Scientific American.

ESTABLISHED 1845

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

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS FOR THE SCIENTIFIC AMERICAN.

(Established 1845.)

One copy, one year, for the U. S., Canada or Mexico.................$3.00
One copy, six months, for the U. S., Canada or Mexico.............. 1.50
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

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

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(Established 1876)

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year, or £1 4s. 8d., to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

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NEW YORK, SATURDAY, DECEMBER 18, 1897.

Contents.

(Illustrated articles are marked with an asterisk.)

Acetylene gas buoy, New York harbor*.... 389
Archæological news.... 390
Boat, the Knapp roller.... 391
Books, new.... 396
British Museum visitors.... 390
Canal, St. Lawrence River.... 394
Dock, the Havana floating.... 387
Electric storage plants.... 387
Furnace, a large welding.... 385
Gate hinge, Choate's*.... 388
Hydraulic pipe testing machine*.... 393
Inventions recently patented.... 395
Inventors, warning to.... 387
Kineoptoscope, Wray's*.... 388
Lap welding*.... 392
Meerschaum pipes (7273).... 396
Mexico, laboring classes of.... 386
Patents granted, weekly record of.... 396
Peary, Lieut., in England.... 387
Photographic developer, a new.... 390
Photographic pictures, intensifying.... 390
Pyramids, problems of the*.... 391
Science notes.... 390
Scrap pile, treasures of the.... 390
Steamer Kaiser Wilhelm der Grosse.... 387
Steam turbine, the.... 386
Steel tubing manufacture, the*.... 385
Storage battery, the.... 387
Swiss lakes, depths of.... 390
Testing machine, a great*.... 393
Torpedo boat catcher, Bailey*.... 395
Tunnel, Gravehals, Norway.... 389
Typewriter, the "Remi-sho"*.... 388
Welding work, large*.... 385
Yacht Ellide, fast.... 390
Yukon region, new map of.... 389

TABLE OF CONTENTS OF

Scientific American Supplement

No. 1146.

For the Week Ending December 18, 1897.

Price 10 cents. For sale by all newsdealers.

PAGE

I. BUILDING.—Straightening a Church Spire.... 18326

II. CHEMISTRY.—Further Experiments on the Liquefaction of Fluorine.—By M. MOISSAN and J. DEWAR.—An important chemical paper.... 18321
The Calcium Carbide Industry.... 18325

III. CIVIL ENGINEERING.—A Tube Tunnel Under the Spree.... 18313
The Glasgow Cable Railway.—A description of an underground railway in which steam and smoke is done away with by using the cable as a motive power.—2 illustrations.... 18313

IV. ECONOMICS.—Condition of the Laboring Classes in Mexico.... 18324

V. ELECTRICITY.—Some Notes on Electrotyping, Plating and Gilding.—A practical paper, giving a number of formulas for plating baths.... 18312
Electric Pumps for Boilers.... 18311
On the Constitution of the Electric Spark.... 18311
Electric Locomotive for Mines.—A description of a German mine locomotive.—3 illustrations.... 18311

VI. FINE ARTS.—Lafcadio Hearn on Japanese Art.... 18325

VII. FUELS.—Converting Sludge into Fuel.... 18316

VIII. MARINE ENGINEERING.—Notes on the Yacht Defender and the Use of Aluminum in Marine Construction.—By RICHMOND PEARSON HOBSON.... 18323
Roller Boats.—Further Details of the Bazin and Other Roller Boats.—5 illustrations.... 18322
Double Rudders.... 18313

IX. MECHANICAL ENGINEERING.—The Early History of Cast Iron Pipe.... 18316
A Modern Gas Power Plant.—By HORACE ALLEN.... 18314
Very Convenient Machine for Drawing Water from a Well Remote from the House Through a First or Second Story Window.—1 illustration.... 18315

X. MEDICINE AND HYGIENE.—How Worry Affects the Brain.... 18326

XI. METALLURGY.—Notes on the Yacht Defender and the Use of Aluminum in Marine Construction.—By RICHMOND PEARSON HOBSON.... 18323
Working and Hardening Steel.... 18314

