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AND

MECHANICS' MAGAZINE.

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1839.

☞ The reader will please bear in mind that *number nine* is repeated; and from this error, another of more consequence arises; viz: numbers 11 and 12 are numbered as 10 and 11, and the folios of the last are the same as those of the preceding number. Therefore in order to distinguish between the folios of number 11 and 12, the letter *a*, is added to those of the latter.

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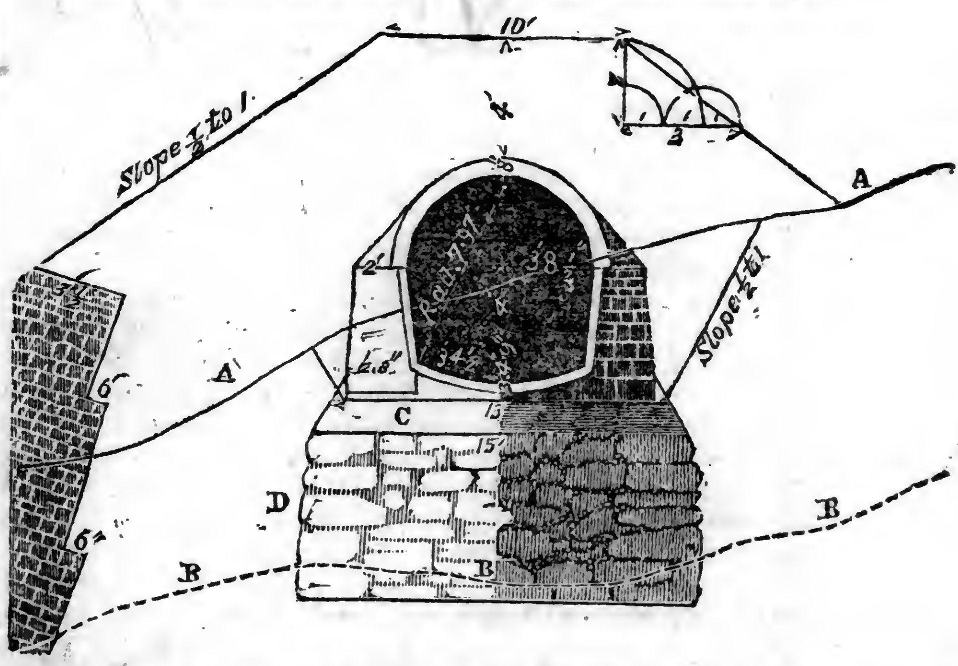
No. 1, Vol. II. New Series. JANUARY 1, 1839. **Whole No. 325: Vol. VIII.**

THE following communication from a young friend, to a non-professional relative in this city, contains so good an account of the Croton Aqueduct that we solicited a copy for publication. To young engineers and novices in the profession, this account will be highly interesting, as containing a description of the every day work, and explanations of terms in constant use.

Description of the Mode of Constructing the Croton Aqueduct.



The materials used are good building stone, of the proper degree of hardness and durability, free from all metals, particularly iron—gneiss is preferred to any other, both because it is more plentiful and more easily worked. Some limestone is also used, but not until it has the express permit of the Resident Engineer. Brick is the next material; it is required to be from the centre of the kiln, such as is thoroughly burnt, free from lime or any other impurity, and to possess a clear ringing sound when struck. The worst accepted are such as cost from $5 to $7 a thousand. Next is the cement, from which the concrete and masonry generally are formed. The Commissioners' specifications are very explicit relative to the manufacture of this article, requiring that the name of the manufacturer should be known; that the cement shall not have been made more than six months before being used; that it shall be transported from the factory in water-tight casks; and, in addition to all this, that each parcel or cargo received shall be thoroughly tested, either by officers appointed for the purpose, or by the Resident Engineer himself. These are the principal materials, stone, brick, and cement. The stone is required to be always clean, and in hot weather, kept wet, and when laid in the wall requiring mortar, it must "swim" in the cement—that is, when the stone is lifted up from its bed, no point or surface of the stone must touch the one below it, each stone must be *surrounded* by cement. When the weather is hot, the top of the wall must be kept moist, and in cold weather all the masonry must be covered so effectually, as to protect it perfectly. The brick must be laid true and even, allowing $\frac{3}{8}$ of an inch joint, or thereabouts. In hot weather, they are to be soaked in water, and to be kept wet while being laid. The cement is mixed in different proportions, according to the work required. For stone work, the proportions are one part of cement to three of sand, (the sand to be of medium size, sharp grained and clean—river sand is accepted.) For brick-work, the proportions are one of cement to two of sand; for concrete, one part of cement, three of sand, and three of clean building stone, broken about as fine as that used for Macadamizing. Concrete is used for forming artificial foundations, is mixed with as little water as possible, and when laid in any part of the work, is left undisturbed forty-eight hours; at the expiration of this time it has become so hard, that a blow with a pickaxe will not break it—it becomes quite a rock.

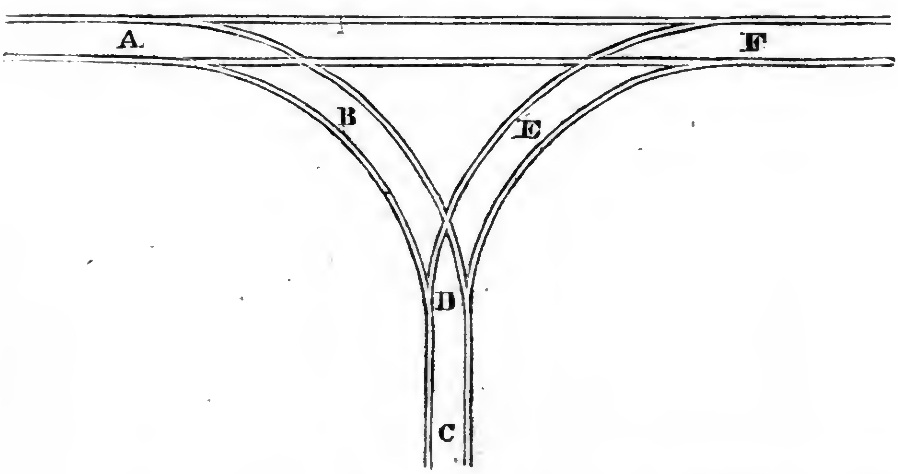
The aqueduct, maintaining a uniform descent, requires that in places the earth should be cut away, and in crossing vallies that they should be filled up. In the former case, the sides of the cut are left standing at a slope of one-half to one—that is, if the perpendicular height of the side of the cut be 6 feet, it will fall off from directly above its base 3 feet. It is one-half horizontal to one vertical. The base of the cut is always 13 feet wide. Pegs, showing the bottom of the side walls, and of the reversed arch in brick are given by the engineers, who, at the same time, determine the centres, if necessary, from these data. The builder lays a small layer of concrete, *at least* three inches, whose top shall be as high as the top of the peg just set—on this concrete he proceeds to build the side walls of the aqueduct. You may see the dimensions by the plan better than I could tell you. The side walls being done, they are filled in behind them, up to the top, with earth, to prevent strain or damage, also to act as a support, and cover up the work as fast as possible. Then the concrete is laid for the bottom of the reversed arch in brick, by means of moulds placed every ten feet apart. When thoroughly set, the brick work is commenced. Selecting the best brick (and it has all been most thoroughly inspected) the reversed arch is laid, and then the "brick-facing"—that is, facing the inside of the wall with brick, when carried up to the top of the wall. The upper arch, consisting of two ring courses (with occasional headers) is thrown; the arch is covered with a thick coating of plaster, and the angle made by the top of the wall and arch, filled with the same kind of masonry as the side walls—the aqueduct is done.

You will perceive it to be a long brick vault stretching from New-York to Croton—ascending at the rate of 13 inches in a mile. The earth removed in the excavation is then "back-filled" over the aqueduct until it is 4 feet deep over the crown of the arch, level on top, and 10 or 8 feet wide, and the sides slope 1½ to 1, (as you see in the figure). When the ground is too steep, a "protection wall" is introduced, (see drawing); this is laid dry, *i. e.*, without mortar, and made to slope one-half to one, as in the drawing, or one to one, at an angle of 45°. So much for the aqueduct in "open cutting in earth." When a valley is crossed, a heavy wall fifteen feet wide on top, with sides sloping one-twelfth to one, must be built. They are large stones firmly embedded in small broken ones; On the top of this wall, a foot of concrete is placed, the aqueduct, as usual, is built *on that.* As water passes through vallies, a stone passage way, called "culvert," is made of suitable dimensions.

In the above plan, I have endeavoured to show the aqueduct in "earth cutting," and on the "foundation wall." By a little observation you will distinguish the characteristics of each.

The plan proposed by Mr. Holcomb, as a substitute for the ordinary turn-table, appears to be worthy of consideration. In many situations its advantages over the ordinary mode would be very great; and it possesses one of the finest attributes of railroad and machine improvement—simplicity.

New Turning-Table.



Washington Co. Geo. January 5, 1839.

Gentlemen—Having been led, by the objections attending the running of locomotives backwards, or with their driving wheels in front, to consider some method of turning them and their trains more efficiently than the common turning-table, which only admits of one or two cars being turned at a time, and having devised a plan which would, I think, effect this desirable end, I take the liberty to solicit for it your kind attention.

