SCIENTIFIC AMERICAN

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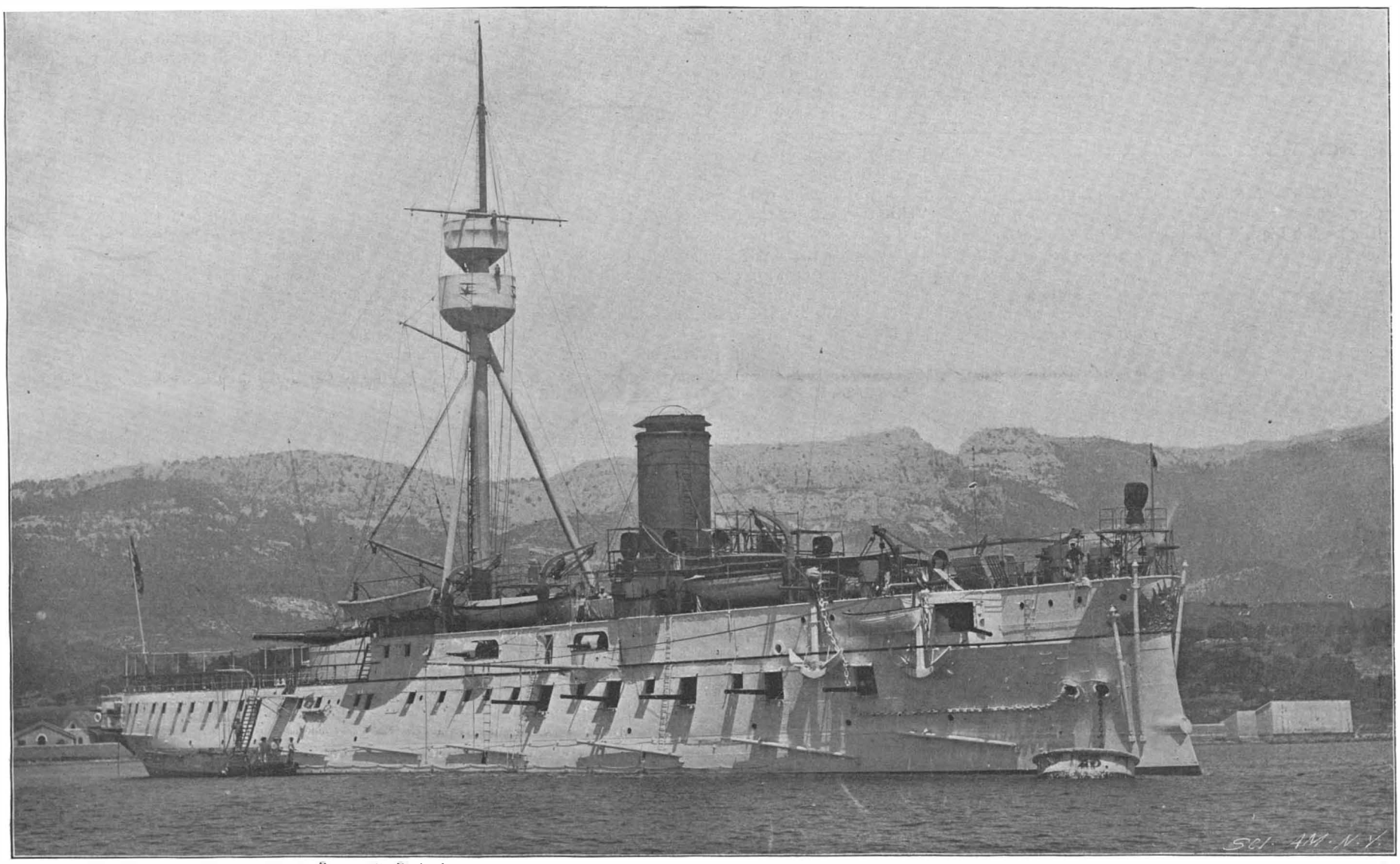
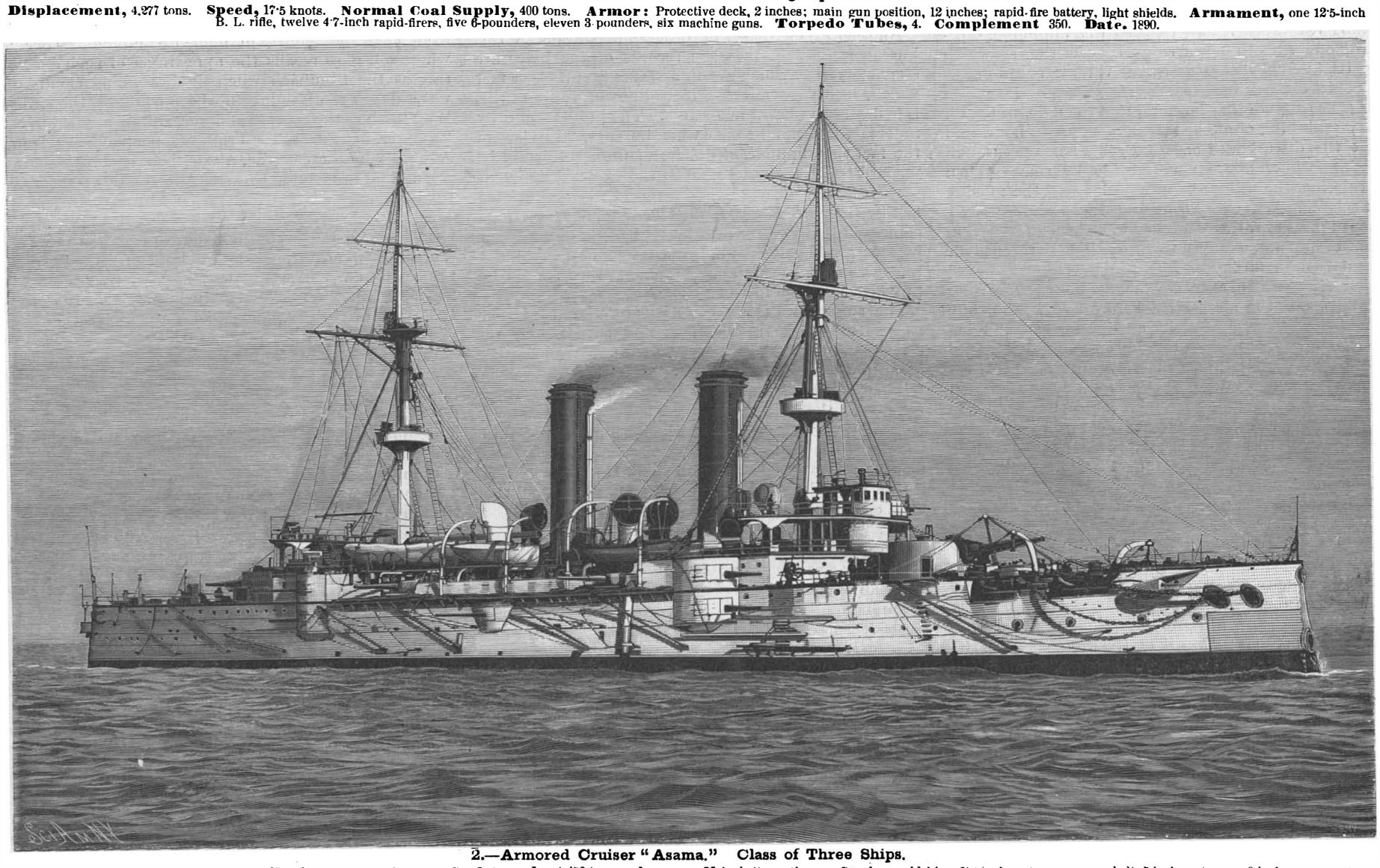


From Photograph by Symonds & Company, Portsmouth, England.

1.—Protected Cruiser "Matsushima"—Admiral Ito's Flagship in the Battle of the Yalu.

Displacement, 4,277 tons. **Speed,** 17·5 knots. **Normal Coal Supply,** 400 tons. **Armor:** Protective deck, 2 inches; main gun position, 12 inches; rapid-fire battery, light shields. **Armament,** one 12·5-inch B. L. rifle, twelve 4·7-inch rapid-firers, five 6-pounders, eleven 3-pounders, six machine guns. **Torpedo Tubes,** 4. **Complement** 350. **Date,** 1890.



2.—Armored Cruiser "Asama." Class of Three Ships.

Displacement, 9,750 tons. **Speed,** 22·07 knots. **Maximum Coal Supply,** 1,450 tons. **Armor:** Main belt, continuous, 7 inches amidships, 3½ inches at ends; upper belt, 5 inches; turrets, 8 inches; casemates, 6 inches; deck, 2 inches. **Armament,** four 8-inch rapid-firers, fourteen 6-inch rapid-firers, twelve 12-pounders, eight 3-pounders. **Torpedo Tubes,** one in bow behind 6-inch armor, four submerged. **Complement,** 500. **Date,** 1898.

NAVIES OF THE WORLD—VII. JAPAN.—[See page 72.]

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NEW YORK, SATURDAY, JULY 29, 1899.

THAT AIR RESISTANCE PROBLEM.

Our discussion of the air resistance problems involved in the recent bicycle ride, paced by a locomotive, has brought to the editor's desk a considerable amount of correspondence and a varied assortment of theories. Most of the writers of these letters are laboring under a common delusion with regard to the nature of the assistance rendered by the locomotive, or by any form of "pacing" machine, mechanical or human, to the rider who follows it. The error is aptly expressed in the letter of a correspondent which we publish in another column, where he says, "if Murphy had taken his feet off the pedals after he had attained his maximum speed, he would have finished just as soon as he did," for the reason that the "suction or inrush of wind behind the train," amounting to "seven horse power of wind at his back," drove him along the track and rendered all exertion on his part superfluous. Our correspondent is by no means alone in his belief that the rider, to use a common expression, was "sucked along" behind the train, and *nolens volens* had to follow it at a speed of over 62 miles an hour.

Perhaps the best way to realize the nature of the assistance rendered to Murphy by the locomotive is to consider the conditions if he were to ride over the course at his fastest speed without pace. The resistance when he had reached full speed, supposing the track to be level, would be made up of the rolling resistance between the tires and the track, the internal resistance (friction of bearings, etc.) of the bicycle, and the air resistance. If our readers will turn to our article on this subject in the SCIENTIFIC AMERICAN of July 15, they will find two diagrams which show that the loss by friction in a special racing bicycle is only from one to five per cent, being less the greater the work that is being performed; and that with highly inflated tires the work absorbed in overcoming rolling resistance is also reduced to a minimum, especially on a smooth board track, such as that on which the trial was made. This leaves the air resistance as the chief obstacle to speed.

Let us suppose that he could ride the mile, unpaced, in two minutes, or at the rate of 30 miles an hour, and that the disturbance caused by his passage through the atmosphere were made visible by some system of coloring, the still air being colorless and the moving air colored. We should then find that a blunt wedge-shaped mass of rather dense air was pushed forward in front of him and a longer wedge of slightly rarefied air was drawn forward after him, the base of the wedge being of course in each case at his body. The rider in addition to the air carried before and behind him would also be surrounded by an envelope of eddying air, moving forward with him but at a greatly reduced speed. The sum total of the resistance of the atmosphere to the movement of the rider and the air which he carried with him, would be found to average so many pounds to the square foot, assumed in our article as equivalent to 15 pounds on 3 square feet of surface normal to the direction of travel.

Now in the case of a locomotive and car moving at 60 miles per hour, there would be the same piling up of the air in front and the same wedge of air following behind, and the same enveloping mass of air moving forward with the train at a slower speed. Speaking of the air which follows the car, we may say that relatively to the board track over which it passes, it is a 60-mile wind, and relatively to an object which, like Murphy, is moving within it at the same speed as itself, it is practically still air. As long as Murphy rode within this wedge of air, his exertions were directed solely to overcoming the internal resistance of the wheel and the rolling resistance of the tires on the track. For it is evident that the wedge of air, moving at the same speed as himself, could neither offer resistance from the front nor exert pressure from behind. The only way in which he could have experienced the pressure of a "60-mile wind behind him to carry him along," would have been by his motion being arrested, and the rush of air would last only until he had dropped out of the moving wedge of air that followed the train and the more slowly moving envelope which closes in and follows after it.

Another correspondent fails to understand why the air behind the moving car should assist the bicyclist and yet exert a retarding effect on a car in the same relative position and forming part of a train. The explanation is to be found in the difference of area of the bicyclist and the front face of a following car. Murphy, representing 3 square feet of area, could move back several feet from the rear of the shield and yet be within the wedge of moving air, but a car with its front area of say 80 to 90 square feet would expose a large percentage of its surface outside of this wedge, all of which exposed surface would offer resistance to the atmosphere, or, to speak more correctly, its passage would be resisted by the atmosphere.

A correspondent, whose letter is given elsewhere, assumes that the "body of air enveloping the entire train is swept along with it at about the same rate of speed," and, therefore, "small projections . . . add little or nothing to the resistance." In this we think he is entirely wrong. The action of a train on the air is fairly analogous to that of a ship on the water, where "skin-friction," or the resistance of the surface of the hull to the sliding contact of the water, is so serious an element that yachts are built of costly alloys in order to reduce skin friction to the limit. The train does draw with it an envelope of air, but its speed is far below that of the train, and every projection on the latter, to say nothing of the broad front faces of the cars, adds to the retarding effect enormously.

ANNUAL REPORT OF THE COMMISSIONER OF PATENTS.

The Annual Report of the Commissioner of Patents cannot fail to produce general satisfaction, particularly when it is learned that some greatly needed reforms in the matter of the system of classification, which have been urged both by former Commissioners and the present incumbent of the office, have been at last carried out. This work is spoken of by Commissioner Duell as "the most notable advance of the year in the work of the office."

"The crying need of this bureau," says the Commissioner, "is for more room." This has been the plea of successive Commissioners for several years, and it is one which this journal has persistently urged on behalf of the vast commercial interests which have their root in the United States Patent Office. The building which was erected for and named after this bureau has been given up largely to the accommodation of the General Land Office, with the result that the overcrowding of the Patent Office has become notorious. The request of the Commissioner that "when the General Land Office vacates the Patent Office building," the Secretary of the Interior "will assign rooms sufficient for the needs of the bureau," finds emphasis in the vexatious delay to which the patrons of the Patent Office have so long been needlessly exposed.

Another crying defect in the accommodations of this bureau is that the priceless records of the office are stored in rooms which are in no sense fireproof—a fact which, if it were not so widely known, would at this late day seem almost incredible. The public will fully indorse the Commissioner when he says, "In view of the fact that millions of dollars of property would be jeopardized by the destruction of our assignment records—many of the original assignments having been lost by their owners, who depend upon duly certified copies—and in view of the fact that many of our other records are largely of a nature that money could not replace, I believe that a fire-proof structure should be provided in which to store them."

The summary of the operations for the fiscal year shows that 41,930 applications and caveats were received, and that the patents granted and trademarks, labels and prints registered numbered 25,404. The number of patents that expired was 16,670. The total receipts of the office were $1,209,554.88; the total expenditures were $1,148,663.48, the surplus turned into the Treasury being $60,891.40. A comparative statement of receipts and expenditures for the past decade shows that the total receipts were $12,700,977 and the total expenditures $10,971,338, making a total surplus of $1,729,637 in ten years.

A significant indorsement of the valuable work done in the new classification, to which reference has been made above, is found in the table showing the number of applications awaiting action on the part of the office in each year of the past decade. Commencing with 6,585 cases in 1890, the total rose to 9,447 in 1892 and then fell to 4,927 in 1895. It had doubled in the following year, and rose to over 12,000 in 1897 and 1898. By June 30 of this year, thanks to the working of the new system and an increase of the force of examiners, backed by a more liberal appropriation, the number of applications awaiting action had fallen to 2,989, a decrease of over 75 per cent.

As the result of the Spanish war the total number of applications, which in 1897 had risen to 47,747, fell in 1899 to 40,320, the smallest record for the decade being 39,206 in 1894. The present indications, however, show a steady increase in the business of the bureau.

EXPORTATIONS OF WHEAT FLOUR.

The millers of the United States have made their greatest record in the fiscal year 1899. While it is true that wheat, corn, oats, cornmeal, rye, and, in fact, all other lines of breadstuffs show a reduction of exportation on account of the decreased demand abroad, flour alone shows an increase which is a phenomenal one. For the fiscal year the total exportation of flour is over 18,000,000 barrels, representing over 80,000,000 bushels of wheat. The exportation of flour from the United States has made its chief development since 1875. Prior to that date American millers followed the old processes in the manufacture of flour, where European millers were experimenting with, and bringing to success, the modern roller-mill methods. As a result, the foreign flour trade of the United States met with serious reverses during the period from 1850 to 1875, the European consumers preferring to buy their wheat and make it into flour with their new processes. In 1854, according to a prominent American miller, we sent 1,846,000 barrels of flour to Great Britain alone, while in 1865 only 200,000 barrels were sent to all Europe. During the period 1825 to 1830, over 99 per cent of the value of wheat and flour exports was flour; in the five years 1870 to 1875, only about 27 per cent of wheat and flour exports was in the form of flour. In 1875 the exportation of wheat flour was 3,973,128 barrels. In 1880 it was almost double. In 1885 it was nearly 11,000,000, and in 1895 it had risen to 15,268,892, while in 1899 the figures were 18,300,000 barrels. This is a most gratifying increase and is in the line of our success in the exportation of manufactured articles. It is especially pleasing to note the quantity of flour sent to the Orient; in 1889, 378,634 barrels were sent to Hong Kong, and in 1899 over 1,000,000 barrels were sent. Germany is also becoming a good customer for flour, and we are now sending her 500,000 barrels against 13,000 barrels ten years ago. The Netherlands are also taking 1,000,000 barrels, an increase of 900,000 barrels in ten years. To the United Kingdom our exports of flour in 1889 were 5,271,244 barrels, and in 1899 they will exceed 10,000,000 barrels. That flour exports should have continued to increase in the face of the reduction of our exportation in other lines of breadstuffs is especially gratifying to those interested in seeing American labor participate as much as possible in the profits of American foreign trade.

THE HEAVENS IN AUGUST.

BY GARRETT P. SERVISS.