XII. MISCELLANEOUS.—Keith's Automatic Liquid Elevator.—1 illustration.... 18315
Engineering Notes.... 18317
Electrical Notes.... 18317
Miscellaneous Notes.... 18317

XIII. PHOTOGRAPHY.—Developer for Films.—1 illustration.... 18316
Photographic Waste Material and What to Do With It.... 18316

XIV. PSYCHOLOGY.—Leftomania.... 18316
Mental Evolution in Man.—By R. M. BUCKE.—An interesting address delivered at the opening of the section of psychology at the annual meeting of the British Medical Association.... 18320

XV. TRAVEL AND EXPLORATION.—The Lipari Islands.—By E. O. HOVEY.... 18319
Pictures of Southwest Africa.—An interesting account of German Southwest Africa.—7 illustrations.... 18318

CONDITION OF THE LABORING CLASSES IN MEXICO.

The discontent following the recent years of business depression has caused us to look about with a view to drawing comparisons with the social and commercial conditions of other nations and especially of those whose natural advantages, climatic, physical or political, bring them into comparison with our own people. We have involuntarily turned our eyes to Canada and Mexico, and especially toward the latter, owing to the fact that silver has been made the standard of value in that country, and because during the campaign of 1896 many allusions were made, by political speakers in various parts of the country, to the great prosperity of this neighboring republic. With a view to ascertaining the true condition of affairs as touching the civilization and social and commercial conditions of Mexico, Mr. Theodore C. Knauff made an extensive trip through this country. The question so often asked was, "Why is it that the Mexican peon, with his sixty cents a day, is making more than the American farmer with all his knowledge and invested capital?" In the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT we publish in full Mr. Knauff's lecture recently delivered under the auspices of the Franklin Institute, in Philadelphia, in answer to this question.

The author explains how little conception the ordinary citizens of the United States have of the extent of or even the natural and physical conditions which prevail in Mexico. The ignorance of our people concerning our neighbor of the south is almost incomprehensible. A map of Mexico projected on a map of the United States of the same scale extends from Maine to Texas. Mexico is sixteen times the size of New York State. Sonora equals Iowa and Ohio combined. Chihuahua equals Pennsylvania and New York combined. Mexico's mountain system is a continuation of the Andes, and widens out into two ranges, leaving in the middle a high flat table land from 4,000 to 8,000 feet above the level of the sea, while many volcanic peaks reach an altitude of 18,000 feet. The city of Mexico is 7,469 feet above sea level or nearly 1,200 feet higher than Mount Washington. Its inhabitants feel the altitude and the great dryness and rarefication of the air. The population of Mexico is about 12,500,000. The lecturer states that two-thirds of this number have never slept in a bed or worn stockings, and that they are able to live at a less expense per diem than it takes to keep the meanest farm horse. Many of the inhabitants wear a single garment called a "sarappe," or thick woolen garment, with a hole at the top through which the head is inserted. This garment forms at the same time the Mexican's coat, hat, and even his bed. The feet are usually bare or clothed in domestic sandals. The women wear a kind of cotton shawl over the head and shoulders, called a "robosa." "The Mexican farm laborers' condition is are inferior to those of the late slaves of our Southern States. Their huts have but one opening, no windows and dirt floors. When wishing to go to bed, they simply unroll their mats, and, without removing their clothing, lie down and go to sleep. The laborer has a certain wage and is given time and place to build himself a house. If he does not build it he has nothing with which to cover his head. The houses are built by the people who live in them. Some of the houses are mud roofed and others roofed by palms or banana leaves or some fiber that will shed moisture when necessary."

These adobe houses are made of large blocks of mud pressed into shape in a mould and then hardened and baked in the sun and laid in flat layers, one on top of the other. This method of construction makes quite a substantial building, which requires a long time, even in the rainy season, to become watersoaked. A church and plaza are required before a settlement can become a city. There are shops in the cities, but the business is largely conducted by peddlers and sidewalk merchants. It is a common thing to see a man working a modern sewing machine in the streets. All branches of trade are carried on outside of the houses. In the cities the houses of the better class are made of stone. Among the rich the rooms are furnished in great magnificence. Mexico is at the same time a land of millionaires, for the land is most unevenly divided among the people. Out of the total population of over twelve million, six thousand people own all the land, "with influence enough," says the lecturer, "to avoid practically all taxation, which falls on the poor." There is no "middle class," so called. The railroad by which one travels passes through one estate for a distance of eighty miles, which enormous landed property belongs to one individual. In another place is an estate of 1,500,000 acres, in another one of 250,000 acres. "At present," says the lecturer, "there is no possible danger of an uprising of the people, because the people are perfectly contented in their lot." If the peon has a few coppers in his pocket, he is perfectly happy, and does not feel compelled to go to work until he is driven to it by hunger or necessity.