That locomotives do not run as well backwards as forwards, will, I think, be readily conceded. That the liability to run off the rails, and that the wear of the driving wheels is much increased, has been proved, upon a road which has come under my observation, beyond the shadow of a doubt.

The plan would, I think, be found simple and effective. The saving of time and manual labor would, I doubt not, be found to be considerably over the common turning-table, and at the same time it would be found to answer very well the purpose of turnouts at water stations. The preceding diagram will explain the plan in question.

Let us now suppose the track laid and provided with switches at the intersections, and a locomotive, with a train of cars behind it, at A. It moves over the first half of the turning-track, B, (which is the quarter of a circle) and stops at C, where the track is made straight for 150 or 200 feet, or for the purpose of receiving or discharging freight quite out of the way, the straight line may be extended to any convenient length. The switch is then changed at D, and the locomotive, with its train moves backwards, over the other half of the turning-track, E, into the main trunk at F, thus having been turned completely around.

That additional room would be required, is true. By adopting, however, a radius of curvature for the turning-track of 400 feet, which would be quite sufficient, and making 150 feet at B, straight, the whole distance out from the main trunk would be but 550 feet.

Yours, respectfully,
F. B. Holcomb,
Assistant Engineer Central Railroad.

P. Alverson's Patent Spiral Spring Drafts, for Railroad Cars.

In a late number, we published a communication referring to an improvement in Railroad Cars, by Mr. Alverson, of New Haven. We are now able to present to our readers a cut illustrating Mr. A.'s own description of his invention.

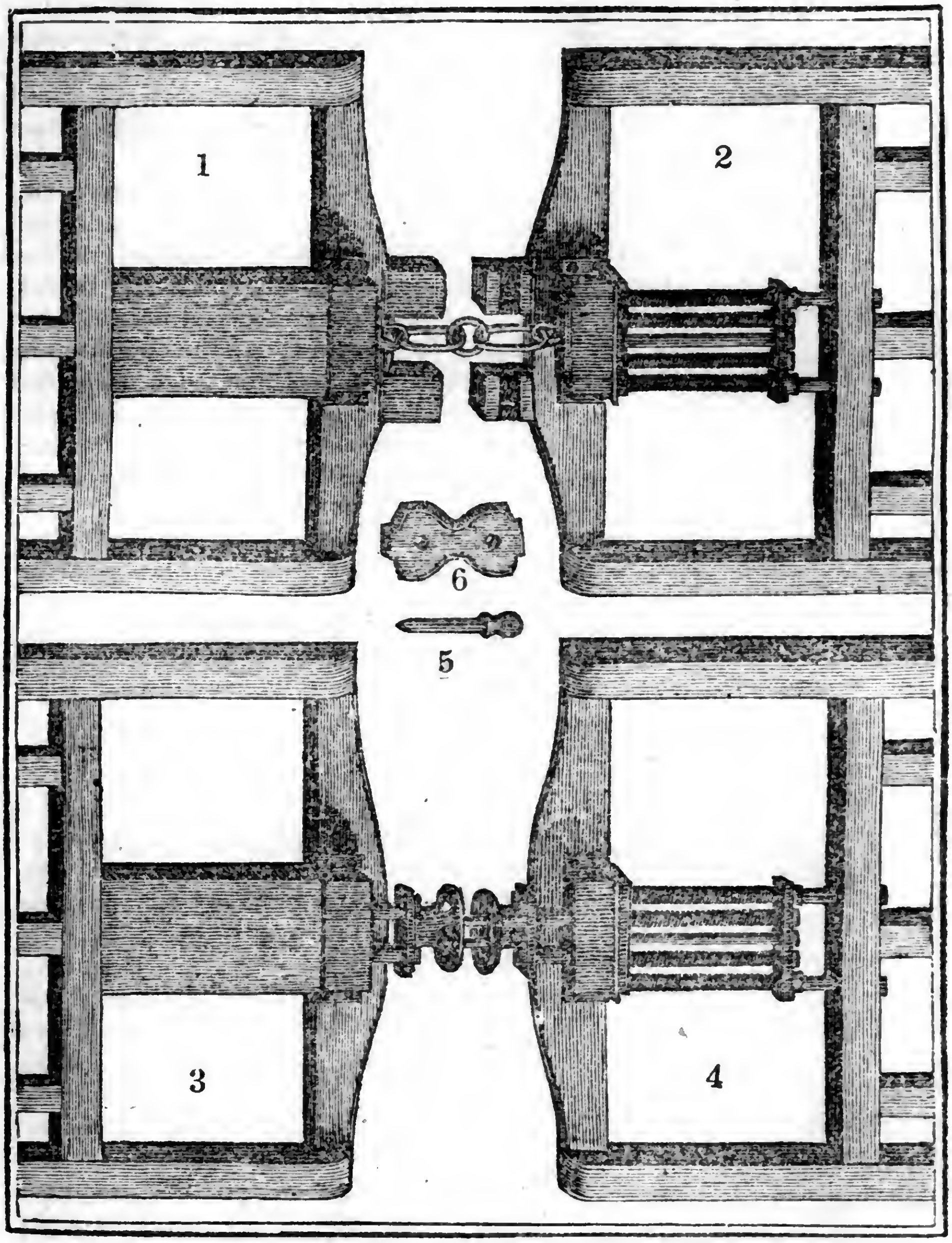
Our own experience has pointed out the absolute necessity of doing away with the stiff connection, at first adopted, whether the comfort of the passengers, or the saving of repairs on the cars, is considered.

Though various modes of obviating this difficulty, even in a slight degree, have been from time to time proposed, it is, nevertheless, true, that on many important roads the old stiff connection is adopted, with the single improvement of the substitution of wood for iron—though even this is not found in all cases.

It is now to be hoped, then, when an improvement so highly approved of as that of Mr. Alverson's, is brought to public notice, it will come into general use.

The wooden link appears to be preferred to the iron one, and is therefore an improvement on the plan first suggested.

We hope that after this, we shall not hear of these unpleasant jerks—one of the greatest sources of nuisance in Railroad travelling—and the more reprehensible, because they can so easily be remedied.



I hereby give notice, that I have invented a new and useful improvement in the mode or method of attaching Railroad Cars to each other, and to the moving power; and have obtained letters patent of the United States, to secure the same to me and my assigns. The object of my improvements is to prevent the jerk usually experienced on the first movement of connected cars, and the shock occasioned by the concussion when suddenly stopped.

My improvements consist substantially in interposing elastic chains, or spiral spring drafts on the front and rear of each car connected together, (whether with one or two bumpers.) When used with one bumper, which I prefer, the spring drafts are made to operate each way, to soften the jerk of the forward motion, and also by reaction to check the recoil. Their forms may be seen by the drawings at the head of this notice. Figs. 1 and 2, my first plan, with hooks, chains, and two bumpers, one showing the rods and springs, the other enclosed in a box. Figs. 3 and 4, the improvement with one bumper operating the springs each way, and the cars at rest. The elastic chains of the several cars may be attached to each other by a single link or bar of iron; but I prefer a link of wood, seen in the cut, fig. 6, of sufficient strength to sustain the forward draft or to resist the recoil, and so shouldered in the single bumper as to admit of no more play than the curvatures of the road requires, and will yield to the oblique force of the leading cars, when suddenly thrown from the road. The advantages resulting from these last improvements, are, that the elastic spring or draft is made to operate easily with a light or heavy train of cars, and the bumpers may be dispensed with; the machinery is less expensive and less liable to get out of order than any method now in use, and costs but little when compared with its advantages; the operation is steadier, is attended with less noise, is much more pleasant for passengers; the cars are less liable to injury, and the mode of connecting the cars is much safer from accident, and the locomotive is assisted thereby in starting a heavy train, also while running on the road. All of which appears more fully in my specification accompanying the patent.

These improvements have been adopted by the Hartford and New Haven Railroad Company, who have fully tested them, and the result is highly satisfactory.

Railroad Companies and Car Builders are respectfully invited to send their orders, or to contract for the right or use of my improvements.

P. ALVERSON.

New Haven, Conn., January 9, 1839.

RECOMMENDATIONS.

New Haven, Jan. 5th, 1839.

Mr. P. ALVERSON: Sir,—I have watched the progress of your improvements in manufacturing the Spiral Spring Draft and Bumpers for Railroad Cars, with great interest, from the time you commenced your experiments, and take great satisfaction in stating, that after more than two months' experience of their operation on the Hartford and New Haven Railroad, they appear to be decidedly the best of all the various expedients hitherto used to move the twitch at starting, and the concussion at stopping a train of cars They entirely relieve the passenger from any unpleasant shock, they save the cars from any racking jar, they enable the engine to start with a perfectly gradual, and constantly accelerated motion, until under full headway, and in my opinion, they will, by their easy and comfortable operation upon the cars, save their entire cost in a very short period Your obedient servant,

SAMUEL J. HITCHCOCK,

President of the Hartford and New Haven Railroad Company.

TO WHOM IT MAY CONCERN.

