Observations on a general iron rail-way, or land steam-conveyance : to supersede the necessity of horses in all public vehicles: showing its vast superiority in every respect, over all the present pitiful methods of conveyance by turnpike roads, canals, and coasting-traders : containing every species of information relative to rail-roads and loco-motive engines

OBSERVATIONS

ON

A GENERAL IRON RAIL-WAY,

OR

LAND STEAM-CONVEYANCE,

&c. &c. &c.

"It has been remarked that Rail-ways have hitherto been confined, almost exclusively, to coal works and other mines; and that inventions, whose only recommendation are *simplicity* and *usefulness*, are often suffered to lie long in a state of public neglect, whilst others, of *no real utility*, being pertinaciously blazoned forth by interested or blinded partisans, are readily adopted."—*Rees' Cyclopædia.*

"No local interests, no partialities must be allowed to interfere; and although petty conflicts might be sustained, they must all yield to this measure of great public utility."—*Lord Liverpool.*

"Soon shall thy arm, unconquer'd Steam! afar
Drag the slow barge or drive the rapid car;
Or on wide waving wings expanded bear
The flying chariot through the fields of air."

Darwin.

"My time indeed has been chiefly employed in facilitating the communication between different places within land by means of roads and canals: in regard to both which great undertakings, I find we are as yet not a great deal farther advanced *than children beginning to walk.*"

Dr. Anderson.

"Every discovery and improvement in Mechanics gives employment to hundreds of all classes of the community.—James Watt, the son of a schoolmaster in an obscure village, has done more real good to the people of Great Britain, *than all the statesmen she has produced since the Revolution.*"

Mechanic's Magazine, No. 55.

See my communication to the Mechanic's Magazine Nos. 19 and 51; Gentleman's ditto for May and October 1824; Monthly ditto for June and October 1824; European ditto for August 1824.

OBSERVATIONS

ON

A GENERAL IRON RAIL-WAY,

OR

LAND STEAM-CONVEYANCE;

TO SUPERSEDE THE NECESSITY OF HORSES IN ALL PUBLIC VEHICLES:

SHOWING

ITS VAST SUPERIORITY IN EVERY RESPECT,
OVER ALL THE PRESENT PITIFUL METHODS OF CONVEYANCE
BY TURNPIKE ROADS, CANALS, AND
COASTING-TRADERS.

CONTAINING

EVERY SPECIES OF INFORMATION

RELATIVE TO

RAIL-ROADS AND LOCO-MOTIVE ENGINES.

BY THOMAS GRAY.

FIFTH EDITION.

WITH MAPS AND PLATES ILLUSTRATIVE OF THE PLAN.

LONDON:
PUBLISHED BY BALDWIN, CRADOCK, AND JOY,
PATERNOSTER-ROW.
TO BE HAD OF ALL BOOKSELLERS.

1825.

C. Baldwin, Printer,
New Bridge-street, London.

CONTENTS.

TO THE PUBLIC.

As these observations were written for the sole purpose of pointing out the most effectual method of improving the internal communication of this country, it may not be irrelevant to recommend this work to public notice purely on account of its advocating the adoption of measures that would contribute to the accommodation of every individual, and, consequently, of all classes of society.

The great success which has already attended the establishment of steam-packets, must, eventually, serve to brush away the prejudice of the most obstinate in favor of our present turnpike-roads, which have nothing, save folly and extravagance, to recommend them.

The superior importance of land-steam-conveyance compared with steam-navigation;

the incredible facility of draught which improved rail-ways afford to mechanic power; the numerous advantages attending this scheme, and its vast economy, demand the consideration and support of all persons engaged in commerce and agriculture.

Yet the Author begs to state unequivocally, that as he has no other interest in this scheme than what the public may confer upon him, he hopes to be shielded from every attack of prejudice, ignorance, and selfishness, which are ever ready to thwart every improvement, and will doubtless exert themselves to the utmost against a plan calculated, *as this is*, to promote the best interests of society.*

* "Although it is only of late years that steam has been extensively applied to the propelling of vessels on water, yet a knowledge of its capabilities for this purpose is of old date. As far back as the 21st of December, 1736, Mr. Jonathan Hulls took out a patent for 'A new-invented machine for carrying vessels or ships out of, or into, any harbour, port, or river, against wind and tide, or in a calm;' and in the following year, he published a pamphlet at London, which is now extremely rare, detailing at length the nature of his invention. In the introduction to his pamphlet Mr. H. prophetically remarks, 'There is one great hardship lies too commonly upon those who propose to advance some new though useful scheme for the public

That opposition is laudable and necessary, in many instances, cannot be denied, and that no public measure ever was, or ever will be, brought forward without encountering it, more or less, is perhaps equally true; such must be the case from the conflicting interests of individuals; no obstacles, however, can long impede what is found essential to general welfare, which is the intention of the proposition now laid before the public, by opening a permanent source of national wealth to all our capitalists, and by affording profitable labour to all the poor out of employment.

benefit, the world abounding more in rash censure than in a candid and unprejudiced estimation of things: if a person does not answer their expectations in every point, instead of friendly treatment for good intentions, he too often meets with ridicule and contempt.' We are willing to think that there is less of this ungenerous feeling to be met with now-a-days than formerly; and *yet even at the present time how many are the projects of genius for the benefit of mankind, which lie, thrown aside, neglected and contemned? How can we be certain that our childrens' children may not have as much cause to wonder at the stupidity of their grandsires, in not adopting some palpable improvements revealed to them, as we have to wonder at the stupidity of ours in leaving untried so fair an invention as the steam-boat.*"—*Mechanics' Magazine*, No. 7, October 11, 1823.

On the publication of the Third Edition, in 1822, *the following Letter was extensively circulated in London, Manchester, Liverpool, Leeds, &c. &c.*

Sir,

Your most serious attention and kind patronage are solicited in behalf of this plan, which, it is humbly presumed, may prove of the first importance to all our capitalists, and amply remunerate them for any advances they may make, however considerable; and at the same time prove an annual saving of several millions to the nation, by the general introduction of mechanic power, so as completely to supersede the necessity of horse-power in all public waggons, stage and mail-coaches, and post-chaises.

A careful and minute investigation of this measure, cannot fail to convince the whole country of the abundance of wealth which might be reaped by each subscriber, and of the great benefit to arise from a general reduction in the charges of carriage and rates of fare, by which the intercourse of all commercial and agricultural branches of society,

and indeed every communication, both in a public and private point of view, are so materially affected.

The exorbitant demands now made on the public, for conveyance of goods and persons by waggons and coaches, are caused principally, if not altogether, by the enormous expence of a stock of horses, the continual renewal of the stock, and the intolerable expence of their keep.

After several years' close application to this plan, I feel assured, when the public shall have duly weighed and compared our present extravagant and ruinous system of turnpike-roads, with the infinitely superior speed, safety, and economy of a general iron rail-way and steam-engines, that the great advantage of mechanic-power, now so well and practically understood, will gain universal encouragement; *it is only through the interest each individual of society has in this national undertaking, and the welfare of the public in general, that I should have the confidence thus to entreat your influence and support.*

I remain, Sir,

Most respectfully,

Your obedient Servant,

THE AUTHOR.

ADVERTISEMENT.

LAND-STEAM CONVEYANCE,

TO SUPERSEDE THE NECESSITY OF HORSES IN ALL PUBLIC VEHICLES.

The practical economy of steam-power is already so fully proved, by its universal adoption in our mining districts, in our manufactories, and on board our packets, as to afford demonstrative evidence of the numerous, *but yet unforeseen*, advantages which might *daily* be derived from its general application to our inland conveyance.

By the establishment of a General Iron Rail-way in a direct line, the distance between the capital and the manufacturing districts and principal cities might be reduced one quarter, and in many cases one third, instead of the ridiculously winding course the stage and mail-coaches now daily run.

The permanent prosperity which would arise to commerce from this rapid communication would soon be felt in every corner of the United Kingdom. The mails from London to Manchester, Liverpool, and Leeds, might be conveyed within the space of twelve hours, and those to Glasgow and Edinburgh within twenty-four: the ordinary stage-

coaches, caravans, and vehicles, for the conveyance of every description of merchandize, might also be transported on the same improved principle.

The farmer would likewise greatly participate in this national improvement. The land now required to produce food for his horses might be cultivated for other purposes far more profitable ; the various products of the farm, as well as live stock of every description, might be conveyed to any market, and manures brought back, without employing a single horse, in one half the time and at one half the expence now incurred.

The introduction of fresh fish throughout the interior of the kingdom would open a source of trade to numerous individuals, and very essentially contribute to the improvement of our fisheries, as well as to the establishment of new ones. This branch of commerce deserves most particular attention, as forming a valuable nursery for our seamen.

As a permanently improving source of revenue to our capitalists, this plan would have no parallel ; the diurnal returns, at the most moderate toll upon each vehicle, would annually produce many millions ; indeed no limits can be assigned to the increase of wealth which this change in our inland conveyance might produce ; there is no branch of agriculture, no branch of commerce, or of arts, but would partake of its endless prosperity. In support of this statement it is merely necessary to

remark, that one steam-engine, *on an improved rail-way*, would draw from London to Edinburgh three stage-coaches (each carrying twice the luggage and number of passengers of ordinary stages) in thirty hours, which now require 300 horses, and at least fifty hours' time for the performance of the journey.

If a public meeting were convened by the wealthy merchants and capitalists of the metropolis, in order to canvass the relative properties of this scheme, the example would soon be followed in the manufacturing districts and principal cities, and the many millions, now *annually* squandered away in purchasing and feeding unnecessary horses, might be divided by the holders of shares in a General Iron Rail-way Company, and in the numerous branch companies which would be established throughout the United Kingdom.

TO THE BINDER.

Plate, Steam-Conveyance and General Iron Rail-way, to face ..... Title.

—— Map of Rail-way for Ireland and for England, to face each other between pp. xxii and xxiii.

—— Draught of a General Iron Rail-way, p. xxiv.

—— Mr. Blenkinsop's Steam-Carriage.. p. 84.

The following Petition was sent to the respective offices of the several Ministers of State, as undermentioned, on the 29th of March, 1822.

To the Right Honourable the EARL OF LIVERPOOL.
To the Right Honourable NICHOLAS VANSITTART, (now Lord Bexley).
To the Right Honourable ROBERT PEEL.
To the Most Noble the MARQUIS SALISBURY
To the Right Honourable the EARL OF CHICHESTER } Post-masters General.

The humble Petition of Thomas Gray, Author of "Observations on a General Iron Rail-way,"

Showeth,

That your petitioner, in the years 1820 and 1821, submitted two addresses to the Right Honourable LORD VISCOUNT SIDMOUTH, on the subject of this petition, the great national importance of which prompts your petitioner again to solicit the influence, patronage, and attention of His Majesty's Ministers.

That by the introduction of Steam-engines on a General Iron Rail-way, several millions of the enormous annual expence of horses employed in stage and mail coaches, post-chaises and waggons, might be saved to the nation, as the plan now proposed would combine all the advantages of the present various establishments, for the conveyance of goods and persons by land and water, at an infinitely less expence to the country.

As a permanently improving source of revenue to Government your petitioner humbly conceives that double or treble the amount of taxes now levied upon horses and carriages might be received from carriages running on a General Iron Rail-way, and that the charges of carriage, and rates of fare, would still be considerably diminished to individuals.

That the General Post-Office would possess more efficient means of forwarding letters to all parts of the United Kingdom, at a very trifling charge compared with the expence of mail-coaches as now established; and that the outward and homeward bound foreign mails would be accelerated with a despatch

and economy yet unknown, as the *greatest* speed in practice, by steam-packets, might be maintained by steam mail-coaches, to all great commercial towns and sea-ports throughout Great Britain and Ireland.

That in time of war, or civil commotion, troops might be despatched from one end of the island to the other in one quarter of the time now required, and that provisions and equipments might be forwarded to out-ports with the greatest speed and facility in fitting out an expedition.

That the expence of forming a general iron rail-way would be considerable; but when the national advantages it might afford are duly weighed and compared with the heavy sums now annually expended in the *purchase and keep* of horses, and the exorbitant charges for repairs of turnpike roads, the trifling yearly expence of this new scheme would soon attract the public attention, and your petitioner feels assured that all the revenue arising from conveyance of goods and persons, would, in time, be exclusively enjoyed by this projected establishment on account of its manifest superiority.

That the present system of roads and canals is found to be, generally speaking, both defective and unprofitable, whereas by the plan now humbly submitted to His Majesty's Ministers, every advantage which the existing methods afford, would be materially improved without being subject to their numerous impediments, for mechanical power possesses all the strength and speed required at one tithe the expence of horse-power.

That the execution of this plan would produce abundance of labour to all the poor out of employment, for many years to come, and prove a source of strength and revenue to the nation, as well as a certain annual profit to our capitalists.

That your petitioner humbly craves the serious attention of His Majesty's Ministers to a measure which would greatly contribute to improve all commercial and agricultural property, by affording the most easy and cheapest means of accelerating the circulation of our foreign and inland trade, by a general and uniform internal communication throughout Great Britain and Ireland.

And your petitioner will ever pray.

TO HIS MAJESTY'S MINISTERS OF STATE.

The humble Petition of Thomas Gray, Author of "Observations on a General Iron Rail-way,"

Showeth,

That your petitioner did, on the 29th day of March, in the year of our Lord 1822, humbly memorialize the several Ministers of State, a duplicate of which memorial is hereunto annexed.

That your petitioner earnestly entreats the most impartial consideration of His Majesty's Ministers to the project now humbly laid before them; and solicits that an inquiry may be instituted by Government into every branch relative to the proposed plan, being fully persuaded that, in a financial point of view, as well as in every other respect, no other system could produce so highly abundant and equitable a source of revenue.

That your petitioner herewith transmits plates illustrative of the plan, and humbly conceives that a kind condescension on the part of His Majesty's Ministers, by an attentive perusal of the same, cannot fail to promote the assistance of His Majesty's Government in behalf of the scheme.

That as a Select Committee was appointed by the Honourable House of Commons, last Session of Parliament, to examine into the merits of steam-navigation, the same attention to the present plan would be productive of the utmost good, as an impartial consideration of the comparative importance of the two systems, Steam-navigation and Land-steam Conveyance, could not fail to establish the manifest superiority of the latter.

That your petitioner shall persevere to the utmost of his power to improve the plan, in the full assurance that, as it shall be more generally known and understood, its great superiority over turnpike-roads and canals must overcome every prejudice, and that your petitioner may at last be entitled to confidence and consideration, and thereby obtain the support of Government and of the public in general.

And your petitioner will ever pray.

27th May, 1823.

TO THE RIGHT HONOURABLE THE PRESIDENT AND BOARD OF AGRICULTURE.

The humble Petition of Thomas Gray, Author of "Observations on a General Iron Rail-way,"

Showeth,

That your petitioner solicits the kind attention of your Honourable Board to the enclosed plates, illustrative of his plan, relying on the well-known superiority of mechanic power, and its practical advantages in the farm, manufactory, and navigation, as being sufficiently demonstrative of the great benefit which might be reaped by its general application to the conveyance of coaches, caravans, and waggons.

That the patronage of your Honourable Board would enable your petitioner to introduce the plan throughout the Kingdom; for as it would tend in every respect to improve our inland communication, so would it, on becoming more generally known and understood, excite the interest of agriculturists, farmers, merchants, and manufacturers.

That your petitioner purposes laying this plan before the Honourable House of Commons the next Session of Parliament, being confident that the many important advantages it would afford the public must overcome every prejudice, and ultimately prevail over the present comparatively bad system of conveyance by the ordinary turnpike-roads, so dangerous to individuals, as the numerous accidents arising from stage-coaches too clearly prove; so unprofitable to the community, as the statements of the Trusts of Roads do exemplify.

That steam-engines would answer all the purposes required for the improvement of our internal intercourse, and prove that the expences now caused by the continual relays of horses are totally unnecessary: the great economy of such a measure must be obvious to every one, when instead of each coach changing horses between London and Edinburgh, say 25 times, requiring 100 horses, besides the supernumerary ones kept in case of accident, the whole journey of several coaches might be performed with the simple expence of one steam-engine.

That your petitioner urges the most serious attention of your Honourable Board to examine into the comparative importance

of steam-navigation and land-steam conveyance, which could not fail to gain the decided approbation of your Honourable Board in support of this measure.

And your petitioner will ever pray.

Nottingham, Sept. 3, 1823.

TO THE RIGHT HONOURABLE THE LORD MAYOR AND GENTLEMEN OF THE CORPORATION OF THE CITY OF LONDON.

The humble Petition of Thomas Gray, Author of "Observations on a General Iron Rail-way,"

Showeth,

That the practical economy of steam-power is already so fully proved, by its universal adoption in our mining districts, in our manufactories, and on board our packets, as to afford demonstrative evidence of the numerous, but yet unforeseen, advantages which might daily be derived from its general application to our inland conveyance.

That by the establishment of a General Iron Rail-way in a direct line, the distance between the capital and the manufacturing districts and principal cities might be reduced one quarter, and in many instances one third, instead of the ridiculously winding course the stage and mail-coaches now daily run.

That the permanent prosperity which would arise to commerce from this rapid communication would soon be felt in every corner of the United Kingdom; the mails from London to Manchester, Liverpool, and Leeds, might be conveyed within the space of twelve hours, and those to Glasgow and Edinburgh within twenty-four; the ordinary stage-coaches, caravans, and vehicles for the conveyance of every description of merchandize, might also be transported on the same improved principle.

That the inhabitants of London might be regularly supplied with coal on reasonable terms, were their markets thrown open to the free competition of this trade; the many disadvantages attending the coal trade in London are sufficiently apparent in the expence of vessels, seamen's wages, protracted voyages, insurance, tonnage dues, light dues, &c. and it should also be remembered, that vessels in this trade, generally, return from

London in ballast: whereas coal waggons coming to London on rail-ways, might be certain of lading on return to all the populous districts through which they might pass.

That one gang of coal-waggons, carrying the full freight of a vessel, might be forwarded from Newcastle to London in three days, by the simple expence of one steam-engine; but the manifold benefits which this measure would throw open to the general commerce of London, and throughout the interior of the country, can only be justly appreciated when they become known and understood.

That it remains only to know the exact amount of capital required for a rail-way, in order to show the feasibility of this scheme; and on this head, if each single rail-way be reckoned at two thousand pounds per mile, and allow two rail-ways for vehicles going, and two rail-ways for those returning, the whole sum per mile will be eight thousand pounds: in order, however, to guard against contingent expences, let the sum be stated at twelve thousand pounds per mile, and this the most experienced engineers and surveyors will allow to be the very utmost extent. The distance between London and Newcastle, in a direct line, will be about two hundred miles, which, at twelve thousand pounds per mile cost of the rail-way, will amount to two millions four hundred thousand pounds capital stock.

That, taking for a calculation the number of chaldrons of coals consumed annually in London to amount to two millions, and reckoning the toll to be levied upon each chaldron at five shillings per the rail-way, for the whole distance from Newcastle to London, this branch of commerce *alone* would yield a revenue of five hundred thousand pounds to the proprietors of the rail-way, without taking into account the numerous daily vehicles of every description for the conveyance of persons and of merchandize of every kind, all which might contribute a three-fold toll to what is now paid on turnpike-roads, and still convey goods and passengers at one half the present charge, and in one half the time.

That if a public meeting were convened by the wealthy merchants and capitalists of the metropolis, in order to canvass the relative properties of this scheme, the example would soon be followed in the manufacturing districts and principal cities, and

the many millions now annually squandered away in purchasing and feeding unnecessary horses, might be divided by the holders of shares in a General Iron Rail-way Company, and in the numerous branch companies which might be established throughout the kingdom.

That as a rail-way is about to be established between Birmingham, Liverpool, and Manchester, your petitioner hopes the citizens of the capital will be zealous in promoting an object so highly beneficial to themselves, as well as to the whole country, by the adoption of the plan now submitted to their serious attention and consideration.

And your petitioner will ever pray.

Nottingham, 10*th May*, 1824.

EXPLANATION

OF THE

Two annexed Draughts (*Nos*, 1 *and* 2) *of a General Iron Rail-way.*

In every branch of Mechanism, simplicity of construction is the surest criterion of a nearer approach to perfection.

A careful examination of the draughts now presented to the public, as a plan of a General Iron Rail-way, will, it is hoped, demonstrate the ease, safety, economy, and celerity, with which vehicles of every denomination, for the conveyance of goods and persons, may be propelled by mechanic power.

The six parallel rail-ways which extend the whole length of plate No. 1, form the general iron rail-way, to run in a direct line *from London to Edinburgh*, and *from London to Falmouth*; the branches from the direct line (see map of the plan) are denominated *branch rail-ways*, and only require one or two rail-ways for carriages going, and an equal number for those returning.

The four circular plates A, are to afford a ready and immediate communication by turning vehicles off (see plate No. 2) into their respective branch rail-ways.

The sliding frame B in the middle of each draught shows (see plate No. 2) in what manner vehicles may be removed into any of the six parallel tracks or rail-ways, in case a carriage of superior speed be obstructed by any other of inferior speed, also in case of accidents or of any necessary repairs.

The circular plates are to be let into the general iron rail-way wherever the communication with a branch rail-way may require it.

The sliding frame should be laid at regular distances, as the public convenience may demand, also for particular and local accommodation, as experience shall best instruct.

The rollers, or machinery, on which the circular plates and sliding frames are to act, must be of sufficient strength and power to carry any weight whatever; the operation of these machines may be effected by horse, or mechanical, or steam power, as circumstances may determine.

The rack, or cog-rail in each rail-way is where the cog-wheel of the steam-engine employs its force to impel the caravans, waggons, and coaches. Being placed in the middle of the track it gives the most uniform power to the permanent action of the steam-engine, and would also exclude the use of horses, and thereby preserve the rail-roads from destruction and continual dilapidation, the attendant consequences of employing horses.

Where the tolls may be collected, it would be necessary to keep a stock of rails, &c. to be ready in case of accidents, or for general repairs, as well as a supply of coals and water to feed the steam-engines. It would also be advisable to have the circular plates and sliding frames laid down at the same places, as the persons appointed as keepers of these stores, or magazines, might, besides collecting the tolls, superintend the duty of turning vehicles off into the different branches, &c.

In order to maintain a level as much as possible, wherever the rail-way may have to cross the old roads, the latter should be carried over the former by strong archways of sufficient expanse to admit the largest vehicles.

OBSERVATIONS

ON

A GENERAL IRON RAIL-WAY,

OR

LAND STEAM-CONVEYANCE.

"Come, bright improvement! on the car of time,
And rule the spacious world from clime to clime;
Thy handmaid arts shall every wild explore,
Trace every wave and culture every shore."

CAMPBELL.

"In a country where the numerous magnificent bridges, docks, harbours, and canals, testify so proudly to the talents of British engineers, it is not a little strange to find no trace of skill, or a particle of science, except in a few recent instances, throughout the whole extent of the turn-pike roads."

EDINBURGH REVIEW.

IF public attention could be roused, in order to examine impartially into the present policy of our inland conveyance, every individual would soon be persuaded of the absolute necessity of an entirely new system of national intercourse. There is no branch of political economy which so imperatively demands particular attention in every district, *and none so worthy of national support*, as

STEAM CONVEYANCE
on a
GENERAL IRON-RAIL-WAY.

No Speed with this, can fleetest Horse compare:
No weight like this, canal or Veſsel bear:
As this, will Commerce every way promote:
To this, let Sons of Commerce grant their vote.

If the conveyance of Mails acroſs the Channels by Royal Mail Steam-Packets prove ſo highly important; how much more ſo, the early diſtribution of the Foreign & Inland Mails, in all our commercial and manufacturing Districts, by Royal Mail Steam-carriages; the ſafe and expeditious conveyance of Paſsengers by Steam-coaches; & the rapid tranſport of Merchandise, of every deſcription, by Steam-caravans and Waggons.

Engd & Printd by Paletborpe Nott.

By the Author of Obſervations on a General Iron-Rail-way.

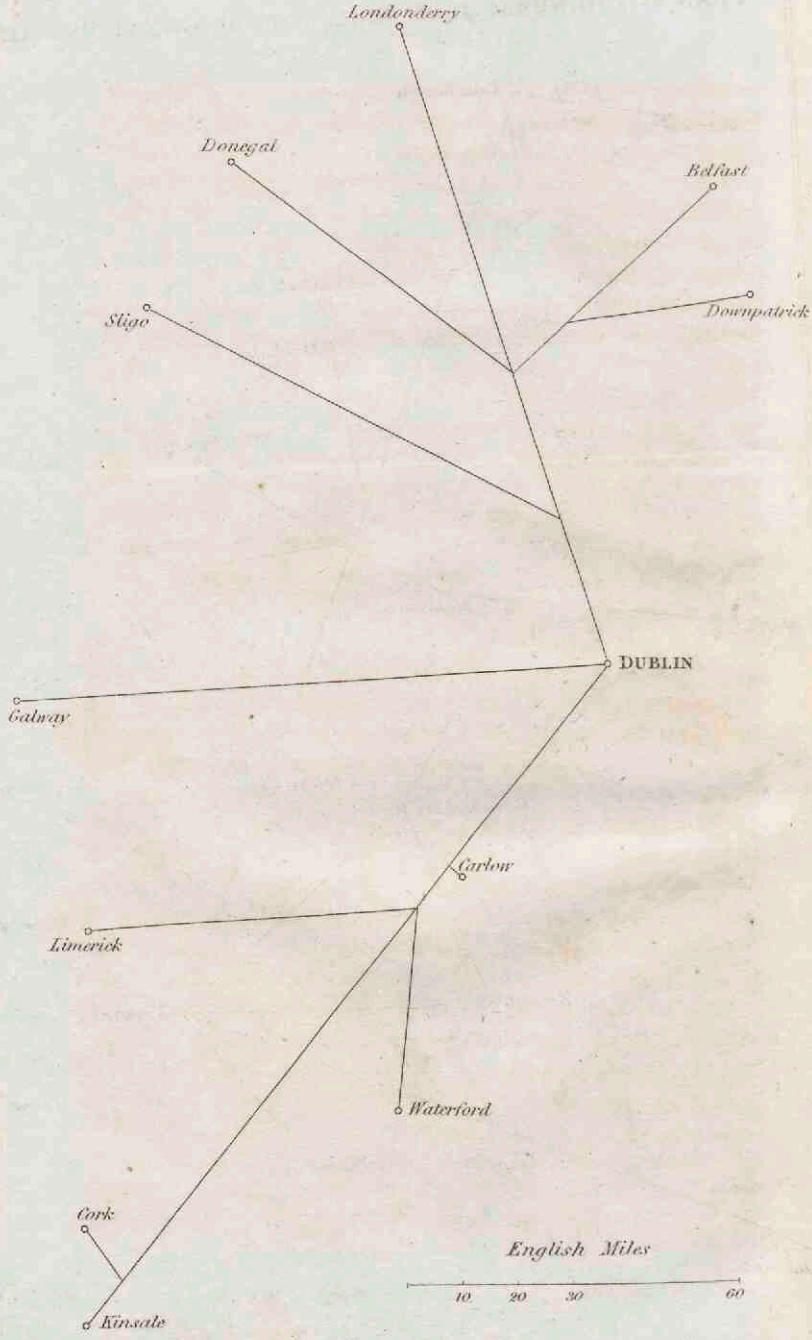
Published by Baldwin. Cradock & Joy. London.

the facility of communication from town to town throughout the country; yet, from the very general nature of this improvement, few persons seem sensible of its importance to individuals: this is proved by perseverance in a system, where want of skill in the direction of all our roads, their accumulating debt, and, generally, bad condition, are the only characteristic features.

There is no tax bears so heavily on the common necessaries and conveniences of life as the expence now attending the daily transport of every commodity; still nothing is done to obtain the necessary improvement; on the contrary, public indifference increases in proportion as the *accumulating* debt of our turn-pike roads augments. Session after session passes on, and the Honorable House of Commons is continually petitioned to grant powers, in order to burthen the country with fresh imposts in support of the old system.

In the nineteenth century *(the boasted age of national improvements)*, undertakings of the most expensive but useless kind are entered upon, in support of our old turn-pike roads, by a few individuals who obtain a power to tax the country without any public benefit being realised, or even to be anticipated, adequate to the expence incurred; and although private individuals have long since demonstrated the superiority, in every respect, of steam-power employed on rail-ways over horse-

PLAN OF A GENERAL IRON-RAIL-WAY FOR IRELAND.



Sidl. Hall, sculp.

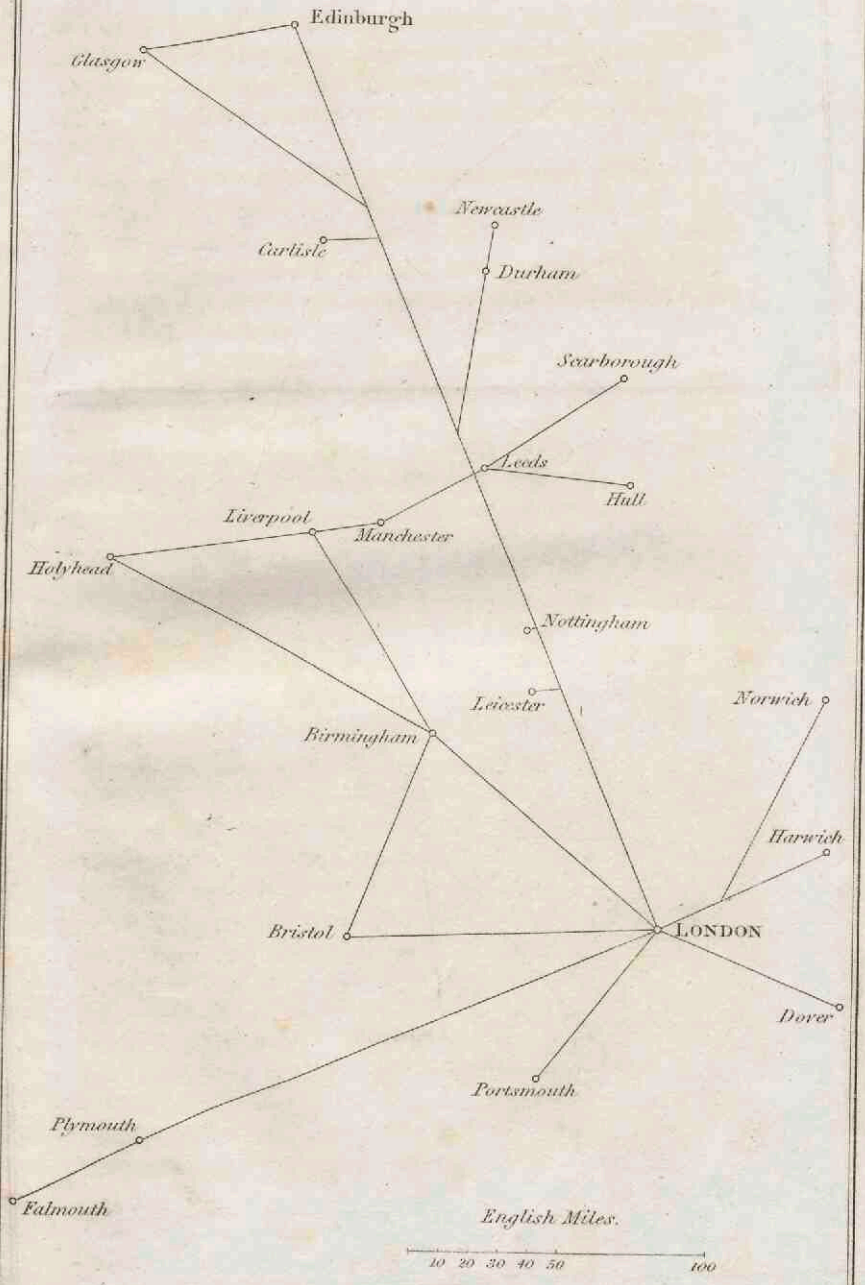
Pub. by Baldwin, Cradock & Joy, Paternoster Row, March 1822.

power on our ordinary roads, and set an example, founded on practical experience, worthy public imitation and universal support, yet this measure, of such vast importance to the nation, is, even in this free country, overlooked and neglected.

The knowledge of the universal benefit which might *daily* be derived by the application of mechanic power to public vehicles will, however, at no very distant period overcome the blind prejudice of those who may for a season oppose this scheme, but who must eventually, as their interest shall lead them, become its staunch supporters; indeed nothing short of individual interest can ever ensure national prosperity.

Under this idea, I am induced to lay before the public the present plan, the heads of which are contained in the Advertisement: the boldness of such a proposition may strike the attention and excite the astonishment of many persons; but unless there be greater obstacles besides levelling the whole line of road required, raising arch-ways necessary to carry the rail-way over many valleys, and bridges to pass the rivers, I cannot conceive why it has not been undertaken many years ago; although it should be confessed, that the long and tedious war in which we have been engaged, must have rendered the expence threefold more than at the present time. The sum of money required would certainly be very great; but it ought to be

PLAN OF A GENERAL IRON-RAIL-WAY FOR GREAT BRITAIN.



Pub. by Baldwin, Cradock & Joy, Paternoster Row, March 1822.

Sidr. Hall, sculp.

considered, when the rail-way is once completed, that the repairs would not be so heavy as on the common turnpike roads, owing to the very good and very substantial foundation which must be laid to begin with; and so soon as the proprietors of shares derive any advantage, the increasing prosperity of this plan would burst upon the public from the moment it shall commence to pay a dividend.

When we witness the numerous canals formed throughout the country, and the very great sums of money lavished on them*, I am persuaded, as

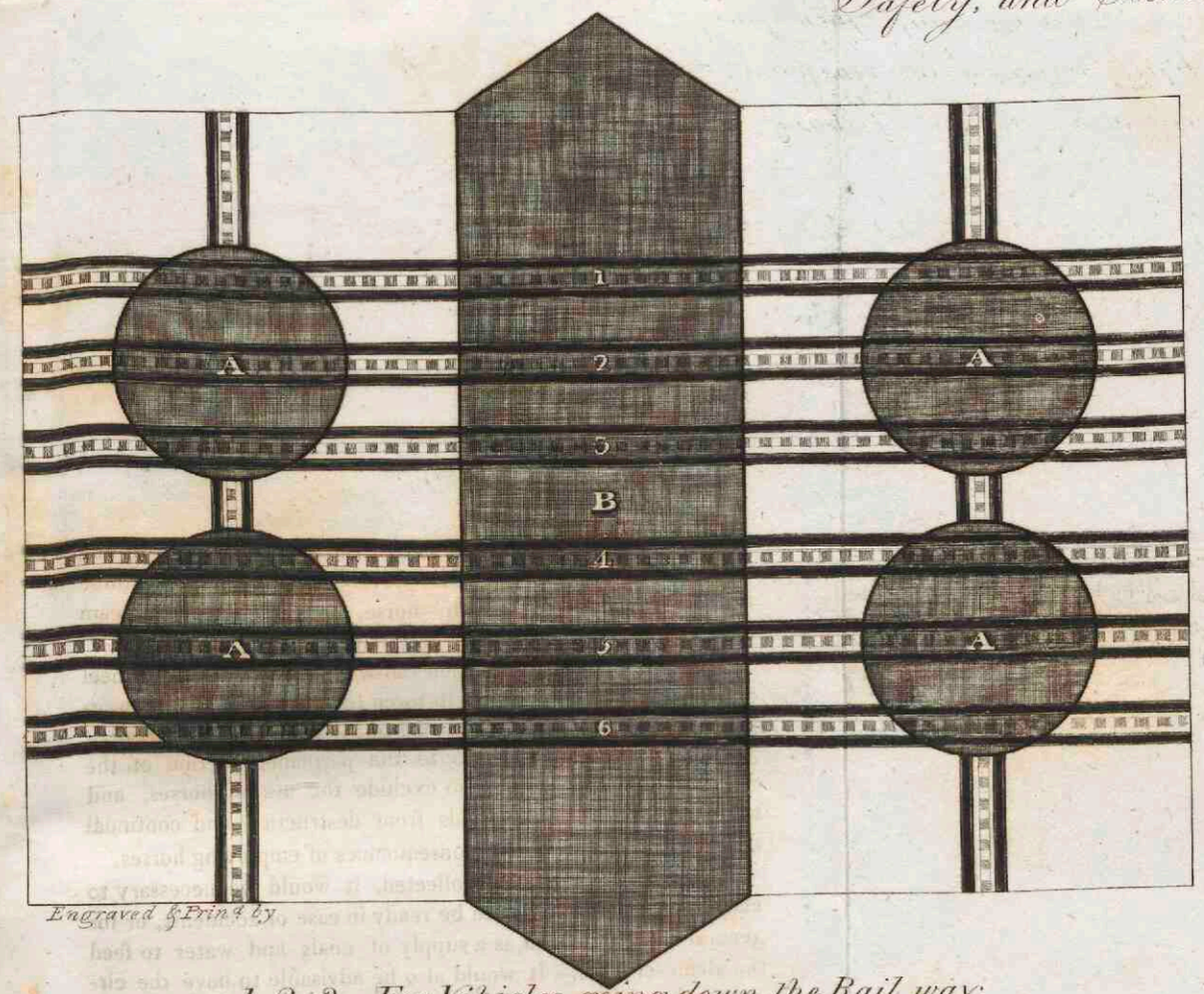
* "CALEDONIAN CANAL.—According to the twenty-first Parliamentary Report, the amount of the canal dues collected on the Caledonian Canal from 1st May 1823, to 1st May 1824, was 1596l. The sum expended on the Canal from first to last is about one million; but this having been disbursed in yearly payments of 50,000l., which began twenty-one years ago, the true value of the capital expended on this great work, including compound interest, is 1,650,000l. To pay simple interest on this sum, the Canal dues should yield 62,500l. a-year; but to pay interest, keep the works in repair, and discharge the expence of management, the Canal dues should produce 120,000l. a-year. Last year, therefore, the Canal has produced a sum equal to the *fiftieth part* of the interest of the capital expended on it; or equal to *one-seventieth* part of the amount which would have been required to remunerate a private company, had such a company executed the work! It appears, however, that the dues are to be raised in May next, and as the trade on the Canal may be expected to increase, we have no doubt that the dues will by and by be much augmented. But it is plain that if these were

DRAUGHT OF A GENERAL IRON-RAIL-WAY.