Mr. Knauff not only gives a picture of the life, habits and customs of the people, but he also depicts at length the commercial growth of the country, its products and manufactures.

For several years American merchants and manufacturers have made earnest efforts to enlarge our trade with Mexico—especially since the completion of the direct all-rail route from the Rio Grande to the city of Mexico—and the commercial travelers and leading merchants of our principal cities are pretty well acquainted with the commercial and social conditions as they are and have been in Mexico. There has been, within a comparatively recent period, some improvement in this trade, and, owing to the introduction of American capital in mining and other enterprises, and an infusion of American enterprise in some departments of industry, there has been better promise than ever before that Mexico was in some degree awaking from its long period of lethargy. The decline of the past five years in the price of silver has, however, proved a serious setback to the progress of Mexico, for to this extent has been enhanced the price of all imports—silver being the main product and the standard of money of the country; and in like ratio has also been increased the interest payable on the national debt. The value of the imports for the year ended June 30, 1896, was $42,253,938, and the exports for the same period were $105,016,902, and the total debt of the country in American money was $213,600,000. Yet Mexico has now in operation about seven thousand miles of railway and over forty thousand miles of telegraph, nearly all of which is of comparatively recent construction, and, notwithstanding the decline in silver, there are many encouraging signs for those who have been so long looking for a better development of her industries and increased trade between Mexico and the United States.

THE SUPREMACY OF THE STEAM TURBINE.

If the compound steam turbine fulfills its present promise, it is likely that in certain branches of engineering it will hold absolute possession before many years have passed. It is announced in the Russian press that the Russian Admiralty has placed orders with the firm of Hawthorne, Leslie & Company, of Hebburn-on-Tyne, England, for the construction of two 38-knot torpedo boats built on the model of the Turbinia and propelled with turbine motors working on four shafts, each of which carries three propellers. This is eight knots faster than the fastest torpedo boat destroyers in the British navy.

Just how much courage is required on the part of the naval architect who signs his name to a contract for a 38-knot boat—38 knots is 44 miles an hour—is evident from a comparison of figures. The 300-ton "destroyers" just mentioned require 6,000 horse power to drive them at 30 knots an hour. At these high speeds the resistance of the water increases as something more than the cube of the speed. The cube of 38 is more than double the cube of 30, and hence the 6,000 horse power of a 300-ton destroyer would have to be raised to over 12,000 to enable her to catch one of the new torpedo boats. But 12,000 horse power reciprocating engines of the common type, with the necessary boilers and coal, would sink a 300-ton torpedo boat, supposing they could ever be stowed away in her hold.

Evidently then a speed of 38 knots involves a radical change in the accepted methods of propulsion. Some form of motor is necessary in which the weight per indicated horse power shall be reduced to a very low figure. Indicated horse power is the product of steam pressure and piston velocity. If either or both of these be increased, there will be a proportionate increase in horse power without a proportionate increase in weight. In the present type of high speed marine engines the steam pressure is as high as can be used to advantage, and the piston speed is as great as the reciprocating type of engine will allow.

The present year has seen the advent of a phenomenal little boat, the Turbinia, in which the problem appears to have been completely solved for speeds from 30 to 40 knots an hour. Steam turbines of the type designed by Mr. Parsons, son of Lord Rosse of telescope fame, were substituted for the ordinary reciprocating type of engine, and by driving them at a speed of 2,100 revolutions per minute, 1,576 horse power was realized from an engine weighing only $4\frac{1}{10}$ tons, or $5\frac{1}{10}$ pounds per horse power. As the total weight of all the machinery and boilers is only 28·7 tons, the turbines develop 55 horse power for every ton of machinery, and 384 horse power per ton of engines. Compare this with the latest battleships, which develop only 9½ horse power per ton of machinery, and 27 horse power per ton of engines.

