

# SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class matter. Copyrighted, 1892, by Munn & Co.]

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

Vol. LXVII.—No. 23.  
ESTABLISHED 1845.

NEW YORK, DECEMBER 3, 1892.

[\$3.00 A YEAR.  
WEEKLY.]

## LOSS OF A GREAT SHIP OF WAR.

On the second of November a squadron of British war vessels, comprising some of the largest ships of the navy, entered the harbor of Ferrol, near Corunna, Spain. Among them were the Royal Sovereign, the Anson, and the Howe, one of the finest war ships afloat.

While rounding the Perreio shoal the Howe took too large a sweep and grounded. The rest of the squadron got in in safety and anchored. It was within an hour of high water. Every exertion was made to get her off, but in vain. Salvage operations on a very large scale have been commenced.

The water tight doors were, of course, closed, but the boiler compartments on the port side appear to have been pierced by the rocks, for, at last accounts, three compartments were full of water in the stoke-hole, and the fires put out. Divers were sent down to explore, anchors were laid out, and every effort was made to lighten the ship by the officers and men of the whole squadron, but as the tide fell the ship's bows settled down, and she was pivoted by the quarter on the rock. The sketch here presented is from the *Graphic*, London, drawn by C. C. Peaty, R.N.

The Howe is a first-class battleship, designed by Sir N. Barnaby, and launched at Pembroke on the 29th of April, 1885. Her displacement is 10,300 tons, and she carries at the water line 150 feet armor 18 inches thick.

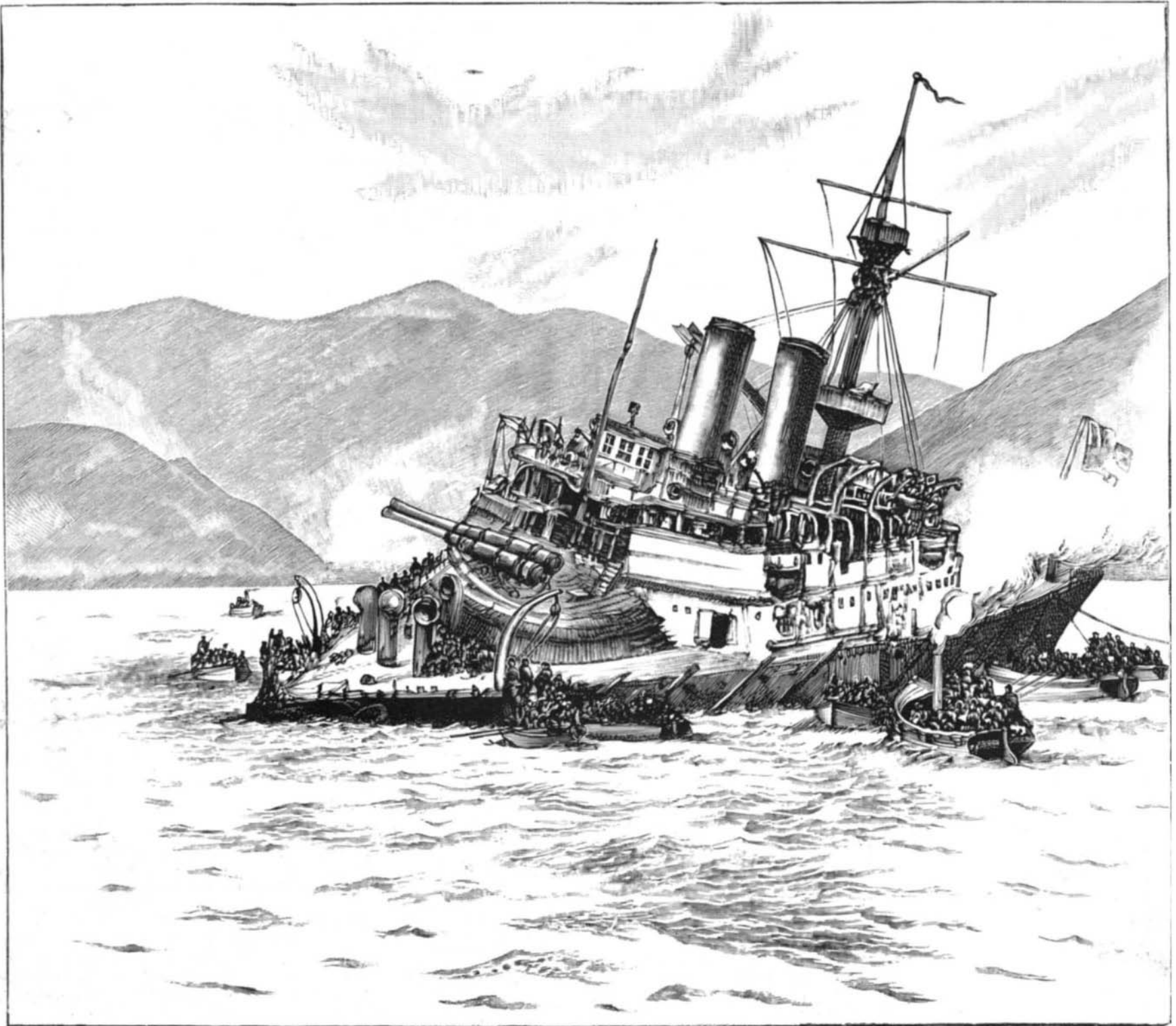
She is 300 feet long over all, 68 feet beam, and draws 27 feet 3 inches. Her engines, by Humphrys, indicate 11,000 horse power. Her speed is 16 knots; she carries two 67 ton breech loaders in each barbette.

