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ENTRANCE TO THE LIVERPOOL STATION.

AN ACCOUNT

OF THE

LIVERPOOL AND MANCHESTER RAILWAY,

COMPRISING

A HISTORY OF THE PARLIAMENTARY PROCEEDINGS,

PREPARATORY TO THE PASSING OF THE ACT,

A DESCRIPTION OF THE RAILWAY,

IN AN EXCURSION FROM LIVERPOOL TO MANCHESTER,

AND A

POPULAR ILLUSTRATION OF THE MECHANICAL PRINCIPLES APPLICABLE TO RAILWAYS.

ALSO, AN

ABSTRACT OF THE EXPENDITURE FROM THE COMMENCEMENT OF THE UNDERTAKING,

WITH OBSERVATIONS ON THE SAME.

BY HENRY BOOTH,
TREASURER TO THE COMPANY.

LIVERPOOL:
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LIVERPOOL & MANCHESTER RAILWAY, WITH THE BRANCH LINES.

AN

ACCOUNT, &c.

CHAPTER I.

INTRODUCTION—PARLIAMENTARY PROCEEDINGS.

The adoption of Railways as a means of inland communication, for the transit of merchandise and passengers, forms an era no less remarkable than the first introduction of Canals, and constitutes a change in the long-established modes of conveyance no less striking and important. The Railway, however, is by no means a recent invention: nearly two centuries have elapsed since the first partial introduction of Tram-roads, rudely constructed of wood, at a trifling outlay of capital and still smaller expenditure of scientific arrangement. The substitution of iron for wood was a great improvement; but the form of the rail continued for a long time very objectionable, con-

sisting of flat pieces of cast-iron laid on the ground, with a side flange rising two or three inches to confine the wheel to its proper track. The rails thus resting on the ground, were unavoidably covered with soil or sand; and it was not till the adoption of the edge-rail, raised above the ground, that Railways attained those advantages over common roads which they are now acknowledged to possess.

In the last quarter of a century Railways have multiplied rapidly, especially in the neighbourhood of Newcastle and Sunderland; and a large amount of capital and skill have been employed in their construction, and in the erection and adaptation of the different kinds of machinery with which many of them are worked. Still these Railways are comparatively of small extent; detached, isolated and private undertakings, and appropriated exclusively to the conveyance of coals to the shipping wharfs on the Tyne and Wear.

The first public Railway, established by Act of Parliament for the conveyance of general merchandise and passengers, as well as coals, was the Stockton and Darlington. This Railway is about twenty-five miles in length, extending from the Witton Park Collieries, in the neighbourhood of West Houghton, in the county of Durham, to Stockton-upon-Tees, and passing within a few hundred yards of Darlington, which is situate about midway between the two extremities of the line. This Railway consists of a single road, with *sidings* every quarter of a mile, to allow carriages to pass one another. A small quantity

of merchandise, and 300 or 400 passengers weekly, are conveyed along this line between Darlington and Stockton : but here, as in the neighbourhood of Newcastle, Coal is the staple commodity, the tolls on this article alone being six or seven times the amount derived from the aggregate of all the other sources of revenue. The subscribers to this undertaking had originally to encounter a long and strenuous opposition on the part of land-owners, whose property was affected, and of coal-proprietors, whose pecuniary interests were interfered with. The first application to Parliament was unsuccessful ; but in 1823 the Act for the present line was obtained ; and the 27th of September, 1825, has become memorable as the day on which the Stockton and Darlington Railway was opened to the public.

The project of the Liverpool and Manchester line was first discussed as early as 1822. Mr. William James, of London, Engineer, having witnessed the powers of the Locomotive Engine in the neighbourhood of Newcastle-on-Tyne, conceived that it might be successfully employed on a Railway for commercial purposes. He brought a letter of introduction to Mr. Sandars, a gentleman who, having had practical experience of the insufficiency of the existing modes of conveyance from Liverpool to Manchester, was prepared to give all due consideration to any plan which proposed a remedy for a tried grievance. Mr. Sandars adopted the scheme, and became father to the present undertaking. A preliminary survey was made of the country between the two towns, Mr.

Sandars being guarantee for the estimated cost. The line of road recommended in this survey was not ultimately adopted, but the project, after some intermission, went forward.

A combination of striking and favourable circumstances evidently belonged to a line of communication between the towns of Liverpool and Manchester: the one a commercial sea port, second in importance only to London; the other a large manufacturing town, and the centre and focus of a populous manufacturing district. Looking, indeed, at the intimate and necessary connection between the two places—foreign produce of every description passing daily from Liverpool to Manchester, and manufactured goods finding their way from Manchester to be shipped at Liverpool to every quarter of the globe; considering this incessant interchange of commodities, comprising at that period upwards of 1000 tons *per day* conveyed between the two towns, and this large traffic being rapidly on the increase—one should reasonably have expected to find the utmost facility of conveyance subsisting between the two towns, or at least that no very serious delays or difficulties would be found to impede the actual transit of commodities from the one place to the other. But how did the fact correspond with this reasonable expectation, and how far had the means of conveyance for goods and merchandise kept pace with the mighty commerce of the two towns?

The great canal proprietors, which for nearly a century had taken charge of the conveyance of merchandise between Liverpool and Manchester, are the

Mersey and Irwell Navigation (commonly styled the Old Quay) Company, and the Trustees of the Duke of Bridgewater's Canal. The flats or barges, in both cases, have to navigate the River Mersey from Liverpool to Runcorn, a distance of about twenty miles, according to the ordinary track which vessels are able to pursue, and thence by separate routes, the Duke of Bridgewater's navigation by canal terminating in Castle-field, Manchester, and that of the Old Quay Company consisting alternately of canals and the Rivers Mersey and Irwell, till it reaches the same great depot; the whole distance being about fifty miles. The Old Quay Company obtained their first Act of Parliament in 1733, and the Duke of Bridgewater in 1760. We shall take it for granted that, at this latter period, the trade of Liverpool had so far increased as to render expedient the establishment of a *second* means of conveyance, namely, the Bridgewater Canal. We have now, therefore, to ascertain whether, since the period of 1760, there has been such an increase in the trade and commerce of this district, as to render it probable that even a *third* line of communication might be desirable and beneficial to the public; and a few leading facts in the comparison will be abundantly sufficient to determine this point.

In 1760, the number of vessels which paid dock duties at Liverpool was 2560.

In 1824, when the Railway Company was formed, it was 10,000; the tonnage of the port having *more than doubled* in the ten preceding years, namely, since 1814.

In 1784, twenty years after the establishment of the

second canal, an American vessel arrived in Liverpool, having on board for part of her cargo *eight bags of cotton*, which were seized by the officers of Customs, under the conviction that they could not be the growth of America!

In 1824, there were imported into Liverpool, *from America*, 409,670 bags of cotton.

In 1760, the population of Liverpool was about 26000.

In 1824, the population was 135,000.

The same stupendous increase is to be found in the trade and population of Manchester.

In 1760, the population was about 22,000.

In 1824, it was 150,000.

The first steam-engine used in Manchester was in the year 1790, thirty years after the *Act* was obtained for the *second* canal.

In 1824, upwards of 200 steam-engines were at work.

In 1824, there were nearly 30,000 power-looms employed, while only ten years previous there was *not one*.*

* Though the present argument required that I should show the great increase of trade up to 1824, it may not be amiss briefly to notice the augmentation of our commerce since that period.

In 1824, year ending 24th of June, the number of vessels paying dock dues in the port of Liverpool is stated above, at..... 10,000

In 1829, it was..... 11,383

In 1824, year ending 31st of December, the cotton imported into Liverpool was..... 447,083 bags.

In 1829, the importation was..... 640,998 ,,

In 1824, the quantity of goods passing daily between Liverpool and Manchester was estimated at 1000 tons. It is now (1830) about 1300 tons per day; in the proportion of 1000 tons passing from Liverpool to Manchester, and 300 tons passing from Manchester to Liverpool.

But the trade which has increased with perhaps the greatest rapidity is the

It may be replied, however, to this statement, that admitting this vast increase in the population and commerce of the two towns, still, by increasing the number of boats, with facilities of loading and discharging, ample accommodation might be afforded to the public. But what are the facts as they existed in 1824? Mr. Sandars, in a pamphlet published in that year, expresses himself as follows:—"Notwithstanding all the accommodation the canals can offer, the delays are such that the spinners and dealers are frequently obliged to cart cotton on the public high road, a distance of 36 miles, for which they pay four times the price which would be charged by a Rail-road, and they are three times as long in getting it to hand. The same observation applies to manufactured goods, which are sent by land carriage daily, and for which the rate paid is five times that which they would be subject to by the Rail-road. This enormous sacrifice is made for two reasons—sometimes because conveyance by water cannot be promptly obtained, but more frequently because speed and certainty as to delivery are of the first importance."—P. 17.

importation into Liverpool of live stock from Ireland, to be attributed mainly to the establishment of steam conveyance. The following is an authentic account of the import into Liverpool, principally from Ireland, for 30 months; and of this large supply no small portion it is calculated will seek a conveyance to Manchester and the neighbourhood by the Railway:—

	Large Cattle	*Calves.*	*Sheep.*	*Pigs.*
From June, 1827, to June, 1828.....	33,164	3,875	133,567	107,066
,, ,, 1828, to ,, 1829.....	49,674	6,786	125,197	155,319
,, ,, 1829, to Dec. 1829, six months ...	32,816	15,846	91,589	82,561
Total in 30 months, ending Dec. 1829.	115,654	26,507	350,353	344,946

About the same period also, the following Public Declaration was signed by upwards of 150 of the most respectable merchants of Liverpool :—

"We, the undersigned merchants and brokers resident in the port of Liverpool, do hereby declare that we have for a long time past experienced great difficulty in obtaining vessels to convey goods from this place to Manchester, and that the delay is highly prejudicial to the trading and manufacturing interest at large. That we consider the present establishments for the transport of goods quite inadequate, and that a new line of conveyance has become absolutely necessary to conduct the increasing trade of the country with speed, certainty and economy."—*(Sandars, p. 29.)*

Considering it, therefore, as undeniable that an increased facility of conveyance between the two towns was highly desirable, it became a question whether a *Railway* would best combine the essential requisites of safety, economy and despatch. In order the better to be enabled to form a judgment on this point, a deputation, consisting of Mr. Sandars, the late Mr. Lister Ellis, Mr. Kennedy, of Manchester, and the writer of this account proceeded to Darlington, where the Railway was then unfinished, and afterwards to the neighbourhood of Newcastle and Sunderland, where various Railways were in operation, and where both Locomotive and Fixed Engines were employed for the conveyance of coals from the pits to the respective places of shipment. This deputation made their Report to a Committee of Gentlemen in Liver-

pool, of which John Moss, Esq. was Chairman, on the 20th of May, 1824, when it was finally determined to form a Company of Proprietors for the establishment of a double Railway between Liverpool and Manchester. A subscription list was opened and speedily filled, principally with names connected with the towns of Liverpool and Manchester. A permanent Committee was afterwards appointed, of which Chas. Lawrence, Esq. at that time Mayor of Liverpool, was elected Chairman. Mr. Geo. Stephenson, of Newcastle-on-Tyne, was appointed Engineer. The necessary surveys were undertaken, and every preparation made for soliciting an Act of Incorporation in the ensuing Session of Parliament.

On the 29th of October, 1824, the Committee issued their Prospectus, which, as the first public announcement of the objects of the Company and the nature of the undertaking, I insert in this place :—

"LIVERPOOL & MANCHESTER RAIL-ROAD COMPANY.

COMMITTEE.

CHARLES LAWRENCE, Esq. *Chairman.*
LISTER ELLIS, Esq.
ROBERT GLADSTONE, Esq. } *Deputy*
JOHN MOSS, Esq. } *Chairmen.*
JOSEPH SANDARS, Esq.
ROBERT BENSON,
H. H. BIRLEY,
JOSEPH BIRLEY,
HENRY BOOTH,
THOMAS SHAW BRANDRETH,
JAMES CROPPER,
JOHN EWART,
PETER EWART,
WILLIAM GARNETT,
RICHARD HARRISON,
THOMAS HEADLAM,
ADAM HODGSON,
ISAAC HODGSON,
JOSEPH HORNBY,
JOHN KENNEDY,
WELLWOOD MAXWELL,
WILLIAM POTTER,
WILLIAM RATHBONE,
WILLIAM ROTHERAM,
JOHN RYLE,
THOMAS SHARPE,
JOHN WILSON, Esquires.

Parliamentary Agent, THOS. MOULDEN SHERWOOD, Esq.—*Engineer*, GEO. STEPHENSON, Esq. —*Solicitors*, Messrs. PRITT and CLAY.—*Bankers*, Messrs. MOSS, ROGERS and MOSS. Liverpool.

PROSPECTUS.

"The Committee of the Liverpool and Manchester Rail-road

Company think it right to state, concisely, the grounds upon which they rest their claims to public encouragement and support.

" The importance, to a commercial state, of a safe and cheap mode of transit, for merchandise, from one part of the country to another, will be readily acknowledged. This was the plea, upon the first introduction of canals: it was for the public advantage; and although the new mode of conveyance interfered with existing and inferior modes, and was opposed to the feelings and prejudices of landholders, the great principle of the public good prevailed, and experience has justified the decision.

" It is upon the same principle that Rail-roads are now proposed to be established; as a means of conveyance manifestly superior to existing modes: possessing, moreover, this recommendation in addition to what could have been claimed in favour of canals, namely, that the Rail-road scheme holds out to the public not only a cheaper, but far more expeditious conveyance than any yet established.

" The Liverpool and Manchester Rail-road is proposed to commence near the Prince's Dock, Liverpool, thence to Vauxhall-road, then through Bootle, Walton, Fazakerley, Croxteth, Kirby, Knowsley, Eccleston, Windle, Sutton, Haydock, Newton in Mackerfield, Golborn, Lowton, Leigh, Pennington, Astley, Irlam, Worsley, Eccles, Pendlebury, Salford, Hume, to the neighbourhood of the westerly end of Water-street, Manchester: in the whole, a distance of about thirty-three miles. By a reference to the plan it will be perceived that the road does not approach within about a mile and a half of the residence of the Earl of Sefton, and that it traverses the Earl of Derby's property over the barren mosses of Kirby and Knowsley, passing about two miles distance from the hall. In deciding upon the proposed route, the Committee have been anxious, at considerable inconvenience and expense, to select a line which may not only be eligible, considered in itself, but may be as little objectionable as possible, with reference to individual and local interests.

" The ground has been surveyed by eminent Engineers, and the estimated expense of a Rail-road, upon the most improved construction, including the charge for Locomotive Engines, to be employed on the line, and other contingencies, is £400,000,—which sum it is proposed to raise in 4000 shares of £100 each.

" The total quantity of merchandise passing between Liverpool and Manchester, is estimated, by the lowest computation, at one thousand tons per day. The bulk of this merchandise is transported either by the Duke of Bridgewater's Canal, or the " Mersey and Irwell Navigation." By both of these conveyances goods must pass up the river Mersey, a distance of 16 or 18 miles, subject to serious delays from contrary winds, and not unfrequently to actual loss or damage from tempestuous weather. The average length of passage, by these conveyances, including the customary detention on the wharfs, may be taken at 36 hours, longer or shorter, according to the favourable or unfavourable state of the winds and tides. The average charge upon merchandise, for the last fourteen years, has been about 15s. per ton.

" By the projected Rail-road, the transit of merchandise between Liverpool and Manchester will be effected in four or five hours, and the charge to the merchant will be reduced at least one-third. Here then will be accomplished an immense pecuniary saving to the public, over and above what is perhaps still more important, the *economy of time*. Nor must we estimate the value of this saving merely by its nominal amount, whether in money or in time: it will afford a stimulus to the productive industry of the country, it will give a new impulse to the powers of accumulation, the value and importance of which can be fully understood only by those who are aware how seriously commerce may be impeded by petty restrictions, and how commercial enterprise is encouraged and promoted by an adherence to principles of fair competition, and free trade.

" The Committee are aware that it will not immediately be understood by the public, how the Proprietors of a Rail-road, requiring an invested capital of £400,000, can afford to carry goods at so great a reduction upon the charge of the present water companies. But the problem is easily solved. It is not that the water companies have not been able to carry goods on more reasonable terms, but that, strong in the enjoyment of their monopoly, they have not thought proper to do so. Against the most arbitrary exactions the public have hitherto had no protection, and against the indefinite continuance or recurrence of the evil, they have but one security: IT IS COMPETITION THAT IS WANTED; and the proof of this assertion may be

adduced from the fact, that shares in the Old Quay Navigation, of which the original cost was £70. have been sold as high as £1250. each!

"But it is not altogether on account of the exorbitant charges of the water carriers that a Rail-road is desirable. The present Canal establishments are inadequate to the great and indispensable object to be accomplished, namely, the regular and punctual conveyance of goods at all periods and seasons. In summer time there is frequently a deficiency of water, obliging boats to go only half loaded, and thus occasioning great inconvenience and delay; while in winter, they are sometimes locked up with frosts for weeks together, to the manifest hindrance of business. From these impediments a Rail-road would be altogether exempt. There is still another ground of objection to the present system of carriage by Canals, namely, the pilferage, an evil for which there is seldom adequate redress, and for which the privacy of so circuitous and dilatory a passage affords so many facilities. Whereas a conveyance by Railway, effected in a few hours, and where every delay must be accounted for, may be expected to possess much of the publicity and consequent safety of the King's highways.

"In addition to the transport of goods between Liverpool and Manchester, an important branch of revenue may be expected to result to the Proprietors of the projected road, from the conveyance of Coals from the rich mines in the vicinity of St. Helens; an advantage which the water companies do not possess, and which, from its importance and extent, may probably enable the Proprietors to reduce their rates of carriage still lower than now contemplated. These coals at present pass along the Sankey Canal and down the Mersey to Liverpool, a distance of about 30 miles. By the Railway, the distance will be shortened one-half, and the charge for transit very materially reduced.

"Amongst the widely diffused benefits to be expected from the proposed Rail-road must especially be enumerated, no inconsiderable advancement in the commercial prosperity of Ireland. The latent energies of that country, her capabilities as a manufacturing power, will be developed by being brought into easy contact and communication with the manufacturing districts of this kingdom: while every

article of her agricultural industry will experience an increased demand from the cheapness and facility with which it will be introduced into the populous counties of Lancaster and York. Whatever shortens the time of conveyance practically diminishes the distance, and whatever is saved in the cost of carriage is a gain to Ireland.

