carbonic acid, being swept along and finally forced out of the upper tube of the siphon. So it will be seen that the perfect type of the siphon, with its two tubes, as illustrated by the clam, is a marvelous organ; and that the simple "head" of the clam, in popular parlance, is more like the tip of a long proboscis, really a very complicated and beautiful organ in all its parts, having various and important functions, interesting not only to the naturalist, but to any stroller along shore.

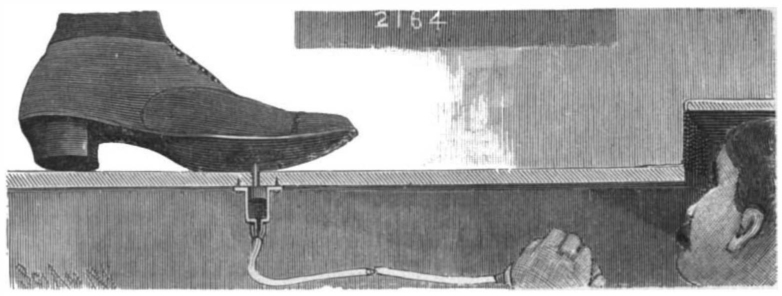
The mollusks are by no means the low creatures generally supposed. They are endowed with many senses; indeed, the wonderful siphon, like the trunk of the elephant, has such varied offices that it seems gifted with a special sense. The clam has olfactory organs, these being found in what is known as the parieto-splanchnic ganglia. It has minute eyes, in the pecten thirty or more are seen on the edge of the mantle, gleaming like gems. Sometimes the eyes are situated upon the siphon, as in the solen or razor clam. They are the simplest form of eyes, yet are sufficient to warn the owner, as every clammer knows, who has seen the wily razor dart down into its den as the shadow passed over it. The ears of the clam are delicate sacs, each containing an otolith, which, like the tongue of a bell, jangles against the cilia that line the sac, so producing sound waves.

A study of the siphons of the mollusks shows the greatest variety. The clam illustrates the maximum length. In the razor clam, ensis, and others, it is very short. In Tellina tenera the siphons are remarkably long, several times the length of the shell, and well illustrate the forms in which the siphons constitute separate tubes.

MENTAL WONDERS.*

The most sphinxlike problem ever presented to the public for solution was the second sight mystery. There have been many exposés of "mental magic," and some of the best of them are described in "Magic: Stage Illusions and Scientific Diversions, including Trick Photography."

We have now to concern ourselves with "mental magic," where the results are obtained by clever tricks. There have appeared from time to time before the public individuals who generally work in couples, termed "operators" and "subjects," who have given performances which were termed mental wonders, silent second sight, etc. The operator invariably tries to impose on the public with the idea that he possesses some mysterious power over the "subject," by which he is enabled to communicate information to her by his will power over her mind without a word being spoken. There are, of course, various methods of performing this trick, as by a code of predetermined signals in which sentences like the following are used: "Say the number. Well? Speak out. Say what it is." But these methods are not comparable with the mechanical means which we are about to describe.

