

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. or Canada, \$3 00
One copy, six months, for the U. S. or Canada, 1 50
One copy, one year, to any foreign country...

Australia and New Zealand.—Those who desire to receive the SCIENTIFIC AMERICAN, for a little over one year, may remit £1 in current Colonial bank notes. Address 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 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, \$5.00 a year, for U. S. and Canada. \$6.00 a year for foreign countries...

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to any address in U. S. or Canada, on receipt of seven dollars.

The safest way to remit is by draft, postal order, express money order, or registered letter.

Australia and New Zealand.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for a little over one year on receipt of £2 current Colonial bank notes. Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information. (2) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, \$5.00 a year, sent prepaid to any part of the world. Single copies, 50 cents.

NEW YORK, SATURDAY, JULY 23, 1887.

Contents.

(Illustrated articles are marked with an asterisk.)

Table listing various articles such as Alabandine, Axle, wagon, lubricating, improved, Ball lightning, Boats, fast, new, Books and publications, Bridge, Mississippi, new, Bridge, suspension, curious, Brown reins or saddle leather, Business and personal, Bury's sebate, Calf weaner, improved, Car coupling, improved, Cart, dirt, self-loading, Clyde-built vessels, fast steaming, Contagion, carriers of, Electric light in telemetry, use of, Fire, cause of, curious, Fluoride of nitrogen, Folding rack for solar printing frames, Fountain for projection, circulating, Glass, plating, Guns, magazine, Gymnastics at school, Harness collars, Horse collars, pad for, Ice plow teeth, fastening for, Insect destroyer of boots and shoes, Inventions, agricultural, Inventions, engineering, Inventions, index of, Inventions, mechanical, Inventions, miscellaneous, Iodine stains, removing, Items of interest, many, Krupp, Alfred, Lantern slide, novel, Lubricator, vehicle, improved, Mammal, an extinct, Mount Pilatus railway, Nitro-glycerine in shells, Notes and queries, Nutshell cutter for confectioners, etc., Oak, gigantic, Photographic notes, Railway, Mount Pilatus, Respiration, artificial, simple method of, Sound, miracle of, Stand, convertible, Steamships, fast, two large, Tramway, long, Type composing and distributing machine, Wealth, does labor produce all

TABLE OF CONTENTS OF SCIENTIFIC AMERICAN-SUPPLEMENT No. 608.

For the Week Ending July 23, 1887.

Price 10 cents. For sale by all newdealers.

Table listing sections I through X with page numbers. I. BIOGRAPHY.—Antoine Laurent Lavoisier.—The life of the great French chemist.—His tragic death.—Translation of a hitherto unpublished letter by him to Black, the great English investigator.—His portrait by David.—1 illustration. 9637
II. CHEMISTRY.—Iron and Steel Analysis.—By J. JAS. MORGAN.—The various leading methods for this work described, with the apparatus needed.—2 illustrations. 9636
III. ELECTRICITY.—Electric Lamp for Divers.—An electric lamp of 100 C. P. fitted to a diver's helmet, to be actuated by a dynamo—1 illustration. 9631
Pellet's Absolute Amperemeter.—A recent French apparatus, described with formulas for its construction.—3 illustrations. 9634
Systems of Distribution of Electricity.—By ELI H. THOMSON.—The seventh Sibley College lecture of the 1887 course.—A full review of the present state of this branch of electrical engineering.—18 illustrations. 9632
IV. ENGINEERING.—Jardin's Hydraulic Press and Injection Pump.—A new hydraulic press for extracting oil.—Its construction for hand and for steam power.—5 illustrations. 9628
The Panama Canal.—A recent review by DR. WOLFRED NELSON of the work on the Isthmus, with special reference to the difficulties encountered. 9624
The Port of Cadiz.—An exhaustive account of the great engineering works at this port and their cost.—7 illustrations. 9625
V. GEOLOGY.—Natural Gas.—The outlook for natural gas in the State of New York.—Prof. Henry Wurtz's remarkable prophecies made in 1871. 9630
VI. METALLURGY.—Composite Steel and Iron.—The defects of steel, its sensitiveness to damage, and attempts to produce a new material free from these troubles. 9635
VII. MISCELLANEOUS.—Correction.—The wave theory of sound considered.—Correction in Prof. H. A. MOTT'S late article on the above subject. 9635
MacCord's Scale.—Note by Prof. MACCORD on the use of his table for gear cutting. 9635
Schadow's Group of the Princesses.—Statue of the princesses of the house of Mecklenburg married to King William of Prussia and Prince Ludwig of Prussia respectively.—1 illustration. 9623
Taking a Bullet from the Brain.—A remarkable surgical operation described. 9637
The Cycle and the Road.—By the Rev. J. M. TAYLOR.—The Oarsman tricycle reviewed and described by its inventor; use of the cycle in war. 9629
VIII. NAVAL ENGINEERING.—Launch of H. M. S. Victoria.—A account of the launch of this ironclad from Sir William Armstrong's yard, with his speech on the occasion, giving the progress of naval engineering. 9627
The French WarShip Neptune.—A recent addition to the navy of France, launched at Brest; her armament of steel plate and cellulose.—3 illustrations. 9625
IX. PHYSICS.—Curious Optical Illusion.—An interesting experiment in physics without apparatus.—1 illustration. 9636
X. TECHNOLOGY.—Diffusion Plant for Cane Sugar.—The diffusion process applied to cane sugar; a full description of a recent apparatus.—5 illustrations. 9661
Practical Lithography in Half Tones.—By J. HUBBARD, Serkt. Major. Rec.—A new process of photo-lithography, with formulas. 9660
Refined Slag in the Manufacture of Glass.—By A. D. EILBERS.—An interesting use for this refuse material. 9630

