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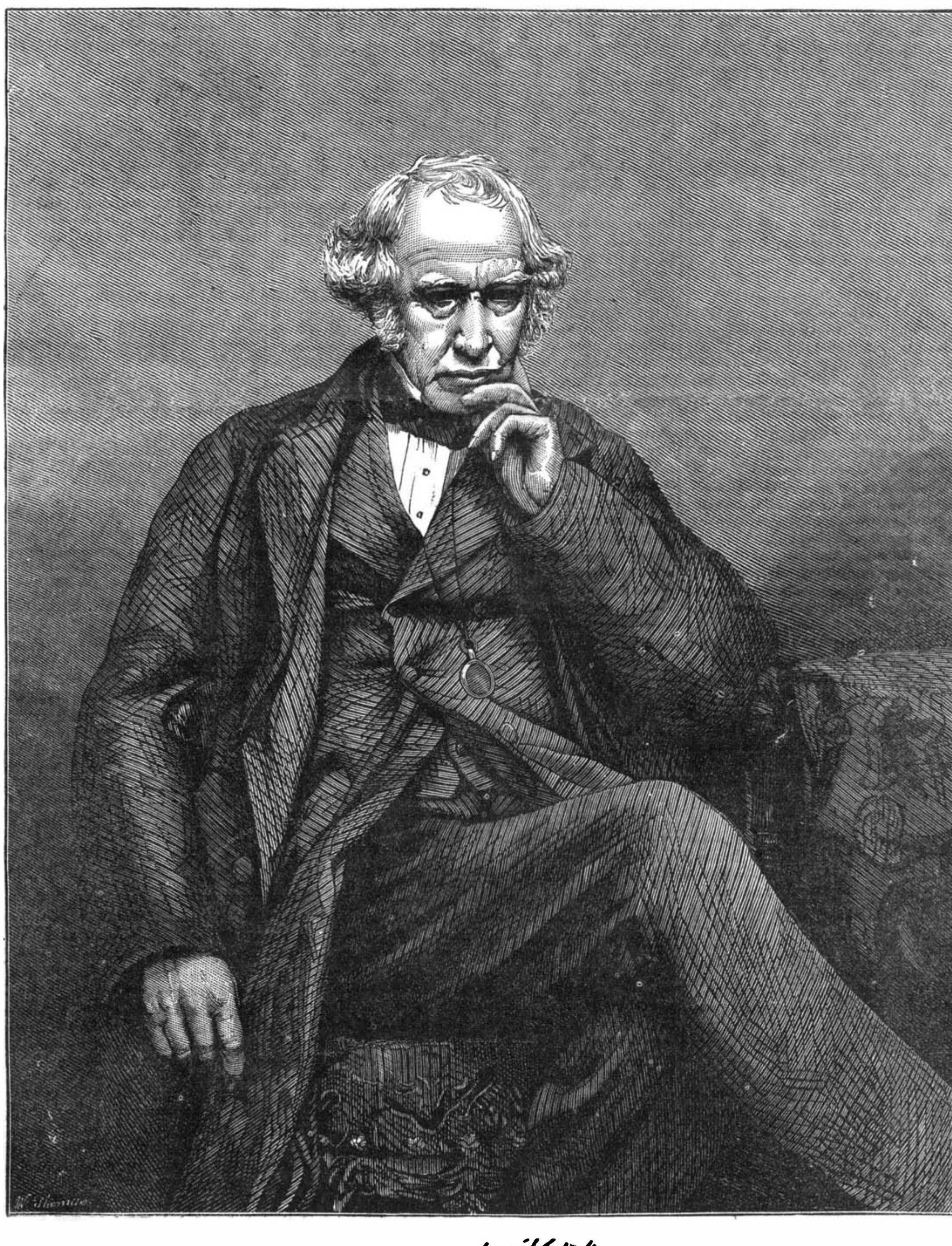
SIR WILLIAM FAIRBAIRN.

Sir William Fairbairn, the distinguished English engineer, whose portrait we give herewith, died on the 18th of August last, at the advanced age of 85 years. One of the first to undertake the construction of iron vessels in England, thus aiding in founding a manufacture in which that country has, nntil lately, maintained an unrivaled supremacy, the first to substitute iron for wood as shafting for cotton mills, the inventor of the riveting machine, the author of experiments and works which have changed the whole practice of iron construction: to few men do the engineering profession and the great metal industries of the world owe so large a debt.