"In the present state of trade and of commercial enterprise, despatch is no less essential than economy. Merchandise is frequently brought across the Atlantic from New York to Liverpool in twenty-one days; while, owing to the various causes of delay above enumerated, goods have in some instances been longer on their passage from Liverpool to Manchester. But this reproach must not be perpetual. The advancement in mechanical science renders it unnecessary: the good sense of the community makes it impossible. Let it not, however, be imagined, that were England to be tardy, other countries would pause, in the march of improvement. Application has been made, on behalf of the Emperor of Russia, for models of the Locomotive Engine: and other of the continental governments have been duly apprized of the important schemes for the facilitating of inland traffic, now under discussion by the British public. In the United States of America also, they are fully alive to the important results to be anticipated from the introduction of Rail-roads; a gentleman from the United States having recently arrived in Liverpool, with whom it is a principal object to collect the necessary information in order to the establishment of a Railway, to connect the great rivers Potomac and Ohio.

"The immediate and prominent advantages to be anticipated from the proposed Rail-road, are increased facilities to the general operations of commerce, arising out of that punctuality and despatch which will attend the transit of merchandise between Liverpool and Manchester, as well as an immense pecuniary saving to the trading community. But the inhabitants at large of these populous towns, will reap their full share of direct and immediate benefit. Coals will be brought to market in greater plenty, and at a reduced price; and farming produce, of various kinds, will find its way from greater distances, and at more reasonable rates. To the landholders, also, in the vicinity of the line, the Rail-road offers important advantages in extensive markets for their mineral and agricultural produce, as well as in a

facility of obtaining lime and manure at a cheap rate in return. Moreover, as a cheap and expeditious means of conveyance for travellers, the Railway holds out the fair prospect of a public accommodation, the magnitude and importance of which cannot be immediately ascertained.

"The Committee do not think it necessary to dwell upon probable and contingent sources of revenue to the Proprietors, and of benefit to the community: but it is impossible entirely to overlook the tendency of increased economy and despatch to extend the commercial intercourse, not only upon the immediate line of road, but diverging in ramifications to the north and the south, and especially towards the rich and populous town of Bolton; a short branch line being sufficient to bring that extensive manufacturing district into rapid and direct communication with this port.

"Such is a brief view of the scheme in which the Liverpool and Manchester Rail-road Company have embarked, and which, while it promises such manifold advantages to the public, the Committee feel confident will afford a fair and liberal return for the capital invested by the Proprietors.

"CHARLES LAWRENCE, *Chairman.*

"*Liverpool, 29th October*, 1824."

Such, then, was the scheme of the Liverpool and Manchester Railway, requiring, however, the sanction of the legislature before it could be carried into effect. Parliament met early in the ensuing year, and a portion of the Railway Committee attended in London, in the first week of Feb. 1825, to watch the progress of the Bill through the House of Commons—an undertaking by no means a sinecure, as those who have had the good or ill fortune to be concerned in carrying forward contested bills will readily admit. The Committee anticipated a strenuous opposition, and they were not disappointed. The Proprietors of

three Canals (the Duke of Bridgewater's, the Mersey and Irwell, and the Leeds and Liverpool,) each in itself no despicable opponent, forgetting their mutual jealousy and former disagreements, appeared in formidable array, acting on one impulse for the common safety, and prepared at all hazards to put down so intolerable an innovation on established modes and vested rights. This was to be expected. But the opposition did not end here. Two noble Lords, the Earls of Derby and Sefton, a part of whose estates the Railway crossed, made common cause with the Canals to prevent the establishment of a Railway. On the part of these noblemen, it was contended that the sanctity of their domains would be invaded, and the privacy of their residences destroyed, by thus bringing into their neighbourhood a public highway, with all the varied traffic of coals and merchandise and passengers, that would be the consequence of such an establishment.

The question being fairly brought before the House of Commons, the proceedings were briefly as follow:— On the 8th of Feb. 1825, the petition for the Bill was presented to the House of Commons, and on the 9th the Committee on Standing Orders resolved that the "orders" had been complied with. On the 18th of Feb. the Bill was read a first time in the House of Commons. On the 2d of March the Bill was read a second time, after a debate of about an hour and a half, on which occasion Sir John Newport, Mr. Huskisson, Mr. W. Peel, Mr. Doherty, Mr. Calcraft, and Mr. Brougham, spoke in favour of the measure—

Mr. Green, Member for Lancaster, and Mr. George Philips against it. The second reading was carried without a division. In the Committee on the Bill, General Gascoyne was requested to act as Chairman, an office which he kindly undertook, and which he fulfilled with infinite patience and perseverance during a protracted contest of nearly three months. On the 21st of March (all preliminary forms having been complied with), Mr. Counsellor Adam, on behalf of the Railway Company, made his opening speech in Committee, and on the following days evidence was heard in favour of the Bill, or in Parliamentary language, in proof of the preamble—the general tenor of the evidence being in confirmation of the statements and arguments put forth in the Company's Prospectus. Mr. Adam was supported by Mr. Sergeant Spankie, Mr. Joy, and Mr. Wm. Brougham. On the 2d of May, Mr. Spankie summed up for the Railway, and on the 3d Mr. Counsellor Harrison led on the hostile van, supported by Mr. Alderson, Mr. Parke, Mr. M'Donald, Mr. Earle, and Mr. Cullen. He did not deny that great inconvenience and delays had arisen from the defective system of Water conveyance, nor that occasionally it took as long a time to transport merchandise from Liverpool to Manchester as it did to bring it from America to Liverpool; nor that a direct line of 30 miles on a Railway would present a speedier conveyance than a circuitous route of near 50 miles through Canals and tide-way. But it was contended that the Canals and River were capacious enough for all the traffic of the port; that, moveover,

our levels and sections were erroneous; that the Locomotive Engine was an unsightly object; and that the formation of the Railway would cost three or four times as much as the estimate: nay, Mr. Francis Giles, Civil Engineer, was produced to record his opinion that it would cost upwards of £200,000. to carry the Railway across Chat Moss alone:—from all which it followed, that, from considerations of kindness to the Proprietors of so wild and impracticable a scheme, the Bill ought to be rejected by the legislature.*

On the subject of the levels and sections, the opponents of the Bill were correct in their animad-

* I subjoin an abstract from Mr. Giles's evidence before the Committee of the House of Commons, on the 5th May, 1825, taken from an official copy:—

Q. Be so good as to tell us whether in your judgment a Rail-road of this description can be safely made over Chat Moss, without going to the bottom of the Moss?

A. I say certainly not.

Q. Will it be necessary, therefore, in making a Rail-road which is to stand, to take out, along the whole line of the road, the whole of the Moss to the bottom?

A. Undoubtedly.

Q. Will that make it necessary to cut down the 33 or 34 feet of which you have been speaking?

A. Yes.

Q. And afterwards to fill it up with other soil?

A. To such a height as the Rail-road is to be carried; other soil mixed with a portion of the Moss.

Q. But suppose they were to work upon this stuff, could they get their carriages to the place?

A. No carriage can stand on the Moss short of the bottom.

Q. What would they do to make it stand—laying planks, or something of that sort?

A. Nothing would support it.

Q. So that, if you could carry a Rail-road on this fluid stuff—if you could do it—it would still take a great number of men, and a great sum of money. Could it be done, in your opinion, for £6000.?

A. I should say £200,000. would not get through it.

Q. My Learned Friend wishes to know what it would cost to lay it with diamonds? &c. &c.

versions: a considerable error had been committed by the Surveyors for the Railway; which, when discovered, was acknowledged in Committee. The rectifying of this error was to the advantage of the Railway Company, inasmuch as the cost of the corrected line would have been less than that of the erroneous section. The impression on the Committee, however, was unfavourable; and some degree of doubt and uncertainty was necessarily thrown on the whole of the surveying department.

On the 30th of May, Mr. Harrison concluded the case for the opponents of the Bill.

On the 31st, Mr. Adam replied; after which, the Committee divided on the preamble, which was *carried* by a majority of *one*, 37 members being in favour of the Bill, and 36 against it.

Such a result, after a three months' Parliamentary campaign, and after 37 working days spent laboriously in Committee, was far from encouraging to the promoters of the Bill. All the clauses and detail of the Bill had still to be discussed, scrutinized, and opposed; and it was hardly to be expected, after so protracted an opposition, that Members of Parliament, without that strong personal and pecuniary interest, in defence of which the Canal Proprietors might be supposed to make every effort, would still persevere in what, to many at least, might now be considered a hopeless contest. Accordingly, on the 1st of June, the first clause of the Bill, empowering the Company to make the Railway, was lost, on a division, by a majority of 19 to 13. The clause to take land was then put to

the vote and also lost; whereupon Mr. Adam, on behalf of the Railway Company, withdrew the Bill.

Such was the result of the first attempt in Parliament to obtain the sanction of the legislature to the formation of the Liverpool and Manchester Railway. Scarcely, however, was the fate of the Bill decided for the passing Session before the first movement was made, and the first steps taken, for a renewed effort in the succeeding year. In the course of Parliamentary proceedings it has been observed, that where a Bill is vehemently opposed, whether with a view to the public good or from the impulse of private interests, still the measure is seldom carried the first year. The ground is broken; the arguments on both sides are stated, and probably exaggerated; the heat of parties is displayed, and in some measure exhausts itself. In another Session the subject is more likely to be discussed with calmness and temper; and if some public benefit be included in the scheme proposed, the chances of success are much increased in the second year.

The promoters of the Railway felt confident that their failure was not to be attributed to any lack of public opinion in favour of the great work in which they had engaged; and understanding that many Members of Parliament were strongly impressed with the importance of the measure in question, considered as a national undertaking, it was thought desirable that a meeting should take place between the Railway Committee and such of the Parliamentary supporters of the Bill as could conveniently attend, to record

some expression of opinion on the then posture of affairs, and especially with reference to proceedings in future. Accordingly, the following Members of Parliament met the Railway Committee (by invitation) on the 4th of June, 1825, at the Royal Hotel, St. James'-street, viz.:—

General Gascoyne.
The Lord Viscount Forbes.
Sir Philip Musgrove.
Sir Robert Wilson.
Right Hon. W. Huskisson.
Right Hon. W. Bagwell.
The Hon. General King.
The Hon. Col. Lowther.
Thomas Spring Rice, Esq.
W. Y. Peel, Esq.
William Holmes, Esq.
Marcus Beresford, Esq.
Richard Hart Davies, Esq.
W. H. Trant, Esq.
Robert Price, Esq.
General Hart.
Colonel Cawthorne.
Colonel Crosbie.
Alderman Bridges.
Robert Downie, Esq.
N. Sneyd, Esq.

General Gascoyne was called to the chair, and after some desultory conversation,

Mr. Huskisson said, that he perceived nothing connected with the discussions on this Bill in the Committee of the House of Commons, or in the rejection of the measure, after the preamble of the Bill was proved, which should deter the subscribers from renewing their application to Parliament another Session. Looking at the immense traffic between Liverpool and Manchester—taking into consideration the well-being of Ireland, which required the utmost facilities of introducing her produce into the great manufacturing districts—he had no hesitation in saying that, in his opinion, some additional and improved

means of conveyance between Liverpool and Manchester would be highly desirable. It was, therefore, that he considered the measure now under discussion of great public importance; and whatever temporary opposition it might meet with, he conceived that Parliament must ultimately give its sanction to the undertaking.

Sir Robert Wilson expressed a wish that, as regarded the opponents of the measure, every discussion and proceeding might be carried on in the spirit of conciliation.

Mr. Spring Rice said, he could state that almost all the commercial bodies in Ireland were favourable to the measure; and he thought Hon. Members would render a great service to that country by supporting the Bill when again brought forward. He considered the Railway would be particularly important in facilitating the intercourse between Manchester and those districts in Ireland which were already engaged in certain processes of the cotton manufacture.

Mr. Holmes read a letter from Lord Lowther, regretting his inability to attend; also a favourable opinion of *Mr. M'Adam*, on the facility of carrying roads over bogs and mosses; a question which had occasioned much discussion in the Committee of the House.

After some further conversation, *Mr. Lawrence*, as Chairman of the Railway Deputation, having expressed his conviction that the subscribers would be disposed to renew their application to Parliament in

the next Session, the following resolution, moved by *Mr. Huskisson*, and seconded by *Mr. W. Peel*, was unanimously adopted:—

"That it is the opinion of this meeting, that for the purpose of insuring increased facility, cheapness, and despatch in the very extensive intercourse in merchandise and manufactured goods between the towns of Liverpool and Manchester, and also in the general trade between this great manufacturing district and Ireland, it is expedient to provide additional and improved means of conveyance between Liverpool and Manchester."

The second resolution was proposed by *Mr. Spring Rice* and seconded by *Mr. Bagwell*,

"That the failure of the Liverpool and Manchester Railway Bill during the present Session, in consequence of the rejecting of two enacting clauses, after the preamble of the Bill had been proved, does not appear to this meeting an event which ought to discourage the subscribers from renewing their application the next Session of Parliament, should it appear to the subscribers advisable to carry this important measure."

After this resolution was agreed to, the meeting broke up; and thus terminated the proceedings of the Railway Committee, in connection with their application to Parliament in the Session of 1825.

The interval was short between the labours of this Session and the preliminary steps requisite to be taken preparatory to the ensuing Parliamentary campaign.

The Committee of the Railway, on the return of their Deputation from London, advertised their intention of adopting "measures for a renewed application to Parliament the ensuing Session:" and on the 1st of July, it was resolved that Mr. John Rennie be requested to undertake the office of Engineer to the Company. After some correspondence, it was agreed that Messrs. George and John Rennie should be the Engineers of the Railway; and Mr. George Rennie, pursuant to instructions, undertook a new survey of the country between Liverpool and Manchester, in order "to report to the Committee the best line for a Railway."

On the 12th of August, the Committee, on the recommendation of the Engineers, determined to adopt a new line of way, passing considerably to the south of the former route. In furtherance of this resolution, Mr. Charles Vignoles, on behalf of Messrs. Rennie, was appointed to prepare the necessary sections and plans of the projected undertaking. As these advanced towards completion, it became evident that the cost of the new line would much exceed the former estimate of £400,000. It became a question, therefore, with the Committee, in what way to raise such additional sum as might be requisite.

In an early stage of the undertaking it was proposed to R. H. Bradshaw, Esq. M. P. as Trustee for the Proprietors of the Duke of Bridgewater's Canal, to become a shareholder in the Railway. It appeared reasonable that the Proprietors of the Canal Navigations, whose property might be considerably affected by the estab-

lishment of a new mode of conveyance, should have the option of taking part in the projected scheme. Mr. Bradshaw, however, declined the proposition. If it be inquired why the same offer was not made to the other great Navigation Company (the Mersey and Irwell), the answer is obvious. The Duke of Bridgewater's Canal is private, entailed, and indisposable property; whereas a Proprietor of the Mersey and Irwell Company had the power, any moment, to reduce his interest in the Water conveyance, and take a share in the Railway, if he so thought fit.

The Committee of the Railway, at the present juncture, determined to renew the overture which they had formerly made, but not through the intervention of Mr. Bradshaw. A communication was opened more directly with the Marquis of Stafford, the party beneficially interested in the Duke's Canal, through the medium of James Loch, Esq. M. P. his Lordship's confidential adviser. The proposal was met in the spirit in which it was made; and, after the discussion of various preliminary points, it was agreed that the Marquis should become a subscriber to the new line of Railway, to the extent of 1000 shares. This arrangement being completed, the Committee lost no time in issuing their second Prospectus, in which the circumstance is made known to the Proprietors and to the public. The following is a copy:—

" LIVERPOOL & MANCHESTER RAILWAY COMPANY.

NEW LINE.

COMMITTEE.

CHARLES LAWRENCE, Esq. *Chairman.*
ROBERT GLADSTONE, Esq. } *Deputy Chairmen.*
JOHN MOSS, Esq. }
JOSEPH SANDARS, Esq. }
ROBERT BENSON, Esq. Liverpool.
H. H. BIRLEY, Esq. Manchester.
JOSEPH BIRLEY, Esq. Ditto.
BEN. BOOTH, Esq. Ditto.
HENRY BOOTH, Esq. Liverpool.
THOMAS S. BRANDRETH, Esq. Ditto.
JOHN EWART, Esq. Ditto.
PETER EWART, Esq. Manchester.
R. H. GREGG, Esq. Ditto.
R. HARRISON, Esq. Liverpool.
THOS. HEADLAM, Esq. Liverpool.
ADAM HODGSON, Esq. Ditto.
ISAAC HODGSON, Esq. Ditto.
JOSEPH HORNBY, Esq. Ditto.
JOHN KENNEDY, Esq. Manchester.
AARON LEES, Esq. Ditto.
W. MAXWELL, Esq. Liverpool.
WILLIAM POTTER, Esq. Ditto.
WILLIAM RATHBONE, Esq. Ditto.
WILLIAM ROTHERAM, Esq. Ditto.
JOHN RYLE, Esq. Manchester.
THOMAS SHARPE, Esq. Ditto.
JOHN WILSON, Esq. Liverpool.

Parliamentary Agent, THOMAS M. SHERWOOD, Esq.—*Engineers*, Messrs. GEORGE and JOHN RENNIE.— *Solicitors*, Messrs. PRITT and CLAY.—*Bankers*, Messrs. MOSS, ROGERS and Moss, Liverpool.

CAPITAL.....£510,000.

PROSPECTUS.

" The Committee of the Liverpool and Manchester Railway, before entering upon the labours which a renewed application to Parliament will impose upon them, are desirous to advert to the causes which led to the unsuccessful termination of their late efforts; and, at the same time, briefly to explain the grounds upon which they rest their anticipations of success in the ensuing Session.

" A very prominent objection, taken by the opponents of the Bill, was founded on the errors in the section and levels, as exhibited before Parliament. These errors the Committee at once acknowledged and regretted; and, to avoid all chance of similar complaint in future, they have engaged the professional services of most eminent Engineers, aided by assistants of undoubted talents and activity, whose combined efforts justify the fullest assurance, not only of the correctness of the plans and sections, but that the whole line will be laid down and arranged with that skill and conformity with the rules of mechanical science, which will equally challenge approbation, whether considered as a national undertaking of great public utility, or as a magnificent specimen of art.

" A second objection to the measure (which, however, was insisted upon out of doors more than in Parliament) was the interruption and inconvenience anticipated from the line of road crossing

various streets in Liverpool and Manchester. This difficulty has been completely obviated. In the new line, recommended by Messrs. Rennie, the Railway enters Liverpool by means of a tunnel and inclined plane, thus effecting a direct and most desirable communication with the King and Queen's Docks, without interfering with a single street. It does not enter the town of Manchester at all, the line terminating near the New Bailey Prison, in the township of Salford.