In August evenings one looks directly south to see the crossing place of the Zodiac and the Milky Way. The line of the former is indicated by the constellations Scorpio and Sagittarius. The red star Antares, with its third magnitude white attendants, one on the west and the other on the east, marks the heart of Scorpio; while Sagittarius, further to the left, is recognizable by the figure called the Milk Dipper, with its bowl upside down, in the streaming Galaxy. Falling from near the zenith, in immense luminous sheets, whose soft glow recalls the appearance of such a cataract as the Staubach when its descending clouds of water-dust are gleaming in the moonlight, the Milky Way justifies the rhetorical figure, often applied to it, "a river of stars." Its brightest portion runs from Aquila, whose chief star, Altair, has two attendants resembling in position those of Antares, down through the little constellation of Scutum Sobieskii, where it breaks into silvery flakes of wonderful beauty, and then descends to the southern horizon across the western part of Sagittarius, while a kind of setback from the main current overflows the eastern region of Scorpio, and the feet of Ophiuchus above. It is the California of the sky, packed with the riches that the star-gazer seeks with his telescope.

While the south glows with these splendors there is near the zenith a single star almost capable of matching alone the united beauty of Zodiac and Galaxy, the star Vega, or Alpha Lyræ. It, too, has a pair of attendants, but they are only of the fourth magnitude, and, instead of standing one on either side of their chief, they mark out with it the corners of a little triangle. The coronet of dazzling blue which surrounds Vega in the telescope is extremely beautiful.

Vega is demonstrably a far greater sun than ours—possibly a thousand times greater—and toward that wonder of the star depths the solar system is flying at the rate of at least 800,000 miles a day. If it should turn out that the solar motion is almost directly toward Vega, interesting experiences are doubtless in store for our descendants some hundreds of thousands of years hence. Our so steady seeming earth belongs to a family of incorrigible adventurers, and its changes of scene were by no means exhausted when the poles sweated with tropic heat, or when ice mountains glittered upon New England. More than once science has wondered whether the endless voyaging of the planet may not be concerned with some of these alternations of climate and temperature. Here is food for reflection as one gazes at Vega sparkling in the summer evening air, and remembers how we are speeding to meet, or to pass, it.

THE PLANETS.

Mercury, in Leo, is an evening star rapidly approach-

ing the sun, with which it is in inferior conjunction on the 19th. At midnight on the 21st Mercury and Venus will be in conjunction.

Venus, which during August crosses Cancer from west to east and passes into Leo, is a morning star, fast nearing the sun. Venus is in perihelion on the 20th. Judging by what is at present known of the position of its poles of rotation, Venus has no such alternation of seasons in each hemisphere as the earth experiences, but, on the contrary, enjoys practically unchanging climatic conditions over its entire surface. This fixedness of climate is emphasized by the comparative lack of eccentricity in the planet's orbit, its change of distance from the sun between aphelion and perihelion amounting to only 940,000 miles, as against 3,000,000 miles in the case of the earth.

Mars, in Virgo, remains an evening star throughout August, and in fact until the end of the year. But it is too near the sun and too far from the earth to present an interesting appearance.

Jupiter, also in Virgo, continues to be a conspicuous phenomenon in the early evening. Observers during the present year have noted many interesting details among its spots and belts. Not only do different spots move at different rates of speed, but the velocity of particular spots, or of the currents in which they are carried, varies apparently in accordance with some periodic law. Not many phenomena of Jupiter's satellites are conveniently visible in August on account of the early setting of the planet. On the 1st Satellite II. will disappear in eclipse at 7 h. 12 m. 18·75 s., and will reappear from eclipse at 9 h. 27 m. 37·9 s. On the 14th the shadow of Satellite I. will be seen on the planet as soon as the darkness of the sky is sufficient to render observations feasible, and will remain in sight until 9:27 P. M. Seventeen minutes before the shadow of I. passes off, Satellite III. will appear advancing upon the opposite edge of the disk.

Saturn, in Ophiuchus, is excellently placed for observation during the evenings of August. Between Scorpio and Sagittarius, it readily attracts the eye with its clear, steady light, exceeding the brightness of a first magnitude star. The rings are not quite so widely opened as in July, although the difference is slight. It is the north side of the rings and the northern hemisphere of the planet which are presented to view. Saturn's brightest satellite, Titan, can easily be seen with a small telescope, and is recognizable from its motion. Anyone may watch it making a complete revolution between the 5th and the 21st. On the first and again on the last of those dates it will be at its greatest western elongation from the planet. Its course lies from west through north, east and south. It reaches northern conjunction on the 9th, eastern elongation on the 13th, and southern conjunction on the 17th.

Uranus is in Scorpio and Neptune in Taurus.

THE MOON.

New moon occurs on the 6th, first quarter on the 14th, full moon on the 20th, and last quarter on the 27th. The moon is nearest the earth on the 20th and farthest from the earth on the 6th. The lunar conjunctions with the planets occur as follows: August 2, Neptune; 5th, Venus; 7th, Mercury; 10th, Mars; 13th, Jupiter; 15th, Uranus; 16th, Saturn.

METEORS.

The celebrated shower of the August meteors is due on the night of the 10th, their radiant point being in the constellation Perseus, which rises in the northeast. Mr. Denning has shown that these meteors continue to meet the earth for a month or more, beginning in July, but their maximum on August 10 is alone interesting to the casual observer. These meteors sometimes leave trails and exhibit fine colors.

REPORT OF THE COMMISSIONER OF PATENTS FOR THE FISCAL YEAR ENDING JUNE 30, 1899.

The following report of the Commissioner of Patents setting forth the condition of the Patent Office for the fiscal year ending June 30, 1899, has just been received.

DEPARTMENT OF THE INTERIOR.

UNITED STATES PATENT OFFICE.

WASHINGTON, D. C., July 15, 1899.

THE SECRETARY OF THE INTERIOR:

SIR: Complying with the request contained in your letter of June 15, 1899, I beg to submit herewith the following report of the business of the United States Patent Office for the fiscal year ended June 30, 1899:

APPLICATIONS AND CAVEATS RECEIVED.

Applications for letters patent	35,352
Applications for design patents	2,292
Applications for reissue patents	91
Applications for registration of trademarks	1,861
Applications for registration of labels	612
Applications for registration of prints	112
Caveats	1,610
Total	41,930

PATENTS GRANTED AND TRADEMARKS, LABELS, AND PRINTS REGISTERED.

Letters patent granted (including reissues and designs)	23,550
Trademarks registered	1,406
Labels registered	372
Prints registered	76
Total	25,404

PATENTS WITHHELD AND PATENTS EXPIRED.

Letters patent withheld for non-payment of final fees	4,021
Letters patent expired	16,670
Applications allowed awaiting payment of final fees	8,055

RECEIPTS AND EXPENDITURES.

Receipts from all sources	$1,209,554.88
Expenditures (including total in all appropriations)	1,148,663.48
Surplus	$60,891.40

APPLICATIONS AWAITING ACTION.

Number of applications awaiting action on the part of the office on July 1, 1899	2,989

COMPARATIVE STATEMENT.

	Receipts.	Expenditures.
June 30, 1890	$1,347,203 21	$1,081,173.56
June 30, 1891	1,302,794.59	1,145,502.90
June 30, 1892	1,268,727.35	1,114,134.23
June 30, 1893	1,288,809.07	1,111,444.22
June 30, 1894	1,183,523 18	1,053,962.38
June 30, 1895	1,195,557.07	1,038,166.08
June 30, 1896	1,307,090 30	1,097,368.85
June 30, 1897	1,343,779.44	1,088,473.16
June 30, 1898	1,253,948.44	1,092,449.83
June 30, 1899	1,209,554.88	1,148,683.48

APPLICATIONS FOR PATENTS INCLUDING REISSUES, DESIGNS, TRADEMARKS, LABELS, AND PRINTS.

June 30, 1890	43,810
June 30, 1891	43,616
June 30, 1892	43,544
June 30, 1893	43,589
June 30, 1894	39,206
June 30, 1895	41,014
June 30, 1896	45,645
June 30, 1897	47,747
June 30, 1898	44,216
June 30, 1899	40,320

APPLICATIONS AWAITING ACTION ON THE PART OF THE OFFICE.

June 30, 1890	6,585
June 30, 1891	8,911
June 30, 1892	9,447
June 30, 1893	8,283
June 30, 1894	7,076
June 30, 1895	4,927
June 30, 1896	8,943
June 20, 1897	12,241
June 30, 1898	12,187
June 30, 1899	2,989

Summarizing these tables, there were received in the last fiscal year 35,352 applications for mechanical patents, 2,292 applications for designs, 91 applications for reissues, 1,610 caveats, 1,861 applications for trademarks, 612 applications for labels, and 112 applications for prints. There were 23,550 patents granted, including reissues and designs; 1,406 trademarks, 372 labels, and 76 prints were registered. The number of patents that expired was 16,670. The number of allowed applications which were by operation of law forfeited for nonpayment of the final fees was 4,021. The total receipts of the office were $1,209,554.88; the total expenditures were $1,148,663.48, and the surplus of receipts over expenditures, being the amount turned into the Treasury, was $60,891.40.

CURRENT WORK.

On June 27, 1898, every examiner had his new work within one month from date of filing, and his amended work within fifteen days of date. This is the first time since December, 1889, when the present form of weekly reports was adopted, that such a report has or could have been made.

ORGANIZATION OF THE CLASSIFICATION DIVISION.

The most notable advance of the year in the work of the office has been the establishment of a classification division, and its entry upon a thorough revision and extension of the classification of patents and printed publications, the examination of which lies at the foundation of our patent system. The necessity for this work, after being repeatedly called to the attention of Congress, was finally recognized, and an Act entitled "An Act for Revising and Perfecting the Classification of Letters Patent and Printed Publications in the Patent Office," was passed by Congress, and received the approval of the President on June 10, 1898, and went into force at the commencement of the fiscal year. Before beginning the work of classification the principal examiners, and other members of the examining corps, were invited to give their views upon the subject, and after giving careful consideration to the same, an order establishing a classification division was made on November 17, 1898, and the division placed in charge of a principal examiner with the title of "Chief of the Classification Division."

As a preliminary step it was considered desirable to ascertain how much of the material was available, and to that end it was decided to rearrange the original drawings of all patents in numerical order and to prepare a list on which they could be checked. These drawings were heretofore arranged by sub-classes, and it was necessary to know the classification of a patent before it could be found, which often necessitated a long search. By the numerical arrangement it is possible to find it at once, and at the same time much storage space is saved. The arrangement of these drawings numerically was at once commenced, and as the first ten thousand patents had no numbers and were only identified by name and date, considerable additional labor was involved to find and properly arrange such earlier patents. The entire work of arranging the drawings of nearly eight hundred thousand patents and trademarks has been substantially completed.

While the arranging of the drawings was proceeding the work of classification has also been going on. This involves the careful consideration of each patent in order to place it in its proper class and sub-class. Many of these patents have to be read to be fully understood, and much care must be taken to select titles which will clearly indicate the contents of each sub-class and to preserve clear lines between them. Cross references are also necessary between sub-classes of the same class by reason of the presence of mixed matter in the same patent. A system of card index of sub-classes and other details have been perfected, which will make it possible to detect and remedy any losses. Arrangements have also been made for the preservation of the classification and for the prevention of unauthorized changes by retaining under the supervision of the classification division all patents hereafter granted.

Owing to the lack of space it has been deemed advisable to detail only a small force up to the present time, but while awaiting the additional space that will be available when the General Land Office removes from the Patent Office building, I have authorized the chief of the classification division to select one assistant examiner in each examining division to commence work on the classification of his own division, retaining his desk therein, but acting under the orders of the chief of the classification division.

It is already patent that the work of the classification division will prove a great benefit to the office, increasing the accuracy and rapidity of searches, and that the public will experience corresponding benefits. It will also produce a corps of experts in classification who will become more familiar with all classes of the office than would be possible were their services confined to a single division, and those who operate in a single division will become more thoroughly acquainted with other classes than they would in working solely in making examinations. During the present fiscal year I expect to see great advances made in the work of classification. The chief of the classification division deserves much credit for what has already been accomplished under his direction, especially in view of the limitations that have necessarily been placed upon him.

ROOM.

This one word expresses the crying need of this bureau. With adequate room whereby our records and stock can be made accessible and the clerical divisions suitably rearranged, our present force can accomplish much more work in a given time and fill all orders with business promptitude.

I earnestly beg that when the General Land Office vacates the Patent Office building you will assign rooms, so far as possible, sufficient for the needs of this bureau. In view of the fact that millions of dollars of property would be jeopardized by the destruction of our assignment records—many of the original assignments having been lost by their owners, who depend upon duly certified copies—and in view of the fact that many of our other records are largely of a nature that money could not replace, I believe a fireproof structure should be provided in which to store them. The American Society of Mechanical Engineers, representing the leading manufacturing engineering interests of the country, as well as other similar organizations, have forcefully urged the erection of such a bullding.

LEGISLATION.

Some general legislation increasing the powers of the Commissioner of Patents, acting under the direction of the Secretary of the Interior, would be beneficial. I refer among others to a readjustment of salaries and a reclassification of the clerical force; authority to dispose of models of expired patents; and the exchange or sale of books in the Scientific Library, not necessary for the use of the office, coupled with authority to replace them with modern scientific works. In submitting my estimates for the next fiscal year these and other matters requiring legislation will be referred to more in detail. Respectfully submitted,

C. H. DUELL, Commissioner.

NEW FEATURES IN THE SCIENTIFIC AMERICAN.

In the future issues of the SCIENTIFIC AMERICAN and the SUPPLEMENT, there will be a rearrangement of the class of reading matter which has appeared in these two publications under the generic term of "notes." The SCIENTIFIC AMERICAN will, in the future, contain each week the Engineering and Electrical Notes, which have formerly been published in the SUPPLEMENT, while the column of Miscellaneous Notes and Receipts will hereafter make its weekly appearance in the SUPPLEMENT. The page containing valuable Trade Suggestions from American Consuls in all parts of the world, which has proved to be of such widespread interest to our readers, will continue to form an important feature of the SUPPLEMENT. The publication of a page of Engineering, Electrical, and Science Notes in the SCIENTIFIC AMERICAN will provide its readers with a digest of the general technical news of the week, in which the many items which do not call for an extended treatment will be condensed into brief paragraphs which will be by no means the least readable of the paper.

Calcium.

M. Moissan, of the University of Paris, who has been successful in the extraction of the rare metals in the electrolytic furnace, has recently undertaken a series of experiments with the metal calcium, which, although abundantly distributed in nature in the state of carbonate, sulphate, etc., has not up to the present time been prepared in any considerable quantity in the pure state. It will be remembered that at the commencement of the century Sir Humphry Davy was the first to establish the existence in lime of a metallic body, and by decomposing it by an electric current in the presence of mercury he obtained an amalgam of the metal calcium. Later on, in 1855, Matthiessen electrolyzed a mixture of chloride of calcium and chloride of strontium, and thus obtained small globules of calcium having a yellow color. A few years later Jobin prepared the metal by a purely chemical process, causing the metal sodium to react upon iodide of calcium in fusion contained in an iron crucible; however, the quantity of metal obtained was small, 300 grammes of iodide giving but 6 to 8 grammes of calcium globules. After other experiments, scarcely more advantageous, M. Moissan has been the first to obtain a relatively considerable weight of the metal. He employs two methods; in the first, which is purely chemical, he utilizes the property which calcium possesses of dissolving in liquid sodium at a dull red heat. In an iron crucible of one liter capacity are placed 600 grammes of anhydrous iodide of calcium, together with 240 grammes of sodium. The whole is heated to dull redness, at which temperature the sodium unites with the iodine of the iodide of calcium, and the calcium set free dissolves in liquid sodium, which is in excess. Upon cooling it crystallizes in the middle of the mass of sodium, and by proper separation one may obtain brilliant hexagonal crystals of pure calcium. The amount of the latter is equal to 50 per cent of the theoretical weight contained in the iodide, and 40 grammes have been obtained at a single operation.

The second process employed by M. Moissan consists in the electrolysis of iodide of calcium in fusion at a dull red heat. A cylinder of pure nickel is used for the negative electrode, and for the positive a rod of graphite. The calcium thus prepared has been examined as to its physical and chemical properties. Among its physical properties may be mentioned the following: it may be melted in vacuo at a temperature of 760° C. and then appears as a brilliant liquid. After cooling, the metal is rather soft and may be cut with a knife. It may be broken by striking it, and the fracture presents a crystalline structure. Its surface, when it has not been attacked by gases, is of a clear white color, approaching that of silver. Its density is 1·85.

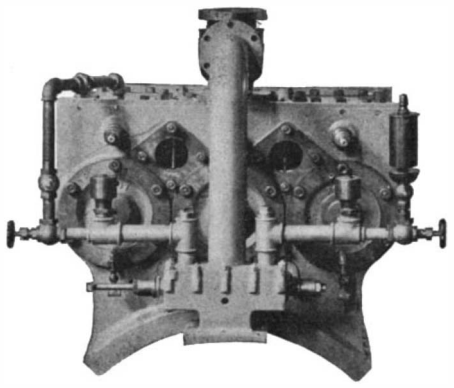
As to its chemical properties, calcium when brought to redness unites with hydrogen, forming a crystalline hydride; it combines with chlorine at 400° C., and with bromine and iodine at a dull red heat. In oxygen the metal, when raised to 300° C., gives a brilliant combustion. It decomposes water at the ordinary temperature, and also decomposes sulphurous acid gas with incandescence. When heated in carbonic acid gas, it becomes covered with a deposit of carbon. Calcium combines with sulphur at 400° C., and burns with incandescence in the vapor of phosphorus. It unites with carbon in the state of lamp black below redness, and produces calcium carbide. Calcium when cold does not unite with nitrogen, but when heated in that gas it absorbs it slowly, and the metal, at first brilliant, assumes a yellow color. This explains why the alloys of calcium, which up to this time were regarded as the pure metal, were all more or less yellow, this color being due to the nitride. The latter compound is obtained in transparent crystals of a yellow-brown color, melting at 1200° C.

Some Greek divers have recently discovered a treasure-ship which was sunk near Chios, where, in 1770, the Turkish fleet was totally destroyed and the Russian flagship was sunk. The latter was found thirty fathoms deep, and over $60,000 in gold and silver has been obtained from the hold of the flagship.