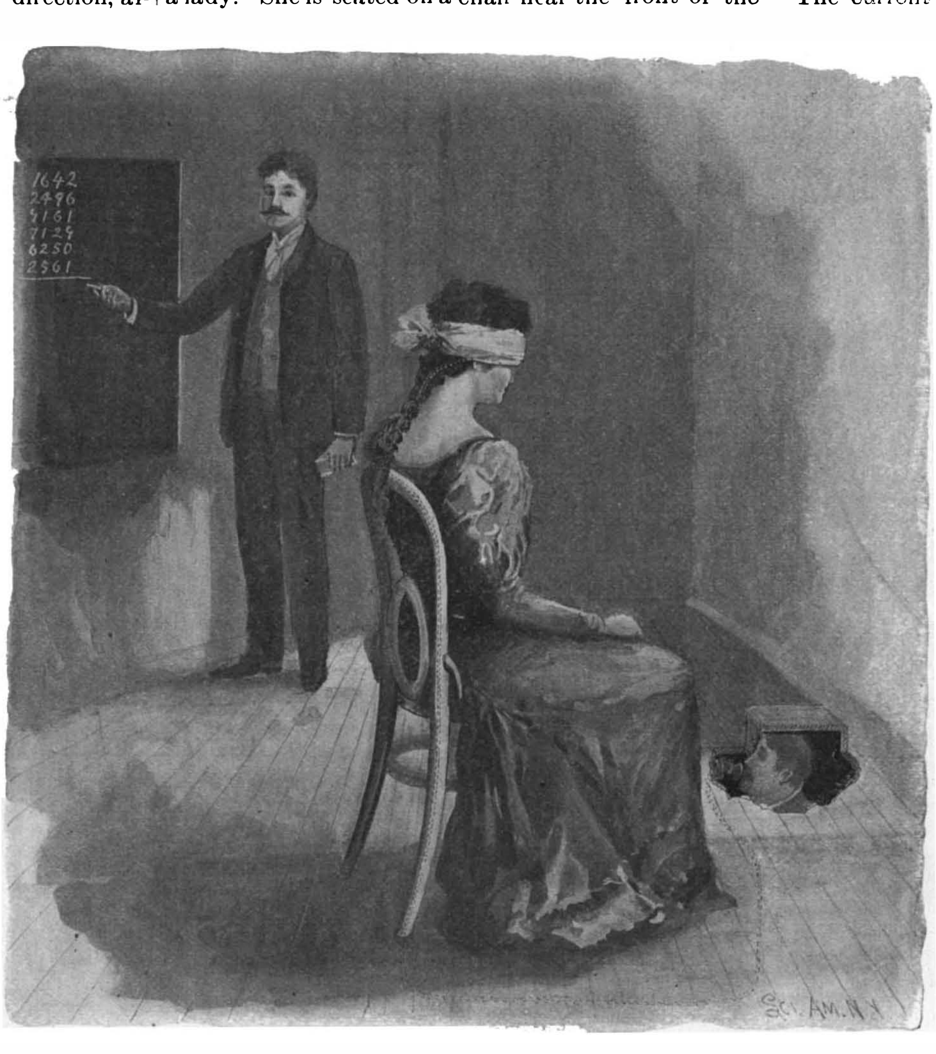


THE FOOT TELEGRAPH.

The "operator," after informing the audience of the wonderful powers of divination which the subject possesses, introduces the "subject," who is invariably a lady. She is seated on a chair near the front of the stage in plain view of the audience. Her eyes are heavily bandaged, so she cannot see. A committee is invited to go upon the stage to see that the lady has had her eyes properly blindfolded and also ostensibly to help the operator. A large black board is placed at one side of the stage behind the lady. One of the committee is requested to step to this blackboard and write on it with chalk some figures, usually up to four or more decimal places, and after he has done so he resumes his seat. The lady immediately appears to add up the number mentally, calling out the numbers and giving the results of the addition. Each member of the committee is invited to step to the blackboard and touch a figure; no sooner has he done so than the lady calls out the number. Other tests of a similar nature are given, such as the extraction of square and cube root, etc. They all prove that the lady has a thorough knowledge of the numbers on the blackboard and the relative position which they occupy. It is, of course, proved beyond a doubt that the lady cannot see the blackboard. The question then arises, How does she obtain the information? There are two methods of performing this trick. In either case her information is obtained from a confederate, who is generally concealed under the stage, who has the blackboard in sight and who transmits to the lady the desired information.

In one method the lady has a hole 1½ inches in diameter cut out of the sole of one of her slippers. She places this foot over a hole in the stage through which a small piston is worked pneumatically by the assistant. The piston is connected with a rubber tube which runs to where the assistant is concealed. The assistant looks at the blackboard and manipulates the bulb, thus causing the piston rod to strike the sole of the foot, giving signals which can be readily understood by the subject. Robert Heller used a system somewhat similar, only an electro-magnet was used instead of the pneumatic piston.

Another and bolder method of conveying information is the speaking tube. In this case a Vienna bent wood chair is used. The chair is specially prepared for the trick. One leg of the chair is hollow and the air passage is continued to the very top. The lady usually has a long braid of hair hanging down her back, and if not blessed by nature with this hirsute adornment, she wears a wig. In either case concealed in the hair is a rubber tube, one end being close to the ear and the other hanging down with the braid, so that when the lady is seated on the chair the operator can easily connect it with the connecting tube in the chair.



THE SPEAKING TUBE.

* From "Spirit Slate Writing and Kindred Phenomena." By William E. Robinson, assistant to the late Herrmann. New York, 1898. Munn & Company, publishers. 16mo. Pp. 148. 66 illustrations. Cloth. Price $1.00.

The Current Supplement.