"A third objection to the measure was taken by the Old Quay Company, on the ground that the Railway interfered with their navigation, by reason of a bridge in the neighbourhood of Manchester, over the River Irwell. The Committee are happy to state that this difficulty is avoided, inasmuch as the new line does not cross the Irwell at all.

"A fourth manifestation of opposition was on the part of the Leeds and Liverpool Canal Company, on the ground that the Railway passed *under* their Canal, in its way to the Prince's Dock. However futile such an objection, it is satisfactory to be enabled to state, that even this assumed ground of opposition is altogether avoided, as the line does not go near the Canal in question.

"Another and more plausible objection was founded on the employment of the Locomotive Engine. It was contended, in the *first* place, that this new and peculiar power was incompetent to perform the task assigned to it; in the *second* place, that it was unsafe; and *lastly*, that in its operation it would prove a public nuisance. By the evidence, however, it was proved that it was perfectly competent to perform all that was proposed to be accomplished; and, before the evidence was closed, the Counsel for the opponents of the Bill admitted that it was *safe*. Upon the third point of objection, the Committee are confident such improvements will be made in the construction and application of this effective machine, as will obviate all objection on the score of nuisance; and, as a guarantee of their good faith towards the public, they will not require any clause empowering them to use it,—or they will submit to such restrictions in the employment of it as Parliament may impose, for the satisfaction and ample protection both of proprietors on the line of road and of the public at large.

" The last, but not the least important objection which the Railway had to encounter, was on the part of several land-owners on the line. Amongst their opponents, on this ground, the Committee regret they were obliged to number the noble Earls of Derby and Sefton, whose estates the Railway crossed for a considerable distance, as well as others, whose property the line unavoidably intersected.

" The Committee most fully admit that the opinions and personal convenience of proprietors on the line of road are entitled to every consideration, and they have been most anxious, by all practicable means, to meet the wishes or to remove the objections of every land-owner on the road. They are happy to be able to state, that they can no longer, in this respect, find an opponent in Lord Sefton, as they do not, in the line of road they are about to apply for, cross any portion of his Lordship's estate. And with reference to the Earl of Derby, they conceive they are entitled to apply the same observation, inasmuch as the new line crosses only a few detached fields of his Lordship's property, far removed from the Knowsley domain, and the great turnpike road from Liverpool to Manchester intervening.

" With reference to the land-owners generally upon the new line, the Committee have to state, that they have spared no pains to accommodate the exact route to the wishes of proprietors whose estates they cross; whether, on the one hand, by removing the road to a distance from the mansions of proprietors, and from those portions of estates more particularly appropriated to game preserves, or, on the other hand, by introducing it more immediately into the vicinity of districts abounding with coal, which, by this means, will be brought into a cheap and expeditious communication with the Liverpool and Manchester markets. And they are happy to state, that their efforts in these respects have been in a great measure successful. In an important national undertaking, where a road has to be carried through a populous country for thirty miles, it will hardly be expected that every proprietor will assent, or that no individual will consider himself aggrieved. The Committee have used every effort to render the measure not only unobjectionable, but advantageous to every land-owner on the line. In all cases they are prepared to give a full value for the land they may require; and, should there be instances where unavoidable inconvenience is occasioned, they

are most anxious to admit, that peculiar damage must be met by peculiar compensation.

" In regard to the existing means of conveyance, the Committee are desirous to state, that they are actuated by no hostile feeling to their interest and prosperity. They have felt that the increased and increasing trade of the two great towns of Manchester and Liverpool, and the rapidly increasing intercourse with Ireland, demanded additional facilities in the means of transit; and the professed and sincere desire of the Committee has been confined to supply this want. The Committee have the satisfaction of being able to state, that, in accordance with this feeling, the opposition of the most powerful of the existing establishments has been removed, by the Marquis of Stafford having, for himself and those of his family who are beneficially interested in the profits of the Duke of Bridgewater's Canal, become a subscriber to the Railway to the extent of One Thousand Shares. Being satisfied that the proceedings of last Session of Parliament have removed the misapprehensions which existed, both in regard to the nature and the management of the Bridgewater Canal, they felt it would be unfit to continue their opposition to the proposed measure in its improved form.

" Having thus disposed of the objections and difficulties which the Committee have had to encounter, they will briefly advert to those prominent and unequivocal advantages of the measure upon which they rest their claim to the favour of the public, and the sanction of Parliament.

" In their prospectus of last year, the Committee stated ' the total quantity of merchandise passing between Liverpool and Manchester at *one thousand tons per day.*' This quantity, it would seem, is underrated, the whole traffic being admitted, on all hands, in Committee of the House of Commons, to be 1200 tons per diem; which immense aggregate tonnage is, at present, subject to all the delays incidental to the river navigation.

" The Committee of the Railway propose to effect the transit of merchandise in a few hours, with uniform regularity, and at such reduced rates as will secure to the towns of Liverpool and Manchester a pecuniary saving, which, whether estimated in proportion to the expenditure upon which it is effected, or with reference to the

aggregate amount, has seldom been equalled in any scheme of improvement submitted to the public.

" Neither is the immediate pecuniary saving to the towns of Liverpool and Manchester to be estimated with reference merely to the cost of conveying merchandise between the respective towns. The *travelling* between Liverpool and Manchester is upon the most extensive scale; and the economy to be effected in this branch of expenditure, though impossible to be estimated with accuracy, must be considered as most important, and, of itself, no small recommendation of the undertaking.

" The advantages, however, above enumerated are only a part of the beneficial results which this scheme proposes. The line of Railway, as now laid down, passes through a rich and extensive coal district, in full working, for the supply of Liverpool, and requiring only a facility of transport to be brought into requisition for the supply of Manchester. At a moderate computation, Liverpool requires for its local consumption 900 tons of coal per day, besides what is required for foreign commerce, and for the numerous steam-packets which sail daily through the season between Liverpool and various ports in Ireland, Scotland, and Wales. An aggregate consumption of 500,000 tons per annum may be taken as under the mark. Of this large quantity, a considerable proportion is brought to market by land carriage; extensive fields of coal in the direct line of the Railway having no other means of access to Liverpool. With reference to Manchester, the ordinary consumption for domestic purposes may be considered the same as in Liverpool, and the quantity used in the extensive factories of that town may be computed as equivalent to the demand for the steam vessels, and for the export trade at Liverpool: the aggregate consumption, therefore, of the two towns may be estimated, with sufficient accuracy, at ONE MILLION of tons per annum.

" The importance to the community of a moderate price to be paid for an article of such extensive and universal consumption is immediately apparent; and some idea of the benefit to be derived from such a facility of transport as may ensure a more enlarged and effectual competition may be formed from the circumstance, that in Manchester the price of coals was advanced 1s. 6d. per ton immediately upon the Railway Bill being withdrawn in the last Session of

Parliament; while in Liverpool, within the last thirty-five years, the price of the best coal has been advanced upwards of 7s. per ton, that is, nearly 100 per cent. But, estimating the reduction in the price of this article at 2s. per ton, here is a saving of £100,000. per annum (an amount equal to the whole assessed taxes of the two towns) effected upon a single article, not of luxury, and confined to the higher or mercantile classes of the community, but an article of the first necessity, of daily and hourly consumption, and forming no small item in the expenditure of every poor man's family.

"Moreover, it would be to take a very narrow and imperfect view of the great question now under discussion, to limit our consideration to the immediate accommodation of the mercantile classes, to the pecuniary saving proposed to the travelling community, or even to the still more important saving to the consumers of coals, and of every description of goods conveyed between Liverpool and Manchester. The question demands a wider survey and the consideration of more distant results. We must contemplate the important effects upon the commerce of the nation, which are to be anticipated, on the one hand, from *affording*, or, on the other hand, from *denying* facilities to the commercial operations of this great county. Above all, we must look to Ireland, the natural granary of the manufacturing districts of this country. To the sister kingdom a facility of intercourse and conveyance between Liverpool and the interior of Lancashire and Yorkshire is of paramount importance; in the first place, for the cheap and regular transport of her agricultural produce; and secondly, for the rapid transit of cotton and woollen goods in different stages of their manufacture, which alone seems wanting to foster the growing industry of Ireland; to give to her some proportionate advantage for her cheap labour, and thus render her an auxiliary and an helpmate to the more stable manufacturing establishments of this country.

"But the subject does not end here. It becomes a question of serious import whether this country, which is indebted for so much of her wealth, and power, and greatness, to the bold and judicious application of mechanical science, shall now pause in the career of improvement, while it is notorious that other nations will adopt the means of aggrandisement which we reject,—whether England shall

relinquish the high vantage ground she at present possesses, not more with a reference to the direct operations of commerce and manufactures, than, generally, in the successful application of the most important principles of science and of art.

" The Committee feel that it is unnecessary to dwell at greater length on the question they have thus brought before the public. They are about to apply for the sanction of the legislature; and they are determined to relax no efforts on their part to bring about the honourable and speedy accomplishment of the great work in which they have engaged.

" CHARLES LAWRENCE, *Chairman.*

" *Liverpool, December* 26, 1825."

The time was now arrived when the question was again to be brought under the consideration of the legislature. A Deputation from the Railway Committee accordingly assembled in London in the first week in February, 1826.

On the 7th of February, the *Petition* for the Bill was presented to the House of Commons by General Gascoyne.

On the 9th, the compliance with the standing orders was proved in Committee.

On the 10th, the Bill was read a *first time* in the House of Commons.

On the 20th, it was read a *second time*, without discussion.

On March 6, Mr. Counsellor Adam made his opening speech in Committee, and on the same side were Mr. Sergeant Spankie, Mr. Joy, and Mr. W. Brougham.

After the estimates and other evidence in the Engineering department had been recorded, the general evidence in favour of the Bill, and with reference to

the trade and commerce of the two towns, occupied two days.

On the 9th of March, Mr. Spankie summed up, and Mr. Counsellor Earle opened his case on behalf of the opponents. The injury to be apprehended to certain land-owners on the line of Railway, and the competency of the Canal Companies to carry on the trade between Liverpool and Manchester, were the topics principally enforced.

On the 15th of March, Mr. Harrison, for the Canals, summed up, in a speech of two hours, the burden of which was, that the Railway, as a conveyance, would be neither cheap nor expeditious; that it would be a grievous injury to the land-owners on the line, and at the same time ruinous to the projectors themselves.

On the 16th of March, Mr. Adam *replied;* after which the room was cleared, and on the division, the Preamble of the Bill was voted to be *proved,* by a majority of 43 to 18.

On the 6th of April, the Bill was read a third time in the House of Commons. The debate on this occasion was spirited; General Gascoyne moved the third reading, seconded by Mr. W. Peel; the Hon. Edward Stanley moved that the Bill be read that day six months, and was seconded by Sir Isaac Coffin. Mr. Huskisson and Sir John Newport spoke in favour of the Bill; and Mr. Philips (now Sir Geo. Philips) and Capt. I. Bradshaw against it. On the division, the numbers were 88 in favour, 41 against—majority 47.

On the 7th of April, the Bill was read a first time in the House of Lords.

On the 10th of April, Lord Dacre moved the second

reading, when the Earl of Derby declared his intention to oppose the Bill in Committee, though he should not object to the second reading.

On the 13th of April, Mr. Adam opened the case for the Railway in the Committee of the Lords, thirty-three Peers being present, Lord Kenyon having consented to take the chair.

The evidence, on both sides, was similar in effect to that offered to the House of Commons. On the subject of the Locomotive Engine, however—a machine which had been represented to the House of Commons in so formidable a light,—evidence was brought forward by the opponents of the Bill; but so poor a case was made, and so little objectionable did the Engine appear to be, even from the testimony of the opponents, that the Lords did not think it necessary to hear any evidence on the other side, although it was tendered by the Counsel for the Bill.

On the 20th of April, Mr. Sergeant Spankie summed up, on behalf of the Railway, and Mr. Alderson opened in opposition.

On the 27th of April, Mr. Harrison summed up for the opponents, and Mr. Adam replied; after which, the Committee adjourned till the 1st of May.

On that day the Committee of the Lords re-assembled, thirty-two Peers being present. On a division, the preamble was declared to be proved, the numbers being 30 in favour—2 against.

Amongst the Peers in favour of the Bill were Lord Kenyon, the Earl of Lonsdale, the Bishop of Bath

and Wells, the Bishop of Chester (now Bishop of London), the Marquis of Salisbury, Earl of Cassillis, Lord Dacre, Earl of Caernarvon, &c. &c.

The Earl of Derby and the Earl of Wilton were the opposing parties. The Bill was then read a third time in the Lords, and passed without a division.

Such is a brief outline of the Parliamentary proceedings on the Liverpool and Manchester Railway Bill; a measure which called into activity very powerful and conflicting interests. It could not, indeed, be expected that wealthy and long-established Companies, exercising their joint monopolies by prescriptive right and undisputed usage, could contemplate with the liberality of advocates for FREE TRADE the establishment of a Company great and powerful as themselves, for the avowed purpose of carrying on, by land, that mighty traffic and interchange of commodities between Liverpool and Manchester, which had been so long and so profitably carried on by water. To put down, in limine, a scheme so startling in its character, and withal so full of unknown consequences, was an object worthy of a strenuous and combined effort. The attempt was accordingly made: no labour was spared, no expedient left untried, no expenditure withheld. The greatness of the effort, however, on the one side, called forth proportionate exertion on the other. The aggregate pecuniary cost entailed on the parties concerned in the contest, was not less than from sixty to seventy thousand pounds: it has been estimated much higher. But the contest is over, and the result will be satisfactory to all who contemplate with pleasure the

commercial prosperity of the country, or who take an interest in marking those great steps in the progress of mechanical science, the successful study and varied application of which, to arts and manufactures, have contributed in no small degree to raise this country to its present pre-eminence in wealth, power, and civilization.

CHAPTER II.

FORMATION OF THE RAILWAY AND EXPENDITURE.

The first General Meeting of Subscribers, under the authority of the Act, was held in Liverpool on the 29th of May, 1826, when twelve Directors were chosen by the Proprietors, in conjunction with three Directors nominated by the Marquis of Stafford, to carry into effect the formation of the projected Railway. The first meeting of *Directors* was on the following day, when Charles Lawrence, Esq. was elected Chairman, and John Moss, Esq. Deputy Chairman; and the Board immediately took into consideration the choice of a Principal Engineer. It was obvious, that in an undertaking of such magnitude, a *resident* Engineer of experience and ability was indispensable; and the Directors naturally turned their attention to Mr. Stephenson, of Newcastle, a gentleman thoroughly acquainted with practical mechanics, and possessing more experience in the construction and working of Railways than perhaps any other individual. The Directors, at the same time, wrote to Messrs. Geo. and John Rennie, requesting them to undertake the professional superintendence of the undertaking On the 17th of June, Mr. Geo. Rennie had an interview with the Directors, on which occasion the subject was discussed; and, in conclusion, Mr. Rennie proposed to the Directors to

superintend the execution of the work, making six visits per annum, and remaining on the ground seven or ten days at each visit, but stipulating, at the same time, that the *resident* Engineer should be of his own appointing. On the 19th of June, the Directors took Mr. Rennie's proposition into consideration. They would have been glad of the professional assistance of Mr. Rennie, but it was their duty to take advantage of the best practical knowledge within their reach. The trust reposed in them, and the responsibility attaching to its due fulfilment, were too weighty to allow of their being much influenced by ordinary punctilios. Their course was direct to the great object they had in view. Mr. Rennie's proposition was respectfully declined, and Mr. George Stephenson was elected Principal Engineer to the Company.

The first point of actual operation was on Chat Moss, where the draining was commenced in June, 1826. The first shaft of the Liverpool Tunnel was opened in September of the same year, but very little progress was made in either of these departments of the work during 1826; and the earth-work (comprising the cuttings and embankings along the whole line) was not commenced till January, 1827. It will not be surprising that some delay should take place in the first instance, before a sufficient quantity of waggons, implements, and materials could be constructed or collected, to enable the Engineer to make much progress in the execution of the work. In Mechanics, it is found that it is not easy to put great weights *speedily* into rapid movement; and a variety

of impediments must generally be encountered at the commencement of great undertakings. In the case of the Railway, the purchase of land was a preliminary step, requiring time and consideration to accomplish. Early in 1827, however, the machine was fairly in motion; the necessary arrangements were made; assistant Engineers were appointed; and operations in various parts of the line were in progress.

One of the objects of the Directors, in the summer of 1826, had been to make arrangements to obtain a loan of £100,000. from the Exchequer Loan Commissioners, appointed by the authority of Parliament to aid the completion of public works by the loan of money, under proper securities for its repayment by instalments, in a series of years. On a correspondence with the Commissioners, it was considered necessary to have the authority of a special Act of Parliament for the purpose; and accordingly, a General Meeting of Proprietors, on the 11th of December, 1826, empowered the Directors of the Railway to apply to Parliament for an Act to authorise the loan in question. The Act was obtained in the spring of 1827, and in June of the same year £100,000. was received from the Commissioners. With the aid of this loan, in addition to the several calls on the Subscribers, the Directors were enabled to push forward the work with more than ordinary vigour, and consequently to give employment to an increased number of labourers, which, at the period in question, and under the circumstances of the time, was an object of no small importance.

During the whole of the year 1827, the formation of the Tunnel under Liverpool was carried forward with spirit and perseverance. Night and day the excavation proceeded, and many difficulties in the execution of the work had to be overcome. In some places the substance excavated was a soft blue shale, with abundance of water; in other places a wet sand presented itself, requiring no slight labour and contrivance to support till the masonry which was to form the roof was erected. In passing under Crown-street, near the Botanic Garden, for want of sufficient props the superincumbent mass fell in from the surface, being a depth of 30 feet, of loose moss-earth and sand.* On some occasions the miners refused to work, and it not unfrequently required the personal superintendence and encouragement of the Engineer to keep them at their posts. Nor is this surprising, considering the nature of the operation: boring their way almost in the dark, with the water streaming around them, and uncertain whether the props and stays would bear the pressure from above till the arch-work should be completed. Those who visit the Tunnel in its present state, illuminated with gas-lights, and traversed by horses, carriages, and crowds of passengers, will not easily picture to themselves the original dark and dangerous cavern, with the roof and sides supported by shores, while the miners pursued their arduous task by the light of a few candles, whose feeble glimmer glancing on the water which ran down the sides, or which spread out

* This happened while the Engineer was absent from Liverpool.

in a sheet below, was barely sufficient to show the dreariness of the place. But while some portions of the Tunnel were excavated under circumstances of no little difficulty and danger, and requiring all the skill and energy of the Engineer to accomplish, other portions were hewn through a fine red sand-stone, clean, dry, and substantial, and requiring neither props nor artificial arching; the natural rock forming the roof of the excavation.

