

January 8, 1850.

WILLIAM CUBITT, President, in the Chair.

The following Candidates were balloted for and duly elected :—
John Joseph Macdonnell and Samuel Power, as Members.

Mr. CUBITT addressed the Meeting in the following terms, on taking the Chair for the first time after his election as President :—

GENTLEMEN,

By your kind suffrages, expressed at the Annual General Meeting, you have conferred on me the distinguished position of President of this Institution; an honour for which I am more indebted to the fortuitous circumstance of being “the Senior Vice-President in duration of office,” and your respect for the rules and regulations of the Society, than for any superior knowledge, or peculiar fitness on my part; indeed, highly as I estimate this flattering testimony of your personal esteem for me, I cannot divest myself of a feeling, that there are among my coadjutors, many better suited for the post; and the consideration of what has been accomplished by my predecessors, would cause me to fear comparison with previous Presidents.

However, Gentlemen, being by your kindness placed in this distinguished position, I would express to you my sincere thanks for this mark of your confidence, which, I venture to hope, may be, to some extent, justified, by my earnest desire to meet the wishes of the general body, and to obtain your countenance and assistance in the administration of the duties of the office.

These duties involve the necessity of my addressing you on assuming the Chair; and, in accordance with custom, I must now claim your attention to a few remarks, which shall, however, be very brief, and be first directed to matters of internal policy.

For the last twenty-six years, during which time I have enjoyed the advantage of being a Member of the Institution, the scientific character of the Society has gradually risen to its present eminence; and the discussions, which form the distinguishing feature of the proceedings, have assumed a character which was not anticipated: these are points of great importance. But as the Institution was originally formed “for the advancement of a profession, in the practice of which the utmost skill of man is called forth, and for which not only a general acquaintance with the higher branches of science is essential, but that familiarity with them, which will facilitate their application to our peculiar purposes;” * and the Royal

* *Vide* The Inaugural Address by H. R. Palmer, Esq., Jan. 2, 1818.

Charter has since recorded, that this is "a Society for the general advancement of Mechanical Science, and more particularly for promoting the acquisition of that species of knowledge, which constitutes the profession of a Civil Engineer;" I am induced to submit to you, whether the best mode of obtaining this desirable knowledge, is not by mutual instruction, or rather by that unrestrained social intercourse, at stated periods, which has been found so beneficial in other associations. Assuming this position to be correct, it has occurred to me, that it would be desirable to terminate the evening meetings at an earlier hour, in order to enable the Members and Visitors to assemble in the Library, for a short period after the formal business of the evening: they would then obtain personal introductions to each other, and great benefit would result from bringing into contact men who, by mutual consultation, and the investigation of opinions and facts, would encourage and assist each other in the elucidation of scientific truths, and the execution of the practical works under their charge. That the introductions already obtained at the Institution have been extensively useful, is a matter of notoriety. I would therefore propose to your consideration, that the Members should assemble so early, as to enable the business of the evening to commence precisely at eight o'clock; that the Papers read should be rendered by the Authors as succinct as may be compatible with their subjects; that the speakers should express their opinions as briefly as possible, confining themselves to the topic under discussion; and that no one should commence any observations after half-past nine o'clock, as on the succeeding evening, on the reading of the Abstract of the Minutes, an opportunity would be afforded for any additional remarks, or for the correction of any previous statement. I know that to this end the arrival of the Council must be punctual, and this, by their kind co-operation can be guaranteed; and if you will give your assistance in the trial of this plan, and support me in my endeavours to curb any extraneous remarks, and to urge onward the formal business of the meeting, we may at least attempt a measure, in favour of which, many of the Members and Associates have already expressed themselves very strongly.

It has been represented, that the reading of the Minutes of Proceedings of the preceding evening, occupies much valuable time: this is true; and the method just proposed would, to a great extent, correct the evil, and by limiting (as far as may be practicable) the discussion to two evenings, would also enable the Papers to be printed and issued at an earlier period.