In the trials just mentioned, the Turbinia's engines were handicapped by too small a steam pipe, the pressure being 200 pounds at the boiler and only 130 pounds at the turbines. This was remedied, and subsequent trials gave a speed of 35 knots with 2,400 indicated horse power. The corresponding figures for this horse power would be 83½ horse power per ton of all machinery and 585 horse power per ton of engines!

One feature that renders these turbines so unusually promising is their remarkable economy. The consumption of steam per horse power hour is only 14 pounds, as against from 18 to 21 pounds for the most economical reciprocating engines, working under favorable conditions. It is evident that at the present

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stage the steam engine, as represented by those of the turbine type, is far in advance of the steam generator, judged on a basis of power for weight. It now remains for someone to make as big a reduction in boiler weights as Mr. Parsons has in engine weights. This will probably come in the direction of the rapid generation of steam in boilers of small capacity, of the kind used by Serpollet in his steam carriage, or that exhibited by De Laval at the Stockholm Exhibition, which is credited with carrying a pressure of 3,000 pounds to the square inch. The difficulty, of course, in the case of steam pressure running into the thousands would be the high temperature it would carry. A small and compact boiler capable of instantly generating 1,000 pound steam from small quantities of water supplied to it as required would be the logical counterpart of the turbine running at 2,000 revolutions per minute and expanding the steam to zero, which is what the Parsons triple expansion turbine now accomplishes.

WARNING TO INVENTORS.

As the new amendments to the patent law go into effect on January 1, 1898, it is well that inventors, both here and abroad, should bear in mind several of the very important changes which may seriously affect their rights.

1. Under the new law a patent cannot be obtained for any invention which has been patented or described in any printed publication in this or any other country more than two years prior to the application.

2. No patent shall be refused nor shall any patent be declared invalid by reason of its first having been patented in a foreign country, unless the said application was filed more than seven months prior to the application in this country.

3. The application must be completed and prepared for examination within one year after the filing of said application. In default thereof it shall be regarded as abandoned.

4. An interference will not be declared between an original application and a patent issued more than two years prior to the date of filing the said application.

In view of these changes in our patent practice, it is desirable that those who are interested and who will be affected by the laws as above mentioned should file their United States applications before January 1.

We have a number of times called attention to these impending changes, but they are of such great importance, particularly those mentioned in paragraphs 1 and 2, that we take this occasion to again call attention to these points.

It should at the same time be borne in mind that the term of the United States patent will not be shortened by the prior filing or issuing of a foreign patent for the same invention. It is possible, therefore, for the American inventor now to proceed with foreign applications without waiting for his United States patent to be issued.

LIEUTENANT PEARY IN ENGLAND.

Lieut. Peary has arrived in England, and before he sailed he stated that after delivering a lecture before the Royal Geographical Society on December 6, and later before the Scottish Geographical Society at Edinburgh, he would go to Dundee, Peterhead and Aberdeen to look over the whaling fleets there and pick out a vessel from 300 to 500 tons register for his next expedition to the Arctic regions. We have already outlined Lieut. Peary's plan of campaign.

Speaking of the doubt that Nansen had thrown upon the genuineness of the meteorite which Mr. Peary recently brought from the Arctic region, the Lieutenant said: "Nansen spoke hastily on his arrival, but when he found he was wrong he frankly and courteously admitted his error. The impression has gone abroad that there is some feeling over the matter between Nansen and myself, but that is not true. I have the utmost admiration for Nansen and the magnificent work he has done." On the afternoon of December 8 Lieut. and Mrs. Peary paid a visit to the British Museum, where they were met by the Director Sir William Fowler and Curator Fletcher, of the Mineralogical Department. Mr. Fletcher examined a specimen of the Cape York meteorite discovered and brought to New York by Lieut. Peary, and unhesitatingly declared it was certainly of meteoric origin. He added that no specimen in the British Museum had meteoric characteristics more sharply or more clearly shown than those of the Cape York meteorite. The opinion of Mr. Fletcher, who is an expert, has so thoroughly convinced Dr. J. Scott Keltie, Secretary of the Royal Geographical Society, that it is considered by him to have settled the controversy as to the Cape York meteorite.