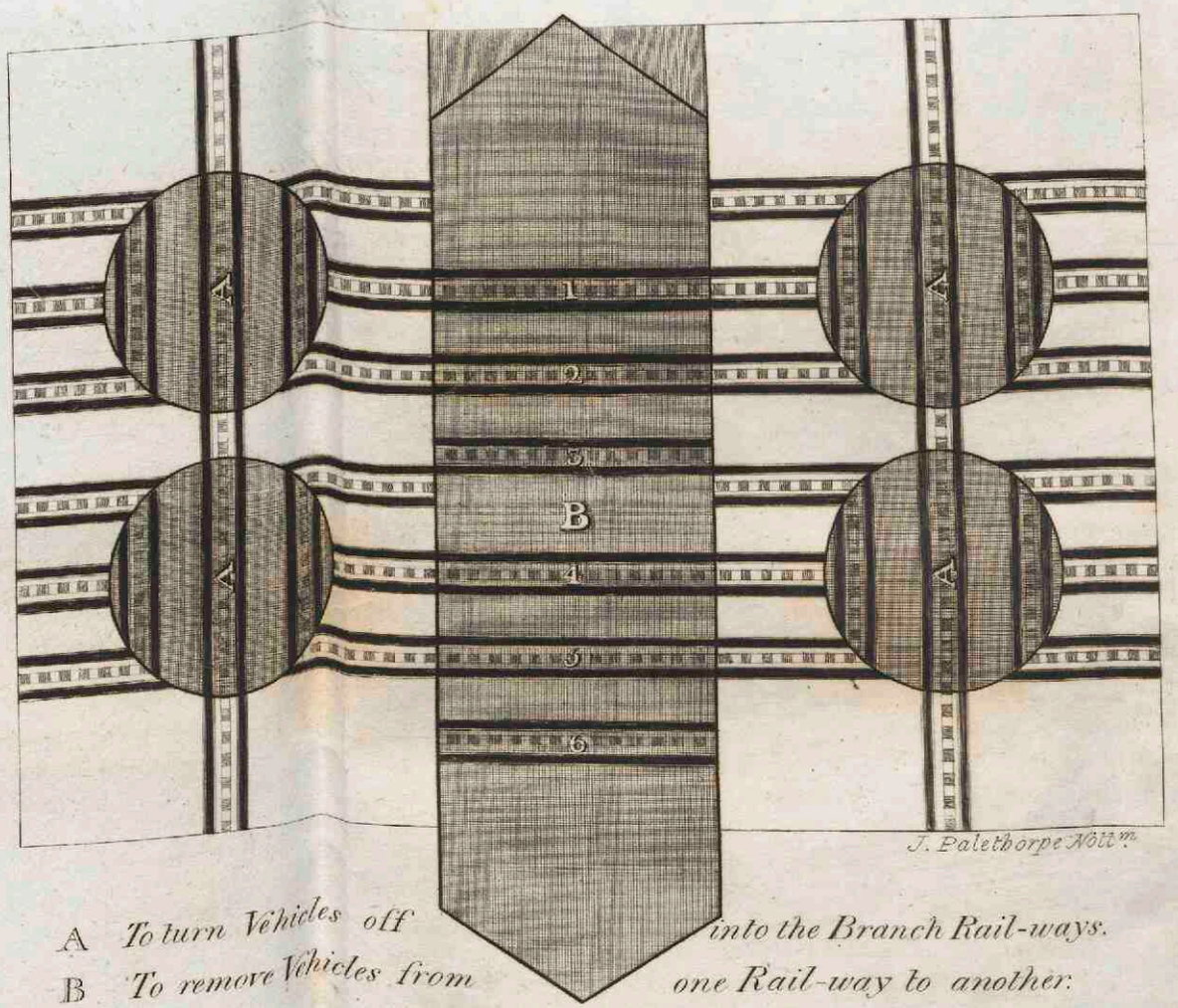
For the conveyance of Coaches, Caravans, and Waggons by Steam-power.

The progressive improvements of Rail-ways and Steam-Engines demonstrate the practicability of establishing a conveyance for Mail and Stage Coaches, Caravans, and Waggons, with a Speed, Safety, and Economy hitherto unknown.

No 1



No 2



Engraved & Print.d by *J. Palethorpe Nott.m*

1. 2. 3. For Vehicles going down the Rail way:

4. 5. 6. For Vehicles returning.

A *To turn Vehicles off into the Branch Rail-ways.*

B *To remove Vehicles from one Rail-way to another.*

* *The Rails on which the Vehicles are to run being* CONVEX *and the Rim of the Carriage-Wheel* CONCAVE *shew at one view the Ease, Security, and Velocity with which Vehicles may be impelled by Mechanic-power.*

The Cog-rail in the middle of each Rail-way 1.2.3.4.5.6. is solely for the operative power of the Cog-Wheel connected with the Steam-Engine.

By the Author of Observations on a General Iron-Rail-way.

Published by Baldwin, Cradock, & Joy. London.

the present plan shall become generally known and understood, that the interest of every class in society will ensure its success; for there can be as little doubt of its superiority over all the present methods of conveyance, as of its superior speed when compared to canals which are merely used for the conveyance of very heavy merchandize; whereas the rail-way is intended, by means of waggons, caravans, and coaches, to embrace every necessary accommodation of transport. It perhaps may be remarked, that the quantity of merchandise now forwarded by canals could not be conveyed by waggons; to this I should answer, that waggons, upon a large construction, would each carry as much or more on the rail-way, than the

even to rise to twenty times the present amount, they would still not pay one-half of the interest of the capital expended. The waste of public money here, therefore, has been quite as great as in those canals and other public works in Ireland, of which so much is said, though there has been less jobbing and abuse in the outlay of the money. We are not, however, disposed to be very severe on ministers in this case. The work was begun from mistaken ideas of public advantage; and if John Bull takes a fancy to give away a million and a half to facilitate the passage of some tons of kelp and slate through the Highlands, John is rich and can afford it; and it is not for us to complain of his generosity. He expended a much larger sum to rather worse purpose when he spent fifteen hundred millions in setting up the Holy Alliance, and in enabling his friends the Bourbons to celebrate High Mass in Paris.—*Scotsman.*

boats generally do on canals; if not, several waggons linked together and drawn by the same steam-engine would answer every purpose, and that goods might be sent from place to place in one quarter of the time taken up by boats: here it may not be amiss to state the very great inconveniences attending canals in time of floods, frost, or drought, which will not affect the rail-way. By laying an iron rail-way in a line with one of our most flourishing canals, the superiority of the former would be easily demonstrated; no further proof would be necessary to convince the public of the infinite advantage of this new mode: if speed and economy be essential in the conveyance of goods and persons, it will soon be found, that both these points may be obtained to a degree *hitherto unknown*, and must therefore produce a most important change in the improvement of property of every description, by affording the greatest facility of communication to the commercial and agricultural branches of society. Innumerable and continual are the complaints of the public on the state of roads, and on the impossibility of finding an effectual remedy; volumes have been written on the subject, but still no *real* improvement takes place in any part of the kingdom; never, perhaps, was there a fitter opportunity than the present for introducing a new system, which may silence the too well-founded remon-

strances on the delays of canal conveyance, and the endless expence of land carriage.

Canals are not only the most expensive and tedious undertakings to establish, or render serviceable, in the limited degree they are now used, but even in the most perfect state they may attain in this country; provided steam-engines, or steam vessels, could be rendered equally effective in our inland navigation, with those of North America,*

* "One of the great sources in America is, and will be, an astonishing command of inland navigation; the Mississippi, flowing from the north of the gulph of Mexico, through seventeen degrees of latitude; the Ohio and the Alleghany almost connecting it with the northern lakes; the Wabash, the Illinois, the Missouri, the Achansos, the Red River, flowing from the confines of new Mexico. These rivers, all navigable, and most of them frequented by steam-boats, constitute a facility of internal communication, not, we believe, to be paralleled in the whole world." EDINBURGH REVIEW.

"The union of the American Lakes with the Atlantic Ocean, which is to render New York one of the most flourishing and powerful states of the same extent of territory that has ever flourished, goes nobly on to completion. A few months more and the grand western canal will cause the inland seas and the ocean to mingle their great waters. Ten thousand men, or about that number, are employed in the enterprise; the offspring of the bold and masculine policy of the American Chief Magistrate." THE NEW TIMES, Oct. 21, 1822.

"The City of New York alone possesses seven steam-boats for commerce and passengers. One of these on the Mississippi passes two thousand miles in twenty-one days, and this too against the current, which is perpetually running down. The

canal property might then become of the first importance to the public as well as to the proprietors, but this can never be, as the working of the engine would, from the narrowness of the ordinary canals, and the want of depth, soon dilapidate, nay completely destroy their banks. In spite, however, of this superior local advantage enjoyed by any other country, we possess, in the ability and persevering energy of our countrymen, and the unbounded capital of the nation, powers that enable us to overcome the obstacles nature has thrown in our way, and, *by plans purely our own*, to present to the world a system of internal communication not to be attempted in any other country. It is difficult to conceive how it came to pass, that canals should have been adopted in preference to rail-ways, which we find were in use at a very early period (1680). Without fearing any contradiction, I do not hesitate to assert, that had the money been expended on rail-ways which has been so prodigally and unskilfully thrown away on canals,* the public would long since have been amply remunerated, instead of seeing numerous individuals

above boat is 126 feet in length, and carries 460 tons, at a very shallow draft of water, and conveys from New Orleans whole ships' cargoes into the interior of the country as well as passengers." PARTINGTON.

* It appears that thirty millions have already been expended on canals in this country!

reduced to the most hopeless circumstances by sinking the whole of their property in canal shares; and were canal proprietors sensible how much their respective shares would be improved in value, by converting all the canals into rail-ways, there would not, perhaps, in the space of ten or twenty years remain a single canal in the country, for the proprietors would not only continue to draw the same amount of revenue they now enjoy, but all vehicles, of every description, would considerably augment their receipts, as the general traffic of the country would then pass along these rail-ways. By reference to Extract No. II., (on Canals), it will be seen that no expence, exertions, or perseverance, have been wanting, and that no obstacles, however great, have been suffered to prevent the completion of numerous canals both in England and Scotland. The almost insurmountable difficulties attending the construction of our canals, *(with the pleasing serpentine direction of most of them)*, such as locks, tunnels, reservoirs, towing-paths, &c., have seemed to excite the skilful spirit of our engineers, in preference to the less expensive, more simple, and profitable method which rail-ways present, and to which they have frequently had recourse where canals could not be effected. With these examples of unremitting perseverance, in plans that never could promise a tithe of recompense to their promoters in com-

parison of the present scheme, what may we not hope for in support and furtherance of this new project, which includes every possible accommodation, in every respect, whilst canals are solely confined to the removal of dead matter? Had rail-ways been laid down instead of our canals, the expence of cutting canals would have been avoided, and no one can doubt that steam-engines would give every necessary strength required, for the ascending or descending of any weight equal to that which passes through the locks, and in one tenth part of the time; nevertheless, I should still recommend a perfectly level line to be observed throughout the country, as, ultimately, more favourable in a national point of view, by giving such an easy and expeditious removal to every kind of heavy matter, all over the kingdom, as no other method can afford. Rail-ways are very commonly used for levelling roads and removing the ground on the formation of canals; this plainly demonstrates the great facility and economy which would attend the construction of a general iron rail-way, and the numerous advantages to arise from it daily as a public conveyance, instead of the partial application of rail-ways as a mere auxiliary to roads and canals. Steam packets were originally intended as auxiliaries to the sailing packets; but the former, from their manifest superiority, have *already* become the sole conveyance for mails

across the channels. The inference therefore is clear, that so soon as public prejudice shall be overcome, our inland conveyance may be conducted on the same improved principle, instead of the ridiculous management of all our roads now so highly praised and extolled by the blind partisans of the times.

Whatever may be advanced in behalf of canals or roads, as at present established, must tend, in a manifold degree, to show the superior importance of this scheme; it is, however, our duty to acknowledge that we owe much to the proprietors of stage-waggons, coaches, and canals, for having respectively rendered the conveyance as effective as possible; but it is to be regretted, that the liberal subscriptions in favor of canals have not been better rewarded; it is this national spirit of enterprise alone which can ensure success to the attempt now made, to consolidate the various branches of conveyance into one, and *with the expence of one establishment to attract the revenue of all.* We have only to witness the exertions made these latter years, to bring steam-engines into general use, and every one must be convinced, that had the powers of this machine been so well known some time back, not a fourth part of the canals would have been taken in hand. Why may not the same facility and dispatch be given on land, as we now find in daily practice by steam-packets from Dover to the

Continent, and from most ports of the united kingdom? Let our engineers answer this simple question. By means of rail-ways and steam-engines, the same, if not superior advantage may be enjoyed throughout England, Ireland, and Scotland, as a general and uniform conveyance to all commercial towns and places of any importance.

In order to establish a general iron rail-way, it will be necessary to lay down two or three rail-ways for the ascending, and an equal number for the descending vehicles. In the immediate neighbourhood of London the traffic might demand six rail-ways; and as the trade between Liverpool and Manchester is already very extensive, with every prospect of a continual increase, it may be as well to lay down rail-ways between these two places the same as recommended for the vicinity of London; but, with these two exceptions, all other towns may be confined to one or two rail-ways for carriages going in opposite directions. The traffic along these rail-ways will, no doubt, be much more considerable than we now find on the ordinary turnpike-roads, or canals; the light expence of transferring merchandize from one market to another for sale, and of keeping up an immediate correspondence with remote parts of the kingdom, will give to all an equal participation in commerce and industry. Waggons laden with merchandize can never be expected to proceed with the same velocity as

coaches, but both should be built exactly on the same plan as to width, which would prove extremely economical, by affording the same accommodation to all; for carriages going with greater speed, may, on coming up to any other, pass off into the next track and fall again into the first track, by which method any carriage of superior speed may continue its course without any obstruction. It is desirable to shew the probable expence of this scheme; but this depends almost entirely upon the state of the country through which it may be found necessary to pass, for, as to a level, some parts may be found nearly ready to our hands, whilst others will require much time and considerable expence, to complete the design of a perfectly level line of road. By the Second Extract, (on Iron Rail-ways) it will be seen that the sums quoted, as the expence of rail-ways, vary too much to be depended upon; but by following the middle course, we may, perhaps, be nearer the mark. I shall, therefore, take the sum of one thousand pounds per mile, for the single rail-way; the present plan, as above mentioned, requiring, at the most, six rail-ways, will consequently cost six thousand pounds per mile: and if we take the draught of the plan, for Great Britain, as our guide, and allow for a few branch rail-ways, which may still be added thereto, the number of miles will be about two thousand, which, at the rate already

stated, will amount to twelve millions sterling; supposing that double, or even treble, this sum be demanded, it would be found, that the present revenue drawn from public roads; the great expence of their repairs; and the enormous sums of money annually expended in the purchase and keep of horses; demonstrate the abundance of wealth this new scheme would yield to its subscribers. It may, in all probability, be urged, that the capital required for the full execution of this plan, can never be raised by subscription; however this may prove, I should wish so to convey my ideas to the public on the subject, as to leave no point untouched relative thereto; for I feel assured, that the total expence of the purchase of horses might be completely saved, *and that the annual expence of their keep alone* would more than provide for the steam-engines necessary for this new project, as well as defray the whole annual expence of repairs on a general iron rail-way: it should also be remarked, that as journeys would be performed in one half the time, proprietors of steam-coaches, caravans, and waggons, would considerably augment their receipts for conveyance of goods and persons, and at the same time diminish the charge to individuals. Let us only reflect on the sums of money now sunk every year, by our present system of turnpike-roads, and a little time more must convince every one, however great the advance may be to complete

this undertaking, in spite of every obstacle, that the revenue which might be drawn from this new establishment would highly compensate its promoters; for the same advantage to be reaped by proprietors of steam-coaches, caravans, and waggons, from the increased number of journeys which might be performed, would, in the same degree, increase the toll receipts of the rail-way.

The conveyance by waggons, caravans, and coaches, must ever prove expensive under the present system, even in the most favourable times, arising from the great prices paid by the proprietors for horses, the precarious existence of these animals employed in coaches and post-chaises, and the intolerable expence of their food.* These several

* "Mr. Waterhouse, whose vehicular head-quarters are at the Swan with Two Necks, keeps 400 horses; those worked within fifty miles of London (which cost on the average 30*l.* each) last about four years; those at a greater distance (costing 15*l.* each) six years. He says, that eight horses on the more distant roads would perform as many miles as ten nearer London; that three horses would draw the mail on Mr. Telford's roads, in North Wales, with as much ease as four on the road from London to Dunchurch. Mr. Horne, of Charing Cross, also keeps 400 horses: he buys 150 every year; those worked near London last but three years; those at a greater distance double the time, in consequence of their work being lighter, their food better, and their lodging more airy. Mr. Eames, (of the White Horse, Fetter Lane) keeps about 300 horses: he finds them last three years in post-coaches, and as long again at a distance from London; he says, that his drivers represent 'the crossing back-

points, duly weighed and impartially considered, will be found the real cause of those heavy charges made on the public, and convince every reflective mind of the impossibility of any reduction. The very great cruelty inflicted on coach and post-chaise horses has long called forth the commiseration of the humane :* and in a country where every nerve has been exerted to abolish the slave trade, it is hoped, that the same national feeling may be excited in behalf of these poor dumb animals; the plan here proposed will not only diminish these acts

wards and forwards through the gravel, heaped sometimes in the middle of the roads near London, as tearing the horses' hearts out.'" *Quarterly Review.*

* "It appears that the extra demand for coach-horses arises out of the new regulations of the post-office, which cause the death of two horses on an average in three journeys of 200 miles. The Highflyer of this city lately lost two horses, and it has cost the Manchester and Liverpool coaches 17 horses since they commenced to cope with the mail, and run ten miles an hour in place of seven and eight. Horses fit for the public coaches therefore met with full prices, and much business was done in the fair, by coach proprietors from all parts of the kingdom, and who calculate upon losing a horse in every run of 200 miles. Several horses, in endeavouring to keep time, according to the new post-office regulations, have had their legs snapped in two on the road, while others have dropped dead from the effect of a ruptured blood-vessel, or a heart broken in efforts to obey the whip. We cannot conceive this system can last long. We sincerely hope not." *Yorkshire Gazette; see Morning Chronicle for 27th December*, 1821.

of cruelty, but also present a more expeditious and considerably cheaper conveyance, even where horses shall be made use of; the strength required would be comparatively trifling to the present system, as the coaches running on the rail-way might convey three times the weight of luggage, and passengers in like proportion, with half the horse power.

But in consequence of the great improvement in steam-engines, the necessity of horses on the rail-way may be superseded, for the public benefit would soon be so evident to every common observer, as to admit of no comparison between horse and mechanic-power; besides, the incitement given to our artisans, by the success of their ingenuity, would still prompt further progress in this useful art: the prejudice of many persons will, however, oppose the system; therefore time must be allowed with the gradual use of these machines to convince the public of their superiority, in the same manner as of steam-packets.* When we shall have attained

* "The new post-office steam-packets to be employed between Holyhead and Dublin, have been inspected by the Duke of Gloucester and other distinguished personages, previously to their leaving the river for their destination, which will be in the course of a few days. The advantages which these vessels will afford to the communication between the two countries are incalculable. The diagonal mode of construction, upon which the navy board has been largely consulted, is so admirable, and the

this point, another important advantage will present itself, in the very great extent of land required to produce food for horses, which might then be cultivated for the growth of corn and vegetables: and if this land could be converted to the use of man, the number of human beings which might be supplied, by this alteration in our national economy, with the means of existence, would be very considerable indeed: the excessive number of horses employed in England demands the serious attention of the public; the increase of coaches may be supposed to show the prosperity of the country, but, when viewed in the light it presents itself to me, there can be no hesitation to pronounce it an evil.

Mechanic power, when once put to the test, by comparison on land and water, will, no doubt, prove more favourable by the former, in proportion as that

machinery with which they have been fitted, from the celebrated manufactory at Soho, is so infinitely superior to any thing yet undertaken, that the passage is reduced to an actual certainty, and the mails from London will be regularly delivered in Dublin early on the second day, an idea which would have been scouted as chimerical but a few months back. In an experiment round the Nore, a few days since, the rate of speed was ascertained at thirteen miles per hour; one of the miles was performed in four minutes, twenty-seven seconds, which considerably exceeds that rate. The accommodations are equal to the qualities of the vessels in other respects; they are peculiarly elegant."—*Morning Chronicle, 26th April*, 1821.

element is more stable, and not under the influence of wind, tides, or currents; besides, the preference given, by the generality of mankind, to land carriage, the misfortunes which might happen to steam-vessels cannot affect steam-coaches or waggons, as the steam-engine on land is a separate vehicle, and only connected with the coach or waggon by a bar or chain. Now with the numerous advantages so evidently in favour of rail-ways, it will require some explanation how this method, embracing every possible convenience of despatch, with the greatest economy, should have been overlooked and neglected; whilst other plans, far more expensive, and less useful, should alone enjoy public patronage and support. Time, however, the best friend of every well digested plan, and the greatest enemy to every foolish one, will, most unquestionably, develope the reason, why this branch of national economy has not only been suffered to remain without any improvement, although possessing *the most abundant source of national and individual property of the highest consideration*, but that every attempt is made to support a system of conveyance, glaringly injurious to the whole nation, without being profitable to any class, unless to lawyers, engineers, and surveyors, and the influence it may give to commissioners. We may not, in our time, be able to reap the advantage that must ultimately accrue to the

public from the free and unlimited use of steam-engines; the benefit is incalculable that may be derived from this machine: future generations, "c'est la postérité seule qui met le véritable prix aux ouvrages," by applying it to all the purposes of which it is capable, may certainly enjoy these advantages in a very superior degree to what we can expect to attain; we ought, however, by our grateful remembrance of the person's name to whom we are indebted for this most invaluable invention,*

* "The name of Mr. James Watt, the great improver of the steam-engine, fortunately needs no commemoration of ours; for he that bore it, survived to see it crowned with undisputed and unenvied honours, and many generations will probably pass away before it shall have 'gathered all its fame.' We have said that Mr. James Watt was the great *improver* of the steam-engine; but, in truth, as to all that is admirable in its structure, or vast in its utility, he should rather be described as its *inventor*. It was by his inventions that its action was so regulated as to make it capable of being applied to the finest and most delicate manufactures, and its power so increased as to set weight and solidity at defiance. By his admirable contrivances, it has become a thing stupendous alike for its force and its flexibility, for the prodigious power which it can exert, and the ease, and precision, and ductility, with which they can be varied, distributed, and applied. The trunk of an elephant that can pick up a pin, or rend an oak, is nothing to it. It can engrave a seal, and crush masses of obdurate metal like wax before it; draw out, without breaking, a thread as fine as gossamer, and lift a ship of war like a bauble in the air. It can embroider muslin, and forge anchors; cut steel into ribands, and impel loaded vessels against the fury of the winds and waves. It would be difficult to estimate the value

to transmit to posterity our decided approbation, by some national token of respect, in the full assurance that our children may, after considerable improvements, hand it down to theirs, as a never failing testimony of the benefit that the public may expect from it for ages to come: an invention of

of the benefits which these inventions have conferred upon the country. There is no branch of industry that has not been indebted to them; and in all the most material, they have not only widened most magnificently the field of its exertions, but multiplied a thousand-fold the amount of its productions. It is our improved steam-engine that has fought the battles of Europe, and exalted and sustained through the late tremendous contest the political greatness of our land. It is the same great power which now enables us to pay the interest of our debt; and to maintain the arduous struggle in which we are still engaged, with the skill and capital of countries less oppressed with taxation. But these are poor and narrow views of its importance. It has increased indefinitely the mass of human comforts and enjoyments, and rendered cheap and accessible, all over the world, the materials of wealth and prosperity. It has armed the feeble hand of man, in short, with a power to which no limits can be assigned; completed the dominion of mind over the most refractory qualities of matter, and *laid a sure foundation for those future miracles of mechanic power which are to reward the labours of after-generations.* It is to the genius of one man too, that all this is mainly owing: and certainly no man ever before bestowed such a gift on his kind. The blessing is not only universal but unbounded; and the fabled inventors of the plough and the loom, who were deified by the erring gratitude of their rude contemporaries, conferred less important benefits on mankind than the inventor of our present steam-engine." *Gent. Mag. Nov.* 1819, p. 463.

more national importance than any other we can boast of.

The progressive improvements of rail-ways and steam-engines, certainly indicate a fair promise of the practicability of my plan; let those who may feel disposed to ridicule the idea of forming a general and uniform internal communication by this method, reflect on the rapid advances stage-coaches, caravans, and waggons have made within the last fifty years; for one half the time formerly required is now sufficient to perform the same journey.* May we not also entertain the hope, with all our practical knowledge gained in mechanics these latter years, of establishing an intercourse throughout the country, within a considerably limited space of time to what has hitherto been

* The following copy of a hand-bill, published in 1706, forms an interesting contrast to modern celerity in travelling.

"YORK FOUR DAYS' STAGE COACH.

"All that are desirous to pass from London to York, or from York to London, or any other place on that road, let them repair to the Black Swann, in Holbourne, in London, and to the Black Swann, in Coney-street, in York; at both places they may be received in a stage-coach, every Monday, Wednesday, and Friday, which performs *the whole journey in four days* (if God permits), and sets forth at five in the morning, and returns from York to Stamford in two days, and from Stamford, by Huntingdon, to London, in two days more, and the like stages on their return, allowing each passenger fourteen pounds weight, and all above, three-pence a pound."

effected? Since my second edition, I learn that individuals have obtained patents for making malleable iron rail-way;* this would enable us to increase the lading along the rail-way, without being confined to a stated weight for each waggon, as is the case on *cast* iron rail-ways.

The plan might be commenced between the towns of Manchester and Liverpool, where a trial could soon be made, as the distance is not very great, and the commercial part of England would thereby be better able to appreciate its many excellent properties and prove its efficacy: and provided that success attend my plan, which nothing but impracticability can prevent, all the great trading towns of Lancashire and Yorkshire would eagerly embrace the opportunity to ensure so commodious and easy a conveyance, and cause branch rail-ways to be laid in every possible direction. The convenience and economy in the carriage of the raw material to the numerous manufactories established in these counties,—the expeditious and cheap delivery of piece goods bought by the merchants every week at the various markets,—and the dispatch in forwarding bales and packages to the out-ports, cannot fail to strike the merchant and manufacturer as points of the first importance. Nothing, for example, would be so likely to raise

* See London Magazine for January and May, 1821.

the ports of Hull, Liverpool, and Bristol, to an unprecedented pitch of prosperity, as the establishment of rail-ways to these three ports, thereby rendering the communication from the East to the West Seas, and all intermediate places, rapid, certain, cheap, and effectual: any one at all conversant with commerce must feel the vast importance of such an undertaking, in forwarding the produce of America, Brazils, the East and West Indies, &c. from Liverpool and Bristol (viâ Hull) to the opposite shores of Germany and Holland, and vice versâ the produce of the Baltic, viâ Hull, to Liverpool and Bristol.

Of all the canals in England, the Aire and Calder navigation, between Leeds and Hull, is perhaps the oldest and most profitable to the proprietors; and if this wealthy company were to lay down an iron rail-way from Leeds to Hull, on the line of the Aire and Calder navigation, it would not only prevent any injurious competition, but, in a short time, yield them, most assuredly, an equal benefit to that which they now draw from their present establishment.

By extract No. 11, it appears the canal between Leeds and Liverpool runs through an extent of country of 117 miles, (Rees's Cyclopædia says 130) although the distance between these two places, by the turnpike-road, is, I believe, about 80 miles; consequently, the canal is nearly half as much more,

and, perhaps, if a direct line of rail-way were laid down, the canal would be found double the distance: this remark may hold good with respect to most of our canals. By thus shortening the distance between all places of considerable traffic, the annual receipts of tolls would be greatly increased, and the commerce of the country improved; it is, therefore, essentially necessary to press the public attention to this particular point, because any extra expence which may be incurred, in order to surmount the difficulties attending the execution of this plan, would be supported by the certainty of the promoters of it reaping a ten-fold revenue to what the most profitable canal now yields, or ever could yield, as the rail-way presents the most perfect conveyance hitherto known, both for goods and persons.

A perfectly direct line of conveyance might with so much ease be effected between the towns of Manchester and Leeds, to the port of Hull, that, when we take into consideration the advantage rail-ways promise to all parties, it is rather unaccountable how the mercantile part of society, in Lancashire and Yorkshire, can submit to the present tediously protracted conveyance. By an advertisement in the Leeds Mercury, it appears that, to forward goods from this town to Hull, the merchants are obliged to undergo the inconvenience, delay, risk of damage, and expence of trans-

ferring or re-shipping their merchandize at Selby, from the Leeds fly-boats to the Hull steam-packets; the distance between Leeds and Hull is only sixty miles, and would, by the plan here proposed, be performed in less than one half the time now required, without encountering any of the objections noticed above, together with various other impediments to which canals are so particularly subject.

The folly of sending goods by coasting-traders will be sufficiently obvious on the realization of this project, which would not subject goods to damage by sea-water, or risk of capture by an enemy in time of war, besides the tediousness of making a voyage of nearly twice the distance that a direct line of road would be from London to all our northern ports.

Let those individuals who are annually travelling through the country be consulted as to their observations on our turnpike-roads, and it must be allowed, that journeys are rendered unnecessarily wearisome and expensive to the traveller and merchant, by the serpentine direction of our roads from the metropolis to the great manufacturing towns; whereas, had each town a branch rail-way from the direct line, the manufacturing districts would then receive intelligence, and might forward their merchandize to and from London in one half the time, and consequently at much less expence. This exposition will be sufficiently apparent to

every reader, on a perusal of the charts of roads and canals throughout the country.

Notwithstanding the great speed with which the steam-packets make the passage from London to Scotland, it would be found, if we reckon the time required for the extremely circuitous course they are obliged to make by sea, that the journey by land would be performed in one half the time; and with the exception of the few summer months which may render a sea voyage agreeable to travellers, that no one can deny the superiority of the present scheme, *in every other point of view.**

* "Steam navigation.—What a revolution in various establishments will not the steam-boats produce? It is not easy to anticipate their effects in the various lines in which their influence will be felt, nor to extend our view to the many objects to which the power of steam-machinery may be applied. In navigation coastwise, and also for traversing channels and narrow seas, we already perceive the inevitable ruin of the ordinary packets. The speed, the certainty as to time, the ease and accommodation of a steam-boat, must secure to it a preference over the packet,—fatal, indeed, to that species of property, but most favorable to public convenience. It will not merely facilitate intercourse, but it may be said to bring distant places nearer to one another. Excursions to the north by sea will now become parties of pleasure, instead of being undertaken with pain, from a motive of irksome economy. The gay will now resort to the watering-places in the north, not merely from novelty, but from the superior advantages which they possess over those on the coast of Sussex, in picturesque scenery, and in the abundance of the luxuries of game and fish. Scarborough,

The public attention is particularly solicited to examine the fish trade, a branch of commerce which admits of very considerable improvement, and would contribute to support an immense number of individuals. The great demand of any commodity creates of course a great supply. The sale of fresh fish throughout the interior of the

Porto-Bello, Aberdeen, Peterhead, will become fashionable bathing-places; and already we read of hundreds emigrating weekly from London for those places, by the steam-vessels already established. Another advantage will be derived to the metropolis, from the independence which the steam-boats have as to winds, that the supply of fish from the north will be regular and uniform.

"We can no longer be for weeks together without an importation. Internal travelling must suffer by this diversion to the sea. Posting and stage-coaches will, of course, feel the effects of this new course; and, with their decline, the inns on the great northern roads, which have always been considered as the first in Europe, must suffer a falling off in their custom. Horses for posting and stage-coaches must be lessened, and the demand from the farmer for provender be in proportion. The post-horse duty must also fall off, and, in short, its consequences will extend to all the trades connected with the fitting out of coaches, harness, &c. as well as to sail-making, and other materials for shipping, on the old plan of navigation.

"Nor can it be overlooked that this new species of vessel is little calculated to breed able sea-men, or to enter into comparison in that respect with the domestic nursery of the coasting trade.

"It may be asked, are these obvious and immediate consequences to particular classes of the community, to be regarded

kingdom would afford employment to thousands on the coasts of England, Scotland, and Ireland, to procure it,* and engage as many to dispose of it in the numerous towns and villages, where the inhabitants, under the present system of conveyance, are totally deprived of this necessary article of food; for the charges by a coach amount to a prohibition, and the waggons go too slow to arrive at any distant place with the fish in a good state: the fish-carts are ill calculated for the purpose, owing to the very limited quantity they carry, and the great expence of the horses. Supposing the rail-way should be adopted, this branch of commerce would become very promising; the despatch with which supplies might be forwarded into the interior, would enable those in the trade to receive it as fresh

as arguments against the introduction of the steam-vessels? Certainly not. *This, like every other improvement in machinery, which tends to lessen labour, though injurious in the first instance to various descriptions of people, tends ultimately to national opulence. Capital, skill, and labour are diverted, indeed; but not destroyed. Human ingenuity adapts itself to the new order of things; and sources of industry, unthought of, are opened, by the application of capital thus let loose.*" *Observer*, 24*th Sept.* 1821.

* "Liberal bounties might prove highly conducive to the promotion of the various fisheries in Scotland, and upon all our other coasts. They are able to supply an almost inexhaustible stock of wholesome and pleasant provision; *they furnish a nursery for seamen, and on that account merit every encouragement.*" *Kett's Elements*, 8th Ed. vol. ii. p. 363.

every day as the fish sent to London. A steam fish-waggon would in one day convey fish enough to supply a town and the neighbouring villages, one or two hundred miles from any of the seaports.

The carriage of oysters renders them so excessively dear in towns remote from the metropolis, that in order to have one small barrel forwarded from London to any friends residing two hundred miles in the country, an additional charge of fifty per cent., or more, on the cost, is made for carriage; this evil would be obviated by the plan now submitted to the public, as proprietors of steam-waggons and caravans would be able to deliver merchandise two or three hundred miles (indeed any distance, wherever the rail-way extends) from London, within the time now required for coaches; and the great quantity taken with such ease and rapidity, would cause the carriage to be only one quarter of the present charge. As almost every one would gladly partake of oysters during the season, this general wish might be gratified by the great reduction in the price of carriage, and at the same time prove highly advantageous to the owners of oyster beds.

All perishable articles, such as fish, fruit, and provisions of ordinary and general consumption, require a speedy conveyance, otherwise they soon spoil from the heat occasioned by any quantity being packed together; therefore the same vehicles

which take the fish, as already mentioned, will afford every necessary means required, and cause a general and uniform supply of these articles of food, at present unknown to the public. The London markets might be daily supplied in the season with fruit of the country, from the most distant parts; and all towns and villages might, in like manner, partake of foreign fruit immediately on importation, and thus improve these several branches of commerce.

As this alteration in the conveyance of vehicles of every description by land, will tend to improve all commercial connexions, by the approximation of the various branches of manufactures with their source, so, in like manner, would the domestic convenience of individuals, residing in the vicinity of London, be much improved: the immense population spread around this great city, going to and fro every day by the numerous stages, might be conveyed with greater personal accommodation and safety, in one half the time and at one half the expence now incurred; the circumjacent country is particularly well adapted for a rail-way in every respect, therefore, I should have thought it as likely for this plan to have commenced at the Capital as soon as at Manchester and Liverpool.

Had a rail-way been laid down instead of the Regent's Canal, the merchants and the public in general, would soon have acknowledged its supe-

riority, and the proprietors would not have had to repent of their subscriptions.

London most particularly requires a new system of communication with the manufacturing districts; the commerce of London must decline in consequence of the tedious delay and heavy expence which attend the exportation or importation of merchandise there, compared with the north; and in order to enable the metropolis to hold its wonted rank as the chief commercial city, it must carefully watch and patronise in the south every improvement of the northern ports, which are progressively gaining strength and rendering themselves independent of the capital; in every view of the subject the city of London would reap the greatest benefit from this project; the East and West India merchants, indeed all merchants of London, might negociate in the populous towns and villages of the north on the same terms as those resident there. Set aside the business of those occupied in feeding the extravagance and luxuries peculiar to London, and it will soon be found that the sole strength of the nation, as to sterling trade, centres in the north; it is not the luxuries of the feeble sons of the capital, nor the gaudy trappings of the state, which give strength or support to the sons of commerce; no, not these, but the diurnal consumption of the hardy sons of agriculture and the labouring multitude, these are the very heart and

sinews of the nation, the trunk of the constitution, and those of the capital its luxuriant branches. The property of London is gradually verging to declension, being so remote from the seat of trade, and if means be not immediately determined upon to reduce the expence of public communication, and to improve the transport of merchandise by greater dispatch; foreign commerce, so far as London is interested, will transfer her rich influence from the Thames to the Mersey and the Humber.

On ascertaining the exact distance between London and the manufacturing towns of the north, the great loss of labour and time in our *daily* communication, by the present foolish method of general intercourse on our ordinary turnpike roads, must astonish every one. Our coaches and other vehicles run an unnecessary course of forty to fifty miles from London to Manchester, Liverpool, and Leeds; and from London to Glasgow and Edinburgh, say from sixty to eighty miles; let this extra distance be calculated in all its relative bearings on the general interest of commerce and agriculture; the retarded communication by mail coaches, the additional expence daily attending this protracted conveyance, and the annual return will be such, *if impartially and diligently sought into*, as to command the unanimous and immediate attention of all those interested. These remarks

are still more applicable to canals, where distance between the capital and all places of commercial importance, is egregiously lengthened by the most extraordinarily serpentine direction of almost all our canals.

The inhabitants of London might be regularly supplied with coal, (from the inland collieries as well as from Newcastle and Shields) on reasonable terms, were their markets thrown open to the free competition of this trade; the many disadvantages attending the coal trade in London, as now carried on, are sufficiently apparent in the expence of vessels, seaman's wages, protracted voyages, insurance, tonnage dues, light dues, lighterage, &c. &c., and it should also be remembered that vessels in the trade generally, I believe, return from London in ballast; whereas coal waggons coming to London on rail-ways might be certain of lading on return to all the populous districts through which they might pass. One gang of coal waggons carrying the full freight of a vessel, might be forwarded from Newcastle to London in three days by the simple expence of one steam-engine; but the manifold benefits which this measure would throw open to the general commerce of London, and throughout the interior of the country, can only be justly appreciated when they become universally known and understood.

It remains only to know the exact amount of

capital required for a rail-way, in order to shew the feasibility of this scheme, and on this head, if we reckon each single rail-way at two thousand pounds per mile, and allow two rail-ways for vehicles going down, and two rail-ways for those returning, the whole sum per mile will be eight thousand pounds; in order, however, to guard against contingent expences, let the sum be stated at twelve thousand pounds per mile, and this, I think, the most experienced engineers and surveyors will allow to be the very utmost extent; the distance between London and Newcastle, in a direct line, will be about two hundred miles, which, at twelve thousand pounds per mile cost of the rail-way, will amount to two million four hundred thousand pounds capital stock. Taking, for a calculation, the number of chaldrons of coal annually consumed in London to amount to two million, and reckoning the toll to be levied upon each chaldron at five shillings per the rail-way, for the whole distance from Newcastle to London, this branch of commerce *alone* would yield a revenue of five hundred thousand pounds to the proprietors of the rail-way, without taking into account the numerous daily vehicles of every description, for the conveyance of persons and of merchandise of every kind, all which might contribute a three fold toll to what is now generally paid on turnpike

roads, and still convey goods and persons at one half the present charge, and in one half the time.