The current SUPPLEMENT, No. 1197, is particularly interesting. It contains an article by H. Percy Ashley, entitled "An Up-to-Date Ice Sloop," accompanied by full working drawings for making the same. As the season for winter sports has now arrived, doubtless many of our readers will wish to make an ice-boat of this kind. Mr. Henry Savage Landor's new book, "In the Forbidden Land," is reviewed at considerable length. Mr. Landor entered Tibet by way of India, and was captured by the Tibetans and tortured by them with great cruelty and very nearly killed. He was finally released and allowed to pass over the border. Mr. Landor's narrative is most thrilling, and his adventures rank among the most interesting travels of the latter part of the nineteenth century. The article is accompanied by illustrations from the book showing Mr. Landor being tortured. "Saline Efflorescence of Bricks" is a timely scientific study dealing with the methods by which this discoloration may be prevented. This number of the SUPPLEMENT contains several papers which were presented at the recent meeting of the Society of Naval Architects: "Economy Test of a Unique Form of Feed Pump," by F. Meriam Wheeler; "Stability of a Battleship under Damaged Conditions," by Prof. C. H. Peabody; "Early Marine Engineering in the United States," by C. H. Haswell. "The Recent Eruption of Vesuvius" is illustrated by an engraving made from an actual photograph of the eruption. "Pekin" is an interesting article describing interesting scenes of that city. "Africa and its Animals" is an article by R. Lydekker. "Distilled Water, its Preparation by Simple Automatic and Inexpensive Apparatus and its Preservation," completes this very interesting number. The usual notes are published.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

PULVERIZER.—JAMES W. RIGG, Mount Carmel, Ill. Journaled in the frame of this pulverizer, are a front roller and a rear-spiked roller. Between the rollers a drag is mounted. Cutters extend down under the spike-roller between the spikes. Runners movable on the frame are adapted to lift the rear end of the frame, in order to bring and hold the spiked roller and drag above the ground. The drag can be raised or lowered in order to break up the clods left by the front roller. The spiked roller in the rear rolls the ground a second time, and the spikes, by passing into the earth, loosen the soil and prepare the ground for the seed.

WHEELED CULTIVATOR.—CHARLES L. KING, Stella, Neb. The improvement in cultivators devised by this inventor consists of a supporting frame, wheel-guiding supports having journaled upright portions, crank-arms at the lower ends of the upright portions extending normally in the direction of the cultivator's motion, lateral spindles on the crank-portions, and wheels on the spindles. The construction for supporting and guiding the wheels is easily controlled, responds quickly to the lever by which it is operated, and includes a construction of connecting bar which acts as a spring for driving detent devices by which the guiding mechanism is held in any desired adjustment.

CULTIVATOR.—WILLIAM M. STEVENSON, Honey Grove, Tex. This invention is an improvement in cultivator-saddles or attachments for the beams thereof, which saddles consist of devices carrying "feet" or standards to which shovels, plows, and the like are secured. The chief characteristic of the improvement is found in the use of rotatable sleeves or cylinders to which the shovel or plow standards are so attached that these standards may be adjusted in different positions or angles, to cause the shovels or plows to work nearer together, farther apart, or to be thrown out of work altogether. The sleeves or cylinders are mounted on horizontal axes, and are held in any position by means of screw-clamps.

Mechanical Devices.

BALLOTING MACHINE.—WILLIAM M. DOUGHERTY, St. Joseph, Mo. The balloting machine of this inventor has for each candidate a numbering apparatus operated by an arm projecting through the casing of the machine, the numbering apparatus being connected with the door of the voting-booth, so as to be operated by the movement of the door. The numbering device or counter for each candidate is inclosed in a box or casing. These boxes or casings are separate from one another, and in the operative machine are held in proximity by fastening devices. As a voter, in entering, opens and closes the door of the booth, the parts of the machine are placed in operative position. By pulling upon one of the arms, previously mentioned, the voter casts his ballot for any desired candidate. Means are provided whereby it is made impossible to vote for two candidates running for the same office.

TOWER WINDMILL.—MAYRO KEENEY, Somersville, Conn. The purpose of this invention is so to construct a wind-wheel of a tower-windmill that it shall be simple, durable, and self-governing, the regulator being capable of such adjustment as nearly to close the fans or blades if the revolutions of the wheel become too numerous. The wheel is so constructed that its fans or blades shall catch the wind from all quarters without changing position, thus obviating the loss of speed or power, and the irregular motion common to many windmills. The fans or blades used are angular in cross-section. This angular construction enables the wheel to turn, not only when the wind is entering the wheel, but also when the wind is leaving the wheel.