Mr. Peary complained in London of Captain Sverdrup's unfairness in going to Smith Sound next summer, but a dispatch from Christiania states that Capt. Sverdrup wrote to Mr. Peary some time ago that he did not aim to reach the Pole, but only intended to explore Greenland and to make a study of the ice. He imagines that Lieut. Peary cannot have received his letter.

ONE OF THE USEFUL APPLICATIONS OF THE STORAGE BATTERY.

BY WILLIAM BAXTER, JR.

When the storage battery first came prominently before the world, it was thought that its great field of usefulness would be that of the transportation of energy from coal fields and large water power sites to centers of industry. It was also believed that it would enable the electric motor to become a formidable rival of the steam locomotive, not only because it would reduce the cost of hauling a train, but because, in addition, it would remove many of the objectionable features of steam transit, such as smoke, cinders, etc. When put to the test it was found that the batteries, at least as then constructed, could not withstand the hard usage to which they were subjected in railroad work; and as to their value as transferrers of energy from the source of supply to the points of demand, it was found upon investigation that they could not compete with existing methods, even if made sufficiently substantial to endure constant usage with slight deterioration, and so perfect electrically as to have the greatest storage capacity, per unit of weight, consistent with theoretical possibilities. In this latter field they would necessarily fail, because, if made as light as possible, they would weigh at least twelve pounds for each horse power hour capacity, and as good steam engines can develop the same amount of energy from three or four pounds of coal, the weight of batteries to be transported back and forth would be three to four times that of the coal necessary to do the same work. The batteries then made weighed from one hundred and fifty to two hundred pounds per horse power hour capacity, instead of twelve; hence, the difference in weight to be transported under the actual conditions was so great as to render it impossible to accomplish anything practical in that field, even if the energy could be obtained free of cost.

When it was seen that the storage battery could not accomplish anything of a revolutionary character, those interested in its development began to study its adaptability to less pretentious work, and soon realized that it would be decidedly valuable as an adjunct to electric lighting stations, as it would be to these what the gasometer is to a gas distributing system—a reservoir from which the demand of customers could be supplied, should it become necessary at any time to stop the machinery for a few hours. Without the aid of storage batteries, if from any cause the operation of the generators is suspended, the lights will instantly go out and remain out until the generators are set in motion again. After years of persistent and very commendable experimental work, the inventors of storage batteries succeeded in making these devices sufficiently durable to withstand the wear and tear they are subjected to in station work, without unreasonable deterioration. Since that time they have been used to a considerable extent in that field, and within the last two years their use has been increasing at a very rapid rate; in fact, a first class station of to-day would not be considered complete without a storage battery plant.

The first battery plants installed in lighting stations were intended simply as a safeguard, to render it possible to keep up a supply of current in case of accident to the machinery; but it was not long before it was realized that by enlarging the capacity of the batteries, the output of the station could be greatly increased without materially increasing the expense of operation. How this result can be accomplished will be readily understood when it is considered that the demand for light is not uniform throughout the whole twenty-four hours, but varies from little or nothing, during the day and the early hours after midnight, up to the maximum amount between nine and ten in the evening. The station capacity, however, must be sufficient to meet the greatest demand; therefore, during the greater part of the time the machinery is only worked to a fraction of its full capacity. By using storage batteries, the generators can be worked to their full capacity all the time, and when the demand of consumers is small the surplus energy is stored, to be given out when the demand is in excess of the amount developed by the machinery.