The Tunnel was constructed in seven or eight separate lengths, communicating with the surface by upright shafts, through which the substance excavated was conveyed away. The exact joinings of these different lengths, so as to form one complete whole, as now exhibited, was, of course, from time to time an object of considerable interest, and to the Directors of some anxiety; and the accuracy with which this was effected is highly creditable to the Engineer, and to Mr. Locke, the Assistant Engineer for that department.

Nearly two-thirds of the Tunnel were completed in 1827, at an expense of twenty thousand pounds; and about the same money was expended in the cuttings and embankings along the line. The total expenditure of the Company on the 31st of December, 1827, including the cost of obtaining the Act of Parliament, and other preliminary disbursements, was £212,855. 19s. 8d.

Early in the year 1828, it became evident, notwithstanding this large expenditure, that the progress of the works was not advancing with that celerity which was to be desired. On the earth-work, the estimate

of which amounted to £138,000., only £20,000. had been expended at the close of 1827. The Directors became fully sensible of the importance of expediting the whole work. The interest on the capital expended, and the loss of all income till the Railway, or at least a considerable portion of it should be completed, afforded motive sufficient to induce the Company to push forward the operations with still increasing speed.

In the spring of this year (1828) the Directors obtained an Act of Parliament for altering the line of road, improving the curves, and shortening the distance, by avoiding several circuitous routes, as laid down in the Parliamentary plan. The improved parts of the road are comprised between certain lands in the township of Sutton, near Rainhill, and that part of the line situate in Culcheth, near Bury-lane.

On the 9th of June, 1828, it was reported to the Directors that the last joining between the several lengths of the Tunnel was effected, and at that time all very serious difficulties in the execution of this branch of the undertaking were surmounted. In this year principally, was effected the *piling* for the foundations of the piers of the great Viaduct over the Sankey valley, a business of much labour and cost, but indispensable for the security of the superstructure. About two hundred piles, varying from 20 to 30 feet in length, were driven hard into the foundation site of each of the ten piers. The heavy ram employed to impart the finishing strokes, hoisted up with double purchase and snail's pace to the summit of the Piling Engine, and then falling down like a thunderbolt on the head

of the devoted timber, driving it perhaps a single half inch into the stratum below, is well calculated to put to the test the virtue of patience, while it illustrates the old adage of—" slow and sure." The Viaduct comprises nine arches of 50 feet span each, stretching across the valley of the Sankey, over which the Railway was to be carried, at a height of nearly 70 feet above the level of the Sankey Canal. During the present year (1828), was completed the Company's bridge over the turnpike road and the old Mill Dam at Newton, and the operations on Chat Moss were carried on without intermission, embanking at each end, and draining, levelling, &c. on the centre portions.

On the 31*st of December*, 1828, the total expenditure was £461,899. 19s. 6d., which included the following items:—

On account of Chat Moss	£17,503	7	3
,,	Cuttings & Embankings	84,565	19	3
,,	Tunnel	33,937	14	2
,,	Sankey Viaduct	32,223	6	9
,,	Land	101,962	9	11
,,	Iron Rails, Chairs, &c.	63,010	3	10

Early in the year 1829, the Directors, with the sanction of the Proprietors, applied to Parliament and obtained their fourth *Act*, the purport of which was—first, to improve the termination of the line at the Manchester end, by carrying the Railway in a more direct course over the Irwell into Manchester, instead of allowing it to terminate near the New Bailey, in Salford, as set out in the original plan. This alteration was a great improvement, as it brought the Railway

to a station in Water-street, in the centre of the great Carrying Companies' Establishments; affording, at the same time, convenient access to the different parts of Manchester, whether with a view to merchandise laden in the Railway waggons, or passengers arriving in the Railway coaches.

Another important object of the Act of the present year was to authorise the Company to raise an additional capital of £127,500. by 5100 £25. *shares*, each holder of an original £100. *share* being entitled to one £25. *share*. The purpose of this new fund was to enable the Company to provide depots, machinery, waggons, carriages, &c. with all appurtenances belonging to a *Carrying Department;* for it is to be observed, that the original Railway Act requires the Company to be carriers, though it does not provide the means of carrying. That the raising of this additional capital was deemed expedient by the Proprietors at large, may be inferred from the circumstance that only fifteen of the new shares (out of 5100) were declined by the parties entitled to them, under the Act.

In the spring of 1829, the Directors were still anxious for increased despatch in the execution of the work, and the Engineer, in consequence, was instructed to order the Contractors at the principal cuttings throughout the line, to employ two sets of labourers, and to work by night as well as day. The operations accordingly proceeded still more rapidly than heretofore, though it must be allowed at considerably increased expense; and had it not been for an extraordinary wet summer and autumn, the earth-work for

a complete line of communication between Liverpool and Manchester might have been accomplished by the end of 1829, or the beginning of 1830, and the Railway laid down for operations within a few months from that period. As it was, very considerable delay was occasioned by the heavy and long-continued rains, besides no triflingexpense to the Company, in pumping the water from the deep cuttings, which were too apt to assume the appearance of a Canal rather than a Railway.

The principal structure completed in 1829, was the Company's bridge to carry the Liverpool and Warrington turnpike road over the Railway at Rainhill. The line of the public road at this place, crosses the Railway in an oblique direction, at an angle of 34 degrees, the span of the arch being 54 feet, while the breadth of the Railway under the bridge is only 30 feet. It is called a Skew Bridge, in popular phraseology, and is a very fine specimen of this kind of building, every stone of the arch being shaped with angles and curve adapted to the position in which it is placed. The Winton bridge, *over* the public road, near Eccles, is a very neat specimen of the same style of arch, but without the massive grandeur of the bridge at Rainhill.

In the present year, one road-way was laid along the whole extent of Chat Moss, and the Rocket Steam Engine, with a carriage and company, passed over it on the first day of 1830. The practicability of carrying the Railway over this Moss was seriously questioned in the House of Commons, and was honestly doubted by numbers who were acquainted with the soft and

pulpy state of this huge bog—in some places 30 to 35 feet deep—and so fluid, that an iron rod would sink through the Moss by its own gravity. The Railway, indeed, for the most part, floats on the surface, its compactness and buoyancy in the most fluid places being assisted by hurdles of brushwood and heather, laid under the wood sleepers which support the rails. The portion of the Moss which presented the most difficulty in its completion was about half a mile on the east border, where an embankment of about 20 feet had to be formed above the natural level. The weight of this embankment resting on a semi-fluid base, pressed down the original surface: many thousand cubic yards gradually and silently disappeared, before the line of road made any approach to the proposed level. By degrees, however, the whole mass beneath and on each side of this embankment became consolidated by the superincumbent and lateral pressure, and a little perseverance finally completed the work.

In September, 1829, was commenced the Company's bridge over the Irwell, in the improved line of road authorised by the Act of that year. This was the last great structure on the line of Railway from Liverpool to Manchester.

In the appendix will be found a general abstract of the total expenditure of the Railway, showing the cost of the different branches of the undertaking. This document may not be without interest to those who shall hereafter embark in similar adventures; though it will be evident that no very exact rule of com-

parison can be laid down, whereby to estimate the cost of different Railways; for not only have the wages of labour and the expense of materials to be taken into the account, but especially, the time and circumstances under which the work has to be accomplished—whether, notwithstanding unfavourable seasons, considerations of the earlier opening of the road, and more speedy acquisition of a profitable income, may still justify the prosecution of the work with unabated vigour—by night as well as by day—even at the increased expense which will thereby unavoidably be incurred. The Liverpool and Manchester Railway is a magnificent work; but it will be useful to keep in mind that such works cannot be executed except at an expenditure of no ordinary magnitude. This Railway will cost above £800,000., including the charge for stations and depots at each end, and machinery, engines, waggons, &c. for a carrying department. The immense traffic between Liverpool and Manchester amply justifies this outlay. But with reference to any similar scheme, in extension of the Railway system, it is desirable the projectors should impartially calculate the cost of the work, as well as the income it may be expected to produce; and especially that they should make an ample allowance beyond the first estimate of the expenditure, before they embark in the undertaking.

CHAPTER III.

DESCRIPTION OF THE RAILWAY—EXCURSION FROM LIVERPOOL TO MANCHESTER.

THERE is so little in scenery that is interesting on the turnpike road from Liverpool to Manchester, that a formal description of the way between the two towns may appear to be rather an unpromising undertaking. The traveller along the Railway, however, will speedily admit that there is little similitude between the two routes; the whole character, structure, and appearance of the Railway being altogether different from the general aspect of the turnpike road. Instead of a uniform, flat, and uninteresting country, the line of Railway is diversified continually by hill and dale, offered to the contemplation of the traveller in a sort of inverse presentment; the passenger by this new line of route having to traverse the deepest recesses, where the natural surface of the ground is the *highest*, and being mounted on the loftiest ridges and highest embankments, riding above the tops of the trees, and overlooking the surrounding country, where the natural surface of the ground is the *lowest*,—this peculiarity and this variety being occasioned by that essential requisite in a well-constructed Railway—a level line—imposing the necessity of cutting through the high lands and embanking across the low; thus, in effect,

presenting to the traveller all the variety of mountain and ravine in pleasing succession, whilst in reality he is moving almost on a level plane, and while the natural face of the country scarcely exhibits even those slight undulations which are necessary to relieve it from tameness and insipidity.

To accomplish a complete survey of the Railway, we should commence our journey of observation at the Liverpool end, in the Company's yard, in Wapping. Here the lower entrance of the great Tunnel is accessible through an open cutting, 22 feet deep and 46 feet wide, being space for four lines of Railway, with pillars between the lines to support the beams and flooring of the Company's warehouses, which are thrown across this excavation, and under which the waggons pass to be loaded or discharged through hatchways or trap doors communicating with the stores above; waggons loaded with coal or lime passing underneath the warehouses to the open wharfs at the Wapping end of the station.

Proceeding along the Tunnel, the line of Railway curves to the right, or south-east, till it reaches the bottom of the inclined plane, which is a perfectly straight line, 1980 yards in length, with a uniform rise of three-quarters of an inch to a yard. The Railway from Wapping to the commencement of the inclined plane is level; the whole rise, therefore, from Wapping to the Tunnel mouth, at Edge-hill, is 123 feet. The Tunnel is 22 feet wide and 16 feet high, the sides being perpendicular for five feet in height, surmounted by a semicircular arch of 11 feet radius: the total

length is 2250 yards. It is cut through various strata of red rock, blue shale and clay, but principally through rock of every degree of hardness, from the softest sand-stone to the most compact free-stone, which the axe or the chisel will with difficulty penetrate. It frequently was found necessary, in the progress of the work, to make an artificial vault of masonry, which has been effected by brick arch-work in those places where the natural rock could not be trusted to support the superincumbent mass. The height from the roof of the Tunnel upwards to the open surface of the ground, varies from 5 feet to 70, the greatest mass of superstratum being in the vicinity of Hope-street and Crabtree-lane. The whole length of this vast cavern is now furnished with gas-lights, and the sides and roof are *whitewashed*, to give better effect to the illumination. The different colours and peculiar appearance of the varying strata through which the Tunnel passes are thus hidden from view, and the attention is no longer attracted to those faults or slips in the solid rock, which indicate that the whole mass has been rent asunder by one or more of those terrible convulsions of nature, of which the traces are so frequently visible, but of which no other record remains. The geologist will be disappointed, in traversing this subterranean vault, to find the natural varieties converted by lime-water into one uniform and artificial appearance; but the principle of utility is paramount in a commercial undertaking.

At the upper or eastern end of the Tunnel, the traveller emerges into a spacious and noble area, 40

feet below the surface of the ground, cut out of the solid rock, and surmounted on every side by walls and battlements. From this area there returns a small Tunnel, 290 yards in length, 15 feet wide, and 12 feet high, parallel with the large one, but inclining upwards in the opposite direction, and terminating in the Company's premises in Crown-street, at the upper and eastern boundary of Liverpool; being the principal station for the Railway coaches, and the depot for coals for the supply of the higher districts of the town.

Proceeding eastward from the two Tunnels, the road passes through a Moorish archway, at present unfinished, which is to connect the two Engine-houses, and will form the grand entrance to the Liverpool stations. This structure is from a spirited design of Mr. Foster's, a representation of which I have placed as a suitable Frontispiece to this account of the Railway. The traveller now finds himself on the open road to Manchester, and has an opportunity of contemplating the peculiar features of a well-constructed Railway, the line in this place being perfectly level; the slight curve, which was unavoidable, beautifully set out; the road-way clean, dry, and free from obstructions; and the rails firmly fixed on massive blocks of stone. Crossing Wavertree-lane, the Railway descends for $5\frac{1}{2}$ miles at the rate of four feet in the mile,—a declivity so slight and uniform as not to be perceived by the eye, but still sufficient to give a mechanical advantage and facility of motion to a load passing in that direction. The road a little beyond Wavertree-lane is carried through a deep marle cutting, under several massive stone archways,

thrown across the excavation to form the requisite communications between the roads and farms on the opposite sides of the Railway. Beyond the marble cutting is the great rock excavation through Olive Mount, about half a mile to the north of the village of Wavertree. Here the traveller passes through a deep and narrow ravine, 70 feet below the surface of the ground, little more space being opened out than sufficient for two trains of carriages to pass each other, and the road winding gently round towards the south-east, the prospect is bounded by the perpendicular rock on either side, with the blue vault above, relieved at intervals by a bridge high over head, connecting the opposite precipices. The sides of the rock exhibit already the green surface of vegetation, and present altogether far more of the picturesque in their appearance than might be expected from so recent an excavation. At night, when the natural gloom of the place is further deepened, the scene from the bridges above will readily be imagined to be novel and striking. The light of the moon illuminating about half the depth, and casting a darker shade on the area below—the general silence interrupted at intervals by a noise like distant thunder—presently a train of carriages, led on by an Engine of fire and steam, with her lamps like two furnaces, throwing their light onward in dazzling signal of their approach—with the strength and speed of a war-horse the Engine moves forward with its glorious cavalcade of merchandise from all countries and passengers of all nations. But the spectacle is transient as striking; in a moment the

pageant is gone—the meteor is passed; the flaring of the lamps is only seen in the distance, and the observer, looking down from the battlement above, perceives that all again is still and dark and solitary.

Emerging from the Olive Mount cutting, you approach the great Roby embankment, formed of the materials dug out of the excavation we have described. This embankment stretches across the valley for about two miles, varying in height from 15 to 45 feet, and in breadth at the base from 60 to 135 feet. Here the traveller finds himself affected by sensations the very reverse of what he felt a few minutes before. Mounted above the tops of the trees, he looks around him over a wide expanse of country, in the full enjoyment of the fresh breeze, from whatever quarter it may blow.

This vast embankment strikingly exhibits how much may be accomplished when our efforts are concentrated on one grand object. There is a feeling of satisfaction by no means common-place, in thus overcoming obstacles and surmounting difficulties, in making the high places low and the rough places plain, and advancing in one straight and direct course to the end in view; while the pleasure afforded by the contemplation of this great work is further enhanced, when considered in contrast with ordinary and every-day impressions.

After passing the Roby embankment you cross the Huyton turnpike road, leaving Huyton Church and village on the left hand, and proceed in a slightly curved direction to the bottom of the inclined plane at Whiston, between seven and eight miles from the

Company's station in Liverpool. This plane rises in the ratio of three-eighths of an inch in a yard, (or 1 in 96.) It is a mile and a half long in one straight line, and the inclination (being so slight) would scarcely attract observation, did not a decrease in the speed of the carriages indicate that an important change had taken place in the level of the way. At the top of the Whiston inclined plane there is a portion of the road (nearly two miles in length) on the exact level. About half a mile from the top of the inclined plane, the turnpike road from Liverpool to Manchester crosses the line of the Railway at an acute angle of 34 degrees, and is carried over the Railway by a substantial stone bridge, of very curious and beautiful construction, being built on the diagonal or skew principle, each stone being cut to a particular angle to fit into a particular place, the span of the arch, measured at the face, being 54 feet, while the width of the Railway underneath, measured from wall to wall, is only 30 feet,—each face of the arch extending diagonally 45 feet beyond the square. Rainhill bridge is nine miles from the Company's yard in Wapping, and it was underneath and on each side of this bridge that the experiments took place with the Locomotive Engines which contended for the premium of £500. in October, 1829.

Passing over the summit level at Rainhill, we come to the Sutton inclined plane, which descends in the opposite direction, and is similar in extent and inclination to the Whiston plane, the top level being 82 feet above the base of each plane. Par Moss is the

next object of attention, the road-way across the principal part of it being formed by the deposit of heavy material (clay and stone) dug out of the Sutton inclined plane. This Moss is about 20 feet deep, and the material forming the Railway, as it was deposited, sank to the bottom, and now forms an embankment in reality 25 feet high, though only four or five feet appears above the surface of the Moss. The borders of this waste are in a state of increasing cultivation, and the carrying of the Railway across this Moss will hasten the inclosure of the whole area.

Leaving Par Moss, we soon approach the great valley of the Sankey (about half way between Liverpool and Manchester), with its Canal at the bottom, and its flats or barges in full sail passing to and fro, between the River Mersey, near Warrington, and the great Coal districts near St. Helen's. Over this valley and Canal, and over the topmasts and high peaks of the barges, the Railway is carried along a magnificent viaduct of nine arches, each 50 feet span, built principally of brick, with stone facings, the height from the top of the parapets to the water in the Canal being 70 feet, and the width of the Railway between the parapets 25 feet. The approach to this great structure is along a stupendous embankment, formed principally of clay, dug out from the high lands on the borders of the valley. Looking over the battlements, there is a fine view down the valley to the south—Winwick spire rising in the distance, and below you, the little stream of the Sankey running parallel with the Canal; while the masts and sails of the vessels,

seen at intervals in the landscape where the Canal is no longer visible, present a vivid specimen of inland navigation. Immediately below you, the barges, as they approach the bridge, escape from view for a few minutes, till, having sailed under your feet, they become again visible on the opposite side of the viaduct.

On leaving the Sankey, we speedily approach the town of Newton, or rather the borough; for this ancient and loyal place sends two representatives to Parliament, under the auspices of Colonel Legh, M. P. A few hundred yards to the south of the town, the Railway crosses a narrow valley by a short but lofty embankment, and a handsome bridge of four arches, each 40 feet span. Under the eastern arch the turnpike road passes from Newton to Warrington, and beneath another arch flows a stream which turns an old corn mill, immediately below the bridge. Adjacent also, is situate one of those antique mansions, built in the ancient baronial style, whose white exterior, with black oak crossings and pointed gables, harmonizes well with the rude scenery around.