These hints are thus briefly laid before the public, (as it is not necessary to enter into detail,) to shew, that were the conveyance of merchandise and persons drawn to one improved system, instead of being divided in different establishments, such as canals, turnpike roads, and coasting vessels, our capitalists would soon partake of the great advantages to arise from this national improvement, and that every individual of society would also participate in the general accommodation which might be introduced through each domestic circle. The experience already had of our canal conveyance cannot fail to convince every reader, after due observation, that the heavy expence attending the construction and repair of canal boats, with all their multifarious tackle, men's wages, horses and their keep, must render the transport much dearer than by a rail-way which so peculiarly combines both economy of time and labour; and the few hands required to superintend a gang of waggons on the rail-way compared with those employed in the conveyance of the same freight by a canal, can only excite the astonishment of every one as I have already remarked, how our engineers should have so particularly directed their attention to this latter system in preference to the former.

The infatuation of many of our engineers in favor of canals is so great as to cause them to recommend rail-ways as mere collateral branches of communication to canals; such recommendation ought not to be followed in any instance, for rail-ways would then partake of the many obstructions so peculiar to canals; whereas rail-ways, unconnected with the present stupid methods of conveyance, are free from all impediments, and if due attention be paid to carry them sufficiently high in all parts of the country subject to be flooded, much inconvenience and delay might be avoided in the conveyance of the mails and the general intercourse of the country.

The present system of conveyance, for the reasons already given, affords but tolerable accommodation to farmers, and the common way in which they generally attend markets, must always confine them within very limited distances; it is, however, expected, that the rail-way will present a suitable conveyance for attending market-towns, thirty or forty miles off, as also for forwarding considerable supplies of grain, hay, straw, vegetables, and every description of live stock, to the metropolis, at a very easy expence, and with the greatest celerity, from all parts of the kingdom.*

* "We understand that a respectable body of landed proprietors, as a means of assisting their tenants, have agreed, by

The present manner of supplying the metropolis, and most market-towns with provisions, must ever prove expensive to all private families; farmers, sixty miles from London, would then be able to forward the produce of their farms and procure manure for their land at much less trouble and expence, than those now distant ten miles.

Each farmer would only require carts or caravans for running on the rail-way, and by having a branch rail-way laid down to his own estate, one horse would draw several carts or caravans to the line of rail-way communicating with the town to which they are destined. Every market day steam-engines might ply along these lines and collect the farmers' caravans or carts in the morning and in the evening the same engine might return and leave them at their respective branches. The common carts and waggons now in use, might be

subscription, to support an establishment of light caravans, principally to supply the London markets with fresh butter, &c. from the dairy farms situated near the roads leading from Exeter and Taunton to London. The plan is arranged to convey such goods into market as quickly as those from Buckingham and Cambridgeshire, which, from their freshness, command a superior price to those sent salted from Devon, Dorset, and Somerset, where the value is greatly reduced by the competition with Dutch, and other salt butter. The establishment, it is evident, must materially benefit the dairy farms, now sadly distressed, and become generally useful to trade by a quicker and cheap transfer of goods." *Observer, 3d Sept.* 1821.

transported to any market in the most simple manner. Carriages built on a low construction adapted to rail-ways, with every necessary apparatus attached to them so that any cart or caravan might be drawn upon them, would, perhaps, afford greater accommodation, because, on arriving at the end of the rail-way branch, horses might then be employed to draw the caravans or carts off the rail-way carriage, and proceed with them into the market or any particular street or place, where on being discharged and ready to return to the farm reloaded, nothing further would be required than to replace them upon the rail-way carriage; but, supposing that farmers' carts or caravans should be built the width required for running on the rail-way, it would be found still more simple and less expensive, to have two sets of wheels for each cart or caravan, one set for our present roads and one set for the rail-way; all public vehicles might also be provided with two sets of wheels, in order to take advantage of rail-ways wherever they may be adopted. Machines might be fixed at the different branch rail-ways, as convenience may demand, to give the necessary strength required for changing the wheels although the carriages be loaded.

The superior facilities, with the great economy, which rail-ways would afford when compared to our ordinary turnpike roads, *with all the delusive*

schemes of modern scientific improvements, are so apparent, that it may truly be said of the present generation, "Eyes have they, but they see not; they have ears, but they hear not!"

There are not less than ten thousand steam-engines daily employed in this country, but not one is yet applied to our inland conveyance; the many attempts made to improve still further our steam-engine, instead of a due application of its present commanding power to the purpose now recommended, must in time disturb the lethargic slumbers of the public, who are hourly smarting under the most oppressive charges for the conveyance of merchandise and persons.

Besides the great advantage to be derived from supplying the city of London with coal by this conveyance, in preference to the employment of vessels, the same economy and dispatch might also be obtained in supplying the corn markets of the metropolis and of every town; and if a candid and impartial examination were adopted in order to contrast the present pitiful methods of conveyance with that which *improved* rail-ways would afford, I feel confident of gaining the immediate support of all those engaged in commerce and in agriculture.

The tedious delay attending the conveyance of goods by coasting traders; the time lost in waiting for tides and fair winds; the melancholy wrecks

on all our coasts every winter; the enormous expences so peculiar to shipping, and the further detentions by canals, (such as the total stoppage to commerce when they are undergoing repair, and in time of floods, or frosts, or droughts), greatly retard the intercourse of the country, and consequently enhance the transport of merchandise: on all these points I refer my readers to the merchants and traders who cannot forbear their testimony in support of this statement.

Rail-ways are free from all these objections, and the great speed with which journeys might be made, would enable coach and waggon proprietors to reduce the present rate of carriage one half, as their returns would be so rapid; indeed, journeys might be made from London to the interior towns in half the time taken up by boats from Gainsborough, Selby, Hull, and other ports, without reckoning all the time lost by the circuitous passage trading vessels make from London to these ports. Surely the wholesale dealers in colonial produce, and the retail grocers of the country towns, cannot long remain indifferent to the importance of this improvement in our inland communication.

It behoves gentlemen to reflect before they subscribe to the specious ship-canal between the English and Bristol channel, or to any other canal; for the time is fast approaching when rail-ways

must, from their manifest superiority in every respect, supersede the necessity both of canals and turnpike roads, so far as the general commerce of the country is concerned; therefore I say, beware of canals, yea even of ship-canals.

Had the attention of the public been drawn to this scheme in the early stage of steam-machinery, it would be difficult to compute the advantages that would ere now have accrued to this country, but such is the dilatory encouragement held out by government that we now see them making a boast of the rapid advance of steam navigation although Jonathan Hulls laid the scheme before the public in 1736!—the very year James Watt was born!!

The inhabitants of Essex, from their proximity to the metropolis and the level state of that county, would find this plan less expensive than in most counties. The great facility with which the Essex farmers might send their produce to London, and the moderate expence of attending markets, would greatly conduce to the general interest and prosperity of that county, as well as promote the adoption of the plan in the adjacent counties; for all farmers and gardeners, within fifty miles of the metropolis, would then enjoy an equal share of the profits of industry, with those now so highly favoured by their grounds lying in the vicinity of London; the great rents, paid in the immediate

neighbourhood of all large places, arise merely from the easy and cheap communication: therefore as it would be to the advantage of landholders, having estates remotely situated as above mentioned, so would it be to the public also; and provided there were no restrictions whatever on the sale of all the common necessaries of life (this particularly applies to London), the supplies might be so abundant, as to put us on a footing with the most favoured nations.

The numerous insurance companies would have it in their power to give more immediate succour against fire: towns and villages, although situated a considerable distance from London, might have an easy communication and prompt assistance from their respective offices in half the time now required; and the same advantage might be enjoyed in more remote parts of the kingdom, by a similar correspondence and aid from every neighbouring town where the agents of these companies reside. A scarcity of water is oftentimes severely felt, and, when this is the case, it completely prevents any effective measures of relief, even after the arrival of the fire-engines: this distress might be much alleviated, if not entirely overcome, by abundant supplies of water, which the present imperfect methods of conveyance render totally impracticable; every considerable village, as well as market-towns, by having water carts and fire-engines

properly adapted to each particular situation, would possess the means of checking those destructive fires which happen so continually in many parts of the country. The private, as well as national advantage of steam-engines and rail-ways will be developed in proportion to the support and encouragement the public give them; the profit to arise from the practical economy of animal power, which individuals may derive from rail-ways being introduced into all farms of any considerable extent, cannot fail to command, in every possible way, their general adoption. The farmer, most probably, may do with one-third of the number of horses he now keeps, for none would be required to convey his produce to market, or to bring manures to his land. Machinery has already been introduced into various branches of farming, the success of which may serve as an inducement to persevere, and consequently lead to further improvements. Although the power of steam, as a means of conveyance, is at present confined in its application to packets or vessels, the public will readily give their support to the present plan, when it shall be more generally known how much shorter journeys may be rendered, both as regards distance and time, and the superior accommodation which rail-ways would offer by crossing in a direct line from place to place as shewn by the map; in fine, by a direct communication through-

out the interior of the united kingdom, and the present facility of crossing the channels by steam-packets, we may confidently promise ourselves the certainty of thus performing the whole conveyance or transport of goods and persons, by the sole power of steam, both by land and water.

Rail-ways should be laid down from every village, to communicate with the general rail-way running from town to town. The property which this system would infallibly create, by the numerous shares circulated all over the country, would prove a never-failing source of revenue. When national and individual interests are thus interwoven by works of such vast and permanent importance, they form, by obtaining universal attention, a spring of internal strength, so as to perpetuate the general happiness and prosperity of our country. Every circumstance perfectly coincides to countenance this plan: the attention of the House of Commons has of late been much taken up in considering the best method of improving the public roads; the blessing of a general peace, which we now enjoy, with a fair prospect of its continuance, and the great amount of unemployed capital, decidedly point out the present time as the most favourable for the execution of such a work, when all labour and materials are at the cheapest rate; and the very same reasons which are here given to show its advantages as a

public undertaking, will prove a sufficient recommendation to all individuals wherever it may be found practicable.

All counties, which from their distance and expence of carriage, are totally denied the use of coals, might, by means of the plan now under consideration, be regularly supplied with this necessary article of fuel, on terms nearly equal with those situated in the more immediate neighbourhood of coal pits. Stone required for building might be had from quarries at a moderate expence, in any direction where there are no canals; indeed all classes of society would soon be convinced of the incalculable advantage to arise from this national undertaking, as a more equal distribution of the conveniences, as well as the necessaries of life, would ensue.

In the first edition it escaped my recollection to lay before the public another branch of this plan, which would prove advantageous to the commercial interest, as well as highly beneficial to the East and West India Dock Companies; the very great traffic between the Docks and the city of London, and the stages running to Blackwall and Poplar, would be regulated much better, both with respect to expence and despatch; as the road from Whitechapel to the Docks is level, a rail-way would be laid down here at as little expence as in any part of the kingdom; and after learning the

great superiority of paved roads,* compared with gravelled road, I leave it with the public to decide whether rail-ways would not be even still superior to paved roads; for the great diminution in the strength required, arising from the facility of draught this plan affords, would soon confirm what is now advanced: besides, the construction of rail-ways would render the expence now incurred in cleaning and scraping roads, quite unnecessary, and at the same time give the 'hardness, smoothness and permanency,' not to be attained by any other system: the first expence of forming a rail-way is the only great expence, and this cannot prevent its adoption when the manifold advantages, of which all would daily participate, shall be fully made known to the public; however, to those who might be intimidated on account of the expence,†

* "We are disposed to agree with Mr. Edgeworth, that for roads near the capital, or great manufacturing towns, 'paving is the only certain method yet known that gives sufficient hardness, smoothness, and permanency.' Mr. Walker (surveyor of the Commercial Road, &c.) says, 'It is not, I am sure, over-stating the advantage of the paving, but rather otherwise, to say, that, taking the year through, two horses will do more work, with the same labour to themselves, upon a paved road, than three upon a good gravelled road, if the traffic upon the gravelled road is at all considerable.'"—*Quarterly Review.*

† "'If the traffic upon the gravelled road (continues Mr. Walker) is at all considerable, the saving of the expence of carriage will be found to be very great, when compared with the

it would by comparison be found, between the draught, on the present system of roads, and that of a rail-way, as about four to one (nay six to one) in favour of the latter. Warehouses should be built by both the Companies about where the New Road crosses the Commercial Road, by which means the East India Company would convey their merchandize at a much lighter expence. Were all the East India Company's warehouses built in this situation, there would be no necessity to employ a single horse for the transport of goods from the docks to their warehouses.

The West India Dock Company might deliver all the merchants' goods from their warehouses as above-mentioned, which would prove a certain profit to the Company, and a very great saving to all merchants.

The rail-way for the county of Essex might join the East and West India Dock rail-way, and thereby render the undertaking mutually advantageous to all parties.

By the establishment of morning and evening mail-steam-carriages, the commercial interest would

cost of paving. If the annual tonnage upon the Commercial Road is taken at 250,000 tons, and at the rate of only 3*s.* per ton from the docks, it could not be done under 4*s.* 6*d.*; say however, 4*s.*; or 1*s.* per ton difference, making a saving of 12,500*l.* or nearly the whole expence of paving in one year. I think I am under the mark in all these figures.' "—*Quarterly Review.*

derive considerable advantage; the inland mails might be forwarded with greater despatch, and the letters delivered much earlier than they were by the extra post; the opportunities of correspondence between London and all mercantile places be much improved, and the rate of postage generally diminished, without injuring the receipts of the Post-office, because any deficiency, occasioned by a reduction in postage, would be made good by the increased number of journeys which mail-steam-carriages might make; intelligence received in London every morning from all sea-ports; the foreign mails, &c. might be forwarded to their destination at ten o'clock in the morning, instead of the present hour of departure (eight o'clock evening) for mail coaches; and the advice of all transactions in business during the day be transmitted by the evening mails. All mail-steam-carriages ought to be confined to the conveyance of letters, bankers' parcels, and packages of a moderate size, and not allowed to take any passengers, which would prevent several delays each day, as well as the robberies of mails and of valuable parcels. The London and Edinburgh mail-steam-carriages might take all the mails and parcels on the line of road between these two cities, which would exceedingly reduce the expence occasioned by mail coaches on the present footing. The ordinary stage coaches, caravans, or waggons,

running any considerable distance along the main rail-way, might also be conducted on peculiarly favorable terms to the public; for instance, one steam-engine, of superior power, would enable its proprietors to convey several coaches, caravans, or waggons, linked together, until they arrive at their respective branches, as pointed out in the map, where other engines might proceed on with them to their destination; by a due regulation of the departure and arrival of coaches, caravans, and waggons, along these branches, the whole communication, throughout the country, would be so simple and so complete, as to enable every individual to partake of the various productions of particular situations, and to enjoy, at a moderate expence, every improvement introduced into society. Steam-engines would answer all the purposes required by the general intercourse and commerce of this country, and clearly prove that the expences caused by the continual relays of horses are totally unnecessary: the great economy of such a measure must be obvious to every one, when instead of each coach changing horses between London and Edinburgh, say 25 times, requiring 100 horses, besides the supernumerary ones kept at every stage in case of accidents, the whole journey of several coaches would be performed with the simple expence of one steam-engine. No animal strength will be able to give

that uniform and regular acceleration to our commercial intercourse which may be accomplished by rail-ways; however great the animal speed, there cannot be a doubt that it would be considerably surpassed by mail-steam-carriages, and that the expence would be infinitely less. The exorbitant charge now made for small parcels prevents that natural intercourse of friendship between families residing in different parts of the kingdom, just in the same manner as the heavy postage of letters prevents free communication, and consequently diminishes very considerably the consumption of paper, which would take place under a less burdensome taxation.

A general iron rail-way would prove one of the most important branches of political economy, by introducing a system of conveyance every way superior to our present establishments, and at the same time presenting a fair opportunity to ministers, in case of necessity, of improving the finances of the country. Many millions of capital now annually required and expended in horses and their provender to keep up our present internal intercourse, might, besides augmenting the revenue of the country, be diverted into other channels of profitable employment, and various improvements in every county. One half the time and expence might be saved to the public, in forwarding the outward and homeward bound mails to and from

Falmouth, and other ports whence the packets sail. The most effective communication might be established between all outports throughout the United Kingdom and the Admiralty, which would not only prove highly beneficial to our commercial interest, but considerably accelerate operations against any enemies that might present themselves on our coasts: indeed, no limits can be assigned to the increase of wealth which this change in our inland conveyance would produce; there is no branch of society, no branch of commerce or of arts, but shall partake of its endless prosperity. As a nation, in peace, it will ensure us every advantage, and in war it will yield us every protection.

In time of war or civil commotion, troops might be despatched from one end of the island to the other in one quarter of the time now required. Provisions and equipments might be forwarded to outports with the greatest speed and facility on fitting out an expedition.

The duty on horses and carriages must be very considerable; therefore it may, perhaps, be as well to state, that the public would be better able to pay the same amount of revenue, or as much more, to be raised from carriages running on the rail-way, than under the present system, deducible from the three following heads:

1. That the repairs of the rail-way (as already mentioned), would be less than on the common turnpike road.

2. That the wear and tear of carriages would be considerably less.

3. That the expence of steam-engines, to supply the place of horses, would be comparatively trifling.

After a careful perusal of the information laid before the Committee of the House of Commons, appointed to examine into the state of the public roads, it will be found, up to this time, at least, that few, very few improvements have been accomplished: but on this part of the subject it is not my intention to dwell, as I am perfectly convinced no improvement, however skilfully managed, in the present system of roads, can answer the national interest; therefore, without further comment, I shall adduce my reasons, in order to substantiate what is now advanced.

The great mortality amongst horses employed in coaches and post-chaises, is so very general, as to admit of no dispute; and it is equally evident to every individual, that the public must bear this expence, as no proprietors of stage-coaches, post-chaises, or caravans, could bear such immense and continual losses, were they not secured by fares and rates of carriage in proportion to the risk: taking the number of horses now employed in coaches and post-chaises *only*, to be 100,000, and each horse to average in value 20*l.* the net amount is two millions sterling; this sum (agreeably to the

statements made by several of the first coach proprietors) is completely sunk within the short space of six years—every six years! and the very same amount, two millions, is annually expended in the keep of these animals, reckoning the same average sum of 20*l.* a head.* No immediate reference has hitherto been made to horses employed in stage-waggons and caravans; there can be no doubt that the number is considerable, and that the expence of first purchase, together with the daily expence of food, will bear a relative proportion to those employed in coaches: for the present, this short remark will be sufficient to convey the idea to my readers, that the sum already given, as a calculation of the aggregate number of horses employed in England, is far under the mark.

An accurate account, however, of the number of horses so employed, might be easily had by reference to the books from which the duties are collected; this would present to the public view the total amount of expences, which might be annually saved by superseding the necessity of horse-power: the annual expenditure in food, and the money continually sunk in order to keep up the stock of horses, when ascertained, must con-

* A stock of one hundred thousand horses, renewed every four years, the keep, and interest of capital included, amounts, in twelve years, to the prodigious sum of thirty-four millions seven hundred thousand pounds.

vince every reader of the abundance of capital we possess, so as to enable us to carry this great work into immediate execution: we may also further increase the revenue of the rail-way *by a three-fold toll to what is now paid, and still convey goods and persons at an extremely reduced charge.* The importance of the present scheme, together with the permanent security and advantage it promises to subscribers, cannot fail to excite the unanimous interest of Government, and to ensure any pecuniary advances which might be required to accomplish this national improvement, by enabling the numerous Companies, through Government, to raise the necessary supplies, by the aid of Exchequer Rail-way Bills. For the encouragement of such a national work it would also greatly conduce to the interest of the proprietors, were parliament to grant a proportionate toll for twenty years, so as to refund any extraordinary advances this undertaking may require to render it complete; for, when once established, the annual revenue would prove an unceasing spring of wealth so long as England shall preserve her present happy constitution, the stability of which alone inspires a confidence unknown and unfelt in other countries, and will enable us, by the blessings of peace, to perform the task now before us, a task which no other country can undertake, for want of that security which renders our government the envy and wonder of the world.

However sanguine may be my expectations, I would not in the slightest degree exaggerate any statement it may be found necessary to lay before the public, as such a step must injure the cause I have in hand, which requires nothing but a simple relation of facts to secure all the advocates of public welfare.

The great success attending the general introduction of steam-machinery into all manufacturing places instead of manual labour, is certainly a very good reason for attempting by the same means to do away with horses as much as possible. The necessity of extending the means of existence to mankind in England, will always claim particular attention; and when it can be effected, by diminishing the need of horses, as the present subject demonstrates, it is doubly profitable. Why may not rail-ways answer the national interest as well as that of individuals? In many parts of England they have long been in use, but in Leeds more particularly are they improved; for this town is regularly supplied with coals, from pits several miles distant, by means of steam-engines, without having any recourse to horse power. The practical advantages are *here* so well known, and so completely proved by daily application of mechanic power, as shewn by the adjoining plate, that I boldly court opposition, and earnestly solicit the particulars of the various objections which may

spring up in the minds of my readers, as it is only through the most impartial examination into the effects likely to result from the adoption of this measure, that its importance to the nation, as well as to individuals, can be properly known.

It is truly astonishing to witness the supineness of wealthy agriculturists, but more particularly of the commercial class, in not promoting, generally, the adoption of this plan; this indifference of the public will afford abundant matter of censure to the rising generation: how will they account for the present abominable mismanagement of all our roads? for the foolish and obstinate perseverance of their papas in a system so notoriously bad in every branch? and for the intolerable tolls and an accumulating debt of seven millions, as the trial and proof of their folly? This is the proud and boasted condition of our roads at the very time when Mr. Blenkinsop has proved, by actual experience, for many years, the great superiority of the use of the steam-engine *on land*, the same as is now in practice on board packets in every port of the kingdom. Should my plan not be acted upon during this generation, the time is not remote when it, or something similar, will supersede all the present expensive conveyance in our internal intercourse; of this I am thoroughly convinced, by the great improvements in all arts and sciences, and the encouragement held out by the practical

knowledge of the superiority of steam over animal power.*

Whenever it shall be found to answer in England and Scotland, it will undoubtedly be adopted in Ireland also, and have the same beneficial effects there in the general improvement of all estates and property of every description; rendering the communication between the two islands mutually advantageous, by a more free and easy intercourse throughout the interior of the United Kingdoms, so highly necessary in our connexions with all countries, both with respect to our foreign and inland trade. Numerous estates, (the produce of which, from our present defective and dilatory system of commercial intercourse, is debarred the advantage of the English markets) might be so improved in value, as to afford constant employment to all the husbandry poor, who, hitherto,

* "The first steps in the useful arts, which are the most difficult, have long ago been taken; their fruits are reaped by society at large, and furnish the greatest incitements to perseverance. Of this kind is the encouragement given to navigable canals, which afford the cheapest and most easy circulation of inland trade. *We may reasonably indulge the hope that many more schemes of the same kind will be realized, because the greatest works, of which we now reap the benefit, once existed only in plans and projects. However at first ridiculed by the ignorant, and discouraged by the idle, they were at last reduced to practice.*"—*Kett's Elements of General Knowledge*, 8th edit. vol. ii. p. 366.

seem excluded the common benefit arising from industry; and, besides, the internal wealth which might accrue, by thus opening new channels of profitable labor to our distressed brethren in Ireland, might also prevent a recurrence of those afflictive events so recently suffered; nor can it be denied that, by a more perfect system of general communication, society, in each district, would enjoy greater security by more efficient and immediate assistance from public authorities in neighbouring counties. Whatever tends to facilitate the means of communication must, particularly in such a great commercial nation as this, meet with the general approbation of the public; and nothing can contribute more to augment our home trade, which is of the first importance, than the well-appointed labour bestowed upon improvements of great magnitude, because, while it occasions the circulation of money expended on such undertakings, it not only opens a new source of national wealth to our capitalists, but extends its beneficial influence to every branch of society throughout the whole kingdom; the trades most likely to reap great and permanent advantage from this plan, would be those of iron and fish; but the happy effects would be felt every where, by the useful labour it holds out to all the working classes for years to come. The immense traffic of this country certainly demands a better system of conveyance,

for although the sums of money now laid out on roads are very great, they not only are defective,* generally speaking, *but altogether unprofitable;* whereas could the conveyance of the whole country be under the care and inspection of those persons who might invest their property in this national work, the public as well as the proprietors would soon enjoy the great benefit to arise from such an improvement of measures; and I have every confidence of obtaining universal attention, when the plan shall have been taken sufficiently into consideration, so as to show its great superiority over turnpike roads and canals, which have been supported at the expence of great capitals, and by the unceasing perseverance of numerous individuals, without answering, as time has long since proved, their promised expectations.

* "We would not be understood as contending that the roads of the kingdom are worse than they were ten or twenty years ago; on the whole, perhaps they are better. It admits of no dispute, however, that they are, generally speaking, bad."—*Quarterly Review.*

"It appears that the stage coach proprietors average not more than three years' labour from their horses; upon some roads, even not more than two; that the turnpike tolls on a four-horse coach, running only forty miles from London, amount to 220*l.* or 230*l.* per annum; that on some roads more than 1000*l.* per mile is collected; that the whole expenditure for the repair of roads throughout England, amounts to two millions a year, and that the turnpike trusts are in debt to the tune of seven millions sterling".—*Gent. Mag.* Dec. 1820, p. 530.

As a select committee was appointed by the House of Commons to examine into the merits of steam navigation, (see parliamentary report) the same attention from Government to the present plan would be productive of the utmost good, as an impartial consideration of the two systems, steam navigation and land steam conveyance, could not fail to produce the most favorable decision in behalf of the latter.

It will be seen by my petitions to the several Ministers of State, that the attention of Government has, long since, been solicited to examine this plan; similar communications have also been made to the General Post-office; to the Board of Agriculture; and, to the Corporation of the City of London.—For if the mere conveyance of mails across the channels by royal mail steam-packets, prove so highly important; how much more so, the regular conveyance and early distribution of the vast correspondence in all parts of the kingdom by royal mail steam-carriages?

When it shall be determined to carry this project into effect, the perfectly level and direct line is recommended as the most eligible plan, on account of the many advantages that would result from this method, rather than from curved or irregular roads, which may be represented by some individuals as less expensive than levelling the whole extent required for the straight line, regard-

less of the difficulties that may, nay will present themselves: economy does not so much depend upon adopting the least expensive measure on the commencement of a great national work of permanent duration, as to proceed at once upon a bold and decisive plan, which may make the line of road so complete, as not to leave it in the power of future generations to upbraid the original projectors for not having fixed upon the direct line, which certainly is the shortest, in the first instance, and would daily prevent great loss of time both to the merchant and traveller, as well as prove a considerable annual saving to the public in every other respect.

It may, nevertheless, in some instances be impracticable to maintain a perfect level, in which case wherever a hill presents itself, rising to a long level, by the erection of an archway, and steam-engine house, at the summit thereof, the necessary aid required for vehicles to ascend or descend might be obtained by affixing the cord or chain from the engine house to the vehicles requiring assistance.

The direct line would, when accomplished, soon confirm the truth of the observation made on England by a French author (M. Dupin), that "every where are seen the signs and effects of economy; but of economy well understood, which knows how to make sacrifices bordering almost on prodi-

gality, in order to reap afterwards, with usury, the fruits of its advances."

It is hoped that the hints already promulgated may so excite the curiosity, and attract the attention of the public and government, as to create a general disposition to examine thoroughly every branch of conveyance throughout the whole country, together with the revenue arising from each establishment; and to cause surveys and estimates to be drawn out by our most skilful engineers and mechanics of the expences of this new plan, and then shew, by comparison,* the only fair and unerring road to perfection, whether the remarks contained in this book are of sufficient importance, as the Author humbly, but sanguinely expects to claim universal attention, because every individual of society, more or less, directly or indirectly, has an interest in the conveyance or transport of property and merchandise, by which all private as well as public affairs are so materially affected.

If we take into consideration the progressive in-

* "We hold comparisons in general to be one of the surest roads to knowledge. The whole system of daily intercourse throughout the world is carried on by it. The most exact of the sciences obtains its positive results by no other means. It is so general in practice that men unconsciously refer to it upon every occasion; so accurate in its conclusions, that in a condition where nothing is absolute it is the *ultima ratio rerum*." —*Edinburgh Review.*

crease of our commerce, the ramifications of which spread so widely throughout the United Kingdom, as well as the improved, and still improving state of our agriculture, with the unbounded wealth issuing from these two national springs, it must be admitted that our present system of internal communication is not equal to the means we possess, nay, in this respect that we are very little superior to our neighbours on the continent, who have every excuse in their limited resources, as well as in the want of that national security which is so peculiarly favourable to all our public measures, and so essentially necessary to enable us to maintain our pre-eminence in the commercial world: but in order to establish this pre-eminence, we must also endeavonr to excel in domestic economy, by rendering all the necessaries of private consumption equally cheap with those on the continent, so as to attract the capital of other countries, and to prevent our own merchants from withdrawing theirs.*

After a review of the many advantages to be derived from this new scheme, owing to the superior speed, safety, and economy which it presents, over

* "Commerce is of a precarious and fluctuating nature, paricularly as it takes its rise from artificial as well as natural wants. Merchants remove from place to place, according to the comparative cheapness of labour, and their prospects of improving heir capitals."—*Kett's Elements*, 8th edit. vol. ii. p. 309.

the pitiful methods now in use: it may not be thought improper to observe, that the public would also find it a cheap and delightful mode of travelling, for all such as are desirous to make summer excursions from one end of the island to the other, also to the numerous, if not innumerable, visitors and frequenters of watering places; and although this may not appear of national importance, it is necessary to be remarked, in order to show the more remote advantages to arise from this plan. A reduction in travelling expences would not only be found beneficial to the commercial interest, but prove a general accommodation to the public, by allowing John Bull a more extensive range on his Sunday trips, as well from the metropolis as from every considerable town in the kingdom.

Notwithstanding the numerous improvements this plan may introduce into every county, and the great increase of inland trade, to arise from the immense capital which it would cause to be circulated in every direction; there may be individuals, as well as some few companies, whose interest might be affected; but it cannot be expected that the accomplishment of so great a work can be obtained without trespassing upon some few establishments. The public benefit, however, will be so very general, and the national interest will so far preponderate, as to render any

attempts to impede its adoption futile and abortive.*

The present proprietors of coaches, caravans, and waggons, are, from their experience, establishments, and connexions, best adapted to benefit by a general iron rail-way.

The proprietors of the *few* canals which do answer, will have the greatest reason to complain; but they, in common with the rest of society, must of course submit to any superior method of improving the conveyance or transport of merchandise, just as the common coasting traders will to the established steam-vessels; with respect to those canals which do not answer, and those that never can, the sooner they are abolished in toto the better; it is unreasonable to expect that the public will give them the smallest encouragement from this time, for the free discussion of the present plan will soon win the majority, in its favour, as the more it is examined in every respect and particular, the more evidently will its manifold advantages appear.

It may, perhaps, be thought that I am too bold in my opinion of canals; the account given in

* "No local interests, no partialities must be allowed to interfere, and although petty conflicts might be sustained, they must all yield to this measure of great public utility."—Lord Liverpool.

Extracts No. 9, 10, and 11, together with the information each individual may gain in his own county and neighbourhood, will serve to convince my readers to the contrary; and the evidence already adduced to show the present imperfect means of internal intercourse by the ordinary turnpike roads, is equally conclusive: on these facts I build my full expectation, and feel assured that a system uniting every necessary facility of conveyance of all merchandise, of whatever description, as well as of persons, with a safety, speed, and economy yet unknown, must be entitled to claim the pre-eminence; the expence of forming rail-ways is not only far less than that of canals, but the former exhibit the peculiar advantage of a better conveyance than roads and canals conjointly afford at present; therefore the whole revenue arising from transport, or conveyance of goods and persons, would most undoubtedly be collected by the General Iron Rail-way Companies, and the branch Companies, which would ensure a more steady return for any advances the proprietors may have to make, and promise a more permanent source of revenue to our capitalists than ever could be reaped from the present system, which time and experience have long since proved both imperfect and unprofitable.

From the particular attention which the public and government are now bestowing upon steam-

navigation, it follows of course that a similar conveyance on land, with its numerous, *but yet unforeseen* advantages, must also command general notice, if we may judge by comparison, how much greater interest it would yield the community in every respect. At the first view of such a plan, individuals are disposed to ridicule it as chimerical; this indeed is the lot of all new schemes;* but it should at the same time be remembered, that it is the peculiar privilege of the ignorant to ridicule what they do not understand.

The lighting of towns with gas was no doubt ridiculed by thousands who *now* hold shares, and *nightly* enjoy the benefit of that *luminous* project!

After mature deliberation it is easy to foresee that this new plan will alter the face of the country, and, in process of time, that the whole line of road, as laid down in the maps, will progressively

* "It appears that up to the present period there are no less than ninety-seven Canals in England, 2471 miles in extent, and that the sum of 30,000,000l. (thirty millions) has been expended in their construction. Such is the present state of the English canals, not a yard of which existed before the year 1755. Till that time the idea of canals was *ridiculed as superfluous and absurd*, in a country like England, enjoying, as it was said, favourable lines of coast, and provided with numerous navigable rivers. It is well known that the Duke of Bridgewater, *by opposing himself to the prevailing opinions and prejudices of the country*, first demonstrated the practicability and importance of such works."

draw the public to it for their own convenience, and that the proprietors of the rail-way would then be enabled to light the whole extent with gas, which would render this scheme as complete as the most sanguine could desire. When a trial shall have been made between Manchester and Liverpool, I am persuaded that the difference in expence between horse and mechanic power will yield sufficient for the further accomplishment of so desirable an improvement to a General Iron Rail-way; and I am more confident of early success, seeing these two great commercial towns have already taken this scheme in hand, as nothing will be wanting which science can suggest or patronage can support, to crown with success this first essay towards its general introduction, and as the commencement of a completely new system of general inland conveyance and internal communication.

By the present opposition to this scheme, between Liverpool and Manchester, it is much to be feared that the blind prejudice of opulent individuals may interfere to retard its establishment, by refusing a passage through their estates: the experience of its universal benefit wherever it may be adopted, would, however, soon cause them to repent their folly, and to solicit what their ignorance had taught them to oppose.* Surely the

* From Gore's Liverpool Advertiser, Dec. 30, 1824.—It appears that the objections of those landholders who have

wealthy merchants and manufacturers of Great Britain will never tamely submit to these landholders, who would be the greatest participators in the benefits to arise from this scheme, and would, if they consulted their own interest, and that of their successors, be also its greatest advocates; if they, however, cannot see the interest they have in this national improvement, but still oppose instead of promoting it, they must be treated

marshalled themselves in opposition to this important measure are exceedingly trifling and puerile. Elderly gentlemen are of opinion that they shall not be able to cross the rail-roads without the certainty of being run over; young gentlemen are naturally fearful that the personal comforts and conveniencies of their foxes and pheasants may not have been sufficiently consulted. Ladies think that cows will not graze within view of Locomotive Engines, and that the sudden and formidable appearance of them may be attended with *premature* consequences to bipeds as well as quadrupeds. Farmers are quite agreed that the race of horses must at once be extinguished, and that oats and hay will no longer be marketable produce.

Such and such like are the visionary fears and anxieties with which certain of our land owners and land occupiers are now dismayed; and so it was with others of a like stamp about the year 1755, when canals were first projected; and nothing but inconvenience and mischief were anticipated from them; but the modern ark moved upon the waters, 18 tons were conveyed across the country by a less power than had before transported one, and neither cows miscarried nor did oats become unsaleable, but on the contrary every interest in great Britain received a new impulse; and its power, its wealth and prosperity were increased an hundred fold.

like all other blind people, and be kindly conducted out of their present crooked and rugged ways to a more straight and even path!

However superior the qualities of any new plan may be, a considerable length of time is necessarily required to gain over the public opinion, so as to promote its adoption: among the numerous arguments already advanced in behalf of this new scheme, none, ultimately, will more effectually tend to its success than the ease and security which it promises to the traveller. The numerous dangers and inconveniencies to which the present coach system is obnoxious, (such as the untractableness of horses, the imprudence of drivers, cruelty to animals, the dust and ruggedness of roads, &c.), would not be encountered on the rail-way, whose solid basis and peculiar construction render it impossible for any vehicle to be upset, or driven out of its course, the rail being convex and the rim of the carriage wheel concave; and as the rail-way must also be perfectly level and smooth, no danger could be apprehended from the increased speed, for mechanic power is uniform and regular, whilst horse-power, as we all very well know, is quite the reverse.

Whatever attempts may be made to bring steam-carriages, or other mechanical vehicles, into use on the ordinary turnpike-roads, the dangers and

inconveniences which would attend their introduction are so apparent, that it is scarcely necessary to make a remark on the impropriety of such a measure: these new carriages, on descending the steep hills of our ordinary turnpike-roads, would, on the slightest accident happening to the machinery, be dashed to pieces; moreover, the small weight drawn by one engine, and the dilatory rate of speed, *compared with what the same engine might effect on an iron rail-way*, are sufficient to shew the folly of the attempt; it must therefore be evident, the only likely way of success is so to form our road, that it may be adapted to the peculiar construction of mechanical vehicles, by a perfectly even and solid surface, so as to accelerate the speed of carriages with a less propelling power, and consequently diminish the expence of conveyance.

To give the necessary encouragement to the rapid improvements in mechanical power, the common turnpike-roads should be given up, without further waste of public money in delusive schemes upon them; and a perfectly new system of conveyance began upon, more consonant with the spirit of the times, and better adapted to the immense intercourse and increasing traffic of this great commercial nation. As wasteful expenditure and want of skill are the only characteristic

features of our common turnpike-roads and canals, so are the opposite extremes of economy and skill combined, alike descriptive of the rail-way.

With our present information and experience of the great utility of the steam-engine to our manufacturers, farmers, and on board our vessels, it certainly must astonish every one to find that, on land,* as a conveyance, this valuable machine is chiefly if not solely confined to the removal of heavy dead matter, yet possessing, when properly applied, every possible means and accommodation of transport, which the various and expensive establishments of turnpike-roads, canals, and coasting traders now yield, and that, with the cost of *one* of these establishments, it would present to the public a system which must, the more it is canvassed, determine the choice of every individual in its favour.

Since my last edition, I find it is determined upon to lay down a rail-way between Birmingham and Liverpool, and between Liverpool and Manchester. This surely may rouse the wealthy inhabitants of populous districts to exert their influence, and, by calling public meetings in their respective neighbourhoods to canvass this new project, promote its extension from town to town.

* "The consumption of coals, however, in all engines connected with steam navigation, is much more considerable than when employed on land."—*Partington.*

The profit to be derived by the public may be computed from the enormous annual expenditure now wasted in purchasing and feeding unnecessary horses. One would scarcely imagine, where every person's interest is so immediately concerned, that it were possible, after the repeated exertions which have been made to draw the public attention towards this work, to find so few individuals, possessing the necessary influence, inclined to forward it; but, however small the encouragement I have yet received, nothing shall divert me from the prosecution of the measure; being fully persuaded, that a steady perseverance in a plan of such vast national importance must have its due reward.*

Much more might be advanced in support of this plan, but the intention of these observations will be sufficiently answered, should the public attention be so far excited as to promote the national good the author has in view;† to be too

* "In any point which prudence bids you pursue, and which a manifest utility attends, let difficulties only animate your industry, not deter you from the pursuit."—*Chesterfield.*

† "It is also of importance to know that, in our endeavours to assist the working classes in a period like the present, it is desirable to employ them in unproductive labour, or at least in labour, the results of which do not come for sale into the market, such as roads and public works. The objection to employing a large sum in this way, raised by taxes, would not be its tendency to diminish the capital employed in productive labour; because this, to a certain extent, is exactly what is wanted;

prolix wearies the mind of the reader, and too frequently perplexes rather than elucidates the work.