Mr. P. ALVERSON has been employed by the Hartford and New Haven Railroad Company for the last two years, at building carriages for their road, during which time he has invented a very useful improvement for connecting a train of Railroad carriages, which he terms "the *Spiral Spring Draft.*"

This improvement has been thoroughly tested for two months past, on the road under my charge, both with light or heavy trains, or passenger and freight carriages; and I have no hesitation in saying, that it far exceeds any connection with which I am acquainted. The whole arrangement is very compact, of cheap construction, and, I doubt not, of great durability. I am confident, could its utility be properly appreciated, it would be universally adopted by all Railroad companies in this country. JOHN T. CLARK,

General Agent of the Hartford and New Haven Railroad Co.

New Haven, January 7th, 1839.

New Haven, December 12th, 1838.

Mr. P. ALVERSON: Sir,—Having fully tested your Spiral Spring Draft and Bumpers, on the Hartford and New Haven Railroad, I take pleasure in saying the improvement is a good one. They operate well, and are of far more importance than can be conceived of by those who have not watched their operations. Having for three or four years past, seen the bad effect of the stiff draft on other roads, upon cars and passengers, I would most cheerfully recommend them to all Railroad companies and car builders, as the best plan now in use: they operate better, and are less liable to get out of order, than any plan I have ever seen. I hesitate not in saying that they will soon pay any Railroad company, in the wear and tear of cars, to make the alteration, and apply them where the stiff draft is used; they are not only a good thing to ease the jerk in starting and stopping, which injures the cars and affects the passengers, but assists the engine much in starting a heavy train. It also is a good thing where horse power is used; it is injurious to a horse to be twitching and jerking at a stiff draft.

I think much of your improvement upon the first, by making the springs operate both ways, and the single bumper. It is much safer for cars and passengers, by the connecting link of wood, in case of accident.

Yours, with respect, WILLIAM F. HARDY,

Engineer and Superintendant of the Motive Power on the H. and N. H. Railroad.

New Haven, December 12th, 1838.

Mr. P. ALVERSON: Sir:—I have had the pleasure of using and testing your Patent Spiral Spring Draft for cars, on the Hartford and New Haven Railroad; which, with the single bumper operating upon the springs each way, is most admirably adapted to do that for which they are designed.

The cars move off, when steam is applied, without the jerk usually experienced on other roads. It not only saves the cars and passengers from a terrible jerk, but gives the engine more power over a heavy train of cars in starting. In a train of ten cars it permits the engine to move six feet before they all are in motion. I perceive the springs yield gradually, each doing their duty through the train without a jerk. It is an exemplary improvement, and worthy the attention of all Railroad companies, even if they have the elliptic springs, to make the change, and much more where the stiff draft is used. I think them to be more durable, and operate better than any plan I have ever seen, and can see no reason why they may not be speedily and universally adopted, for the good and safety of cars, passengers, and the locomotive. Yours, respectfully,

C. R. WOOLSON, *Engineer.*

Internal Improvement in the State of New-York.

We take great pleasure in laying before our readers that portion of the Message of Governor Seward, which relates to the subject of Internal Improvement.

The recommendation in regard to a Board of Improvement is one deserving of consideration. It has long been felt, that an organization, embracing the general system of Railroads as well as of Canals, was necessary to the successful execution of our public works.

The Message, from the great length to which it was necessarily extended, does not refer to the subject of Internal Improvement in a manner sufficiently distinct.

In addition to the three great lines mentioned as most important, one is to be found in that connecting the cities of New-York and Albany, through our Eastern counties. The bearing of this line upon the general interest, is well developed in the report of Mr. Johnson on the New-York and Albany Railroad, published in this number. To this, we might add the Long Island Railroad, forming a connecting link of the greatest importance. This Road would prove an artery of a valuable member of our body politic.

The general necessity of a well digested system of improvement, is now more than ever apparent.

That such a system can only be carried into effect by the organization of a Board of Improvements, as proposed by the Governor, or by some similar arrangement, has long been evident.

We annex the proceedings of the State Convention in 1835, in which such a plan was developed, for the first time, in the resolutions then presented by Mr. Bloomfield.

It will be an easy matter to apportion the aid the State may think proper to give to public works, when a definite system shall have been agreed upon. A definite system will be found necessary, as a basis for all future operations; and the sooner it is determined, the better it will be.

The rank which our State holds in the Union, is only dependant upon her own exertions; and she herself is to determine the question of advancement or retrogression.

Extracts from Governor Seward's Message.

Thirteen years' experience has proved the inadequacy of all our thoroughfares for the transportation of persons and property between the frontier and tide waters. It is submitted whether sound policy does not require that the enlargement of the Erie Canal be completed as speedily as will be consistent with the public convenience. This generation may as well participate in its manifold advantages as resign them. The loss of interest upon partial expenditures during a long term of years, is an item not unimportant; and the expenses of transhipment and other inconveniences resulting from the navigation of different parts of the canals with boats of different forms and magnitude, are auxiliary arguments to prove that the public interest requires the earliest feasible enjoyment of the cheapness and expedition of the improved navigation.

The year 1838 has been signalized by the momentous confirmation of the highest hopes excited by the successful application of steam power to the propulsion of boats. But this wonderful agent has achieved almost unobserved, a new triumph, which is destined to effect incalculable results in the social system. This is, its application to locomotion upon the land. Time and money are convertible. Husbandry of the one is economy of the other, and either is equivalent to the economy of labor. Railroads effect a saving of time and money: and notwithstanding all the incredulity and opposition they encounter, they will henceforth be among the common auxiliaries of enterprise. Happily, it is not in our power to fetter the energies of other States, although we may repress our own. This useful invention, like all others, will be adopted by them, although it gain no favor with us; and they who are willing that New-York shall have no railroads, must be ready to see all the streams of prosperity seek other channels, and our State sink into the condition of Venice, prostrate and powerless, among the monuments of her earlier greatness.

A glance at the map would render obvious the utility of three great lines of communication by railroads, between the Hudson river and the borders of the State. One of these would traverse several of the northern counties, and reach with its branches to Lake Ontario and the St. Lawrence. A second, keeping the vicinity of the Erie canal, would connect Albany and Buffalo. A third would stretch through the southern counties, from New-York to Lake Erie.

It is certain that neither one nor two of these improvements would accomplish the useful ends of all, and when the growing wealth and importance of the several regions directly interested in these improvements are considered, it is not less clear, that however delayed, all must eventually be completed. It remains, then, to be decided whether it is wiser to regard them as rival enterprises, each by the operation of local jealousies hindering and delaying the others, or whether all shall be considered as parts of one system, and equally entitled to the consideration and patronage of the State.

Capitalists have conceived not only the usefulness, but the productiveness of the central route, and notwithstanding the adverse influences of the recent pressure, have accomplished one-half of the whole undertaking. The public defence may some time demand, and the public convenience already requires, as great a reduction of the distance as possible, between our commercial metropolis, the capital of the State, and the populous cities and long line of flourishing villages of the west.

The attention of far-seeing and patriotic citizens was early directed to the route through the southern counties. That enterprize has been commenced and prosecuted by an association with commendable perseverance, under circumstances most embarrassing, resulting not only from the same commercial revulsion, but also from the magnitude of the undertaking, which exceeds that of any work of internal improvement ever completed, except the Erie canal. Legislative aid, in the form of loans, has been granted to both the central and southern roads.

I earnestly hope that you will inquire into the condition and prospects of both of these undertakings, and bestow a careful examination upon the conduct, management and resources of the associations engaged in their construction; and, assuming the principle that there is neither economy nor wisdom in procrastination, adopt such measures as will secure their completion without delay.

The advantages and claims of the various projects of the northern line, including those of two distinct and entire routes, are yet under discussion. The whole subject merits, as I doubt not it will receive, your dispassionate consideration. I have only to add, in regard to this improvement, that I know no reason for delay when the most feasible and advantageous plan is ascertained. I shall cheerfully concur in any measures you may adopt to secure to that flourishing and hitherto neglected part of the State, an early and full participation in the benefits of our system of internal improvements.

I have called your especial attention to three great projects of improvement, because their routes, extending from the borders of the State to tide water, are obviously designed to accommodate large and important divisions of our population; and to open to the reach of labor and capital extensive regions of the State which, whatever may be their present prosperity, have scarcely begun to disclose their resources. They are important parts of a system of public defence which it is wise to have always in view, and certain to become thoroughfares of the boundless internal trade to be carried on with the western States and British America. They are, therefore, works of great importance to the whole State, and entitled to be regarded as arteries in that great system of internal improvements which an enlightened and prophetic vision of the future wealth, and resources, and relations of the State would have suggested, while its solitudes were yet untrodden by civilized man. They deserve to be classed with those parts of the same great system already completed, or in process of construction—the Erie and Champlain, the Oswego, the Seneca and Cayuga, the Chenango and Chemung, the Genesee Valley and the Black River Canals; and if their completion cannot speedily or advantageously be effected otherwise, like them they ought to be constructed at the expense of the State.