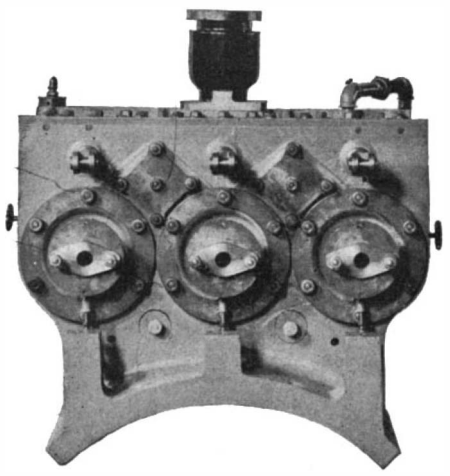
A HUGE OVERLAND TRACTION ENGINE.

One of the largest traction engines ever built was recently completed by the O. S. Kelly Company, of Springfield, Ohio, and shipped to Cuba, where it has been used with considerable success on one of the largest sugar plantations.

The engine is essentially a triple-cylinder geared locomotive with enormous drive wheels, especially adapted to the roads over which they are to travel. The three cylinders with their valve-chests form a single large casting placed on the forward end of the boiler. Steam passes directly from the boiler to the central steam-chest and thence to the outside chests. The engine has a three-throw crank-shaft with cranks 120 degrees apart, fitted with three pairs of eccentrics. As the point of cut-off is carried late enough always to insure admission of steam to two pistons, heavy loads are easily started. The boilers are of the locomotive type with grate surfaces varying from 9 to 12 square feet. The boiler pressure is 180 pounds per square inch. The engine gives a continuous tractive force of 12,000 pounds at the wheel rim, moving at a rate of 330 feet per minute; the horse power developed is therefore 120.



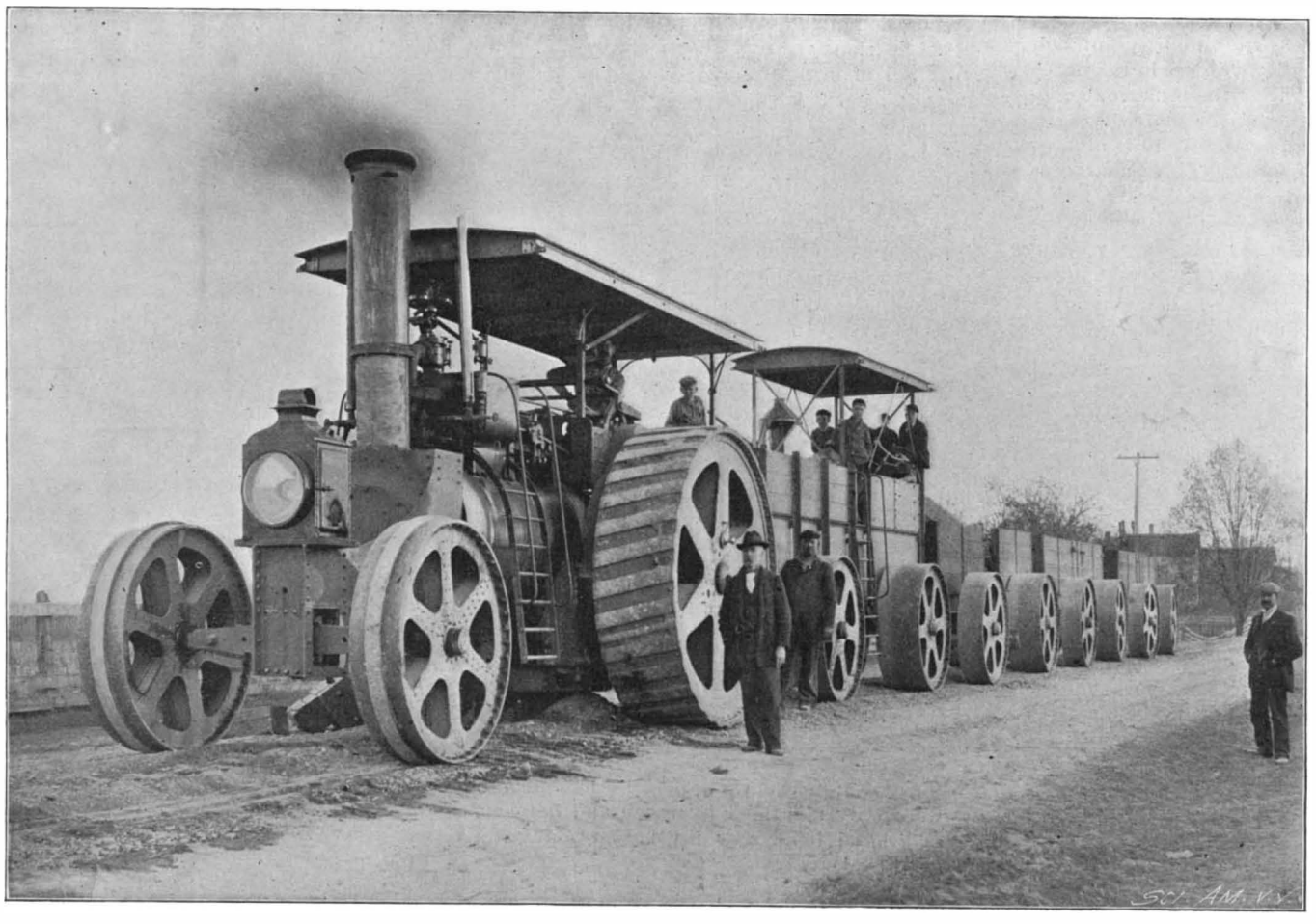
FRONT VIEW OF CYLINDERS.



REAR VIEW OF CYLINDERS.

The drive-wheels are eight feet in diameter and are built up from center castings to which side sheets are riveted. The steel plate tires are provided with cleats four inches wide and two inches thick, extending completely across the face at such an angle and distance apart as to insure the complete bedding of one cleat on each wheel before the preceding cleat has left the ground. The front wheels are five feet in diameter, and are similarly constructed. Steering is effected by the usual hand-wheel, worm, and shaft, fitted with chains secured to the front axle.

By the use of steam traction-engines pulling wagons adapted to the kind of freight which they are to contain, not only may large loads be readily transported, but an economy is effected even in countries where beasts of burden are cheap and easily obtained. With a grade not exceeding five per cent, a load of thirty tons exclusive of engines and wagons can be hauled thirty miles per day. Over dry, natural soil, even 112 tons have been hauled. The engines are adapted to haul freight from plantations and from mines so remote from railways that the transportation of low-grade ores becomes unprofitable.



THE TRACTION ENGINE AND ITS LOAD UNDER WAY.

Hardening Articles of Plaster of Paris.

A German patent has been granted for the treatment of articles of plaster of Paris with an aqueous solution of ammonium borate, for the purpose of hardening them and rendering them insoluble in water. A simple and efficient process for accomplishing this object would be highly desirable, as it would serve to greatly prolong the life of plaster casts, which being quite soft and not entirely insoluble, sooner or later become superficially defaced, and washing specially wears down the outlines of the object.

The process above referred to is said to give results decidedly superior to anything that has heretofore been proposed. The hardening liquid may either be mingled with the plaster in the act of moulding or may be applied on the surface of the finished casts with a brush.

The solution is prepared by dissolving boracic acid in warm water and adding thereto sufficient ammonia to form the borate which remains in the solution.

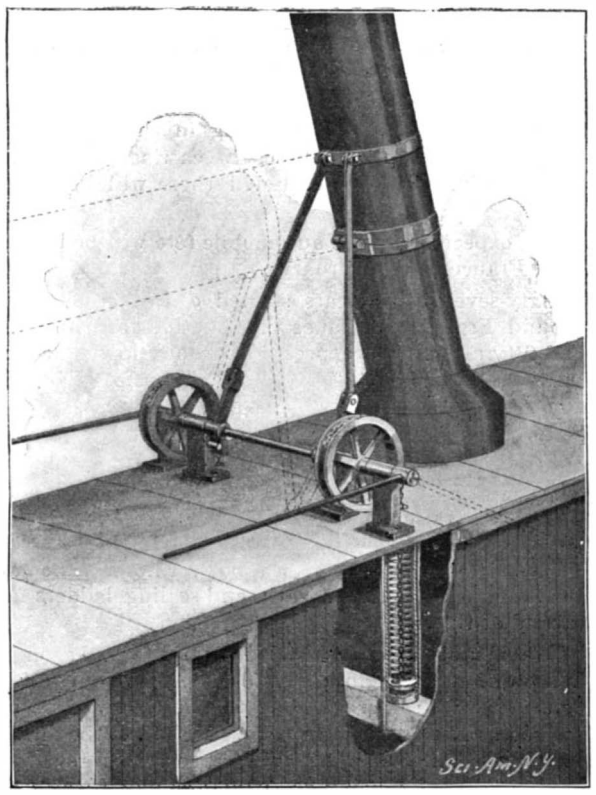
The manner of using the solution is thus described: The saturation of the gypsum or painting of the plaster of Paris is carried out in the cold. The objects are subsequently rinsed off and dried. The surface becomes very hard after two days and insoluble in water, while the induration in the interior advances more slowly. By means of the fluid described, gypsum floors can be hardened and rendered more durable and impervious to the influence of the weather. Saturating with ammonium borate is said to be epecially useful on exterior walls of buildings, barracks, etc.; on the latter, because experiments have proved an antiseptic action of the liquid.—Journal of Franklin Institute.

A Southern Exposition.

A Southern Exposition will be held in the Grand Central Palace, New York city, October 31 to November 25, 1899. Its aim will be to display the commercial resources of the Southern States and to show the use which has been made of them. It is believed that the exposition will be of vast benefit in attracting capital to the Southern States, where there are great opportunities for investment. The present is a particularly auspicious time for the display of Southern products in the North, owing to the new era of good feeling, and a warm reception is assured to the Southern visitors. The mineral wealth of the South will be suitably illustrated, and also its industries. Col. John J. Garnett is the Director of the Exposition, and the advisory committee includes prominent men.

A NOVEL DEVICE FOR RAISING AND LOWERING SMOKESTACKS.

In passing under bridges the crew of a steamer often find it necessary to lower the smokestack, an operation which entails the expenditure of no little time and labor. A device has been invented by John D. Dailey, One Hundred and Thirty-third street and Southern Boulevard, Harlem River, New York city, which provides a simple means for lowering a smokestack or



A NOVEL DEVICE FOR RAISING AND LOWERING SMOKESTACKS.

mast, and for automatically returning it to its normal position.

The smokestack is composed of a fixed lower section and a hinged upper section, connected by means of links with the swinging arms of a rock-shaft. Fitted on this rock-shaft are two grooved wheels, over which chains pass downward into wells. To the end of each chain a sliding block is secured, and coiled about the chain, between the block and well cover, is a spring.

When it is desired to lower the upper section of the stack, the rock-shaft is operated by means of levers secured to its ends. The stack will then be brought to the position shown by dotted lines in the illustration, the springs being thereby compressed. When the levers are released after the vessel has passed the bridge, the springs in expanding will return the upper hinged portion of the smokestack to its normal position.

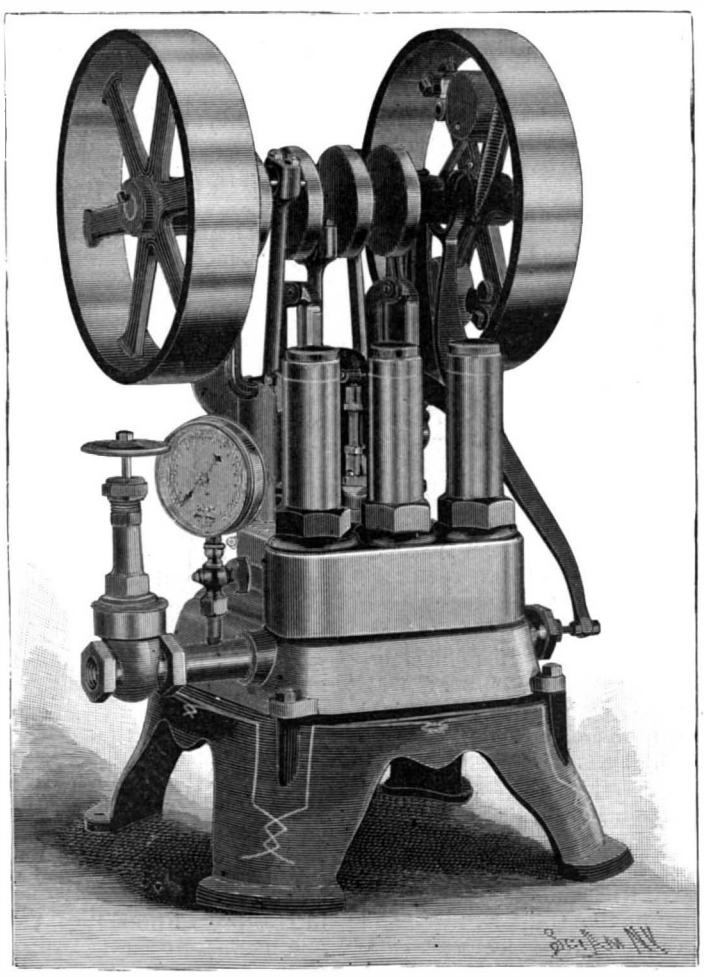
THE JOHNS HYDRAULIC ENGINE—A COMBINED WATER AND AIR MOTOR.

One of the most ingenious and efficient hydraulic motors which has yet appeared is being made by the Elmira Manufacturing Company, of Elmira, N. Y. The operative principle of the engine is certainly unique, embodying as it does a combination of hydraulic and air pressure. In addition to the power given by direct pressure of any given head of water, the engine employs the pressure produced by suddenly checking the momentum of the water flowing to the cylinder. In other words the principle of the hydraulic ram is applied to the hydraulic engine without any loss of water.

The motor which forms the subject of our illustrations is a three-cylinder vertical engine, having a three-throw crank shaft, with cranks set at an angle of 120°. The three cylinders have a common supply chamber, from which separate inlets lead to the valves for each cylinder, a check valve being provided to prevent back flow from the momentum of the water in the supply pipe. Above each inlet is an air chamber. Back of the supply chamber, underneath the cylinders, is an exhaust chamber, and between this chamber and each of the inlets are ports which lead to the bottom of the cylinders and are put successively into communication therewith. An outlet passage is carried down to the exhaust chamber and is coupled with the exhaust pipe at a point so as to trap the water in the exhaust chamber at the end of the return stroke of each piston without, however, exerting back pressure.

The inlet and exhaust piston valves controlling the cylinder ports are coupled with rocking levers. Cam-arms reciprocating with the pistons engage these levers so that each piston, when nearing the top of its stroke, by means of its cam-arm, actuates the valve for the next cylinder in order, holding the valve open while it pauses at the top of the stroke, and closing the valve quickly on its descent. Upon the quick closing of each valve the water will be suddenly cut off from the corresponding inlet, but will continue to flow from the supply chamber past the check-valve into the air-chamber, compressing the air until the momentum of the water is checked. The check valve is then closed so as to maintain the air within the air-chamber in its compressed state. Upon the next opening of the valve the compressed air in the air-chamber will force the water under this increased pressure into the cylinder during the upstroke of the piston, this increased pressure gradually diminishing until the normal pressure of the water supply has been reached. The check-valve will then reopen, and the water will again flow from the supply chamber through the inlet to begin the cycle anew.

The nearness of the air-chambers to the cylinders and pistons gives an elastic action to the flow of the water, which, with its accumulated extra air pressure, adds greatly to the efficiency of the motor—an efficiency of about fifty per cent over the power obtained from the simple pressure and quantity of water alone. The elasticity of the water in following the piston allows the engine to run at a higher speed than the ordinary hydraulic motor. In the hydraulic motors commonly in use the power depends upon the volume and pressure of the water alone; but in the motor described there is the additional power obtained from compressed air. It develops a much greater power with the quantity of water used than in any other form of water motor. The engine is built in all sizes from one-quarter horse power up, there being no more limit to size than where steam is used for motor power. The company has its New York office at 159 Greenwich Street, and is glad to give further information to anyone desiring it.



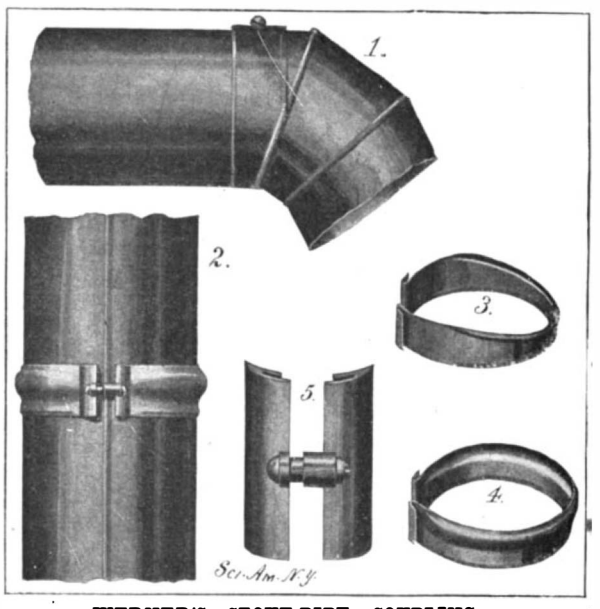
THE JOHNS HYDRAULIC ENGINE—A COMBINED WATER AND AIR MOTOR.

AN IMPROVED STOVE-PIPE COUPLING.

An efficient form of coupling for stove-pipes has been invented by Jacob J. Werner, of Hebron, Neb., which is so constructed that the adjacent ends of stove-pipe and elbow sections may be rigidly held together without the use of riveted joints, supporting screw-hooks, or the like.

Of the accompanying illustrations, Fig. 1 is a side elevation of the coupling applied to a stove-pipe and elbow. Fig. 2 is a front elevation of a stove-pipe with the clamping-band applied. Fig. 3 is a view of a form of clamping-band used on straight sections of pipes. Fig. 4 is another form of band used on straight pipes. Fig. 5 is an enlarged front elevation of a tightening device used on the band.