HOISTING APPARATUS.—SAMUEL L. COOPER and FRANK W. KEYS, Yonkers, N. Y. This invention provides a hoisting apparatus designed to be attached to a wagon used in street and sewer cleaning. Upon the wagon a crane is mounted to swing. A hoisting rope, to the outer end of which a bucket is attached, passes over a wheel journaled in the upper end of the crane, and is wound about a drum mounted in the vehicle. The bucket, after having been filled, is raised by rotating the drum. When it has reached the desired height, the bucket is swung inwardly by means of the crane, and the contents dumped into the wagon.

CLOTHES-WRINGER.—ALBERT G. CARLING, Hackensack, N. J. With a frame and with two shafts carrying rolls and rotating in the frame, are connected two interchangeable, meshed cog-gears and two countershafts. The cog-gears are located one on a roll-shaft and one on a countershaft. On the lower roll-shaft and on both countershafts, sprocket-gears are mounted and connected in pairs by sprocket-chains. The rolls and shafts are driven by means of a crank-handle adapted to engage with an end of the lower roll-shaft or with an end of one of the countershafts. By changing the positions of the gearing and of the crank-handle, heavy goods or light goods may be wrung, and the necessary power for each properly applied.

SAWMILL-DOG.—ALBERT D. LANE, Montpelier, Vt. Crooked logs, owing to their peculiar shape, are not readily held in place by ordinary dogs, and hence cannot be readily sawn. In the present device, two dogs are used, one engaging the log from the under side and the other from the upper side. Both are readily adjustable in height, by means of a hand-wheel which operates a rack and pinion to draw the dogs toward each other in order to hold the log firmly in place.

TYPE-WRITING MACHINE.—FREDERICK S. WENDELKEN, Dallas, Tex. The present invention endeavors to provide means whereby a type-writer platen may be turned and the carriage brought back to its starting point by depressing keys or key-levers. To turn the platen automatically when the carriage is returned, the inventor provides the carriage with a bell-crank lever having one arm arranged to engage an abutment on the frame, and its other arm connected with one end of a lever pivoted between its ends and arranged at its other end to bear beneath the bail-lever so as to lift the bail-lever when the bell-crank is in engagement with the abutment. The carriage is automatically returned to its original position by means of a key-lever which acts on a spring and gearing to bring the carriage back to its original position.

Miscellaneous Inventions.

FURNACE-CLEANER.—Dr. PAUL MEYER and LATIMER D. GRAY, Golden, Col. The purpose of this invention is to furnish an attachment for fire-boxes, by means of which attachment the ashes may be quickly removed from a grate. The furnace is provided with a rigid dead-plate located forwardly of the grate-bars and provided with an opening through which clinkers may be dropped into the ash-pit. A cover commands the opening, is mounted to slide back and forth on the dead-plate in a plane parallel with that of the plate, and is supported by continuous engagement with the top of the dead-plate.

LUBRICATOR.—WILLIAM HUNT, Winnipeg, Canada. This invention has for its object the provision of a dust-proof lubricator arranged to operate in a simple manner. The lubricator consists of a cup containing oil, which cup is formed on the bottom with a stem screwing into the part to be lubricated. The stem is formed with a passage, through which oil flows to the parts to be lubricated. This passage is adapted to be closed by a valve formed on a screw-plug. By screwing the plug up or down, the flow of oil can be regulated, means being provided whereby the plug is held in adjusted position. The lower end of the plug has an opening normally closed by some soft fusible material which melts when the parts to be lubricated become heated, and thus permits the oil to flow to the operating parts of the machine to which the device is applied.

SCRAPER.—ALICE E. HOUGHTON, Slidell, La. The scraper provided by the present invention is intended for use in kitchens. The scraper comprises a plate or thin bar bent into a flattened S shape to form three parallel sections connected by bends. The outer sections are sharpened and the middle section serrated at one edge. The peculiar shape and construction of this device enable it to be used in scraping surfaces of nearly every variety.

CASKET-LOWERING DEVICE.—MARQUIS T. ROBB, Granby, and ANDREW J. PATTERSON, Wentworth, Mo. In this device are combined a railing for an open grave and a bier adjustable on the railing, together with a windlass carried by the railing or frame, through the medium of which a coffin may be conveniently lowered. The entire device is so constructed that the parts may be conveniently wheeled from place to place.