Nature, never jealous of her co-operation, supplies us with resources and facilities, but presents few of her works finished for our immediate use. Thus she leaves us incentives to invention, and scope for action, while she seldom fails to indicate the right direction for effort. The policy of our State is so legibly written upon its surface, that to err in reading, or to be slothful in pursuing it, is equally unpardonable. The ocean reaches through the tide waters of the Hudson far inland. The lakes and reservoirs within our bounds, as well as the seas upon our borders, were designed to fill the artificial channels we have constructed as tributaries to our noble river. It is a policy even more obvious to maintain the natural uses of the river itself, and to perfect every feasible branch of its navigation. This is only to secure a natural and free circulation in the heart, while we are diffusing it to the extremities of the system. I congratulate you upon the success which attends the efforts of the General Government in removing the obstructions in the vicinity of Albany. The prosecution of this enterprise, although carried on by that Government, will constantly deserve. and perhaps may, as heretofore, require your attention. I respectfully commend, as a part of the same policy which devolves peculiarly upon the State Legislature, the improvement of such of the northern branches of the Hudson as are capable of being rendered navigable. The settlement of the public lands of the

State would be facilitated, and large portions of our fellow-citizens accommodated by this improvement.

There are other projects, both of railroads and canals, of less magnitude, many of which, however, embrace wide and important interests, and whose accomplishment would largely promote the public convenience, and advance the public good. It would be invidious to discriminate among these projects, in a communication which does not admit the discussion of their merits. Internal improvement regards the highest possible cultivation of every part of the State, and the perfect evolution of its resources; the widest possible extension of the territory which can be made tributary to its markets, and the greatest possible diminution of the cost of transportation of persons and property; and consequent increase of population and labor, and the diminished cost of production. All such improvements, therefore, rightfully engage the public attention, and will doubtless receive from the Legislature the discriminating favor due to their respective merits.

Taxation for purposes of Internal Improvement is happily unnecessary, as it would be unequal and oppressive. The founder of the system had always in view its prosecution to the full extent, consistent with the physical formation of the State, although the invention of Railroads was unknown or partially understood by him; and consequently the manner in which the system was to be carried forward was unforeseen. He asserted most truly, that the argument for such a system, was not a mere question of dollars and cents—that its revenues were unimportant, compared with its more general, more enduring, and more beneficent results; the continual advance, by millions, in the value of real estate; the increase in quantity and value of agricultural productions and manufactured fabrics; the establishment and enlargement of inland commerce, and the swelling of foreign trade; economy in the expense, saving of time, and increase in amount of travel; augmentation of population; the unbounded prosperity and increase of rising villages, cities and towns; and all the consequent advantages to morality, piety, and knowledge. But he maintained that independently of all these results, the interests of the State, in regard to the mere question of revenue, required the prosecution of the system. Freely conceding that there must be parts which would not immediately, and some which would never yield a revenue equal to the cost of their construction, he maintained that they might yet be admitted as tributaries to the greater channels; and that the aggregate revenues of all would defray the entire cost of construction, and yield a surplus large as the munificence which a republican government ought to bestow upon institutions of charity and education. It is history now, that these enlarged and comprehensive views were by no means generally sustained; that his magnanimous efforts to enlarge the wealth, promote the happiness, and elevate the fame of his native State, were resisted by a policy which regarded his glowing anticipations as visionary, and the entire system fraught with intolerable taxation and ruin; that his antagonist policy early became ascendant, and the several enterprises since undertaken have been hard-worn triumphs over the prevalent convictions of the Legislature.

Fortunately this momentous question is decided. The present resources and credit of the State, show that the most ardent advocates of the system failed altogether to conceive the vast tribute which it has caused already to flow into the treasury.

I respectfully refer you to a report of a committee of the last House of Assembly, in which this subject is discussed with eminent ability, and which results in shewing that the canals are a property substantially unincumbered; and that their productiveness would warrant the State in expending in Internal Improvements $4,000,000 annually, during a period of ten years; and that the revenues of the Canals alone would reimburse this expenditure previous to the year 1865. This sum far exceeds any estimate of expense required to complete the entire system; while it is not to be doubted that the parts yet to be constructed, will eventually be productive of revenue. The conclusions of this report, although of vast interest to the State, and, I trust, decisive of its policy, have not been questioned.

The following is a brief statement of the entire indebtedness of the State at the close of the last fiscal year:

DEBT OF THE GENERAL FUND.

Loaned at 5 per cent., Astor stock,	$561,500 00
Loaned at 5 per cent., Bank Fund,	586,532 43
Loaned of the Canal Fund, without interest,	800,000 00
Total debt of the General Fund,	$1,948,932 43

CANAL DEBT.

Erie and Champlain Canal Debt,	$711,314 12 at 5 per cent.		
		458,520 53 at 6 per ct;	
Oswego Canal,	421,304 00		
Cayuga and Seneca Canal,	237,000 00		
Chemung,	316,000 00		
Crooked Lake,	120,000 00		
Chenango,	2,362,535 65		
Black river Canal,	591,446 10		
Genessee Valley Canal,	2,000,000 00		
Enlargement of the Erie Canal,	1,000,000 00		
Total of the 5 per cent.,	$8,750,599 88		
Total of the 6 per cent.,		$548,520 53	
		8.759,599 88	
			9,308,120 41
Total State Debt,			$11,256,152 84

But there is a surplus on hand sufficient to pay the Erie and Champlain Canal debts,		$2,259,834 65
There was on hand on the 30th September last, of the money borrowed for the Chenango canal,	36,801 21	
The Black river canal,	490,282 77	
Genesee valley canal,	1,740,546,95	
		$2,267,630 93
		$4,527,465 58
Balance of State debt over funds on hand,		6,728,687 26

It will be noticed that the temporary loans made by the Comptroller, to meet the current demands, do not enter into this statement; nor do the State stocks issued to sundry Railroad companies, in pursuance of the laws passed at the last session of the Legislature. The issue of these stocks is regarded as a loan of the credit of the State upon undoubted security.

The construction of the canals of this State has been carried on chiefly with funds derived from loans. The whole amount borrowed is about fifteen millions; the balance of the debt for their construction is less than five millions; and the Erie and Champlain canal fund alone, it has been seen, yields a nett revenue, after paying all legitimate charges upon it, and all deficiencies of the auxiliary canals, of $718,650 91.

History furnishes no parallel to the financial achievements of this State. It surrendered its share in the national domain, and relinquished for the general welfare all the revenues of its foreign commerce, equal generally to two-thirds of the expenditures of the federal government. It has, nevertheless, sustained the expenses of its own administration, founded and endowed a broad system of education, charitable institutions for every class of the unfortunate, and a penitentiary establishment, which is adopted as a model by civilized nations. It has increased four-fold the wealth of its citizens, and relieved them from direct taxation; and in addition to all this, has carried forward a stupendous enterprise of improvement, all the while diminishing its debt, magnifying its credit, and augmenting its resources.

This cheering view of our condition ought to encourage neither prodigality of expenditure, nor legislation of doubtful expediency. All appropriations for the purposes of Internal Improvement ought to be made with a view and constant purpose to call into co-operation individual capital and enterprise. Rigid economy ought to be enforced, and perfect accountability exacted in this, as in every other department of the public service.

Action is the condition of our existence. Our form of government chastens military ambition. The action of the people must be directed to pursuits consistent with public order and conducive to the general welfare. Our country will else be rent by civil commotions, or our citizens will seek other regions, where society is more tranquil, ambition enjoys greater freedom, enterprise higher motives, and labor richer rewards.

We are required to carry forward the policy of Internal improvements, by the abounding experience of its benefits already enjoyed; by its incalculable benefits yet to be realized, by all our obligations to promote the happiness of the people, to multiply and raise their social enjoyments, to maintain the fame of the State, inestimably dear to its citizens; to preserve the integrity of the Union, and by the paramount duty we owe to mankind, to illustrate the peacefulness, the efficacy, the benificence and the wisdom of Republican Institutions.

That legislation is unwise which is exclusively devoted to enterprises of great moment, and overlooks measures of obvious, but common utility. The present condition of our highways has resulted from the necessity of constructing roads over an extended surface, with the scanty means and efforts of a sparse population. But this inconvenience has in a great measure ceased to exist. The labor expended upon our highways is a grievous tax, and yet our roads are scarcely improved. The summer repairs accomplish little more than restoring them to the condition they maintained before the injuries of the winter season occurred. The evil lies in a misapplication of the labor assessed. Your experience in regard to this subject, is sufficient to convince you of the necessity of reform, as well as to suggest the most effectual measures for its accomplishment.

* * * * * * *

The aggregate of loans made for the construction of canals now in progress, is $2,615,182 84, to wit, for the Black River Canal $613,076 29, and for the Gennessee Valley Canal $2,002,106 55. There have been paid on account of the construction of these canals $334,352 12, to wit, for that of the former $122,993 52: for that of the latter $261,559 60; and there remains on deposite in the banks, drawing an interest of five per cent. (equal to that on the loans) the balance $2,230,829 72.

It is respectfully submitted, that more perfect responsibility would be secured if the term of office of Canal Commissioners should be limited so as to bring them periodically before the appointing power, retaining the provision for their removal at earlier periods, if the public interests should require. Of the $1,481,602 canal tolls received, $104,645, about one-fourteenth part is expended in payment of Inspectors, Clerks, Collectors, and Tenders of Locks. And the sum of $639,714, almost one-half, is consumed in these payments and repairs. It scarcely admits of doubt, that the system is capable of such revision as would reduce these heavy expenses, and proportionally increase the nett revenues of our canals. The compensation of the Superintendents and Collectors ought to be fixed by law, instead of being left to the pleasure or caprice of the Canal Commissioners, or the Canal Board.