At the Annual General Meeting, on the 18th of December, 1849, an opinion was expressed, "that it would be desirable, if

compatible with the Charter and Bye-Laws, to retain the assistance and co-operation of the past Presidents, and whilst acknowledging their valuable services, to place them in a position to distinguish them from the general body, and to enable the Acting Council to have the benefit of that advice, which their experience of the wants and progress of the Institution, would enable them to give so beneficially for the Society."

The Council, ever ready to entertain any proposition emanating from the general body, have carefully considered the question, and have with great pleasure recorded on the Minutes of the Council the following resolution:—

"That Mr. Walker, Sir John Rennie, and Mr. Field, having respectively occupied, for two years and upwards, the Presidential Chair of the Institution, be invited to give the Council their advice and assistance, as Honorary Councillors, in the Council Room and in the Theatre; and that in future those Members who, in regular succession, shall have served the offices of Vice-President and President, having filled the latter post for not less than two successive years, be considered Honorary Councillors, and have seats at the Council table, both in the Council Room and in the Theatre, in order to afford advice and assistance in the discussion of questions of importance to the Institution; but that such Honorary Councillors shall not be entitled to exercise any right of voting, upon the matters brought before the Council."

I have great pleasure in communicating to you this resolution; and you will, I know, join me in the hope, that the past Presidents may be long spared, to give us that cordial support and co-operation, they have ever afforded, and from which the Institution has reaped such signal advantage.

The Gazette of January 3rd contains the appointment of a Royal Commission, for the promotion of the Exhibition of the Works of Industry of all Nations, to be held in the year 1851, under the auspices of our Honorary Member, H.R.H. the Prince Albert. I have been honoured by a nomination to this Commission, as your representative; and, feeling assured of your best wishes for the objects of the Exhibition, I would ask your suggestions, counsel, and aid, in fulfilling the objects for which your President has been placed in this position, and your cordial concurrence in this real "Peace Congress."

Although during the past year there has not been so great a demand for the talents, or the energies of Engineers, several remarkable works have been finished, or have far advanced towards completion; I will allude briefly to a few of them, and if others of importance escape notice, it must be attributed to the Engineers

not having brought accounts of them before the Institution, or even incidentally mentioned them in the discussions.

Among these, the Tubular Bridges across the River Conway, and the Menai Straits, are pre-eminent, for the boldness of the conception, the scientific simplicity of the design, and the difficulty of the execution.

In tracing the original idea of the most advantageous disposition of a certain amount of material, in a tubular form, the more definite conception of a hollow beam, to permit the passage and support the weight of an engine and train; the experiments for determining the proper distribution of the material, to prevent compression, or disruption; the arrangements for the construction and building up these gigantic masses of material; the means of floating them to their situations, and of raising them to their ultimate destination, at an elevation of one hundred and two feet above the sea (at high water of spring tides);—we must feel justly proud of possessing among us the man, whose comprehensive mind could originate this magnificent design, and so successfully perform a portion of the work as to leave no doubt of its ultimate accomplishment. The world already duly appreciates this great undertaking, and we should not be behindhand in testifying our estimate of the bold conception of Mr. Robert Stephenson in the original idea, his professional skill in the design and execution, and his care and caution in availing himself of the talents and experience of Mr. W. Fairbairn and Mr. Eaton Hodgkinson, whose scientific investigations* respecting the strength of cast-iron are so well known to the world and so highly appreciated by our profession, and his entrusting the general construction and elevation to Mr. Frank Forster and Mr. Edwin Clarke. Upon the merits of all these gentlemen we may look with pardonable pride and partiality;—their labours speak for themselves.

However advantageous may be the results of this construction in facilitating an important communication, as I shall have occasion to allude to hereafter, it has already been extremely useful in directing attention to the more general employment of wrought iron, for purposes to which it had not previously been deemed applicable; and it will be found, that its introduction to structures of all kinds will become more common, exactly as the method of using it becomes better understood.