CURTAIN-POLE.—WILLIAM OSTENDORFF, Union, Hudson County, N. J. This invention seeks to provide a simple curtain fastener which, when applied, will hold a curtain in any desired position. The fastener can be made of a single piece of spring wire or like material. The fastener is so constructed that rings and the like will be dispensed with. When applied, the fastener will be entirely hidden when the curtain is in place, and will be but partially exposed when the curtain is down.

BRINE-EVAPORATOR.—ROBERT D. MILLER, Warsaw, N. Y. By means of this apparatus, the salt crystals obtained by evaporating brine are deposited upon a suitable conveyer and automatically conducted away. The brine-evaporator has a tank provided in its upper portion with an inclined bottom having projecting lower edges, beneath which edges the tank is extended to form a well. An inclined chute extends upwardly from one end of the well to the water-level. Two parallel endless chains extend along the well and through the chute to a point above the water-line. Bars connect the chains at frequent intervals, and a belt is connected with the chains and bars. The inclined bottom extends over the edges of the belt, so that the salt crystals are collected upon the belt and automatically conveyed outside of the tank.

APPARATUS FOR DEVELOPING AND REGULATING WATER SUPPLY.—HOWARD V. HINCKLEY, Topeka, Kan. In order to draw water at pleasure from a subterranean flood-plane or underflow, this inventor employs a series of submerged wells or cribs, and a series of inclined conduits connecting the wells to draw the water therefrom by gravity. The flow of the underground water is regulated by gate-valves. The system is designed for use in the arid regions of our Western States and Territories.

SPRING-HEEL FOR BOOTS AND SHOES.—EDWIN L. BARBER, Larwill, Ind. This invention is an improvement in spring-heels such as are used for the purpose of relieving one of the strain due to walking. The spring-attachment comprises a spring-heel plate having one or more front fingers, and a base-plate having one or more transverse slits, through which the fingers project. The inventor has also applied his device to detachable insoles.

INK-WELL.—JOHN T. FORREST, Chehalis, Wash. In the present invention an ink-well has been provided which comprises two pivoted plates, the one having screw-holes for attachment and the other having an ink-well pocket. The two plates have a cam-joint at their pivoted ends, by means of which joint one plate is tightly bound against the other when the well is closed. Thus there is produced an air-tight and dust-proof joint.

APPARATUS FOR MAKING CLEAR CAN-ICE.—JOHN E. SIMON, Louisville, Ky. In manufacturing "can-ice," there is formed an objectionable center core, which detracts from the appearance of the ice-block and causes the ice to become offensive to taste and smell. The present invention seeks to overcome this objection by introducing air into the can during the freezing process. This is accomplished by means of a flexible tube adapted to hang down into the can and supported by a rod extending over the can beneath the lid.

Designs.

WIND-WHEEL.—THEODORE A. SCHLAEBITZ, Lincoln, Neb. The leading feature of this design is a pyramid surmounted by a globe or sphere. The pyramid rests upon a disk, below which disk a second disk of larger diameter is mounted. Upon this second disk funnels are located. Above the ball or sphere is the figure of a cock standing upon a weather-vane.

SPOON.—FRANK S. SWALM, Brookhaven, Miss. This inventor has designed a paper spoon having a ring formed at the outer end of the handle. The spoon-bowl is so formed that the handle, if prolonged, would bisect the ring.

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(7526) W. H. J. asks: For what purpose is a solution used on copper wire previous to winding on the silk when insulating? What is the solution composed of? A. We do not know any solution universally used on copper wire before winding on the silk insulation. If it were desired to improve the insulation, shellac could be used in this way.

(7527) J. O. N. asks: Is there any substance through which two magnets will have no attraction for one another, and the substance not to exceed ½ inch in thickness? A. A magnet is screened from exterior magnetism by surrounding it with a covering of iron. Iron less than one-half inch thick will answer this purpose.

(7528) G. E. S. asks: Is there any process or preparation by which cast steel can be made to have the appearance of frosted silver? A. By etching the polished surface with acid. The articles are first heated to about 212°, then a thin coat of beeswax is melted over their surface, and when this cools the design is scratched through the wax by a needle, the acid is then poured on the design, and may be prevented from falling off by a little wall of wax built around the design. Muriatic acid answers very well for etching. The time required for the operation is best found by a little practice, as the fine lines of the design take more time to etch than is required for the coarse ones. When it is decided that the etching is complete, with clean cold water thoroughly wash away all traces of acid, and then with a little benzine remove the wax and polish with clean, dry chamois leather. 2. Would such process or preparation or bluing be cheaper than nickel plating? A. No; use bluing.

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NOVEMBER 29, 1898,

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