With the extension of our internal improvements, there has been an immense and unlooked-for enlargement of the financial operations and the official power and patronage of the Canal Commissioners and the Canal Board. These operations are conducted, and this power and patronage exercised and dispensed with few of those requirements as to accountability and publicity enforced with scrupulous care in every other department of the government. So inconsistent and unequal are the best efforts to maintain simplicity, uniformity and accountability throughout the various departments, that a greatly mysterious and undefined power has thus grown up unobserved, while the public attention has exhausted itself in narrowly watching the action of more unimportant functionaries. It is a proposition worthy of consideration, whether greater economy and efficiency in the management of our present public works would not be secured; a wiser direction given to efforts for internal improvement throughout the State, and a more equal diffusion of its advantages be effected by constituting a Board of Internal Improvements, to consist of one member from each Senate district. This board might be divided into two classes, the term of one of which should expire annually. It should discharge all the duties of the present Canal Board; should audit all accounts, have the general superintendence of the Canals, and all other public works, with powers of investigation in regard to those in which the State has an interest by loan or otherwise; report upon all special applications for surveys or aid, and annually submit a detailed statement of its proceedings of the Legislature. It is the worst economy to devolve upon officers constituted for one department, duties appurtenant to others. Its universal results are diminished responsibility and diminished efficiency in both the principal and incidental departments.

The aggregate of tolls, including rents of surplus water, collected on all the canals during the last fiscal year, was $1,481.602 41. The cost of repairs and of the collection of tolls on all the canals was $639,714 32, which deducted from the receipts, leaves the nett proceeds from tolls, for the year, $841,888 09. The cost of repairs and collection during the last year exceeds that of the previous year $30,806 59. The nett revenue of the last fiscal year exceeds that of the preceding $123,085 25.

The income of the Erie and Champlain canal fund from all sources, including the interest on $2,259,834 65, (the sum set apart to pay the remainder of debt contracted on account of the Erie and Champlain canals) is $1,553,136 34. Of this amount there have been expended as follows: For repairs of the canals $449,058 64: of which were expended by superintendents of repairs $365,661 95, and by the Canal Commissioners $83,396 69; for interest on the debt $129,374 05, and sundry payments $26,892 65, leaving the surplus revenue of the canal fund for the last year $947,811 50.

The Canal Commissioners have expended in the last fiscal year for the enlargement of the Erie Canal $1,161,001 80. They borrowed under the act of April 18, 1838, including the premium, $1,005,650, leaving an excess of expenditure over the amount loaned of $155,351 80, which was paid from the surplus, and leaves the nett surplus of the Erie and Champlain Canal fund, after paying all charges, $791,859 70.

The amount of tolls collected on all the lateral canals is $58,264 76. This amount exceeds the aggregate of the preceding fiscal year $12,979 58, and falls short of that of the year which ended on the 30th September, 1836, before the navigation of the Chenango Canal, $2,531 42. The deficiency in the income of all the auxiliary canals to meet the expenses of repairs and of collection of tolls, and the payment of interest on the debt contracted for their construction, is $220,160 59; which amount, deducted from the aforesaid nett revenue of the Erie and Champlain canal fund, leaves the nett revenue of that fund, after paying all charges upon it, and the deficiencies of all the auxiliary canals $562,699 11.

The deficiences of the several lateral canals are as follows: Of the Cayuga and Seneca Canal $15,517 62; of the Crooked Lake $10,37 55; of the Oswego 54,460 70; of the Chemung 29,833 11, and of the Chenango $119,311 61. The aggregate of tolls collected on all the canals during the last fiscal year exceeds that of the previous year by the sum of $154,821 51, and falls short of that of the fiscal year which ended on the 30th September, 1836, $120 173. But the tolls collected on all the canals during the season of navigation in the year 1838, exceed those of the same season in 1837, by the sum of $297,555, or 23 per cent Of this excess $130,788 97, or 44 per cent., is upon ascending, and $166,766 03, or 56 per cent., upon descending freight. This estimate is made upon data which may be assumed as substantially correct, although it is to be understood as not precisely accurate. This comparison, while it demonstrates the severity of the pressure which has recently visited our State, not only furnishes cheering evidence of returning prosperity, but gives assurance of the constantly increasing productiveness of our System of Internal Improvements.

Proceedings of the State Convention in 1835.

Joseph E. Bloomfield, in behalf of the committee of ten, appointed at the previous sitting of the Convention, then made their unanimous

REPORT.

Whereas, the growing interests of this State require the timely provision of means to give efficient aid to the developement of the resources of our vast interior: And whereas, it is important that information on the subject be collected and disseminated among the people of this State: And whereas, it is believed, that we have among us public spirited citizens, willing to devote an adequate portion of their time to promote plans which would be calculated more rapidly and effectually to realise the vast resources which are yet but partially brought into action; therefore, Resolved, That it is recommended to form a *State Society for the Promotion of Internal Improvements*, and that this Convention, at its adjourned meeting, adopt means to organize the same: the duty of which society shall be, to collect and diffuse such information as may be deemed of public utility. The society shall consist of a member from each county in this State, who shall appoint such officers and agents, and adopt such by-laws and regulations, as they may deem necessary.

Resolved, That to enable the society to execute its functions, each county in this State be requested to form therein a County Society of Improvement, which Society shall, at its stated meetings, propose plans of public utility to the State Society, and shall raise such sums by subscriptions, as the friends of Internal Improvements may find it proper to subscribe, to defray every expense incidental to carry into effect the operations of the State Society, and to remit the amount of such funds to the Treasurer thereof.

Resolved, That the State Society petition Congress to appropriate means to improve the Atlantic and Lake frontiers of this State, for naval and commercial purposes.

Resolved, That it is earnestly recommended to the people of this State, to take early measures for the construction of a Ship Canal around the Falls of Niagara, by an application to the State Legislature, or Congress.

Resolved, That the members of Congress from this State, be requested to urge upon the consideration of that body the propriety of allowing foreign goods to be transported across the territory of the United States, under proper regulations, to the provinces of the Canadas.

Resolved, That in carrying out the views of this Convention, all local and sectional jealousies should be deprecated, and that the people of this State owe it to themselves to direct their combined energies to the speedy completion of all the great works of Internal Improvement, tending to facilitate the intercourse between the different sections of this State with each other and with the other States.

It was then Resolved, That the report be laid on the table for the consideration of the Convention at their adjourned meeting, and the committee be discharged.

It was then Resolved, That *this* Convention do adopt the fifth resolution reported by the Committee.

The following resolution was then presented by Mr. Copeland, and laid upon the table: "That it be very respectfully recommended to the Legislature to cause a topographical, and, if of sufficient importance, a geological survey of the State, or as much of it as may not already have been surveyed, for the purpose of having before them such information of a definite character, as will enable them to form a just estimate of the wants of every section of the State."

Preserving Scythes, &c., from Rust.—To preserve scythes, reaping hooks, and other steel tools from rust, after the season for using them, wipe them clean and dry, and hold them before the fire, and keep drawing them backwards and forwards until warm enough to melt wax; then take some bees' wax and rub it all over. A half-penny worth of wax will be sufficient for a scythe. Then put it a dry place, but not warm; it needs no other covering. The usual method is to wrap a hay-band round; but in winter time this naturally contracts moisture, or the damp air strikes in betwixt the folds of the hay-band.—*Farmer's Magazine.*

Engineer's Report to the New-York and Albany Railroad Company.—
E. F. Johnson, Chief Engineer.

To the President and Directors of the New-York and Albany Railroad Company:—

Gentlemen—The following statement of the results of the surveys made between the cities of New-York, Albany and Troy, for determining the route of the New-York and Albany Railroad, is respectfully submitted:—

The route, as surveyed, commences on the north bank of the Harlem river, at a point from which a convenient entrance may be made into the city of New-York, either by the Harlem Railroad, or such other route as may be preferred.

From thence it proceeds north, through the county of Westchester, occupying for the first 35 miles nearly middle ground between the Hudson river and the waters of Long Island Sound.

From the North line of Westchester county, it passes through the Eastern part of Putnam and Dutchess counties—through the centre nearly of Columbia county, thence to the town of Greenbush, opposite Albany, and also to Troy, in Renssalaer county.

The profile of the route presents two principal summits, one near the centre of Westchester county, the other in the North East part of Dutchess county.

The lowest point of depression between the two is situated in the valley of the Croton river.

The ascent to, and descent from these summits is very gradual, not exceeding, at any one point, 30 feet per mile,* the steeper grades being confined to about four-tenths of the distance. The remaining six-tenths varying from a level to 25 feet per mile.

The average rate of ascent and descent to and from these summits, is as follows:—

Harlem river to first or lowest summit, 26 miles, 16 feet per mile, ascending.

First summit to the valley of the Croton, 12 miles, 20 feet per mile, descending.

Valley of the Croton to second summit, 54 miles, 10½ feet per mile, ascending.

Second summit to the Hudson river at Albany, 48·7 miles, 16 feet per mile, descending.

The line from the Harlem river traverses successively portions of the vallies of the Bronx, Croton and Ten Mile rivers, the latter of which is a tributary of the Housatonic. It traverses also the vallies of Ancram creek, and of Cline Kill, a branch of the Kinderhook creek. From thence it passes over the Kinderhook and Schodac plains to the termination opposite Albany.