The clamping-band used is swaged to give a suitable cross-section such as an ogee form, the top and bottom edges being bent inwardly. The ends of the band have exterior flanges standing at a slight angle to each other, sufficient flare being thereby given to the band to insure a tight binding on the large and small ends of the pipe-sections. These flanges are made to fit into grooves formed in two bars, hammered in place on the ends of the band to interlock with the flanges. The ends of the band are held tightly together by means of a clamp or tightening device comprising a pin which extends longitudinally from one of the bars referred to, has an internal screw-thread, and is fitted to slide in a tube secured to the other bar. A screw engages the threaded pin and is adapted to abut with its head against the outer end of the tube. Hence, by turning



WERNER'S STOVE-PIPE COUPLING.

the screw, the diameter can be made larger or smaller, and the ends of the band can be drawn so tightly together that the pipe-sections are rigidly joined. The swaged body of the band fits on the correspondingly swaged small end of the pipe; and the bent edges of the clamping-band fit snugly upon the pipe to prevent any escape of smoke or gas from the joint between the sections. The elbow-band is similar to the one described, but differs therefrom in having a reduced middle portion and in having a bead adapted to engage a bead between the small end section of the elbow and the large end section of the pipe, so that the elbow and pipe are not liable to be drawn apart. The reduced portion of the band fits snugly on the reduced or inner portion of the elbow section.

Lightning Strikes the Washington Monument.

It is not uncommon for the Washington Monument to be struck by lightning, but during the thunderstorm of July 14 a bolt of lightning struck the monument and burnt out the wires used to give signals to the elevator conductor. There are one hundred and eighty points at the top of the monument to catch the lightning, and the wire conductors run down the inside of the shaft. While it is not uncommon for lightning to descend with the aid of these conductors, no person has ever been injured in the structure from this cause.

SIR WILLIAM CROOKES is preparing a reply to the many severe criticisms which have been published regarding his British Association address of last year, in which he showed that the wheat supply of the world will fall short in the next century.

Correspondence.

Air Resistance to Moving Bodies.

To the Editor of the SCIENTIFIC AMERICAN:

In concluding an editorial on air resistance to moving bodies, suggested by Murphy's bicycle riding feat, you offer for the special consideration of railroad managers this problem: If a body presenting three square feet of surface to air resistance, and moving at the rate of sixty miles per hour, requires seven horse power for its propulsion, what would be the resistance in horse power to a train moving at the same velocity, but presenting 400 to 600 square feet of surface? This is not at all difficult, as a mathematical problem, but to my mind it suggests another, which I confess is a "corker." If from 933 to 1,400 horse power is required to overcome the direct air resistance to a train moving sixty miles per hour, and this resistance is about equivalent to the utmost capacity of the locomotive, how are the inertia, frictional and other resistances overcome at this and much higher speeds? The men who formulated the extremely elastic formulæ on which such calculations are based should give their attention to this problem, in which event it is probable that we should soon hear of a solution equally interesting and valuable. But if they have any misgivings as to the accuracy of their calculations, it is suggested that they should not attempt to verify them by any experiments conducted on the pilot of a fast locomotive without first erecting thereon some very substantial fortifications against those delusive seven or more horse powers which otherwise they would be called upon personally to resist. If these gentlemen should unfortunately be afflicted with a physical corpulency to correspond with the inflated generosity of their imaginations, the dangers of the undertaking should certainly deter them from making, in other respects, such a promising experiment in the suffering interests of science.

The simple fact that the bicyclist Murphy was able to ride from 10 to 15 feet in the rear of the car or shield shows conclusively that a body of air enveloping the entire train is swept along with it, at about the same rate of speed, and that, therefore, small projections, window embrasures, and gaps between the cars, add little or nothing to the resistance.

If a bicycle rider, without a pacer, would have to exert seven horse power at sixty miles per hour, it would, at least, be safely within the limits of the accuracy of Mr. Adams' calculations to say that one horse power would be required at 30 miles per hour; but it is known that the best riders are unable to make a sustained effort of much over half a horse power, and if the double of this is demanded for air resistance alone, we must all admit that the rider who makes a record of 25 or 30 miles per hour is the most wonderful phenomenon that nature has ever produced.

W. F. CLEVELAND.

Moncton, N. B., Canada.

[The points raised by our correspondent are well made, and the reductio ad absurdum in the case of the horse power required to drive a bicycle at thirty or draw a train at sixty miles an hour is evident. We know that 1,400 horse power is not exerted by the locomotive in overcoming air resistance, and we know that a bicyclist cannot exert one horse power for more than a few seconds at a time, certainly not for two minutes; nevertheless, assuming that even the lowest tables of wind pressure are correct and working upon the 33,000 foot-pounds basis, as we did in the editorial referred to, these impossible results inevitably follow. As a matter of fact, there is a crying need to-day for careful investigation of the subject of wind pressure and air resistance, not so much to determine the disturbances of the atmosphere when agitated by moving bodies, as the exact pressures developed. The impossible results arrived at in working on our present basis of wind pressure prove that our tables are altogether too high; and if they are too high, we are putting tons of weight into our bridges, roofs and framed structures subject to wind stress, which represent simply a clumsy waste of material. The other point raised in this letter is taken up in our editorial column.—ED.]

Air Resistance.

To the Editor of the SCIENTIFIC AMERICAN:

Your valuable paper of July 15 to hand yesterday, and contents of article headed "Murphy's Ride a Hint to the Railroads," noted.

It seems to me that you leave one factor out of all your calculations, namely, the suction or inrush of wind behind the train. You only credit the engine and car with one-half of their work. They not only cleared the way for Murphy; they created a 60-mile per hour wind behind him to carry him along. This new factor will cancel all your previous figures, as, according to them, Murphy had seven horse power of wind at his back.

That the frontage of engines, etc., offer some resistance to the air, there can be no doubt; but it is insignificant in comparison to the results of your figures. I will venture to say that if Murphy had taken his feet off his pedals after he had attained his maximum speed he would have finished just as soon as he did.

A few years ago, I followed a trolley car across the meadows between Rutherford and Jersey City, at a distance of some 20 to 30 feet. The car stopped unexpectedly (to me) to hail another car coming in an opposite direction. With all the back pressure I could exert I could not stop quick enough to avoid smashing my wheel, and I only saved myself by getting out from behind the car. ROBERT MANCHLIN.

New Holland, Pa., July 15, 1899.

[Our correspondent is confusing a 60-mile per hour train with a 60-mile per hour wind. The pressure on a stationary square yard of surface exposed to a 60-mile wind is the same as the pressure on a square yard of surface moving at 60 miles per hour through still air. According to our correspondent's theories, if he took shelter from a 60-mile per hour wind behind a square yard of board fence, he would find a 60-mile wind (or suction as he terms it) blowing him against the fence on the lee side of it. As a matter of fact, the air on the lee side of the fence would be still or "dead" air, just as (according to Murphy) there was still or as he called it "dead" air behind the shield.—ED.]

THE PARIS EXPOSITION MEDAL.

Our engravings give an admirable idea of the appearance of the new medal which will be given to the most deserving exhibitors at the great Exposition which will open its doors next year in Paris. The medal is of bronze, $2\frac{1}{16}$ inches in diameter, and is the work of the French sculptor, M. Georges Lemaire. It consists of a female figure, modeled in considerable relief, holding in her right hand a branch, while with her left hand she sustains an airy bit of drapery. The wording is simply "L'Exposition de Paris," and the sun with conventionalized rays at her left has the figures "1900" imprinted across it. The figure is seated on the capital of a column which is almost hidden by the ample folds of the drapery, which are excellently

THE MEDAL OF THE PARIS EXPOSITION OF 1900.

handled. At her feet is a scroll, a palette, and a lyre, typifying the fine arts.

The reverse of the medal is made up of a cartouche which is to receive the name of the recipient of the medal. At one side and secured by a banderole is a sheaf, presumably of corn, typifying agriculture. Below, at the center, is an airship, at its right is a telegraph pole, and at the left a battleship bristling with fighting tops, conning towers, and turrets. The lower part of the composition is made up by the usual cog wheels, anvil, governor, etc., which have served, from time immemorial, for works of this kind. There is also a camera, telephone, a globe, books, and an alembic. The obverse of the medal is very handsome, but the reverse consists of a confused jumble of conventional representations of various arts, manufactures, and discoveries, and can hardly be called very successful. The medal will be warmly appreciated by its recipients, and we trust that the American exhibitors will take away their full share of them.

The Arctic Club.

The Arctic Club of America is the name of a unique club which has headquarters in New York city. It was organized by the members of Dr. Cook's Arctic expedition of 1894 on the ill-fated ship "Portia," which was sunk so recently. The members of the expedition had been wrecked off the southwest coast of Greenland, their ship being the "Miranda," the sister ship of the "Portia," that ran upon the reefs off the coast of Greenland, the magnificent collections being lost. The party was rescued by a little Gloucester fishing schooner, and when they reached Halifax they embarked for New York on the "Portia." The members of the expedition met together on September 8, 1894, and organized the club, whose active members should consist of all persons upon the passenger list of the "Miranda" on her cruise. Prof. W. H. Brewer, of Yale University, was made president. It was decided that an annual dinner be given by the club. The first banquet took place December 7 of the same year. Since that time the scope of the club has been widened, and it now embraces among its members nearly every prominent Arctic explorer in the United States, and even Dr. Nansen is one of its honorary vice-presidents. The objects of the club are to promote a live interest in Arctic matters and to disseminate accounts of the results of expeditions. The club has a banner of its own, which is now being borne toward the north pole by Lieut. Peary, Walter Wellman, and others, and the members of the club are living in hopes that their banner will soon float above the pole, the goal of all Arctic explorers.

Automobile News.

A service of motor vehicles has been started between Rosas and Figueras, in Spain, a distance of twelve miles. The vehicles are of eight horse power and have a seating accommodation for nine passengers.

The New England Electrical Vehicle Transportation Company has made a beginning in the automobile business in Boston by putting five carriages in service. Within a month it is expected there will be thirty more.

It is expected that an automobile fête will be held at Pau, France, next February.

Sixty-seven motor cars started on July 16 to race around France, a distance of some fourteen hundred and fifty miles. It is expected that the trip will occupy nine days, with two intervals of a day each.

The first electric cart of the firemen of Paris is now running on the streets and has already begun its work of saving life and property. It is a handsome vehicle, with a seat in front for several firemen, and a horizontal steering wheel. Back of this is a "dos-a-dos" arrangement which will permit of seating several firemen. Between these seats is a box for hose. The batteries are carried underneath, and scaling ladders are carried at the side.

The Illinois Electric Vehicle Company will soon be in a position to begin operations. At first only a few vehicles will be operated, but the number will be increased as fast as they can be obtained from the manufacturers. The demand for electric carriages is so great that the manufacturing companies cannot furnish an adequate supply.

Some time in the fall electric automobile street sweeping machines will be used in Paris, and the old clumsy dust machines will be done away with. The motor is in front, while underneath and behind is a tank for water, and the sprinkling device in the rear and the sweepers, which can be raised out of contact with the pavement whenever desired. The new machine can be run back and forth over a street to sprinkle it. It will then return and sweep the dirt in piles and electrically-driven carts will carry away the dirt after it has been heaped in piles.

The French electric wagon Jeantaud recently made a trip of eighty-five miles in seven and a quarter hours, without recharging the battery.

Test of the New Naval 4-inch Gun.

A new type of 4 inch, 50-caliber gun for the navy has just been tested at the Indian Head Proving Ground, giving excellent results. With a charge of 17 pounds of perforated grain navy smokeless powder, a muzzle velocity of 2,991 foot-seconds was obtained, with a muzzle energy of 2,049 foot-tons, with a chamber pressure of 16·95 tons per square inch. With a charge of 16¾ pounds a muzzle velocity of 2,937 foot-seconds was obtained, with a muzzle energy of 1,972 foot-tons.

The gun was designed for 3,000 foot-seconds muzzle velocity within the limits of 17 tons pressure per square inch, and there is no doubt but that, with a powder of the proper grain, the requirements will be easily fulfilled. The weight of the new gun is 2·72 tons, while that of the old type 4-inch gun is 1·5 tons. The old type gun, with smokeless powder, has a muzzle velocity of 2,200 foot-seconds, and a muzzle energy of 1,108 foot-tons. The muzzle energy of the new gun is, therefore, 78 per cent greater than that of the old.

The old gun has a muzzle energy of 738 foot-tons per ton of gun; the new gun has a muzzle energy of 750 foot-tons per ton of gun. The old gun has 92 foot-tons muzzle energy per inch of shot's circumference, and the new gun has 170 foot-tons muzzle energy per inch of shot's circumference. The old gun has a muzzle energy of 33·5 foot-tons per pound of projectile, and the new gun has a muzzle energy of 62 foot-tons per pound of projectile.

A new type of mount for the heavy 4-inch gun was also tested and worked in a thoroughly satisfactory manner during the firing of the thirty-five rounds to which the gun was subjected.

The new monitors, in addition to their 12-inch turret guns, will each have an auxiliary battery of four of the new 4-inch guns.

The Ordnance Bureau of the navy is much gratified with the performance of the new gun, as the larger calibers of the new high powered gun now being manufactured for the battleships of the "Maine" class and the monitors are designed practically on the same lines as the 4-inch gun just tested. The next new gun to be tested will be one of 6-inch caliber, and it will be interesting to note its performance, as a new 6-inch gun manufactured by Vickers Sons & Maxim, of England, will soon be fired at Indian Head.

Science Notes.

The British steamship "Holbein," which recently arrived at Liverpool, picked up Capt. William A. Andrews, known as the "lone navigator," who left Atlantic City on June 18 in a little vessel barely twelve feet in length, to attempt to cross the Atlantic. He was found in an exhausted condition on July 12, about 700 miles from the Irish coast.

Dr. Lambert Lack of London has for a long time been investigating the origin of cancer. His theory is that cancer is not a germ disease, but is due to specific injury to the basement membrane of the mucous membranes and allied structures. Dr. Lack promises that he will communicate full details of his investigations to the medical press in a short time.

A short time ago the "Captain Cook Reserve" at Kurnell, on the shore of Botany Bay, New South Wales, Australia, was formally opened. The reserve is the ground which marks the spot where Capt. Cook, the great navigator, landed one hundred and twenty-nine years ago. The park was inaugurated with appropriate ceremonies, and H.M.S. "Goldfinch," which lay in the harbor, fired a salute.

The opal mines in Mexico and the United States have been about exhausted, no gems of much value being extracted from them, though at one time large sums were made out of these mines. Opals occur in veins in the same manner as silver or gold. Those coming from below the level of water in a mine are not considered desirable. They may lose their color or crack after being exposed to the sunlight, so as soon as a mine reaches water level, it is abandoned.

Henry G. Bryant, of Philadelphia, the well-known explorer and mountain climber who led a search party for Lieut. Peary a few years ago, and who has now in view the ascension of Mount St. Elias in Alaska, has left Banff for Mount Assiniboine to make preparations for the ascent of the peak. He has been considering the ascent of the great peak of Assiniboine for some time. He will be accompanied by Swiss guides from Interlaken, who have been recently introduced at the Selkirk glacier and other mountain points for the benefit of Alpine clubs.

After September 1, the sirups used in soda water in New York city will be subjected to the careful scrutiny of the Health Department, and not only will the small venders who peddle from their carts come under the jurisdiction of the department, but the large drug stores which dispense soda water from pretentious fountains will also be under their supervision. The act is aimed particularly at imitations of lemon and orange juices, which are very injurious. Imitation pineapple made from ethers is also unwholesome. The selling of adulterated sirups is now a misdemeanor in the State and is punishable by fine or imprisonment.

Rome and the surrounding country was visited by a severe earthquake on July 19. Considerable damage was done in the central part of the city and a number of churches were injured. Several blocks of stone fell from the Coliseum, and the columns of the Forum rocked, but remained intact. Otherwise the antiquities were not seriously injured. In the Alban Hills the shock was very severe. The villa of the Pope at Castle Gandolfo was seriously damaged, and the town of Frascati was injured worst of all. The shock it is believed can be attributed to the same causes which made Mount Etna begin an eruption the day before.

The colored screens used in orthochromatic photography are far from being identical among themselves, especially when they consist of a small glass cell filled with colored liquid. It thus becomes necessary to verify them each time before using, a process which is quite difficult. In order to facilitate this comparison, M. Villain has had the idea to utilize an apparatus which is very simple, known to chemists and color makers as the colorimeter of Houton-Labillardière. This colorimeter consists of a rectangular box of which one of the sides has two openings preferably rectangular, while opposite to them on the other side of the box is a larger rectangular opening, through which the first two are visible. Behind each of the two openings is placed a glass tube, about 15 mm. in diameter and 15 cm. long, open at the top, into which are poured the liquids to be compared. Screens of glass or gelatine may take the place of the tubes. By looking through the large aperture at the two screens, it is easy to detect any difference of color. The construction of this small apparatus is very simple as well as cheap, but it may be still further simplified, and one may in fact transform his own camera into a colorimeter with little trouble. It is only necessary to take off the lens and to replace the frame containing the ground glass by a thin piece of wood or even thick cardboard slid into the back of the camera. In this are cut two openings, as above, and the tubes or screens are fixed to the back in any convenient manner. The two screens to be compared being thus in place, they are observed through the opening left by the removal of the lens, the head being covered by the cloth. In this way a very small difference of color may be easily detected.

Engineering Notes.

The Lachine Rapids Hydraulic and Land Company is contemplating many additional improvements. An additional wing dam 1,000 feet long will be constructed to avoid the frazil ice. The company will also build about 1,000 feet of crib work. A steam plant is also to be installed to provide for emergencies.

Four engineers have been selected to prepare plans for the construction of the memorial bridge across the Potomac River at Washington, from the Naval Observatory grounds to the Arlington estate. The men selected are George S. Morison, Leffert L. Buck, William H. Burr and William R. Hutton. They are all engineers who have done important work in this line.

The Knapp roller boat, which we have already described, set out from Toronto a short time ago. The roller boat would not roll, and according to The Canadian Engineer became unmanageable, even in a moderate wind. Five days after leaving Toronto the "roller" was reported as being tied to a tree about two miles west of Bowmanville, Ontario, having rolled forty-one miles in five days.

It is announced that a contract has been made between the Carnegie Steel Company, Limited, and the Schoen Pressed Steel Car Company, at Pittsburg, which will run for ten years. During this time the Carnegie Company is to furnish the Car Company with 1,000 tons of steel plate daily. The yearly contract will amount to $6,000,000. It is said that this is the largest single contract ever made in this country.

The power of the Mannlicher rifle was recently demonstrated in an accident near Prague. Two gendarmes entered a room in an inn and closed the door, putting their rifles in the corner. One rifle fell and discharged itself, the bullet going through the door into the next room, where a party was dancing, passed through the body of a musician, killing him, and then through the bodies of five other men, all of whom were dangerously wounded.

On the new street cars between St. Paul and Stillwater there will be air brakes and whistles, the air being supplied by a small motor which operates an air pump. The whistles will be used in the country, where a high rate of speed is maintained. Each car is also to be provided with a telephone and fifty feet of wire. Each half mile there will be a place where this telephone can be attached, so that the conductor can communicate with the power house or car barn.