## Recent Important Additions to the British Navy.

By the launch of the *Revenge* from the works of Messrs. Palmer's Shipbuilding and Iron Company, Jarrow, on the 3d of November, and the floating of the *Royal Oak* from her building dock at Messrs. Laird's establishment, Birkenhead, the fighting strength of the British navy, says *Industries*, has been materially increased. These vessels belong to a class of eight, provision for the construction of which was made in the Hamilton Defense act of 1889, and they are considered on all hands to be, as regards strength and power for battle, superior to any first-class battle ships possessed by foreign powers. In their design all the elements upon which the efficiency of a battle ship depend have been embodied, in so far as the normal displacement of 14,150 tons permits. They are endowed with great offensive as well as defensive powers, with unusual protection for men, guns, and the vital parts of their structure, while their speed will be quite equal to that of some of the modern cruisers. In fact, speed, as well as handiness and power of maneuvering quickly, were made strong points in the original conception of the class to which these vessels belong. As the two ships

are identical in design and arrangement, the following description of the *Royal Oak*—the latest addition to the navy—will apply with equal accuracy to the *Revenge*:

The *Royal Oak* is built of steel throughout, on the longitudinal system, and measures 380 feet in length between the perpendiculars, with an extreme breadth of 75 feet, and will have, when complete for sea, a displacement of 14,150 tons on a mean draught of water of 27 feet 6 inches. A double bottom extends throughout the engine and boiler rooms and main magazine spaces, and, as showing to what extent unsinkability has been considered in her design, the hull is subdivided into 220 watertight compartments. The upper deck extends from stem to stern without a break, and above this is a shelter deck with two conning towers, one forward and the other aft, from either of which the vessel may be commanded in action. At the load water line she is protected by a belt of steel-faced armor, 8.5 feet in breadth, extending over two-thirds of her length, and tapering in thickness from 18 inches amidships to 14 inches at the ends. This belt is terminated at either end by transverse armored bulkheads, surmounting which is a 3 inch steel deck, and before and abaft the belt the protection is completed by a strong underwater deck of steel, terminating forward at the ram. The broadside over the belt is protected to a height of 9.5 feet above the water by 5 inch armor, with screen



STRANDING OF THE BRITISH IRONCLAD HOWE, FERROL HARBOR, SPAIN.

bulkheads similarly armored inclosing a central battery.

At the fore and aft ends of the armor belt, and rising directly from the protective deck, are barbettes of steel-faced armor 17 inches thick, in which are mounted the main armament, comprising four 67-ton breech-loading guns, two in each barbette. The auxiliary armament includes ten 6-inch 5-ton quick-firing guns, six of which are carried on the upper deck and protected by shields, while four others are mounted in armored casemates on the main deck, sixteen 6-pounder and nine 3-pounder quick-firing guns, besides machine guns and seven torpedo tubes for launching Whitehead torpedoes. Four of the tubes are on the broadside, one at the stem, and two submerged. The magazines are situated on either side of the engine and boiler spaces, immediately beneath the barbets, and, in view of the development of high explosives and quick-firing guns, precautionary measures have been taken for the protection of the ammunition supply during its passage from the magazines to the guns. The propelling machinery consists of two sets of triple expansion engines capable of developing, collectively, upward of 9,000 horse power with natural draught and 13,000 horse power with forced draught, producing speeds of 16 knots with open stokeholds and 17 1/2 knots with closed stokeholds. Each set of engines is contained in a separate compartment, the two being divided by a longitudinal middle line bulkhead extending the whole length of the magazine spaces. There are eight boilers, each supplying steam at a working pressure of 155 pounds per square inch. The auxiliary engines will number, altogether, sixty-nine, and will include steering engines, electric light engines, workshop engine, boat hoisting engine, and air compressing engines. Her bunkers will take 900 tons of coal and with this quantity it is estimated that she will cover a distance of 5,000 nautical miles at a speed of ten knots. When fully equipped and ready for sea, the value of the Royal Oak and Revenge will be about £1,000,000 sterling or \$5,000,000 each.