A few miles beyond Newton is the great Kenyon excavation, from which about 800,000 cubic yards of clay and sand have been dug out, part being carried to form the line of embankment to the east and west of the cutting; and the remainder, deposited as spoil banks, may be seen heaped up, like Pelion upon Ossa, towering over the adjacent land. Near the end of this cutting, the Kenyon and Leigh Junction Railway joins the Liverpool and Manchester line by two branches, pointing to the two towns respectively. This Railway joins the

Bolton and Leigh line, and thus forms the connecting link between Bolton, Liverpool, and Manchester. From the Kenyon excavation the transition is easy to the Brosely embankment, formed of the material dug out of the cutting, as before described. Moving onward, we pass over Bury-lane and the small River Gless, or Glazebrook, being arrived on the borders of the far-famed Chat Moss. This barren waste comprises an area of about twelve square miles, varying in depth from 10 to 35 feet, the whole mass being of so spongy and soft a texture that cattle cannot walk over it. The bottom is composed of clay and sand, and it is not an uninteresting, if not a very profitable speculation, to carry our ideas back to that remote period when the sea flowed over the basin of this huge fungus. There are they who profess, by examining the vegetable fibre of the Moss, to calculate its age; as the fortune-teller will cast your nativity by the furrows in your hand. No doubt this mass of vegetable matter is still increasing. The flower and the leaf of the heather still bud, grow to maturity, and fall; and the process of decomposition amalgamates the new and the old fibre; but what is thus deposited has been previously extracted from the Moss, save what has been supplied from the hydrogen and other gases absorbed and combined in this great laboratory. At a very moderate calculation, Chat Moss comprises sixty millions of tons of vegetable matter; and we shall leave to philosophers to calculate in how many centuries this weight could be drawn from the clouds and the air. Northward of the Moss, in the distance,

is Tildsley Church, one of the modern Parliamentary edifices; and as we approach the eastern boundary, conspicuous on a gentle eminence to the left, is Worsley Hall, the seat of R. H. Bradshaw, Esq. M. P. so well known as Trustee for the management of the Duke of Bridgewater's Canal.

Beyond Chat Moss we traverse the Barton embankment, crossing the low lands for about a mile between the Moss and the Worsley Canal, over which the Railway is carried by a neat stone bridge. At this spot it is evident you are approaching a manufacturing district. On the banks of the Canal a great cotton factory rears its tall sides, with its hundred windows, and the fly-wheel of its steam-engine pursuing its continuous and uniform revolutions, as if symbolical of that eternal round of labour and care, of abundant toil and scanty remuneration, of strained exertion and insufficient repose, which, through day and night, through seed time and harvest, through years of civilization and ages of barbarism, have been the condition and tenure on which the existence of so large a portion of mankind has depended.

From the Barton embankment we soon arrive at Eccles, four miles from Manchester, leaving to the right the vicarage and parish church of that village. Between this place and Manchester the Railway passes at no great distance from several country seats and villas, whose rich lawns and flourishing plantations afford an agreeable variety, after the great sand hills at Kenyon, or the wide waste of Chat Moss.

The immediate approach to Manchester, by the

Railway, is through a portion of Salford, as little interesting as can well be imagined. Over the River Irwell the Railway is carried by a very handsome stone bridge, and then over a series of arches, into the Company's station in Water-street and Liverpool-road, Manchester; from which the traveller whose object is pleasure rather than business, will probably make his way, without loss of time, to the more genial attractions of the Albion Hotel, or New Bridgewater Arms.

CHAPTER IV.

MECHANICAL PRINCIPLES AND PROPERTIES, AS APPLICABLE TO RAILWAYS.

THE most obvious mechanical advantage which a Railway possesses over a common turnpike road, is to be found in its superior hardness and smoothness of surface. This comparative advantage, it is evident, can be measured by no fixed standard; though it is common to estimate it in the proportion of *seven* to *one*. It should constantly be borne in mind, however, that this ratio of superiority in favour of a Railway can only exist on an exact level. Let there be a very moderate ascent—such as on an ordinary road would scarcely attract observation—one foot in fifty for instance, and the effect of a horse on a Railway is at once reduced to about one-fifth of its effect on a horizontal plane; and on arriving at such an inclination, with a load calculated for a *level*, the horse would be unable to move a single yard with the utmost exertion of its strength; while on a common road, undulations such as I have stated are of ordinary occurrence—a horse being able to exert a sufficiently increased power as he ascends the eminence, and relieving himself as he descends on the opposite side. But let it not be imagined that the *absolute* resistance occasioned by a certain inclination, is more on a Railway than on a turnpike road: it is precisely the same, and this peculiarity in the *comparative* result may be easily

explained. The resistance on a Railway to the progress of the carriage wheels (sometimes called the rolling friction) being only about one-seventh what it is on common roads, the ordinary load on a *level Railway* is *seven times* as great as the load on a turnpike road. Consequently, when the force of *gravity* is brought into operation by an ascending plane, this opposing force (of gravity) being proportioned to the *load*, will be seven times as great as on a turnpike road.

Most of the Railways hitherto constructed have had an inclination *downwards*, being for the conveyance of coal from the pits to the river side. For purposes of general traffic, however, and where there is any thing like an equality of tonnage passing in both directions, it cannot be too constantly kept in view, that to render the moving power uniformly effective, and to maintain for the Railway its full comparative advantage over the common roads, it must, as far as practicable, be *level*. In the Liverpool and Manchester line, this object has been in a great measure attained, as will appear from the annexed section. From the top of the Liverpool Tunnel to Manchester, with the exception of two inclined planes at Rainhill (one ascending and the other descending at an inclination of 1 in 96, and where some assistant power must be used), there is no greater inclination than in the ratio of about 1 in 880; and since the advantage on the descending side will nearly counterbalance the disadvantage in ascending so gradual a slope, the Railway may be regarded, for practical purposes, as nearly horizontal.

SECTION OF THE LINE OF RAILWAY FROM LIVERPOOL TO MANCHESTER.

From	a	to	b	Tunnel	Inclined Plane	Length	1760 yards	Rise 1 in 48	Perpendicular Height 185 feet
	b		c			1100		Level	
	c		d			2 miles		Fall 1 in 1092	
	d		e			1		Rise 1 in 96	Perpendicular Height 82 feet
	e		f					Level	
	f		g					Fall 1 in 48	48
	g		h			1		1 in 2640	
	h		i			1		1 in 88	
	i		k			1		Rise 1 in 220	
	k		l			1		Level	

NB. The Surface of the Rails at the top of the Tunnel is between 50 & 60 feet above the Railway at Manchester

A level line being attained, it is scarcely of less importance that the Railway should be *straight*, or at least free from any *abrupt curves*. As carriages are kept on the rail by flanges on the wheels, it is obvious that where the curves are quick, the friction on the sides of the rails, and consequent retardation, must be very great. This is a point which, till lately, has not been sufficiently attended to. In the Liverpool and Manchester Railway, the curves seldom exceed a deviation from a straight line of more than 4 inches in 22 yards; forming a segment of a circle, which, if extended, would embrace a circumference of fifteen miles. The setting out of the curves on the ground is a work requiring considerable skill and exactness, and the manner in which this is performed affects the real efficiency of the Railway no less than it does the style and beauty of its appearance.

The material of which the rails were to be composed, whether of *cast* or of *forged* iron, was a matter of some importance. Each description of rail has its advocates; but after due consideration, and inquiry into their respective merits, the Directors determined to adopt the forged or rolled iron rail, in lengths of five yards each, made after Mr. Birkinshaw's pattern, as described in Mr. Nicholas Wood's excellent book on Railways. A similar rail is used on the Darlington way, but somewhat lighter; the Darlington rail weighing 28 lb. and the Liverpool and Manchester 35 lb. per lineal yard. The rails are supported every three feet on stone blocks, each block containing nearly four cubic feet of stone. Two holes, six inches deep and an inch diameter, are

drilled in each block, and into these are driven oak plugs; and the cast-iron chairs or pedestals, to which the rail is immediately fitted and fastened, are firmly spiked down to the oak plugs; forming, altogether, a construction of great solidity and strength. On the embankments, where the foundation may be expected to subside, the rails are laid on oak sleepers.

But supposing the Railway to be completed, of the most improved construction and the best material, the kind of *carriage* to be used, and the *power* to be employed, afford scope for ample discussion and the most conflicting opinions; for so new, or so little understood, it would seem, is the application of mechanical principles to a Railway, that as much difficulty presented itself to the Directors, in their endeavours to come to a conclusion on these points, as if the matter at issue involved a question of law or metaphysics. On the first announcement of a projected Railway, on a complete scale, from Liverpool to Manchester, the ingenuity of speculative mechanics anticipated the most astonishing results to be obtained from the most undeniable and acknowledged principles. It was understood to have been previously ascertained by Coulomb and Professor Vince, that *friction* (as applicable to carriages) was the same at all velocities. It seemed to follow, that on a level Railway, where friction constituted the *whole* resistance, the inert mass being once put in motion, it would be as easy to travel *twenty* miles per hour, as *five*. The fallacy of this idea arises in a good measure from a misconception of the operation of the principle

alluded to—that *the friction is the same at all velocities* —from which it appears to have been inferred, that if you provide a power sufficient to overcome the friction at a very slow speed, and call that power *one*, and then apply additional power to augment the speed *ten* fold, you may at pleasure relinquish this additional power, and continue to move at the *ten* fold speed with the power *one*. The truth is, however, that for every ratio of increased *speed* you must exert increased *power*, and must *continue* to use it. On a level Railway, friction constitutes the *whole* resistance ; and if it require a certain power to overcome such resistance at two miles per hour, it will require ten times that power to overcome the resistance at twenty miles per hour, and it will require the *increased* power to be *continued* as long as the speed is intended to be kept up. If to convey a certain load at the rate of five miles per hour requires a Locomotive Steam Engine with a boiler and pistons of a certain given area, then to move the same load at the rate of fifteen miles per hour, the boiler and cylinders (if there be no improvement in the construction) must be *three* times the *area*. In this latter case, therefore, there will be *three times* the steam (or power) expended *per hour*, but the *journey* will be effected in *one-third* the time: the *whole* expenditure of steam (or power), therefore, in overcoming the friction will be nearly the same, whether the journey be performed at a slow or a quick speed. We will suppose, for illustration, that a *weight* has to be *raised*, instead of *friction* to be *overcome*—the same principle will hold good. If it require a certain power to raise a ton weight *one hundred* feet

high in ten minutes, it will require *ten* times the power to raise it the same height in one minute—that is, at ten times the speed ; yet a ton is a ton, at all velocities, exactly as *friction* is the same, whatever the speed.

There is another error on the subject of friction, to which it may be as well briefly to advert. Mr. Rankin, in his publication on Railways,* lays it down as a principle, that " the friction of wheel carriages is equal in equal times ;" and in proof of this position, details several experiments with a carriage drawn by a weight descending from a pulley, which weight, he found, fell according to the ascertained law of gravity, accelerating in the known ratio, in equal portions of time. It appears to me that the result, as stated, proves that friction is equal *in equal spaces*, and *not in equal times*. Mr. Rankin does not give either the moving weights, the load drawn, or the velocity, as not being necessary to determine the principle. I will suppose a case, therefore, to illustrate my position. A weight, by the law of gravity, will fall—

16 feet in the 1st second of time,
48 feet in the 2d second of time,
80 feet in the 3d second of time.

Now the same weight, with the load or carriage attached to it by means of a rope and pulley, we will suppose to fall—

5 feet in the 1st second of time,
15 feet in the 2d second of time,
25 feet in the 3d second of time,

Accelerating as before, according to the law of gravity.

* A Popular Exposition of the Effect of Forces on a Railway, with some Experiments on Friction. By David Rankin, Esq. Glasgow, 1828.

Thus we have a descent, in *equal times*, of 5, 15, 25, instead of 16, 48, 80. That is, the *friction* of the carriage caused the weight to fall in the first *second* only 5 feet instead of 16, being a *retarding* force of 11. In the second period the fall was 15 instead of 48, being a retarding force of 33, or in the proportion of 15 to 5. In the third *second* of time the fall was 25 feet instead of 80—being a retarding force of 55—being as 25 to 5, or exactly in proportion to the *spaces* passed over, and not at all according to the *times;* in perfect conformity, however, with the law of gravity. In Mr. Rankin's experiment the friction was a uniformly retarding force, which we have supposed to be 11 out of 16; but, whether it were 11 or 3 in the first 16 feet, it would be the same in *every* 16 *feet:* the friction, therefore, by the experiment was equal in equal *spaces.* On the other hand, supposing the friction to be equal in equal *times*, a power which would move a carriage six miles in one hour, would encounter only *one-fourth* the friction in traversing the same six miles in *one-quarter* of an hour, which would be very convenient, if it were the fact. But experiment corroborates the doctrine, that the same resistance has to be overcome, and therefore the same power must be expended, in traversing a certain *space*, whatever be the *time*—whether you take *one hour* or three to accomplish it.

Of course, in laying down this general rule as an approximation to the truth, we suppose a perfect Railway. If the road present considerable inequalities or obstructions, the greater the speed, the greater will be the resistance, from the shocks to be encountered.

Moreover, at great velocities the resistance of the *air* must not be left out of the calculation. At ten miles per hour it has been found, by experiment, that the resistance of the atmosphere is about half a pound weight on a square foot of flat surface; at fifteen miles the resistance is 1 lb. per square foot; and at twenty miles about 2 lb. per square foot; the increased resistance being nearly as the squares of the velocities. Now if we suppose the moving power calculated to draw, at twenty miles per hour, one carriage weighing 4 tons, and presenting in front a surface of 20 square feet, the resistance of the air would be $20 \times 2 = 40$ lb., or 10 lb. per ton drawn; being about as much as the *friction*, and consequently *doubling* the whole resistance. In practice, it will probably be expedient to fasten a *train* of carriages to one moving power, in which case the *first* waggon, or the Engine itself, will bear the brunt of the air's resistance; which, considered in proportion to the whole weight drawn, and avoiding, as far as may be, square flat surfaces in front of the procession, will be less important. On the other hand, it seems probable that a further modification must be admitted at very high speeds; for we can easily imagine a velocity, where the *projectile force* must be so great as very much to *diminish the gravity*, and consequently the friction. But again, as we are acquainted with no convenient power but steam, with which to effect rapid motion—and since steam loses part of its force from a very quick transmission through the cylinders—or since, if you keep the velocity of your piston moderate, you must increase your speed by a

complication of wheels, or a diminution of your cranks, in which case the loss by the friction of the rubbing parts would be greater than by the quick movement of the pistons, any gain by the diminution of gravity at high velocities, will be more than counterbalanced by the mechanical disadvantages we have stated; bringing out the practical result, within a certain range for weight and speed, pretty nearly in conformity with the rule as above laid down—subject, however, to exceptions and irregularities, tending to prove, that when the construction of an Engine is adapted to a quick speed and a light load, you cannot, with proportionate advantage, substitute a heavy load and a slow speed; while it would be equally unavailing, with an Engine calculated for a heavy load and a slow pace, to attempt to substitute a light load and a high speed.

But without dwelling any longer on the difficulty of reducing, with minute exactness, abstract principles to practical operation, it will easily be imagined that the consideration of the *kind of power* to be employed on the Railway occupied no small portion of the Directors' time and attention: whether horses—or Locomotive Engines—or Fixed Engines, drawing the load, by means of ropes, from one station to another. Each of these modes had been tried, and each had its advocates, for in this case experience had by no means settled the point at issue.

Multifarious were the schemes proposed to the Directors, for facilitating Locomotion. Communications were received from all classes of persons, each

recommending an improved power or an improved carriage; from professors of philosophy, down to the humblest mechanic, all were zealous in their proffers of assistance; England, America, and Continental Europe were alike tributary. Every element and almost every substance were brought into requisition, and made subservient to the great work. The friction of the carriages was to be reduced so low that a silk thread would draw them, and the power to be applied was to be so vast as to rend a cable asunder. Hydrogen gas and high-pressure steam—columns of water and columns of mercury—a hundred atmospheres and a perfect vacuum—machines working in a circle without fire or steam, generating power at one end of the process and giving it out at the other—carriages that conveyed, every one its own Railway—wheels within wheels, to multiply speed without diminishing power—with every complication of balancing and countervailing forces, to the *ne plus ultra* of perpetual motion. Every scheme which the restless ingenuity or prolific imagination of man could devise was liberally offered to the Company: the difficulty was to choose and to decide.

The great theatre of *practical* operations on Railways was on the Stockton and Darlington line, and on the Railways in the vicinity of Newcastle-on-Tyne. All the established modes of conveying carriages on Railways were there exemplified—Horses, Locomotives, and Fixed Engines. Facts were wanted to lead to a correct decision, and personal observation seemed necessary, in order to arrive at a satisfactory result. The Directors accordingly appointed two of

their own body, accompanied by the writer, to proceed to Darlington and the neighbourhood of Newcastle, to obtain on the spot, the requisite information, and to report the same to the Board, with their opinion on the subject. This journey of inspection took place in the beginning of October, 1828, and the Deputation returned with a fund of information; but of so mixed, and in some respects of so contradictory a nature, that the great question as to the comparative merits of Locomotive and Fixed Engines was as far from being settled as ever. One step was gained. The Deputation was convinced, that for the immense traffic to be anticipated on the Liverpool and Manchester line, horses were out of the question. The debateable ground being thus narrowed, how was the remaining point to be decided? Was a capital of £100,000. to be invested in Stationary Engines or in Locomotives? The Directors resolved to obtain the assistance of two professional Engineers, who should visit the Darlington and Newcastle Railways, carefully examine the working of the two species of mechanical power, taking note of the advantages and disadvantages of each, make an accurate calculation of the *cost* of both modes of conveyance, and report to the Board fully on the whole subject.

James Walker, Esq. of Limehouse, and J. U. Rastrick, Esq. of Stourbridge, being severally applied to for the purpose, undertook the office assigned to them. On the 12th of January, 1829, they attended at the Board of Direction in Liverpool, previous to their setting out on their professional tour. On the

9th of the following March, their separate *Reports* on the comparative merits of the two systems of moving power, were laid before the Directors, and ordered to be printed.