An interesting gyroscopic device, termed the "oscillometer," has been put on the market by a Milanese firm. It consists of a small electric motor mounted in gimbals like a ship's compass, with its armature running in a vertical position at a very high rate of speed; the frame of the instrument being attached to the vessel follows any change in direction. As the ship rolls, the armature maintains its original position, while the frame, of course, follows the motion of the ship. As the motor armature continues to revolve always in the original plane, any change in the direction of the vessel is at once indicated. Suitable scales and pointers are provided, so that the amount of movement can be accurately determined.

A story is now going the rounds to the effect that the Chinese government will soon make a contract for tearing down the Great Wall, which is 1,300 miles long. It is very unlikely that any attempt to do this will be made, because the expense of taking down such a wall, even with the cheapest labor, would amount to an almost impossible figure. The reservoir at Forty-second Street and Fifth Avenue, New York city, may be compared to the wall of China in certain ways. It is estimated that it will cost over $100,000 to remove the reservoir, and when its very small size is considered, it will be seen that to pull down 1,300 miles of wall would cost a billion or more dollars. It is probable that the wall may, however, be utilized as a quarry for those in search of building materials.

The Compagnie Générale des Omnibus de Paris is installing on the cars of their Louvre-Saint-Cloud line a low pressure acetylene lighting system. The vehicles while built under the form of an omnibus are really street cars, for they run on tracks and are provided with an "imperial" or second story. The material which generates the gas is not ordinary calcium carbide, but is what is called "acétylithe," which has been devised by Létang and Serpollet. This substance is calcium carbide which has been treated with glucose after an immersion of several weeks in petroleum; this prevents an over-production of gas. The generator is placed on the platform of the car, under the stairs which lead into the imperial, and is of a new form, and is simple and effective. The gas after being generated is dried and the impurities are removed. Lead pipes conduct the gas to the burners, which are inclosed in globes somewhat similar to those used for the Pintsch light; there are two in the car proper, one on the imperial and one on the platform, as well as a small signal light of five candle power. The total expense for the five lights is about four cents per hour, which is much cheaper than an equivalent amount of electric light.

Electrical Notes.

Stockholm, Sweden, has probably the largest number of telephones for its population of any city in Europe. There are 23,000 telephones to less than 300,000 inhabitants.

The Hudson River Power Transmission Company has received permission to erect poles and string wires along the Erie Canal for a distance of twenty miles from Mechanicsville, where the power is generated, to Albany.

The freight traffic of the Detroit, Ypsilanti and Ann Arbor electric railway promises to be a profitable branch of the business of that line. Every day two shipments are made from its office depot on Griswold Street, in Detroit, says The Tribune of that city, and two shipments are received back at the same place. The receipts from inbound freight average $10, and for outbound freight about $25 a day, and it is expected that the total receipts will be increased to more than $100 a day by June, 1900. Ann Arbor takes about half of the freight and Ypsilanti is next in volume, but shipments to Wayne are daily increasing. A good deal of the freight consists of vegetables and groceries, although trunks and all light articles usually carried in express cars on steam railroads are also taken.—Western Electrician.

It is stated that the electric locomotive destined for the Jungfrau mountain railway is the most powerful rack-wheel machine hitherto constructed. It is designed to haul the trains over the steepest portion of the track. The motors are placed under the passenger cars, whereby greater adhesion between the driving wheels and rails is obtained. The car truck is provided with two bearing axles and two driving axles, which latter are situated between the former. Two motors, each of 125 horse power, at 800 revolutions per minute, actuate the toothed wheels through the medium of duplicate gearing. If required, these motors are capable of working up to 300 horse power. The driving current is conveyed overhead at a tension of 500 volts. The pivots of the toothed wheels are of aluminum bronze, the teeth being of cast steel. Three methods of braking are provided for; an electric brake arranged to work on the driving shaft, a hand brake, and a third brake which grips the rails by means of cheek pieces. The locomotive was constructed by Messrs. Brown, Boveri & Co.—English Electrical Review.

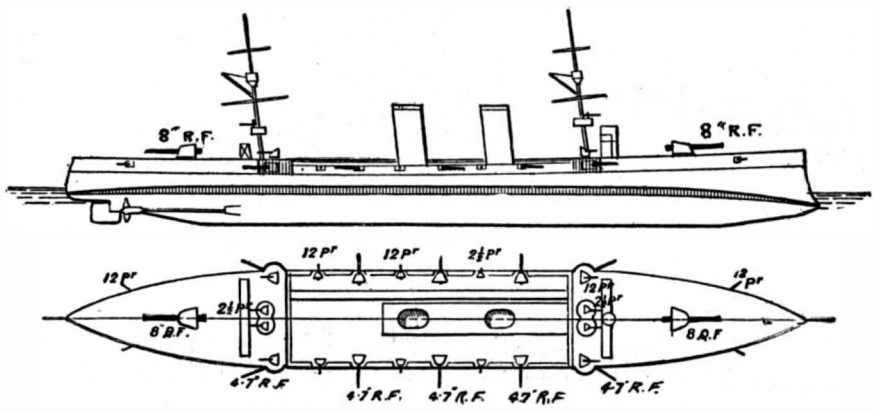
Mrs. Ayrton, the wife of the electrician, recently created quite a sensation by reading a paper on the hissing of the electric arc. The paper was an important one and has been highly commended by electricians. She appears to have demonstrated, according to The Electrical World, that an arc hisses as soon as its cup overflows, that is, as soon as the crater in the positive carbon breaks its walls and the arc commences to ascend the side of the positive carbon. So long as the crater is kept within the sides of the carbon, or at the end of the positive carbon, the arc is silent, but the moment the crater expands so as to leave the end and cut into the side wall, the hissing promptly commences. The cause of this remarkable disturbance appears to be a rhythmical disturbance due to combustion. In the hissing arc air is able to gain more or less complete access to the highly heated surface of the crater and this is accompanied by a direct combustion of the carbon at the crater's surface, with semi-rhythmical rapid alternate heating and cooling. The paper is worthy of study, as showing how a subtle and apparently complex phenomenon may be explained and elucidated by systematic research.

In Manila the central station plant is near the center of the city. The Pasig River, which runs through the city, divides the old from the new town, and the current is carried across the river by three bridges on steel poles, the lines being tapped to supply lights to each bridge. There are 450 steel and 1,400 wooden poles, and the lines are carried in oil-filled porcelain insulators. The Manila Electric Light Company has a contract to light the streets for 20 years, 16 of which are still to run. General Otis has taken over the responsibilities of the contract, says Industries and Iron, of London, and is paying the electric-lighting bills for the streets. The original contract provided for 140 2,000 candle power arc lamps and 1,000 20 candle power series incandescent lamps at $60,250 a year. The arcs are 50-volt lamps, 20 in series, on a 1,000-volt circuit. The number of street lights has greatly increased. On wide streets the steel poles are in the middle, and it is provided that the lights should be switched in 20 minutes after sunset and off 20 minutes before sunrise. There are about 6,000 incandescent 16 candle power lamps, running on 100-volt alternating current circuits. The charge is $1.50 (Mexican) a month for a 16 candle power lamp, burning half the night, and $2 for an all-night lamp. The central station is equipped with six compound condensing engines of 300 horse power each, 10 alternating current generators of 2,00 volts, of 60 kilowatts capacity each, and four 65-light 2,000 candle power arc dynamos, running at 3,250 volts each. The capacity of the station is 12,000 incandescent lamps and 260 arc lamps.

NAVIES OF THE WORLD.

VII. JAPAN.

At such a time as the present, when Japan is taking the momentous steps which will constitute her one of the great family of nations, it would be unpardonable, in a series of articles on the navies of the world, to omit from the list the Japanese navy—the youngest and, in proportion to its numbers, perhaps, one of the most formidable of them all. Starting under the impulse of the famous victory of the Yalu, and carefully observing its tactical and technical lessons, this young giant of the Pacific has built up in less than half a decade a navy which is to be reckoned as of the first class in every point but that of numbers. As will be seen from the table herewith, the navy contains five first-class battleships with an average displacement of close to 14,000 tons and an average speed of over 18½ knots. Every one of these vessels has been launched since 1896, carries the latest high power guns, and is protected with either Harveyized or Krupp steel. To these must be added the "Chin-Yen," a second-class battleship, a little larger than our "Texas," which has been thoroughly overhauled by the Japanese since she was captured in the Chinese war. Next in importance are the five powerful armored cruisers which are completed and building in British and French yards. They are larger than our "Brooklyn," more powerfully armed, and of about the same speed. Next in the order of importance are eight protected cruisers of about 4,400 tons displacement and an average speed of 21 knots. Four of these have been built in American and British yards and have shown speeds of from 23 to 24 knots, being, indeed, the fastest ships of their class in the world. The balance of the navy, with the exception of some modern gunboats and smaller cruisers, antedates the China-Japan war of 1894–95, but is of fairly modern construction.



Protected Cruiser "Takasago." Class of Four Ships.

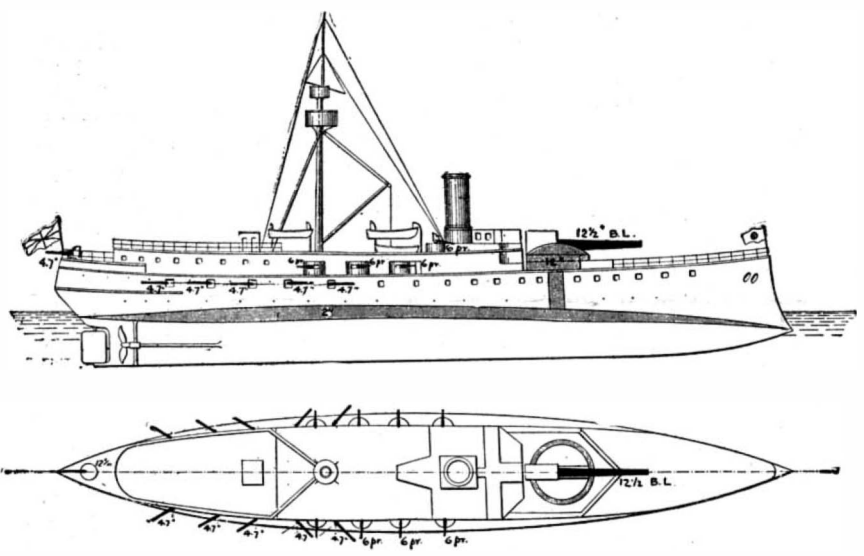
The "Takasago" and mate: **Displacement,** 4,300 tons. **Speed,** 24 knots.
The "Chitose" and "Kasagi": **Displacement,** 4,760 tons. **Speed,** 23·7 and 22·5 knots.

The two most important lessons learned by the Japanese in the war with China were the immense value of the rapid-fire gun and the great powers of resistance of the modern battleship. The Japanese fleet at the Yalu did not include a single battleship, all of the vessels being of the cruiser type; but the armament of the fleet was chiefly made up of modern rapid-fire weapons, and while the unprotected nature of the vessels rendered it unwise to risk an action at close quarters with the two battleships which constituted the chief fighting element of the Chinese fleet, the rapid-fire guns at a range of several thousand yards cut through the unarmored portions of the enemy's ships and won a practical victory. On the other hand, although the Chinese battleships "Ting Yuen" and "Chen Yuen" were terribly cut to pieces in their unarmored portions and the crews decimated, the belt and the barbette armor around the main gun positions was practically intact. Moreover, shells from the 12-inch guns of these ships had wrought terrible havoc on the Japanese unarmored vessels, Admiral Ito's flagship being put out of action, with the loss of 90 officers and men killed and wounded, by a single 12-inch shell that came aboard between decks.

Among the first orders placed after the war was one for two first-class battleships, the "Yashima" and "Fuji." The former was built at Elswick, the latter on the Thames, and both have been turned over to the government. In size these two ships are about 2,000 tons smaller than the "Royal Sovereign" class of the British navy; but they are a knot and a half faster and carry a larger coal supply. The Harveyized armor moreover is superior to the compound armor of the "Royal Sovereign," and the Armstrong guns, though lighter, are of a later pattern and of greater power. The waterline belt is 18 inches in thickness and the upper belt 4 inches. The barbettes of 14-inch armor carry each two 12-inch B. L. rifles, and the rapid-fire battery amidships consists of ten 6-inch rapid-fire guns disposed four in casemates of 6-inch steel on the gun deck and six behind 6-inch shields on the main deck. Twenty-four 3-pounders and 2½-pounders are distributed on the gun deck, main deck, and in the tops. These ships are to-day among the fastest battleships afloat, the "Fuji" having made 18·5 knots and the "Yashima" 19·2 knots on her trial, rivaling the fast battleships of the Italian navy.

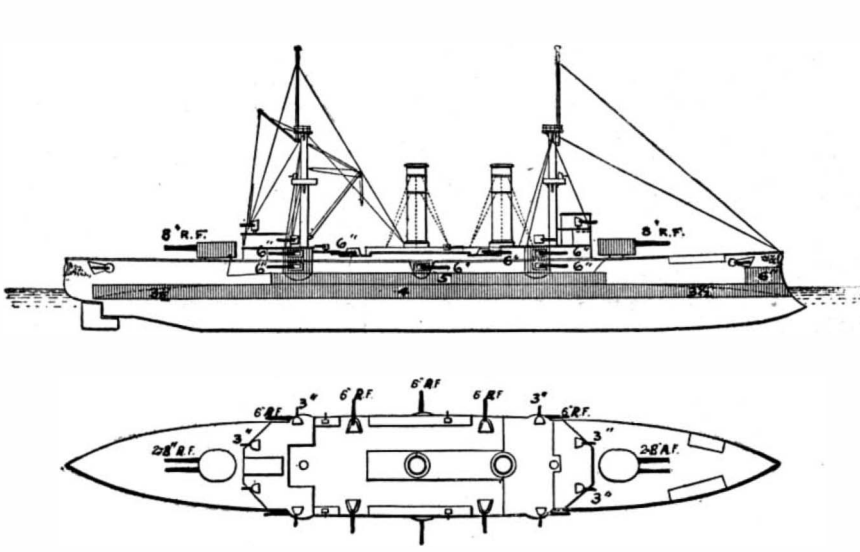
The "Fuji" and "Yashima" were followed by the "Shikishima," now building at the Thames Iron Works, and her mate (not yet named), which is under construction at Elswick (Armstrongs). They are improved "Fujis," the weaker points in the earlier vessels being strengthened in accordance with general drift of battleship construction. Thus the belt is made continuous from bow to stern; the deck is increased in thickness from 2½ to from 3 to 5 inches; the armament is increased by raising the strength of the rapid-fire battery from ten to fourteen 6-inch rapid-fire guns, and substituting twenty 12-pounders for the twenty 3-pounders on the "Fuji." The six 6-inch guns on the main deck are also placed in 6-inch casemates. The normal coal supply is to be 700 tons, the complement 741, and the displacement 14,850 tons.

The latest battleship to be laid down is an improvement over the "Shikishima," and is very similar to the "Formidable" class now building for the British navy. With a displacement of 15,200 tons the "Asahi" is the largest warship in the world. Her armor is more complete than that of the "Shikishima," the 9-inch main belt extending from end to end at the waterline and up to the berth deck amidships. Two of the fourteen 6-inch guns that are on the main deck on the "Shikishima" are placed on the gun deck in the "Asahi," which thus has a battery of ten 6-inch long-caliber rifles protected by 6 inches of Harvey steel. The four 6-inch guns on the main deck are placed in 6-inch casemates. The speed with 15,000 horse power will be about 19 knots. The battleship "Chin Yen" is the former Chinese "Chen Yuen," which acquitted itself so creditably in the battle of the Yalu. She was built at Stettin, Germany, in 1882. The following are her chief



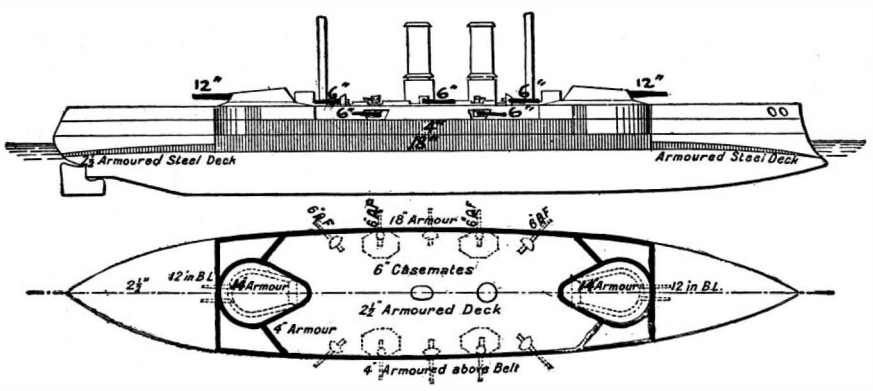
Protected Cruisers "Itsukushima" and "Hashidate." Also with modifications, "Matsushima."

Displacement, 4,277 tons. **Speed,** 17·5 knots.



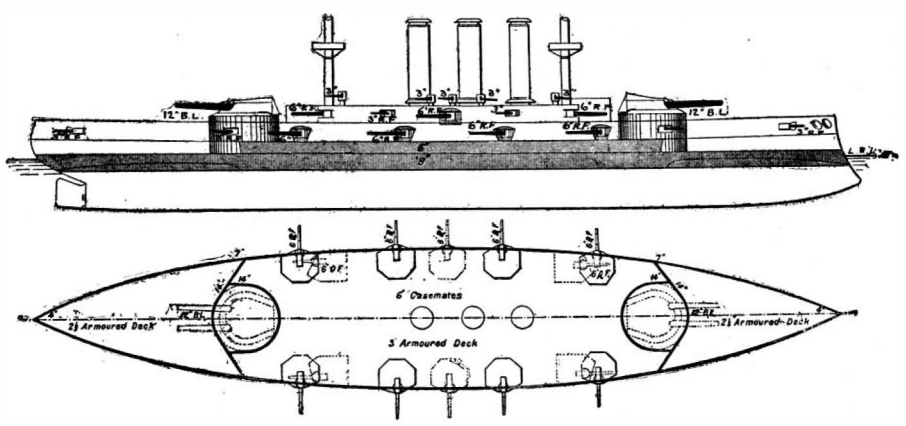
Armored Cruiser "Asama." Class of Three Ships.