From the very fact that the demand for current is variable, it becomes possible for batteries to be used not only to reduce the cost of production and increase the capacity of the station, but also to reduce the cost of line wires. This last result can be accomplished in any case where the station is located at some distance from the district in which the current is distributed. To illustrate this point, suppose the station is located say one mile from the center of the city or town in which the lights are used. If the current runs direct from the generators to the customers' lamps, the line wires must be of sufficient size to carry the maximum supply with a loss of pressure low enough to not interfere with the brilliancy of the light. If the maximum demand lasted for a considerable portion of the day, the full capacity of the line wire would be used to a reasonable extent, but the duration of this maximum demand is seldom over one-half, or, at the most, one hour; therefore, during the rest of the time a large portion of the line capacity may be regarded as wasted. The difference between the average and the greatest demand varies within wide limits, in different stations, but in the majority the ratio is not much below one to two. Whatever it may be, however, if the current could be supplied at the average rate, and the excess over the demand when the consumption is small were stored, the amount so stored could be used to supply the deficiency when the demand is large. This is accomplished in many cases at the present time by placing a storage battery plant at the center of the district in which the customers are located. The wires coming from the generating station are so connected with the battery and the distributing mains that, whenever the drain is less than the current coming from the station, the batteries are charged, and when the demand is in excess of the current from the station, the battery feeds into the distributing mains. The current passing from the generating station to the battery station is about ten per cent more than the average demand, so as to cover the loss in the charging and discharging of the batteries.

The saving in wire by this arrangement will run from about twenty-five to seventy-five per cent, depending upon the relation between the average and the maximum current, and also upon the amount of energy that is lost in transmitting the current from the generators to the battery. When the generating station feeds directly into the distributing mains, the loss of energy in transmission is governed by the condition that the pressure of the current must not drop so much as to interfere with the brilliancy of the lights, and therefore the line loss is generally low; but when batteries are used, located at the center of distribution, they regulate the pressure of the current supplied to the lamps; and, therefore, the loss between generator and battery may be made anything desired, without affecting the brilliancy of the lights. If the power is obtained from a waterfall or from coal near a railroad, when it can be obtained at a very low price, it may be more economical to increase the loss of energy between generator and battery, and thus reduce the cost of line wire, but such conditions cannot be taken advantage of if the battery is not used.

FURTHER RECORDS FOR THE KAISER WILHELM DER GROSSE.

The Kaiser Wilhelm der Grosse has added further records to those which she has already placed so rapidly to her credit. As already mentioned in previous issues, she has accomplished the longest all-day run by covering 564 knots within the twenty-four hours, and she now holds the record of an average hourly speed of 22·35 knots for the whole trip across the ocean. This is 0·34 knot faster than the best trip of the Campania. When she left New York on her last passage she passed the Sandy Hook Lightship 4:30 P. M. Six days later she passed the Needles at 3:10 P.M., the total distance covered being 3,065 knots, and the actual time five days, seventeen hours and eight minutes. This is equivalent to a railway speed of 25½ miles per hour; and when we remember that this speed was maintained uninterruptedly for a distance equivalent to 3,524 land miles, we realize that steamship travel is well up to the average performance of the overland trains of but a few years ago.

AN EXCELLENT HOLIDAY GIFT.

As the Christmas season approaches we desire to call the attention of our readers to the appropriateness of our new work, "Magic: Stage Illusions and Scientific Diversions, including Trick Photography," as a holiday gift. It is a large octavo volume of 568 pages, embellished with 420 illustrations, and is tastefully bound in imported cloth stamped with ink of three colors. The book appeals to all classes, and purchasers have the satisfaction of knowing that the profession have indorsed it as "the standard work on magic." The press notices have been quite exceptional. A number of interesting letters have been received from prominent magicians. Our readers hardly need to be informed of the quality of the illusions or the thorough manner in which the tricks are exposed, as excellent examples have been in the SCIENTIFIC AMERICAN since the publication of the book.

SINKING OF THE HAVANA GRAVING DOCK.

In our issue for October 16, 1897, we illustrated the new floating dock for the port of Havana, procured in England at great expense and transported to Cuba with great difficulty. On December 6 the dock began to sink slowly. It is now beneath the waters of the bay. The unexpected disappearance of the dock created great consternation in the navy department and in the palace of the captain-general. The floating dock went down slowly and majestically and no one appears to know what was the matter with it. It is thought by some that the Cuban insurgents did something to it which caused it to sink, but this seems hardly possible, as there was no difficulty in guarding the dock. It is fortunate it went down slowly; for, had it gone down suddenly, there would probably have been great loss of life. Over two hundred men are working to float the dock, but their efforts thus far have been unavailing.

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