The record of the long and useful life, now closed, shows, during early years, that persevering struggle against limited means and humble birth, which has characterized the initial efforts of many of the most famous men. Born in the year 1789, at Kelso, on the Tweed, his sole education consisted of such rudiments as were taught at the parish school. With a knowledge of writing and arithmetic which is described as "imperfect," he entered upon an apprenticeship as an engine wright, in the Percy Main Colliery, and when his time had expired worked for two years in London as a journeyman. Travel in those days was a necessary part of every workman's education, and Fairbairn availed himself of opportunities to visit various portions of the kingdom, working a short time at every place, and, while not neglecting his books, posting himself thoroughly in every particular of the practical portion of his trade.

About the year 1817, we find him settled in Manchester in partnership with Mr. Lillie, founding a firm which steadily progressed and became known as the leading machine makers of the city. From this period, it appears, date the investigations and inventions which eventually rendered their author one of the greatest of modern engineers. With the limited space at our disposal, it is impossible to review all these works in detail, nor is it necessary, since the published reports of the English scientific societies of the period and Fairbairn's own volumes contain the full descriptions. One of his earliest inventions was that, already alluded to, of substituting iron for wood as shafting in cotton mills, and the introduction of lighter and improved machinery in factories, more simple than the contrivances then in use. These modifications resulted not only in the reduction of the cost of machinery, but allowed of speeding the same from 40 to 160 revolutions per minute. Then followed the introduction of



Yours faithfully W Fairbairn

a double flued boiler for alternate firing, productive of economy of fuel and consumption of smoke, improvements of feeding apparatus in millstones, the adoption of a better principle of suspension and the use of ventilated buckets in water wheels, the invention of the riveting machine, and, finally, in 1836, the introduction of improved architecture for factories.

Experiments upon canal boats engaged Fairbairn's attention in about the year 1821, and through these researches he was led to examine the advantages of iron for the construction of vessels. One of his earliest attempts was the building of a small iron ship, which was set up at his works and carted through the streets of Manchester to the water. His experiments thus begun resulted, five years later, in his development of iron construction in ships of the largest class, at Millwall, London, on the premises afterward occupied by Mr. Scott Russell. Here more than one hundred vessels were built by Fairbairn's firm, ranging from frigates to small boats. It is to Fairbairn that we owe the repeated enforcement of the fact that a ship is, in many respects, to be regarded as a huge beam or girder.

In conjunction with Mr. E. Hodgkinson, the subject of our sketch conducted a series of experiments, resulting in the determination of the comparative strengths of hot and cold blast iron, of the tenacity of boiler plates of various thicknesses, of the best form of section of cast iron beams, of the resistance of hollow tubes to outside pressure, and also in the general use of wrought iron plate girders in ordinary building operations. One of the first edifices ever constructed of iron was a corn mill, manufactured in 1838 by Fairbairn, the castings, etc., of which were sent to Constantinople, where it is still standing.

Mr. Fairbairn's experiments on tubes were conducted during the erection of the celebrated tubular bridge over Menai Straits; and although considerable controversy was engendered at the time, the original plans of Robert Stephenson were modified in accordance with the results. Stephenson suggested a circular tube supported by chains, but Fairbairn found that a rectangular structure, strengthened by a series of cells at the top and the bottom, and suspended, without supports, from pier to pier, was best adapted to the stipulated conditions.

Subsequently to this period, Mr. Fairbairn made researches into the strength of wrought iron plates and rivets for shipbuilding, and also into boiler explosions. He believed that steam could be worked with greater economy at a pressure of from 150 to 200 lbs. per square inch, and that at a high rate of expansion, with two or more cylinders. With this view he first constructed the Lancashire boiler, and subsequently, in 1872, a fire tube boiler, which was tested safely to 400 lbs. per square inch, and found to stand uniformly the first mentioned high pressure.

Mr. Fairbairn was one of the founders and afterwards President of the British Association. His published works, besides a large number of papers on special subjects, are: "Iron, Its History and Manufacture," "Mills and Mill Work," "Application of Iron to Building Purposes," "Iron Ship Building," and three series of "Useful Information for Engineers," all standard volumes of reference. He was a corresponding member of the Institute of France, a Chevalier of the Legion of Honor, and a Baronet, the last named honor being conferred upon him in 1869.

NEW INDUSTRIAL RESOURCES OF FRENCH COLONIES.