May I here be permitted to diverge for an instant, in order to

* *Vide* several Papers in the Memoirs of the Literary and Philosophical Society of Manchester, &c.

direct attention to a subject of considerable importance to the profession. In the year 1847 a Commission was appointed (of which I was named a member), for the purpose of inquiring into the conditions to be observed by Engineers, in the application of iron, in structures exposed to violent concussions and vibration; and for endeavouring to ascertain such principles and forms, and to establish such rules, as should enable the Engineer and the mechanic, in their respective spheres, to apply the metal with confidence, and should illustrate, by theory and experiment, the action which would take place, under varying circumstances, in the Iron Railway Bridges which had been erected.

Numerous witnesses of great theoretical attainment and practical experience were examined before the Commission, and a very interesting series of experiments was carried on, for ascertaining certain points relative to the compression and extension, the tensile and crushing strength, the effect of statical pressure, and of vibration, concussion, &c. The result of this laborious investigation is (in the words of the Report, which will shortly be made public) that "considering that the attention of Engineers has been sufficiently awakened, to the necessity of providing a superabundant strength in railway structures, and also considering the great importance of leaving the genius of scientific men unfettered, for the development of a subject as yet so novel and so rapidly progressive as the construction of railways, we are of opinion, that any legislative enactments, with respect to the forms and proportions of the iron structures employed therein, would be highly inexpedient."

It would be foreign to my present purpose to enlarge upon the importance of this decision; but I must recommend the Report to your careful perusal and consideration.

The Harbours of Refuge now in progress are works of national utility; those at Dover, and in the Channel Islands, by Mr. Walker, deserve particular attention; the former has already produced extraordinary effects on the littoral currents and in the movement of the shingle on the coast, and the latter will afford protection to the storm-driven mariner, where he before expected only danger and death.

The breakwater off Portland Island is important, not only as utilizing one of the finest bays on our coast, but also as an immense engineering work, intended to be executed almost entirely by convict labour, and on that account it was necessary to render its construction as simple as possible. This has been achieved by Mr. Rendel, whose design is to form along the site of the intended

breakwater a timber staging, carried upon Mitchell's screw piles. On this will be laid railways connected by inclined planes with the quarries on the hill, whence the trains of stones will be brought, and their contents be distributed simultaneously, and in a regular thickness over given areas, enabling a careful admixture of large and small materials to be effected, and the whole mass to rise gradually to the surface, and being thus self-supporting, to prevent the washing away of the materials, which has been experienced in other works of a similar nature.

The harbour at Holyhead and the new docks at Leith and at Grimsby, also by Mr. Rendel, do equal credit to his comprehensive designs and his executive skill.

In conjunction with these maritime works may be mentioned two lighthouses, both possessing remarkable features. The first is an erection now in progress upon the Bishop Rock, one of the Scilly Islands, for the Corporation of the Trinity House, London, and under the direction of their engineer, Mr. Walker.

The Bishop Rock is situated about thirty miles from the Land's End, Cornwall, and four miles due west from St. Agnes Lighthouse. Its position is more exposed to the force of the Atlantic than the Edystone, and the rock is also lower and smaller. The local difficulties, and a due regard to economy, have induced the trial of such a structure as should present the least possible obstruction to the waves. It consists of six hollow cast-iron columns 16 inches in diameter, sunk to a depth of 5 feet into the Rock, where they form a hexagon of 30 feet diameter, tapering upwards to the height of 100 feet. At the upper part there will be an iron framing to support the dwelling for three light-keepers, affording space also for provisions and stores for four months, and the whole is surmounted by a lantern 12 feet in diameter. A bar of wrought iron, 4 inches diameter, is dovetailed into the Rock, and carried up inside to the top of each column, where it is screwed down, thus attaching the columns to the Rock. The space between the inside of each cast-iron column and the internal wrought-iron rods is to be filled up solid, with a heavy metal and cement concrete. In the centre of the hexagon is a cast-iron tube, 3 feet in diameter, forming the upright and principal support of the structure. The lower part of this tube, to a height of 14 feet above high water, being the part most exposed to the force of the seas, is to be filled up solid; the means of ascent up to this level will therefore be external, but from thence to the top there will be an internal spiral staircase. The central and external columns, or tubes, will be strongly connected and braced laterally by wrought-

iron rods, 4 inches and 3 inches diameter. The difficulties to be overcome in the execution of this design can scarcely be appreciated without a more detailed account, which we may hope to receive in due time after the completion of the structure.*