There can be no doubt, through the great ability and skill of British engineers, that the establishment of rail-ways would form one of England's proudest features, and be no inconsiderable era in the reign of His Majesty King George the Fourth.

but it might, perhaps, have the effect of concealing too much the failure of the national demand for labour, and prevent the population from gradually accommodating itself to a reduced demand. This, however, might be in a considerable degree corrected by the wages given. And altogether I should say, that the employment of the poor in roads and public works, and a tendency among landlords and persons of property to build, and to employ workmen and menial servants, are the means most within our power, and most directly calculated to remedy the evils arising from that disturbance in the balance of produce and consumption, which has been occasioned by the sudden conversion of soldiers, sailors, and various other classes, which the war employed, into productive labourers."—*Mr. Malthus's New Work on Political Economy.*

An Abstract Statement of the Comparative Difference between Horse and Mechanic power.

The real number of waggon, coach, and post-chaise horses employed on our main turnpike roads, will, perhaps, be found to exceed 500,000: taking, however, this number for a calculation, and computing the value of each horse at £20,—the keep at £20 each, per annum; in the course of twelve years, allowing for the renewal of stock every four years, and the interest of capital, the consequent expence in this limited space of time is - -				£173,500,000	0	0
The expence of 10,000 steam-engines, £300 each in value, which would, on a rail-way, be more than equivalent to the horse-power, above stated, amounts to - -	£3,000,000	0	0			
Interest of this capital for twelve years	1,800,000	0	0			
The fuel necessary to feed the steam-engines, taken at 14s. per day for each engine, in twelve years amounts to	30,660,000	0	0	35,460,000	0	0
				£138,040,000	0	0

I take the liberty to repeat the observations, that horses under the most favourable circumstances, but more particularly those employed in coaches, caravans, and post-chaises, do not generally last

six years, nay, a very considerable proportion not more than half this time, whilst steam-engines, I am informed, remain effective without any very material expence for nearly three times that period. The very great advantage to be derived from the increased number of journeys which might be made by mechanic power, in comparison with the time now required both for waggons and coaches, cannot fail to attract general attention.

In support of the arguments adduced in the preceding pages, it is thought proper to give the following Extracts, to confirm the reader in the belief of all that has been advanced by the author of Observations on a General Iron Railway.

EXTRACT, No. 1.

Mr. Blenkinsop's Patent Steam Carriage and Rail-way.

	DESCENT.
Length of Rail-way from the foot of Middleton incline plane to top of Hunslet Plane	1751 yds. 58 ft. 11 in.
Length of Hunslet Plane	351 yds. 60 ft.
Length from foot of do. to South end Of Coal Staith at Leeds	2266 yds. 26 ft. 4
Length of Coal Staith	198 yds. level.

Expence of laying a single road:—

Plain Rail..40 lb. per yard
Pedestal .. 6 lb.
Cogged-rail 56 lb.
Pedestal ..14 lb.

116 lb. at 12s. per hundred for Rails.	*s.*	*d.*
And 18s 8d. do. for Pedestals	13	7½
Two Sleeper stones at 1s. each	2	0
Laying down 1 yard of road forward	0	7
	16	2½ per yd.

Road forming, making cuts and embankments uncertain.

LOCOMOTIVE ENGINE,

FOUR HORSE POWER.

The engine draws 26 waggons, loads 68 cwt. each—empty twenty three cwt. each waggon—

travels at the rate of 4 miles an hour.—Cost of new engine £350.

Expence of each engine per annum.—Wear and tear, including hemp, tallow, &c. £102—consumes about 9 cwt. a day of coal—500 gallons of water.

Inclination of a rail-way to transport goods loaded downwards, and returning empty from $\frac{1}{8}$ to $\frac{1}{18}$ of an inch to a yard.

Transporting goods both ways—a level road.

For the above information and plate of the same I am indebted to Mr. Blenkinsop, whose great politeness to me, at all times, merits my best thanks.

EXTRACT, No. 2.

" The origin of rail-roads may be traced back to the year 1680. About that period coal came to be substituted for wood as fuel in London, and other places; the consequence was, that at the mines the greatest inconvenience accrued in conveying the coal from them to the ships, as well as immense expence in horses and machinery for the purpose; to remove which, waggon roads were made, consisting of wooden rails or ledges, which the waggons were formed to move upon, and from out of which improvement it was found that a single horse could easily draw a waggon on these rails, which previously required three or more horses to be employed to effect by the common

roads; and it was also drawn more quickly, arising from laying down the frames upon an easy descent, which was always done.

"In 1738 this improvement was farther improved, by substituting cast-iron rails instead of the old wooden ones; but owing to the old fashion waggons continuing to be employed, which were of too much weight for the cast-iron, they did not completely succeed in the first attempt. However, about the year 1768, a simple contrivance was attempted, which was to make a number of smaller waggons and link them together; and by thus diffusing the weight of one large waggon into many, the principal cause of the failure in the first instance was removed, because the weight was more divided upon the iron. In 1797, these roads having stricken the minds of intelligent men as of great importance, numerous essays appeared, setting forth their utility, and as many plans for rendering them of permanent construction. Hence, cast-iron rail-roads became a second desideratum to canals; excepting only that the invention is due to Englishmen.

"After this time the cast-iron rail-ways began to be constructed as branches to canals, and in some places as roads of traffic from one place to another, established upon permanent principles, so as to produce a permanent revenue to the undertakers. In surveying a line to set out a rail-way upon, it

will be necessary, as a preliminary step, to ascertain, as accurately as the nature of the thing admits, the quantity of lading expected to traverse each way upon its line; because in forming the slope or descent, this will be the data on which to ground a medium for effecting the required purpose most easily.

"If it should turn out that as much lading is expected one way as the other, with a preponderance at periods only, the railing must in such a case be set out in levels, or in lines nearly level, and the ascents and descents made by planes inclined accordingly. Previously to beginning any part of the work, that is, of laying the sleepers, &c. for the iron rails, a rough sketch or section of all the different routes intended to be passed by the rail-way should be made, from which, and a view of the ground, the engineer will be enabled to determine the place, and also the extent of the inclined planes which will be required in passing the steeper parts, or the rising ground to which these planes are to be employed: it will always be desirable to get them as short as the site of the place will admit.

"When sudden valleys present themselves approaching to higher ground, it will be necessary so to conduct the line as to cut into the hill at each side, and the cutting from the latter will be useful in raising the road-way of the former. On ap-

proaching rivers or brooks, which it is determined to pass, it will be necessary to keep up the rail-road to a higher level by embankments, and on passing the water to raise a platform on purpose for it, composed of piers of masonry or columns of iron, with a covering of iron also to receive the rails; or a bridge altogether similar to an aqueduct bridge will answer the purpose. Rail-ways may be divided into single and double: by the former are understood, when a single road only is formed; by the latter, when two or more are made for the ready passage of waggons up and down the road. Single roads are generally made, including horse and attendant paths, four yards wide; and double ones vary from six to eight yards wide, exclusive of all the common appendages of such roads, of drains, fences, &c. &c.

"Every tram or rail-road must be provided with passing places; a passing place consists in forming large plates of cast-iron, in such a manner as to admit of common rails being joined to them, and which will allow the waggons traversing the road to pass off into another or adjoining track. The cast-iron plates at the passing places should be somewhat stronger than the common rails, as at the passing places there is the greatest wear and tear upon the whole line. The iron moveable tongues should be of wrought iron, and made about two feet six inches or three feet long, stand-

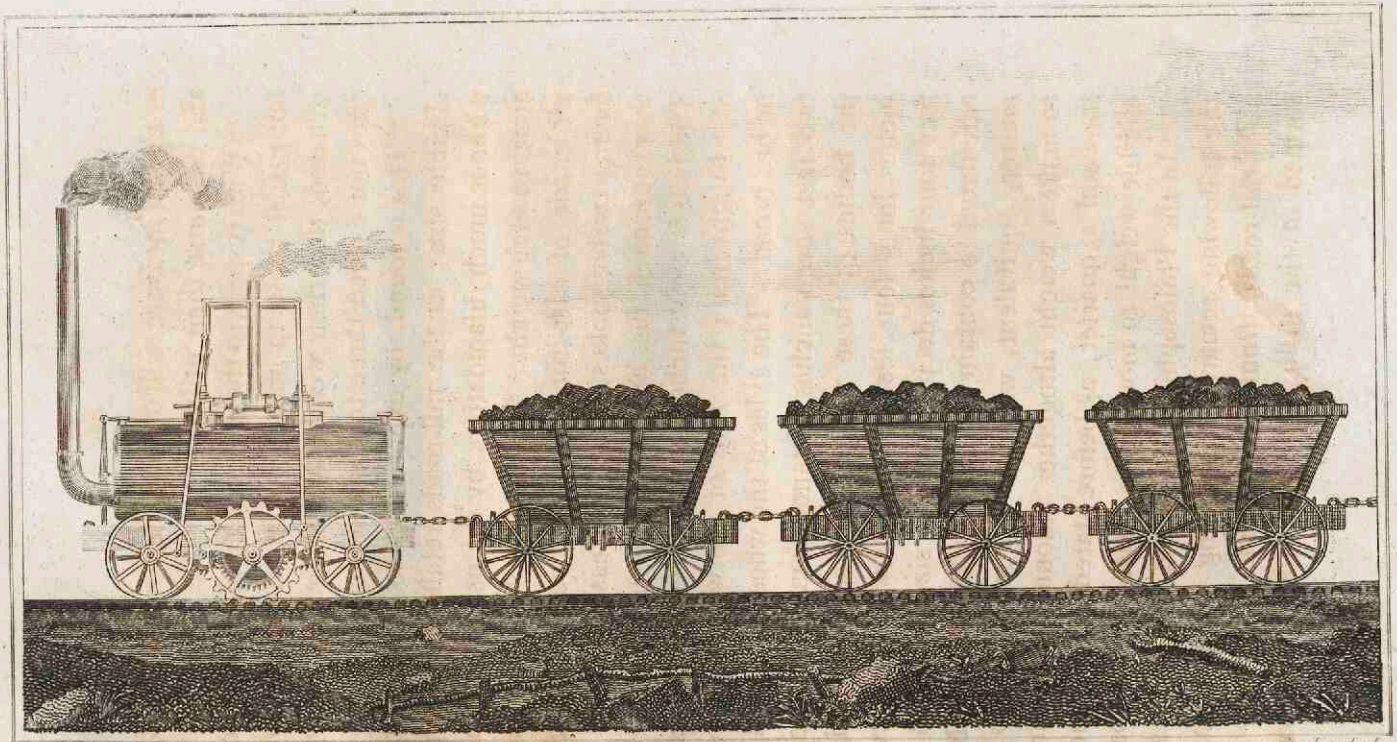
ing up upon the plate equal in projection to the highest part of the rim of the common rails. It should be on a good strong axis or pin, that it may be strong and yet allow of being easily turned round, which it will require to be every time the waggons are passing by the different tracks up and down the rail-way. In passing deep descents, pieces of cast or wrought-iron must be provided, called sledges or slippers ; these are provided to be placed under the wheels of the waggons to prevent their too rapid descent, and are similar in principle to the same kind of instrument made use of, and appended to our road waggons, for putting under the wheels on their going down a hill. When the whole iron rail-way is fixed and levelled to the satisfaction of the engineer, it will be necessary to begin to prepare the horse and attendant paths: the foundation of the former should be, if possible, composed of good lime-stone, broken into small fragments, and strewed to the consistence of at least from 10 inches to 14 inches in thickness, rather convex towards the centre of the path ; upon this, large screenings of gravel should be laid : the attendant path should be firm and regular, with a gravelly surface. The horse tracks and rails ought to be always kept clear and free from soil, which is constantly collecting on rail-roads of great traffic ; and they ought also to be properly drained and kept dry at all seasons of the year ; as on this,

in a great measure, will depend their substantiality, and of course their utility.

" With respect to the waggons employed on iron rail-roads, those in most general use are so constructed, that their weight, including their lading, does not exceed three tons and a quarter.

" This is found, by experience, to be the most eligible size; as the rail-roads retain their shape without much dilapidation, by the use of waggons equal to such weight. The wheels of the waggons are made of cast-iron, two feet five inches high, having twelve spokes, which increase in width as they approach the hub or centre of the wheel. The hub is eight inches long, and receives an axle of wrought-iron; the rims of the wheels are two inches broad. The axles of the wheels are fixed at two feet seven inches distance from each other; the bodies of these waggons are seven feet nine inches long, four feet five inches wide, and two feet four inches deep; and this sized waggon is calculated to contain the quantity of coal or other matter, equivalent, with the waggon added to it, to make a weight altogether amounting to three tons and a quarter, as before stated, as the most eligible weight to move upon a cast-iron rail-road.

" In the Philosophical Magazine, July 1811, are the following remarks concerning waggons, and also rail-roads, from which some idea may be formed of the utility of such roads. ' The wag-



Engraved for "*Observations on a General Iron Rail way*" Pub.d by Baldwin Cradock & Joy London.

J. Blenkinsop's Patent Steam Carriage, Middleton near Leeds.

Capable of moving One Hundred Tons 3 1/2 Miles in Hour, on a Level Rail Road.

gons on our cast-iron rail-roads have not received the improvements of which they are capable; but with their present disadvantages, the following facts will evince the great saving of animal force to which rail-ways have given rise: first, with a declivity of one and a quarter inch per yard, one horse takes downwards three waggons, each containing two tons: second, in another place with a rise of $1\frac{6}{10}$ths of an inch per yard, one horse takes two tons upwards. Third, with eight feet rise in 66 yards, which is nearly one fourth of an inch per yard, one horse takes two tons upwards. Fourth, on the Penrhyn rail-way, (same slope as above) two horses draw downwards four waggons, containing one ton of slate each. Fifth, with a slope of 55 feet per mile, one horse takes from 12 to 15 tons downwards, and four tons upwards, and all the empty waggons. Sixth, at Ayr, one horse draws on a level five waggons, each containing one ton of coal. Seventh, on the Surrey rail-way, one horse, on a declivity of one inch in 10 feet, is said to draw 30 quarters of wheat. From these cases, and the known laws of mechanics, we may perhaps safely infer, that where the apparatus is tolerably good, and well constructed, and the slope 10 feet per mile, two horses may draw five tons upwards, and seven tons downwards.

"'In cases in which inclined planes are to be had recourse to, to carry the rail-road over high ground,

(and as there are several now passing such ridges,) the mode pursued in raising the waggons may not be unacceptable. The common plan is by a perpetual chain suspended at each end: it is so contrived, that the waggons disengage themselves the moment they arrive at the upper or lower extremity of the inclined plane. In some cases, the laden waggons descending serve as a power to bring up the empty ones; but where there is an ascending as well as a descending traffic on the rail-way, steam-engines, water-wheels, or other machinery, to answer the same purpose, are used. At Chapel le Frith there is an inclined plane of 550 yards. On the proposed rail from Glasgow to Berwick several inclined planes will be required, the summit of that rail-way being 753 feet above the level end of Berwick quay. As to the expence of rail-ways, they are inconsiderable in comparison of canals.

"'According to Mr. Fulton, the cost of a single rail-road, with sufficient crossing places for a descending trade, was estimated at 1,600*l.* per mile. In Dr. Anderson's Recreations, 1,000*l.* is mentioned as the estimate for a double one. However, Mr. Fulton's is most likely to be the nearest to accuracy, as his calculations were made from observation, and embraced the whole minutiæ of such a work.

"'The principal rail-ways in England and Wales are, the Cardiff and Merthyn, 26¾ miles long, and

running near the Glamorganshire canal; the Caermarthen; the Sexhowry, 28 miles, in the counties of Monmouth and Brecknock; the Surrey, 26 miles; the Swansea, 7½ miles; one between Gloucester and Cheltenham; besides several in the north of England.'"—*Martin's Circle of the Mechanical Arts.*

EXTRACT, No. 3.

(*Partington, on the Steam-Engine.*)

"The great practical use of machinery to a commercial country is so well known, and its superiority to animal force so universally acknowledged and felt in every branch of our manufactures, that but little apology will be necessary for introducing to the man of science and practical artizan, a work, the avowed object of which is, to render the uses and general principles of the steam-engine familiar to every class of persons. That it has enabled England to support a proud pre-eminence, both in arts and political power, is equally apparent; and it is a fact much to be deplored, that while some of the least important of the arts connected with domestic life, have been illustrated and explained by men celebrated for scientific research, a description and account of the uses of

this stupendous machine have been left to the Cyclopædias, and other works of a general nature.

"To the mining interests this valuable present of science to the arts has been peculiarly acceptable; as a large portion of our now most productive mineral districts must have long ere this been abandoned, had not the steam-engine been employed as an active auxiliary in those stupendous works. In draining of fens and marsh lands, this machine is in the highest degree valuable; and in England, particularly, it might be rendered still more generally useful. In practice it has been ascertained, that an engine of six-horse power will drain more than 8,000 acres, raising the water six feet in height; while the cost of erection for an engine for this species of work, including the pumps, will not exceed 700*l.* This is more than 10 windmills can perform, at an annual expenditure of several hundred pounds; while, in the former case, the outgoings will not exceed 150*l.* per annum.

"To the mariner, also, the steam-engine offers advantages of a no less important and novel nature than those we have already described. By its use he is enabled to traverse the waters, both against wind and tide, with nearly as much certainty, and, as the machinery is now constructed, with much less danger, than by the most eligible road conveyance.

"In proof of the speed of these vessels, it may be sufficient to state, that the passage from or to London and Margate, which is more than 80 miles by water, is often performed in the short space of six or seven hours! *It too frequently, however, happens, that the faults of any new invention are unjustly magnified, while its real advantages are seldom duly appreciated;* and this axiom has been fully verified, in the clamour so unjustly raised against the application of the steam-engine to nautical purposes. Accidents are now, however, of but rare occurrence; and it is more than probable, that the great improvements that have been made in the boiler and safety-valve, will effectually secure these parts of the engine from a recurrence of those tremendous explosions which unfortunately characterized the first introduction of steam navigation.

"And, lastly, the political economist must hail with the most heartfelt gratification, the introduction of so able and efficient a substitute for animal labour as the steam-engine. It has been calculated that there are at least 10,000 of these machines at this time at work in Great Britain; performing a labour more than equal to that of 200,000 horses, which, if fed in the ordinary way, would require above 1,000,000 acres of land for subsistence; and this is capable of supplying the necessaries of life to more than 1,500,000 human beings.

"We have hitherto viewed the steam-engine, when employed as a substitute for animal force, in giving motion to mills, raising of waters, and a variety of other employments, all of which, however, are of a fixed and stationary nature. But some progress has likewise been made towards the application of the same power to moveable machinery, and when constructed for this purpose it is called a *locomotive engine.*

"The employment of an internal mechanism to impel waggons on a plane road is of very early date, but the first application of the steam-engine to this purpose took place, we believe, in the Royal Arsenal at Paris, towards the close of the last century. From this time till 1802,* but little progress appears to have been made in the use of this species of wheel carriage; but about the latter period, Mr. Trevithick commenced a series of experiments on the use of the high-pressure engine

* The high-pressure engines of Messrs. Trevithick and Vivian [the patent is dated March 24, 1802] were expressly intended for the propelling of carriages upon rail-roads. When employed for this purpose the boiler was composed of cast iron of a cylindrical form; this was mounted horizontally upon four wheels, the cylinder of the engine being placed vertically on the end. Two connecting rods, descending from the cross bar of the piston, were then made to communicate motion to the wheels by means of a crank; no fly wheel being necessary, the momentum of the carriage carrying the cranks past the lines of the centre.

for the above purpose; and this, with some improvements, has since been adopted.

"When these engines were first tried, it was found difficult to produce a sufficient degree of re-action between the wheels and the track road, so that the former turned round without advancing the vehicle. This was remedied by Mr. Blenkinsop, who, when he adopted this species of conveyance, took up the common rails on one side of the whole length of the road, and re-placed them with rails which had large and coarse cogs projecting from the outside. The impelling wheel of the engine was made to act in these teeth, so that it continued to work in a rack the whole length of the road.

"An engine of four horses' power, employed by Mr. Blenkinsop, impelled a carriage lightly loaded at the rate of ten miles an hour; and when connected with 30 coal waggons, each weighing more than three tons, it went at about one-third of that pace.

"The application of the steam-engine to impel carriages on the public roads, has hitherto been considered as a refinement in mechanics, rather to be wished for, than a matter of reasonable expectation. It has however been stated that a vehicle of this description is now constructing in Ireland, intended as a stage coach, and it is added, that when loaded with a weight equal to four tons, it

will be enabled to advance at the rate of 15 English miles per hour. *But it must, we think, be sufficiently apparent that the employment of this species of prime mover on a common gravel road, would be in the highest degree destructive, and a considerable increase in the toll would be the certain consequence.*

"In proof, however, that the necessity of employing an iron track road for these vehicles is not so serious an objection as at first view might be supposed, more particularly in our mining districts, the neighbourhood of Newcastle alone affords, within an extent of 28 square miles, more than 75 miles fitted for this species of conveyance; and it is a well known fact, that there are many situations in which iron rail-roads might be advantageously employed, in which it would be quite impossible to open a navigable canal."

To the Commitee of the Promoters of the intended Rail-way from the Cromford Canal to the Peak Forest Canal.

GENTLEMEN,

In pursuance of your directions, I have examined the country between the Cromford and the Peak Forest Canals, and have taken the levels for a rail-way in the most direct line of communication with

them without diverging for the purposes of any local trade, which in fact would not be materially affected by any variation to the east or west; and taking into consideration the elevated, mountainous, and occasionally precipitous district of country through which it passes, (the summit level of the rail-way being a thousand feet above the Cromford Canal, and upwards of eleven miles in length,) the line on the whole is exceedingly favourable.

I have drawn a plan of the country to accompany this Report, which will assist in explaining the course of the rail-way; the line is laid down from actual admeasurement, the roads connected with it from surveys which Mr. Heacock obligingly lent me, and from the general maps of the county, correcting them by my own observations: the general features I ascertained by compass bearings and by sketches taken at the same time, which are sufficiently accurate for the purpose.

The rail-way commences at the canal half a mile distant from Cromford by an inclined plane, which attains an elevation of 465 feet, and will pass over the summit of the road between Cromford and Wirksworth at Steeple House, by an archway 20 feet higher than the surface of the road; it proceeds a short distance on a level towards Middleton Cross, where a second inclined plane is necessary, which rises 265 feet; it then

continues on a level to the summit of the Via-Gellia, between Cromford and Hopton, which it must cross by an archway, when a third plane of 60 or 70 feet rise and about $3\frac{1}{4}$ miles distant from the commencement of the rail way, reaches an elevation of about 800 feet above the canal, which may be continued nearly 12 miles, passing Brassington Moor, and on the lowest part of the hill to the left of a high rocky point near Mr. Gregory's of Harbro'; thence more westerly, over the lowest part of the ridge where the Ashbourn and Bakewell road passes, between Long Cliff and Straight Knoll; it then inclines more northerly, leaving the high hill of Mininglow to the right, till it approach Pike Hall, where the range of high land terminates in a northerly direction, and it becomes necessary to go westwardly and embank the valley near Mininglow farm, and pass between Gotham and Pike Hall. It crosses the Newhaven and Pike Hall, and the Ashbourn and Bakewell roads, leaving Newhaven Inn half a mile to the left, and inclines towards the Manchester road; when from the gradual rise of the ground, it is necessary (if the same level be preserved) to tunnel about 1400 yards, the lowest part of the range being 75 feet above this level of the railway; it then proceeds above Custard House and below Mr. Abbot's of Coatsfield, to the Moneyash and Hartington road, where a fourth plane attains

the summit level of 1000 feet above the Cromford Canal, and 760 above the Peak Forest Canal at Whaley. If a tunnel of 1400 yards through lime-stone should be thought objectionable, its neces-sity may be obviated by an additional plane. The fourth plane will then take place either near Elke-low hill or at the hill between Mr. Alsopp's of Burntcliff, and the Manchester road; and the fifth, to attain the summit near Hurdlow, dividing the ascent of the single plane with a tunnel, into two smaller ones without it. From the top of the plane near Hurdlow the level is continued over the lowest range of ground between Chelmerton Low and Brierlow, on the west side of the Man-chester road. The rail-way for three or four miles passes a rugged and uneven country to the Axe Edge range of mountains, its course being westwardly round Brierlow and Hindlow along the rocky hill side near Hillhead, then northwardly to the Harper hill lime-works, and westwardly under High Edge, to Dale Head, near Thirkelow Gate, where the country becomes very favourable, and continues so to the end. From Dale Head, the direction is northwardly along Ladmanlow and Burbage Edge, crossing the deep gully which divides the two hills, it passes to Edge End, (at which point the waters separate, running to the eastern and western seas:) the lowest part of the

range of mountain is 1140 feet above the Cromford Canal, and is so favourable for a tunnel, that the depth of 140 feet is passed by one of 500 yards long, through shale and coal measures. The summit level is continued through the tunnel and until it pass the Goyt road, and is altogether 11¼ miles in length. The line then descends 460 feet to the valley of the Goyt, by an inclined plane; and of necessity, from the abruptness of the rise at the foot of the hills, crosses the river Goyt into Cheshire, for a few chains only. From the bottom of this plane the level gradually leaves the river on account of the rapid descent of the valley, and passes along the side of the hill, until it cross the Manchester road, near Ferneylee, and continues forward to the east of Shallcross Hall, and there descends by a plane 265 feet into the valley at Horridge. There is a further fall of 45 feet to the Peak Forest Canal at Whaley Bridge, which may be passed either by a short plane or by continuing the canal to Horridge Bridge, the feeder being 15 feet higher than the foot of the plane; the distance to the canal is 50 chains.

I have perhaps been more minute than is necessary in describing the course of the rail-way, but it will afford information to those gentlemen, who are locally interested. The Plan will explain to the Committee the causes which make the circuitous

course round Buxton unavoidable; yet on the whole the direction of the line is favourable and the distance less than 32 miles.

Although from the irregularities of a mountainous country, the expence of forming the line will be considerable, on the other hand it abounds with excellent materials for making the rail-way. In a survey taken solely with a view of ascertaining the direction of the line, the necessary data are not afforded on which an estimate can be formed, but I have a feeling amounting almost to conviction, that the sum originally stated (£4,000. per mile on the average) will be sufficient for the purpose, and it may not be improper to add that I have had many years' experience in similar works to assist me in forming an opinion.

The rail-way is proposed to be constructed on the system of levels and inclined planes, by which steam engines may be employed as the moving power to convey the waggons. The locomotive or travelling engines being used on the level parts, and stationary engines at the inclined planes. Rail-ways so constructed, are equally adapted to the employment of engines or horses, for on the level parts, the friction of the wheels of the locomotive carriages against the rails, is sufficient to propel them. As steam engines, where the trade is extensive, have many advantages over horses, conveying at much less cost and with greater ex-

pedition, it would be desirable for the Committee to obtain powers, to enable the company of proprietors, either to become the carriers, or agree with individuals, who may be disposed to embark capital in the waggons and engines, for that purpose; this is the more necessary, as from the greater velocity with which the steam engines may travel, horses and engines could not use the rail-way in common, without disadvantage.

In compliance with the wishes of the Committee, I have estimated the probable trade of the rail-way. Although such statement can only be considered as an approximation to the truth, it is self-evident that a communication which forms the connecting link to several well-established canals—which shortens the distance of intercourse between the great manufacturing districts of Lancashire, and of Derbyshire and Nottinghamshire, and also of the eastern and southern agricultural counties—which will save time and expence in transport—which will convey as cheaply and with more expedition than a canal, and be effected at one-fourth of the cost—which has in its course valuable mines and extensive quarries of lime-stone and grit-stone—it is evident (I repeat) that such a communication cannot fail to remunerate amply the promoters of the measure.

A few observations are necessary to explain the grounds from which the amount of some of the

articles of the estimate is derived. The population of Lancashire in 1821 was 1,052,859, and must have increased considerably since that period, from the immense increase of manufactures and trade, and may now be estimated at 1,200,000, which is more than one person to each acre of land; and the average of England being three acres for each person, the subsistence of two-thirds of Lancashire must be drawn from other sources; which proportion of its whole annual consumption of grain is upwards of 400,000 tons: of this I have supposed a tenth part to pass along the rail-way. The amount of cotton wool annually imported is 80,000 tons: the produce of sheep's wool 20 years ago was 70,000 tons, and must have increased. Of these two articles, some will pass one way and some both, in their raw and their manufactured state. The coals taken from Cromford exceed 40,000 tons annually, and will of course increase with the greater facility of conveyance. The Hopton Wood stone has hitherto been limited in its sale only by the means of conveying it away, and will become an extensive article of carriage. The large flat paving-stone, which is of excellent quality, and stone slates produced at Goyt's Clough Quarries; the lime-stone, grit-stone, minerals, &c. will be very considerable; but without entering further into particulars, I proceed to the statement deduced from them, which I will call the

PROBABLE REVENUE.

	TONS.		£.
Grain as before stated	40,000,	carried 30 miles, at 2*d.* per ton per mile	10,000
Coal	60,000,	on the average carried 10 miles, at 1*d.*	2,500
Lime and Lime-stone	10,000,	8 miles, at 1*d.*	333
Paving Stones, Slate, &c.	10,000,	30 miles, at 1*d.*	1,280
Hopton Wood Stone and Grit-stone	5,000,	average 20 miles. at 1*d.*	465
Pig Iron, Bar Iron, and Lead	4,000,	30 miles, at 1*d.*	500
Timber, Hay, &c.	1,000,	30 miles, at 1*d.*	125
Wool and Cotton (raw)	2,000,	30 miles, at 2*d.*	500
Nottingham, Derby, and Leicester trade to Manchester and the Neighbourhood	2,000,	30 miles, at 2*d.*	500
Manchester trade to the Southward and Eastward,	5,000,	30 miles, at 2*d.*	1,250
Huddersfield and Yorkshire trade	1,000,	30 miles, at 2*d.*	250
Groceries, Spirits, &c.	1,000,	30 miles, at 2*d.*	250
Sundries, as Hops, Cheese, Salt, Earthenware, Dying and Bleaching Goods, Moulding Sand, Provisions, and many other articles	3,000,	30 miles, at 2*d.*	750
			£18,676
From which deduct the repairs of 32 miles of Railway, at 30£. per mile	960		
Agency and Incidental Expences	1,040		2,000
Being 11 per Cent. on a capital of £150,000.			£16,676

Exclusive of the above rates, a charge is intended to be made for the use of the Steam Engines on the Planes, and to cover the expence of the cost and maintenance of the Locomotive Engines, all of which may be comprehended under the head "Carriage," and together will not amount to a penny per ton per mile.

I have the honour to be, Gentlemen, your most obedient Servant,

Butterley, 1st September, 1824. JOSIAS JESSOP.

Mr. Jessop's second Report to the Committee of the proposed Rail-way from Cromford to the Peak Forest Canal at Whaley Bridge.

GENTLEMEN,

Having completed the survey of the proposed rail-way from Cromford to the Peak Forest Canal at Whaley, and prepared the plans necessary to enable you to proceed to parliament in the next session; I now submit to you the estimate for a double line, formed from accurate admeasurement, of which the particulars are detailed in the accompanying paper, and the following is an abstract.

	£	s.	d.
Common Forming,	2319	19	0
Cutting and Banking,	17,015	10	8
Face-walling to Embankments	1175	17	0
Bridges and Culverts,	1633	10	0
Tunnel at Burbage Edge,	5700	0	0
Stoning,	7656	0	0
Fencing,	6400	0	0
Cast Iron Rails,	61,950	0	0
Blocks, Nails, and Laying Down,	5810	0	0
Land,	4800	0	0
Houses and Compensations,	1000	0	0
Wharfs and Warehouses,	2000	0	0
Contingencies at 10 per Cent	11,746	0	0
	£129,206	16	8
Steam Engines, &c. for the Inclined Planes	20,000	0	0
	£149,206	16	8

Although I have made considerable allowance for the advance on iron and the probable rise of labour, yet the estimate does not exceed the sum originally stated as the probable expence.

In the direction of the rail-way I have not seen reason to make any material alteration from the course described in my former report, but to avoid the necessity of tunnelling through the high ground near Haven Lodge, I have made the rail-way ascend an eleventh of an inch in a yard after passing the embankment near Pike Hall, and continued that ascent for 3½ miles, which leaves a deep cutting of 24 feet at the brow of the hill; this slight rise will not be attended by any inconvenience, as its obstruction to carriages will not be greater than is caused by the curves of the rail-way: it will only require the precaution of laying the curves in this part perfectly level.

As the general opinion of rail-ways has been formed from those of long standing, and imperfect construction,—no public one on the new system being yet completed, their effect and advantages are probably much under-rated, and it may be necessary that I should notice the improvement which has so greatly extended their utility, and given them so decided an advantage over all known modes of conveyance for expedition and economy combined with safety.

Every one is aware of the immense advantages

that have accrued to this kingdom from the introduction of steam-engines to our mines and manufactures, which by giving cheapness and facility to labour, and by enabling one man to direct the power which performs the work of hundreds, has raised the country to its present distinguished pre-eminence,—had any one ventured to predict it forty years ago, when these changes were in their infancy, there would have been some reason to disbelieve that so important an effect could be produced by a cause apparently so inadequate; but with the experience of the past, there can scarcely be a doubt that these advantages will extend to our modes of conveyance, as it is only an application of the same principle, the substitution of a cheap and powerful mode of performing labour, in place of a more expensive one.

The mode of conveyance that most nearly assimilates to rail-ways, is canals: but to them, the agency of steam cannot be available, as they are limited to the size of their loads, and as regards utility, to the speed of conveyance; for to draw a load of 40 or 50 tons with double the speed that is now done by one horse, could not be effected on a common canal by any power that can be applied.

The comparatively small expence of forming rail-ways will be a cause of extending our resources and finding new channels for capital and

industry, that would for ever have been neglected, if there were only the more expensive modes of roads or canals to resort to; the first being expensive in the carriage,—the latter in the execution: —but a rail-way can, according to circumstances, be made at from a half, to a fourth of the expence of a canal,* and convey goods more cheaply, which would render them lucrative when any other mode would be ruinous.

The old system of forming rail-ways, was to make them with a regular inclination, adapted to the natural declivity of the country through which they passed; so that a horse had to perform the labour of ascending as well as to overcome the friction of the carriages, (for beyond a very small rise, a locomotive engine will not work to advantage); the improvement has been to separate as far as possible, the mechanical power from the friction, concentrating the power at fixed points, where by means of stationary steam-engines applied to inclined planes, the ascents are overcome at once, leaving only the friction and the distance to be done by the horse or the locomotive engines. A rail-way on this system is therefore equally suited to a mountainous or a level country,

* A canal to form the same connection as is proposed by the rail-way, was estimated in October, 1810, by the late Mr. Rennie, to cost £650,000.

and either horses or locomotive engines may be used upon it (though not both with advantage at the same time from their difference of velocity,) the waggons being drawn along by the locomotive engine, which derives its motion from the contact and friction of the wheels against the rails, the wheels being attached directly to the steam-engine.

Where a rail-way is level, the power required to move the waggons is little more than the friction, which is found to amount to about a two-hundredth part of the weight to be conveyed; or in other words, a power of one pound applied in the direction of the motion, will draw forward 200lbs. but as this supposes all parts of a rail-way to be equally perfect, it is right in practice not to calculate on more than 150lbs.

The power to which a locomotive engine can be worked on a level rail-way, by the friction of the wheels against the rails, before the wheels slide or revolve without advancing, varies under the circumstances of the weather:—when the rails are wet, the friction is equal to 4-32 parts of the weight and when dry 5-32, but practically a tenth part of the weight only should be calculated on as the effective power.—A locomotive engine of 10-horses power will draw 120 tons at the rate a draught horse generally travels, or 50 tons at the rate of six miles in an hour: the engine requires

the attendance of only a man and a boy, at a daily expence of 5s.; the coals consumed in 10 hours, would be from 20 to 30 cwt.; therefore the expence altogether would be less than 30s. per day, for which 50 tons may be conveyed 60 miles in 10 hours, which is less than half a farthing per ton per mile; so that making ample allowance for delays, the return of the empty carriages, the cost and maintenance of the engines, and providing the waggons, the expences are altogether inconsiderable. I may here remark that the rate of travelling may be increased to surpass that of mail coaches, and that the locomotive engine will as readily convey 25 tons (including its own weight) at the rate of 12 miles an hour as double the weight in twice the time.

It is more than 20 years since the locomotive engine, worked simply by the friction of its wheels, was used upon the Myrthyr rail-way in South Wales; but owing to the rail-way being made on the old principle, with a declivity, it had not the advantage that was expected. Its next application, was on the rail-way from Mr. Bradling's collieries near Leeds, where a cogged wheel worked into cogs upon the side of the rail-way to propel the waggons, but in this instance the advantage was inconsiderable from the same cause, the ascent of the rail-way. It was then intro-

duced among the Newcastle collieries, and observation soon pointed out that it was most effective, as the rail-way approached to a level: where ascents or descents were unavoidable they were obviated by the introduction of inclined planes, up which the loaded waggons were drawn by stationary engines, or the loaded waggons descending drew up the returning empty ones. Their present degree of perfection has thus been gradually attained, and four or five years' experience has fully proved their simplicity, cheapness, and regularity.

On the proposed rail-way where the ascent from Cromford by four inclined planes is nearly 1000 feet, and the descent to the Peak Forest Canal between seven and eight hundred feet, by three others, the average cost of working each plane will be about a halfpenny per ton.

When these very moderate expences of carriage are considered, it furnishes an additional argument in favour of the opinion I expressed in my former report, that a rail-way forming so important a connection between rich and populous districts,* and with canals which yield an abundant

* The proposed rail-way will form a direct communication between the great manufacturing district of Manchester, and the manufacturing districts of Derby, Nottingham, and Leicester.

revenue, cannot be a speculation of hazard, but must be a secure and a lucrative mode of investing capital.

I have the honour to be, Gentlemen,
Your most obedient servant,
JOSIAS JESSOP.

Butterley Hall, Nov. 29, 1824.

Prefatory Remarks to the Fourth Extract.

A careful and particular attention to the following extract cannot fail to convince the whole country that every branch of our turnpike-roads, as now established, is radically bad, and totally inadequate to answer the purposes required; and it is confidently expected, when the plan now submitted to public consideration shall be viewed in comparison with the existing method, that the great capital demanded for the establishment of a General Iron Rail-way may not prove any hindrance to its adoption, because the annual expenditure to keep it in perfect repair, compared with that of the common turnpike-roads, would be so trifling as to claim universal attention.

The most promising feature in this plan, and from which it is expected that the public may draw a never-failing annual profit, is the introduction of

steam-engines to supply the place of horse-power generally in all stage-waggons, caravans, and coaches; and it is humbly presumed, that were the attention of parliament, and the skill of our numerous engineers (now wasted in bolstering up a system which mocks all their exertions, and is completely hopeless in all its bearings,) directed towards a General Iron Rail-way, it would be a continually improving property both to the country and to every individual subscriber; whereas turnpike-roads are not only unprofitable, but millions have been, and now are frittered away upon them, without the most distant prospect of any advantage, whether nationally or individually considered.