A French commission has recently carried on extensive investigations into the resources of the colonies of France, with a view of determining as to whether certain indigenous productions can be utilized for industrial purposes. From the results elicited, it appears that active measures will be taken for the introduction of some products and for the cultivation of others. Special attention is to be given in the Réunion Islands to the cultivation of vanilla. Plantations are established, which will be renewed every ten years, and are designed solely for the propagation of healthy slips for distribution, it being hoped that, by this means, the gradual disappearance of healthy plants may be checked.

The Tahiti Islands furnish the finest variety of mother of pearl now known; but commerce therein is at present carried on by English and German merchants. French government officials have been supplied with funds, and efforts will, through them, be made to establish a French trade, both in this substance and in tortoiseshell. Ramie is found in large quantities in Tahiti, but is too costly a production to figure in commerce. Another variety, also adapted to textile manufacture, has been recognized in the Antilles and in French Guiana. The crop averages about 3,420 pounds to the acre, the white fibers being some 6 feet in length, and worth 18 cents per pound. This yield per acre is superior to that of sugar. The sap of the *balata minusops*, or Guiana gutta percha tree, was rejected, in 1867, as valueless, on account of the friable properties of the resulting product, and the resinous effervescence which appeared thereon. Some fragments of the plates employed in the tests have lately again been experimented upon, and the material is now found to possess all the qualities of good gutta percha. The former defects were due to bad preparation. Further investigations into this product will be inaugurated.

The commission has also found a large deposit of valuable fertilizer in the bones of the cod from the fisheries of St. Pierre and Miguélon. The remains are rich in phosphate of lime, and contain 21 per cent of ossein.

JUMPING OF GAS FLAME.—This is caused by water condensing in some low place in the fittings. Have the pipe cut, and a T piece put in, with a small tap, so that water may be let out before turning on the gas.

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Contents:

(Illustrated articles are marked with an asterisk.)

THE TORPEDO PRACTICE AT NEWPORT.

The torpedo practice during the recent fleet drill at Key West, it will be remembered, was not exactly of a nature calculated to impress the public mind with a sense of the tremendous destructive force of bags of powder poked out on the ends of sticks; and consequently, since that time, slurs upon our naval torpedo system have been more frequent than commendations for the efforts of the very zealous corps of officers, who, for several years past, have been quietly working and experimenting, at their station on the bleakest of the islands in Newport Harbor. With the publication of the excellent results of the recent trials at Newport, however, the cloud which has obscured the labors of the experimenters is dispersed; and we must admit that, in lieu of sticks and powder sacks, the torpedo officers, Professor Moses Farmer and Lieutenant John P. Merrell, have developed for us a means of warfare of terrible efficiency.

The recent trials took place on successive days, in the presence of a congressional committee, and a large concourse of spectators. The initial experiment was the explosion of a ground torpedo of fifty pounds of powder enclosed in an iron-cased shell. This was blown up by Professor Farmer's dynamo-electric machine. Two fifty pound torpedoes were then fired by the contact of a boat with the circuit closers; and the blowing up of apparatus improvised from ordinary water breakers followed, to show how easily these destructive weapons could be constructed from the simplest materials, and without special machinery.

The plane table was used in the explosion of a three hundred pound torpedo, the current being established at the instant the approaching vessel was seen through properly adjusted sights. A column of water, two hundred feet high, marked the tremendous violence of the escaping gases. An attempt was made to blow up an old hulk, by the aid of submarine torpedoes; but through some mal adjustment of the latter, the vessel, though badly damaged, was not destroyed. An excellent feature of the operation was, the firing of a torpedo through a mile of cable, the main object being to show that this means of offense or defense could be safely carried on beyond the range of the enemy's fire. An explosion of 500 igniters simultaneously, proving that several mines could readily be blown up at once, concluded the experiments of the first day.

An old coal schooner formed the objective point of the second day's operations, the interest of which was greatly hightened by the participation therein of the new ironclad torpedo boat Intrepid. This vessel is a small steamer, built expressly for torpedo manœuvering. She steams at a rate of about nine knots per hour. The hulk being stationed out in the stream, the Intrepid backed astern for about a mile in order to get good way on, and then rushed ahead at full speed. The Harvey torpedo, which she towed on her starboard side, was brought in contact with the hulk and, at the instant of touching, fired by an electric fuse, smashing in a huge hole in the vessel's side. Immediately the Intrepid dashed up for a second trial, and this time exploded a spar torpedo, rigged out from her port side, directly under the bottom of the fated craft. A fearful explosion, followed by the hurling aloft of great fragments of wood and masses of water, showed that the weapon had done its work. The ship was literally torn to pieces, leaving but a few large portions drifting about. A second torpedo blew these out of existence, and the total disappearance of hulk marked the close of, probably, the most successful extended series of torpedo experiments conducted under naval auspices in this country.

