THE LATE MR. BRUNEL.

ISAMBARD KINGDOM BRUNEL has passed suddenly from among us, not ripe in years, but at an age at which many men are ready to put forth their greatest power. Mr. Brunel was one of the very few, among the present generation of engineers, whose practice had been co-extensive with the history of railways and of ocean steam-navigation, and still fewer of the profession have so distinguished themselves in the grand period of engineering of which the opening of the Liverpool and Manchester Railways was the commencement.

The late Mr. Brunel, the son of Sir Marc Isambard Brunel, was born at Portsmouth in 1806. At the age of fourteen he was sent to Paris, to prepare for his entrance into the College of Henri Quatre, where he remained two years. It was upon his return to England that Mr. Brunel may be said to have commenced his professional career, under his father, Sir Marc, to whom he was of great assistance. The young engineer inherited a considerable share of the power of invention, and mental calculation for which his father was celebrated; and possessed, in addition, executive powers of a more than common order. From 1825 to 1828 the Brunels, father and son, were engaged together upon the Thames Tunnel. At the latter period, the younger Brunel, consequent upon the stoppage of the works at the Tunnel, commenced the practice of engineering upon his own account. After having executed various works, mostly at and in the neighbourhood of Bristol, Mr. Brunel received the appointment, in 1833, of Chief Engineer to the Great Western Railway Company, at that time organised. Under this appointment, which, virtually, he continued to hold until his death, Mr. Brunel became at once widely known. In all his works he showed a degree of boldness, almost amounting to professional *abandon*, which many of his contemporaries considered imprudent, and which, it must be said, was imitated by very few of those engaged upon similar works. He at once decided, upon undertaking the construction of the Great Western line, to complete it upon a scale of magnificence beyond anything which had been contemplated up to that time. He was in the meantime conspicuous before Parliamentary Committees, battling manfully against opposition of every kind from almost every quarter. Among the opponents to the Great Western Railway, Dr. Lardner was not the least persistent and influential, and Mr. Brunel had full scope for the verbal adroitness and ready application of facts for which, when under the batteries of legal and technical cross-questioners, he was so celebrated. We all know how Mr. Brunel finally carried his points. The line was built in all respects in accordance with his plans. Time has unquestionably shown that the arguments upon which the claims in behalf of the broad gauge were rested, were for the most part specious only, and that, irrespective of the disadvantages of a break of gauge, the narrow gauge, whilst it fulfils all the mechanical and commercial conditions imposed, is the most economical in working, and on most accounts is altogether to be preferred. The broad gauge, however, made, and still makes, an imposing appearance and found considerable favour. The Box Tunnel, the longest of its kind which had been attempted up to the time of its completion, was certainly a difficult and expensive work, but with certain slight modifications in the route, and which would not probably have compromised the permanent interests of the line, the necessity of this tunnel would have been altogether obviated. In justice, however, to the reputation of Mr. Brunel, it must be said that he was probably driven to the adoption of the Box Tunnel as was Mr. Stephenson to making the Kilsby Tunnel, by the opposition of landholders in the vicinity of the line. Another work, the execution of which attracted much attention, was the railway bridge crossing the Thames at Maidenhead. Partly in consequence of the seeming necessities of the situation, Mr. Brunel determined upon adopting two very flat semi-elliptical arches of 128 ft. 6 in. span, and remarkably enough, he selected brick as the material for their construction. The attempt, bold as it certainly was, was unsuccessful. The work fell more than once whilst in course of construction, until at last it became necessary to form an arch of solid concrete of considerable thickness, over the brick voussoirs, which do not therefore support the structure by virtue of their own resistance as might be supposed. The resources of modern engineering would have supplied Mr. Brunel with means altogether better adapted to the construction of a work in such a situation, although it appears singular that, upon a line, the cost of which was generally so great, the estimates were not slightly increased to include the cost of stone structures, if not throughout, at least for works of such magnitude as the Maidenhead and Wharncliffe Viaducts. The latter, although an extensive work, cannot be accepted as a test of engineering skill, since it involved no especial difficulties of execution, and inasmuch as such works, from the simplicity of their construction, are seldom remarkable for anything more than their bulk and cost.

As for the railway itself, or rather for the permanent way, Mr. Brunel's original ideas, upon which the work was partly carried out, were proved by costly experience to have been faulty. The rows of piles, upon which the longitudinal timbers were originally laid, proved themselves objectionable in various respects, and the supports had afterwards to be so laid as to be clear of them. The longitudinal system also of permanent way, as carried out upon the Great Western line, has proved objectionable in many points essential to the safe and economical maintenance of railways. The Great Western Railway, however, more perhaps through the lavish expenditure at which it has been made, and from its public importance than from any especial merits which it may possess as a work of engineering, will always be remarkable, and even the errors by which its cost has been increased are not without their value.