If, after minute investigation, it should be found that the number of horses now employed in mail-coaches, stage-coaches, caravans, waggons, and post-chaises, amounts to five hundred thousand, agreeably to the calculation already given for their keep, viz. 20*l.* each, per annum, the yearly expen diture of ten millions might be completely saved to the nation, by substituting mechanic-power for horse-power, without taking into account the original cost of the stock of horses, to keep up which such vast sums of money are continually expended.

EXTRACT, No. 4.

"The funds placed by the legislature at the disposal of the Commissioners for the care of turnpike-roads are very considerable, and might be supposed, with proper management, fully equal to the object: they are principally from toll duties, and a proportion of statute labour.

"As long as it shall be necessary to raise large sums for the maintenance of roads, the present means must continue; toll duties, although liable to many objections, are so *immediately* and *effectually* productive, that little hope can be entertained of the possibility of their being reduced, until a continuance of a better system shall have materially amended the roads, and reduced the expence, so as to leave means for extinguishing the heavy debt owing by the country for this branch of the public service.

"Statute labour, in kind, was decreed by Parliament at a time when no better means could be devised, when a circulating medium was deficient, and when a fair quantum of labour could not, in many parts of the country, be obtained for money.

"Personal labour, for a public service, can never be made profitable, or fairly productive; at the same time it is liable to the great objections of

being made an instrument of partiality and oppression under the direction of a class of men with whom such a power should never be lodged, and over whom, in this instance, no adequate controul can be placed.

" The causes which operated to induce Parliament to resort to personal service having ceased, it will be found expedient to commute statute labour for a moderate assessment in money. This has been effected with great advantage in Scotland, by most, if not all of the local and county Acts for turnpike-roads.

" The sum of money annually raised in the kingdom for roads is very great, and would be found, if carefully examined into, much beyond the general belief. Government have procured information as to the sum raised annually for *parish* roads (generally denominated highways), but they have not yet enquired into the amount of the much greater sum raised for the maintenance of the *turnpike-roads*, nor into the amount of the debt incurred for the same purpose.

" These funds, considerable as they are, continue to be expended, *nominally*, under the direction of Commissioners, but *effectually* and *practically* under the Surveyors, over whom the Commissioners have very uncertain means of useful controul; and there is no doubt that much abuse exists in the expenditure, partly from ignorance, but much

more from peculation and patronage very much misplaced.

"Under such circumstances, the protection of the funds would be promoted by the inspection and controul of a superior officer; and, finally, it might be desirable that a report from each trust should be made to Parliament of the receipt and expenditure for the year.

"That the funds provided by Parliament for the roads are either insufficient for the object, or that they are improvidently expended, is best proved by the numerous applications to Parliament in every session for extension of powers and increase of tolls, setting forth, that without such aid the debts cannot be paid, nor the roads kept in repair. In the Session of Parliament, 1815, thirty-four such petitions were presented; and in the session of 1816, thirty-two; all which bills were passed *as a matter of course*, the petitioners being only required to prove the *actual necessity* to the Committee, but no enquiry seems to have been made as to the *cause* of that necessity.

"An efficient, uniform, and constant controul of the expenditure of road funds, and an annual report of the result to Parliament, would enable the House of Commons to form a judgment whether the deficiency proceeded from inadequacy of the means, or from improvident expenditure, and thereby that honourable house would

be enabled to use means for preventing the growing amount of debt which the petitions presented each sessions sufficiently show to be increasing to an alarming degree, and which, being incurred under the authority of Parliament, must ultimately become a claim upon the justice of the country.

"Upon consideration of this important subject, it appears that a review of the turnpike laws has become indispensable, for the purpose of altering and amending obsolete, useless, and oppressive regulations, and for substituting others more consonant with the present state of society. This review is required by experience of the inadequacy of the present system to the great object of forming the best and easiest communications through every part of the country, with a due regard to economy, and for preventing the increase of a debt which has been allowed, *in silence,* to accumulate to an extent that will hardly be credited when properly and accurately ascertained.

"Many and important improvements have originated from the good sense and zeal of individual commissioners, or from particular district meetings, the good effects of which have been confined to the place of origin; such improvements have also ceased to operate on the death or removal of their authors, and have been thereby finally lost for

want of a general superintendance, which would have an interest in the improvement of the whole

"The defective state of the roads, independently of the unnecessary expence, is oppressive on agriculture, commerce, and manufactures, by the increase of the price of transport, by waste of the labour of cattle and wear of carriages, as well as by causing much delay of time.

"Under an efficient and responsible executive department, established and directed by the wisdom of Parliament, this subject would be brought within the means of examination and regulation, and many local improvements which have been confined to small districts would be brought forward, and communicated generally for the public benefit.*

"The author has abstained from any notice of the parish roads, although their condition, and the

* Since this Essay was written I have visited England, and have found, on a journey of many hundred miles, scarcely twenty miles of well-made road. In many parts of the country, and especially round London, the roads are in a shameful condition. This must strike the public; and sooner or later the good sense of the English nation will feel the necessity of adopting some means of improvement.—*Edgeworth's Essay, preface, p. 7.*

In Ireland the cross-roads are generally better than the great roads, and comparing all the roads in that country with the roads in England, the shameful inferiority of the latter would evidently appear.—*Edgeworth's Essay, p. 46.*

state of their funds, are more deplorable than that of the turnpike-roads. The legislative enactments for their maintenance and repair are so inadequate to the object, that they may be considered as being placed almost out of the protection of the law.

"There can be no apparent good reason why such a distinction should be made between the two description of roads; and their being both placed under the care of the commissioners, with the benefit of the scientific direction of a general surveyor, would ensure an equal improvement of the parish roads.

EXTRACT, No. 5.

"*The foregoing remarks on roads cannot be better concluded than by the following Extract from the Report of the Committee of the House of Commons in* 1811.

"'The many important advantages to be derived from amending the highways and turnpike-roads of the kingdom need hardly be dwelt upon. Every individual in it would thereby find his comforts materially increased, and his interest greatly promoted. *By the improvement of our roads every branch of our agricultural, commercial, and manufacturing industry would be materially benefited.*

*Every article brought to market would be diminished in price; the number of horses would be so much reduced, that by these, and other retrenchments, the expence of five millions would be annually saved to the public. The expence of repairing roads, and the wear and tear of carriages and horses would be essentially diminished; and thousands of acres, the produce of which is now wasted in feeding unnecessary horses, would be devoted to the production of food for man.** In short, the public and private advantages which would result from effecting that great object, the improvement of our highways and turnpike-roads, are incalculable; though from their being spread over a wide surface, and available in various ways, such advantages will not be so apparent as those derived from other sources of improvement of a more restricted and less general nature.'

" The roads in Scotland are worse than those in England, although materials are more abundant, of better quality, and labour at *least* as cheap, and the toll duties are nearly double; this is because road-making, that is, the surface, is even worse understood in Scotland than in England. By a late discussion in Parliament on the subject of

* These advantages would be felt in a tenfold degree by the introduction of a General Iron Rail-way. AUTHOR.

mail-coaches paying toll, it was universally allowed that the roads in Scotland were in a deplorable state, and in their circumstances bankrupt. It is understood that the Postmaster-general was obliged to give up the mail-coach from Glasgow to Ayr, on the road towards Ireland, on account of the expence of tolls, and the bad condition of the road, there being 10 turnpike gates on 34 miles of road.

" The unnecessary expence attending the making of new roads in the manner hitherto practised, is one great cause of the present heavy debt upon the road-trusts of the kingdom. The principal part of the large sums originally borrowed have been sunk in the useless, and, in my opinion mischievous preparation of a foundation. This debt presses heavily on the funds of all the roads in England, and, in many cases, absorbs almost their whole revenue in payment of interest. In Scotland this pressure is still more heavily felt: indeed it is not of uncommon occurrence in that country for creditors to lose both principal and interest of their loans of roads.

" This causes not only a great and unnecessary loss in the first instance, and a deficiency of means for ordinary repair and maintenance of the roads, but it also discourages the formation of new roads. Were a better and more economical system gene-

rally adopted and acted upon, many great additions and improvements of the communications of the country would take place, from which, at present, the landholders are deterred by fear of the extent of the expence and the difficulty of obtain- loans of money." — *M^c^Adam on Roads, 5th edition*, 1822.

EXTRACT, No. 6.

Abstract of Returns of Turnpike-Trusts round London.

Name of Trust.	Length of Road.	Amount of Tolls, 1818.	Expences, 1818.	Debt.
Surrey New-road - -	6m. 440 yards	£ 9,210 0 0	£ 9,210 0 0	£ 9,000 0 0
City Road - - -	1— 440 ——	1,645 0 0	1,661 6 4	1,623 12 6
St. Mary-le-Bone - -	4—1584 ——	3,960 0 0	3,808 16 10	3,500 0 0
Kensington - - -	17—	14,660 tolls	12,933 18 8	11,500 0 0
Cannon Street - - -	1— 747 ——	1,167 0 6	962 9 2	3,519 18 6
New Cross - - -	39— 660 ——	11,833 8 3	11,660 11 8	2,464 16 0
Whitechapel - - -	34— 220 ——	12,450 0 0	13,086 2 1	2,300 0 0
Surrey and Sussex - -	57— 798 ——	14,606 10 0	14,758 18 7	3,750 0 0
Highgate and Hampstead -	20—	11,536 0 0	14,183 17 2	7,900 0 0
Hackney - - - -	6— 880 ——	4,355 0 6	3,942 0 0	2,100 0 0
Old Street - - -	1— 880 ——	1,520 0 0	1,255 0 0	——
Stamford Hill - - -	20— 880 ——	10,540 0 0	11,393 0 0	15,000 0 0
	210m. 489 yards	£97,482 18 9	£98,856 0 6	£ 62,658 7 0
		£464 4 per m.	£470 14 per m.	£298 7 per m.

Mc Adam on Roads, 5th edit. 1822.

EXTRACT, No. 7.

Abstract of Minutes of Evidence taken in 1819.

(See Mr. M'Adam's Work.)

Mr. William Waterhouse called in and examined.

Have not the tolls very much increased of late years under new Acts of Parliament?—It is my opinion that the tolls generally have doubled within these last fifteen years.

Have the roads improved in any degree in the same proportion?—No, they have not.

Have you calculated the average rate per mile which a coach with four horses pays for toll?—I have: it is my opinion that the average amount throughout the kingdom is 3½*d.* per mile; it was above 3*d.* when I took them above twelve months ago.

How many coach-horses do you keep?—About four hundred.

Mr. William Horne called in and examined.

Do you find that your horses that are employed in the stages near London wear out sooner than those at a greater distance?—Much sooner, I should think. I employ about four hundred horses myself, and I am sure I buy one hundred and fifty a year to support the number, and keep the stock in order. I consider that my stock wears out fully in three years.

Mr. John Eames called in and examined.

How long do you find that your horses upon an average last that are employed in the first stages from London?—My horses upon an average don't last above three years, in the fast coaches.

Including the mails?—Yes.

John Loudon M'Adam, Esq. called in and examined.

Have you any loose guess in your own mind as to the extent of the revenue, throughout the kingdom, raised for the purpose of maintaining roads? —I have been led to guess a million and a quarter a year, as the toll revenue, from the circumstance of there being five and twenty thousand miles of turnpike-roads in England and Wales.

That is an increasing revenue?—It is certainly increasing very much. I think the revenue has been increased by the increase of travelling, and particularly stage-coaches.

Has not it been the practice to augment the tolls considerably in all recent Turnpike Acts?— In the three sessions of Parliament preceding the present, I think there were about ninety petitions to Parliament for a renewal of acts, and an increase of their tolls, because they were in a state that they could not pay their debts with the assistance of Parliament.

Do not you believe that the present system of maintaining roads is the means of a continued increase of expence in the debt and tolls throughout England?—I think the debt is increasing very much throughout the kingdom, and that the debt is perhaps greater than the gentlemen in Parliament are aware of; at present tolls are increasing.

Do you consider that there is a corresponding improvement in the roads in proportion to the increase of the tolls and debt?—By no means; my belief is, that where the greatest expence is, there the worst management is, or rather, that the worst management produces the greatest expence.

Can you give any information as to the total amount of general debt on the roads now existing in England and Wales?—I have been inclined to believe that the debt at present amounts to about seven millions in England and Wales.

NOTE.

By reference to the "Returns of Turnpike Trusts round London," it appears that none of the turnpike roads defray the annual expence of repairs; that the debt is £298 per mile, where the receipts are the greatest in the kingdom. Taking all the turnpike roads throughout the country collectively, they are in debt £280 per mile, and nothing but a continual increase of tolls can ever be expected

from the present miserable state of the finances of our roads.*

EXTRACT, No. 8.

Parliamentary Report.

The following particulars are taken from the Parliamentary Report on the turnpike roads of the united kingdom.

In Edinburghshire there are 273 miles of turnpike roads; £12,110 annual income; income per mile, £44; amount of debt, £28,552; debt per mile, £104; annual expenditure, £16,070; expenditure per mile, £58; excess expenditure, £3,960; interest of debt, nil.

Lanarkshire, 371 miles of road; annual income, £27,744; income per mile, 74; amount of debt, £269,260; debt per mile, £725; annual expen-

* "Above fifty stage-coach journeys are made daily between Bristol and Bath: the author's observation leads him to the conclusion, that the toll duty paid by them does not indemnify the funds for the wearing of the roads.

"When the legislature shall have provided the means of putting all the roads in the United Kingdom into the best and fittest state for the accommodation of the agriculture and commerce of the country, they will naturally consider of the most proper mode of protecting them from injury, or *for indemnifying the funds for the effects of use, which are unavoidable, by imposing toll duties in a just and equitable proportion on the carriages occasioning such injury.*"—*M'Adam.*

diture, £25,579; expenditure per mile, £68; excess of income, £2,165; interest of debt, £21,845.

Renfrewshire, 185 miles of road; annual income, £13,702; income per mile, £74; amount of debt, £109,962; debt per mile, £594; annual expenditure, £8,057; expenditure per mile, £43; excess of income, £5,645; interest of debt, £1,593.

Ayrshire, 431 miles of road; annual income, £9,213; income per mile, £21; amount of debt, £36,066; debt per mile, £83; annual expenditure, £11,481; expenditure per mile, £26; excess expenditure, £2,268; extent of debt, £4,160.

Dumbartonshire, 56 miles of road; annual income, £2,192; income per mile, £39; amount of debt, £8,960; debt per mile, £160; annual expenditure, £2,211; expenditure per mile, £39; excess of expenditure, £19; amount of interest, £551.

Stirlingshire, 158 miles of road; annual income, £8,304; income per mile, £72; amount of debt, £49,891; debt per mile, £359; annual expenditure, £6,768; expenditure per mile, £42; excess of expenditure, £1,536; interest of debt, £1,520.

The annual income of all the turnpike roads in Scotland is £129,635; the total debt, £1,124,273; the annual expenditure, £152,820; the excess of expenditure, £6,671; the interest, £140,826; and the total number of miles of turnpike roads in Scotland, completed and not completed, 3,611.

TURNPIKE ROADS.

In all the other kingdoms of Europe, and in the United States of America, the management of Turnpike roads reposes in the Government, and great advantage is admitted to result from such a system. We are from circumstances inclined to think that our own Government have it in contemplation to submit some plan for the sanction of Parliament on this important subject; and that it is as a prelude to such a plan that the following papers have just been published, which, from their general interest, we copy at full length.

No. 1.

Annual Average of Income and Expenditure per Mile, with the Excess thereof, for the Years 1818, 1819, 1820.

Counties.	Miles.	Income per mile.	Expend. per mile.	Exc. of Income.	Exc. of Exp.
1 Bedford	248	£72	£72	—	—
2 Berks	319	48	47	1	—
3 Bucks	246	57	56	1	—
4 Cambridge	278	61	53	8	—
5 Cheshire	348	58	44	14	—
6 Cornwall	312	27	24	3	—
7 Cumberland	215	30	28	2	—
8 Derby	568	39	31	8	—
9 Devon	783	37	37	—	—
10 Dorset	347	29	29	—	—
11 Durham	359	53	43	10	—

4023 carried forward.

Counties.	Miles.	Income per mile.	Expend. per mile.	Exc. of Income.	Exc. of Exp.
Brought forward	4023				
12 Essex	247	£110	£95	15	—
13 Gloucester	897	57	35	22	—
14 Hants	797	33	33	—	—
15 Hereford	540	25	23	2	—
16 Herts	170	131	144	—	13
17 Huntingdon	146	55	68	—	13
18 Kent	616	89	69	20	—
19 Lancaster	640	121	125	—	4
20 Leicester	445	41	43	—	2
21 Lincoln	537	47	40	7	—
22 Middlesex	157	608	548	60	—
23 Monmouth	315	18	25	—	7
24 Norfolk	271	38	26	12	—
25 Northampton.	358	48	71	—	23
26 Northumb.	499	26	26	—	—
27 Nottingham	301	42	36	6	—
28 Oxford	342	60	58	2	—
29 Rutland	18	25	32	—	7
30 Shropshire	939	21	22	—	1
31 Somerset	756	56	50	6	—
32 Stafford	627	46	42	4	—
33 Suffolk	279	34	31	3	—
34 Surrey	281	157	149	8	—
35 Sussex	616	52	70	—	18
36 Warwick	460	44	35	9	—
37 Westmorland.	284	21	21	—	—
38 Wilts	768	55	50	5	—
39 Worcester	583	48	46	2	—
40 York	1426	61	69	—	8
	18,329				
Wales	2,591	14	19	—	5
Scotland	3,611	33	43	—	9
	24,531				

No. 2.

Average Annual Income per Mile in each County, 1818, 1819, 1820.

£6 Cardigan, Merioneth, Radnor; £10 Pembroke; £11 Carnarvon; £12 Kircudbright; £13 Montgomery; £15 Glamorgan; £18 Carmarthen, Monmouth; £19 Banff; £20 Peebles; £21 Brecknock, Ayr, Dumfries, Wigton, Shropshire, Westmorland; £25 Hereford, Rutland; £26 Northumberland; £27 Cornwall; £28 Denbigh, Aberdeen, Roxburgh; £29 Dorset, Flintshire, Kincardine; £30 Cumberland; £31 Elgin; £33 Hants; £34 Haddington, Suffolk; £37 Devon; £38 Blackmannan, Norfolk; £39 Anglesea, Berwick, Dumbarton, Derby; £40 Selkirk; £41 Forfarshire, Leicester; £42 Nottingham; £44 Edinburgh, Warwick; £46 Stafford; £47 Lincoln; £48 Berks, Northampton, Worcester; £52 Sussex; £53 Perth, Durham; £55 Huntingdon, Wilts; £56 Somerset £57 Bucks, Gloucester; £58 Cheshire; £60 Oxford; £61 Cambridge, York; £72 Stirling, Bedford; £74 Lanark, Renfrew; £89 Kent; £110 Essex; £121 Lancashire; £131 Herts; £134 Linlithgow; £157 Surrey; £608 Middlesex.

No. 3.

Average Annual Expenditure per Mile in each County, 1818, 1819, 1820.

£3 Kirkcudbright; £5 Merioneth; £6 Cardigan, Radnor; £8 Carnarvon, Pembroke; £10 Banff; £12 Glamorgan; £13 Peebles; £14 Kincardine; £19 Carmarthen, Elgin; £21 Westmorland; £22 Brecknock, Wigton, Shropshire; £23 Hereford; £24 Aberdeen, Cornwall; £25 Monmouth; £26 Ayr, Norfolk, Northumberland; £28 Roxburgh, Selkirk, Cumberland; £29 Denbigh, Dorset; £31 Dumfries, Derby, Suffolk; £32 Flint, Montgomery, Rutland; £33 Hants; £35 Gloucester, Warwick; £36 Nottingham; £37 Devon; £39 Dumbarton; £40 Lincoln; £42 Stirling, Stafford; £43 Renfrew, Durham, Leicester; £44 Cheshire; £45 Anglesea; £46 Worcester; £47 Berks; £49 Berwick; £50 Somerset, Wilts; £57 Haddington; £53 Cambridge; £54 Perth; £56 Bucks; £58 Edinburgh, Oxford; £64 Clackmannan; £68 Lanark, Huntingdon; £69 Forfar, Kent, York; £70 Sussex; £71 Northampton; £72 Bedford; £95 Essex; 125 Lancashire; £132 Linlithgow; £144 Herts; £149 Surrey; £548 Middlesex.

On the above the New Times observes,

"The general importance of facilitating an inter-

course between the different parts of a country is now too well and too generally understood to require illustration. This object is attained by the construction and maintenance of roads, bridges, canals, and harbours. In most other countries these objects have been almost wholly under the care and direction of Government; in Great Britain they have been chiefly the result of private undertakings. Our roads are of two kinds—the turnpike roads and cross roads: the latter it is difficult to estimate, the former extend above 24,000 miles. The annual income of the turnpike roads on the average of the years 1818, 1819, 1820, was as follows:—

England	170,618
Wales	37,672
Scotland	129,635
	1,137,925

But this income, besides the necessary expence of continual repairs, was burthened in the year 1821 with the following debt:—

England	3,874,255
Wales	201,962
Scotland	1,124,273
	5,200,490

It is very remarkable, how great the difference is both in income and expenditure, between the

roads in different parts of the island. The annual expenditure per mile varies from £3 to £548 on the average of different counties; and the annual income varies from £6 to £608. Where the expenditure is highest the income is not only highest, but affords by far the highest excess over the expenditure. This, as may readily be supposed, is near the Metropolis. While in one part of England the expenditure exceeds the income £23 per mile, in Middlesex the income exceeds the expenditure £60.

The Tables show the extraordinary gradations of income and expenditure; but the causes of such difference it might be difficult to analyse. Doubtless the travelling on the roads near the extremities of the kingdom must be much less than on those near the Metropolis; a much less expence, therefore, is necessary to keep them in repair, and much less income is afforded to meet that expenditure. This circumstance, however, is far from affording a complete explanation of the difference. There are local advantages of soil and materials, which give some districts a great advantage over others. The sort of vehicles in use in some parts of the country is more, in others less, injurious to the roads; but perhaps the most operative cause of all, is the different share of skill and attention which is bestowed on the construction and repair of the roads by different managers.

It is a great question whether the formation of roads should precede or follow the necessity for their use. The President of the United States, in his late message to Congress, states, that there are established by law (in that country) eighty-eight thousand six hundred miles of post roads. Now it is scarcely possible to believe that such an extent of road can be called for by a necessity adequate to the burthen it imposes on the people. Some of these roads, we believe, are extremely good, and have been formed at no small cost; but we apprehend that if the whole income which they could be made to produce were compared with that of the British roads, it would be trifling indeed. Several even of the English roads have been injudiciously planned, and consequently are much more burthensome than they might have been; but in Ireland it may be said that at least half the money expended on roads has been thrown away, partly from want of skill, but more generally from the suggestions of personal interest. In France all roads of the kingdom are under the direction of a Councillor of State, who is a kind of minister, and has under him a regular distribution of officers. To this department belongs the superintendance of canals, mines, &c., and engineers and schools of mining are attached to it. Of course there is more uniformity and more general science in the management of the French than of the English

roads, but the actual benefit of the country is probably on the whole less promoted, because the inhabitants in England consult their separate interest; and where the private advantage of each is promoted, the general benefit of all must be advanced. On the other hand, there must necessarily be among the great number of Trustees of the roads in England many instances of entire ignorance, and at all events much conflict of opinion, competition for materials, and other causes tending to impede the adoption of an uniformly good system of management. The general result is a vast inequality in the pressure of the burthen, for the tolls are a tax upon that intercourse which roads are intended to promote: and the table of the gradations of expenditure leaves no doubt but that this tax falls far heavier on some parts of the country than on others. Whether sound policy would not suggest that some measures should be adopted to equalise the burthen, is a question which at present we do not feel ourselves called upon to discuss.

Derby Mercury, 4th *Feb.* 1824.

EXTRACT, No. 9.

"The problem to be solved in all rational attempts to improve public highways, is to secure the means of communication between certain

given parts of the country with the least possible expenditure of time and labour. Should it be affirmed that in these points much has been effected among us during the last few years, this much, it may with truth be replied, either is, or ought to be regarded as nothing, compared with what yet remains to be accomplished.

" In the latter light particularly, the accelerated rate of travelling which has of late prevailed deserves to be viewed; for the system of road management in England having continued essentially the same for half a century past, and our carriages, though better constructed, being, beyond comparison, more loaded now than formerly, this increased celerity can only be owing to harder—the writer may safely say it is owing only to the most merciless, driving. The advantages, in fact, which we ought to have reaped principally from the wise and careful improvement of our roads, we are now content to realize by goading into the most unheard-of efforts the generous animals that toil upon them.

" In a cool statistical estimate of the facilities of intercourse enjoyed in this country, contained in a very recent publication (the Edinburgh Review for January last), it is, without comment, related, that ' a public carriage was established not long since on one of our southern roads, to run twelve miles per hour; but seven horses having died in

three weeks, the rate is now reduced to ten miles per hour.'

"The casualties attending this cruel experiment were, doubtless, more than usually numerous, but if inquiry is made of them, the most merciful of modern stage-coach proprietors will acknowledge that they average not more than three years' labour from their horses; upon some roads even not more than two. A calculation not widely dissimilar, will, in all probability, hold good of post-horses employed upon our main roads.

"*The expediency, upon opening a communication with any distant place, of making the communication direct, is so obvious, that common sense, it might have been supposed, would have dictated it to men the most rude and uncivilized. With all the boasted light and science of the present period, this obviousness, however, appears to be quite lost upon us, it being the least that can be said, that the roads in the country are innumerable, by which the distance between towns of magnitude, or places on other accounts of importance, is absurdly aggravated. Blindly conforming here, as in too many other instances, to the practice of those who have preceded us, we double head-lands, and take large offings in our progress from one spot to another, as though the earth was an element which could be traversed only, subject to the same endless windings and reduplications of our course as the ocean.*

"The intercourse which many towns of importance maintain, not only with each other, but even with the metropolis, is carried on by roads which will strictly bear the writer out in this representation; and a precisely similar character will hold good of the roads which form the connecting links between whole districts, and our coasting trade and inland navigation: cases these, whence it may at once be seen that there are other roads in the country besides those of the very first magnitude, which have a direct bearing on the general well-being, and in the improvement of which the whole nation may be said to have a lively concern.

"It is impossible but that our trading interests must, in a greater or less degree, suffer from a state of our roads like that here described. The writer will ask of all commercial men, if they do not sometimes encounter an almost insuperable obstacle to the sale of their commodities in the very heavy charges for carriage, to which the buyers of their goods are at present subject? Except where purchasers reside upon a road communicating by a direct line with the source whence they are to be supplied, or who are able to avail themselves of water carriage, these expences, to the writer's certain knowledge, frequently operate to the partial, if not to the entire exclusion of merchandize of various kinds from markets that are every way desirable. One of the first conse-

quences then of curtailing our roads would be a diminution, throughout the country, of the charges for carriage, by which relief would, in a corresponding degree, be afforded to our trade and manufactures.

" The dearth, in many parts of the country, of those important articles, fish, coals, and manure, is well known; and provided our roads are as they are represented to be, unnecessarily circuitous, what, more than their abridgement, can tend to prevent this dearth?

" The writer will not enter on the interminable task of citing roads in proof of the charge at present preferred by him. He has particularized some roads which cannot be adduced for this purpose, and the reader would thence have inferred, if the writer had not expressed himself to such an effect, that the charge was meant to apply, with few exceptions, to the whole of the remainder. If there is one observation that can be made of more universal application than any other, as it regards our roads, it is, that instead of proceeding directly to their respective objects they meander about the intermediate country like our brooks.

" For the correctness of this statement the writer will appeal to every individual whose acquaintance with the interior of the country qualifies him to speak to the point. If the inquiry be worded accordingly, the writer is confident the

reply will bear him out in asserting, that to the very tortuous character of our roads, frequently one-fourth, sometimes a third, and occasionally as much even as one-half of the distance now intervening between places is exclusively to be attributed.

"Of course in proceeding to abridge our roads encroachments upon private property, and little sacrifices of private pleasure, would occasionally be called for. That society possesses a right to enforce the sacrifice of both, where really necessary, no one will for a moment dispute. But the instances would be few in which this right would have to be compulsorily exercised. Those form no inconsiderable proportion of the requisite curtailments of our roads, which are perpetually suggesting themselves to observant travellers, where, instead of crossing single protruding fields, or knots of fields, our roads deliberately wind round them. Under our existing laws it is by no means impracticable for individuals of a certain degree of weight in the neighbourhood in which they reside, to alter a direct and approved line of road. And this they do, influenced by motives which, as the writer has intimated, we should doubtless sometimes have to contend with in proceeding generally or indiscriminately to abridge our roads: such motives, for instance, as that the beauty of their estates may be more preserved, their fondness for a recluse life be

more indulged, or that in some other way their personal pleasure may be more elaborately consulted. The consent of neighbours and dependents may undoubtedly be obtained, and this too without much difficulty, to these acts of agression; but surely the consequences, as it regards strangers, claim some little consideration on these occasions.

"The opinions entertained by scientific men of hilly roads have already been hinted at. Indeed it has long been their decided recommendation, that rather than toil up a severe hill we should patiently wind round it. *The perfection of travelling, however, requiring not less the economy of time than of labour, this expedient is obviously of less value than the course which the writer with all humility prescribes, namely, that instead of toiling up, or winding round hills, we should force ourselves a way through them.*

"That so little should have been done in the way of levelling roads in a country where not only so much was needed, but where, on account of the numerous canals that have been constructed, and rivers that have been made navigable, the operation in itself might be said to be a most familiar one, may well, as it appears to the writer, excite some astonishment. We have excavated, and even embowelled the earth at an enormous expence, in multiplying or improving these latter channels of communication, though a little excess

of heat, of cold, of rain, or drought, will alike serve hermetically to close them up to us; and though, were it made to rest on this ground alone, the superiority of land carriage is such, and in a country like our own ever must be such, as to entitle it to a decided priority of regard and attention from us.

"The neglected state of English roads, viewed in connexion with the immense sums which have been squandered upon canals in this country, has tempted the writer to minute down, from the most correct information he can obtain, the present value of a few canal shares.

"He will just preface his list by remarking, that Smith's Map of the navigable rivers and canals of England and Scotland, published in 1815, makes the number of both to be not more than seventy-five or six. How good an account of a large proportion of them their respective proprietors can present will here at one glance be seen.

EXTRACT, No. 10.

Names of Canals.	Original worth, or amount of what has been advanced.			Present value.		
	£.	s.	d.	£.	s.	d.
Bolton and Bury	250	0	0	100	0	0
Grantham	150	0	0	126	0	0
Brecknock and Abergavenny	150	0	0	60	0	0
Ellesmere and Chester, united	138	0	0	75	0	0
Oakham	130	0	0	45	0	0
Wey and Arun	110	0	0	68	0	0
Wisbeach	105	0	0	60	0	0
Chelmer and Blackwater	100	0	0	90	0	0
Leicester and Northampton	100	0	0	87	10	0
Montgomery	100	0	0	70	0	0
Dudley	100	0	0	59	0	0
Gloucester and Berkley	100	0	0	54	0	0
Grand Surrey	100	0	0	54	0	0
Basingstoke	100	0	0	50	0	0
Rochdale	100	0	0	45	0	0
Grand Union	100	0	0	37	0	0
Thames and Severn	100	0	0	17	0	0
Ashby de la Zouch	100	0	0	15	0	0
Andover	100	0	0	10	0	0
Sleaford	100	0	0	5	0	0
Ashton and Oldham	97	18	0	65	0	0
Worcester and Birmingham	79	0	0	25	0	0
Grand Western	79	0	0	3	15	0
Peak Forest	78	0	0	63	0	0
Stratford-on-Avon	75	0	0	16	10	0
Huddersfield	58	0	0	13	0	0
Crinan	50	0	0	2	2	0
Regent's	49	0	0	28	0	0
Lancaster	48	0	0	27	0	0
Thames and Medway	43	0	0	23	0	0
Kennet and Avon	40	0	0	19	10	0
Croydon	25	2	10	3	15	0
Wilts and Berks	20	0	0	8	0	0
Hereford and Gloucester, Merthyr, Nottingham	100 each			Worth, the writer believes, nothing whatever.		
North Walsham and Dilham	35	0	0			
North Wilts	25	0	0			
Carlisle	25	10	0			

"The Caledonian Canal, which is still incomplete, and to carry on which such large sums are from time to time granted by Parliament, very much resembles, in the objects it is intended to answer, the celebrated French Canal of Languedoc.

"Of this latter undertaking, Mons. Say remarks in one of his recent works, that it cost one million two hundred and fifty thousand pounds sterling, and that its annual returns at present do not exceed fifteen thousand pounds; that is, less than $1\frac{1}{4}$ per cent. on the capital expended!"—*The Improvement of the Public Roads, by W. Wickens.*

EXTRACT, No. 11.

"Within the last fifty years a great number of canals have been cut in various parts of England, which have greatly contributed to the improvement of the country, and the facilitating of commercial intercourse between the trading towns. The first of these, in point of date, is the Sankey canal, the Act of Parliament for which was obtained in 1755. It was cut to convey coals from the coal-pits at St. Helen's to the river Mersey, and so to Liverpool, and is in length 12 miles.

"But the canals of the late Duke of Bridgewater, the great father of inland navigation in this country, are of much greater importance, both for the extent and the natural difficulties that were

surmounted by the fertile genius of that extraordinary mechanic, Mr. Brindley. Of these great works the first was begun in 1758, at Worsley Mills, about seven miles from Manchester, where a basin is cut, containing a great body of water, which serves as a reservoir to the navigation. The canal runs through a hill, by a subterranean passage large enough for the admission of long flat-bottomed boats, towed by hand-rails on each side, near three-quarters of a mile, to the Duke's coal works. There the passage divides into two channels, one of which goes 500 yards to the right, and the other as many to the left. In some places the passage is cut through solid rock, in others arched over with brick. Air funnels, some of which are 37 yards perpendicular, are cut at certain distances through the rock to the top of the hill. At Bartonbridge, three miles from the basin, is an aqueduct, which, for upwards of 200 yards, conveys the canal across a valley, and the navigable river Irwell. There are three arches over this river, the centre one 63 feet wide, and 38 feet high above the water, which will admit the largest barges to go through with masts and sails standing. The whole of the navigation is more than 29 miles; it falls 95 feet, and was finished in 5 years.

"The Grand Trunk, or Staffordshire Canal, was begun in 1766, under the directions of Mr. Brind-

ley, in order to form a communication between the Mersey and Trent, and, in consequence, between the Irish Sea and the German Ocean. It was completed in 1777, after the death of Mr. Brindley, who died in 1772, by his brother-in-law, Mr. Henshall. Its length is 22 miles, it is 29 feet broad at the top, 26 at the bottom, and five deep. It is carried over the river Dove by an aqueduct of 23 arches, and over the Trent by one of six. At the hill of Harecastle, in Staffordshire, it is conveyed through a tunnel more than 70 yards below the surface of the ground, and 2880 yards in length. In the same neighbourhood there is another subterraneous passage of 350 yards, and at Preston-on-the-Hill another, 1241 yards in length. From the neighbourhood of Stafford a branch goes off from this canal, and joins the Severn near Bewdley: two other branches go, the one to Birmingham, and the other to Worcester. The Braunston, or Grand Junction Canal (so called from its uniting the inland navigation of the central counties) extends from the Thames, at Brentford, to the Oxford Canal, at Braunston, in Northamptonshire. A branch of it likewise goes from Uxbridge to Paddington, and a plan has been proposed, and considerable sums of money subscribed, for extending a cut from the latter place to the new West India Docks, at Blackwall; but whether this design will be carried into execution

is as yet uncertain. A great number of other canals have been cut in various parts of the kingdom, as the Lancaster canal, the canal from Liverpool to Leeds, carried through an extent of 117 miles; the canal from Halifax to Manchester, 31 miles; a canal from Basingstoke, in Hampshire, to the Thames, at Weybridge; another from Andover, in the same county, to the river near Southampton, and many others which it would be tedious here only to enumerate.—*Guthrie's Geography*, 20th edit. p. 138.

"A canal forming a junction between the rivers Forth and Clyde, was begun in 1768, and finished in 1790, when, on the 28th of July, a hogshead of the water of the Forth was poured into the Clyde as a symbol of their junction. This canal in its dimensions is much superior to any work of the same nature in England. It is 35 miles in length, in the course of which navigation the vessels are raised, by means of 20 locks, to the height of 155 feet above the level of the sea; proceeding afterwards on the summit of the country for 18 miles, it then descends by 19 other locks into the Clyde. It is carried over 36 rivers and rivulets, and two great roads, by 38 aqueducts of hewn stone. By one of these, 400 feet in length, it passes the Kelvin, near Glasgow, at the height of 70 feet above the bed of the river in the valley below. It crosses the great road from Edinburgh to Glasgow by a

fine aqueduct bridge, and is carried over the water of Logie by another aqueduct bridge, the arch of which is 90 feet broad. The great utility of this communication between the Eastern and Western seas to the trade of Great Britain and Ireland must be evident from the consideration that it shortens the distance between them by the shortest passage, that of the Pentland Firth, nearly 600 miles.

"Other canals are executing and projecting in Scotland. The canal of Crinan, which will save a circuitous and difficult navigation round Cantire, is begun, and in a considerable state of forwardness; and in April, 1804, a bill was brought into Parliament for making an inland navigation from Inverness to Fort William, through Loch-Ness and Loch-Lochie, to Loch-Linney."—*Guthrie's Geography*, 20th edit. p. 306.

Grand American Canal.

This great work, which was begun in 1817, and will be completed next year, is the longest canal in existence, and though upon a small scale as to breadth and depth, is, we believe, in point of pecuniary outlay, the greatest work of the kind ever executed. It is 335 miles in length, 40 feet wide at the surface of the water, 28 at the bottom, and four feet deep, and will cost about five millions of dollars (£1,100,000) or £3,000 per mile on an

average. Such a vast under taking, completed in the short period of seven years, by a state (New York) with 1,368,000 inhabitants, affords a striking proof of the energy and enterprise generated by free institutions. It is a work worth a thousand Escurials and Versailleses, because it creates wealth, while these only consume it; and it is a monument of public spirit and national prosperity, while these are only monuments of idle magnificence, vain glory, and despotic oppression.

The canal, which extends from Black Rock, at the east end of Lake Erie, to Albany on the Hudson, will render their river the chief, almost the sole outlet, and New York, the great emporium of a fertile country extending along the Lakes, much larger than the British Isles, and fast filling with inhabitants. Proceeding eastward from Lake Erie the canal rises 48 feet, and from the summit's level falls 601 feet to the Hudson, making an aggregate rise and fall of 649 feet, which is effected by 77 locks. Two levels or reaches extend over 65 and 70 miles without lockage, a circumstance, perhaps, without a parallel, except in China. There were 238 miles finished last autumn, and much of the rest was in a very advanced state. The stimulus it gives to improvement is already seen in the villages and towns, which are springing up with astonishing rapidity along its whole course. Passage-boats and batteaux already ply on the parts

completed. The former, which are generally of a size to carry 90 passengers, travel at the rate of 100 miles in 24 hours, and the charge is but 1½d. or 2d. per mile.