The other is a stone lighthouse, called the Skerryvore, erected by Mr. Alan Stevenson on a small desolate rock, situated about eleven miles W.S.W. of the Island of Tyree, and fifty miles from the mainland of Scotland. The rock is exposed to the full fury of the North Atlantic, and is surrounded by an almost perpetual surf. The talent and perseverance of the engineer enabled him, however, to complete, without loss of life, or limb, great as were the difficulties he had to contend with, a structure far exceeding the dimensions of the famed Edystone and Bell Rock Lighthouses,—their relative heights being—

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| The Edystone | . . | 68 feet ; |
| The Bell Rock | . . | 100 feet ; |
| The Skerryvore | . . | 138 feet 6 inches. |

The difficulties of the construction, the merits of the structure, and the system of lighting, are so fully described in Mr. Stevenson's published account of it,† that it is not necessary for me to do more than to point to it, as one of the remarkable works of the present day, of which we have justly reason to be proud.

In steam navigation, great efforts have been made by some of the principal marine engineers, and the builders of wood and iron vessels. The result has been the production of four steamers, with engines by Messrs. Seaward, Miller, Penn, and Forrester, in vessels built respectively by Messrs. Mare, Miller, Thompson, and Laird, for conveying the mails; and an equal number of engines by Messrs. Maudslay and Field, Forrester, and Bury, in vessels by Messrs. Wigram, Mare, Laird, and Vernon, for carrying passengers between Holyhead and Dublin, which have attained the speed of nearly eighteen miles per hour, and accomplish the passage, on an

* The erection here described was rapidly advancing towards completion, when the bad weather of the winter of 1849 came on, before the filling up of the centre column could be accomplished. Notwithstanding the want of this important element of stability, the unfinished erection withstood all the force of the waves up to the period of the tremendous storm of the 5th of February, 1850, when the whole was swept away down to the level of the rock.

Secretary Inst. C.E., September, 1850.

† *Vide Account of the Skerryvore Lighthouse, with Notes on the Illumination of Lighthouses. By A. Stevenson. 4to plates. Edinburgh, 1848.*

average, in four hours. By these means, when the Britannia Tubular Bridge is completed, the journey between London and Dublin may be accomplished within eleven hours. This is an extraordinary advance upon the opinions of only a few years since, when it was reported to be possible to perform the same distance in fourteen hours.

The excellent machinery of Messrs. Maudslay and Field, and of Messrs. Forrester and Co., in the iron steamers built by Mr. C. Mare and Mr. J. Laird, have also contributed mainly in accomplishing a journey to Paris, as we have recently seen it performed in eight hours and a half; giving a death-blow to the onerous system of passports, which have interfered so materially with that free and unrestricted communication so essential for the mutual benefit of the two countries.

In the accomplishment of this rapid communication with Paris, I may be permitted to feel some pride, as, in my capacity of engineer of the South Eastern, and in my professional connexion with the Boulogne and Amiens Railways, the possibility of expediting the intercourse between the two capitals, constantly occupied my mind; and so long ago as in June, 1843, before the present fast steam-boats were placed on the station, I undertook and accomplished the task of conveying the directors and their friends from London to Boulogne, and home again, between six in the morning and ten in the evening, with a sufficient interval for a public reception at Boulogne.

Among the builders of steam vessels, Mr. Scott Russell must be particularly mentioned, for the successful investigation and application of the wave lines to the forms of vessels, so that the curves of least disturbance can at once be adapted to a vessel, the ultimate, or greatest velocity of which has been previously determined; and thus high speeds, and easy motion through the water, can be attained; whilst a given immersion is arrived at with certainty. These points were remarkably shown in the 'Manchester,' a vessel for carrying passengers across the Humber, at New Holland, and with its consort steamer, the 'Sheffield,' constructed by Messrs. Rennie's, becoming as it were floating bridges, completing the line of the Manchester, Sheffield, and Lincolnshire Railway, and conveying the contents of the trains, from point to point, at a speed of about sixteen miles an hour.