RECENT METALLURGICAL RESEARCHES.

Some facts of interest to metallurgists, in gold and silver, are to be found in a recent memorandum of Mr. Chandler Roberts, chemist to the British Mint. We learn that the spectroscopic assays, begun last year, have been successfully prosecuted, giving results that prove that, for purposes of quantitative analysis, the spectroscope must form an auxiliary of the highest value. It is stated that differences of composition amounting to less than $\frac{1}{10000}$ part may thus be determined.

Mr. Roberts quotes the interesting results obtained by M. Serol, of the Paris Mint. This chemist finds that, while a silver copper alloy containing 71·893 per cent of the former metal is homogeneous, in all alloys containing more silver than this amount the center of the solidified mass is richer than the interior. A mass of 112 ozs. of silver copper alloy, melted, carefully stirred, and allowed to solidify, was found not to be homogeneous. The silver accumulated at several points, not bearing any apparent relation to the geometrical form of the mass. A homogeneous plate was at last obtained by assaying all parts of a plate of standard silver and cutting off those portions which varied from the required standard. Perfectly pure gold was obtained by reducing the chloride of gold with oxalic acid and fusing in a clay crucible with bisulphate of potash and borax. The electrolysis of cyanide of gold and potassium gave a product containing 999·9 of fine gold in 1,000, while reduction of the chloride with sulphate of iron and subsequent fusion gave only 999 85.

PROTECTION FROM LIGHTNING.

During a recent thunderstorm in the village of Trumbull, Conn., a family of three persons, husband, wife and child, who had taken refuge on a feather bed, were instantly killed by lightning; the house had no rods. In the same village, during the same storm, a dwelling house, which had two lightning rods upon it, was seriously damaged. Several of our readers, who have seen the accounts of these disasters, and others who cite analagous examples, have had their faith in feather beds, as a place of safety during thunder storms, severely shaken; while some of them would fain believe that lightning rods serve to destroy rather than to preserve life and property. We are asked to print something upon the subject; and we cheerfully comply, premising, however, that there is little that is new to be said, and that the subjoined information has for the most part been heretofore reiterated in our columns.

ARE FEATHER BEDS A PROTECTION FROM LIGHTNING?

Feather beds are not a protection from lightning, and the popular belief that they are, doubtless results from a misapprehension of the laws that govern the passage of electricity. The human body is a better conductor of electricity than feather beds or other objects ordinarily contained in the apartments of dwellings, and therefore, *a priori*, when the lightning enters an apartment, the human body is likely to form one in a chain of inductions, determining the path of an electrical discharge, unless better conductors are in its vicinity to divert this action.

WHAT IS THE SAFEST PLACE DURING A THUNDERSTORM?

The only place of absolute security in a thunderstorm is an iron building; or next in safety is a building properly protected by lightning rods.

Houses constructed entirely of iron manifestly stand in no need of lightning rods at all, because the electric fluid, on striking so good a conductor, would rapidly diffuse itself in all directions and flow into the ground, provided, of course, that the construction of the building is such as to allow its free escape.

ARE LIGHTNING RODS OF ANY REAL VALUE?

Unquestionably they are. Examples are numberless where the lightning has been seen to fall upon the rods of buildings and descend harmlessly to the earth; while the fact is undisputed that the principal damages suffered from lightning are in connection with buildings that are not provided with conductors. Notwithstanding these facts, some people are apt to be indifferent whether their houses and stores are provided with lightning rods or not, and are always ready to give an example where some building so provided was struck in spite of its protection. Such cases are quoted by the old fashioned "practical men" with much satisfaction, because they hail in them what they are pleased to call the victory of their sound common sense and the discomfiture of the scientific man. This class is, however, rapidly diminishing in numbers under the influence of the extensive diffusion of scientific education among the people.

It may be well to assure unbelievers that the efficacy of the lightning rod is no longer an open question, and that any