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THE EXHIBITION OF IRON AND STEEL.

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THE BESSEMER PRODUCTS—SUCCESS OF THE SWEDES.

Those interested in the iron manufacture and in the progress of the Bessemer process, will find much in the Exhibition to interest them. The circle next inside of that devoted to machinery is in most cases chiefly devoted to metallurgical exhibitions. Many of specimens present little that is of interest, but there are some that are deserving of attention. In the Swedish department there is one of the most instructive collections of specimens of Bessemer steel containing different per centages of carbon. They are in the form of round bars which have been torn asunder by Mr. Kirkaldy's testing machine in London, to ascertain their relative tensile strength as well as their ductility. The number of bars is quite large and the experiments appear to show that nine tenths of one per cent of carbon gives the greatest tensile strength. Above that proportion the steel loses tenacity, as it approaches the condition of cast iron. A number of small bars are broken across to show the difference of fracture caused by repeated meltings, up to fifty times. The change due to this cause appears to be very slight, while that consequent on the varied proportions of carbon is of course very great. The Swedes have succeeded in accomplishing what many makers have been unable to do, viz., to draw fine wire from the Bessemer metal. A large coil of No. 47 is shown, and it is said that they draw even finer numbers than that. Specimens of cutlery are also exhibited, and warranted by the makers to be of excellent quality. A model is shown of a calcining kiln much in use in Sweden, and with which any percentage of sulphur less than four per cent may be wholly expelled from the ores. It is much higher than usual and tapers to a less diameter towards the top. It is fed with gas from the furnaces near the bottom, air being drawn in through holes in the brick work at intervals for a considerable portion of its hight. A high temperature is attained, the heat being as great as can be employed without agglomerating the ore, and doors are provided near the tweers by which in case of partial sticking together of the ore it may be loosened. The charge is drawn through doors at the bottom. Of course the display of ores is very fine from this country.

In the Russian department the only objects for which the exhibitors can claim superiority are horseshoe nails of their usual excellent quality of iron, and the beautiful Russia sheet iron with its non-oxydizing skin, with which we are so familiar in America, but which is so little used elsewhere.

THE FRENCH METALLURGICAL DEPARTMENT.

The most remarkable exhibitions by French makers are contained in special buildings in the grounds. In one of these Messrs. Petin, Gaudet & Co. exhibit two halves of a large steel ingot weighing 25 tuns, which has been broken across to show the fracture. It appears remarkably free from the porosity generally existing in these ingots before hammering. A steel crank-shaft weighing 7½ tuns and about 18 inches in diameter is also exhibited, and a steel gun of 9½ inches bore and 16 tuns weight, besides a number of other articles of steel, as shot, rails, tires, etc., representing the usual branches of this manufacture. The display of iron is equally interesting. There are a number of rolled girders of varying hights, from 3 feet 3⅜ inches downward, and of lengths increasing as the hights diminish, the weight of each specimen being not far from 2½ tuns. A rolled engine-beam 36 feet long, 5 feet 11 inches wide in the center, and 2½ inches thick, is also shown. This firm, who have been able to compete very successfully with the large Sheffield makers of armor plate, exhibit a plate weighing nearly ten tuns and approaching very nearly in thickness to the crop end sent by Messrs. John Brown & Co., being 11⅞ inches thick. The quality of iron produced at these works is very good. The ore is largely brought from Sardinia, and some fine specimens of this are exhibited.

On the opposite side of the main entrance to the grounds from this building is another, containing the collection of objects sent by the Compagnie Anonyme des Forges de Chatillon Commentry. The works of this company are among the most extensive in France, and the amount of iron produced, I am informed, is about one twelfth of the total production in the whole country. The most remarkable object in the collection is a rolled girder, of which a number were made for some docks at Bordeaux, of the extraordinary hight of 3 feet 7½ inches, the width of the top and bottom flanges being very nearly 12 inches. Another piece, of the same section has been curved in a vertical direction. These girders are not welded, as some might be inclined to imagine, but have been regularly rolled from piles formed of suitable slabs. The same company also send specimens of armor plate, but though of what would but a short time ago have been considered remarkable thickness, they do not approach those exhibited by the last mentioned firm or the English makers. Whether their rolls are heavy enough for such sizes or not I do not know.