It may be supposed that the great question was now finally set at rest, and that the Directors would have no further difficulty in coming to a decision on the points at issue. Just the reverse. The advantages and disadvantages of each system, as far as deduced from their own immediate observation, were fully and fairly stated, and, in the opinion of the Engineers themselves, were pretty equally balanced. The cost of an establishment of Fixed Engines between Liverpool and Manchester, they were of opinion, would be something greater than of Locomotives, to do the same work; but the *annual charge*, including interest on capital, they computed would be less on a system of Fixed Engines than with Locomotives. The cost of *moving* a ton of goods thirty miles, that is from Liverpool to Manchester, by Fixed Engines, they estimated at 6.40d., and by Locomotives at 8.36d., supposing in each case a profitable traffic *both ways*. But with a system of Locomotives, the cost of the first establishment need only be proportioned to the demands of the trade; while with Stationary Engines, an outlay for a complete establishment would be required in the first instance. And it was further to be considered, that there appeared more ground for expecting *improvements* in the construction and working of Locomotives than of Stationary Engines. On the whole, however, and looking especially at the

computed annual charge of working the road on the two systems on a large scale, Messrs. Walker and Rastrick were of opinion that *Fixed Engines* were preferable, and accordingly recommended their adoption to the Directors.

On a careful consideration of the real state of the case at this moment, it will not be matter of surprise that the Directors still felt themselves unable to come to a decision on the subject; more especially when it is remembered that Mr. Stephenson, the Company's Engineer, was decidedly, as he had uniformly been, in favour of Locomotive Engines, which he was confident would be found to be the most economical and by far the most convenient moving power that could be employed. On the whole, therefore, the Directors found themselves in pretty much the same situation as they were before the recent survey was undertaken. The leaning on the part of a majority of the Directors was in favour of Locomotives, provided they could be constructed of adequate power and at a less weight than the travelling Engines then in use, which were generally 8 to 9 tons in weight, and some still heavier; the consequence of which was no small injury to the Railways, and proportionate expense in keeping the road in repair. And further, it was quite essential, according to the provisions of the Railway Act, that they should not *smoke*. The Directors determined to obtain, if possible, a Locomotive Engine of improved construction, that should comply with these conditions. Mr. Harrison had for some time been of opinion, that the excitement of a reward, publicly

offered by the Company, would be the most likely means to obtain for them what they were in search of. In this opinion his brother Directors now coincided; and accordingly they resolved, on the 20th of April, 1829, to offer a premium of £500. for the most improved Locomotive Engine, subject to certain stipulations and conditions, a copy of which I subjoin:—

"*Railway Office, Liverpool, 25th April,* 1829.

"STIPULATIONS AND CONDITIONS

"*On which the Directors of the Liverpool and Manchester Railway offer a premium of* £500. *for the most improved Locomotive Engine.*

"1st.—The said Engine must "effectually consume its own smoke," according to the provisions of the Railway Act, 7th Geo. IV.

"2d.—The Engine, if it weighs six tons, must be capable of drawing after it, day by day, on a well-constructed Railway, on a level plane, a train of Carriages of the gross weight of twenty tons, including the Tender and Water Tank, at the rate of ten miles per hour, with a pressure of steam in the boiler not exceeding 50 lb. on the square inch.

"3d.—There must be two Safety Valves, one of which must be completely out of the reach or control of the Engine-man, and neither of which must be fastened down while the Engine is working.

"4th.—The Engine and Boiler must be supported on springs, and rest on six wheels; and the height, from the ground to the top of the chimney, must not exceed fifteen feet.

"5th.—The weight of the Machine, *with its complement of water* in the boiler, must, at most, not exceed six tons; and a Machine of less weight will be preferred, if it draw *after* it a *proportionate* weight; and if the weight of the Engine, &c. do not exceed *five tons*, then the gross weight to be drawn need not exceed fifteen tons; and in that proportion for Machines of still smaller weight—provided that the Engine, &c. shall still be on six wheels, unless the weight (as above) be reduced to four tons and a half, or under, in which case the

boiler, &c. may be placed on four wheels. And the Company shall be at liberty to put the boiler, fire tube, cylinders, &c. to the test of a pressure of water not exceeding 150 lb. per square inch, without being answerable for any damage the Machine may receive in consequence.

" 6th.—There must be a mercurial gauge affixed to the Machine, with index rod, showing the steam pressure above 45 lb. per square inch; and constructed to blow out a pressure of 60 lb. per inch.

" 7th.—The Engine to be delivered complete for trial, at the Liverpool end of the Railway, not later than the 1st of October next.

" 8th.—The price of the Engine, which may be accepted, not to exceed £550., delivered on the Railway; and any Engine not approved, to be taken back by the owner.

" N. B.—The Railway Company will provide the *Engine Tender*, with a supply of water and fuel, for the experiment. The distance within the rails is four feet eight inches and a half."

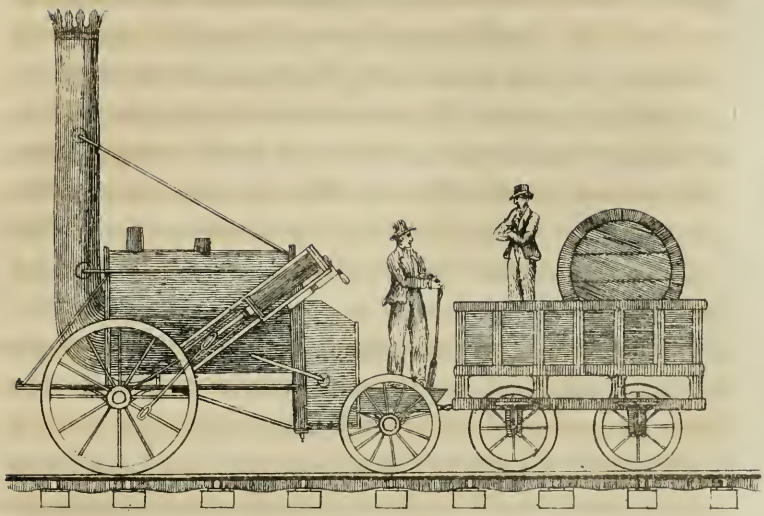
Meanwhile, all measures relative to the moving power were suspended, till the result of the trials of the specimen Engines should be ascertained. On the 6th of October, which was the day subsequently fixed for the trials, four Locomotive Steam Engines were on the ground appointed at Rainhill, a level portion of the Railway, about nine miles from Liverpool. That the Directors might come to the most correct decision on the merits of the different machines produced, they had engaged the professional assistance of Mr. Rastrick, of Stourbridge, and Mr. Nicholas Wood, of Killingworth, both Engineers of great practical knowledge; aided by the co-operation of John Kennedy, Esq. of Manchester, who kindly complied with the request of the Directors, that he would be one of the Judges, on the occasion.

The Steam Engines which were entered on the

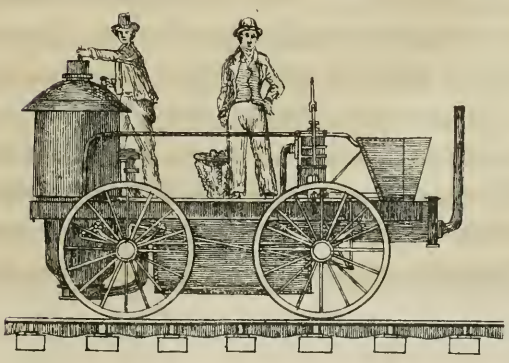
lists to contend for the premium, were the " Novelty," a beautiful machine, of a new construction, built by Messrs. Braithwaite and Ericsson, of London; the " Rocket," built by Messrs. Robt. Stephenson and Co. of Newcastle, with a boiler of a new construction, suggested by the writer of this account; the " Sans Pareil," built by Mr. Timothy Hackworth, of Darlington; and the " Perseverance," by Mr. Burstall, of Leith.

The peculiarity of the exhibition, on the several days of trial, attracted a large concourse of spectators; and the unexampled speed of the " Novelty" and the " Rocket" excited universal surprise and admiration. The trial of these Engines, indeed, may be regarded as constituting a new epoch in the progress of mechanical science, as relating to locomotion. The most sanguine advocates of travelling Engines had not anticipated a speed of more than ten to twelve miles per hour. It was altogether a new spectacle, to behold a carriage crowded with company, attached to a self-moving machine, and whirled along at the speed of thirty miles per hour. The contest for the premium was principally between the " Novelty" and the " Rocket." This latter Engine was the first to undertake the task assigned by the Judges, as a test of the Engine's power. The distance appointed to be run was seventy miles; and it was a condition, that when fairly started, the Engine should travel on the road at a speed of not less than ten miles per hour, drawing after it a gross weight of 3 tons for every ton weight of itself. The prescribed distance it should,

ROCKET, LOCOMOTIVE.



NOVELTY, LOCOMOTIVE.



be understood was, owing to the circumstances of the Railway, obliged to be accomplished by moving backwards and forwards, on a level plane of one mile and three-quarters in length. Of course, the Engine had to pass along the plane forty times, having to make as many stops, and each time to regain the lost speed and momentum. On the 8th of October, the "Rocket," weighing 4 tons 5 cwt. including the water in the boiler, started on her journey at about half-past ten in the morning, and performed the first thirty-five miles in three hours and twelve minutes, being nearly at the rate of eleven miles an hour. About a quarter of an hour was then consumed in filling the water tank and obtaining a fresh supply of coke. The second thirty-five miles were performed in two hours and fifty-seven minutes, or at the rate of twelve miles per hour, including stoppages. The whole time, from the first starting to the final arrival, was under six hours and a half. The speed over the ground, with the prescribed load, was frequently eighteen miles per hour, and occasionally upwards of twenty. The whole performance was considerably greater than required by the stipulations, or than had hitherto been accomplished by a Locomotive Engine.

The "Novelty" was the next Engine which undertook the appointed task; but owing to some derangement having occurred in her pipes or machinery, she was obliged to stop almost at the commencement of the task assigned. Another day was appointed, and another derangement took place. It became evident, therefore, she was not in a state of completeness to

warrant the Proprietors in prolonging the contest. Accordingly, they informed the Judges that they withdrew from the competition on the present occasion; having, nevertheless, full confidence in the merits and principle of the Engine, and in its relative performance, when they should have repaired the defects in the structure or workmanship of the machine.

The Darlington Engine, the "Sans Pareil," was the next on the list; but being 5 cwt. above the weight prescribed in the conditions, it may not be necessary to discuss her merits in other respects. Mr. Burstall, after consideration, withdrew from the contest, leaving the field to the "Rocket." The Report of the Judges corresponded with the above statement, and the Directors accordingly awarded the premium to the writer of this account and the Messrs. Stephensons, to whose excellent construction of the machinery I was much indebted for the favourable award of the Umpires.

From this date, the question between Locomotive and Fixed Engines must be considered as practically settled. The fitness of Locomotives for the purposes of *travelling*, at almost any speed that could be desired, was strikingly exemplified; and the importance of this circumstance was duly estimated; the conveyance of passengers between Liverpool and Manchester having long been considered a valuable branch of the undertaking. There still remained one point to be settled—I allude to the *kind of power* to be employed in ascending the inclined planes of Whiston and Sutton. These planes are each a mile and a half long, with an inclination of three-eighths of an inch to a yard, being a rise of 1 in

96. Stationary Engines on the summit, with ropes passing over sheaves or pullies along the whole ascent, are the means resorted to at the inclined plane in the Liverpool Tunnel; also on the Darlington inclined planes, and at the collieries in the north. It was quite evident, however, that such a plan of operations in the centre of the Liverpool and Manchester line, with the interruption to be expected from a *change* of the moving power, to say nothing of the danger always to be apprehended from a system of ropes and pullies, was to be avoided, if possible. It became an object, therefore, of no small interest to ascertain the power of the new Locomotives on the planes in question; and in the first place, as the effective power of the Engine is necessarily limited by the adhesion of the wheels on the rails (in as much as if a force be exerted beyond that point, the wheels will turn round, while the carriage will remain stationary), it was important to know whether this difficulty was likely to occur on the planes in question. It has been ascertained that the adhesion of the Engine wheels (as now constructed with wrought-iron tires) on wrought-iron rails is equal to $\frac{1}{20}$th of the weight of the machine, in the most unfavourable state of the rails. If the Engine weigh $4\frac{1}{2}$ tons, the adhesion on the four wheels would be $\frac{1}{20}$th of that weight, or about 500 lb.; or supposing—which is frequently the case—that the machinery is only connected with two wheels, then, if the weight be equally divided, the adhesion will be = 250 lb.; which, multiplied by 200 (the *friction* being only $\frac{1}{200}$th of the *gravity* of the load), gives 22 tons as the load, com-

mensurate with the adhesion, in the most unfavourable state of the rails,—about 40 tons being the adhesive load in an average state of the rails. Now these being the data, an inclined plane rising one yard in a hundred, will present no impediment on the ground of adhesion, provided the system be to maintain the same speed throughout the journey; for supposing, as above, that the adhesion of the Engine wheels on the level, be = 250 lb., it will be the same on the inclined plane, minus $\frac{1}{100}$th part ($2\frac{1}{2}$ lb.); a difference so small as to occur, every day, in the varying states of the rails, and quite unnecessary to be taken into the calculation. The question to be decided, therefore, was the *power* of the Engine to take a load up the inclined plane, the adhesion being equal to the power, at similar speeds. For instance, 7 tons on an inclined plane rising one in a hundred, is a proportionate load to 30 tons on a level, at fifteen miles per hour, the weight of the Engine being $4\frac{1}{2}$ tons, as explained hereafter. But if it be attempted to take 30 tons up the plane, by going proportionably *slower*, the *power* of the Engine might do this, but the adhesion of the wheels would be insufficient, and they would turn round, while the Engine stood still, because 30 tons on the inclined plane = 99 tons on a level, and we have supposed the adhesion to be equal to 40 tons on a level. It follows, therefore, either that the Engine must be worked *below* the adhesiveness of the wheels on the level, or you cannot increase the proportionate load, by diminishing the speed on the inclined plane.

During the trials for the premium, at Rainhill, the

"Rocket" frequently ascended the Whiston inclined plane, with a carriage holding twenty to thirty passengers, at a speed of fifteen to eighteen miles per hour; and the ease and regularity with which this was effected produced a general and confident impression, that even up the inclined planes, the Locomotive Engine would be the power employed. Indeed, the feeling at the moment, was very prevalent, that it was immaterial whether the Engine travelled up an inclined plane, or on a level; and various schemes were speedily in agitation for converting turnpike roads into Railways, regardless of the ordinary inequalities of the ground. Time and reflection will correct a notion so plausible, but yet so erroneous; otherwise the most grievous disappointments will be the consequence. Dazzled and gratified with the spectacle of the Engine, with her carriage and twenty passengers, moving up the plane at a speed hitherto not attained by the swiftest mails, the spectator forgot, or was not aware, that she would have taken *four* carriages, each with its score of passengers, at the *same speed*, on *a level;* or, in more general terms, that the *annual performance* of a Locomotive Engine, on a *level* Railway, would be about four times as great as on an inclined plane, rising one yard in a hundred. I have said *about* four times; for the comparative ratio will depend much on the *weight* of the Engine, the speed of travelling, and the construction of the carriage wheels and axles. The more power you can comprise in the same *weight* of Engine, the greater will be her *comparative* performance on an *inclined plane;* and on the other hand,

the greater the improvement in wheels and axles, and the more the *friction* is *diminished*, the greater will be the *comparative* performance on a *level*. Mr. Nicholas Wood, in his book on Railways, estimates the friction of loaded waggons at $\frac{1}{200}$ of the load moved; that is, that one pound weight, suspended over a pulley, would draw 200 lb. on a level Railway. Since Mr. Wood made his experiments, further improvements have been made in the construction of wheels and axles; perhaps to the extent of 25 per cent., leaving the amount of friction on a level Railway $\frac{1}{250}$ of the load moved, or 9 lb. per ton. This ratio, however, allows nothing for the resistance of the air: it supposes both waggons and Railway in very complete order, and the line an absolute and undeviating level. Moreover, experiments on the *friction* of waggons have generally been made on *single* waggons; and there is reason to believe, that the resistance offered by a number of waggons fastened to each other is greater than the proportionate weight would indicate: and this may be accounted for by the separate carriages being *out of square*, with reference to each other, thereby occasioning a straining and lateral friction. On the whole, perhaps, we shall come sufficiently near the truth if we adopt Mr. Wood's ratio of $\frac{1}{200}$ as the amount of resistance to a train of waggons on a level way, under ordinary circumstances of rails and waggons, wind and weather. The inclination of the Whiston plane being 1 in 96, the opposing force of gravity of any load on its ascent will be $\frac{1}{96}$th of the whole weight moved; or if we say $\frac{1}{100}$th part, the

resistance by *gravity* will be *double* the resistance by *friction*. It will follow, then, that if a Locomotive Engine, weighing 4 tons 10 cwt. is exactly able to draw after it 30 tons weight on *a level*, at fifteen miles per hour (which I estimate to be the power of an Engine on the "Rocket" principle, with the latest improvements), the same Engine will draw only 7 tons, at the *same speed*, up an *inclined plane* rising one yard in a hundred. This result may be illustrated as follows:—

The load *drawn* on the inclined plane is declared to be..... 7 tons.

Now the *additional* resistance (by *gravity)* is double the resistance by *friction;* then, as the load drawn is 7 tons, the *gravity* of the plane equals the *friction* of ....14 tons.

But the Engine weighs 4 tons 10 cwt., and is opposed by a force of gravity equal to the *friction* of double that weight, or..... 9 tons.

Therefore 7 tons on the *inclined plane* equals the draught of... } 30 tons on a *level*, at 15 miles per hour.

Or the same result may be brought out by another process, as follows:—The gross weight proposed to be drawn on *a level* is 30 tons, at fifteen miles per hour, on which the friction, estimated at $\frac{1}{200}$, = 336 lb.

Then, on an inclined of 1 in 100, the gross weight is declared to be 7 tons, on which the friction, estimated at $\frac{1}{200}$, is..... = 78.4 lb.
Resistance by gravity, $\frac{1}{100}$ of 7 tons..... = 156.8 ,,
Resistance by gravity on $4\frac{1}{2}$ tons, the weight of the Engine at $\frac{1}{100}$ ..... = 100.8 ,,

= 336 lb.

The resistance to be overcome, in both instances, being 336 lb., at fifteen miles per hour, besides the *friction* of the Engine, which does not enter into the calculation in either case—the *effective performance* being what is required for all practical purposes. If a *slower* speed be submitted to, a heavier load may be drawn on the level, and the performance on the inclined plane (if the adhesion be sufficient) will be found, by the same formula, to be *more* than *proportionably* greater; the resistance by *gravity* of the Engine being a fixed quantity, but smaller, *comparatively*, as the load drawn is *greater*. Thus an Engine of the same weight being exactly able to draw 45 tons on a level, at ten miles per hour, would take 12 tons on the inclined plane at the same speed.