Displacement, 9,750 tons. **Speed,** 22 knots. Also two ships of about same displacement and less speed and lighter armament.



First-class Battleships "Fuji" and "Yashima."

Displacement, 13,320 tons. **Speed,** 18·2 and 19·2 knots.

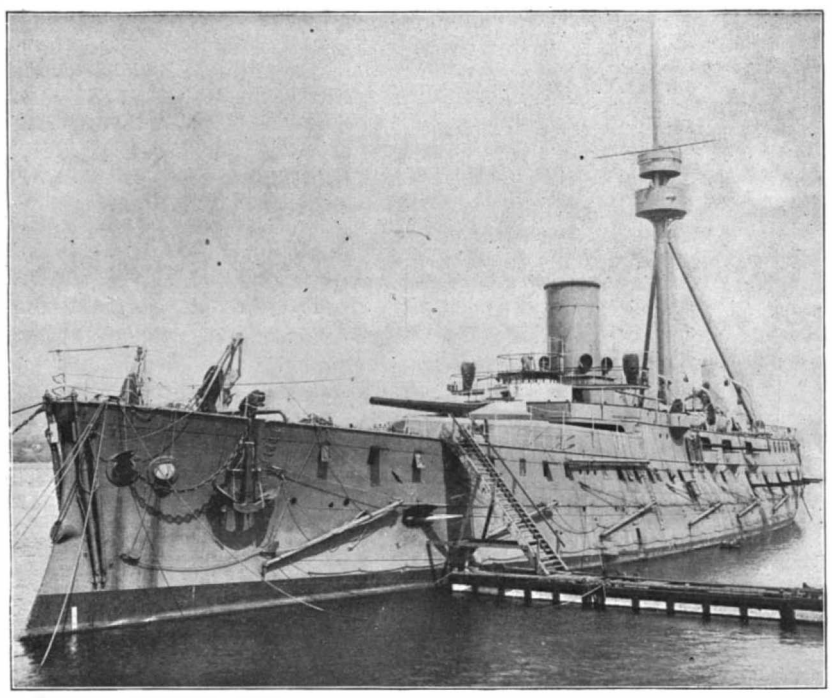


First-class Battleships "Shikishima" and mate. Also, with modifications, the "Asahi."

Displacement, 14,850 tons. **Speed,** 18·5 tons. **Armor:** Main belt, 9 inches; upper belt, 6 inches; deck, 3 to 5 inches: gun positions, 14 and 6 inches. **Armament,** four 12-inch, fourteen 6-inch rapid-fire, twenty 3-inch, eight 3-pounders, four 2½-pounders. **Torpedo Tubes,** 5. **Date,** 1899.

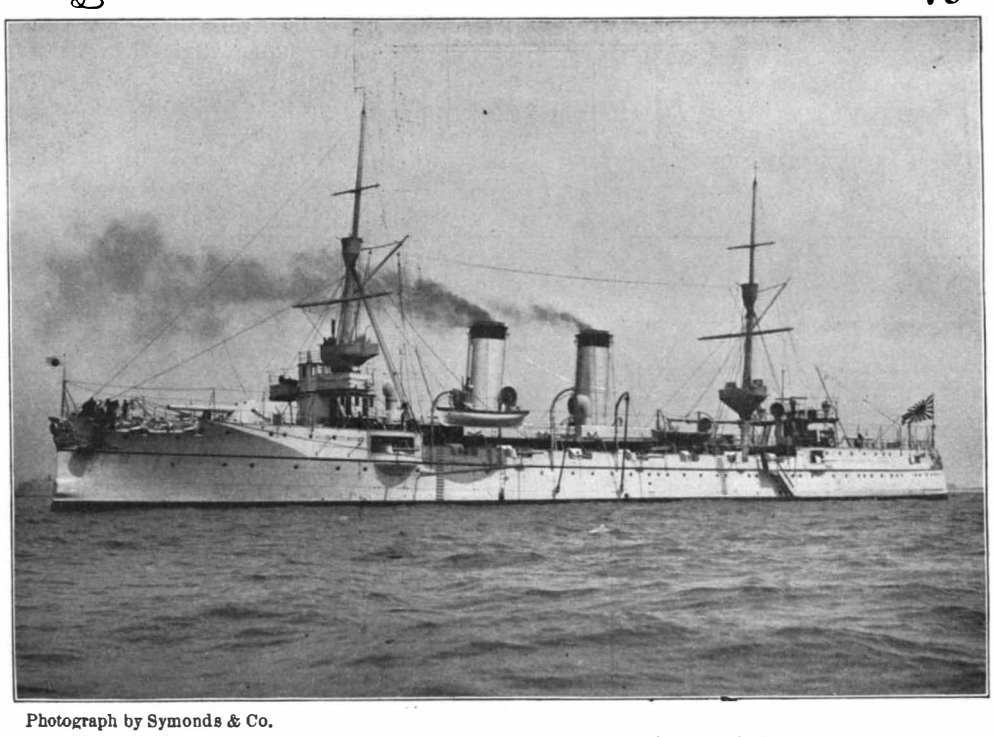
NAVIES OF THE WORLD—VII. JAPAN.

The three armored cruisers building at the Armstrongs are sister ships. The "Asama," of which we present an illustration, is completed and the "Tokiha" and an unnamed vessel are under construction. The "Asama" is an extremely powerful ship, either for offense or defense. Her armor protection weighs altogether over 2,000 tons. It comprises a continuous belt 7 inches thick amidships, sloping to 3½ inches at the ends. An upper belt 5 inches thick reaches to the gun deck and on this deck are six 6-inch rapid-fire guns in 6-inch casemates. On the main deck are eight more 6-inch rapid-fire guns, four in 6-inch casemates, and four behind shields. Forward on the same deck is an



Photograph by Symonds & Co.

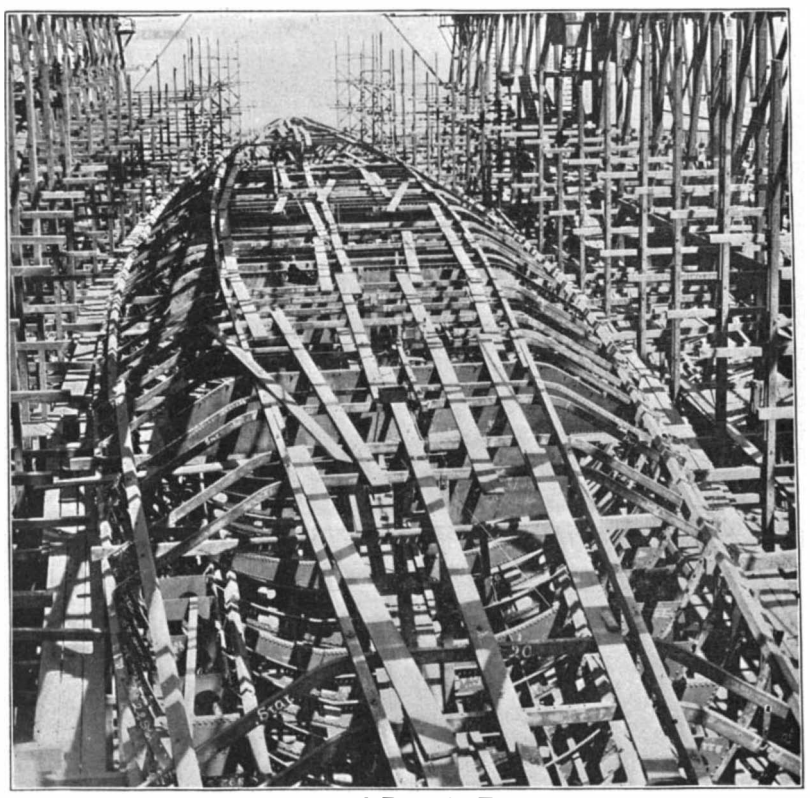
3.—Protected Cruiser "Itsukushima." Also "Hashidate."
Displacement, 4,277 tons. **Speed,** 17 knots. **Normal Coal Supply,** 400 tons. **Armor:** Deck, 2 inches; main gun position, 12 inches. **Armament,** one 12·5-inch B. L. rifle, eleven 4·7-inch rapid-fire guns, five 6-pounders, eleven 3-pounders, six machine guns. **Torpedo Tubes,** 4. **Complement,** 350. **Date,** 1801



Photograph by Symonds & Co.

4.—Protected Cruiser "Takasajo." Class of Four Ships.
Displacement, 4,300 tons. **Speed,** 24 knots. **Maximum Coal Supply,** 1,000 tons. **Armor:** Deck, 4½ inches; shields, 4½ inches. **Armament,** two 8-inch rapid-firers, ten 4·7-inch rapid-firers, sixteen 3-pounders. **Torpedo Tubes,** 5. **Complement,** 400. **Date,** 1898.

5.—Armored Deck Plated in; Side Framing Carried to Main Deck.



6.—Armored Deck in Frame.

CONSTRUCTION OF THE PROTECTED CRUISER "CHITOSE" AT UNION IRON WORKS, SAN FRANCISCO.

NOTE.—The "Chitose" and "Kasagi," the latter built at the Cramps' yard, differ from the "Takasajo" as follows: **Displacement,** 4,760 tons. **Speed,** "Chitose," 23·7; "Kasagi," 22·5; and they carry 12-pounders in place of 3-pounders.

From Photograph by Symonds & Company, Portsmouth, England.

7.—First-class Battleship "Fuji." Also "Yashima."
Displacement, 13,320 tons. **Speed,** 18·2 knots. **Normal Coal Supply,** 1,100 tons. **Armor:** Main belt, 18 inches; upper belt, 6 inches; main gun positions, 14 inches; secondary battery, 6 inches; deck, 2½ inches. **Armament,** four 12-inch B. L. rifles, ten 6-inch rapid-firers, twenty 3-pounders, four 2½-pounders. **Torpedo Tubes,** 5 (4 submerged). **Complement,** 600. **Date,** 1896.

NAVIES OF THE WORLD—VII. JAPAN.

JAPANESE NAVY.

DESCRIPTION OF TYPE.	Number of Ships.	Average Displacement.	Total Displacement.	Average Speed.
Battleships, 10 years or less.	5	13,908	69,540	18·7
Battleships, 10 to 20 years.	1	....	7,400	14·0
Totals.....	6	....	76,940	...
Coast Defense Vessels.	2	2,859	5,718	12·1
Armored Cruisers, over 9,000 tons.	5	9,707	48,536	21 1
Armored Cruisers, Below 5,000 tons.	3	2,283	6,850	15 0
Totals.....	8	....	55,386	....
Protected Cruisers over 4,000 tons.	8	4,391	35,131	21·0
Protected Cruisers 2,000 to 4,000 tons	7	3,021	21,150	18·6
Totals.....	15	....	56,281	...
Small Cruisers and Gunboats.	15	1,169	17,53	16·0
Grand totals.....	46	..	211,857	....

8-inch steel turret carying a pair of 8-inch rapid-firers, and another similar turret is mounted aft. A peculiar feature on these vessels is that 6 inches of steel plating protects the bow torpedo discharge, the plating extending 25 feet back from the bow. This plating is shown by a darker shade in the engraving of this vessel. The other four torpedo-discharges are below the water line. The maximum coal supply is 1,450 tons. The trial speed under natural draught was 20·4 knots, and under forced draught 22·07 knots. The concentration of fire is two 8-inch and four 6-inch forward or aft, and four 8-inch and seven 6-inch on either broadside. With their good protection, powerful batteries and high speed these vessels are comparable to anything in this class at present afloat. The two other armored cruisers of this class are the "Azuma," 9,436 tons, building at Rochefort, and the "Yakumo," of 9,850 tons and 20 knots, building at Stettin. The armament in each vessel is smaller by two 6-inch guns, otherwise they are similar to the "Asama." The other armored cruisers are the "Chiyoda," of 2,450 tons and 17·5 knots, carrying ten 4·7-inch rapid-fire guns, built in 1889, and two ships built 20 years ago, the "Hi-yei" and "Kon-go," of 2,200 tons, now used as training ships. Each carries three 6·6-inch and six 5·9-inch Krupp guns.

Among the protected cruisers the most interesting vessels historically are the sister ships "Matsushima," "Hashidate," and "Itsukushima," all of which were prominent at the Yalu. They are similar in all respects but two, the first-named carrying her 12·5-inch gun in a barbette aft of the secondary rapid-fire battery and the other two carrying it forward, as shown in the respective engravings of the ships. No vessels possessing the peculiarities of these vessels exist in any other navy, for although they carry no side armor and only a light protective deck, they mount a gun which is even to-day one of the most powerful in the world. It is protected by a barbette of 12-inch armor, and an armored tube leads from the barbette to the magazine below the protective deck. The combination is not a happy one, for the unprotected condition of these vessels would prevent them from engaging the heavily armored ships against which their 12·5-inch guns should properly be directed. As it was, the few 12-inch shells from the Chinese battleships that did land, wrought fearful execution, a single shell that entered the "Matsushima" dismounting two of the guns in the 4·7-inch rapid-fire battery, and killing nearly one hundred officers and men. The rapid-fire battery on the "Matsushima" consists of twelve 4·7-inch rapid-fire guns and on the sister ship of eleven of this caliber. The displacement of these vessels is 4,277 tons and the speed 17·0 knots to 17·5 knots.

The four sister ships of the "Chitose" and "Kasagi" protected cruiser class have especial interest for Americans from the fact that these two vessels were built in American yards, the former by the Union Iron Works, of San Francisco, and the latter by the Cramps, of Philadelphia. The two other ships of this class, the "Takasago" and another, as yet unnamed, are completing at the Armstrongs. The "Chitose" and "Kasagi," launched in 1897 and 1898, are of 4,760 tons displacement and 22·5 knots contract speed. This latter was exceeded in the case of the "Chitose," which made 23·7 knots on her trial trip. The protective deck, 1¾ inches on flats and 4½ inches on slopes, is the sole armor protection to the hull. Two of our views show the protective deck of the "Chitose" in process of construction. The armament in each ship consists of two 8-inch Armstrong rapid-fire guns, mounted one forward on the forecastle deck and one aft on the poop behind shields; ten 4·7-inch rapid-fire guns in broadside on the main deck, and twelve 12 pounders, with two 6-pounders and two 2½-pounders. There are 5 torpedo tubes.

The Armstrong built ships are somewhat smaller (4,300 tons), and their contract speed is 24 knots, or 1½ knots greater. They carry the same armament except that 3-pounders take the place of the 12-pounders. In speed these ships compare favorably with our "Columbia" and "Minneapolis," while their battery is greatly superior. They would prove dangerous vessels in the work of commerce destroying.

The other seven protected cruisers have an average displacement of 3,021 tons, and an average speed of 18·6 knots. They carry modern rapid-fire batteries, and are serviceable, up-to-date ships; but there is nothing in their design that calls for special mention. The small cruisers and gunboats, of which there are fifteen, have an average displacement of 1,169 tons. With a few exceptions, they are modern vessels and quite up to the standard of vessels of other navies in the same class.

The fate of the Spanish fleets in the late war has taught us that fine ships may be rendered ineffective by neglect, inefficiency, and disregard of the principles of strategy and tactics. Japan has a truly magnificent navy, second to none in fighting and sea-keeping qualities. Has she a naval administration, a trained personnel, and the requisite courage and staying power among her crew to match it? We think she has abundantly proved that she has, and there is every reason to believe that the tactical skill and steady courage and discipline which won the first pitched battle to occur between modern navies will prove to be abiding characteristics of the Japanese navy.

An Important Air Brake Decision.

An opinion, written by Judge Shipman, was handed down by the United States Circuit Court of Appeals July 18, affirming the decision of the Circuit Court, Judge Wallace, in favor of the New York Air Brake Company. For the past two years there has been litigation between the Westinghouse Air Brake Company and the New York Air Brake Company over an alleged infringement of patents by the latter corporation.

The Westinghouse Company contended that the device owned by the New York Air Brake Company infringed claims 1, 3, 4, 5, and 6 of patent 538,001, which was granted in 1895; and also claims 3 and 5 of patent 382,023, granted in May, 1888.

The decision, written by Justice Shipman, is in part as follows:

The Westinghouse patent of 1895 was an improvement upon the quick-action air brakes described in letters patent 360,070 and 376,837, which were issued to Mr. Westinghouse, and which have frequently been the subject of litigation in the Federal courts. The device of 376,837 has gone into universal use and has been the standard quick-action air brake upon long freight trains in this country. Westinghouse, in his attempt to create immediate service upon each car of a long train, enlarged the venting system so that when reduction of train pipe pressure had commenced by the turn of the engineer's valve, the triple valve under each car should also vent the train pipe of that car. Each car contained its own venting mechanism. Westinghouse also saved power by compelling the compressed air thus vented to pass into the brake cylinder instead of into the open air.

In 1892 Mr. Westinghouse made a new invention, by means of which he vented the train pipe air into the brake cylinder by the use of a compound piston connected to the brake cylinder piston. A valve in a passageway leading directly from the train pipe to the brake cylinder controlled the discharge of air from the train pipe. The application for a patent on this later invention was filed in March, 1892. Changes were made in the claims and the application lay in the office for about three years, but there was no suggestion that the invention had a broader scope than a new method of venting the air of the brake cylinder until after March 6, 1895, when the defendant's counsel sent to the complainant's counsel for their examination a statement and description of the new air brake machinery which the defendant proposed to adopt and by which the train pipe was vented into the atmosphere. Thereupon, as it was deemed that the atmospheric pressure venting employed the compound piston method of venting into the brake cylinder which was contained in the pending application of March, 1892, six new claims were caused to be added to the application, which, by the use of general language, enlarged the claims so as to make them apply to the device when used in air brakes. This amendment was allowed, and the patent was issued accordingly. Claims 1 and 6 are the amended and claims 7 and 13 are the restricted claims.

The contention on the part of the complainant is that the invention was actually of a broad and primary character, and was "a train-pipe vent-valve directly operated by a piston, which is the secondary part of a compound piston so organized that the opening of the vent-valve is dependent upon the manner or rate of movement of the primary part of such compound piston." The defendant is of the opinion that the mode by which the train pipe is vented to the brake cylinder constituted the scope of the invention.

It is manifest that the inventor meant to confine himself to the investigations which resulted in the application of 1892 to the system which he had previously perfected. It seems clear that the invention was merely an alteration in a pre-existing perfected system, and was not of a primary character. We are, therefore, of the opinion that the claims inserted by amendment in 1896 must be limited to a piston attached to or moved by the brake cylinder piston for venting the train pipe into the brake cylinder.