Treasures Found in Street Excavations.

In Rome the eighty-two miles of new streets made last year yielded the following "dugups": 905 amphorae. 2,360 terra cotta lamps. 1,824 inscriptions on marble. 77 columns rare marble. 313 pieces of columns. 157 marble capitals. 118 bases. 590 works of art in terra cotta. 540 works of art in bronze. 711 intaglios and cameos. 18 marble sarcophagi. 152 bass-reliefs. 192 marble statues. 21 marble figures of animals. 266 busts and heads. 54 pictures in polychrome mosaic. 47 objects of gold. 39 objects of silver. 36,679 coins.

Even this astonishing list does not cover everything, but embraces only those objects which were worthy of a place in the museums.

How a German Train is Started.

According to the Railway Review, an official of the Pittsburg and Lake Erie Railroad recently returned from Europe, referring to railway practice in Germany, says: "The roadbeds are about perfect, while the stations are simply magnificent, even in the most insignificant places being very fine. The roadbeds are quite rigid, but this is mainly due to the iron and steel cross ties that are used. The locomotives are fine pieces of mechanism, but their capacity is scarcely equal to those on this side of the Atlantic. Their entire passenger equipment is a way behind that in use here. Their trains, however, run like clockwork, and the connections are perfect. The method of starting trains is altogether unique and peculiar, and will cause local agents and trainmen to smile. The agent is an imposing, dignified and solemn-looking official, attired in elaborate uniform, literally gilt-edged, and he acts as master of ceremonies on the imposing occasion. When the train arrives at a station he is standing bolt upright in an almost military position, and he is on dress parade. One minute before the train starts he reaches up and taps a gong three times. Then a strange scene takes place, and it would seem that he had pressed a button, for at the last tap the conductor, who has been at the rear car, comes galloping along the entire length of the platform, shouting in German the name of every station the train will stop at. When the engine is reached he wheels about, and on his return quickly closes and locks the car doors, darts back to the van to his perch on the rear car, whistles thrice on a tin or metal whistle, which is instantly repeated by the brakeman at the front end, and the train starts.

Scientific American.

ESTABLISHED 1845.

MUNN & CO. Editors and Proprietors

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

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 belonging to Postal Union. 4 00
Remit by postal or express money order, or by bank draft or check.

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

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 32 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 to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to any address in U. S., Canada or Mexico on receipt of seven dollars. To foreign countries within Postal Union, nine dollars a year.

Building Edition.

THE ARCHITECTS and BUILDERS EDITION OF THE SCIENTIFIC AMERICAN is a large and splendid illustrated periodical, issued monthly, containing floor plans, perspective views, and sheets of constructive details, pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To builders and all who contemplate building this work is invaluable. Has the largest circulation of any architectural publication in the world.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, \$2.50 a year. To foreign Postal Union countries, \$3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, \$5.00 a year; to foreign countries, \$6.00 a year. To foreign countries, \$11.50 a year.

Spanish Edition of the Scientific American.

LA AMERICA CIENTIFICA E INDUSTRIAL (Spanish trade edition of the SCIENTIFIC AMERICAN) is published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number of La America is profusely illustrated with the most interesting industrial material printed in the Spanish language. It circulates throughout Cuba, the West Indies, Mexico Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. \$3.00 a year, post paid to any part of the world. Single copies 25 cents. See prospectus.

MUNN & CO., Publishers,

361 Broadway, New York.

The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO. Readers are specially requested to notify the publishers in case of any failure delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, DECEMBER 3, 1892.

Contents.

(Illustrated articles are marked with an asterisk.)