Mr. Brunel took an early interest in ocean steam navigation, and it was natural that, as the engineer of the Great Western Railway, he should have put forth his best exertions towards making Bristol the principal station for the line of transatlantic steam vessels which was being established in 1836. He acted as engineer to the company for whom the Great Western was designed and built by Mr. Patterson, of Bristol. He was subsequently engaged, in a similar capacity, in the fitting out of the Great Britain, iron steamship, also designed and built by Mr. Patterson. Although both these vessels proved unfortunate, as commercial speculations, their success as examples of steamship construction certainly exercised a considerable influence in stimulating steam navigation enterprise, and especially in promoting the employment of iron in shipbuilding. Mr. Francis Pettit Smith, and those who like him had devoted their efforts to the demonstration of the practicability of screw propulsion, found in Mr. Brunel appreciation and support of their views. Disdaining precedent, excepting so far as precedent might be clearly conclusive, Mr. Brunel never allowed himself to overlook any new discovery giving promise of value in its application to engineering. Being in a position to exercise considerable influence, he did not hesitate to employ it in introducing the new means of propulsion, which has finally wrought such a marked change in the construction and working of our ocean steam marine.

Mr. Brunel's efforts in the introduction of the atmospheric system of propulsion for working railways were not attended with success. He adopted the system upon the South Devon line, in essentially the form in which it had been tried upon the London and Croydon Railway; but, as is well known, this mode of working was after a short time abandoned upon both lines. Mr. Brunel always retained, however, a considerable degree of faith in the applicability of atmospheric power to railway purposes.

Among other extensive works, the South Wales and the Cornwall Railways, including respectively the great bridges at Chepstow and Saltash, are imposing monuments of Mr. Brunel's boldness and skill. The principle upon which the bridges in question were planned has been much criticised, but the works as executed undoubtedly possess great strength and durability. The foundations of these bridges, under the customary modes adopted with such works, would have been extremely difficult of execution, but Mr. Brunel's ready appreciation of the merits of new discoveries enabled him to take full advantage of the pneumatic process, by a modification of which he was enabled to establish the foundations of the principal pier of the Saltash Bridge, at a depth of water and soft mud at which no works of the kind had been previously founded.

With Mr. Brunel's connection with the Great Eastern the public are familiar. The mere idea of a ship, of a capacity six or eight times that of anything afloat, had doubtless occurred to many an enthusiastic schemer, for the sentiment of magnitude and immensity is innate in all in whose character imagination is an element. But Mr. Brunel, in the year 1852, begun to give shape to his idea by preparing plans and otherwise convincing himself of its practicability. As an example of naval construction, the Great Eastern is unquestionably the work of Mr. Scott Russell, every way as much so as were the Great Western and Great Britain the works of Mr. Patterson, of Bristol. Yet Mr. Brunel's services were of hardly less importance, and every one at all conversant with the organisation of an establishment devoted to the construction of steam vessels, is aware that the duties of the naval architect and builder and those of the engineer are each clearly defined and in no way conflicting. Certain it is that, whether the Great Eastern prove successful or otherwise, Mr. Brunel's name will be indelibly associated with her history as long as that shall survive.

Mr. Brunel's health had been undermined by the exertions and anxiety with which he devoted himself, two years ago, to the completion of the Great Eastern, which was destined, however, to remain uncompleted until within a few days of his death. By a coincidence, as it would appear, Mr. Brunel went on board the great ship, for the last time, on the first day when it could be said she was ready for sea. If not so in every detail, she was, as a whole, essentially completed, although still untried. On that day, the 5th instant, Mr. Brunel suffered an attack of paralysis from which he never recovered. He sunk until the evening of the 15th instant, when he passed away, still young, and upon the completion of the greatest work of his life.

However brilliant may have been Mr. Brunel's career, it was, in many respects, an unfortunate one; and, we believe, none felt this truth more keenly than himself. Notwithstanding the number and imposing character of his works, many of them, often indeed from no fault of his own, have proved unsuccessful. There is a class of disappointments which ever fall to the lot of those whose ambition prompts them onward, and into the foremost ranks of progress. Such men ever do good, and posterity, at least, deals out even-handed justice to their memory. Mr. Brunel certainly effected great good in showing, in many cases, the development of which the ideas of others were capable. He seized upon, modified, and carried out many valuable discoveries which came before him, and in this way often gave them a value which they would not otherwise have possessed. Judged by another standard, that of the financial results of the vast sums of money the expenditure of which he controlled, Mr. Brunel was almost uniformly unsuccessful. It is an unwilling confession that few of his works have ever paid. He was never accustomed to be stinted for means, and if he undertook, at any time, to give an illustration of economy in his constructions, it was as likely to be done in cases where extreme economy was inconsistent with the general character of the enterprise. Apart from the magnitude of many of his works, and apart from whatever merit may be due to their magnitude alone, it would be difficult to say in what respect many of them have advanced the practice of engineering. The Great Western line presents little in its structure which another engineer could profitably copy, and beyond its earthworks and masonry and its gauge, there is hardly a relic of its original construction in existence. The permanent way and the equipment were made the subjects of a costly process of trial and error, of proving what could be done by proving what could not be done; and in the capital account of the company, if not upon the line itself, the evidences of this system are manifest. The permanent way was wrong and was altered; the carriages were no better, and were remodelled or put aside; there were engines, intended for great speeds, and having less than 500 ft. of heating surface for 10 ft. driving-wheels; and throughout the establishment other mistakes, more or less expensive, were visible, or else there were to be seen the means by which, at additional cost, they had been corrected. In steamship construction, whilst Mr. Brunel's practice led popular opinion, it cannot be said that he has given new resources to the constructor. There were earlier and hardly less able advocates for the use of iron in steamship construction, and large iron steam vessels had been built. Mr. C. W. Williams had, years before, introduced the iron bulkheads; whilst certainly Mr. Brunel did not make any material improvement in the form of steam vessels; and the marine engine and boiler are perhaps still less indebted to him. Of all men, indeed, Mr. Brunel would probably have been the last to claim merit for himself in these respects. The most he did was in giving prominence to the ideas of others less known than himself. Mr. Brunel did not succeed in attaching, nor did he appear desirous to attach around him, by sympathy and large-hearted dealing, a class of devoted followers, without whom no chief can be considered great, nor his influence of the kind which perpetuates itself. He did not seek, in proportion to his opportunities, to raise those beneath him, and comparatively few men enjoyed his confidence. He often managed to quarrel with his contractors, and some have declared themselves ruined by him. He had little sympathy for struggling genius; he seldom lost an opportunity for decrying against inventions and inventors, notwithstanding that his reputation was largely due to the applications which he had made of the ideas of others. Against patents he professed to be especially hostile. He gave little encouragement to efforts for elevating the workman, and seemed to take a pride in saying that his best engine drivers could neither read nor write. Judging other minds by the restless character of his own, he would defy any professional man to drive an engine, and would profess to be unable to so far concentrate his own thoughts as to perform such a task himself. However plausible all this might be there was a flush of insincerity about it which was not creditable to its author. If, however, he was sincere, such convictions were his misfortune.