The defendant caused its new device, known as valve *C*, to be invented for the purpose of escaping from the Westinghouse system of venting exclusively into the brake cylinders. It vents into the atmosphere, and uses for that purpose a compound piston, which is a part of the triple valve piston, the action of which is not dependent upon the brake cylinder piston. It follows from the construction which we have given to the patent of 1896 that the defendant's device known as valve *C* is not an infringement.

Some Curiosities of Our Calendar.

"As we are at the beginning of a year," says La Science pour Tous, "there is still time to recall certain curiosities of the Gregorian calendar. Thus, since the reform of the calendar by Pope Gregory XIII. in 1582, no century can begin with a Wednesday, a Friday, or a Sunday. Also the same calendar can be used every twenty years. January and October of the same year always begin with the same day. So do April and July, also September and December. February, March, and November also begin with the same day. New Year's Day and St. Sylvester's Day also fall on the same day, except of course in leap-years. Each day of the week has served as a day of rest somewhere; Sunday among Christians, Monday with the Greeks, Tuesday with the Persians, Wednesday with the Assyrians, Thursday with the Egyptians, Friday with the Turks, and Saturday with the Jews. Finally, the error of the Gregorian calendar, compared with the actual course of the sun, does not exceed one day in four thousand years. As it is quite probable that neither you nor I shall ever verify this, we shall not risk very much by believing the statement."

Origin and Significance of Spines.

Charles E. Brookes has endeavored to arrive at general conclusions relating to the origin and significance of spinosity from the study of plants and animals. He considers that spines, whether prickles, thorns, or horns, represent a stage of evolution, a degree of differentiation in the organism, a ratio of its adaptability to the environment, a result of selective forces, and a measure of vital power. The spines of plants are referable to two main categories. The first is the restraint of the environment causing the suppression of structures; thus, in desert or arid regions leaves and branches may be suppressed to form spines. The other category is intrinsic suppression of structures and functions; this includes those prickles of brambles and climbing plants that are not produced by suppression of stipules, leaves, etc. Spinosity is a limit to variation, since organs of various kinds are changed into spines, but spines are never changed into other organs.—American Journal of Science, through Botanical Gazette, 27, 147.

Poisoning from Artichokes.

M. Roger has reported to the Société de Biologie a small epidemic of gastro-enteritis which occurred in his practice recently, which he was able to trace directly to the ingestion, by those attacked, of preserved or canned artichokes. Examining the contents of one of the boxes, the vegetable was found to be of a handsome, almost natural green color, which at first gave him the idea that he had to deal with the effects of a copper salt. Chemical analysis, however, revealed not a trace of that metal. He then submitted the material to an examination by bacteriological methods, and was able to isolate a coli-bacillus and a micrococcus. The latter, on pure cultivation, was found to have the property, when cultivated on slices of artichoke, of communicating to the latter an intense green color. The micrococcus is pathogenic to the rabbit.

Japanese Railway Bridges.

The last of the eighteen steel bridges built for the Chinese Railway, by the Phœnixville Bridge Works, have been completed and accepted. These bridges were built within ten weeks after the work was begun, and all but three are on their way to Vladivostock, their destination. A St. Petersburg engineer, who has superintended their construction, states that he does not believe there is a concern in Europe where the work could have been done so quickly.

THE Hamburg-American line is continuing its experiment with carrier pigeons for the purpose of conveying news from the vessels at sea either to New York or Hamburg. The "Augusta Victoria" recently set several pigeons free during a voyage to New York; one of these homed from midocean, 1,500 miles to Hamburg, inside of two days.

The Volta Centenary.

Information regarding the electrical exhibition at Como and the Volta Centenary is of rather mournful interest after the recent fire which destroyed the entire exhibition. The site chosen for the buildings was picturesque in the extreme, being located near the southeastern corner of the beautiful lake, says a correspondent of the English Electrical Review, and was easy of access by rail or water. The exhibition building proper consisted of a crescent-shaped galley with façade, the extremities of the towers being constructed in imitation of the well known Voltaic pile. From the back of this construction opened three extensive galleries, the center one terminating in a circular building. Running parallel with the face of the building, and intersecting the center of the circular gallery, were other galleries devoted to electrical exhibits. A very large part of the exhibit consisted of ingenious electrical domestic appliances. Our English contemporary says, "We were surprised to find that in nearly every instance an inspection proved these appliances to be of American manufacture." This paper is of the opinion that as an electrical exhibition it was of little or no importance. At the southern end of the galleries was the exhibit of relics of Volta and Galvani, which we have already illustrated and which were unfortunately nearly all destroyed by the fire.

A TRANSCONTINENTAL AUTOMOBILE VEHICLE.

Our engraving represents Mr. and Mrs. J. D. Davis starting on what will probably be the longest automobile trip on record, the goal being San Francisco. In this country we have not as yet had any very long runs, Cleveland to New York (708 miles) being, we believe, the longest on record. There is no more delightful way of seeing the country than to view it from the comfortably cushioned seats of an automobile vehicle, which is never tired, and knows neither hunger nor thirst. After the industry becomes better established, we would not be at all surprised if automobile trips from New York to Boston or New York to Lake George were of almost daily occurrence during the season when the roads are in good condition.

With a strongly constructed touring car made especially for the purpose there would be no difficulty in making sixty to seventy miles a day over ordinary roads and probably few travelers would care about doing more than forty miles a day. At present carriages using some of the products of petroleum as fuel are the best adapted for touring purposes, but undoubtedly, in time, along all important roads there will be charging stations, so that the electric vehicles will be on the same plane as those driven with the aid of gasoline or benzine.

We understand from press accounts that Mr. and Mrs. Davis are making satisfactory progress in their trip, notwithstanding a few mishaps which are apt to occur in running a vehicle of this kind. The start was made at about eleven o'clock on Thursday morning, July 13, from the front of the New York Herald building, Thirty-fifth Street and Broadway, New York. Crowds witnessed the start and cheered the venturesome tourists as they began their long journey. Owners and manufacturers of motor carriages united in giving Mr. and Mrs. Davis an escort up Fifth Avenue as far as the Harlem River. The horseshoe which is suspended in front of the carriage seems to indicate that the riders have not enmity toward horses, and it is hoped the omen of good luck will prevent horses from being frightened along the country roads of the 3,700-mile journey. The touring car used by Mr. Davis is of the well-known Duryea type which we have illustrated and described on a number of other occasions.

The route of the Davis party is up the valley of the Hudson River to Albany, then along the banks of the Mohawk, passing through Utica, Syracuse and Rochester to Buffalo, then skirting the shore of Lake Erie to Toledo, and then finally to Chicago. We believe that the route beyond this point has not been definitely decided as yet.

MANY people are apt to consider that corporations are grasping and soulless. Of course, no one will deny that this is sometimes the case, but the Montreal Street Railway Company is certainly generous. It has set apart $25,000 a year for the benefit of its employes. They will be insured in an accident insurance company of good standing, and the premium will be paid by the Street Railway Company. This insurance will amount to $1,000 in the event of an accident by any cause, one-half this amount for total disablement, and $5 per week for time lost for injuries specified in the policy. Motormen and conductors who have been in the service of the company for two years will receive an increase of pay, and motormen and conductors who have been regularly in the company's service for five years and over will receive their uniforms free of cost.

AN ITALIAN PRINCE BOUND FOR THE NORTH POLE.

Prince Luigi of Savoy, Duke of Abruzzi and nephew of King Humbert, is about to attempt, as others have attempted before him, the pacific conquest of the North Pole.

The prince is the third son of the late Amadeo, ex-King of Spain. He is a captain in the navy, has twice made the tour of the world, and will be remembered

PRINCE LUIGI OF SAVOY.

for his bold ascent of Mount Saint Elias, in Alaska. He is twenty-six years of age and does not, at first sight, appear to be blessed with the strongest of constitutions; but energy and decision are read in his juvenile countenance.

The principal companions of the duke in his expedition will be his aide de camp, Capt. Umberto Cagni, an officer who is as intelligent as he is courageous, and who accompanied him to Alaska; Dr. Cavalli, of the royal navy; and Lieut. Count Quarini, a linguist, belonging to an old Venetian family. Count Quarini, during the Cretan insurrection, distinguished himself by his bravery and coolness, and received the silver medal awarded for military valor.

The Duke personally directed all the preparations for the expedition with scrupulous care.

He took on board of his ship, the "Stella Polare," two tried Italian sailors, four mountain guides, ten Norwegian sailors who have had experience in the Northern seas, and an Esquimo who knows how to drive dogs harnessed to sledges. At Archangel more than a hundred dogs will be embarked. The duke's equipment will include fifteen hundred oak cases containing clothing, food, scientific material, two balloons constructed at Paris, and apparatus for the manufacture of hydrogen.

The "Stella Polare," which was fitted out at Christiania, weighed anchor Monday, June 12. After touching at Franz Josef's Land, the duke intends to proceed by easy stages, marking his route by stations that will show his progress and assure his retreat in case of necessity. The duration of his exploration will be about three years.

For the above particulars and the engraving, we are indebted to L'Illustration.

THE START FOR THE 3,700-MILE TRIP ACROSS THE CONTINENT.

The Coloring Matter of Blue Coral.

Prof. Liversidge has made a series of experiments on the blue pigment of Heliopora cœrulea on material obtained by the Funafuti Expedition. His results are interesting, although they do not, unfortunately, throw much light upon the nature or relations of this very curious pigment. He finds that "dead" coral after treatment with hydrochloric acid yields a black pigment which dissolves in formic, acetic, and lactic acids to form a bright blue solution. The pigment is slightly soluble in absolute alcohol, but quite insoluble in ether. The residue after ignition is bulky, and contains much phosphoric acid, iron, lime, and magnesia. Curiously enough Prof. Liversidge found that pieces of "live" coral, or coral which had been gathered while growing, although of a distinct slaty blue color, did not yield blue solutions, but merely pale green ones. The pigment itself was also of a pale chlorophyl green tint. The paper concludes with a list of other blue or green coloring matters in animals. In connection with these we would draw the author's attention to the asserted occurrence of the mineral vivianite in the skeleton of Belone and some other forms.—Natural Science.

The Wyoming Exploring Party.

The expedition to the fossil fields of Wyoming left Omaha on July 18. It numbered three hundred scientific gentlemen representing nearly every university and college in the United States. The Union Pacific Railroad Company pays all the expenses of the trip, and it is hoped that the expedition will result in developing the possibilities of this great region which is so rich in fossils of the Dinosaur period. After reaching Laramie the party will go directly into the fossil fields. They will be organized into messes of ten men, each group being provided with two wagons for riding and another wagon for carrying tents, provisions and other supplies. A dark room and complete photographic outfit will be provided. Prof. Wilbur C. Knight, of the University of Wyoming, will have charge of the party. It will take one course to the Grand Cañon of the Platte and will return by another course, giving an opportunity for viewing some of the finest scenery in the West and also giving a chance to collect great quantities of vertebrate fossils.

Antique Safety Pins.

The Metropolitan Museum of Art has some interesting examples of antique safety pins, although they were not called by that name. The antique fibula is really a safety pin, and is constructed on the same principle, consisting of a pin with a coiled spring to keep the point pressed against the sheath to insure a safe fastening and to prevent injury from being stabbed by the point. The manner of using the pin may be seen by reference to many antique statues, notably the Apollo Belvidere. These bronze fibulæ vary from two to seven inches in length. Some have a guard to protect the point of the pin; others simply have a catch of bent wire. The backs of the fibulæ are of all shapes. In some cases the wire is twisted into odd forms, but usually the back is broadened out so as to admit of ornamentation. Some of the large ones have their backs hollowed, making a mere shell of bronze, on the outer surface of which are cut wavy lines and zigzag decorations. The group of buckles are also very interesting and resemble the ones in use to-day. Several of them were illustrated in a recent number of The New York Sun. In beauty of design the ancient buckles were more than the equal of anything of the kind which is being made at the present time.

The Hyacinth Pest in Florida.

The hyacinth pest in Florida is of alarming proportions, especially on the St. John's River, and its tributaries. For several years residents have strenuously battled against the plague of the hyacinth plant which has invaded their waterways, hindering not only commerce, but various industries and inflicting severe pecuniary loss on many. At last the plague has reached so serious a stage that the War Department investigated the matter and bills were introduced into Congress with a view of remedying the difficulty. The Windsor Magazine recently had an interesting article on the subject entitled, "A River Choked with Hyacinths," written by Walter Akroydd, from which we obtain our information. The particular species of hyacinth which chokes the St. John's River thrives only in water or in places where the soil is very marshy. As a rule it simply floats upon the surface of the water without any attachment whatever of its roots to the soil, and under these conditions it flourishes more luxuriantly. The flower is not of the pretty bell-shape which characterizes the bloom of the flower which we ordinarily know by the name of hyacinth, nor is the range of color so varied. The flowers are invariably of either a light blue or violet. In the springtime the vast expanse of flowers upon the surface of the water presents a very striking picture; the leaves grow to considerable size, a bunch of stems frequently averaging from one to two feet in height. The roots also grow, in many cases, to a length of three feet, and in exceptional cases, even longer.

A pond at Edgewater, four miles above the town of Palatka, was first infested with the hyacinth plant. In 1890 the sheet of water was cleaned out and the plants were thrown in the river. They immediately grew luxuriantly and travelers and tourists were much struck by the pretty sight, and being ignorant of their multiplying propensities, they carried away specimens to grow in the rivers near their homes. In four years the fishermen began to be alarmed at the hyacinth which entangled their nets, steamers also found that their progress was retarded by huge clumps of the hyacinth. The evil has grown until at the present time the hyacinth invest the St. John's River for a distance of over 200 miles, the banks on either side of the water being fringed with a border of plants from 25 to 200 feet in width. The stream is so sluggish that the hyacinth is able to hold its own and multiply rapidly. At places the entire river is covered with a dense mat of plants so that there is a vast expanse of flowers a mile wide during the period when it blooms. Small boats with screw propellers find it almost impossible to make any headway, as the plants become entangled in the screws. Side-wheel paddle steamers fare better, but the plants are apt to collect in the paddle box, making an impenetrable blanket, so that the steamers are entirely blocked and cannot move in either direction. Steamers with low-pressure engines have their injection pipes blocked by the plants. Pieces of wood and other débris are often concealed by plants. The timber industry has been brought almost to a standstill by the hyacinths, and the loss to fishermen is most severe. In addition the towns along the river are menaced by another evil which is even more serious. When heavy rainfalls or floods occur, small drifting islands of hyacinths are carried along by them until they strike a bridge; here they clog and form a dam. The pressure of water is very great, and if the barrier does not succumb, the surrounding country is flooded. In 1894, 65 feet of trestle work that spanned the river at Rice Creek was carried away. At another bridge men had to be specially employed to push the plants through the space under the piers.

Various schemes have been devised for exterminating the plants, but it is not believed that they can be permanently banished, although it is thought that they can be kept under control. The War Department recommends the construction of a light draft stern-wheel steamer, having a double bow or outrigger, which, on being forced into a mass of plants, will cause them to gather toward the middle of the boat, where the inclined carrier will pick them up and deposit them in front of rollers driven by machinery. These rollers in turn will force the water from them, thus greatly reducing their bulk. The crushed material would then be thrown into barges and would be taken where no damage could be done. The process would be very expensive and a steamer would have to be constantly employed. It is believed that the plant cannot be entirely extirpated. Other suggestions have been the use of booms, which will catch the plants traveling with the current and bring them to a standstill. They can then be taken out and destroyed. So far, however, none of the schemes have been carried into effect. This is a splendid example of the trouble which comes from destroying nature's balance and the whole difficulty could have been prevented if the weeds had not been thoughtlessly taken from the pond in which they were and thrown into the river.

One of the things with which our Department of Agriculture charges itself is the determination of questions of this kind. Any citizen can obtain expert information in matters of this kind by writing to the Department, and if their advice was more often sought and accepted vast sums would be saved. Now, however, when it is too late, the inhabitants have invoked the aid of the Division of Vegetable Physiology and Pathology of the Department of Agriculture, and Mr. Webber has been detailed to investigate the matter. After a prolonged and careful search, Mr. Webber has discovered a disease which he considers would do widespread damage among the hyacinth plants. This is a parasite fungus which attacks the leaves in spots and in time completely kills it. It is hoped that considerable quantities of this fungus may be obtained for introduction among the hyacinths. If it does not entirely kill off the plants it will, at any rate, keep their growth in check.

ON the Burlington and Missouri River Railroad, discarded locomotive flues are being utilized as fence posts. About half of the wooden fence posts are destroyed by fire, so that the new iron posts present great advantages. It is said that two workmen can turn out fifty posts per day. The total cost of the new posts is about 15 cents each, counting only labor and the value of the tubes for scrap iron.

The Current Supplement.

The current SUPPLEMENT, No. 1230, has many articles of sterling value. "Incandescent Mantles" is an article by Vivian B. Lewes and gives exactly the kind of information which our readers are always desirous of knowing regarding incandescent mantles. "Rules for Conducting Boiler Trials" gives the recommendations of the American Society of Mechanical Engineers on this important question. "The Preservation of the Dune of Helgoland" describes an important engineering work on the North Sea. "Winged Carriers of Disease" is a most interesting article by Eliza Priestley. "The Wear of Modern Guns" illustrates the erosion caused by smokeless powders. "Magnetism" is a lecture by Prof. J. A. Ewing. "Miscellaneous Notes and Receipts" is published for the first time in this issue.

Contents.

(Illustrated articles are marked with an asterisk.)

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

HARROW.—LEONARD F. FOWLE, Rudd, Iowa. The present invention provides a simple riding attachment for harrows to which any form of drag may be quickly applied. The beam has at its forward end a depending portion fastened to the drag-bar, and on opposite sides of the beam side braces are arranged, which are secured at their forward ends to the drag-bar at points laterally to the point of connection of the beam therewith, converging thence to the beam, and secured at their rear ends to the beam. The drags can be connected with the drag-bar, so that they may play freely between the beam and the side braces.

CANE-CARRIER AND FEEDER.—DANIEL H. WALSH, Plaquemine, La. The cane-carrier and feeder is designed to remove cane from cars or other vehicles and to deliver it to carriers. The invention comprises a supporting guide-frame along which the rake-frame is fitted to slide. The guide-frame is mounted upon supports in such a manner that it may be laterally moved to accommodate the rake to the width of the cane-pile and swing in a vertical plane about one end, so as to enable the rake-proper to be lifted, if need be, over the cane in its reverse movement.