The course of the line, as will appear by an examination of the map, (which has been executed, on a large scale, by Mr. E. S. Coe,)

* The line of the survey terminates at the upper ferry, opposite Albany. If the lower ferry is selected as the place of termination, the maximum grade will probably be somewhat increased at that point, and the total distance lessened about two-thirds of a mile.

is quit direct—there being but one departure from a generally straight course. This deviation occurs in Columbia county, by which the line at that point is thrown in nearer to the Hudson river, a circumstance deemed rather favorable than otherwise, as it affords the means of connecting by a very short line with the Catskill and Canajoharie Railroad, and also with the city of Hudson; while at the same time the route inclines in its course south, sufficiently near to the boundaries of Connecticut and Massachusetts, to secure to the road the travel and business from the Western portions of those States.

The whole distance by the line, as surveyed from the City Hall in New-York to Albany, is 147·71 miles; no greater, it is believed, than the distance between the same points by the channel of the Hudson river. Notwithstanding, therefore, the route is situated, for most of the distance, from 15 to 25 miles from the river, the course which it pursues is quite as direct as by the river, a conclusion confirmed by the fact that the radii of curvature upon the line of the Railway are large, exceeding, with two exceptions, 1,500 feet, so large as to occasion, from considerations of safety, no necessity for any material reduction in the speed. In respect to straightness, it is ascertained that the proportion of straight to curved line is as seven to three—only three-tenths of the entire distance being curved. This is only six per cent. greater than the proportion upon the Utica and Schenectada Railroad, which is straighter than the majority of Railroads in the northern section of the Union.

The traveller upon the Hudson river, or by the post road on its eastern side, derives no correct idea of the true features of the country as they exist along the proposed route of the Railroad.

The highlands which appear so formidable from the river, are intersected by the Railroad in their north-easterly course into Massachusetts and Vermont, 50 miles from the place where they are divided by the Hudson river, and are there passed through a depression elevated 769 feet above tide, being the highest of the two principal summits to which reference has been made.

The deep ravines and precipitous banks which appear in many places along the eastern slope of the Hudson river valley, and which from their unfavorable direction, would present serious obstacles to the construction of a Railway in the vicinity of the river, are all avoided by the line as surveyed.

The maximum grade of 30 feet per mile upon the road can be overcome with locomotive steam power, at a speed of 12 miles per hour, with a load of 100 to 150 tons, equal to that which can be conveyed on a level at 20 miles per hour. As it is seldom, however, upon roads doing a large passenger business, that the engine is loaded to the full extent of its power, the average velocity in ascending the maximum grade will probably not fall much short of the velocity upon the level. Whatever is lost, will be easily made up upon the descending portions of the line, which are not so much inclined as to make it unsafe to take advantage of the aid afforded by gravity in compensating for the diminution of the velocity upon the ascending portions.

It is a very favorable feature in the profile of the road, when considered in reference to the expense of transportation upon it, that the bulk of the transportation occurs upon the longest portion south of the highest summit, where the line has a general average descent to New-York city, of about eight feet per mile, in a direction favorable to the preponderance in the trade.

The character of the road in respect to the maximum grade, which limits the load of the engine, will be better understood by a comparison with other roads which are in operation, as general throughfares of trade and travel. The maximum grade is 20 per cent. less than upon the Boston and Providence road; 12 per cent. less than upon the Stonington road; $33\frac{1}{3}$ per cent. less than upon the Camden and Amboy road; 40 per cent. less than upon the Philadelphia and Columbia road; 25 per cent. less than upon the Harlem road, where steam power is used. No greater than upon the Boston and Worcester, Auburn and Syracuse, New Castle and Frenchtown, and New-Jersey roads. Only eight feet per mile greater than upon the Utica and Schenectada road, and only the same amount greater than the maximum grade on what is usually termed the *level* portion of the Mohawk and Hudson road between the inclined planes.

It is, I conceive, an important feature in the New-York and Albany road, that it is located wholly within the limits of New-York. It had been supposed from representations, in which great confidence was placed, previous to the examination made by Mr. Morgan on the northern portion of the line, that a route for a railway could not be found within the limits of the State, without encountering an elevated summit, to pass which would require the construction of a tunnel, or a resort to inclined planes, either self-acting, or operated by horse or stationary power. Under this impression, attention was directed to a route passing through a portion of Connecticut and Massachusetts. By this latter route, the distance and expense, and acclivity of grades, would have been considerably increased, compared with the line as now surveyed. By avoiding this route, from 350 to 380 feet vertical rise is saved in the elevation of the main summit; and the line is relieved from the expense and embarrassment attending its construction and operation, consequent upon its being composed of different portions located in three different States, under the authority of charters obtained from each.

Pursuing as the line does in its course from New-York to Albany, a succession of vallies for most of the distance, and for the remainder traversing the comparative level surface of the Kinderhook and Schodac plains, great facilities exist for the construction of a cheap and permanent road. Although there are a few points requiring more than ordinary expenditure, one in descending from the level of the Schodac Plains to Greenbush, another small portion in the towns of Ghent and Claverack, and another in Westchester county; yet, there are none requiring excessive expense, such as are frequently met with upon public works of a similar character. I allude now to tunnels, either in earth or rock—deep and extensive excavations through rock, long and heavy embankments, &c. The streams also are not large, and with the exception of the Harlem river, require no expensive bridges, or heavy slope walls to protect the road from injury by floods.

Stone for the masonry and timber for the sills and cross ties of the superstructure or rail track, including most of the materials necessary for the construction of the road, with the exception of the rail plates and rail timbers, can be obtained of an excellent quality from the section of country through which the road passes. The iron for the rails or rail plates being imported free of duty, is procured at less expense from abroad. The rail timbers, should the plan of construction require them, can be obtained either from the South or from the North and West. The line of the road, for most of the distance, passes over the more level ground near the bottoms of the vallies. South of the main summit, limestone, and granite, and gneiss rock, is encountered occasionally in the excavations; north of that summit, slate rock is met with in several places. The excavations in earth are composed principally of gravel, sand, and loam, the two first predominating over the last.

The excavation on the whole line is very similar in its general character to what appears on the six miles which have been put under contract near the Harlem River, and which for the grading and masonry for a single track, will not exceed, according to the terms of the contract, $5000 per mile.

A detailed estimate of cost of the whole line will be found embraced in the annexed reports of Messrs. J. I. Shipman and R. P. Morgan, Resident Engineers—by which it appears that the clearing, grubbing, ditching, grading, masonry, bridging and fencing upon Mr. Shipman's division, embracing the county of Westchester 42.38 miles, amounts to, including ten per cent. added for superintendance and contingencies, $508,753 16

The same for the portion surveyed by Mr. Morgan, extending from the north line of Westchester county to Greenbush, opposite to Albany, a distance of 98 1-3 miles, amounts to 907,253 60

Total for the whole line, ...		$1,416,006 76
Giving per mile, ...	$10,063 30	
For the railway or superstructure for a single track, the cost per mile for timber rails, surmounted by iron plates, of the proper thickness, with a timber foundation, similar to the Utica and Schenectada Railroad, will amount to $5300, or for 140.71 miles, ...		$745,763 00
Total, ...		$2,161,769 76
Add for turns out 10 per cent., ...		216,176 98
Total for grading and superstructure for 140 71 miles, .		
Or per mile,	$16,899 63	$2,377,946 74

This estimate does not of course include the expense of lands, and damages to buildings, neither does it embrace any of those items which belong to the transportation account, such as warehouses and fixtures at the depots, engine houses, engines and carriages.

Should an entire iron rail be adopted, the cost will be enhanced about $3600 per mile, and should it be determined to grade for a double instead of a single track, the cost would be still further enhanced about $2100 per mile.

On this subject, I would remark that the capacity of a single track railway for transportation, when provided with suitable turns out, is very great. This arises in a great measure from the degree of perfection which has been attained in the construction and operation of the locomotive engine, by which its powers for traction and speed are so well understood and regulated, that its times of arrival and departure, and of passing particular points upon a road with grades as favorable as the N. York & Albany, can be determined with a great degree of precision.

As it regards the probable revenue, data cannot be obtained for forming as correct a statement as in the estimate of the expense. It has been already stated that the route of the New York and Albany Railroad, passes for some distance near to and parallel with the west line of Connecticut, and near the south west part of Massachusetts.

The counties through which the route passes, viz: Westchester, Putnam, Dutchess, Columbia, and Van Renssalaer, are among the richest in agricultural, manufacturing and mineral resources in the sta'e. They also contain a very dense population, numbering according to the last census in the aggregate 197,306 inhabitants, equal to one tenth part nearly of the population of the state.

If to this be added the population of the counties of New York and Kings at the South, and Albany, Schenectada, Saratoga and Washington, at the North, all of which are in the immediate vicinity of the route, and will furnish to it more or less business, the aggregate is 652,782, equal to the one third part nearly of the whole population of the state. The preceding is exclusive of those portions of Connecticut and Massachusetts, situated near the route, and which, if they do not present so dense a population, are rich in manufacturing and mineral resources, embracing in addition to many valuable beds of iron ore, the finest marble region in the United States.