Table listing various articles such as Aluminum, malt; Mercury, how to purify; Motor, ether, De Suisin's; Navy, British, additions to; Notes from the Great Fair; Patents granted, weekly record; Photographs, developer—para-amidophenol; Photographic paper and films; Photography, color; Photos that yield colors; Pipe industry, the corn cob; Plans, position in December; Railway appliances, recent; Railway train, a great grain; Rapid transit in N. Y. City; Roads wanted, good prairie; Rope walking; Sodium, metal; Sugar, agavose; Sword trick, stabbing through abdomen; Telephone, the railway; Train, German, how started; Treasures found in Rome; Turmeric.

TABLE OF CONTENTS OF SCIENTIFIC AMERICAN SUPPLEMENT No. 883.

For the Week Ending December 3, 1892.

Price 10 cents. For sale by all newsdealers.

Table listing detailed contents of the supplement by page number, including sections on Architecture, Astronomy, Bacteriology, Botany, Civil Engineering, Forestry, Medicine and Surgery, and Miscellaneous.

EXTENSION OF RAPID TRANSIT FACILITIES IN NEW YORK CITY.

In addition to the many first-class horse and cable street railways which gridiron the city in all directions, no less than four of the finest avenues of the city, running north and south, are occupied and darkened by hideous iron bridges, known as the elevated railways. On some of the avenues the tracks are supported on iron columns that stand on the sidewalks. In other examples two rows of columns are set in the middle of the streets, where they seriously obstruct the travel of ordinary vehicles, and are the cause of many accidents. The noise of the steam trains, the dirty droppings from the cars, the cinders, gas, and escaping steam, all conspire to render the presence of these elevated railways a serious nuisance. Still, as a convenience to the public, they are almost indispensable, and by many are regarded as a highly desirable sort of nuisance. This is proved by the hosts of people who travel upon them; also by the fact that large and valuable buildings have been erected on both sides of the lines of these railways. Many of these buildings are tenanted by families, who, strange as it may seem, appear to take pleasure in the din and dust raised by the steam trains close under their windows.

The New York elevated railways are probably the most largely patronized and most profitable of any railway works in the world, mileage considered. They have an aggregate length of about forty miles. Last year they carried over two hundred and fifteen millions of passengers. The gross earnings were almost eleven millions of dollars and the net earnings about five millions of dollars.

In the early days of these railways the man who appears to have most highly appreciated their value and foresaw their great future was Mr. Jay Gould, a Wall Street broker. He bought out the Tilden and Field interests and so gained control of the works. The roads are admirably managed, and their extension in various directions would greatly add to the public convenience. But so strong is the passion of envy in the municipal heart that no further privileges can be extended to Jay Gould; he is making too much money already, and for fear he should make more, he must not be allowed to improve or extend his roads, even if the people thereby suffer.

So great is the need of additional facilities for rapid transit that a new commission was appointed some two years ago, under legislative authority, to lay out new routes, designate the plans for construction, and inaugurate a new and independent system for faster rapid transit in the city.

The commission has lately completed its work, the plans have been drawn, and the franchise is soon to be sold at public auction.

As a whole the new system consists of railways to be built underground. The main line is to run under Broadway, which is one of the greatest thoroughfares of the city; from this as a stem branches are to extend in various directions. In the northerly parts of the metropolis the tunnels give place to elevated structures.

The purchaser of the franchise must pay 10 per cent cash to the city, and must also deposit \$1,000,000 as a guarantee of full compliance with the terms of sale.

The company to build the road must be organized within two months. The capital stock of the company must be \$50,000,000, divided into 500,000 shares at \$100 a share. The company may mortgage its property for \$50,000,000. The limit of fare permitted to be charged is 5 cents. The company must give a bond of \$2,000,000 to protect the city and property owners from damages.

Work on the road must be begun within four months from the time the contract is awarded, and the road must be finished and in operation within five years of beginning it. The part between the City Hall and Fourteenth Street must be finished in two years, the part south of the City Hall and the parts between Fourteenth and Fifty-ninth Streets and between Fourteenth and Forty-third Streets on the east branch within three years, the part between Fifty-ninth Street and Harlem River within four years and the rest within five years.

In case the corporation fails to begin or finish the construction within the times limited, it forfeits its rights, and upon the forfeiture being adjudged by the court, the commissioners will have the power to advertise and resell the franchises of the road and so much of the road as shall have been constructed, and the proceeds of the resale will be applied to the payment of the expenses of the resale, then to the discharge of any liens which may have been created.

The articles of incorporation must be signed and acknowledged by not less than twenty-five persons. Books of subscription to the capital stock of the company must be opened at once. The capital stock must be held by not less than fifty persons, and the stockholders must choose thirteen directors. After the organization of the company and the sale of the stock the company must pay the State a tax of one-eighth of