At a little distance from these is another building devoted exclusively to the products of the works of Mr. Schneider, at Creusot. In addition to two large machine engines, and a fine winding engine for a mine, which I shall have occasion to mention in a future letter, there are some very interesting specimens of iron and steel. The exhibitor has shown great judgment in the arrangement of the pieces. They are divided into classes according to the percentage of carbon contained, or the process by which the manufacture has been carried on, whether it be by puddling or the Bessemer process, by squeezing or by hammering in the subsequent treatment, or finally whether the hammer or the rolls have been employed to produce the finished article. In each class he gives first a specimen of the primitive bloom and then successive samples showing the condition of the material in each stage of its working. A number of iron rails are exhibited, broken so as to show the fracture, but though there are some that look very well, the majority appear too soft for proper durability. Accompanying his exhibition of products are very interesting models showing the entire arrangement of the various buildings composing the works, with the facilities for the shipment of goods by railway. The walls are also hung with diagrams and tables illustrating the system of education for the children of the operatives in schools connected with the establishment, and also other matters of interest, such as the average prices of labor of all kinds, separately and collectively, for each year since the works have been in operation. This is very simply and clearly represented by diagrams, and the gradual and almost uniform increase that has taken place is very noticeable.

THE BRITISH IN DEFAULT.

In the British department it seems as if the objects exhibited hardly represent fairly the state of the iron and steel manufacture in that country. There is nowhere any imposing display, and with a few exceptions nothing that is not equaled by articles sent from other countries. Many of the most prominent makers have sent little or nothing, relying on their already world-wide reputation to sustain their claims to notice. Thus, I find nothing from Messrs. Cammel & Co., of Sheffield, while the Bolton Iron and Steel Company content themselves with sending a plain locomotive crank shaft, remarkable for nothing as far as the eye can judge. The Low Moor and Bowling companies, which, before the days of steel, stood so high in the manufacture of locomotive tires, and still have the credit of producing the best qualities of boiler plate and other kinds of soft iron, send specimens of their products, some of which have been subjected to severe tests of flanging. In one we have a plate pressed into the shape of a high crowned hat, in another a thin sheet has been folded over a number of times in directions at right angles to each other without cracking at the corners, and other similar tests designed to exhibit the thorough tenacity of the iron. In addition to their iron they also show specimens of their beautiful coal, which has so much to do with the excellence of the former. The exhibition of the Earl of Dudley's works is also worthy of notice for the good quality of the iron and the variety in its characteristics, from very soft to crystalline or steely.

AMERICAN MINERALS.

In the American department little or nothing is shown in the way of finished products, but there is a fine and well arranged collection of specimens of ores and coals which give some idea of the natural capabilities of our country for this most important branch of industry. SLADE.

The American Lattice Bridge.

It may be considered as a generally received opinion among engineers of the present day—since it is even tacitly conceded by its once strenuous opponents—that the open web girder offers superior advantages, upon the whole, to the older and more solid sided form. Were any proof required of the general favor with which they are now regarded by the profession, two out of three large bridges erected would bear witness to the fact. When, twenty years ago, a commission was appointed to inquire into the application of iron to railway structures, its verdict respecting the open web form was that "lattice girders appear of doubtful merit," and Mr. Fairbairn in one of his works expresses a nearly similar opinion. In spite, however, of all the cold water thrown upon the new claimant for engineering consideration, it has continued steadily to make way; and it is interesting, and not a little amusing besides, to contrast its present position with that which was virtually predicted for it. The disparaging statements and condemnatory arguments urged against all girders of the open-sided form on their introduction, serve to forcibly point out that men of scientific attainments are not exempt from those foibles and prejudices which some people fondly imagine are confined to the less educated and instructed world at large. The commission was evidently wedded to the old system and could not perceive that their favorite example embodied all the particular attributes and features of the ancient methods of construction. Any one who glances at the wo different forms, beholds in the cumbersome, shapeless proportions of the solid-sided girder, the presence of that solidity and massiveness which formed a distinguishing characteristic of the days when science was unknown, or at any rate unpracticed, and when brute force was the sole power employed to counteract and resist the action of external agents. In the open web beam we recognize a worthy offspring of scientific construction. It resists the action of the strains brought upon it, not *en masse*, as in the case of its older rival, but by that due proportioning and accurate adjustment of all its various parts which can alone impart to a structure the appearance of lightness and elegance; while at the same time it bestows upon it all that strength and rigidity inseparable from the duties it has to perform. The open-web girder, which, in its widest signification, includes all those classed under the various denominations of triangular, trellice, lattice, and truss, was borrowed by us from our ingenious transatlantic brethren who were first to erect some splended timber bridges upon this principle. They possess at the present day numerous gigantic examples of this method of construction, embodying every principle, with the exception of that of suspension, which could possibly be introduced in the erection of timber spans. It must not be supposed that the form of girder in question sprung into full developement upon its first appearance among us. Far from it. The earliest examples of wrought iron open-sided girders were erected in Ireland. We may select as a specimen of their original construction a bridge carrying the Dublin and Drogheda Railway over the Royal Canal in Dublin. However worthy of commendation as a pioneer of the new principle this bridge may be considered, it cannot be otherwise regarded than as a miserably inefficient application of it, or rather as no correct application whatever. The web wherein lies the especial value of the system, is composed of a series of thin bars closely interwoven and riveted together, so closely as to present a completely reticulated appearance, and without the slightest attempt at proportion or distribution of material, and constitutes a perfect mockery of all the laws laid down by theory for correctly designing girders of this nature. Curiously enough, about thirty miles further on, upon the same line of railway, we have in the Boyne Viaduct one of the finest existing examples of the lattice principle, where the laws of theory have been closely adhered to, and only received that modification which must always accompany their practical application. Comparing these two structures together and contrasting the total absence of all scientific principles and theoretical requirements in the one, with their full and accurate development and application in the other, it is scarcely possible to believe that the two designs could have emanated from the same individual.—*The Engineer.*