National works are great or little by comparison; and to give a just idea of the enterprise displayed by the State of New York in this instance, we shall state the dimensions and cost of some other great works of the same kind.

The celebrated canal of Languedoc is 152 miles long, six feet deep, and has 100 locks: it has its summit level 639 feet above the sea, cost 13,000,000 livres (equal to £650,000) and was finished in 15 years. The Forth and Clyde canal is 35 miles long, was originally seven feet deep, and has 39 locks, rises to the height of 156 feet above the sea, cost £300,000, and was finished in 22 years.

The Caledonian canal * is 21½ miles long (exclusive of the locks), is 20 feet deep, has 22 locks, rises 93 feet above the sea, will cost £950,000, and will be finished in 20 years from the time it commenced (1804).

The American canal, though its length renders it more expensive, has a much smaller section than any of these.—*Mechanic's Magazine*, No. 7.

* This, I believe, is the canal on which our Government has so *partially* bestowed the public money.—AUTHOR.

"Inland navigation has not been entirely unattended to in Sweden. The canal of Trolhaetta, lately completed, has been wrought with great labour, assisted by the powerful force of gunpowder, through the midst of rocks. The object was to open a communication between the North Sea and the Lake Wenner, by forming a new channel where the Gotha is rendered innavigable by Cataracts. The length of this canal, in which there are nine locks, is nearly three miles, the width 36 feet, and the depth in some places above 50. "It is not easy" says a late judicious traveller, "for any one to form an idea of the difficulties that were to be surmounted in the formation of this wonderful canal, unless he were an eye-witness. It was undertaken and begun by Charles XII; formed part of a grand plan meditated by Gustavus Vasa, and attempted by some of his successors, for joining the Baltic from the North Sea, by means of a communication cut through the kingdom. If a canal should be extended by the Lake of Wenner, by Oerebo, to the Lake of Hielmar, the Swedes may then, by a conjunction of this lake with that of Maelar through the sluices of Arboga, transport all kinds of merchandize in the same vessel from Gothenburg to Stockholm. Thus a passage would be opened between the North Sea and the Baltic; and among other advantages, the duties of the Sound would be avoided. The

canal of Trolhaetta may justly be considered as, in some respects, characteristical of the Swedish nation, for it represents them as they are, prone to the conception of grand enterprises, and distinguished by mechanical invention. As a work of art, and of bold and persevering design, it is not too much to say that it is the first in the world; even the Duke of Bridgewater's canal in England, and that of Languedoc in France, not excepted."—*Guthrie*, 20th Ed. p. 83.

EXTRACT, No. 12.

Parliamentary Report on Steam Navigation.

The select committee appointed to consider of the means of preventing the mischief of explosion from happening on board steam boats, to the danger or destruction of His Majesty's subjects on board such boats; and who were empowered to report their observations and opinion thereupon to the House, together with the minutes of the evidence taken before them; have, pursuant to the order of the House, considered the matters to them referred, and agreed to the following report:—

"Your committee entered on the task assigned them, with a strong feeling of the inexpediency of legislative interference with the management of

private concerns or property, farther than the public safety should demand, and more especially with the exertions of that mechanical skill and ingenuity, in which the artists of this country are so pre-eminent, by which the labour of man has been greatly abridged, the manufactures of the country carried to an unrivalled perfection, and its commerce extended over the whole world.

"Among these, it is impossible for a moment to overlook the introduction of steam as a most powerful agent, of almost universal application, and of such utility, that but for its assistance, a very large portion of the workmen employed in an extensive mineral district of this kingdom, would be deprived of their subsistence.

"A reference to the evidence taken before your committee, will also show with what advantage this power has lately been applied in Great Britain, to propel vessels both of burden and passage; how much more extensively it has been used in America, and of what farther application it is certainly capable, if it may not be said to be even now anticipated in prospect.

"Such considerations have rendered your committee still more averse than when they entered on the inquiry, to propose to the House the adoption of any legislative measure, by which the science and ingenuity of our artists might even appear to be fettered or discouraged.

" But they apprehend that a consideration of what is due to public safety, has on several occasions established the principle, that where that safety may be endangered by ignorance, avarice, or inattention, against which individuals are unable, either from the want of knowledge, or of the power to protect themselves, it becomes the duty of Parliament to interpose.

" In illustration of this principle, many instances might be given; the enactments, respecting party-walls in building, the qualification of physicians, pilots, &c. the regulations respecting stage-coaches, &c. seem all to be grounded upon it. And your committee are of opinion, that its operation may, with at least equal propriety, be extended to the present case, on account of the disastrous consequences likely to ensue from the explosion of the boiler of a steam-engine in a passage-vessel, and that the causes by which such accidents have generally been produced, have neither been discoverable by the skill, nor controllable by the power of the passengers, even where they have been open to observation.

" Your committee find it to be the universal opinion of all persons conversant in such subjects, that steam-engines of some construction may be applied with perfect security, even to passage-vessels; and they generally agree, though with some exceptions, that those called high-pressure

engines, may be safely used with the precaution of well constructed boilers, and properly adapted safety-valves; and further, a great majority of opinions lean to boilers of wrought iron or metal, in preference to cast iron."—PARTINGTON.

EXTRACT, No. 13.

Parliamentary Report on Steam-packets.

"The Select Committee appointed to inquire into the state of the roads from London to Holyhead, and from Chester to Holyhead, into the regulations for conveying his Majesty's Mail between London and Dublin, and between the northern parts of England and Dublin, and between Dublin and the interior of Ireland, into the state of the mail-coach roads in Ireland, and to report their observations thereupon, together with the minutes of the evidence taken before them, from time to time, to the House, have, pursuant to the order of the House, further examined the matters to them referred, and have agreed to the following Report:

"'Your Committee have proceeded, in compliance with that part of the instructions of the House which relates to the conveyance of his Majesty's mails between Holyhead and Howth,

to examine into the circumstances attending the establishing of steam-packets, at Holyhead, in the course of last year. For this purpose two vessels called the Royal Sovereign and Meteor were built, by order of the Postmasters General, in the River Thames, on a plan to give them the greatest possible strength, and the advantage of the most improved engines. The evidence which has been given to your Committee by a commander of one of them, Captain Rogers, leaves no doubt of the practicability of performing the Post-office service at Holyhead, by steam vessels, with as great safety as it can be performed by sailing vessels, even in the most tempestuous weather; and at the same time by voyages on an average not exceeding one-half the number of hours which formerly was the average of the voyages of the sailing packets. But your Committee are not as yet prepared to enter into all the details of this important subject; their object in presenting this report to the House, is merely to convey to the House an opinion they have come to in consequence of the evidence of Mr. George Henry Freeling, and of Captain Rogers, that the Postmasters General ought immediately to give orders for building a new steam-packet; so that at least there should be three packets on the Holyhead station, before the commencement of next winter, of that peculiar construction which has enabled the Sovereign and

Meteor to go to sea throughout the whole of the last winter.

" 'Your Committee strongly recommend the same general plan of construction should be adopted in building a new packet, as that on which the Sovereign and Meteor were built; and also that the engine should be made by Messrs. Boulton and Watts. They also recommend that the suggestions of Captain Rogers should be attended to in all matters respecting the building of a new packet, as those suggestions will come from a person who appears to your Committee to possess great knowledge in seamanship and ship-building, and by the experience of commanding a steam vessel through a most tempestuous winter, to have made himself master of the best method of managing one at sea, and also of the main properties of the mechanism of the engine.

" 'Your Committee have annexed to this Report the evidence of Mr. George Henry Freeling, Captain Rogers, Mr. J. Brown, and Captain John Percy, and also certain queries which they have sent to several persons who have had the most experience in constructing and navigating steam vessels. They intend to continue their inquiries upon this interesting subject, and hope to present to the House a full Report upon all its details before the close of the Session.' *April* 2, 1822."

PARTINGTON.

FROM

WETENHALL'S COMMERCIAL LIST,

DECEMBER 10, 1824.

N. B. Prices since this Date have fallen considerably.

No. Shares.	Div. per Sh. per Ann.	CANALS.	Price per Share.
1776 ¼ sh.	5*l.*	Ashton & Oldham, Average 97*l.* 18*s.* sh.	310*l.*
1482		Ashby-de-la-Zouch...Average 113*l.* sh.	25*l.*
9,945*l.* 12*s.*	5*l.* per ct.	Ditto Bonds, various amounts	106*l.* p. ct.
720	12*l.*	Barnsley .....160*l.* sh.	340*l.*
1260		Basingstoke.....100*l.* sh.	19*l.*
50,000*l.*	3*l.* per ct.	Ditto Bonds .....100*l.* ..	50*l.* p. ct.
958	7*l.* 10*s.*	Brecknock and Abergavenny..150*l.* sh.	180*l.*
56,465*l.*	5*l.* per ct.	Ditto (Notes) .....100*l.* sh.	
4000 ⅛ sh.	12*l.* 10*s.*	Birmingham, ⅛ share.....17*l.* 10*s.*	360*l.*
472	5*l.*	Bolton and Bury .....250*l.* sh.	163*l.*
600		Bridgewater & Taunton, 100*l.* sh. 75*l.* pd.	75*l.*
400	5*l.*	Chelmer and Blackwater .....100*l.* sh.	
500	44*l.* and bs.	Coventry .....100*l.* sh.	1340*l.*
4545		Croydon.....Average 31*l.* 2*s.* 10*d.* sh.	4*l.* 10*s.*
11,810*l.*	5*l.* per ct.	Ditto Bonds .....100*l.* sh.	60*l.* per ct.
460	14*l.*	Cromford .....100*l.* sh.	
1851		Crinan .....50*l.* sh.	
2060¾	3*l.*	Dudley.....100*l.* sh.	87*l.*
3575¾	3*l.* 10*s.*	Ellesmere and Chester, Average 133*l.* sh.	107*l.*
1297	20*l.*	Forth and Clyde, Average 400*l.* 16*s.* sh.	550*l.*
11,650	10*l.*	Grand Junction .....100*l.* sh.	296*l.*
2,849½		Grand Union .....100*l.* sh.	31*l.*
19,327*l.*	5*l.* per ct.	Ditto (Loan Notes).....100*l.* sh.	105*l.* p. ct.
1500		Grand Surrey.....100*l.* sh.	50*l.*
Ab. 60,000*l.*	5*l.* per ct.	Ditto (optional) Loan .....100*l.* ..	105*l.*
3096		Grand Western.....100*l.* sh. 79*l.* paid	16*l.*
600	13*l.* 12*s.* 8*d.*	Glamorganshire, Avr. cost 172*l.* 13*s.* 4*d.*	280*l.*
1960		Gloucester and Berkley.....106*l.* sh.	
269	5*l.* per ct.	Ditto (optional) Notes ....60*l.* ..	
749	10*l.*	Grantham.... .....150*l.* sh.	190*l.*
6238	1*l.*	Huddersfield....Average 57*l.* 6*s.* 6*d.* sh.	39*l.*
25,328	1*l.*	Kennet and Avon, Avr. 39*l.* 18*s.* 10*d.* sh.	29*l.* 10*s.*
11,699½	1*l.*	Lancaster....Average 47*l.* 18*s.* 10*d.* sh.	46*l.* 10*s.*
2879¾	15*l.*	Leeds and Liverpool .....100*l.* sh.	570*l.*
18¾	9*l.* 12*s.*	Ditto (New).....80*l.* sh.	
540	14*l.*	Leicester .....140*l.* sh.	390*l.*
5	11*l.*	Ditto ditto.....110*l.* sh.	
1899	4*l.*	Leicester & Northampton, Avr. 83*l.* 10*s.*	107*l.*
70	200*l.*	Loughborough ..Average 142*l.* 17*s.* sh.	
2409	10*l.*	Monmouthshire .....100*l.* sh.	245*l.*
43,526	5*l.* per ct.	Ditto (Debentures) .....100*l.* sh.	105*l.* p. ct.
700	2*l.* 10*s.*	Montgomery .....100*l.* sh.	
		Merthyr .....100*l.* sh.	

No. Shares.	Div. per Sh. per Ann.	CANALS.	Price per Share.
250	11*l.*	Melton Mowbray .....100*l.* sh.	255*l.*
500	35*l.*	Mersey and Irwell	1000*l.*
250	15*l.*	Neath .....100*l.* sh.	400*l.*
500	32*l.*	Oxford .....100*l.* sh.	900*l.*
2400	4*l.*	Peak Forest....Average about 78*l.* sh.	190*l.*
2520		Portsmouth and Arundel .....50*l.* sh.	21*l.*
12,294		Regent's (or London) Avr. 40*l.* 10*s.* sh.	59*l.*10*s.*a60*l*
5631	4*l.*	Rochdale .....Average 85*l.* sh.	145½*l.*
500	7*l.*	Shropshire .....100*l.* sh.	175*l.*
800	9*l.*	Somerset Coal .....100*l.* sh.	
45,000	5¾*l.* p. ct.	Ditto Lock Fund Stock	
700	40*l.*	Stafford and Worcester .....140*l.* sh.	960*l.*
500	10*l.*	Shrewsbury.....125*l.* sh.	206*l.*
300	10*l.* 10*s.*	Stourbridge..... .....145*l.* sh.	220*l.*
3647	1*l.*	Stratford-on-Avon, Avr. 79*l.* 9*s.* 8*d.* sh.	48*l.*
200	31*l.* 10*s.*	Stroudwater .....150*l.* sh.	450*l.* 420*l.*
533	10*l.*	Swansea .....100*l.* sh.	250*l.*
1300		Thames and Severn, black....100*l.* sh.	
1150	1*l.* 10*s.*	Ditto ditto.....red.... .100*l.* sh.	35*l.*
4000		Thames Tunnel .....50*l.* sh. 7*l.* pd.	
1300½ sh.	75*l.* and bs.	Trent and Mersey, ½ share .....100*l.*	2300*l.*
350		Tavistock (Mineral) .....100*l.* sh.	120*l.*
2670		Thames & Medway, Avr. 42*l.* 9*s.* 5*d.* sh.	35*l.*
1000 sh. 1000½	11*l.*	Warwick and Birmingham....100*l.* sh.	320*l.*
980	11*l.*	Warwick and Knapton .....100*l.* sh.	280*l.*
6000	1*l.*	Worcester& Birmingham, Av. 78*l.* 8*s.* sh.	59*l.*
20,000		Wilts & Berks, Average 16*l.* 17*s.* 8*d.* sh.	8*l.*
800	6*l.*	Wyrley and Essington .....125*l.* sh.	150*l.*
126		Wisbeach ....105*l.* sh.	40*l.*
905	1*l.*	Wey and Arun .....110*l.* sh.	

To the Author of "Observations on a General Iron Rail-way."

London, 12th Oct. 1821.

Sir,

Having perused the second edition of your valuable pamphlet, published by Baldwin and Co. I cannot refrain from congratulating you on the probability of your plan being generally adopted, in proportion as it becomes known; at least we may infer this from the *best* plan (whether commercial or professional) being always chosen ultimately, in preference to the *better*, and the *better* in preference to a *simply good one*. In political economy, as well as in grammar, we must admit three degrees of comparison, the positive, the comparative, and the superlative; the ordinary roads are the positive, the canals are the comparative, and your General Iron Rail-way is doubtless of the superlative order!

It is not, therefore, to be supposed that, with all the appliances of steam-engines to boot, we shall be content to jog on like our forefathers, and submit to the innumerable and irremediable inconveniences of a common turnpike road, or the snail-like conveyance peculiar to canals: it has particularly struck me that your scheme, like a word spoken in due season, cannot fail attracting the attention of the public in the same manner as

the steam-packets now do. If these last enjoy so large a share of public patronage, in defiance of winds and waves, of fire and water, what may we not expect, *a fortiori*, from your unexceptionable steam-packets, or caravans going by land? where there can be none of the dangers nor obstacles to contend with which must ever impede the perfection of marine establishments.

In short, we may reasonably hope that in the course of the next twenty or thirty years canals and turnpike-roads will be, in a great measure, superseded, if not entirely abolished, by the universal adoption of your excellent projection; and that it will be as easy and as cheap for farmers to send the produce of their farms to market-towns 50 or 100 miles off, as it now is for them to make a journey of 20 or 30 miles, and that consequently the whole country will partake of the benefits arising from particular situations, which are now exclusively enjoyed by farms in the neighbourhood of large towns (but particularly the farms within 10 or 15 miles of the metropolis).

The speed with which goods *of every description* can then be forwarded from one end of England to the other will, as you say, give a new spring to commerce, and render the communication between the most *distant* counties as easy as it now is between London and Margate.

To suppose that there are not the same, and

greater inducements to establish steam conveyances upon iron rail-ways, as well as steam-packets upon the Thames, would be absurd indeed, especially after weighing over the comparative merits of *land* and *water* carriage.

It will be found, on trial, that no danger can possibly arise from this species of land travelling, which is not ten-fold greater by water; and yet we see steam-packets springing up daily, in almost every port of the United Kingdom. Why then, in the name of common sense, should not the same means of travelling be tried upon terra firma? and render England at once the admiration and envy of every other country, by the introduction of a system of conveyance, both for persons and goods, infinitely superior to that enjoyed by any other nation.

The free circulation of the blood is not more necessary to the health and existence of the natural body, than a perfectly free and easy communication is indispensable to the prosperity and well-being of a country.

How many estates of good land are rendered comparatively nothing worth, merely from the impossibility of conveying their productions to a good market: this is a very common case with some of the best and most productive districts which I have seen in a neighbouring kingdom, where farms, that would otherwise yield the proprietors consi-

derable annual benefit, are left in the most deplorable state, for want of roads to convey away the produce to a place of sale, in the same manner as lands in the immediate vicinity of large towns. Most excellent mansions, for the same reason, are let for a mere nothing, or remain untenanted, whereas, could the proprietors enjoy the benefit of a good road, such estates would soon become valuable, and easily find tenants, instead of being inaccessible and unhabitable a great part of the year, as they now are.

Thus having given you my sentiments in a few words, I shall here conclude, with my best wishes for the success of your plan, and of its universal adoption.

I am, Sir,

Your obedient servant,

AGRICOLA.

APPENDIX.

SUNDRY EXTRACTS

From Newspapers since the publication of this Work.

LEEDS MERCURY, JUNE 1822.

Having recently perused a publication entitled "Observations on a General Iron Railway," I cannot forbear contributing something in furtherance of an undertaking so completely national. That our present system of turnpike roads is capable of improvement no one can deny; heavy tolls are almost everywhere collected, but the public does not receive any adequate benefit. Our canals, too, put in competition with rail-ways, only serve to prove that the former is a very inferior medium of conveyance to the latter. Let the wealthy merchants of Manchester and Liverpool make the attempt between these two places, and such success must inevitably attend the undertaking, that other towns could not but follow their example. Our capitalists will not be backward in the promotion of an object so beneficial to all, but especially to themselves. The day, I hope, is not far distant when men, and the endless produce of their labour, shall be transported from one corner of the British empire to another with facilities hitherto unknown, and of which mechanical power alone is capable. Then will the man of sensibility, as he travels, cease to witness those cruelties inflicted by his fellow upon the noblest of the brute creation.

TIMES, JULY 29, 1822.

Iron Rail-way between Manchester and Liverpool.

For many years past, an undertaking of this sort has at different times been a subject of consideration; but there has not hitherto been a sufficient combination of interest or property engaged in favour of the plan, to admit of its being commenced. We understand, however, that the attention of a great number of the leading merchants, both in Manchester and Liverpool, has recently been turned to the subject, and that a variety of calculations have been made to show the great public advantage which may be expected to accrue from the undertaking being carried into effect. The result, it is probable, will be that public meetings of the inhabitants of this town and Liverpool will speedily be called to consider of the scheme, and that early application will be made to Parliament for the powers requisite to carry it into effect. It is perhaps scarcely necessary to add, that the use of steam-carriages is contemplated.

Manchester Guardian.

COURIER, SEPTEMBER 21, 1822.

We stated some weeks ago, that it was in contemplation to establish a communication between this town and Manchester, by means of a Rail-way; and with the view of carrying this stupendous undertaking into effect, notice has been given of an application to Parliament next session for an act with the requisite powers. It is also intended to have a rail-way from Newton to Bolton, thereby connecting the communication with that town and Liverpool and Manchester, as the direct rail-road between these two places will pass through Newton. A notice for an act for this purpose has also been given.—*Liverpool Courier.*

BIRMINGHAM CHRONICLE, May 6, 1824.

Rail-Roads.

We flatter ourselves, from the vast importance of this subject, and from the great interest which it is now exciting in this town and neighbourhood, there is no need to frame an apology to our readers for the insertion of the following particulars respecting this species of road or carriage-way. It is extracted from vol. vi. part ii. of the Supplement to the Encyclopædia Britannica, just published, and it is understood to be the production of the Messrs. Fareys, of London.

Wooden Rail-ways.—Wooden rail-ways are said to have been introduced at the Newcastle coal-mines so early as the year 1680, for transporting the coals from the mouths of the pits to the ships in the river Tyne. Even at that period, many of these mines employed each of them 400 or 500 carts in this traffic; it became, therefore, an object of manifest importance to reduce the great expence thereby incurred in the keeping up of horses, drivers, and roads; and the plan of wooden-rails was the best, and, indeed, the only effectual method which could at that time have been devised for the purpose; for which also the situation was in other respects favourable, presenting in most cases an easy descent towards the river. These rail-ways were then very generally introduced, and continued for a long period in use in this part of the kingdom. Slips of ground of the requisite breadth for the rail-way were marked out between the coal-pits and the river, and were either leased by the coal-owners, or purchased of the different proprietors whose ground the proposed line of road intersected in its course. To obtain the most easy and regular descent, this line was varied in its direction to meet the inequalities of

the ground; or, where these inequalities were inconsiderable, it was carried straight forward, and the regular slope made by embankments and cutting. The ground being then smoothed and levelled, as for an ordinary road, large logs of wood, termed *sleepers*, cut in lengths equal to the breadth of the road, were laid across it, and firmly bedded into it at short distances, to sustain and hold fast the rails or slips of wood on which the waggon wheels were intended to run. These rails were made of beech, and were laid end to end, so as to form two continued lines of rails or wooden ridges, running parallel to each other, along each side of the road, crossing the large logs at each of their extremities, on which they rested as on so many foundations; and were also nailed, or otherwise secured, to keep each piece in its proper place. The waggons were of the usual construction, but of a large size, so as to contain several tons of coals, and set upon low wheels, the smoothness of the way rendering wheels of the ordinary size unnecessary. On these rails a single horse could readily draw three tons of coal from the pits to the river. Where any steep declivity occurred on the road, this was termed a *run*, or an inclined plane; and on it the descent of the waggons was retarded, and regulated by a species of brake, or crooked lever, termed a *convoy*, attached to the waggon, and managed by the driver. The banks of the Tyne, near Newcastle, are remarkably steep on each side; but instead of forming inclined planes on them, the rail-way was here continued on a wooden stage, raised to the same height as the top bank of the river, and carried forward until it came perpendicularly over the river side, where a wooden platform, termed a *staith*, was erected for the convenience of delivering the coals; the waggons being emptied into a trough, or spout, down which the coals descended either directly into the ships, or into the store below.

Iron Rail-ways.—Such was the construction of the original rail-ways, in which we evidently perceive all the parts and members of the rail-way as it is formed at the present day, viz. the regular formed road, the rails, the sleepers, the low waggons, and the inclined plane. Their only defect consisted in the soft and decaying nature of the wood, the wear and tear of which caused such expence for repairs, as greatly limited their application; so that it was only the shortness of the distance, and the great extent of the traffic, which rendered their application at all beneficial. It was only about the year 1738 that they were attempted in the collieries of Whitehaven; and it does not appear that they were adopted in any other part of the kingdom. The use of iron, therefore, in the place of wood, was an essential improvement in the construction of rail-ways, and caused, indeed, a complete change in this, as it has done in every other branch of practical mechanics into which it has been introduced. Flat bars of iron were at first fastened on the top of the wooden rails; but after various unsuccessful attempts, the rails themselves were at last wholly composed of iron, cast in short bars, united at their extremities, and resting on sleepers, or square blocks of stone, disposed at short distances along each side of the road; and this construction having been once fairly reduced to practice, was not only adopted universally in the place of wood, but soon led to new and more extensive applications. Iron rail-ways were quickly introduced into all the coal and mining districts of the kingdom. They were employed on canals, in place of locks, to raise the barges on an inclined plane from a lower to a higher level; in some instances they were adopted in preference to the canal itself; and, on the whole, they now form an important auxiliary to inland navigation, pushing the channels of trade and intercourse

into districts otherwise inaccessible, and even into the interior of the mines.

Rail-ways in England and Wales.—The rail-ways in Britain are so numerous, that it would exceed our limits to specify the particular lines. In the Newcastle coal district, on the river Weare, in the coal and mining districts of Yorkshire and Lancashire, as well as of Derbyshire and Staffordshire, there are numerous rail-ways branching off from the navigable rivers and canals to the different mines. In Shropshire also, and in the great mining districts along the vale of the Severn, the use of rail-ways is very general, and it was here that the inclined plane was first brought in aid of inland navigation. In Surrey there is a rail-way of considerable extent, termed the Surrey Rail-way, and this presents one of the first attempts that have been made to form public rail-ways for general use. In the great mining districts on the West of the Severn, including South Wales, the rail or tram roads are very numerous; and here, owing to the steepness and impracticable nature of the ground, they have been of essential utility in supplying the place of canals. In the year 1791, there was scarcely a single rail-way in all South Wales; and in 1811, the completed rail-roads connected with canals, collieries, iron and copper works, in the counties of Monmouth, Glamorgan, and Caermarthen, amounted to nearly 150 miles in length, exclusive of a great extent within the mines themselves; of which one company in Merthyr-Tydvil possessed 30 miles under ground. In Monmouthshire the Sirhoway rail-way forms one of the first in point of magnitude which has hitherto been constructed. It extends from Pilgwelly, near Newport, to the Sirhoway and Tredogar iron-works, distance 23 miles, whence it is continued five miles further to the Trevil Lime-

works, in Brecknockshire, along with a branch to the west, to the Rumney and Union Iron-works. This rail-way was made by the Monmouthshire Canal Company, under the authority of an Act of Parliament. From Sirhoway, a branch proceeds eastwards to the Ebbwy Works, and from thence down the course of the Ebbwy down to Crumlin Bridge, whence it joins the canal from Newport; and from Sirhoway again, the Brinare rail-way is continued over the Black Mountain to the vale of the Uske at Brecon, and from thence to Hay on the river Wye. In Glamorganshire the principal rail-ways are the Cardiff and the Merthyr-Tydvil, the Aberdare, and the Swansea rail-ways. In Caermarthenshire, the principal rail-way is that which extends from Caermarthen to the lime-works near Llandebie, a distance of 15 miles.

Rail-ways in Scotland.—In Scotland there are various rail-ways proceeding from the different mines throughout the kingdom. The principal one in point of magnitude, is the Duke of Portland's rail-way, extending from the town of Kilmarnock to the harbour of Troon, a distance of nearly ten miles. Its chief object is the export of coal and lime, in which articles a great trade is carried on by means of the rail-way. In the coal and mining districts round Glasgow, there are numerous smaller rail-ways, and also in the coal fields of Mid Lothian and Fife. Plans have been proposed for a public rail-way from Edinburgh to the different coal-works in the neighbourhood. An extensive rail-way was also at one time projected from Glasgow to Berwick-upon-Tweed, but none of those schemes have been carried into effect.

Construction of Rail-ways.—The original wooden rail-ways, already mentioned, are the model on which all the succeeding ones have been formed, and of which we shall

now describe shortly the construction. In regard to the road itself, this should, in the first place, be formed in such a direction, and with such a declivity as may best suit the nature of the ground through which it passes, and of the trade to be carried on upon it. If the trade for example be all in one direction, the road should obviously decline that way, so that the waggons, with their contents, may descend on this inclined plane as much as possible by their own gravity. The inclination should be proportioned to the extent of the trade up the rail-way, so that the draught each way may be equal. If the exports and imports, therefore, be equal, the road should be on a level; and where the ground will not permit that declivity or level best suited to the trade, the line should be varied, and the inequalities made up, if it can be done at a moderate expence, so as to bring it as near as possible to the proper standard. If the inequalities are such as to render this impracticable, the only resource lies in inclined planes. Where the difference of level, for example, between the two extremities of the road is such as would render an equal declivity too steep, the road must then be carried, either on a level or with the due degree of slope, as far as practicable, and then lowered by an inclined plane; on which the waggons are let gently down by means of a brake, are dragged up by means of an additional power to that which draws them along the road, or at once let down and drawn up by means of a roller or pulley, the heavy preponderating over the lighter. In laying out a line of rail-way, therefore, as every situation presents peculiar circumstances, no general rule can be laid down, and the plan must be left to the skill and judgment of the engineer.

The line of a rail-way being fixed on, the road is then properly formed, and of such a width as will be sufficient for

containing the opposite rails, and for forming a footpath on one side. The distance between the opposite rails varies from three to four and one-half feet; some preferring a long and narrow waggon, and others a broad short one. Hence a breadth from nine to twelve feet will be sufficient for a single road, and from fifteen to twenty for a double one. The next operation is the setting and firm bedding of the stone sleepers. These consist of solid blocks of stone, each of the weight of one or two cwt. Their shape is immaterial, provided their base be broad, and their upper surface present an even and solid basis for the rail. They are placed along each side of the road, about three feet distant from each other from centre to centre; the opposite ones being separated by the width between the opposite rails. The ground under them is beat down to form a firm foundation, or, if it be of a soft nature, it is first laid with a coat of gravel or small metal, and this beaten under the stones; the situation of each stone being properly guaged both as to its distance from the adjoining ones, and as to the level or declivity of its upper surface, on which the rails are intended to rest. The space between the sleepers is then filled up with gravel, metal, or other road materials, such as may consolidate into a hard and firm mass.

The next object is the construction of the iron rails; and on this point two very different plans have been adopted, each of which has its advocates, and is practised to a great extent. The one is termed the *flat rail*, or tram plate; the rails being laid on their side, and the waggon-wheels travelling over their broad and flat surface. The other is termed the *edge rail*: the rails being laid edgeways, and the wheels rolling on their upper surfaces. The flat rail, or tram plate, consists of a plate of cast-iron about three feet long, from three to five inches broad, and from half an inch to an

inch thick; extending from sleeper to sleeper, and having a flaunche, turn up, or crest on the inside, from two and a half to four inches high. The rail bears on the sleepers at each end at least three inches, where the rails are cast about half an inch thicker than in the middle. As there is no intermediate bearing for the rails between the sleepers, except the surface of the road, the use of the flaunche is not merely to prevent the waggon from being drawn off the road; it resists the transverse strain arising from the weight of the waggon; on this account it is often, and with great propriety, raised higher in the middle than at the sides, forming an arch of a circle; and, to strengthen the rail still farther, a similar flaunche, arched inversely, is added below. The weight of each rail is from forty to fifty pounds. To unite these rails into one continued line, they are merely laid to each other, end to end, all along each side of the road; being kept in their places, and at the same time made fast to the sleepers, by an iron spike driven through the extremity of each rail into a plug of oak fitted into a hole in the centre of each sleeper. The spike is about six inches long; it has no head, but the upper end of it forms an oblong square, about one inch broad, half an inch thick; and the hole in the rail through which it passes, is formed by a rectangular notch, half an inch square, in the middle of the extremity of each rail; the opposite notches of each rail forming, when laid together, the complete oblong square of one inch by half an inch, and slightly dove-tailed from top to bottom, so as to fit exactly the tapering head of the spike, which is driven clear below the upper surface of the rail.

Wherever the rails cross any road, the space between them and on each side must be paved or causewayed to the level of the top of the flaunches, that the carriages on the

road may be enabled to pass clear over the rails. In single rail-ways it is necessary to have places at certain intervals where the empty waggons, in returning, may get off the road to allow the loaded ones to pass. A place of this kind is termed a *turn out*, and the waggons are directed into it by a moveable rail termed a *pointer*, fixed at the intersection between the principal rail and the turn-out, and turning on its extremity, so as to open the way into the turn-out, and shut that along the road. This contrivance is also used whenever one side of a rail-way crosses another.

The tram roads have been universally adopted in Wales, where they are preferred to any other species. They are also used in most parts of England. The Surrey rail-way is of this description, and was designed by Mr. Jessop. In Scotland the Duke of Portland's rail-way, which, we believe, was planned by the same engineer, is of the same kind, and the rails of the same dimensions. These flat rail-ways have one advantage, of admitting waggons or carts of the ordinary construction, and this is particularly exemplified in the Troon rail-way. According to an account with which we have been favoured by Mr. Wilson of Troon, "there are several kinds of waggons used upon the rail-way under certain restrictions; such as four-wheeled waggons with flat bottom and low shelmets for carrying stone, limestone, grain, timber, slates, &c. from the harbour to Kilmarnock, the mills," &c. "The common make of a cart is allowed to use the rail-way if the wheels are cylindrical, and there be no greater load on each pair than 28 cwt. A great deal is done with these carts in carrying timber, barks, grain, &c., as, with the same cart, they can carry these articles into and through the streets of the town."

The other rail-ways in Scotland, however, are chiefly of the edge kind. In the principal collieries of the north of

England also, the flat rail has been almost entirely superseded by the edge rails, and the latter are now generally admitted to be decidedly superior in the ease of draught which they occasion; the edge of the bar presenting less friction, and being less liable to clog up with dust and mud, or to be obstructed with stones driven off the road upon the surface of the rails. The edge rail consists merely of a rectangular bar of cast-iron, three feet long, three or four inches broad, and from half-inch to one inch thick; set in its edge between the sleepers, and bearing on the sleepers at its extremities. The upper side of the rail is flaunched out to present a broader bearing surface for the wheels, and the under side is also cast thicker than the middle for the sake of strength. But the greatest strength is evidently attained by casting the rail not rectangular, but deeper in the middle than at the ends, to resist better the transverse strain. The ends may be safely reduced nearly to one third of the depth in the middle, and still be equally strong. To unite the rails together, and at the same time preserve them in their places and in their upright position, and to bind them also to the sleepers, they are set in a cast-iron socket or chair, which is firmly attached to the sleeper. This socket embracing the extremities of the adjacent rails, which are here made to overlap a little, a pin is driven at once through the rails and through the socket, and binds the whole together. This is the general method of uniting the edge rails, but the shape and dimensions of the metal chair and of the overlap of the rails are varied according to the judgment and taste of the engineer. Since edge rail-ways have come into more general use, an essential improvement has been made in their construction by the use of malleable iron, in place of cast-iron, in forming the rails. The advantage of malleable iron rails is, that they are less subject to breakage than cast-

iron; a circumstance of importance in this case, where it is not easy to avoid those jolts and sudden shocks which cast-iron is least of all capable of withstanding, and though they should happen to give way, they are easily repaired. They can also be laid in greater lengths, and requiring therefore fewer joints; they can be bent with ease to the curvature of the road; when worn out they are of greater value; and lastly, their first cost is very little, if at all, greater than that of cast-iron rails. Malleable iron is no doubt less able to withstand exposure, decaying more readily under the influence of air and moisture; but hitherto this inconvenience has not been felt, and, on the whole, the malleable iron is now decidedly preferred. These rails are laid and joined in the same manner as the cast-iron, only in greater lengths. Malleable iron, we believe, was first introduced in rail-ways by Mr. George Grieve, at Sir John Hope's collieries, near Edinburgh, where it was first tried on the lighter work which is done under ground. The rails consisted of square bars one inch or one and one-fourth inch square, nine feet long, resting on one or two sleepers in the middle, and resting and made fast to sleepers at the extremities; a simple knee being formed on each end of the bar, and the two knees of each two adjacent rails jammed into one socket in the sleeper. The use of these rails was found so beneficial, that they have since entirely superseded the flat cast-iron rail in general use at the time of their invention. For heavier loads the rails are made deeper. We have been favoured with the following account of their construction by an engineer (Mr. Nielson of Glasgow) who has formed several of the kind.

"One of them is on the property of the Earl of Glasgow, commencing at the Hurlet extensive coal and lime-works, and extending to the Paisley canal, a distance of

about two miles. It is formed of flat bar iron two and one fourth inches deep, by nearly three-fourths of an inch thick, and the rail in lengths of nine feet, each rail being supported at every three feet by a sleeper and cast-iron chair. The joinings are formed by a cast-iron dovetailed socket suited to receive the jointed ends of the bar, and a dovetailed glut or key, by which means the several rails are joined as if one continued bar."

"An improvement has lately been made in the construction of malleable iron rails, which promises to be of essential utility. It consists in the use of bars, not rectangular but of a wedge form, or swelled out on the upper edge. In the rectangular bar there is evidently a waste of metal on the under surface, which, not requiring to be of the same thickness as where the waggon wheel is to roll, may be evidently reduced with advantage, if it can be done easily. The bar may then be made deeper, and broader at the top than before, so as with the same quantity of metal to be equally strong, and present a much broader bearing surface for the wheel. This has been accomplished by Mr. Birkinshaw, of the Bedlington iron works, who has obtained a patent for these broad-topped rails. Their peculiar shape is given them in the rolling of the metal, by means of grooves cut in the rollers, corresponding with the requisite breadth and depth, and curvature of the proposed rail. Mr. B. recommends his rails to be of 18 feet in length. We have seen one of these patent rails at Sir John Hope's colliery; and it certainly forms the most perfect iron rail which has hitherto been contrived; combining very simply and ingeniously in its form the qualities of lightness, strength, and durability. It is 12 feet long, two inches broad along the top, about half an inch along the bottom, and still thinner between. It rests on sleepers at every three feet, and at those places the rail is two inches deep,

while in the middle point between the sleepers it is three inches deep. All these inequalities, we believe, are produced on the metal by means of the rollers; and this circumstance is well deserving of attention, as it may obviously be applied not merely to the formation of rail-ways, but to a variety of other purposes in the arts. The moulding and shaping of the metal in this manner is quite a new attempt in the iron manufacture, and it is not easy to say how far such an invention may yet be caried by the skill of British artists."

Waggons used on Rail-ways.—The waggons used on rail-ways are of various sizes, but of nearly the same general shape, and all set on four wheels from two to three feet diameter. They are made to carry from 20 to 30 cwt. exclusive of the waggon itself, which weighs from 12 to 15 cwt. The axles of the fore and hind wheels are fixed three feet asunder or more, so that the rail is never loaded with more than one-fourth of the waggon at once. According to Mr. Wilson, "The sizes of the coal waggons of Kilmarnock colliery are, on an average, mean length 80 inches, mean breadth 45 inches, and depth 30 inches. Each contains 40 bushels, equal to 32 cwt. of fine coal, and 35 cwt. of blind or malting coal. The weight of the waggon, exclusive of the coal, is 13 cwt. Each waggon, including two pair of wheels and axles, cost from about £13 to £15, and are mostly lined with sheet iron." In Sir John Hope's rail-way the waggons are also nearly of the above dimensions. In the Sirhoway rail-way each waggon carries two and one-half tons.