In connexion with this railway must be mentioned, the large pontoon, recently built by Messrs. E. B. Wilson and Co. (of Leeds), from the design and under the direction of Mr. John Fowler. This immense iron vessel, which is 400 feet long, 50 feet wide, and

8 feet deep, with a deck area of 20,000 square feet, serves as a floating landing stage for these fast passage steamers, rendering the railway trains independent of the tide, and of the muddy shores of the Humber.

The deck area of this landing stage is about half that of a somewhat similar structure, built a short time before from my designs, and under my direction, at Liverpool, and of which a description and drawings will be prepared for an early meeting of the Institution; as an earnest of my intention to practise, what I have ventured to impress upon all those, who not only possess the information, but the power of imparting it, for the benefit of their professional brethren.

A number of fine steamers have also been constructed, for the Government, for private companies, and for foreign states, in which the beautiful engines of Maudslay and Field, Miller, Seaward, Penn, Napier, Rennie, and others, have fully maintained their European reputation.

This incomplete sketch of a few of the engineering works of the past year, leaves untouched that vast subject, the railway system, towards the completion of which, much has been accomplished within the last twelve months, without that public excitement which accompanied all its former progress. There are now nearly five thousand five hundred miles of railway completed in Great Britain, at a cost of about two hundred and twenty millions sterling, which immense sum, derived from private sources, has been expended within the realm, encouraging in an extraordinary degree productive industry of all kinds, and inducing a revolution in all mercantile transactions and social relations. The steam-engine and the power-loom have been regarded by the sober-minded political economist, as the real sources of the power and influence of Great Britain; and though the gallantry of her hardy sons, both in the military and the naval services, may have been more publicly apparent, and were, in fact, inestimably valuable when called into action, it is the productive classes of this country that constitute its real strength. The example of England, in boldly abandoning the finest roads, and adopting throughout the length and breadth of the land, a network of iron ways, over which, by the aid of steam, passengers and merchandise are conveyed at a velocity, which, at its first proposition, was by the world deemed worse than visionary, first filled our Continental neighbours with astonishment, and then compelled their imitation, so that within a few years, by this new power, the relative positions of the Continental States are changed, and the ultimate effect must be to introduce wants,

and consequently civilization, to the most remote corners of the world.*

If this be true, we are naturally led to inquire who were the authors of this great revolution, what minds conceived, and what energies executed these vast projects, thwarted and controlled, as they must have been, by vested interests on the one hand, and the necessity of urging into action a whole nation, before such a momentous change could be effected. The reply, gentlemen, must spring spontaneously from you all. The civil and mechanical engineers, have been the great actors in this most interesting chapter of the social history of our country; and if we may look back, almost with reverence, to the splendid careers of Arkwright, Brindley, Smeaton, Jessop, Mylne, Ralph Walker, Dodd, Watt, Telford, Rennie, and a host of other illustrious names, we may with equal pride, look around upon the men of our own time, whose voices have frequently been heard within these walls, instructing and urging us onward, in the course they had so successfully followed: some of them are removed from among us, but the names of Rennie, Walker, Stephenson, and Brunel, are yet here, and they have left worthy scions to complete the works they so nobly commenced. One great duty the departed have enjoined on us—the record of their works and of our own; and let us remember, that if we desire to hand down our names to posterity, as useful members of society, it is our duty to render this Institution the depository of the accounts of our works, that the future historian of this eventful age, may find in our archives, not only accounts of the works themselves, but of the men who conceived and accomplished them, and to whom their country is so deeply indebted.

For the junior members of the profession, many of whom have already given indications of talent and power, auguring well for their future fame, a wide field is opened in the sanitary question,

* A Report addressed by me to the Chairman, Deputy Chairman, and Committee of the Liverpool and Manchester Railway Company, dated "Ipswich, February 23rd, 1825," contains the following passages:—

"6th. That on a level railway, a locomotive engine may be made to move a total weight of fifty tons, itself included, as many miles per hour as there are horses' power employed in the engine,

"11th. That on a direct and nearly level line, like that from Manchester to Liverpool, it is easily practicable to convey passengers, on a railroad, by means of locomotive engines, with greater ease, safety, speed, convenience, and economy, than by any other known means of land conveyance."