The position of the main line of the Road is such that branches can easily be extended into the western part of Connecticut and Massachusetts to connect with the line of Eastern rail roads from New Haven and the Great Western railroad from West Stockbridge, to Springfield and Boston. These lines of railroad are now partially in operation, and will soon be completed. The line from Boston to Worcester has been for some time in operation. From Worcester through Springfield, to the west line of Massachusetts, it is now mostly under contract, and will speedily be completed under the efficient aid afforded by the state of Massachusetts. From Springfield to Hartford, along the Connecticut river valley, surveys are now being made, and as the distance is short, and the ground favorable, the time cannot be distant when this portion will be in a course of construction. From Hartford to New Haven, the line is one half in operation, and the remainder under contract, and public attention is now being directed to the construction of the only remaining link required to complete the chain of coastwise railway communication from Maine to Carolina,—I allude to the portion between New Haven and New York. The navigation upon the Sound from New York to New Haven, and intermediate places, being generally safe and available most of the year, renders less necessary, perhaps the immediate construction of this line, but that it will sooner or later be opened, and if properly located, will occupy some thirty or more miles of the New York and Albany railroad, there is not, from the best information I have been able to obtain, much doubt.

In a communication made to the President and Directors of the New York and Erie Railroad Company during the last session of the Legislature, I urged the necessity in view of the great and constantly increasing importance of New York City as the leading commercial emporium of the union of *continuous* lines of railroad extending from the city to the northern and western lakes, and to the navigable waters of the Ohio. The New York and Albany railroad holds a prominent rank in this system, being the main stem or trunk to the branches leading north and west to the lakes, along one of the greatest thoroughfares for trade and travel in the United States.

These branches are now nearly perfected ; but one link is wanting from Saratoga to Whitehall, to complete the connection with Lake Champlain. One only from Utica to Oswego to complete the connection with Lake Ontario, and if we except the Utica and Syracuse and Auburn and Rochester railroads, which are both in a course of construction, one link only is wanting from Batavia to Buffalo to complete the connection with Lake Erie.

The inquiry will naturally be made as to how much of the business furnished by these branches will be contributed to the New York and Albany road. There cannot be much doubt that during the winter season the New York and Albany road is destined to become the main channel for the immense travel and trade of the country west and north of Catskill and Albany, including both the Canadas, with much to the east of those places, embracing the western portions of Connecticut, Massachusetts and Vermont.

During the season of navigation upon the Hudson River, the bulk of this business will, it is presumed, continue as heretofore, to be borne upon its bosom. Considering, however, the vast accumulation of the business and travel between New York and Albany at this season, it will not be unreasonable to assume that some portion of it will be diverted to the railroad, more especially if a saving in time is effected, as it easily may be upon the Railroad, of from two to four hours, compared with the time hitherto occupied by the fastest boats in passing between New York and Albany.

To the accessions from this source must be added the way travel and trade, which, for so extended a line, passing through so populous and wealthy a region, must of itself afford a revenue sufficient nearly to sustain it. For important information upon this subject, of a satistical character, I refer to the Report of the Executive Committee, recently made, and also to a pamphlet containing valuable "facts and suggestions," illustrative of the importance of the New York and Albany Railroad, by W. C. Redfield, Esq., of New York city, a gentleman who has contributed largely to promote the cause of internal improvements.

Perhaps no more satisfactory opinion can be formed of the business prospects of the New York and Albany Railroad, than by a comparison with the Utica and Schenectada Road, which forms a part of the same line to the lakes, the stock of which ranks among the most stable and valuable of any in the market.

During the season of suspended navigation on the Hudson, it will be obvious, from what has already been stated, that the business upon the New York and Albany Railroad will probably be greater than upon the Utica and Schenectada, as it will receive in addition to what is furnished by that road, all that will naturally concentrate upon it from the North and East. In addition to this, the New York and Albany Road possesses the privilege of carrying freight, which has thus far been denied to the Utica and Schenectada and other roads in the vicinity of the Erie canal. That this restriction, under a more enlightened view of the subject, will be removed, so as to permit the Utica and Schenectada, and the other roads mentioned, in the same line, leading west to Buffalo, to carry freight free of tribute to the State, I do not doubt; and have as little doubt also, that when the restriction is removed, and the line of Railway is completed to Buffalo, with the necessary arrangements for carrying freight, that even during the season of navigation, notwithstanding the cheaper transportation by the Canal, merchandise will be transmitted by the Railroads to a very considerable extent. This opinion is based upon the circumstance that to the States and Territories west, rapidity of transit is of the greatest importance, as is evinced by the fact that the Steam-vessels upon the lakes, notwithstanding the charges are higher than in Sail-vessels, are now doing the greater portion of the freighting business.

The New York and Albany road, situated as it is, from fifteen to twenty-five miles from the Hudson river, will command in summer, as well as in winter, an amount of freight which will add greatly to its revenue.

That freight can be transported upon Railroads at all seasons, with little danger of interruption, is now satisfactorily proved.

On several leading Railroads in the country, particularly the Boston and Worcester, and Philadelphia and Columbia, both of which are great thoroughfares for travel, the total annual receipts from freight are nearly equal to the receipts from passengers.

With an equal amount of business, the cost of transportation per ton, or per passenger per mile, will be less upon the New York and Albany, than upon the Utica and the Schenectada road, in consequence of the greater length of the former. The superiority of the latter over most other roads, is, owing in a great degree to the economy in transportation, resulting from its great length, 78 miles, being the longest Railroad in operation, with the exception of the Philadelphia and Columbia, in the Northern States. A very limited addition to the number of engines, carriages, superintendents, &c., on the Utica and Schenectada Railroad, would probably suffice to do an equal amount of business upon the New York and Albany road The intelligent Directors of the Utica and Schenectada, and Utica and Syracuse Railroads, appear to be fully aware of the importance of this fact, as I understand that an arrangement has been made, by which the engines and carriages of the former company are to traverse the whole extent of both roads, 131 miles, an arrangement which I do not doubt, will be of great advantage to both companies. The superiority which long lines of railway possess over short ones, in the economy of transportation, is abundantly manifest in the experience upon the Mohawk and Hudson Railroad—it having been ascertained that the cost of transportation upon that road, exclusive of the expense of stationary power at the inclined planes, is but little less than the total cost for a level road of twice or perhaps three times the extent.

Upon the Utica and Schenectada Rail road, as upon most other roads, the way-travel forms a prominent part of the business which is transacted upon it. In the year 1837, the number of *through*-passengers on this road, amounted to 79,000; and the number of *way*-passengers to 60,000.

Upon the New York and Albany Railroad, the intercourse between all parts of the line and the city, will necessarily be frequent, from the contiguity of the latter, and as it has a greater population in proportion to its length to sustain it, it is reasonable to infer that the way travel will be in a corresponding degree augmented.

Isolated Railroads, limited in extent, do not afford facilities sufficient to induce travelling to any great extent in winter. In proportion, however, as the Railroad system is extended, the travel will be increased, particularly in winter, in consequence of a large portion of the population being more at leisure at that season. Every new road that is constructed where there is no direct collision, adds to the business of those already in operation.

The population of the country is rapidly increasing; this is another important cause operating to increase the travel and business upon Railroads.

The New York and Albany Railroad is likewise essential to the rapid transmission of the mail at all seasons, and as affording a cheap and easy communication from the capital of the State to New York city, and intervening places, during the session of the Legislature.

The preceding are some of the more important reasons for supposing that the New York and Albany Railroad, when completed, will take a high rank among the leading public works of the State.

Important as this work is, in continuing to the city of New York the chain of Railroad communication, now so nearly perfected, from Albany and Troy, North and West to the Lakes, it is deserving of particular attention and support, by all who are interested in the growth and prosperity of the city. This attention and interest is more particularly demanded at the present time, in consequence of the efforts making to reach Albany by Railroads, from other sea-ports in the states of Connecticut and Massachusetts.

I cannot better, perhaps, close this report than by quoting the following from the communication to which I have already alluded, as having been but recently made to the President and Directors of the New York and Erie Railroad Company:

"While other cities upon the sea-board, Boston, Philadelphia and Baltimore, have opened to themselves railway communications, extending into the interior, by which supplies of provisions, fuel, &c., can be procured at all seasons, New York is, as yet, unprovided with any such communication.

"From the period of the closing of the canals to the opening of the navigation in the Spring, embracing more than one-third of the year, she is dependent mainly for her supplies upon the accumulation during the season of navigation, and the contributions of the adjacent country, which are usually reserved to the period when they will command the highest prices.

"The opening of a *continuous* line of Railway, leading into the fertile regions of the interior, will remedy, to a very considerable extent, this evil, and serve to prevent the existence of those monopolies which so easily spring up under the present limited sources of supply, and which will continue to be more severely felt in proportion as the population of the city and the adjacent county is augmented.

"The great interest possessed by the city of New York in the construction of the New York and Albany Railroad, necessarily induces a reciprocal interest on the part of those portions of the interior of the State, which are so situated as to be able to avail themselves of the road when constructed.

"The benefits accruing to those portions, in being able to communicate with the city at all seasons, with the great additional value which the road will impart to the lands and other property wherever its influence shall be felt, cannot, from their magnitude, be easily calculated. As a public enterprise, in this view alone, it will richly repay to the people of New York, any favors it may receive at their hands, in aid of its construction."

EDWIN F. JOHNSON,
Chief Engineer of the New York and Albany Railroad.