Because the *load* on the incline being..... 12 tons,
The resistance by gravity is double that by friction, or..... ..... 24 ,,
And the resistance by gravity of the Engine being equal to double its weight on a level = 9 ,,

= 45 tons,

on a level.

I am aware that the recent performance of Loco-

motives, on our inclined planes, has been considered greater than in the ratio I have given: it is very possible, however, that the attained speed and momentum of the Engine and carriages, *before commencing* the ascent, have not been taken into the account. The "Comet" Locomotive (a new Engine, on the "Rocket" principle) had to ascend the Whiston inclined plane with about 26 tons behind her. With this load, she attained a speed of sixteen or eighteen miles per hour, on the level way, *before coming to the ascent*. Assisted by this momentum, she accomplished the task: her speed, however, diminished from sixteen or eighteen miles to about three or four miles per hour, before she reached the top; the distance being one mile and a half, and having sufficient steam the whole time. Now it would be quite erroneous, from these data, to take the average speed between three miles and eighteen, and to infer that the power of the Engine was equal to convey a load of 26 tons, up an inclination of 1 in 96, at ten miles and a half per hour; her real power, as shown by the experiment, and estimated in a *continuing* speed with the load as stated, being only three or four miles, or proportionate to about 7 tons up the same plane, at fifteen miles per hour. It becomes worthy of remark, therefore (connected with this branch of our subject), that in considering the section for a projected Railway, the *length* of the inclined planes should be taken into the account, as well as the steepness of ascent; since, on a plane half a mile long, it is evident much more may be accomplished than on one, three or four times that length.

The actual cost of conveyance by Railway and Locomotive Engines is perhaps not yet very accurately ascertained. The necessity of using *coke* instead of *coal*, in order to comply with the Parliamentary restrictions as to smoke, will increase, in some degree, the expense of the Engines on the Liverpool and Manchester line.* Until the late trials, it was doubtful how far coke could be used at all, except at a very serious sacrifice of the power and efficiency of the Engine. By an improved construction of machine, this difficulty is in a great measure obviated; and the difference in expense between coke and coal, which still subsists, should be cheerfully borne by Railway Companies, to relieve the community at large from the volumes of dense black smoke, with which, it is to be feared, Railways will be disfigured, where there is no Parliamentary enactment, to protect the public from so serious and unnecessary a nuisance.

* The consumption of coke, by the different Engines in the ordinary business and working of the Railway, has yet to be determined by experience. Messrs. Braithwaite and Ericsson, the patentees of the "Novelty," have contracted with the Company to furnish an Engine not exceeding 5 tons weight, which shall draw 40 tons gross from Liverpool to Manchester in two hours (being assisted up the inclined plane), the consumption of coke not to exceed half a pound weight per ton drawn per mile.

CHAPTER V.

CONSIDERATIONS—MORAL—COMMERCIAL—ECONOMICAL.

Before concluding our account of the Railway, we shall take a single glance at the position we occupy, and the probable changes, whether for good or evil, which may be expected to occur (as the consequence of our operations) in the state and circumstances of the community around. The first and most obvious result must needs be a great revolution in the established modes of conveyance, both for merchandise and passengers, between Liverpool and Manchester; and consequently in the private interests of a large class of persons, who have been engaged, directly or indirectly, in the coaching or carrying business. An undertaking like the Liverpool and Manchester Railway, completed at a cost, including its machinery and carriages, of upwards of £800,000. for a line of thirty-one miles, and professing to be decidedly superior to existing establishments, cannot be brought imperceptibly or silently into operation. But though a great change must take place in the application of capital, and the distribution of revenue, amongst large companies and wealthy proprietors, the effect on the whole, with reference to the employment of the labouring classes, may be considered as decidedly favourable. It has frequently been matter of regret, that in the progress

of mechanical science, as applicable to trade and manufactures, the great stages of improvement are too often accompanied with severe suffering to the industrious classes of society. The machinery of the present day continually supersedes that of a few years back; and as the substitution of mechanism for manual labour is the object generally aimed at, immediate privation to the labouring community seems the inevitable result. It has consequently been a subject of speculation, how far the rapid extension of manufactures, by the instrumentality of successive improvements in machinery, is advantageous to a country, as regards its moral and social condition. I recollect that, during the progress of the Railway Bill through Parliament, when some members of the Railway Committee waited on Lord Harewood, and urged the advantages to trade and manufactures to be anticipated from the facilities of communication to be afforded by the Railway, his Lordship demurred at once to our proposition, that any new impetus to manufactures *would* be advantageous to the country. And before this point can be settled, we must determine the broader and more general question, whether it be desirable that a nation should continue in the quiet enjoyment of pastoral or agricultural life, or that it should be launched into the bustle and excitement of commerce and manufactures. We must refer to the history of the world, and compare the characters and capabilities for happiness, of different ages and nations. We must decide between qualities of different kinds and claims of opposite characters—between the simple

and the refined; between the passive and the active; between a state of society presenting fewer temptations, and adorned by humbler virtues, and one where, amidst the collision of interests and the excitements of passion, there is room at least for the exercise of the highest qualities, both moral and intellectual. We must determine in what happiness consists: whether in the cultivation and exercise of all the active powers and faculties which belong to us as men, and citizens, and freemen; or whether it be wise to limit our ambition to more sober and tranquil enjoyments, to a state of society, where, if there be fewer pleasures there are also fewer pains, and where, at least, may be realized the poet's definition of contentment—"Health, peace, and competence." Fortunately, we are not required to make choice between two conditions of society, separated, in the history of man, and in the ordinary course of events, by centuries of gradual and imperceptible transition. It must be admitted that the golden age is past, and it is to be feared the iron age has succeeded; that, with reference to many of us, our lines are fallen amidst eternal rivalries and jealousies—agricultural, manufacturing, and commercial. The stern principle of competition is prominent in every department of industry. The most strenuous activity is hardly sufficient, in the present day, to secure to the artizan, or his employer, a scanty return for his labour or capital. Every invention, by which time is saved and business expedited, is seized with avidity, and in self-defence. Every increased facility of production, though its inevitable tendency be to glut the

market and to lower prices, yet, as it affords immediate gain to its possessor, is eagerly resorted to. If profit be reduced to the smallest per centage on capital, every one is active to realize this minimum, as expeditiously as possible: one step diminished in the process of a manufacture, or the saving of a few hours in the period of conveyance from one town to another, forms part of a nice calculation, every small item in which must be attended to, in order to secure a very moderate remuneration. Hence all the contrivances for abridging labour, for shortening distances, and expediting returns. Every one is on the alert in his own department, or he is left behind; the most active exertion being barely sufficient to enable a man to maintain his station in the world. The race of competition is universal and unceasing—every manufacture striving against every other; cotton and silk and woollen reciprocally against each other, and against themselves, and iron against iron, in all its multifarious branches. Every class, and every individual, in every department of industry, hurrying along, struggling with fortune and the times, and jostling his fellow-sufferers; while the Land-owner boldly enters the list against the field—"Protection" his motto—viewing with complacency the desperate efforts of the rival competitors, and especially the never-ceasing race of population against subsistence—the great first mover in the busy drama.

But how little soever to the taste of the contemplative mind may be the present condition and aspect of society, as constituting a vast trading community,

the Liverpool and Manchester Railway presents one great object for our admiration, almost unalloyed by any counteracting or painful consideration. We behold, at once, a new theatre of activity and employment presented to an industrious population, with all the indications of health and energy and cheerfulness which flow from such a scene. Or if we take a wider range, and anticipate the extension of Railways throughout the country, intersecting the island in every direction where the interchange of commodities, or the communication by travelling, will warrant the cost of their establishment; if we look to the construction of only one hundred Railways, equal in extent to the Liverpool and Manchester, comprising a line of three thousand miles, in various situations, and absorbing a capital of fifty or sixty millions of pounds sterling, what a source of occupation to the labouring community! what a change in the facility of giving employment to capital, and consequently in the value of money!

But perhaps the most striking result produced by the completion of this Railway, is the sudden and marvellous change which has been effected in our ideas of time and space. Notions which we have received from our ancestors, and verified by our own experience, are overthrown in a day, and a new standard erected, by which to form our ideas for the future. Speed—despatch—distance—are still relative terms, but their meaning has been totally changed within a few months: what was quick is now slow; what was distant is now near; and this change in our ideas

will not be limited to the environs of Liverpool and Manchester—it will pervade society at large. Our notions of expedition, though at first having reference to locomotion, will influence, more or less, the whole tenor and business of life. In the commercial world, the first successful attempt to introduce fresh energy and despatch into the system of our foreign trade was the institution of Packet Ships, a few years ago, to sail between New York and Liverpool, on stated days, whether fully loaded or not. The convenience, both to passengers and shippers of goods, from knowing precisely the day of sailing, soon made the Packet Ships the favourite conveyance, and accordingly their numbers and destinations rapidly multiplied. But this improvement, though great, was less open to general observation, and its effects, therefore, less striking than what may be expected from the establishment of Railway conveyance and Locomotive Engines. A transition in our accustomed rate of travelling, from eight or ten miles an hour, to fifteen or twenty (not to mention higher speeds), gives a new character to the whole internal trade and commerce of the country. A saving of time is a saving of money. For the purposes of locomotion, about half the number of carriages will suffice, if you go twice the speed; or the aggregate travelling of the country may be doubled, or more than doubled, without any additional expense to the community. The same may be said of the number of waggons for the conveyance of merchandise. The saving of capital, therefore, in this department of business is considerable, from expedition alone. A

great part of the inland trade of the country is conducted by the agency of travellers; and here, what a revolution in the whole system and detail of business, when the ordinary rate of travelling shall be twenty miles instead of ten, per hour. The traveller will live double times: by accomplishing a prescribed distance in *five* hours, which used to require *ten*, he will have the other five at his own disposal. The man of business in Manchester will breakfast at home—proceed to Liverpool by the Railway, transact his business, and return to Manchester before dinner. A hard day's journeying is thus converted into a morning's excursion. It has been well observed, in our public journals, that Manchester is thus brought as near to Liverpool as the east to the west end of London, whether we estimate vicinity by the cost of conveyance, or the time not unfrequently spent in effecting it. Gradually, the whole internal traffic of the country, with all the varieties of local intercourse, will assume a new character. Already a Railway, on a grand scale, is advertised from London to Birmingham, and from Birmingham to Liverpool; and thus is commenced that grand trunk, which will unite the north and the south, and bring into closer communication the Capitals of England, Scotland, and Ireland. The rapid transit of intelligence, from one end of the country to the other, will not be the least important of the results to be accomplished; while the quick conveyance of merchandise will infuse new life into trade and manufactures. The grocer in Birmingham will receive his ponderous

hogsheads of sugar or coffee with the celerity of a parcel by the post-coach; and the *warehouseman* in the Metropolis will be supplied with his bales of spring goods, from Manchester, in less time than he has been accustomed to receive his patterns by the flying van.

But we must not confine our views to London, or Liverpool, or Manchester: there can be no question that foreign countries will adopt the Railway communication, as one great step in mechanical improvement and commercial enterprise. France and Germany and America have already their Railways; and the Pasha of Egypt may be expected to follow close on the heels of his brother potentates. The country of the Pyramids, of Memphis, and of Thebes, shall then be celebrated for Railways and Steam Carriages; the land of the proud Mameluke or the wandering Arab, of Sphynxes and Mummies, will become the theatre of mechanical invention, science and the arts. The stately Turk, with his turban and slippers, will quit his couch and his carpet, to mount his Engine of fire and speed, that he may enjoy the delight of modern locomotion. So long is it, since a reward was offered to the inventor of a new pleasure, that some scepticism were excusable as to the possibility of any great and novel excitement. But the Locomotive Engine and Railway were reserved for the present day. From west to east, and from north to south, the mechanical principle, the philosophy of the nineteenth century, will spread and extend itself. The world has received a new impulse To the fortunate few, who are independent of times and circum-

stances, the present moment is a period of more than ordinary interest; to the world at large, it continues, as it was wont to be, a season of labour and difficulty. Whether the period will ever arrive when a whole community shall enjoy the pleasures and satisfactions to be expected from that happy combination of the powers and capabilities of the human race, which is conceivable, but has hitherto been realized only by the Utopian theorist;—whether we shall ever see united, the energy, activity, and enterprise of a refined and commercial people, with the simplicity and quiet enjoyment of philosophical life, in its most favoured aspects;—whether the period will sometime come, when the fervour of an earnest enthusiasm—religious, moral, social—shall not be inconsistent with the calculations of the merchant, or the speculations of the political economist;—when science and literature, commerce and the arts, and all the stirring influences of man's nature, in the highest state of wealth and civilization, shall be enlisted to promote the improvement and well-being of the whole community;—when, by a happy alchemy, the iron and the golden age shall be amalgamated, and man be allowed to enjoy the benefits of two states of society, hitherto deemed incompatible, or at least separated, in our experience, by intervening centuries, if indeed either counterpart has ever been realised.—These are speculations which we may glance at, for a moment, in passsing, and forget when the vision is gone. But the world and its inhabitants are constantly before us; and here we find no pause or resting place—no period of uninterrupted

enjoyment or repose, for the million. The genius of Watt, or Davy, or Stephenson, may improve the state of nations, or the fortunes of individuals, but it affects not the condition of the great mass of the human race: for this consummation we must look to other sciences than chemistry and mechanics; to the tardy overthrow of prejudice, and the slow progress of unpopular truth; to the diffusion of that knowledge which teaches the laws and principles on which depend the moral, physical, and political condition, the subsistence, and well-being of mankind.

Meanwhile, the genius of the age, like a mighty river of the new world, flows onward, full, rapid, and irresistible. The spirit of the times must needs manifest itself in the progress of events, and the movement is too impetuous to be stayed, were it wise to attempt it. Like the "Rocket" of fire and steam, or its prototype of war and desolation—whether the harbinger of peace and the arts, or the Engine of hostile attack and devastation—though it be a futile attempt to oppose so mighty an impulse, it may not be unworthy our ambition, to guide its progress and direct its course.

APPENDIX.

GENERAL ABSTRACT OF EXPENDITURE TO 31ST MAY, 1830.

Advertising Account		£ 332 1 4
Brickmaking Account		9,724 4 4
Bridge Account		99,065 11 9
Charge for Direction		1,911 0 0
Charge for Fencing		10,202 16 5
Cart Establishment		461 6 3
Chat Moss Account		27,719 11 10
Cuttings and Embankments		199,763 8 0
Carrying Department, comprising		
Amount expended in Land and Buildings for Stations and Depots, Warehouses, Offices, &c. at the Liverpool end	£35,538 0 0	
Expended at the Manchester Station	6,159 0 0	
Side Tunnel, being the approach to the Crown-street Station	2,485 0 0	
Gas Light Account, including cost of Pipes, Gasometer, &c.	1,046 0 0	
Engines, Coaches, Machines, &c.	10,991 11 4	
		56,219 11 4
Formation of Road		20,568 15 5
Iron Rail Account		67,912 0 2
Interest Account (balance)		3,629 16 7
Land Account		95,305 8 8
Office Establishment		4,929 8 5
Parliamentary and Law Expenditure		28,465 6 11
Stone Blocks and Sleepers		20,520 14 5
Surveying Account		19,829 8 7
Travelling Expenses		1,423 1 5
Tunnel Account		34,791 4 9
Tunnel Compensation Account		9,977 5 7
Waggon Account		24,185 5 7
Sundry Payments for Timber, Iron, Petty Disbursements, &c. not included in the foregoing Accounts		2,227 17 3
		£739,165 5 0