How my "visionary opinions" of that period have been more than realised, you can judge better than other men.

which embraces the subjects of the drainage and sewerage, the paving, lighting, and cleansing of cities and towns; the more copious and less expensive supplies of water and gas; and, in conjunction with the architects, the improvement of the dwellings of the labouring classes; the establishment of baths and wash-houses; and the introduction of abattoirs.

In this latter portion of the question, the railways should act an important part; for if their establishment has created a wish, or a necessity for travelling, and produced great changes in commercial transactions, by rendering unnecessary the intervention of a third person, between the manufacturer and the tradesman, it would appear feasible to use the same facilities for bringing up from the country large supplies of animal food, ready for sale, instead of the living animals, to be slaughtered in a crowded city, and introducing noxious and unhealthy trades, for using up those portions not fit for food. If, as we have been recently informed by the Journals, there be a great discrepancy in the prices of food, between London and the country towns, the aid of the railways should be invoked, and the same producers should be glad to avail themselves of an opportunity of supplying the metropolis, in such a manner as would soon equalize the general prices.

The engineers have always been the real sanitary reformers, as they are the originators of all onward movements; all their labours tend to the amelioration of their fellow-men; and though in times past the introduction of machinery was looked upon with jealousy, education has now happily caused a more just appreciation of their labours; indeed they would deserve the highest encomiums if only for the application of steam, which, in production alone, now represents the power of forty millions of human beings, who, even if they had been able to perform the labour, would have been degraded by it to the level of mere animals, instead of thinking creatures, sent upon the earth each to perform his part in the complete system of social life.

The heavy demands on the invention and skill of engineers, in the construction of railway works, during past years, have left but little time for the devotion of their energies to the improvement of the mechanical and commercial working of the lines. A wide field is, however, now opened for the exercise of professional skill and ability, in perfecting the applications of tractive power, and all the machinery of railway plant; and it may be reasonably expected, that the opportunities thus afforded to railway companies, of bringing the highest engineering skill of this country to bear upon these questions, may not only produce great economy in the working

expenses, and greater efficiency in the general plant, but lead to radical improvements in the construction and maintenance of the destructible parts of the (so-called) "permanent way," and thus set at rest the question of depreciation—a desideratum which is now felt to be of almost vital importance to railways as an investment.

I feel, Gentlemen, that, hurried and imperfect as this sketch may be, the subjects have carried me far beyond the limits I had originally intended, and I must request your indulgence for having occupied so much valuable time. You will not, however, find me so trespass upon you again; and, with reiterated thanks for the honour you have conferred on me, I will at once enter on the duties of the office, and proceed to the regular routine of the evening meeting.

Being duly moved and seconded, it was Resolved, That the President be requested to permit his Address to be printed and circulated with the Minutes of Proceedings.

The discussion upon Lieutenant Colonel Lloyd's Paper, No. 818, "On the Facilities for a Ship Canal across the Isthmus of Panamá," was continued to such a length as to preclude the reading of any communication.

January 15, 1850.

WILLIAM CUBITT, President, in the Chair.

No. 792.—"An Account of the Blackfriars Landing Pier." By Frederick Lawrence.

THE large and increasing steam-boat traffic on the river Thames, renders the subject of landing-piers one of considerable importance, and it is surprising, that more attention has not been devoted to it. Many of the principal landing-places are, at present, both inconvenient and dangerous, being merely formed by barges, moored together, and rising and falling with the tide; indeed, until very recently, the only permanent landing-place above bridge, was that at Southwark Bridge.

In the year 1839, a landing stage, composed of barges, was erected at Blackfriars Bridge, by a few watermen, as a speculation; this served, though imperfectly, for the small traffic which then existed; but as the number of passengers increased, on account of the reduction of the fares, it was soon found to be totally inadequate for the wants of the situation.