Winter on the Pacific Railroad.

Snow in scattering patches enlivened the hills around Dutch Flat, and varied the scene as we rolled along on the Central Pacific Railroad.

The further on we moved the deeper the snow became; twelve miles ahead and we were rolling on through banks of snow on either side from five to seven feet deep, the space of the track being cut out with the smoothness of the wall of your room. Along the road were scattered squads of men keeping it in repair and keeping the snow off the track.

We were now approaching Cisco, and for six to eight miles it seemed we were traveling between great gorges, as snow stood on an average six or eight feet above the tops of the cars, and in places 100 feet or more above the track, and almost perpendicular. It looked terrific—certainly grand; and to think I was on the Pacific Railroad, the boldest work of the age, added a majesty to the scene and a pleasure to the mind which language cannot convey. As you look back on the railway canal as it were, daringly cut through mountains of snow, it spoke in unmistakable language that it is only to possess the will to do, and anything can be accomplished. We soon arrived at Cisco. Here the snow, I was informed, was 15 feet deep, but I do not think it exceeded ten. This is now the terminus of the railroad, and here you take sleighs.

We jingled along gaily, all enjoying the scene and making merry, the snow still getting deeper. We were now riding on top of it, and its depth could only be estimated by the telegraph poles, which are 24 feet long. At times the wire was entirely submerged, and then the poles would stick out, it may be two, four or six feet. Now and then along the roadside you could see a chimney of some lone cabin sticking out and seeming a minature smoking volcano, or an incline tunnel cut down to some farmhouse.

We reached the summit, and what a scene! I thought snow scenes on Lake Superior were beyond competition, but the scene of the summit of the Nevada baffles all description. At this locality are a number of buildings, some entirely covered over with snow: others set up on posts, with two stories and a sharp peaked roof, have the extreme part of the peak sticking out. The snow here is from 27 to 30 feet deep, and in some places double it. The mountains are almost spotless white. Notwithstanding the depth of snow, there are quite a number of Chinamen and other individuals walking around, and who all at once at times drop out of sight, like ground squirrels into their holes. I must not forget to mention one shrewd *hombre* who rather conceived the idea that he would not be buried up altogether, and built a cabin on the top of about 20 feet of snow, propping it up as the snow falls. The probability is his real estate will fall some about next July.

There have been, about the summit, several snow slides, in one instance burying, some say 30, others 60 Chinamen. The towering, ponderous bodies of snow speak loudly, "beware of my power if I start." Snow slides, when they move, are worse than whirlwinds; they are typhoons, earthquakes and whirlwinds consolidated. They make a clean channel as they move; immense trees are but pipe-stems, and ponderous boulders are carried along as pebbles. They can be likened to shooting stars in their speed.—*Corresp. Bulletin.*

The Sacramento *Union* says of the winter's work:—The first great fall of snow was easily managed, though before the line was fairly restored, other storms broke upon the mountains, and from that time until the middle of March, the snow plows were kept in almost continual service. The winter was one of the fiercest ever known in the Sierra Nevada. Snow fell five days of one week. Yet the railroad men persisted, determined to prove that even in this terrible season, without the instruction of experience, and bothered by the settling of a new road bed, they could run trains to Cisco. It was found that with the aid of the big independent snow plows, where the track was not walled in by rock and earth, the result of the heaviest storms could soon be cleared away, the bulk of the snow being thrown into the ravines. The greatest difficulty was in the deep cuts. The freight cars which came into Sacramento loaded with snow, have borne witness to the kind of work done in clearing them. The railroad men have decided on covering the cuts, and have adopted a plan for strong roofing structures.

ECLIPSE OF JUPITER'S MOONS.—On the 21st of August next a celestial phenomenon will be witnessed which has only twice before been recorded in history. The planet Jupiter will at that date be seen unaccompanied by her satellites for nearly two hours. Of her four moons three will be invisible on account of their passing simultaneously over Jupiter's disk, and the fourth will be immersed in the shadow of the planet.