Expence of constructing Rail-ways.—In regard to the expence of constructing a rail-way, this will depend greatly on the ease or difficulties to be met with in forming the road, and making up the inequalities to the required slope. The above rail-way described by Mr. Nielson cost only £660 per mile; but where there are considerable embank-

ments to form, bridges to build, and deep cuttings, the expence may rise to £4000 and £5000 per mile. The usual rate of tonnage on coals, &c. conveyed on rail-ways is 2*d.* per ton per mile.

Comparative Ease of Draught.—An important consideration regards the work done, or capable of being performed, on a rail-way. On this point, however, the accounts from different rail-ways are various; the performance depending on many circumstances little attended to in the general estimate of work; such as the quality of the horses, the state of the road, the greater or less declivity of the rails, and various other circumstances. More exact observations or experiments are therefore wanting to form correct notions on this subject; but in the mean time, we shall state such facts as have been noticed by different observers. The most exact experiments were made by Joseph Wilkes, Esq. of Measham, in Derbyshire. The result is that one horse, value £20, on a rail-way declining at the rate of one foot perpendicular to 115 the length of the road, "drew 21 carriages or waggons, laden with coals and timber, amounting in the whole to 35 tons, overcoming the *vis inertiæ* repeatedly with great ease." This performance appears, no doubt, enormous; but was evidently owing not so much to the diminution of friction by the rail-way, as to the great declivity; circumstances whose effect must be distinguished in order to obtain any general rule for future works. It is well known that, on any inclined road or plane, every carriage has a tendency to descend of itself, and with a force in proportion to its own weight, exactly as the height of the plane is to its length. In the above example, therefore, the carriages, independent of any external force of traction, would have been urged by their own gravity with a force of 115th of their

weight, and equal therefore to 680 lbs. But as it will not be too low an estimate to assume 150lbs as the working draught of a horse, hence the waggons would descend by their mere weight as if they had been dragged on a level way by at least four horses. If then, to this 680lbs. we add 150 for the action of the horse, the sum, or 830lbs will be equal to power necessary to overcome the friction and inertia of these waggons, and which appears by division to amount to 1-94th of their whole weight; so that if the rail-way had been level, the horse would only have drawn 6¼th tons. Carriages on an ordinary road require 1-12th or 1-15th of their actual weight to draw them along; so that on a rail-way the ease of draught is six times greater than on a common road. The same horse, Mr. Wilkes observes, drew up the declivity five tons with ease. Here the weight of the waggon, or its 115th part, would act against the horse, which would not only have to overcome their friction and inertia, but to drag also this additional load upwards. But 1-94 + 1-115 of five tons = 216lbs. the force of traction, which was evidently a strained effort. The same horse drew three tons up an acclivity of 1 in 20. Here 1-94 + 1-20 of three tons = 407 lbs. a power of traction which few horses can exert, and none could sustain for any length of time. The other experiments of Mr. Wilkes agree nearly with the above. Mr. Outram, engineer, observes, that with a declivity of 1 in 108, the waggons will almost descend of themselves, so that the horse has only to pull a little of the load: this would make the friction and inertia nearly 1-100th of the weight, and the draught of a horse nearly 6¾ tons. Mr. Telford observes, that in a rail-way, with a declivity of 1 in 98, a horse will readily take down waggons containing from 12 to 15 tons, and bring back the same with four tons in them. The total load in

the first case would be about 18 tons, and in the second 8 tons. Here the waggons being urged with 1-98th of their weight, this makes the friction and inertia equal to 1-70th of the weight, and the draught of a horse on a level way only 4¾ tons. In the Troon rail-way, the declivity is about 1 in 660; and, according to Mr. Wilson's account, some horses take down two and and some three waggons, each containing 32 cwt. of coal, and weighing itself 13 cwt. travelling at the rate of three miles an hour. The total load here may be averaged at 115 cwt; and the waggons being used with 1-660 of their weight, this makes the friction and inertia 1-75th of the weight, very nearly equal to the last. We have been favoured by Mr. Grieve with the following particulars regarding Sir John Hope's rail-way, which is of the edge kind. It is on a level, and one horse draws five loaded waggons, each containing 30 cwt of coals, and weighing unloaded, 12 cwt. equal in all to 210 cwt. or 10¾ tons; travelling at the rate of four miles an hour, deducting stoppages. This makes the friction 150th of one load. This performance is beyond any that we have yet stated, and has decidedly the ease of draught of the edge rail. Previous to the formation of this rail-way, it required eight horses for the work which is now done with one. On the whole then, it may be concluded, that on a level tram road, making allowance for the weight of the waggon, one horse will be required for every four tons of coals or other articles conveyed; and on an edge rail-way, one horse will be required for every seven tons. On an ordinary canal, one horse with a boat, will be sufficient for every 80 tons. But the first cost of a canal is three or four times greater than that of a rail-way; so that in some cases it may become a question, whether a rail-way might not be adopted with advantage.

DERBY MERCURY, July 7, 1824.

Considerations upon Canals and Rail-ways.

As the public attention has been called to the consideration of extending the inland communication of this county, the importance of which is too generally acknowledged to need argument in its support, it remains to be determined how the object shall be attained, at the least expence with the greatest advantages to the country. Canals and rail-ways present themselves to our consideration. Canals have hitherto been considered the most economical mode of conveyance, but the progress of science adds to our knowledge, and our opinions or prejudices when not founded on correct views, are liable to change, and the investigation of principles not only removes erroneous ideas, but unfolds new results. This is peculiarly the case with rail-ways.

On their first introduction they were merely intended to give a smooth and regular surface for the wheels to pass over iron constructed with inclined surfaces adapted to the country through which they passed; and when the inclinations were considerable, they presented few advantages in the saving of animal power over the common road. Canals, from their nature being perfect levels, the resistance of the water to the progress of the vessel is nearly all that has to be overcome; and at the slow rate with which vessels move it is very inconsiderable; but as the resistance increases in the ratio of the squares of the velocity in an open expanse of water, in a contracted canal, even moderate velocity is unattainable. Rail-ways also, when perfectly level, may be compared to canals, the resistance to motion being occasioned only by friction, and it is, when rail-ways are made to ascend, that mechanical power, independent of friction,

has to be overcome, which increases with the angle of inclination. On a well constructed rail-way the friction amounts to only one two-hundredth part of the weight of the loaded waggon, so that if a horse's power be considered equal to 150lbs., he would draw two hundred times that weight on a perfectly level rail-way, or near 14 tons with a velocity of 2½ miles per hour, but on a rail-way having an ascent of only one quarter of an inch in one yard, the weight the horse would draw will be reduced to about six tons. It is therefore obvious that rail-ways should be constructed on levels, to do which it is only necessary to obtain the elevations by the aid of inclined planes, upon which the waggons are drawn by stationary steam-engines. And as considerable elevation may be obtained at one point, they are not frequently required, and a single inclined plane would obtain an elevation that might require 20 or 30 locks on a canal.

The expences attending the steam-engine and planes do not exceed that of horses drawing on the levels, and on the levels one penny per ton per mile is found to cover the expence of horses; but if the traffic be considerable, a more economical substitute may be applied, and instead of horses on the levels the travelling steam-engine will perform the work at less than half the expence, and their construction is so simple that the friction of the wheels on the rails is sufficient to propel the waggons, and their velocity may be accelerated to six, eight, or even ten miles the hour without increasing the expences, as, unlike the canal, the resistance keeps pace only with the velocity.

Rail-ways on this principle have latterly been extensively constructed from the collieries in the neighbourhood of Newcastle, and experience has confirmed the advantages

above stated, and the simplicity attending them:—they obviate many objections to canals arising from the localities of the country. When great elevations have to be passed over, the lockage on canals is excessive, and the consequent supply of water expensive, and perhaps only to be obtained by interfering with the vested rights of mill-owners. Extended tunnels may be required to pass through the ridges, and where the expences of first cost are great, those attendant on the maintenance of expensive works will be proportionally enhanced.

Rail-ways may be constructed at one-fifth part of the expence of canals; and as it has been shewn that they will convey as cheaply, where the prospect of remuneration to the adventurer in one case is doubtful, the lesser expence makes the other certain; and as few persons have the public spirit to embark in unprofitable speculations, the lesser cost of a rail-way may secure to a district the advantage of cheap conveyance of the first necessaries of life, as well as give value to its mines and produce, and to the public that of free communication with distant places, whilst benefit to the adventurers is not lost sight of.

Canals take the richest land, and are circuitous by following the valleys, and the carriage from them is ascending.

Rail-ways may pass along the tops and sides of hills from whence the carriage of coal and heavy goods will be conveyed into the neighbourhood without the obstacles of hills, and their elevation admits of branches from them at little expence wherever mines or a populous village make it desirable.* More might be added, but the limits of a News-

* The same security that is obtained by coach and caravan conveyances may be given to the most valuable goods by covered waggons, to which springs may also be added.

paper have already been trespassed on; I shall therefore conclude Mr. Editor,

Your humble servant,

A. B.

FROM THE LIVERPOOL MERCURY.

Rail Roads.

We have been favoured with the perusal of the report of a number of gentlemen who were deputed to inspect the rail-roads in the north of England, from which we make the following extracts, for the information of our readers:

They first touched upon the new Darlington rail-road, at West Auckland, and inspected the same for about three miles. The rail-road is proceeding in the execution, and is expected to be completed in twelve months. The width of the rail-road, inside, is four feet eight inches. A small part of it is laid with cast-iron rails, of three feet long each piece, by way of experiment; but the principal part is laid with the patent malleable-iron rails, fifteen feet long each piece embedded in stone blocks, and kept at their proper width by cast-iron chairs, every three feet of the length. The highest embankment on this line of road is forty-eight feet, and the deepest cutting twenty feet. The greatest ascent is about one-third of an inch in a yard: but this is for a small part of the way; the principal part of the road is from a level to about one-twelfth of an inch to a yard. This road is only a single line, with turn-outs, and is intended to be worked by horses and locomotive engines upon the flat, and by stationary engines up the inclined planes.

They afterwards inspected the Bedlington Iron Works and the Killingworth Colliery rail-roads. At the former they saw some of the malleable-iron rails, only seventeen

pounds per yard, which had been laid down upwards of three years, but which did not appear to be the least injured by rust. The same was the case at the latter; but the iron rail was much stouter than the former. They saw two locomotive engines, for drawing along these roads; but they were not at work. The boilers of these engines were eight feet long, and four feet diameter; and they usually took down fourteen waggons, carrying fifty-three cwt. of coals each, at about four miles an hour. The engineer said that he once took nine loaded waggons one mile in five minutes and a half, which is equal to eleven miles an hour. They next proceeded to view the Hetton Colliery Company's rail-road, and soon met an engine hauling sixteen loaded waggons, containing fifty-three cwt. of coals each, going at about four miles an hour. This rail-road is laid with cast-iron, on the plan of a patent granted to Losh and Stevenson. It is in lengths of three feet, upon stone sleepers; and is the best specimen of cast iron road they have seen. They soon after met another engine, with sixteen carriages laden as above-mentioned; and, in walking up the line of road, the first engine they met had discharged her cargo, and was returning, leading the empty carriages. At the desire of the deputation the engineer stopped his carriage, which he did instantaneously; and, unhooking the engine from the carriages, he ran it down a turn-out, attached it to the lower end of the carriages, and drove them before it. They then got upon the coal and water carriage, and proceeded at about four miles an hour, until they arrived at the inclined plane. The engine was there attached to sixteen more loaded carriages, and they returned with it to the staith, about three miles, in half an hour; and they were exceedingly surprised to see the extraordinary facility with which the engine is managed, either in proceeding forward, retro-

grading, or going faster or slower, before or after the carriages, or in the middle of them, at the will of the tender. In their way to the staith, with this engine attached to sixteen loaded carriages, the rail-road passes for about four hundred yards parallel to and within the distance of twenty yards from the turnpike-road; and, whilst they were passing by the latter, several horses and riders passed, and also a gig, with a lady and gentleman, and the horses, in neither case, seemed at all alarmed, or took the least notice of the engine passing.

GORE'S GENERAL ADVERTISER,

LIVERPOOL, AUGUST 12, 1824.

Proposed Rail-road.

Mr. Stephenson, of Newcastle-upon-Tyne, has laid down the line between Liverpool and Manchester; the distance is $33\frac{1}{10}$ miles. The surveys are nearly completed, and the committee entertain not the least doubt of being ready for the next session of parliament. Independent of the great benefit which the commercial interest will derive from the project, which, both as regards time and cheapness, will prove most important, the landed interest in the vicinity of the line will also derive very great benefit. The communication will be so cheap and rapid, that the distance from a market for produce, or for the supply of manure, will amount to very little. New collieries will be opened, and coals will be much reduced in price. The public in general entertain wrong impressions respecting rail-ways: they never hear them mentioned without referring to such as are seen in the neighbourhood of coal pits and stone quarries. But such improvements have taken place that they are no longer the same thing; besides which, a rail-way without a loco-motive

engine is something like a cart without a horse, a trade without profit, or a canal without water.

FROM THE COURIER.

Rail-roads and Loco-motive Steam Engines.

The public generally are but very little aware of the uses to which rail-roads are about to be applied; the following information therefore will, we trust, be acceptable to our readers.

Hitherto, rail-roads have been used for very limited purposes, and whenever they are spoken of it is in connection with coal pits and stone quarries; but they are now about to be applied for the purpose of conveying merchandize over very extended lines of country, and thus they are becoming an object of great national interest.

Rail-roads, as hitherto worked by horses, possess very little, if any, advantage over canals; but rail-roads worked by the loco-motive steam-engine, have so decided a superiority, both as regards time and expence, that there can be no question but they will be generally adopted wherever a new line of conveyance has become necessary, either from an increased trade, or from the exorbitant demands of canal proprietors.

By the loco-motive engine fifty tons of goods may be conveyed by a ten-horse-power engine on a level road, at the rate of six miles an hour, and lighter weights at a proportioned increase of speed. Carriages for the conveyance of passengers, at the rate of 12 or 14 miles per hour. For canals it is necessary to have a dead level, but not so for rail-roads; an engine will work goods over an elevation of one-eighth of an inch to the yard. Where the ascent or descent is rapid, and cannot be counteracted by cuttings

or embankments, recourse must be had to permanent engines and inclined planes, just as recourse is had to locks for canals; but here again the rail-road system has a great advantage; the inclined plane causes no delay, while locking creates a great deal.

Two Acts of Parliament have already been obtained, namely, the Stockton and Darlington Act, and the Moreton Act. On these lines which exceed thirty miles each, it is intended to adopt the loco-motive engine, and they will both be very soon ready for the conveyance of goods.—There are also three or four other rail-roads projected.

Two years ago several gentlemen in Liverpool and Manchester subscribed to obtain a survey of a line between those two towns. It was accomplished and found practicable. From various causes the prosecution of the plan was delayed; but a few months since it was undertaken with great spirit. A deputation from both towns was appointed to inspect the rail-roads and loco-motive engines of the north; they inspected the Stockton and Darlington line, and enquired minutely into its cost; they witnessed the engines working on the Helton rail-road, near Sunderland, and made a most favourable report. The committee immediately appointed Mr. George Stephenson, of Newcastle-upon-Tyne, their engineer, who has since surveyed and adopted a new line. Its length is 33 and 1-16th miles, and the greatest ascent or descent, is only 1-16th of an inch to the yard. The distance by the high road is 36 miles, and by the canals and river 50 miles. The shares appropriated to Liverpool and Manchester have all been disposed of, but the committee have a small number placed in their hands, to be distributed as they may deem proper. Application for an Act will be made next session of Parliament; the cost is estimated at about 300,000*l*. Mr. Stephenson has

also laid down a line between Birmingham and Liverpool, of which report speaks most favourably; and the Birmingham committee will also go to Parliament next session.

It is intended to meet the Peak Forest and Cromford Canal by means of a rail-road; a rail-road is also spoken of at Stroud, and the High Sheriff of Northumberland has convened a county meeting to invite the expediency of establishing one between Newcastle and Carlisle.

The attempt on the part of canal proprietors to prevent their adoption is utterly hopeless. The discovery of the loco-motive engine will be almost as important to the trade and commerce of this country as the discovery of the steam-engine itself. In fact, it is only a new application of the power of the steam-engine. A few weeks since we witnessed the Prime Minister and his coadjutors, surrounded by men distinguished for their scientific and patriotic pursuits, assembled for the purpose of voting a monument to the memory of Mr. Watt, for the distinguished services he had conferred on his country and on mankind. Surely, then, parliament will never refuse to permit the country to reap the full benefit of his discovery, by throwing out the bills intended to be applied for. Whatever parliament may do, they cannot stop the course of knowledge and improvement; the American Government has possessed itself, through its minister, of the improved mode of constructing and working rail-roads, and there can be no doubt of its immediate adoption throughout that country. The writer of this article has reason to know, that there is scarcely a government in Europe, even down to that of the enterprising Pacha of Egypt, which is not informing itself, through its agents, on this important subject. Monsieur Dupin, the celebrated French traveller has observed in his work on England, that though he could find monuments to the

memory of statesmen, soldiers, sailors, and poets, he could find none to its greatest benefactor, Mr. Watt; it would form an everlasting reproach to the spirit and enterprise of this country, if foreigners should be the first to embrace generally the advantages which the discovery of the locomotive engine presents, and which, undoubtedly, we mainly owe to Mr. Watt.

The following Memorial of the Liverpool and Manchester Company we submit to our readers; though it contains matter chiefly of local interest, there are parts of it well entitled to general consideration :--

"*To the Worshipful the Mayor and Common Council of the Borough of Liverpool.*

"The Memorial of the Subscribers to the projected railroad between Liverpool and Manchester,

"Showeth,—That the merchants of this port have for a long time past, experienced very great difficulties and obstructions in the prosecution of their business, in consequence of the high charges on the freight of goods between this town and Manchester, and of the frequent impossibility of obtaining vessels for days together.

"That the high rate of freight, and the scarcity of vessels are owing to the monopolies possessed by the two existing Carrying Establishments of the Old Quay, and the trustees of the late Duke of Bridgewater.

"That it is true, that these two lines of conveyance are at all times open to any parties who may choose to navigate them with their own vessels; but your memorialists beg to represent, and to press upon your attention, that this is little better than a nominal right; for the Old Quay has not sufficient warehouse room at Manchester, and the trustees of the Duke have monopolized so much of the

land and warehouses there, that what is called a by-carrier is subject to delays, costs, and impediments, which completely put an end to all fair and open competition, and enable the trustees to exact twice the amount of tonnage to which the Acts of Parliament obtained by his Grace entitle them.

"That, in addition to the monopoly which is thereby obtained, but never intended to be given to them by parliament, these two companies are strengthened and supported in their proceedings by the paucity of accommodation which your corporate body is enabled to offer to new companies of carriers by water; so that in point of fact, a state of things has arisen which never was contemplated, and which ought not to be submitted to, if a remedy for so serious a grievance can be suggested.

"That your memorialists, considering the actual difficulties with which they have had to contend, and which appear from the rapid augmentation of trade, to be likely to increase, have, after due investigation of the costs and the advantages, determined to seek a remedy, and to apply to parliament in the ensuing session for an act to obtain permission to form a rail-road between the aforesaid towns.

"Your memorialists submit, that they have already made out a sufficient case for interference and competition with the two companies named, and that for the reasons stated, they trust they are entitled to your countenance and support; but they lay a claim to your co-operation and assistance on broader and stronger grounds—they claim, on behalf of this populous town, on behalf of Ireland, and of the manufacturing population of this part of the empire, your active and hearty support to a measure which will reduce the present charge on the conveyance of goods at least 25 per cent, and the time of conveyance nearly three-fourths.

" That, in addition to these claims which they prefer to your support, there is still another of great moment to the population of this town and neighbourhood, namely, the very great reduction which must take place in the necessary article of coals, in consequence of the rail-road passing through the collieries situated on the line, and laying them open to a cheap and quick conveyance.

" Your memorialists further beg to urge, that by the rail-road system, delays from floods, droughts, frosts, or storms, can never occur; that goods will escape damage by water, and that the owners will be exposed to no risk by wreck, or from any other cause.

" That your memorialists are as little disposed to trifle with their own property as with what are called the vested rights of others; but they are satisfied, after a patient and diligent inquiry, that the undertaking will be attended with pecuniary recompense to themselves, with incalculable advantages to the country; and that to this town in particular, and to the revenue of the corporation, the benefits will be immense.

" That as to vested or exclusive rights, they acknowledge none except such as are specifically provided for by legislative enactment, or by patent; and as to patents, they were intended as an incitement to improvement rather than as a prohibition. That your memorialists have yet to learn that because the trade of the country has been greatly facilitated and increased by canals, no farther extension or improvement is necessary. That since nature has determined the limit to which canals can be carried, by the number of rivers and springs which she has supplied, they have yet to learn that it would be wise to declare, that steam should not be employed in competition with water; and they beg to state their opinion, that as the existing navigations have

monopolized the whole of the streams between here and Manchester, it would be just as reasonable that all water-mills should be protected from steam-mills as that the present canal proprietors should be protected from the power of the loco-motive engine.

" That your memorialists are sensible, that the conduct of your corporate body never evinced a more liberal and enlightened spirit than at the present moment: and that, for the purpose of promoting their own views, it is quite unnecessary that they should refer you to precedent; nevertheless, for the honour of your body, and for the credit of the town, they cannot resist stating, that the mayor and corporation of Liverpool can claim the distinguished merit of being the earliest promoters of inland navigation. On reference to your records in 1765, you will find that the country is mainly indebted to the corporation of Liverpool for the establishment of the Trent and Mersey navigation; and that the funds of the burgesses, and the influence of the members for the Borough and County, were employed to obtain the Act of Parliament under which that canal was established.

" That your memorialists are aware that the projected plan may affect the value of certain canals in this neighbourhood; but they have no idea that the reduction will be greater than from exorbitant to liberal and fair returns for the capital employed; and, when this reduction is compared with the great public benefit which will result from the measure, they trust that the proprietors of those canals will submit without resistance, for it cannot be denied, that they have long derived pecuniary compensation far greater than they ever anticipated.

" Your memorialists have further to observe, that these canals, as well as all others, were commenced and supported

under the plea of benefitting the public, or, to use the words of the Old Quay Act, 'because they will be very beneficial to trade, advantageous to the poor, and convenient for the carriage of coals and merchandize;' and as these canals superseded, in a great measure, the previously existing modes of conveyance for goods, your memorialists confidently trust, that the proprietors will not swerve from the principles which gave them existence, by opposing the project which is now laid before you—a project which cannot fail of benefiting the public in a very eminent degree.

"Your memorialists, therefore, pray that you will take all these premises into your serious consideration, and give them such support, both in and out of Parliament, as you may consider the importance of their case demands.

"JOHN MOSS, Chairman.

"*Liverpool, June* 1, 1824."

LEEDS INTELLIGENCER, SEPTEMBER 30, 1824.

Proposed Rail-way between London and Edinburgh.

A plan, likely to prove of considerable importance to those towns which will enjoy the benefit of its operation, is, we understand, in contemplation, for the construction of a rail-way between London and Edinburgh, for the conveyance of goods and passengers; the propelling power to be loco-motive and stationary steam-engines. It is understood that the distance between those places may be reduced to about 340 miles; and, if the same rate of travelling be adopted on this road as is proposed for the Liverpool and Birmingham rail-way, namely, eight miles an hour for goods, and 12 miles an hour for passengers, the time of conveyance will be reduced to 43 and 29 hours respectively.

"The propriety of fixing upon this line as the Grand Trunk

Rail-way" (says the Caledonian Mercury) 'of the kingdom, is particularly obvious. Besides being the communication between the two capitals, it forms the longest direct line, and passes through one of the most populous manufacturing districts of England. It passes near to Bradford and Leeds. It leaves, at a short distance to the west, the manufacturing towns of Northampton, Leicester, Loughborough, Nottingham, Mansfield, Chesterfield, Sheffield, Barnsley, and Halifax, with all of which places it will communicate. By means of side rail-ways it would, in a similar manner, communicate on the east with Huntingdon, Stamford, Worksop, Doncaster, York, and Durham, passing nearly at equal distances between Carlisle and Newcastle. From Edinburgh it might easily communicate with Glasgow, and also in its southern extremity, be the line of communication with Manchester, through Derby.' A letter has, we understand, been received by the Mayor of Leeds, directing his attention to this very promising project, and the advantages likely to result to this town, if carried into effect. The Lord Provost of Edinburgh is, it appears, well disposed to promote the objects of the company about to be formed for the purpose of realizing this project. There can be no doubt that the plan is not only very feasible, but would be extremely beneficial to the trade of a town so commercially important as this.

GLOBE AND TRAVELLER, OCTOBER 26, 1824.

Rail-way between Manchester and Liverpool.

In the year 1822 a project was formed for constructing a rail-way between Liverpool and Manchester, on which steam-impelled carriages should travel, both with merchan-

dize and passengers, at the rate of 10 miles an hour. A number of gentlemen in Manchester and Liverpool, persuaded of the practicability of the design, entered into a subscription to defray the expences of a survey, with a view to a parliamentary application, and the requisite sum of 300 guineas was subscribed for the purpose. In the autumn of that year Wm. James, Esq. an engineer of London, executed the survey, and suggested a line of road, as marked upon the map accompanying this volume, from Manchester by way of Eccles, Chatmoss, Newchurch, Newton, Rainhill, Huyton, and West Derby, to Liverpool, making a distance of 31 miles. Public notices were accordingly given of the intended application to Parliament, but the measure was not followed up, owing to an apprehended opposition from the whole body of inland navigation proprietors throughout the kingdom, and other causes. How long these causes will operate it is difficult to say; but if, as is asserted, the conveyance of goods between the two towns of Manchester and Liverpool can, by means of a rail-way, be effected at little more than half the present charge for water-carriage and in a quarter of the time, the resistance of any body of men, however powerful, to so great a public improvement, will, in the end, prove as futile as was the resistance of the land-carriers of the last age to the construction of canals.—*Bain's History.*

COURIER, November 19, 1824.

Our attention has of late been called to an improvement in the internal communication of the country by the formation of rail-roads for carriages, to be worked by steam, projected in different parts of the kingdom, and in our paper

of this day will be found a prospectus of one of these undertakings between Manchester and Liverpool. It appears by the prospectus, that there are two canals for the carriage of goods between those towns, and it is a curious fact, that it is proposed to carry goods by the rail-road not only in one-seventh of the time, but at one-third less expence than by canals. This indeed is partly accounted for by the statement that the canals have a monopoly, and have in consequence imposed immoderate charges; but this requires explanation. Canal dues are fixed by Act of Parliament, and cannot be increased at the pleasure of their proprietors. Whatever dues are levied, therefore, must have been thought by Parliament only a proper remuneration for the capital employed in the construction of the canal; but admitting, for the sake of argument, that the proprietors, contrary to the intentions of Parliament in such cases, have acquired what is termed a monopoly, or the power of charging what they think proper, and have actually been in the habit of charging equal to one-third upon the whole amount of carriage between the two places above what they ought, still it only brings the price of both to a level; for the question does not appear to be whether water carriage is not cheaper than land, but whether land is not cheaper than water, by the new mode of conveyance? The first step in the advancement of a country is to make good roads; the second is to make them better; and we look with pleasure to the prospect of so great an improvement in our internal economy. A measure of such obvious utility sufficiently recommends itself.

The following able Paragraph was the leading article of the Globe and Traveller Newspaper, of the 23d of November last.

There was published last week in this paper, the prospectus of a company for the establishment of a rail-road between the two great towns of Manchester and Liverpool, the one of which may be called the centre of production, the other the great outlet, of the manufacturing district of Lancashire. There is so obvious a utility in increasing to the utmost the facilities of communication in every kind between two such places, that it would be superfluous to add any thing to what the committee of the company have themselves said, if we did not find from the writings of the persons interested that the plan is likely to be opposed in Parliament. We have seen too much of the manner in which the private bill business is managed in Parliament not to know that as, on the one hand, there is no proposal so mischievous as may not, by dint of private canvassing among members, have a fair chance of success, so there are none so obviously useful as not to be exposed, from the same causes, to dangerous opposition. We more than once, in the course of the last Session of Parliament, had occasion to advert to this subject, and to what we conceived to be the causes of the evil we complained of. The opposition which is to be got up to this rail-road bill will afford a fair illustration of our remarks.

It appears that there are two canal companies who convey goods between Manchester and Liverpool, who, finding that coalition is much better than competition, have, by various contrivances, raised their charges to an extravagant rate; but, notwithstanding this, from the vast increase of

the population, production, and trade of the district, their business and their profits have wonderfully extended. These gentlemen, some of them connected with persons in the possession of great parliamentary influence, very naturally think that it will be convenient to them to continue to have the towns of Manchester and Liverpool taxable *a la merci—a la misericorde*. They therefore intend to go before Parliament with the modest request that the people of these towns shall be prohibited from carrying their goods by land, in order that they (the canal proprietors) may continue to charge them exorbitantly for carriage by water.

The canal proprietors will object, perhaps, to this statement of their case—"The manufacturers may carry their goods by land, they may carry them along the ordinary roads in broad-wheel waggons, or in stage-coaches, or in wheel-barrows, or in pack-saddles; we simply object," they may say, "to the only cheap and practicable mode."

Taken even with this limitation, it certainly does not speak much for the state of the legislature of the country that any men should venture before it with such a case. If carriage by canal be *in its nature* cheaper than conveyance by rail-way, the proprietors of the canals can continue to preserve their business by lowering their profit to its natural level. If it be in its nature dearer, what possible reason is there for the legislature to go out of its course to prevent the cheaper mode from being established?

Parliament has constantly been in the habit of granting rewards to those ingenious persons who invent machines by which there is a remarkable saving of human labour. But as no machine can be invented or improved without making some older and clumsier machine less valuable, Parliament (according to the principle which the canal proprietors

would seek to establish) should not only cease to reward, but should punish inventors and prohibit their inventions. The plough diminished the value of the spade, as the spade itself had rendered less valuable the vested interest in a strong set of nails.

What is most impudent in this case is, that the canal proprietors derive all their wealth from the singularly rapid race of improvement and invention which the inhabitants of that wonderful district of Lancashire have run—wealth, which, so long as they are subject to free competition, need be envied by no one. They tell the people of Manchester—"Exert all your ingenuity to improve your manufacture, and to surpass the people of foreign countries—let your old machines be thrown aside or broken up as soon as labour can be saved by new ones; your industry and skill is our wealth; but as soon as there is an invention which enables you to carry your goods cheaper, and thus to interfere with our gains, we shall apply to Parliament to stop the career of improvement, and to keep the manufacturing districts in that state in which it is convenient to us that they should stand."

The real state of the case is, that canals must continue to be a valuable, and, with the increasing wealth of the country, an increasing property. For certain sorts of goods they will continue, if they make fair charges, to be the best mode of conveyance—for more rapid transit railways will have the advantage. This difference of capabilities makes the opposition to them, if possible, more flagrantly unjust. The canal proprietors might as well attempt to make us send letters by canal.

BIRMINGHAM CHRONICLE, *December* 16, 1824.

To the Editor of the Birmingham Chronicle.

Wolverhampton, December 10, 1824.

Sir,

While perusing the Birmingham Gazette of the 6th inst. my attention was attracted by an advertisement inviting opposition to the projected rail-way from Birmingham to Liverpool, and to which was appended a most formidable list of names—to each of which my imagination assigned a degree of consequence in that part of the country through which the intended line is to pass, proportioned to the importance of the undertaking; and I naturally enough felt inclined to believe, that the proposed rail-way was merely a scheme got up by a few interested individuals, in direct defiance to the wishes and opinions of the major part of those who were entitled to a voice upon the occasion.

Not choosing, however, to make up my mind as to the merits or demerits of a plan from a specious advertisement, which might, for what I knew, be inserted from mercenary motives, I made such inquiries as enabled me to arrive at the real truth, and no doubt many, who may have been, with myself, equally deceived, will feel astonished at the information I received, viz. that out of sixty-three names which so ostentatiously appeared with opposition fraught, only eighteen are really land-owners; and to add to this farce, the rest are tenants to these very owners whose names thus appear. Going a step further, and analyzing this list of eighteen out of sixty-three, it appears that most are shareholders in those canals, from which, in consequence of the monopoly upon, and the illiberal conduct of the proprietors, the attention of the agricultural and trading communities has been drawn to some more eligible mode of

conveyance. The name of one of those who figure in the van of the opposing phalanx does not appear in any shape on the books of reference, and consequently he has no right to assume any voice in this tribunal, constituted for the purpose of stemming the tide of improvement. Another too, has always been notorious for opposing every step in anywise conducive to public convenience and benefit, and particularly in one recent instance in that part of the country in which he resided, where the utility of the undertaking was admitted even by the most inveterate sticklers for things as they are.

Recurring to the list of tenants, it is a fact, that many have previously expressed their decided conviction of the material benefit likely to result to them as agriculturists, from the direct communication with the neighbouring markets which the projected rail-way must necessarily afford, as well as from the increased facility with which the transportation of fuel and other necessary commodities might be effected.

The only way to account for their names appearing to a declaration so directly at variance with their sentiments, is by taking into consideration the influence which land-owners necessarily possess over their tenants; and if the case I have stated, as to their previous opinions, be true, there must have been a degree of influence made use of highly discreditable to those who availed themselves of their power; and under such circumstances, forty-five out of the sixty-three must be considered mere cyphers. Taking these facts into consideration, the impartial portion of the community will be able to judge how far they ought to rely upon any statements which the canal partizans may think fit to put forth. This advertisement bears upon its face an unworthy wish to bias general opinion; and as these facts so

impressively speak for themselves, it is not necessary that I should encroach further upon your time. It has not been my wish, nor do I intend to enter into any discussion as to the utility of the plan; and I shall conclude by remarking, that if the statement I have made is not correct, the same motive which caused the insertion of the advertisement I refer to, will no doubt produce a refutation of that which I have advanced. If, however, as I confidently anticipate, the truth of these remarks must be admitted, then the parties who are the moving springs of this and other previous advertisements, will stand confessedly convicted of a pitiful attempt to poison the public mind against an undertaking as spirited and creditable as it is likely to be generally beneficial, and this for the purpose of keeping up a system of monopoly and exaction as injurious as it is unjust.

OBSERVER.

From the same Paper.

SIR,

The importance of the subject, and the interest it so generally excites, will be a sufficient apology for this second letter.

Mr. Pitt has very justly observed—"to different tempers different motives must be applied. There are some men who care but little for the honesty of a Minister, if he is accounted wise: there are others who care but little for his talent, if he is not corrupt." As it is in politics, so it is in business. There are some men who will not engage in any undertaking, unless it be great in theory: there are others who will not do so, unless it be immediately practicable, and marked out in characters so plain, that those who run may read them. Fortunately, the supporters of the rail-road include men of both descriptions; the theorist finds room for his imagination—the practical man for his reason.

In my last letter I prognosticated that the time would shortly be at hand when every 50*l.* share in the projected rail-road would be worth, at least, 1500*l.* I gave my reasons for thinking so. I then stated, that those shares in the Old Birmingham Canal, which originally cost but 140*l.* had recently been sold for upwards of 3000*l.*; and I now add, that the other canals which continue the water communication with Liverpool, have risen in nearly the same proportion. I am, if possible, more firmly convinced of the truth of that assertion. An eminent engineer, not employed by this company, assures me, that the rail-road between Birmingham and Wolverhampton may be laid down in three quarters of a year after the passing of the Act, and that Act will be obtained in the course of a few months. The distance from Birmingham to the Mersey, opposite to Liverpool, by the projected rail-road, will be 86 miles; the distance by the canal is 112 miles; and, I believe, besides this, there is a passage of 18 or 20 miles down the river Mersey. The average time of conveying goods by the rail-road, from Birmingham to Liverpool, will be 10½ hours—that by the canal is 4½ days, and occasionally a longer time is required. The distance from Birmingham to Wolverhampton, by the rail-road, will be 11¼ miles, and the time occupied in conveying goods from Birmingham to that place, will be about 1½ hour; while the distance by the canal is 20 miles, and the time of conveyance seven hours. The tonnage on the rail-road will be less than that on the canal. I am not prepared to lay before the public an estimate of the expence of the projected rail-road; but for the present it will be sufficient to state, that the expence of a rail-road for 86 miles never was, and never can be, equal to the expence of cutting a canal for 112 miles.

I understand it is the intention of the canal proprietors to

oppose the passing of the bill; and that they found their opposition upon what they term their vested rights. If they suppose that Parliament will attend to their representations, they will find themselves miserably disappointed. Is not every individual who embarks, or rather who vests his property in trade, liable to the opposition of any fellow tradesman who chooses to oppose him? Are not both parties frequently ruined in the competition? Yet is the former of these to fly to Parliament, to demand their protection against this opposition, under the plea that he had vested his property in business before his fellow tradesman, and consequently was not to be opposed by him, because that would be an attack upon his vested rights? Perhaps these gentlemen may tell me their case is different: that when one tradesman opposes another it is but free competition; but when the interests of a few companies are opposed to the interests of a nation, and that nation calls for an alteration, it is no longer to be considered as free competition, but as an attack upon their vested rights. When Sir Richard Arkwright invented his cotton machine, did not that invention greatly benefit himself, and, to a certain extent, injure others who were in the same trade? Yet did any of those individuals who had large fortunes vested in that trade, come forward to oppose his patent, under the pretence that it would injure their vested rights. Shortly, an application will be made to Parliament for an Act for a New Turnpike-road from Birmingham to Tewkesbury and Cheltenham. By this new road, the distance from Birmingham to Tewkesbury will be six, and to Cheltenham 11 miles less than by the present road; and it will not pass through either Bromsgrove or Worcester. Have the innkeepers, &c. at Bromsgrove, Worcester, and along the old line of road, no vested rights? In the river Thames only, there are

many hundreds, if not thousands, of packets and small sailing vessels, and there are numbers employed along the whole of the English coast. Has not the general use of steam-vessels brought their unfortunate owners to a state of want and misery, which before they never knew? Have they no vested rights? Or are they beneath the notice of an English Parliament? They have vested rights; their all is vested in their little vessels. They are not beneath the notice of an English Parliament. The Parliament see their distress; they see them reduced to want, almost to beggary; they feel for their unhappy situation: but, Sir, Parliament have but one course to pursue—but one duty to perform: it is a duty which they owe, not to this nor to that class of people, but a duty which they owe to the vested interests of the English nation. That which is withheld from the poor will never, in England, be granted to the rich.

Arguments similar to those now made use of by the opponents of the rail-road company, were formerly used against public roads, even against canals, and all other great improvements, be they what they would.