ALFRED KRUPP.

The news of the death of the chief proprietor of the great Krupp steel works, at Essen, Prussia, has just been cabled to this country. On July 14, at his villa near Essen, Alfred Krupp breathed his last. He has been aptly classed with Bismarck and Moltke as the third of Germany's warriors, as his cannon did such fearful execution in so many battles for the fatherland.

Though it was in Alfred's hands that the works attained their great magnitude, he was not their founder. His father, Friederich Krupp, was born in 1787, and was proprietor of a small "hammer forge" driven by water power, and situated near the present Essen. In 1816 he moved to Essen, and on a locality in the center of the present works erected his modest shop. Here he remained to the day of his death, executing a variety of small work in steel. The works were of the smallest scale. The age of steel had not yet come. Four years before he moved to Essen, his eldest son was born. On April 26, 1812, Alfred Krupp first saw the light. On October 26, 1826, his father died.

The works were placed in charge of Alfred, who conducted them for his mother Theresa. For many years his younger brother Hermann worked as a workman in the forge. The growth of the business was very slow, and long before it attained any size, the brother Hermann left it and entered upon another line of work. On February 24, 1848, the firm was given the name of "Friederich Krupp," in honor of the founder of the Essen works.

The growth of the works became more rapid as steel was more widely used. In 1851, Krupp was already in the front ranks of the world's steel producers. He sent to London world's fair of that year a great block of steel, the largest that up to that time had ever been produced. Agricultural and engineering appliances received most of Krupp's attention until the manufacture of steel cannon was undertaken by him. In the Paris exposition of 1867 a prize was awarded him for his cannon, that four years later were to be a powerful factor in bringing about the conclusion of the Franco-German war. He was one of the early advocates of steel guns, and at an early period saw that the successful breech-loading cannon was to be the gun of the future. The size of his pieces increased year by year. He maintained a hot rivalry with Sir William Armstrong in the production of the largest and most powerful gun. With the exception of England and the United States, almost all of the principal countries bought cannon at Essen. The more peaceful branches of his business were not neglected, as massive steel forgings of all kinds of axles, crank shafts, locomotive tires, and the like were and are made in vast quantity at Essen. In 1864, at the conclusion of the Danish war, letters of nobility were offered him by the King of Prussia, but he refused them.

The works, and incidentally the town of Essen, had grown with unprecedented rapidity. The economic triumphs of his life, in developing such an establishment, are perhaps the greatest, exceeding in their beneficial aspect his metallurgical exploits. His father's works, it is said, began with two workmen. In 1860, 1,764 hands were in Alfred Krupp's employ. In 1870, 7,084 men were on his rolls. To-day, including the works, blast furnaces, and mines, nearly 20,000 workmen, representing with their families, as it is computed, about 66,000 souls, are maintained by the Essen works and dependencies. The establishment is classified by sections: 1, the factory at Essen; 2, three coal mines at Essen and Bochum; 3, five hundred and forty-seven iron mines in Germany; 4, several iron mines in Spain north of Bilbao; 5, the blast furnaces, in 1885 eleven in number; 6, a range for trial of artillery at Meppen; 7, other smaller ranges; 8, four steamers for marine transport; making eight sections into which the business is divided.

The management of the works is in the hands of a syndicate of the owners, who consult with Friederich Alfred, the only son of the late proprietor, as to the more practical details of the work.

The town of Essen now numbers nearly one hundred thousand inhabitants. Outside of the city limits a great portion of the employes have their homes, lodgings to the number of four thousand being owned by the firm.

NEW FAST BOATS.

The New York is the name of a new and splendid passenger boat designed for service on the Hudson River. She is 311 ft. long; depth moulded, 12 ft. 3 in.; hull of iron; tonnage, 1,552; feathering paddle wheels, 30 ft. diameter; three boilers each 33 ft. long, 9 1/4 ft. diameter, working pressure 50 lb., furnish 3,850 horse power. Her average speed is expected to be 23 miles per hour. On a trial trip on the 13th July, she is reported to have exceeded this rate.