Electrical Apparatus.

CURRENT TRANSFORMER.—SETH K. HUMPHREY, Boston, Mass. This invention is an improved device for transforming a multiphase current from one voltage to another and also from an alternating to a direct current without the employment of a rotary transformer. The device comprises a core consisting of a disk having a series of openings through and over which a number of primaries are reaved, arranged in sets placed opposite one another and connected, one set with the opposite set. The secondary winding consists of a series of coils, each having connection with segments of a stationary commutator. Auxiliary windings are extended across the center of the disk and connected in parallel with the primaries.

AUTOMATIC CIRCUIT-BRAKER.—CHARLES M. CLARK, Brooklyn, New York city. The circuit-breaker has a spring-pressed rotary disk normally in position to render the circuit continuous. An electromagnet in the circuit is arranged for action on an overload of current. To lock the disk against the tension of its spring, a spring-pressed latch is employed, connected with the electromagnet to be actuated thereby and to unlock the disk upon an overload of current. An electromagnet for the latch, likewise in the circuit, movably holds the latch in a locking position relatively to the disk, and permits the spring of the latch to actuate the latter and unlock the disk upon the passing of an overload of current.

PRIMARY BATTERY.—EDWARD BAINES, Brooklyn, New York city. To the ordinary gravity battery the inventor adds a perforated plate or grid located between the electrodes. Upon this grid crystals of copper sulphate are placed so as completely to cover the upper side of the grid. The current can then pass from the positive to the negative electrode by way of the interstices between the crystals. The negative electrode is, hence, in a clear solution and out of contact with the crystals.

Railway-Appliances.

TRAIN-SIGNALING DEVICE.—WILLIAM A. and BENJAMIN S. H. HARRIS, Greenville, S. C. The invention provides a simple construction whereby a sound-signal can be given to the engineer by a slight reduction of pressure in the train-pipe without necessitating the use of a separate signal-pipe parallel with the brake-pipe, by placing a signaling device in direct connection with the train-pipe between the engineer's valve and the train-line. This signaling device forms part of the train-pipe and permits the transmission of signals from any car by a slight reduction of pressure in the train-pipe by the operation of the conductor's discharge-valve, the reduction being too slight to set the brakes.

CHOKE-VALVE FEED FOR LUBRICATORS.—WILLIAM G. WELDON and EDWARD L. EGGER, Centralia, Ill. This attachment facilitates the feeding of oil to the chest and locomotive cylinder when the engine is working steam, and when not working steam, or when the automatic lubricator is out of order and fails to feed oil. Connected with a casing adapted for communication with a steam-chest and lubricator-pipe, is an automatic reciprocating valve provided with an oil-passage adapted to permit the feed of oil in all positions of the valve, and having its recessed or cup-shaped lower end accessible or exposed to the action of steam from the steam-chest.

Miscellaneous Inventions.

COMBINED STAND-PIPE AND FIRE-ESCAPE.—HENRY VIEREGG, Grand Island, Neb. In this combined stand-pipe and fire-escape, the stand-pipe is mounted on a hanger arranged to roll on a track in front of a building, so that the stand-pipe may be placed in any position with regard to the building. The stand-pipe is provided with rungs, forming a ladder on which persons may ascend and descend.

FRUIT GRADER, DIPPER, AND SPREADER.—FERDINAND M. STARRETT, Silverton, Ore. The fruit grader, dipper, and spreader comprises a grading cylinder which separates the fruit into desired sizes. The separated fruit drops into a dipping cylinder of lye-water, whence it is passed into a second tank containing clear water, the object being to check the skin of the fruit, so that it will dry more quickly, and also to clean the fruit. After being dipped for the second time the fruit is passed to the drying trays, in such a manner that it is dried in a single layer.

WINDOW-SASH.—ETTIE M. SQUIRE, Peckville, Penn. The window-sash has a main portion to which a swinging portion is hinged. The main portion is rabbeted to receive the swinging portion, and the bottom rail of the swinging portion is formed of two parts fastened together, between which the glass is clamped. One section of the rail is rabbeted to form a ledge overhanging the adjacent parts of the main portion of the sash. The vertical rails of the main portion are notched to receive the ends of the ledges. The swinging sections open without movement of the main parts of the sash, and when closed, form an absolutely air-tight connection.

CORNER-SHIELD FOR WAGON-BOXES.—DANIEL W. MCCLAUGHRY, Fox Lake, Wis. The object of the invention is to provide a simple device capable of attachment to any wagon-box and adapted to protect the faces and ends of the side boards, so that they will not be injured. The device consists of a shield formed with flanges and sides, the spaces between the sides being such that the shield may snugly fit the side faces of the wagon-box, so that when the shield is placed in position, the lower edge of the inner face of the shield may rest upon the bed of the wagon-box.

STEAM-HEATER.—FREDERICK M. RADKE, Manhattan, New York city. The heater comprises a novel arrangement of mud-drum, steam-drum, stand-pipes, circulating-pipes, and feeder. Because of the arrangement of tubes in which steam is generated, the steam is forced directly into service when at its driest and hottest point. Owing to the small amount of fuel required and the use of a self-feeder, the heater requires less attention than similar devices.

COMBINED CELLAR-CUPBOARD AND DUMB-WAITER.—GEORGE W. MENTZER, Elgin, Ill. The combined cellar-cupboard and dumb-waiter consists of a counterpoised cupboard raised and lowered by a rope and pulley, and adapted to be arranged in a room immediately above a cellar or dry pit. When in its lowermost position the top of the cupboard is flush with the floor. The device possesses the merit of being portable. No nails are used in hanging. The cupboard-dumb-waiter, it is said, takes the place of a refrigerator, requires but little room, and is so constructed that it can be very readily put into any house.

SLEIGH-BRAKE.—ABNER D. POLLEYS, Melrose, Wis. The brake is designed to retard a sleigh when descending a hill and to prevent the sleigh's slipping back in ascending the hill. The device consists of a bifurcated lever provided with a spur adapted to enter the ground in response to a pull from a link connected with a handle in reach of the driver's hand. In backing the sleigh, the spur is automatically driven further into the ground, thus preventing the sleigh from slipping down an incline.

BARREL-CLOSURE.—FRANZ KÖHN, Ploen, Prussia, Germany. Barrels used in transporting fish are provided with large openings closed by covers during transit. The present invention provides a cover of this kind, consisting of two hinged lids which cover the opening and which are furnished with hasps engaging the inner edges of the opening. The lids are held in place by a lever, pushed under a hasp.

HUB FOR WHEELS OF VELOCIPEDES, ETC.—EUGÉNE GERMAINE, Paris, France. On a spindle an adjusting bearing member is screw-threaded, which is provided with an engaging portion. A locking-device longitudinally movable with relation to the spindle has an engaging portion to co-operate with that of the bearing member. A spring maintains the locking device normally in engagement with the adjusting member, the spindle and locking member being prevented from relative rotation.

CASE FOR SACERDOTAL ARTICLES.—JOHANN J. EUGSTER, New Riegel, Ohio. The case is adapted to contain in such a manner that each of them will be readily accessible, articles such as are required by clergymen for sacerdotal use. These articles are used particularly in the visitation of the sick. The invention hence provides a convenient case constructed to contain within a comparatively small space all the articles required by a priest for administering the extreme unction and for like purposes.

BALL CHECK-VALVE.—JAMES ESSEX, London, Ontario, Canada. The check-valve comprises a body having a straightway passage in one end of which is an inwardly-facing valve-seat. From an upwardly-extending connected chamber a curved ball-raceway leads to the valve-seat. Within the chamber is a ball adapted to fit the valve-seat and to be forced up the raceway into the connected chamber to clear the raceway. The inventor states that the valve is trustworthy in operation, that it can be used with a brass, rubber, and even a glass ball. The chief merits claimed are cheapness of construction and efficiency of operation.

PACKAGE-SEALING DEVICE.—JOSEPH T. CRAW, Jersey City, N. J. The present invention seeks to provide a simple device whereby the end flaps or wings of empty paper boxes or cartons, usually packed flat, may be quickly and securely sealed at one end. The device consists of a surface over which the portion of the box to be closed is passed. The surface has an opening adapted successively to receive the sealing-flaps of a box. The walls of the opening are arranged to direct the flaps to a closed position; and a cement is applied to the surface. Guides define the path in which the box is to be moved.

HAND-STAMP.—JAMES COOKE, Omaha, Neb. The stamp consists of a handle on which is fitted a screw turned by a fixed nut. An impression disk is fixedly secured to the screw to move therewith. A second impression-disk is mounted upon the first impression-disk and is movable independently. By means of a rubber or elastic sleeve, the impression portion of the stamp has a connection with the handle that is in a measure yielding, enabling the stamp to adapt itself to inequalities of the surface to be marked.

GAME-APPARATUS.—AMSEY N. COSNER and GILBERT L. MATTHEWS, Newton, N. J. It is the purpose of this invention to provide an amusing game through

the medium of which a game of shooting matches may be played. A tilting chute is provided, adapted to hold a ball which is to be delivered upon a tray. A gun is provided for the tray, the charge of which gun is to be fired at the ball while it is traversing the board.

WINDOW-CLEANER. — LEWIS COCHRANE and FRIEDRICH THIELEMANN, Brooklyn, New York city. This device consists essentially of a tubular arm, which is slotted throughout the greater portion of its length and contains a slide provided with an arm passing through the slot and carrying outside the tube a device adapted to hold a sponge or rag by which the window-pane is cleaned. This slide is connected with the end of a spring band or bar which projects from the inner lower ends of the arm, where it may be engaged to move the slide up and down in the arm. The device can be used to clean the outside of a window from the inside of a room.

CHRONOMETER-ESCAPEMENT. — ARTHUR V. CHARDON, Rue de Bretagne 23, Paris, France. In detent-escapements as now used, the flank of the tooth of the escapement-wheel which drives the balance-wheel is straight and radially inclined. The result is that between the moments when the tooth meets and leaves the driving stud, there is a sliding movement of the stud on the tooth, which results in bad driving. To obviate this, the inventor has devised an escapement-wheel of which the tooth has a curve formed so as to reduce friction at the part where it acts on the stud.

BEVEL SQUARE.—SPENCER F. BROWN and CHARLES BEAUCHÉNE, Lake Linden, Mich. This invention provides a try and miter square, by means of which a miter may be delineated and a straight cut indicated at the top or bottom and at the side of an object, and marked with a single stroke of a marking-tool. Two square sections are rigidly joined together, one of the sections having a slot in which portions of a miter-plate fit. The miter plate is mounted on a bolt fitted in the square, whereby movement of the miter-plate is permitted. Means are provided for locking the miter-plate on the square.

TYPE-CASE.—CHARLES J. BOTZ, Sedalia, Mo. The type-case has a number of obliquely-arranged boxes adapted to hold type. When a box is full, a storage-box is slid in the frame of the type-case to receive the type from the full box. The storage-box, after having been filled, is removed, and the empty box is ready to receive another charge. The manipulation of the apparatus is simple, its capacity unlimited owing to the use of storage-boxes, and type may be distributed with great ease and rapidity.

CLAMP.—WILLIAM H. SHEELEY, 156 Fifth Avenue, Manhattan, New York city. It is the common practice to attach temporary blocks to mitered casings that are to be glued together, so as to give a bearing surface for the handscrews used to hold the parts together while being glued. It is the object of the present invention to correct the faults of this method. This end is attained by means of a miter-clamp, the frame of which has flanges projecting from one side and extending at an angle with each other corresponding with the angle of the miter-joint. One of the flanges is a skeleton-flange; and in this skeleton-flange a block is moved toward and from the other flange by means of a cam. A friction-roller is journaled upon the sliding-block and is engaged by the eccentric. A projecting arm upon the block engages the opposite side of the cam to withdraw the block.

SPOOLING DEVICE FOR SEWING-MACHINES.—CAROLINE C. M. WAGNER, Hamburg, Germany. By this attachment a separate spooling-device, such as is used in lace-making, is rendered unnecessary and the spooling is greatly accelerated by reason of the greater number of revolutions obtainable with the sewing-machine. The attachment consists of a bobbin which is held in an adjustable sleeve driven by a friction-wheel engaging the hand-wheel of the machine.

FIREPLACE.—CASSIUS B. NAY, Fairmont, W. Va. To provide a simple construction by which to prevent the escape of fire or smoke at the top or sides of the front, is the purpose of this invention. With this end in view, a fire-front is used comprising a front plate provided with inwardly-projected side flanges and with benches projecting beyond the adjacent faces of the side flanges and adapted to receive the side linings of brick.

APPARATUS FOR HANDLING COAL.—WILLIAM H. WALL, Nanaimo, Canada. The apparatus comprises a frame or platform with supply and dumping tracks at intervals of which are openings. The platform has a series of chutes lying below the dumping-tracks. To transfer the coal-cars from the supply-track to the dumping-track, a carriage is used. Tilting gripping-dogs move the cars along the tracks and are operated by cylinders and pistons; and valves and operating means control the passage of pressure to the cylinders. The apparatus is designed for loading vessels and transfer-cars with coal.

RUDDER-FRAME AND GEAR FOR SHIPS.—FRANK S. CORMIER, Moncton, New Brunswick, Canada. This invention is designed for temporary use on ships, and is attached to a vessel when the rudder has been broken away or injured. The temporary steering device comprises a cage-like rudder frame to the front of which a strut-brace is hinged, having a forked forward end fitting on each side of the stern-post. A rudder is hinged to the rudder-frame; and a series of guys hold the rudder-frame and brace in place and turn the rudder.

Designs.

PAPER-BOX BLANK. — EDWARD E. PINKERTON, Sioux City, Iowa. The leading feature of the design consists of a center-piece, slotted sides, and ends having divided tongues.

TELEPHONE-RECEIVER CAP.—HENRY R. COOL, Urbana, Ohio. The design provides a novel arrangement of earpiece whereby it is said the holding of the telephone is rendered less fatiguing than usual, and the sound is improved.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
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Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(7700) H. Y. N. asks: Are buildings covered with iron or steel roofs more or less liable to be struck by lightning? Are instances on record of buildings so protected being struck? A. We suppose that an iron roof upon a building would render it more liable to be struck by lightning. We have no instances to cite in support of our opinion.

(7701) W. A. M. writes: 1. Suppose I compress air with an ordinary air pump direct into storage tank, maintaining a constant pressure of 80 pounds. What power would that air generate if used at once in a cylinder 7 inches by 18 inches? A. About 50 per cent of the power used in compressing air may be returned by immediate use of the compressed air. 2. What would be the minimum sized tank that would insure full power for one stroke of cylinder piston full length? A. The size of the tank is of little value, except as an equalizer for the strokes of the compressor piston, to catch condensed moisture and as storage for special uses. It may be from five to ten times the capacity of the compressor cylinder. 3. Would it be advisable to use a water jacketed air pump or air compressor, or would not the air heated by compression be more powerful when used at once, and less expensive to install the plant? A. For 80 pounds pressure, the temperature of the air will rise from 60° to 433° Fah., which is too high for economy in operating the compressor. The high temperature will not conduce to the best conditions in the press. 4. It is proposed to compress air with an ordinary air pump 2½ inches by 6 inches cylinder, running at 30 strokes per minute, into a tank 16 inches by 60 inches. The air compressed to 80 pounds would be used in the cylinder above mentioned, 7 inches by 18 inches, for one stroke only, one in every two minuees. Would this proposition be feasible? And would the power exerted be quick or slow? For the full length of the stroke, 18 inches? A. Your compressor or air pump should be three times larger in capacity or run three times faster than stated, in order to fill the press every two minutes at 80 pounds pressure. Six and one-third volumes of free air is required to make one volume at 80 pounds pressure. The transfer of air power is quick, and your arrangement is feasible.

(7702) P. C. T. asks: Can you give me a formula or formulæ for producing cold by the mixing of chemicals? A. There are many substances which produce a fall of temperature when they are dissolved. We give several formulæ. All parts are by weight.

1.	Snow	3 parts.
	Crystallized chloride of calcium	4 "
This will freeze mercury.		
2.	Water	1 "
	Nitrate of ammonia	1 "
3.	Sal ammoniac	5 "
	Nitrate of potash	5 "
	Sulphate of soda	8 "
	Water	16 "
4.	Sulphate of soda	8 "
	Hydrochloric acid	5 "

The nitrate of ammonia and water as above are the chemicals used by the makers of portable freezing machines. In the liquefaction of nitrate of ammonia a large amount of the heat of the water becomes latent when the temperature falls to near zero Fah. The machine may be simply a large pail or can with a cover, a smaller can sitting inside containing water or other material to be frozen or cooled. Water as cold as can be obtained is poured into the outer chamber and an equal quantity of nitrate of ammonia put into the water in the outer chamber in several portions with a small scoop

NEW BOOKS, ETC.

ELECTROTYPING. A Practical Treatise on the Art of Electrotyping by the Latest Well Known Methods. By C. S. Partridge. Chicago: The Inland Printer Company. 1899. Pp. 149. 16mo. Price $1.50.

The literature of electrotyping, though quite considerable, is not up to date, and for this reason electrotypers will undoubtedly warmly welcome Mr. Partridge's book. It is a thoroughly scientific treastise on electrotyping as conducted in modern foundries, and the illustrations of the apparatus and machinery show that the latest methods are described. There is considerable field for a book of this kind at the present time.

HINTS ON AMALGAMATION AND THE GENERAL CARE OF GOLD MILLS. By W. J. Adams. Chicago: Modern Machinery Publishing Company. 1899. Illustrated. Pp. 111. Price $1.50.

CHIMNEY DESIGN AND THEORY. A Book for Engineers and Architects. By William Wallace Christie. New York: D. Van Nostrand Company. 1899. Pp. 164. 8vo. Price $3.

The literature upon chimneys has been mostly scattered through periodical literature, so that a really comprehensive and up-to-date work upon the subject has long been needed. The author has performed his task admirably, and the tables, formulas, and illustrations are most excellent. We do not admire the abbreviation "illus." for illustrations. There is no authority for it, but this is, however, a detail. It is a substantial addition to engineering literature, and the author has performed a signal service to the engineering profession in giving such valuable data in condensed form.

ENERGY AND HEAT. By John Roger. New York: Spon & Chamberlain. 1899. Pp. 36. 16mo. Price 50 cents. Supplement to the same, 25 cents.

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