The inhabitants of Middlesex petitioned against canals and public roads, because these would enable the agriculturists of other counties to supply the London market with grain and cattle. Had the inhabitants of Middlesex no vested rights? Had not they vested their property in land, cattle, &c. and did not these improvements do them a temporary injury? Yet, even in those times the Parliament would not grant their petition. And let me ask these monopolists what would have been the state of England now, if they had done so? Would London have increased to its present size? Would Middlesex, with its old roads and no canals, have been able to have supplied the present population of London with provisions? Would the trade

and population of this country have increased to what it now is? Should we have been able to have borne an annual taxation of eighty millions—to have carried on a war for upwards of twenty years, and during a part of that time, against every powerful state in Europe? But, perhaps, they will tell us we have arrived at a state of sufficient perfection: that a stop shall be put to all future improvements. To complete this farce—to gain them that credit to which they are entitled—and to ensure them the more general contempt of the English nation, let them add, this we will do in the nineteenth century, while Canning and Peel are Secretaries of State, and Huskisson is President of the Board of Trade.

I am, Sir,

A Friend to Great Britain.

Birmingham, December 14, 1824.

The following important Calculations respecting Rail-roads, are copied from the Scotsman *Journal, of December* 8, 1824.

On a well made road a horse will draw a load of one ton, in a cart weighing 7 cwt. at the rate of two miles an hour—*(Leslie's Elements*, p. 253.) The whole strength of the horse is exerted in overcoming the friction. On such a road, therefore, a force of traction of 100 pounds, moves a weight of 3,000 pounds, or the friction is 1-30th part of the load (the cart included.)

On a rail-way of the best construction, it has been shown in our former paper, that a horse travelling at the same rate of two miles an hour, draws 15 tons, including the vehicles. In this case then a power of traction of 100 pounds, moves a weight of 33,600 pounds; the friction of

course is 1-336th part—or in round numbers 1-300th part of the load.

On a canal, a horse travelling at two miles an hour, draws 30 tons in a boat weighing probably 15 tons.* Reducing the ton to 2,000 pounds for the sake of round numbers, as in the last calculation we find here that a power of traction of 100 pounds moves a mass of 90,000 pounds, or the resistance which the water opposes to the motion of the vessel is equal to 1-900th part of the load or entire weight. At sea, where the water way is of unlimited breadth, the resistance is probably one-third less; but as a compensation for this, when steam power is employed, there is probably a loss of one-third in consequence of the disadvantageous mode of its application.

We see then that the effect produced by the draught of a single horse is ten times as great upon a rail-way, and thirty times as great upon a canal, as upon a well made road. Yet a rail-way costs only about three times as much as a good turnpike road,† and a canal about nine or ten times; and the railway and canal in repair are probably less in proportion to the original outlay, than in the case of a road. It is obvious, then, that were rail-ways to come into general use, two-thirds or more of the expence of transporting commodities would be saved. With regard to the comparative advantages of canals and rail-ways, so

* Boats in some cases carry only 15 or 20 tons; in others 35, (as the coal boats on the Union Canal,) but in the one case they travel quicker, and in others slower, than the rate mentioned.

† In Mr. Telford's estimates for portions of new road between Edinburgh and Woollar, we find the expence to be from one thousand to one thousand one hundred pounds per mile, including the price of the ground.

far as the present facts go, we may observe, that if a horse power effects three times as much upon a canal as upon a rail-way, the canal costs about three times as much, and will of course require nearly the same rates or dues per ton to make the capital yield the same interest.

But here it is of great importance to recollect that this computation refers solely to a velocity of two miles an hour. If the friction which impedes the motion of a car or waggon, and the resistance which the water offers to the progress of a ship, were governed by the same laws, the same conclusions would hold true whatever the velocity might be. But this is far from being the case, as we shall presently see. In illustrating this point, it will be convenient, instead of estimating effects by the variable measure of a horse power, to refer to a determinate and constant force of traction of a given amount. We shall therefore assume, that the body to be moved is urged forward by force exactly equivalent to a weight of 100 pounds suspended over a pully at the end of the plane on which it moves. First, with regard to the motion of a body in water. It is deduced from the constitution of fluids, and confirmed by experiment, that the resistance which a floating body encounters in its motion through the fluid is as the square of the velocity.* Now, taking as a basis the known effect of force of traction of 100 pounds at two miles an hour, let us ascertain what force would move the same body at a greater velocity. On a canal, or arm of the sea, we have seen that a body weighing 90,000 pounds is impelled at the rate of two miles an hour by a force of 100 pounds: therefore to move the same body

* See Playfair's Outline, I. 198; Leslie's Elements, sec. vii. and Article "Resistance;" Encycl. Brit.

At 4 miles an hour,	will require	....	400 pounds
At 6	ditto	....	900 do.
At 8	ditto	....	1600 do.
At 12	ditto	....	3600 do.

Or conversely:—

100 pounds moves	90,000 pounds	at	2 miles an hour.
	or 22,500	at	4 ditto
	or 10,000	at	6 ditto
	or 5,620	at	8 ditto
	or 2,500	at	12 ditto

Hence we see that when we have to contend with the resistance of water, a great increase of power produces but a small increase of velocity. To make a ship sail three times faster, for instance, we must employ nine times the power; and to make her sail six times faster, we must employ no less than thirty-six times the power. Let us suppose, for example, that it were required to determine, since one horse draws a boat loaded with thirty tons at two miles an hour, how many horses would draw the same boat at four miles. We find, first, that since the boat is to move two times as fast, it will require four times the absolute amount of power, or 400 pounds. But a horse moving at four miles an hour, pulls only with a force of 64 pounds. Of course, it would require six horses to exert a power of 400 pounds, and move the boat at the rate proposed.

Let us now see what amount of power will produce corresponding effects upon a rail-way. And before we make more particular enquiry, let us suppose that the retardation occasioned by friction, instead of increasing as the square of the velocity like the resistance of a fluid, increases in the simple ratio of the velocity. We have seen, then, that a force of traction of 100 pounds, upon a level rail-

way, moves a body weighing 30,000 pounds, at the rate of two miles an hour. We may hence calculate the effect produced by any greater amount of power:—30,000 pounds are moved at 2 miles an hour by a power of 100lb.

at 4 miles	by	200lb.
at 6 miles	by	300lb.
at 8 miles	by	400lb.
at 12 miles	by	600lb.

Or conversely:—

A power of 100 pounds moves 30,000lb. at 2 miles per hour.
or 15,000lb. at 4
or 10,000lb. at 6
or 7,500lb. at 8
or 5,000lb. at 12

Hence we see that, though a moving force of 100 pounds produces three times as great an effect upon a canal as upon a rail-way at two miles an hour, this superiority of the water conveyance is lost if we adopt a velocity at six miles an hour, and at all greater velocities the same expenditure of power will produce a greater effect upon a rail-way, than upon a canal, a river, or the sea.

This calculation proceeds on the hypothesis that the friction increases in the simple ratio of the velocity. Such was the opinion of Ferguson, Muschenbrock, and some other writers; but the more recent and accurate experiments of Coulomb and Vince have overthrown this doctrine, and established conclusions extremely different, of which the following is an abstract: *—

* Leslie's Elements, p. 188, &c.; Playfair's Outlines, I. 88, &c.; Journal de Physique, 1785; Philosophical Transactions, 1785. Dr. Brewster has given the results of Coulomb's experiments in a tabular form, in the Article *Mechanics*, in his Encyclopædia.

1. The friction of iron sliding on iron is 28 per cent. of the weight, but is reduced to 25 per cent. after the body is in motion.

2. Friction increases in a ratio nearly the same with that of the pressure. If we increase the load of a sledge or carriage four times, the friction will be nearly, but not quite, four times greater.

3. Friction is nearly the same whether the body moves upon a small or greater surface; but it is rather less when the surface is small.

4. The Friction of rolling and sliding bodies follows nearly, but not precisely, the same law as to velocity; and that law is, that the friction is the same for all velocities.

It is with this last law only we have to do at present; and it is remarkable that the extraordinary results to which it leads, have been, so far as we know, entirely overlooked by writers on roads and rail-ways. The results indeed, have an appearance so paradoxical, that they will shock the faith of practical men, though the principle from which they flow is admitted without question by all scientific mechanicians.

First, It follows from this law that (abstracting the resistance of the air,) if a car were set in motion on a level railway, with a constant force greater in any degree than is required to overcome its friction, the car would proceed with a motion continually accelerated, like a falling body acted upon by the force of gravitation; and however small the original velocity might be, it would in time increase beyond any assignable limit. It is only the resistance of the air (increasing as the square of the velocity) that prevents this indefinite acceleration and ultimately renders the motion uniform.

Secondly, Setting aside again, the resistance of the air (the effects of which we shall estimate by and by,) the very

same amount of constant force which impels a car on a rail-way at 2 miles an hour, would impel it at 10 or 20 miles an hour, if an extra force were employed at first to overcome the inertia of the car, and generate the required velocity. Startling as this proposition may appear, it is an indisputable and necessary consequence of the laws of friction. In fact, assuming that the resistance of the air were withdrawn, if we suppose a horizontal rail-way made round the globe, and the machine (supplied with a power exactly equivalent to the friction) to be placed on the rail-way, and launched by an impulse with any determinate velocity, it would revolve for ever with the velocity so imparted, and be in truth a sort of secondary planet to our globe.

Now, it would be at all times easy (as we shall afterwards show) to convert this accelerated motion into a uniform motion of any determinate velocity; and from the nature of the resistance, a high velocity would cost almost as little, and be as easily obtained as a low one. For all velocities, therefore, above four or five miles an hour, rail-ways will afford facilities for communication prodigiously superior to canals or arms of the sea.

LEEDS MERCURY, DECEMBER 18, 1824.

The Scotsman of Saturday last contains a concluding article on the subject of rail-ways, from which, on account of its important calculations and results, we make the following copious extracts:

It will be convenient before we proceed further, to give a short summary of the propositions already laid down respecting the motion of bodies on rail-ways, viz.

1. The resistance to the motion of the body, arising from friction, is the same at all velocities: that is, the resistance

is equal in equal times, whatever be the space passed over. This is the primary law, established by the experiments of Vince and Coulomb.

2. It follows from this law, that a body impelled along a rail-way by any constant power, exceeding what is sufficient to overcome the resistance of friction (which is a uniform quantity), will have its motion continually accelerated in the ratio of the squares of the times. A body, for instance, so impelled, which travels one foot or one yard in the first second, will travel three feet or yards in the next second, five feet or yards in the third, seven in the fourth, and so on. Its motion, if not strictly conformable to this principle, will at least approximate to it.

3. It follows also from the same law, that if the power expended in overcoming the *inertia* of the moving body in the earlier part of its journey, is saved, by an impulse given at the moment of starting, the body will proceed exactly as it would have done, had it arrived at the same degree of velocity by its own accelerating power; that is, it will not only maintain the high velocity thus communicated, but increase it. In other words, the same constant power which would maintain a velocity of two miles, would equally maintain a velocity of twenty miles an hour. It is to be remembered, that we take no account here of the resistance of the air.

We shall now show how the effects of a certain force of traction upon a horizontal rail-way are to be computed. As the friction of a given body is a fixed and constant quantity, the power employed in impelling the machine may be conveniently divided into two portions—one to balance the retarding effect of the friction; the other to urge it forward, which of course constitutes the *accelerating force*. Let us then suppose that a force of traction equal to 200

pounds is applied on a rail-way, to a waggon or machine weighing, with its load, 30,000 pounds. Of this force let us suppose 100 pounds to balance the friction; of course the remaining 100 pounds is applied to the acceleration of the machine. Now the accelerating force of 100 pounds is equal to the 300th part of the weight of the body to be moved. The machine will therefore advance through a 300th part of 16 feet in the first second; through three times this fractional space in the next second; five times the same space in the third second, &c. By pursuing this calculation, we find that the machine will travel 8¼ miles in 15 minutes, 33 miles in half an hour, and 130 in an hour. Such would be the result in space absolutely void; but a degree of speed approaching to this is rendered utterly impossible by the resistance of the atmosphere, which retards the motion from its commencement, and ultimately renders it uniform, however great may be the moving power employed. It is to be observed, that with an accelerating force double of the one assumed (or 200 pounds), the space gone over in the same time would be double; with a treble force (300 pounds) it would be treble, and so on.

We shall now estimate the retarding effect produced by the resistance of the air. During high winds this resistance is so considerable, that means should be taken to lessen its amount, first by making the vehicle long and narrow rather than broad and short; and secondly, by giving the front a round or hemispherical form. Let us suppose, then, that there are two steam vehicles, each weighing, with its engine, fuel, and load, 15 tons. The one, a steam-waggon for conveying goods, is six feet high and five feet wide, and has of course a front of 30 square feet, which, in reference to the pressure of the air, is reduced to 15 feet, by giving it a rounded form. The other, a steam-coach for carrying

passengers, is eight feet high and eight wide, or seven feet high and nine wide, presenting a front of 60 square feet, but reduced to 30 by its rounded form.

Now, still air is found by experiment to press with a force of 16 grains upon a body presenting a front of one foot square, and moving at the rate of one foot in a second, and the pressure increases as the square of the velocity. Hence our steam-coach, when moving at four miles an hour, in a still atmosphere, would encounter a resistance from the pressure of the air of $2\frac{1}{4}$ pounds; at eight miles an hour the resistance would be nine pounds; at 12 miles, 20 pounds; at 16 miles, 36 pounds; at 20 miles, 57 pounds. The steam-waggon, presenting only half the surface in front, would experience only half the resistance.

Let us assume, according to what we have already stated, that a power of 100 pounds would just put the steam-coach in motion; then if we allow an additional power of 33 pounds for acceleration—making 133 pounds altogether, we find that if the air did not oppose its progress, it would move over 43 miles in one hour. But since it is propelled only by a force of 33 pounds, as soon as the resistance of the air pressed it back with a force of 33 pounds, the acceleration would cease, and the motion become uniform. Now this would take place within 15 or 20 minutes, and when the velocity had risen to 14 or 15 miles an hour. With the steam-waggon, presenting only half the front, the velocity would become uniform at 22 miles an hour. Hence we see, that if we had always a perfect calm in the atmosphere, we could impel 15 tons along a rail-way with a velocity of 15 or 22 miles an hour (according to the extent of surface the vehicle presented), by a force of 133 pounds. We may now compare the resistance of a rail-way with that of a canal or arm of the sea, in a calm atmosphere.

According to the table formerly given, the force required to impel a vessel weighing, with her load, 15 tons, through water at different velocities, would be as follows:

At 4 miles per hour -	133 lbs.
6 - - -	300 do.
8 - - -	533 do.
12 - - -	1200 do.
16 - - -	2133 do.
20 - - -	3325 do.

On a rail-way, we have merely to add to the power required to overcome the friction (100 pounds), a few pounds more to balance the resistance of the atmosphere at the velocity proposed. For the steam-coach with 30 feet of front, it would be as follows:

At 4 miles per hour -	102 lbs.
6 - - -	105 do.
8 - - -	109 do.
12 - - -	120 do.
16 - - -	137 do.
20 - - -	158 do.

We see from this table the astonishing superiority of the rail-way over the canal, for all velocities above four miles an hour. Nearly three times as much power would be required to move an equal mass at six miles an hour on a canal as on a rail-way; five times as much power would be required at eight miles an hour; ten times as much at 12 miles; fifteen times as much at 16 miles; and twenty-one times as much at 20 miles an hour. It is evident, also, that an addition of power, too trifling to add any thing material to the weight of the vehicle, would raise the *terminal* or uniform velocity from four miles an hour to 20; and that, speaking practically, it would cost no more to command a velocity of 20 miles an hour on a rail-way, than a velocity

of one. Except for the chances of injury to the rail-way or the vehicle, there would not be the smallest reason for conveying goods, even of the coarsest kinds, at four miles, rather than at 20 miles an hour!

The writer then proceeds to show that the resistance of the air in high winds should be provided against; and for this purpose he suggests that the moving power of the vehicle should be from 200 to 500 pounds, which would ensure a velocity of 20 miles an hour in all but the highest winds. He concludes with the following remarks:—*Among all the new projects and inventions with which this age teems, there certainly is not one that opens up such a boundless prospect of improvement as the general introduction of rail-ways for the purpose of commercial communication.* We have spoken of vehicles travelling at 20 miles an hour. But we see no reason for thinking that in the progress of improvement a much higher velocity may not be found practicable. Tiberius travelled 200 miles in two days, and this was reckoned an extraordinary effort. But in our times, a shopkeeper or mechanic, on the most ordinary occasion, travels twice as fast as the Roman Emperor; and twenty years hence, he may probably travel with a speed that would leave the fleetest courser behind. Such a new power of loco-motion cannot be introduced without effecting a vast change in the state of society. With so great a facility and celerity of communication, the provincial towns of an extensive empire would become so many suburbs of the metropolis—or, rather, the effect would be similar to that of collecting the whole inhabitants of a country into one city. Commodities, inventions, discoveries, opinions, feelings, would circulate with a rapidity hitherto unknown; and above all, the personal intercourse of man with man would be prodigiously increased. Were the ugly

despotisms that retard civilization on the continent annihilated, Europe might be made as it were one family, by such a system of internal communication.

LEEDS MERCURY, DECEMBER 24, 1824.

We have heard it said that the nation is going "Rail-way mad;" and unquestionably the rage for speculation has taken so decided a turn in this direction, as to present several symptoms of the popular delusion which sometimes arises out of a strong and general excitement of the most active passions of human nature. A popular cry of any kind is wonderfully infectious, even when it respects mere matters of opinion; but when the *love of money* is stimulated by flattering hopes—when some new and great project is set on foot, in which the first speculators have derived enormous profits—when universal hope is raised, by the mutual encouragement of those who entertain it, into universal confidence—when all the world seems hastening to be rich; in such a case there is no small danger that prudence will be lost sight of, and that a violent delusion will seize upon the nation. There have been several memorable examples of this popular madness, and it is seen to a certain extent in the eagerness with which merchants rush into any new market for their goods, till they produce a glut that results in severe loss.

But we must say, that we have hitherto seen nothing in the new zeal for rail-way speculations, which we have not hailed with pleasure. If this mode of communication and conveyance is, as we really believe, very greatly superior to those at present in general use, we shall not think the speculation excessive, till a rail-way is constructed on every much-frequented line of road in the kingdom. Easy and

expeditious internal communication is of great importance to every country. In many cases, it makes all the difference between obtaining a market, and not obtaining one, for produce and manufactures. A few shillings expended in carriage or freight often makes it impossible to bring a commodity into a domestic or foreign market, in competition with other commodities of the same kind, produced with no less labour and expense, but nearer at hand. The excellent internal communications of this kingdom were strongly insisted upon by several witnesses, before the Artisans' Committee of the House of Commons in the last session, as one of the essential advantages which England possessed over France, for manufactures and commerce. Such communications enable a country to make the most of all its various and scattered sources of wealth. Different counties have peculiar advantages for different products. One district has mines of tin and copper; another has iron and coal; another, salt mines; another, lime; another is rich in agricultural products: one county is favourably situated for the cotton manufacture; another for the woollen; another for pottery; another for hardware. It is of immense importance to all these districts, to have such easy intercourse as will enable each to avail itself of the resources of the others, and to supply them with its own productions. These scattered advantages are thus practically concentrated. Several counties, though fertile, are thinly peopled, merely because their communication with the busier parts of the island is difficult; and the most densely inhabited districts are those which, either by nature or art, combine the greatest number of advantages. The woollen manufacturers of our own district have coal and iron in their immediate neighbourhood, without which they could never have flourished; but they derive their raw material, and many

articles necessary to the manufacture, from various distant parts of this and other countries. The wool comes from Scotland, Lincolnshire, and the South; from Saxony and Spain; the dyeing wares from America and the Indies; the brass work of the machinery from Birmingham, and originally from Cornwall or Peru; the provisions, &c. which support our population, from every part of the globe. Let any man consider how entirely we should be cut off from many of the most important of these supplies, if the Aire, the Ouse, and the Humber were to be blocked up; how many of our manufacturers must of necessity relinquish their business; and how difficult the rest would find it to send their goods to market, without this grand outlet, and the Leeds and Liverpool Canal. Lancashire is still more obviously indebted to its excellent communications with different parts of the kingdom and of the world, for its manufacturing prosperity. Manchester, which is the centre of the greatest manufacturing district in the world, receives its cotton, dye wares, &c. by the Mersey from Liverpool; the iron of its machinery from Staffordshire, and many of its tools, machines, &c. from Birmingham, with both of which places it has an excellent communication by canal. Fill up the canals and the Mersey, and all Lancashire would be starved. The various collieries, potteries, and manufacturing districts owe their prosperity in a very great degree to the excellent roads and the navigable rivers and canals which intersect the kingdom. There are also many flourishing agricultural districts, where the land would be worth extremely little, if such modes of communication did not enable farmers to receive from a distance tools, bricks, lime, salt, and manure, and to send to market in return their grain, roots, and cattle.

If then industry, wealth, and population have been so

greatly promoted by the existing modes of communication, it is obvious that still improved modes would cause a higher degree of prosperity. We have not the least doubt that, with rail-ways intersecting the whole kingdom, and with a free corn-trade, England might receive a prodigious increase in the number of its inhabitants and the amount of its wealth. We recollect reading in the Monthly Magazine, eight or ten years ago, an article by Sir Richard Phillips, in which that gentleman looked forward with a prophetic eye to many of the improvements now making or in contemplation; and we were particularly struck with the remark, that, if a small part of the money we had spent in the late war had been applied to internal improvements, we might at that time have been travelling along rail-ways, at the rate of 20 miles an hour, through every part of the kingdom. The sagacity of Sir Richard is now fully illustrated. Not only, however, would the country be rendered richer and stronger by this facility of traversing it, but knowledge and intelligence would be at least as much promoted as wealth. The inhabitants of towns are always better informed than those of villages and hamlets, and the population of the metropolis than that of the country. This arises from the more frequent intercourse of mind with mind, as well as from the greater abundance and easier circulation of books, where the inhabitants are closely congregated; and this frequent intercourse and easy circulation may soon be enjoyed, in a degree at present scarcely to be conceived, by the inhabitants of the agricultural districts.

Several companies have already been formed with immense capitals, for connecting the principal cities and towns of the kingdom by rail-ways. Notices of these undertakings will be found in our miscellany and in our third page. In order to bring them into one view, we may mention that,

by these various companies, rail-ways will in all probability be constructed from London to Birmingham, from Birmingham to Bristol and Liverpool, from Liverpool to Manchester, from Manchester to Leeds, from Leeds to Hull, from Hull and Leeds to London, from London to Dover, from one end of Derbyshire to the other, from Berwick to Kelso, and from Edinburgh to the Clyde. If these projects are carried into effect, the following important districts will be intimately connected with each other and with the out-ports: the metropolis, the iron and hardware district of Warwickshire, the port of Bristol, the collieries of Gloucestershire and Staffordshire, the potteries of the latter county, the cotton district of Lancashire, the port of Liverpool, the silk districts of Coventry, Macclesfield, and Manchester, the woollen and linen districts of the West Riding of Yorkshire, the lace and hosiery districts of Nottinghamshire and Leicestershire, the populous towns of Kent, on the banks of the Thames, and in the routes to Maidstone, Dover, and Sandwich, and the lowlands of Scotland. All these important districts, except Scotland, will be within a few hours of each other, both for travellers and for goods, without being subject to any interruptions from frost or drought. This of course supposes, that loco-motive engines can be applied to them, capable of moving with great celerity, which there is every reason to expect. One of the rail-way companies at present contemplates a speed of only eight miles an hour; but another, in its prospectus, speaks of conveying passengers at twice the speed of the present stage-coaches; and we look forward pretty confidently to the attainment, in a few years, of a velocity of 20 miles an hour. Several millions sterling are already subscribed for accomplishing these great projects.

It is to be expected, that a grand opposition will be

made to the rail-way companies, when they apply for bills in the next session of parliament, by the proprietors of canals, roads, stage-coaches, waggons, and every less convenient mode of carrying persons and goods through the country. These classes, finding their own profits in danger, will cry out that the rail-ways are all a delusion, though their only fear is that they will answer too well. Many will acknowledge the possibility of their success, but will oppose them on the ground of the large capitals vested in canals, &c. which would be rendered much less productive by the adoption of rail-ways. There never, perhaps, was any improvement made, which some individuals did not find, or think, contrary to their interests. But if parliament, from the investigations which will doubtless be made, sees reason to conclude, that rail-ways will constitute an improvement, it would be folly of the grossest kind to prevent their adoption, from a fear of injuring individuals whose capital may be embarked in the old modes of conveyance. There is scarcely a piece of machinery in the country, which has not superseded some old machinery, and perhaps none which is not destined to be improved upon and superseded in its turn. All the present modes of conveyance are recent improvements: first, we had the string of pack-horses with their bells; then the lumbering waggons; then the heavy coaches; then the vans and light coaches; bridle ways were made into turnpike roads; canals were cut through the country; land conveyance was partly superseded by water conveyance, and sailing packets by steam-packets. Yet the country has not been absolutely ruined by the repeated "sacrifices of vested capital," which all these improvements involved; and we hope there is not a man to be found even within the walls of St. Stephen's, who will avow the opinion that *now* we have gone as far in the course of improvement

as we ought to go, and that we should not adopt new machinery because we shall thus sacrifice the old. Precisely the same arguments as are now to be used against rail-ways by the proprietors of canals, were formerly used against canals by the proprietors of waggons and roads; and the one outcry is just as wise as the other. It is however, to be observed, that canals will by no means be dispensed with, as many bulky articles, and many goods of every description, which do not require speedy transit, will still be conveyed by water; whilst the trade of the country may be so far increased, as after all, to give the canal conveyances nearly the same quantity of employment as they have at present, though certainly with diminished profits.

We do not, however, regret the opposition that will inevitably be made to the rail-way companies. On the contrary, we rejoice that they will be compelled publicly to prove the practicability and benefit of their undertakings. It is highly desirable, that these companies should proceed with great caution, and even at a slow pace, towards the accomplishment of their designs. The manner of forming rail-ways on the best construction is very imperfectly understood even by able engineers; nor have the steam-coach and steam-waggon, that are to move at the rate of eight, ten, twelve, or more miles per hour, yet been seen in operation. Many errors will be committed in the first instance, and many improvements suggested after a little experience. We should particularly recommend companies out of the metropolis to exercise patience. There is no urgent need for the rail-ways, and no capital is lying idle during the delay, as the subscribers are only called upon to advance the amount of their shares in instalments as the work proceeds. Perhaps the Liverpool and Manchester rail-way will be the first to be undertaken; and few, if any, of the companies

more recently formed will now be able to apply to parliament for a bill during the next session, as the time for giving notice of private bills is already passed. We have no doubt that rail-ways will ultimately prove a great public and private benefit, but we hope that as little money as possible will be squandered in premature and ill-judged efforts to establish them.

A Statement of the Claim of the Subscribers to the Birmingham and Liverpool Rail-road to an Act of Parliament, in reply to the Opposition of the Canal Companies. London: Baldwin, Cradock, and Joy. Price Two Shillings.

We mentioned last week that we should make copious extracts from the above pamphlet on the subject of Rail-roads, which was published some days since.

We are sure that there needs no apology to our readers for the space we have of late allotted to the discussion of the relative advantages of rail-roads and canals. A more important inquiry, or one in which the great interests of the country, its trade and commerce, are more deeply concerned, has not occurred for many years. It is most important and interesting, as connected with the present property and capital employed in land and water carriage, and still more important to the future interests of the commercial world. It is needless to regret the party spirit and prejudice which attend the discussion and first introduction of all new schemes and undertakings; the "nature of man" ever has been and will be the cause; and to repress, not to extinguish, irritation and prejudice, is the only reasonable hope of the public writer and journalist. We can only say for ourselves that we have no interest on the one side or the other; that our bias is certainly in favour of free trade,

competition, and patronage of British ingenuity and industry, and that our columns will be open equally to the statements, letters, and arguments of the different parties.

Our readers are aware that a great deal of desultory and acrimonious writing has been bestowed on the subject of rail-roads, and perhaps with the exception of Mr. Sandars's letter, and the prospectus and advertisements of the different rail-road companies, there has been no analytical or comprehensive view, till the publication of the pamphlet before us, of the preliminary question on which they are so much at variance with canals—viz. their right to obtain from parliament an authority for new modes of transit, when parliament has already privileged large companies to invest their capital in canals. It is obvious that this is the first and most important question to solve, and must be settled before the comparative merits of the rival modes of transit can be considered. It is this particular and exclusive point that the pamphlet before us debates; and the argument is conducted on the simple and sound principles of political economy with brevity, force, and impartiality. The motto in the title page is a type of the argument, and is one of those axioms which, independent of the great name attached to it, has now become nearly the universal creed of political economists:—

"Every individual is continually exerting himself to find out the most advantageous employment for whatever capital he can command. It is his own advantage indeed, and not that of society, which he has in view. But the study of his own advantage naturally, or rather necessarily, leads him to prefer that employment which is most advantageous to society."—*Smith's Wealth of Nations*, vol. ii. c. 2.

We shall be brief in our remarks, that the extracts may more critically speak for themselves.

The following preliminary observations open the subject:—

"At a period when all parties of politicians and political economists are the advocates of free trade, and of the anti-restrictive system of commerce, there needs no exposition of the abstract principles of the nature and causes of public wealth. The luminous works of Turgot, Adam Smith, Bentham, Say, Ricardo, Mill, and M'Culloch, have converted all thinking men to the belief in those principles, however their sinister interests may render them averse to their practical adoption. The present enlightened commercial ministry of Great Britain, has also conferred an additional stamp on those opinions, by exhibiting in practice the truth of theories formed only speculative. It is now universally admitted, that the old system of commercial restriction was not only mischievous, but also useless—means altogether unadapted to the attainment of the contemplated ends. Monopoly and corporate restrictions have been ascertained to be large spokes in the swift wheels of human invention and improvement; and it is at last conceded, after ages of error, that every man is the best guardian of his own interest, and that, in the pursuit of wealth, the public interest and that of every individual are the same; that security to property is the only protection required at the hands of the Legislature; and that any attempt on its part to prescribe the channels in which labour and capital shall flow, or any precautions to save a man from ruining himself, cannot be otherwise than injurious."

"It cannot however be a matter of great astonishment that after the long continued thraldom commerce and trade have struggled with, in the gripe of selfish and despotic monopoly, some persons are still firmly bound in the armour of prejudice and the impregnable fortress of self-interest.

There will also, doubtless, for a long time to come, exist many persons substantially interested in maintaining certain remnants of the old system, however incompatible such 'vested rights' may be with the interest of the community at large. Every expedient will be resorted to for the perpetuity of these supposed rights and interests. The public are told that there is no general rule without an exception—that the interest of the monopolist is one of those seasonable exceptions. Corporate bodies, and joint-stock companies, have more address than the agriculturists and the mass of the public: they are more expert in the direction and concentration of their influence: their lawyers are the artillery always ready to take the field; and it generally happens that the very persons to be benefited by the dissolution of monopoly, are those foremost and fiercest arrayed against their real interests. 'It is not more than 50 years ago, that some of the counties in the neighbourhood of London petitioned the parliament against the extension of the turnpike roads into the remoter counties. Those remoter counties, they pretended, from the cheapness of labour, would be able to sell their grass and corn cheaper in the London markets than themselves, and would thereby reduce their rents, and ruin their cultivation. Their rents, however, have risen, and their cultivation has been improved since that time.'* The sagacious writer, above quoted, also observes, 'that persons of the same commercial persuasion seldom meet together but the meeting naturally terminates in a conspiracy against the public, or in some contrivance to raise prices.' Every new plan and commercial speculation is denounced without examination, if it be thought to intrude upon, or be suspected of superseding, the old established modes and ways of trade. The worn out argument of 'No inno-

* Smith's Wealth of Nations, ed. 1812, vol. 1, c. xi. p. 208.

vation,' is certainly extinct in modern conversation, but it only stalks about in a different shape. Touch the real or supposed interest of these 'vested rights,' and they contend that however true the free principles of trade in the abstract, it is not now the time for experiment or their adoption: that this country is in a peculiar state; or that they are 'good in theory and bad in practice.' The old alarm of the destruction of capital, a frequent and vulgar mistake for its transfer and diversion, is rung in various changes. This opposition to the formation of new rival companies, and to the immediate adoption of new inventions of unquestioned utility, has one exclusive origin—viz. the never-failing spring of human action, *Self-interest*—the trifling mistake of conceiving the loss of the few to counterbalance the gain of the many. If direct opposition, however, is too palpable and barefaced to be made, compensation is then erected as a barrier against the inroad of improvement and competition.

"How far the canal opposition to the intended Birmingham and Liverpool rail-road bill is justified, on the ground of 'vested rights,' will subsequently appear in those pages; and any claim to compensation for those 'rights,' not only never vested by the legislature, but, as will be seen, never even solicited, would be drawing largely indeed on the credulity and pocket of the country.

"Without, therefore, entering into voluminous remarks on the first principles of trade, it will only be necessary to consider the single inquiry in political economy in theory and practice, connected with the present pamphlet, and which resolves itself into two divisions—

"1. The importance of markets and the free transit of produce, to the wealth of nations.

"2. The local inquiry as to the present and proposed

English modes of transit between Birmingham and Liverpool."

The first division of the subject—the importance of markets and free transit, is then briefly shown, from historical facts, which prove that all great nations have pre-eminently by their natural or acquired advantages derived their greatness from the facilities of markets, roads, navigation, &c. The pamphlet then defines the essentials of transit in the following simple and comprehensive sentences:—

"The inquiry therefore now arises, what are the essentials necessary for the practicable transit of goods; and what for their most perfect transit?

"1. The first essential, is preservation and security: if the risk of damage exceed a certain ratio, the mode of transit would be useless.

"2. The second, is the time that elapses in the transit from the place of production or manufacture to that of destination. An extreme time would in many instances be incompatible with the first essential, preservation—and so enhance the price as to make the transported product unmarketable.

"3. The rate or pecuniary charge of transit.

"The superiority and inferiority of every mode of transit, that ever has been or may be invented, will be greater or less according as it may or may not possess the above three essentials. And every minor and secondary quality will be found comprehended in that classification, viz. preservation, time, and expence."

A short chronological account then follows of the improvements in roads, river navigation, turnpike laws, canals, and the successive advances towards superior transit; of the opposition to all these improvements, and detailing the refutation of the vulgar objections in the successive advantages attendant upon their introduction.

The second part of the inquiry is then pursued, "as to the present and proposed English modes of transit between Birmingham and Liverpool." An interesting account follows of the original formation of the Old Birmingham Canal Company, and the progressive increase in the value of their property.

"The original subscription for this canal was about £55,000 in shares of £100; no one person to hold more than ten shares.

"By various subsequent acts and collateral cuts, this canal, which has now changed its name to the style of the 'Birmingham Canal Navigation Company,' is extended to a distance of about 60 miles of water, containing 99 locks or thereabouts, 10 fire engines to raise water, number of bridges not known to the present writer.

"The original shares are generally computed to have cost the proprietors £140 each. In 1782, they were marketably worth £370, and in 1792, £1110. In 1811, an act increased the shares 500 to 1000, or in other words, for marketable convenience, divided them. In 1813, the half share sold as high as £585. In 1818, power was given to the company of proprietors further to subdivide the shares as they should deem advisable, on due public notice, &c. The shares are now in eighths. Thus at the present time, and at the last quoted prices in Wetenhall's list, there are 4000 shares of eighths marketably worth £360 per eighth, each receiving an annual dividend of £12. 10*s*. Thus the original cost, compared with the present value of the 500 shares, is as £70,000 to £1,444,000, the original share having risen from one hundred and forty pounds sterling (or thereabouts) to the sum of two thousand eight hundred and forty pounds!

"These facts on the increased value of this canal, which

exceeds twenty times its original cost, prove also that the public transits might have been performed at much cheaper rates, and yet the company obtain an adequate remuneration: this is presumed to be an undeniable inference. True it is, that this company is limited to a certain rate of tonnage, but it is not bound to a reduction of rate commensurate with the increase of the tonnage; nor perhaps would such a restriction have been justified by the free principles of trade: but on the other hand, if any monopoly, any 'vested right' for them only to carry the public produce, had been given, a clause would doubtless have been discovered for rateable reduction of charge. The legislature never could have intended to insure to this company such a geometrical progressive ratio of increasing profit.

"Now the first question that arises, before the subject matter of contest can well be introduced, is—Does, or does not, the 'Birmingham Canal Navigation Company' possess any 'vested right,' or in other words, any monopoly, to the exclusive transit of the product of their fellow-creatures' industry?—The answer is, No.

"They could not legally enjoy such an exclusive right from the crown by patent; and even patents, we know, are limited by law.

"Could they, or did they procure it from parliament? No.

"On examining their original resolutions, advertisements, petitions, and notices, it is evident they never asked it of parliament. They went to parliament for a bill, because no such undertakings can be executed without the powers of an Act of Parliament: they went to parliament for power to compel their neighbours, willing or unwilling, to sell their land, that a canal might be made in certain districts—for powers of management and self-government, which they

could not have without an act of incorporation—that they might sue and be sued in a corporate name—that they might purchase lands without incurring the penalties or forfeiture of the statute of Mortmain—and for other reasons recited in their preamble. But not one word exists in their acts as to any exclusive rights of carriage, or a syllable which can be construed into any such 'vested rights.'

"Indeed, when convenient to this company, as, for example, in some of its contentions with the Coventry and Worcester canals, and in the parliamentary warfare for some of their own acts, the company itself has then been the opponent of this monstrous doctrine: at other times, when defending its own tonnage, the abettor of the doctrine. But of any real argument in its favour, they cannot show a particle in statute law, in common law, or common sense.

"Surely such a doctrine would have kept society, the arts and sciences, stationary. It is the natural effect of improvement to diminish price: it is the effect of competition to beget improvement. But here are incorporated societies of tradesmen saying—'We alone, from 1767 to the end of time, have a right to the exclusive transit of your goods from Birmingham to Liverpool by water. Whatever the improvements in science, whatever the discoveries of time, you shall not adopt them: water, and our water, is the only transit you can send by! This may appear from its monstrosity exaggerated, but it is the real position of these companies. There is no medium; they either have or have not such a power.

"This monstrous doctrine, if true, would justify all the old sumptuary and restrictive laws. If acted upon, it would have effectually kept out of use the progressive improvements from the pedlar to the pack-horse—the drag—the waggons—the water carriage itself—and every successive invention

and advancement towards more perfect transit of property. The proprietors of the old hoys and smacks might have opposed the introduction of steam packets and the Acts of Parliament for their safe management. The Lancashire cottagers were then justified in driving Mr. Arkwright from their county, and the Luddites in their opposition to the power loom.

"These companies made no invention, no sacrifice for the public, to entitle them to patent privileges: their undertakings were for their own interests, although mutually beneficial to themselves and the public. And they, in common with their countrymen, must doubtless encounter the unavoidable risk of the inroad of new inventions and improvements on their 'vested interests.' Parliament never could, and never did, in granting their acts, legislate for posterity.

"Now a most important inquiry presents itself, connected with the subject, viz. the then state of the kingdom at the time of passing the first Birmingham Canal Act in 1776, compared with its present trade and commerce. First, because, supposing (for a moment) parliament did grant the canal companies a monopoly of carriage, it could never be construed to extend to a subsequent increase of trade and commerce, not only never contemplated, but unparalleled in the history of the world."

THE END.

C. Baldwin, Printer,
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