The Now and Then is a new steam yacht built by Herreshoff & Co., for Mr. Norman L. Munro, of New York. This boat is 85 ft. long, 10ft. beam, draught 3 ft. 3 in. On the 12th July she ran from Newport to New York, 170 miles, in 7 hours 4 minutes, being an average of 24 miles an hour. This is claimed as the fastest time for a steam vessel, for any considerable distance, on

this side the Atlantic. The parties interested make considerable brag over her performances.

The speeds of both the above vessels are excellent, but they fall considerably short of the latest engineering realized in England. For example: The new passenger steamer Queen Victoria, of the Manx line, plying between Liverpool and the Isle of Man, is 340 ft. long, 39 ft. beam, 24 ft. depth, gross tonnage 1,500 tons, engines 6,000 horse power. Believed to be the fastest merchant steamer afloat. She lately steamed from Greenock to Liverpool, about 240 miles, in 9 hours 23 minutes, her average speed being 25.62 miles per hour.

The Prince of Wales, another boat of same build and dimensions, is expected to have the same speed. The Cunard steamer Etruria, plying between New York and Liverpool, sometimes steams 557 miles in 24 hours, being an average of over 23 miles per hour. J. & G. Thompson, of Clydebank, are now building two new steamers which are to surpass the Etruria in speed.

The Italian iron clad Dogali, 267 ft. length, 37 ft. beam, mean draught 14 ft. 6 in., has a speed of 23 miles an hour.

The new German war steamer Greif can make 25 1/2 miles per hour. The Thornycroft torpedo boat lately built at Chiswick for the Spanish government is 147 ft. 6 in. long, 14 ft. 6 in. beam, and draws 4 ft. 8 in. water. On a recent trial trip, tide in her favor, she attained a speed of 33 1/2 miles an hour with the tide, and a mean speed of 30 miles per hour, with and against tide.

A torpedo boat lately built by Yarrow & Co., for the Chinese government, is 128 ft. long, mean speed 27 1/2 miles per hour. The same builders have delivered to the British government boats of the Falke type that average 26 1/2 miles per hour, 135 ft. long, 14 ft. beam, boilers 1,660 h. p.

Torpedo boat number 79, same builders, reached a mean speed of 26 1/2 miles per hour; 125 ft. long, 13 ft. beam. Engines 1,000 h. p.

The twin screw torpedo boat recently built at Poplar, by Yarrow & Co., for the Italian government, attained a mean speed loaded of 28 miles per hour. Length 140 ft., beam 14 ft., draught 5 ft. 4 in., displacement 100 tons. Engines 1,400 i. h. p.

It is doubtful if there are any corresponding vessels in our waters that can equal the foregoing in point of speed, nor is there any present evidence of our ability to construct them. We are building new war ships, but before they are finished they will be out of date in respect to speed. Not one of the new vessels is expected to run as fast as the boats above mentioned.

Whether for use in war or peace, the first requisite, in these active days, is high speed.

In the forthcoming international yacht race, in which sailing vessels only will compete, it is to be hoped our transatlantic rivals will, as before, suffer defeat; but if the race were to be with steam vessels, it is certain we should be left in the lurch.

Is there no one in this great country possessed of means and brains enough to produce a steam vessel that shall beat the world?

Magazine Guns.

The repeating rifle of the German army differs from the ordinary rifle in the fact that the stock, instead of stopping short where it is grasped by the left hand, is prolonged to within an inch of the end of the barrel. This constitutes the reservoir of cartridges. The firing consists of three movements—the "ready," during which each man gives a sharp turn to the right to a lever above the lock of his gun, and the familiar "present" and "fire." The company stand four deep, the two front ranks firing while the two rear ranks recharge their magazines. So rapid are the movements that the magazine is emptied, with a perceptible allowance each time for rapid aim, in ten seconds. To think of what would happen to any body of men exposed to half a minute of firing like this is simply appalling.

It is all very well for a Russian governor to issue orders to his troops calling upon them to remember that battles are won by courage, and not by repeating rifles; but the moral effect of the new weapon both upon those using it and those opposed to it must be enormous. To be able to wait until the enemy, in whatever form he may be, is within a few yards of you, and then to deliver your fire upon him at the rate of a shot a second, is quite enough to revolutionize all attack formations.—Broad Arrow.

Butyl Sebate.

Butyl sebate is a colorless liquid of an agreeable and aromatic odor and a burning taste. It is insoluble in water, miscible in all proportions with alcohol, but less readily with ether. Its density at 0° is 0.9417. It boils, under ordinary pressure, at 344° to 345° without decomposition. A few drops placed on a glass rod burn with a very luminous flame, the nucleus of which is a splendid deep blue. Strong sulphuric acid decomposes it, even in the cold. Caustic potassa saponifies it, ammonia gives a white precipitate of sebamide in microscopic crystals.—G. Gehring.