SCHEDULE OF BRIDGES ON THE

	NAMES OF BRIDGES, *Commencing at the Liverpool end.*	No. of Arches.	Skew or Square built.	Railway *under* or *over* the common road.	Span of the Arch, in feet, on the skew face. Ft.	In.	Whether Ashler, Rubble, or Brick Work.
1	Parks' Bridge	1	Square.	Under.	—		Ashler with brick arch, faced with stone.
2	Old Lane Bridge	1	Square.	Under.	—		Brick-work.
3	Wright's Bridge	1	Square.	Under.	—		Brick-work.
4	Rathbone's Lane Bridge	1	Askew.	Under.	38	0	Ashler with brick arch, faced with stone.
5	Sandown Bridge	1	Square.	Under.	—		Ashler.
6	Mill Lane Archway	1	Askew.	Under.	25	6	Brick-work.
7	Wavertree Nook Bridge	1	Askew.	Under.	38	0	Ashler.
8	Ainsworth's Bridge	1	Square.	Over.	—		Ashler.
9	Case's Bridge, No. 1	1	Square.	Over.	—		Ashler.
10	Ditto, No. 2	1	Square.	Over.	—		Ashler.
11	Childwall Lane Bridge	1	Square.	Over.	—		Brick arch and ashler quoins.
12	Pilch Lane Bridge	1	Square.	Over.	—		Ditto.
13	Jamieson's Bridge	1	Square.	Over.	—		Ditto.
14	Lord Derby's Bridge	1	Square.	Over.	—		Ditto.
15	Baron's Bridge	1	Square.	Over.	—		Ditto.
16	Ball's Bridge	1	Square.	Over.	—		Ditto.
17	Huyton Hey Bridge	1	Square.	Over.	—		Ditto.
18	Seel's Bridge	1	Square.	Over.	—		Rubble, with ashler quoins.
19	Lee's Bridge, No. 2	1	Square.	Over.	—		Brick arch and ashler quoins.
20	Ditto, No. 1	1	Square.	Over.	—		Ditto.
21	Whiston Bridge, No. 1	1	Square.	Under.	—		Ditto.
22	Ditto, No. 2	1	Askew.	Under.	47	0	Ashler with brick arch, faced with stone.
23	Makin's Occupation Bridge	—	Unfshd.	—	—		Timber on stone piers.
24	Cumber Lane Bridge	1	Square.	Under.	—		Ashler.
25	Stone Lane Bridge	1	Square.	Under.	—		Wood with stone piers.
26	Spring Lane Bridge	1	Square.	Under.	—		Ashler with brick arch, faced with stone.
27	Rainhill Bridge	1	Askew.	Under.	54	0	Ashler.
28	Bourne's Tunnel	1	Askew.	Over.	14	0	Ashler and rubble.
29	Marshall's Cross Bridge	1	Square.	Under.	—		Ashler.
30	Sutton Bridge	1	Square.	Under.	—		Ashler.
31	Sankey Viaduct	9	Square.	Over.	—		Brick with stone face, quoins & parapets.
32	Legh's Cattle Archway	1	Square.	Over.	—		Brick-work.
33	Sandy Main's Bridge	1	Askew.	Over.	15	6	Brick-work.
34	Newton Bridge	4	Square.	Over.	—		Brick-work, with stone facing
35	Parkside Bridge	1	Askew.	Under.	32	6	Brick-work.
36	Lockingstump Lane Bridge	1	Square.	Under.	—		Brick-work.
37	Kenyon Tunnel	1	Square.	Under.	—		Brick-work.
38	Hardman's Bridge	1	Square.	Under.	—		Brick-work.
39	Newton's Bridge	1	Square.	Under.	—		Brick-work.
40	Broseley Bridge	1	Square.	Under.	—		Brick-work.
41	Withington's Bridge	1	Square.	Over.	—		Brick-work.
42	Duckinfield's Bridge	1	Square.	Over.	—		Brick-work.
43	Bury Lane Bridge	1	Square.	Over.	—		Brick, with stone quoins.
44	Glazebrook Bridge	1	Square.	Ov. Brook	—		Brick, with stone quoins & stone pillasters.
45	Hodgkinson's Cattle Bridge	1	Square.	Over.	—		Brick.
46	Chat Moss (Frame) Bridge	1	Square.	Over.	—		Brick and timber.
47	Legh's Brick Arch	1	Square.	Over.	—		Brick.
48	Worsley Brook, Great Culvert	1	Square.	Ov. Brook	—		Brick.
49	Trafford's Bridge	1	Square.	Over.	—		Brick.
50	Sandy Lane Bridge	1	Square.	Over.	—		Brick and stone quoins.
51	Winton Skew Bridge	1	Askew.	Over.	31	0	Brick and stone pilasters.
52	Canal (Duke's) Bridge	2	Square.	Over.	—		Dressed ashler.
53	Monks' Hall Bridge	1	Square.	Under.	—		Brick.
54	Eccles Bridge	1	Sq. & Askew	Under.	34	0	Brick and stone quoins.
55	Whitaker's Mill Dam	.....	.....	.....	.....		Brick-work and Masonry ...
56	Stothard's Occupation Bridge	1	Square.	Under.	—		Brick.
57	Gore Booth's Bridge	1	Square.	Under.	—		Brick.
58	Cross Lane Bridge	1	Askew.	Under.	30	3	Brick and stone quoins to arch.
59	Jones's Bridges—No. 1	1	Askew.	Under.	30	4	Brick.
60	No. 2	1	Askew.	Under.	30	3	Brick.
61	No. 3	1	Askew.	Under.	30	3	Brick and stone quoins.
62	Oldfield Lane Bridge	1	Askew.	Under.	33	0	Brick and stone quoins.
63	Irwell Bridge	2	Askew.	Ov. River	65	0	Ashler.
	Sundry Culverts, Foot Bridges, and compensation in lieu of Occupation Bridges						

	Description of String Course and Coping.	Abutments, whether Rock, Masonry, or Brick Work.	Width of way, in feet, between Parapets *over* Arch.		Width of way, in feet, between Side Walls *under* Arch.		Height under the centre of the Arch, from Railway or common road, in feet.		Slope of common road *over* the Railway.	Slope of common road *under* the Railway.	Number of feet common road is *raised*.		Number of feet common road is *sunk*.		COST.		
			Ft.	In.	Ft.	In.	Ft.	In.			Ft.	In.	Ft.	In.	£.	S.	D.
1	Stone.	Masonry.	28	0	30	0	26	9	Level.	—	—		—		741	5	9
2	Stone.	Brick.	12	0	30	0	18	0	Level.	—	—		Unfshd.		156	10	0
3	Stone.	Brick.	15	0	30	0	18	0	Level.	—	—		—		184	5	6
4	Stone.	Masonry.	23	6	30	0	24	3	Level.	—	—		Unfshd.		973	14	2
5	Stone.	Masonry.	15	8	40	0	40	6	Level.	—	—		—		765	13	1
6	None.	Rock.	60	0	25	0	35	0	Level.	—	—		—		91	3	11
7	Stone.	Rock.	20	0	37	6	18	0	1 in 20	—	3	0	—		274	9	4
8	Stone.	Masonry.	34	6	12	0	13	6	—	Level.	—		—		418	5	10
9	Stone.	Masonry.	34	6	12	0	16	0	—	Level.	—		—		418	0	2
10	Stone.	Masonry.	34	6	12	0	16	0	—	Level.	—		—		493	0	3
11	Stone.	Masonry.	66	6	14	0	16	0	—	Level.	—		—		346	12	1
12	Stone.	Masonry.	34	6	16	0	16	0	—	1 in 30	—		5	6	270	1	0
13	Stone.	Masonry.	34	6	12	0	18	0	—	Level.	—		—		202	7	0
14	Stone.	Masonry.	34	6	12	0	20	0	—	Level.	—		—		241	16	1
15	Stone.	Masonry.	34	6	12	0	16	0	—	Level.	—		—		240	9	11
16	Stone.	Masonry.	34	6	12	0	19	0	—	Level.	—		—		204	5	5
17	Stone.	Masonry.	34	6	12	0	12	4	—	Level.	—		—		302	3	2
18	Stone.	Masonry.	34	6	12	0	14	0	—	1 in 30	—		1	6	215	0	3
19	Stone.	Masonry.	34	6	12	0	14	10	—	Level.	—		—		215	8	10
20	Stone.	Masonry.	34	6	12	0	21	10	—	Level.	—		—		282	0	9
21	Stone.	Masonry.	47	6	22	0	18	0	1 in 13	—	14	0	—		960	5	0
22	Stone.	Masonry.	24	0	30	0	18	0	1 in 20	—	15	0	—		1174	0	1
23	—	—	—		30	0	—		—	—	—		—		74	15	2
24	Stone.	Masonry.	16	0	30	0	18	0	1 in 20	—	12	0	—		536	13	0
25	Stone.	Masonry.	9	0	45	0	18	0	Level.	—	—		—		193	15	3
26	Stone.	Masonry.	16	0	30	0	18	0	1 in 30	—	8	0	—		418	19	8
27	Stone.	Masonry.	30	0	30	0	18	0	1 in 26	—	12	0	—		3735	6	7
28	Stone.	Masonry.	104	0	7	0	7	0	—	—	—		—		165	5	9
29	Stone.	Masonry.	24	0	30	0	18	0	1 in 20	—	5	0	—		864	13	10
30	Stone.	Masonry.	26	6	30	0	23	0	Level.	—	—		—		470	8	9
31	Stone.	Brick-work.	25	0	50	0	60	to Canal	—	—	—		—		45,208	18	6
32	None.	Brick.	None.		12	0	6	0	—	—	—		—		257	18	5
33	Stone.	Brick.	35	0	12	0	15	0	—	—	—		—		429	0	1
34	Stone.	Brick.	25	0	30	0	27	0	—	—	—		—		5340	12	5
35	Stone.	Rock.	20	0	30	0	18	6	1 in 18.	—	6	0	—		316	19	6
36	Stone.	Brick.	20	0	30	0	18	0	Level.	—	—		—		491	14	9
37	Stone.	Brick.	—		30	0	19	0	Level.	—	—		—		1703	19	1
38	Stone.	Brick.	12	0	30	0	20	0	1 in 9	—	—		3	6	434	7	9
39	Stone.	Brick.	12	0	30	0	18	0	1 in 12	—	7	0	—		369	12	2
40	Stone.	Brick.	20	0	30	0	18	0	1 in 18	—	7	0	—		663	4	10
41	Stone.	Brick.	35	0	12	0	14	0	—	Level.	—		—		419	15	4
42	Stone.	Brick.	35	0	12	0	14	0	—	Level.	—		—		323	10	3
43	Stone.	Brick.	35	0	16	0	16	0	—	1 in 20	—		3	0	621	1	7
44	Stone.	Brick.	35	0	30	0	30	ab. Riv.	—	—	—		—		1758	8	6
45	Stone.	Brick.	35	0	9	0	10	0	—	—	—		Unfshd.		13	9	0
46	Stone.	Brick.	25	0	12	0	13	0	—	—	—		—		466	19	6
47	Stone.	Brick.	25	0	16	0	16	0	—	Level.	—		—		513	9	6
48	Stone.	Brick.	125	0	13	0	13	to Wat.	—	—	—		—		1598	5	8
49	Stone.	Brick.	69	0	12	0	13	0	—	Level.	—		—		589	6	0
50	Stone.	Brick.	25	0	16	0	21	0	—	Level.	—		—		1093	18	4
51	Stone.	Masonry.	25	0	22	0	20	0	—	Level.	—		—		1725	10	5
52	Stone.	Masonry.	25	0	25	0	12	to Wat.	—	Level.	—		—		1158	8	11
53	Stone.	Red Rock.	36	0	30	0	18	0	1 in 18	—	6	0	—		453	19	11
54	Stone.	Red Rock.	48	0	30	0	18	0	1 in 24	—	6	0	—		954	0	1
55															631	10	2
56	Stone.	Brick.	12	0	30	0	16	0	1 in 14	—	5	0	Unfshd.		31	19	0
57	Stone.	Brick.	18	8	30	0	18	0	1 in 18	—	5	0	—		417	13	7
58	Stone.	Brick.	48	0	30	0	18	0	1 in 30	—	6	0			801	12	3
59	Stone.	Brick.	42	0	30	0	18	0	1 in 20	—	6	0					
60	Stone.	Brick.	42	0	30	0	18	0	—	—	6	0	Unfinished		559	14	5
61	Stone.	Brick.	48	0	30	0	18	0	1 in 20	—	6	0					
62	Stone.	Brick.	48	0	30	0	18	0	1 in 13	—	7	0			988	15	11
63	Stone.	Masonry.	53	0	63	0	30	to Riv.	—	—	—				8795	4	4
															4296	16	0
															£ 99,065	11	9

OBSERVATIONS.

Brickmaking Accounts.—The greater part of these Bricks are fast using in the building of the Manchester Warehouses, Offices, &c. and some in completing the Bridges at each end of the line.

Bridges.—The foregoing description of the several Bridges in a tabular form, I have thought would not be uninteresting, as affording a popular view of the kind of structures that may be expected to occur in similar undertakings. It will be seen that several of the Bridges are still unfinished, though fast approaching their completion —for this purpose a fund is reserved, as per the estimate below.

Chat Moss.—Under this head is comprised the earth-work from Bury-lane Bridge to Legh's Occupation Bridge, on the east border of the Moss, a distance of $4\frac{3}{4}$ miles. The Embankments in this space consist of about 277,000 cubic yards of moss earth, in the formation of which about 677,000 cubic yards of raw moss have been used; the difference in measurement being occasioned by the squeezing out of the superabundant water, and consequent consolidation of the moss. The expenditure on this district has been less than the average expenditure of the rest of the line.

Cuttings and Embankments.—Under this head is comprised the earth-work on the whole line, exclusive of the Chat Moss district. The Cuttings somewhat exceed the Embankings: the surplus is principally deposited along the border of the great Kenyon Cutting. The Excavations consist of about 722,000 cubic yards of rock and shale (including some side cuttings at Eccles, to expedite and improve the consistency of the Barton Embankment), and about 2,006,000 cubic yards of marle, earth and sand. This aggregate mass has been removed to various distances, from a few furlongs to between three and four miles; and no inconsiderable portion of it has been hoisted up by machinery, from a depth of 30 to 50 feet, to be deposited on the surface above, either to remain in permanent spoil banks, as at Kenyon, or to be afterwards carried to the next embankment, as at the deep rock cutting through Olive Mount; the process in this latter case being rendered expedient from considerations of increased expedition. Where land for the deposit of spoil banks has been purchased, the cost of the land forms part of the expenditure

under this head, and a good deal of substantial and lofty walling in the deep cuttings is also included. The unavoidable expense of pumping out the water from the several cuttings on the line during a wet season, was adverted to in the text.

Formation of the Permanent Road.—This consists of what is termed ballasting the road—that is, depositing a layer of broken rock and sand, about two feet thick, viz. one foot *below* the blocks, and one foot distributed *between* them, serving to keep them firm in their places. Spikeing down the iron chairs to the blocks or sleepers, fastening the rails to the chairs with iron keys, and adjusting the rail-way to the exact width and curve and level, come under this head of expenditure.

Iron Rail Account.—This expenditure comprises the following items:—

Rails for a double way from Liverpool to Manchester, with occasional lines of communication, and additional side lines at the different Depots, being about 35 miles of double way, = 3847 tons, at prices averaging something less than £12. 10s. per ton £48,000 0 0

Cast-iron Chairs, 1428 tons, at an average of £10. 10s...	15,000	0	0
Cost of Spikes and Keys, to fasten the Chairs to the Blocks and the Rails to the Chair.....	3,830	0	0
Cost of Oak Plugs for the Blocks	615	0	0
Sundry Freights, Cartages, &c. &c.	467	0	2
	£67,912	0	2

Land.—This is a heavy item of expenditure. The price of land in the vicinity of large towns is usually high; and the outlay was further enhanced by numerous claims for compensation, owing to the prejudice which a few years since existed against Railways, and especially against what now appears their peculiar recommendation—the Locomotive Engine. A great change has taken place in this respect. At the close of 1828 the charge under this head was nearly £102,000., but a portion of this amount being for the Depots, has been transferred to the Carrying Department.

Office Establishment.—This comprises the salaries of Treasurer and Clerks, Office Rent, Stationary, Printing, &c. since October, 1824.

Stone Blocks and Sleepers.—Out of the 31 miles, about 18 are laid with Stone Blocks, and 13 with Wood Sleepers, oak or larch; these latter being laid principally across the Embankments, and across the two districts of moss. A considerable quantity of Wood Sleepers have been destroyed, unavoidably, in the progress of the work.

Surveying Account.—This comprises the cost of Surveys, Plans, &c. for the two applications to Parliament, in 1825 and 1826; also the salaries of the Engineer, and principal Assistants, Stationary, &c. from the commencement of the undertaking.

Travelling Expenses.—This includes the cost of sundry journeys and deputations to London, Darlington, Newcastle, &c. since 1824: also the cost of journeys of inspection on the line of Railway during the progress of the works.

Tunnel Compensation Account.—This consists of compensation paid to parties under whose premises the Liverpool Tunnel is excavated, for damage, either real or supposed; and further, of loss sustained on the re-sale of sundry houses and lands which the Company were required to purchase. There will be a credit to this account for premises re-sold to the extent of about £2500.

Waggon Account.—This expenditure is principally for waggons used in the progress of the work. There will be a credit to this account from the re-sale of such waggons as cannot conveniently be adapted to the future purposes of the Railway, and by a transfer of the remainder to the carrying department, at their estimated value.

It will be observed that the statement of expenditure is up to the 31st of May, 1830. The Railway, however, will require a further outlay to render it complete, though the Locomotive Engine has passed over every foot of ground from Liverpool to Salford. The slopes of the Cuttings want dressing, and several of them want protecting with foot walls. The permanent road-way is not quite finished, and some portions that have been laid down require adjusting and re-levelling. The fencing also in portions of the line will be incomplete for some time.

The Directors, in their Report dated 25th March last, estimated

the total expenditure, including Warehouses, Machinery and Carriages, at £820,000., which may be apportioned as follows:—

Expenditure, as above, in actual payments, to 31st May	£739,165	5	0
Outstanding engagements to the same date	7,500	0	0
For Walling the Slopes in sundry places, and completing permanent road	6,750	0	0
For completing the Bridges, including the Irwell, £6000, and Parapets of the Sankey Viaduct £1400, and compensation in lieu of bridges	9,500	0	0
Additional Engines, Waggons and Machinery, part under contract for delivery	17,000	0	0
Completing Stations, Wharfs, Warehouses, Offices, &c.	25,000	0	0
Fencing at sundry places	3,000	0	0
Contingencies	12,084	15	0
	£820,000	0	0

The public opening of the Railway is a subject of interest and inquiry. It is some time since coal for the Company's purposes was conveyed from the Elton Head Collieries, in Sutton, to the Crown-street Station, in Liverpool; and on the 14th of the present month (June), an experiment was made which may be regarded as a preliminary measure to a general opening, well calculated to exhibit the peculiar character of Railway conveyance, and to put to the test the capabilities of the Locomotive Engine. On this occasion the Directors, in two of their carriages (the one a close glass coach, the other an open carriage) proceeded in a journey of inspection from Liverpool to Manchester and back. The Arrow Locomotive, one of the improved Engines on the Rocket principle, was the moving power. The gross weight drawn was about 33 tons, consisting as follows:—

Stone in seven Waggons	20 tons.
Weight of Waggons	7 „
Engine-Tender and six persons	3 „
Two Carriages and 20 persons	3 „
	33 tons.

With this load she travelled from the Engine House, Liverpool, to Old-

field-lane Bridge, Salford, Manchester, the distance being about 29 miles, in two hours and 25 minutes, including two stoppages to take in water. Up the Whiston inclined plane she was assisted by the Dart, an Engine of similar construction and power, and the first quarter of a mile of the ascent was accomplished at a speed of 17 miles per hour, which however decreased to about 4 miles per hour before the summit was gained, the mile and a half being accomplished in 12 minutes, the average speed, therefore, being $7\frac{1}{2}$ miles per hour. At the top of the ascent, the Dart was unyoked, and the Arrow proceeded with her cargo along the straight and level plane at Rainhill at the rate of 16 miles per hour. On the return from Manchester the Engine-Tender and the two Carriages with passengers, constituted the whole load drawn. The first $9\frac{1}{4}$ miles from Oldfield-lane Bridge to Glazebrook Bridge, including the Chat Moss district, were accomplished at a speed averaging from 19 to 20 miles per hour. The whole distance was accomplished in 1 hour and 46 minutes, including stoppages, the speed generally varying from 18 to 25 miles and upwards per hour, and the Engine not working to her full power, a great portion of the way. The speed up the Sutton inclined plane, (without any assistant Engine,) averaged more than 15 miles per hour. The day was wet, and the rails, in places, very dirty; the whole performance therefore, took place under circumstances by no means favourable; but the result was highly satisfactory.

It will now be in the discretion of the Directors to name the day when they shall consider the Railway in that state of completeness which may render expedient the public conveyance of passengers or merchandise, either the whole distance, or along part of the line in the first instance. It may be sufficient to refer the date of the opening of the Liverpool and Manchester Railway to the summer of 1830.

Liverpool, June, 1830.

FINIS.

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