Whatever may have been the imperfections of his character and the disadvantages of his peculiar temperament, Isambard Kingdom Brunel was nevertheless a man of talent, and, as an engineer, well versed in all the intricacies of his craft. His reputation will endure as long as his works shall remain in testimony, not more of his own skill than of the spirit and liberality with which the means for their execution were confided to his care.

PATENT LAW OF BRAZIL.

THE *Scientific American* gives the following abstract of the Brazilian Patent Law, passed 23rd August, 1830:—

Article I. The law assures to the discoverer or inventor of any useful industry the proprietary and exclusive use of his discovery or invention.

II. He who will improve a discovery or invention has, in the improvement, the right of a discoverer or inventor.

III. To the introducer of a foreign industry will be granted a reward proportioned to the utility and difficulty of the introduction.

IV. The right of the discoverer or inventor will be confirmed by a patent allowed gratis, payment only to be made for the seal and workmanship; and to obtain it—

1. He will show, by a writing, that the industry to which it refers is of his own invention or discovery.

2. He will deposit in the public archives an exact and certain exposition of the means and process he has employed, with plans or delineations, drawings and models, to explain it, without which the subject cannot be exactly elucidated.

V. The patents will be granted according to the qualities of the discovery or invention, for a term of five to twenty years, a special law being required for a longer time.

VI. If the Government will buy the secret of the invention or discovery, he will order it to be published; but in case of only having granted a patent, the secret will be concealed till the expiration of the term allowed to the patent.

VII. The infringer or transgressor of a patent will lose the instruments and products; and will, besides, pay a fine equal to the tenth part of the value of the products manufactured, the costs being always subjected to the indemnification of loss and damages. The tools, instruments, products, and fine will be given up to the owner of the patent.

VIII. He who possesses a patent may dispose of it as he likes, using it himself or pass it to one or several persons.

IX. In case of there being two or more applicants for a patent (interested in the same invention) it will be granted to them collectively.

X. All patents will be finished and without effect, upon—

1. Being proved that the possessor has not been faithful and true in what he has said, or has been short or abridged, concealing any essential matter in the exposition or explanation made to obtain the patent.

2. Being proved not to be the original inventor or discoverer.

3. If the invention or discovery is not put into operation within two years after the granting of the patent.

4. If the inventor or discoverer has already obtained a patent in any foreign country; but in such a case, he will obtain, as an introducer, the right of the reward established in Art. III.

5. If the goods or objects made or manufactured are proved to be prejudicial to the public good or contrary to the laws.

6. Making public or using the invention before the patent is obtained.

XI. The Government is authorised to order the patents to be passed according to the provisions of the present law, the king's attorney being always heard on it, &c.

XII. All the laws and provisions to the contrary are revoked.

THE WEIGHT OF A TON.—The Great Western, and also most of the Midland Railway and Canal Companies, have advertised that on and after the 1st of October next all goods carried by them will be charged on the actual gross weight at 2,240 lb. to the ton, except iron, which will be charged at 2,400 lb. to the ton. A correspondent of the *Times*, describing himself as an "Unfortunate Shareholder," says he should like to know the precise meaning of this notificati and what has called it forth, how many pounds the companies has hitherto been supposed to weigh, and why some goods sh favoured at the expense of others. The "Unfortunate Sha can easily ask the information he desires at the forthcomi but the trading public, who have not the same mea questions, would also, perhaps, like to know the pr regulation is calculated to effect.