NEW YORK CITY, December, 1838.

Southern Division—Report of J. I. Shipman.

OFFICE OF THE NEW-YORK AND ALBANY RAILROAD CO.
December 28, 1838.

To E. F. Johnson, Esq. Chief Engineer N. Y. & A. R. R.:—

SIR—I have the pleasure to present to you a report, or general description of the operations of the Engineer Department on the lower division of the New-York and Albany Railroad, with maps and profiles illustrating the same, also a detailed statement of the various grades and curves upon one of the principal routes examined; together with an approximate estimate of the cost of graduation and masonry.

The survey of the lower division was commenced on the 14th of July, 1838, at a point on the northern bank of Harlem river, nearly opposite the termination of the Fourth Avenue of the city of New-York, in which the Harlem Railroad is located. From thence it was continued in a northerly direction to the valley of Mill Creek; crossing this stream, about two miles from the Harlem river, with a culvert of twelve feet span, and thence along its eastern bank to its source, a distance of four miles.

The general character of the valley of Mill Creek is favorable for the economical construction of a railroad, being, with the exception of a little rock cutting on the Eastern face of the ridge near Harlem river, chiefly composed of sand and gravel, and admitting of a very moderate grade, with curves of large radii.

From Mill Creek Valley, the route crosses the dividing ridge at an elevation of 22·04 feet above tide water, with a very moderate excavation, principally gravel, to the valley of the Bronx river, which it crosses upon a short embankment, and a bridge of twenty-five feet span, fourteen feet above the stream. From the latter point it continues on a generally direct course along the valley of the Bronx, a distance of twenty miles. This valley, near the stream, is composed of a broad level flat, three feet above the bed of the stream, averaging about five hundred feet in width. This bottom level or flat is skirted on both sides by a table land composed of gravel, and rising abruptly about thirty feet above the flat, averaging about two hundred feet in width. From this limit, the ground rises gradually on either side to an elevation above the stream, varying from one to three hundred feet. Upon the table land mentioned, the line was traced; the whole route admitting a moderate grade, averaging 17 feet per mile, and not exceeding 30 feet per mile. When rock occurs, which it does at a few points, it is chiefly granite and gneiss. Two quarries of marble are found upon the ridges above the table land—and stone for culverts and other purposes may be obtained within reasonable distances. Passing the dividing ridge between the waters of the Bronx and Kisto rivers, at an elevation of 443·5 feet above tide, by a moderate excavation, the route continues on side lying ground, northerly to the plains of New Castle. From thence it follows the valley of Muddy Brook, by a descending grade to the valley of Cross river, at Jay's meadow. This valley is similar in character to the valley of the Bronx; the Cross river is passed by a bridge of 40 feet span, elevated 30 feet above the water. From the Cross river, the course of the line continues very direct, and traverses a series of gravel knolls, with very moderate excavations, and embankments, to the valley of the Croton river, near the residence of J. H. Purdy, Esq., at which place it will be necessary to change the course of the stream for a short distance. Thence the line proceeds along the Croton river valley, crossing the Titicus river fifteen feet above the stream, on a bridge of 20 feet span, to the Putnam county line, being a distance of 42·383 miles from Harlem, and 257·92 feet above tide.

For the more perfect illustration of this route, I refer to the Map and Profile designated A.

A line diverging to the left at station 1088, near Davis' Brook, in and following the valley of that stream to the valley of the Saw Mill river, and connecting with the route yet to be described, in the valley of that stream, was examined, and presents favorable features, which will merit consideration in deciding upon the final location of the road.

A line diverging from the main route near Robbins' Mill, and passing through the villages of Mile Square, Bedford, Cross river and North Salem, to the Putnam county line, and connecting with the main line at Milltown, 48 miles from Harlem, as also a line by way of Hardscrabble to Doanesville, was carefully examined, and it is believed that the data necessary for a proper decision of the question of location in that quarter are fully obtained.

A third deviation from the main line was made near Whitlockville, in a more easterly direction, by the valley of Cross river, through North Salem, which completes the eastern portion of the survey.

The western portion of the survey commenced at the same point on Harlem river, described in this report, and continuing on the North bank of the river passes up the valley of Tibbett's brook, and forms a junction with a very feasible route, by way of Sprain brook, leading from the valley of the Bronx river, by an easy grade and light excavation, to the valley of the Saw Mill river. This latter valley is of the same general character with the valley of the Bronx, except that the course is less direct. At Unionville this line unites with the route from Davis' brook, 22 miles from Harlem. From this junction the route pursues the valley of the Saw Mill river to its source, and passing through the Dead Swamp, and the valley of the Kisto, it reaches the summit at Muddy Brook, and thence by a descending grade to the valley of Cross river, to connect with the central, or main line.

The character of the central route, as to grade and curvature, is exhibited in the following tables. It is upon this route only, and its modifications, that the estimates of cost are presented, there not being time sufficient allowed to enter into a minute examination and calculation of the expense upon the other routes.

Notwithstanding the distance from the Harlem river to the northern termination of the survey is only 43 miles, yet the whole extent of line surveyed, in making the examination, amounted in the aggregate to about two hundred miles.

To Mr. A. A. Goodliff, my principal assistant, together with the other members of the corps, I am greatly indebted for the energy and skill which they evinced in the execution of the surveys.

Respectfully submitted,

J. I. SHIPMAN,

Resident Engineer.

Southsrn Division.—Estimate of Cost of Graduation.

SECTION, No. 1.

Extends from Harlem River to the line between the towns of East and Westchester, being 6.532 miles.

Excavation and haulage, common earth, cubic yards, ...		127.738,	*a* 18 cts.	22,992 86
Do. do. Rock,	cubic yds.	4.000,	*a* $1 00,	4,000 00
Masonry in 8 culverts,	" "	200,	*a* $3 00,	600 00
Do. Road Bridge, 20 ft. span,	" "	285,	*a* 3 00,	855 00
" " over Bronx,	" "	218,	*a* 4 00,	872 00
Superstructures do. . . .		.	. .	720 00
Excavation in pits,	" "	500,	*a* 30 cts.,	150 00
Fencing, . .	" rods,	2.184,	*a* 1 25,	5,225 00
Grubbing and clearing,	" acres,	11¾,		675 00
				$36,089 86

SECTION, No. 2,

Extends from East and Westchester town line to the line between Scarsdale and White Plains, 10·227 miles.

Excavation and haulage of common earth, cubic yards,	318·172, *a*	18 cts.	$57,270 96
Do. do. Rock, cubic yds.	35·000, *a*	$1 00,	35,000 00
Masonry in 15 culverts, " "	667, *a*	3 00,	2,001 00
Excavation in pits, " "	600, *a*	30 cts.	180 00
Grubbing and clearing, acres,	28,		1 320 00
Fencing, rods,	6545, *a*	1 25,	8,181 25
			$103,953 21

SECTION, No. 3,

Extends from Scarsdale and White Plains town line to the line between Mount Pleasant and Newcastle, 8·997. miles.

Excavation and haulage common earth, cubic yards,	457·502, *a*	18 cts.	$82,350 36
Do. do. Rock, cubic yards,	14 208, *a*	$1 00,	14,208 00
Masonry in 19 culverts, " "	1·082, *a*	3 00,	3,246 00
" Bridge over Bronx, " "	300, *a*	4 00,	1,200 00
" Road Bridge, " "	270, *a*	3 00,	810 00
Excavations in pits, " "	1·340, *a*	30 cts.	402 00
Superstructures do.			740 00
Grubbing and clearing, acres,	15½,		712 50
Fencing, rods,	5·758, *a*	1 25,	7,197 50
			$110,866 36

SECTION, No. 4,

Extends from the line between Mount Pleasant and Newcastle to the line between Bedford and South Salem, 8·484 miles.

Excavation and haulage common earth, cubic yards,	592·792, *a*	18 cts.	$106,702 56
Do. do. Rock, cubic yards,	12,000, *a*	$1 00,	12,000 00
Masonry in 20 culverts, " "	1·094, *a*	3 00,	3,282 00
" Bridge over Cross river "	600, *a*	4 00,	2,400 00
Excavation in pits,	1·100, *a*	30 cts.	330 00
Superstructure,			760 00
Grubbing and clearing, acres,	14½,		750 00
Fencing, rods,	5430, *a*	1 25,	6,787 50
			$133,012 16

SECTION, No. 5,

Extends from Town Line, between Bedford and South Salem, to the Putnam County Line, 8·144 miles.

Excavation and Haulage common earth, cubic yards,	382·067, *a*	17 cts,	$64 951 39
Do. do. Excavation, Rock, cub. yds.	2000 *a*	$1 00	2,000 00
Protection wall, "	500 *a*	1 00	500 00
Masonry in ten culverts, "	457 *a*	3 00	1,371 00

" Bridge over the Titicus, "	300	a	4 00		4,200 00
" in two large culverts, "	222	a	3 00		666 00
Excavation in pits, "	1,120	a	30		336 00
Superstructure to Bridge, ...					310 00
Grubbing and clearing, . . .		acres 15			732 00
Fencing, ...	Rods	5280	a $1 25		6,515 00
					$78,581 39

AGGREGATE OF THE SECTIONS.

No.	*Distance Miles,*	*Amount.*
1	6·532	$36 089 83
2	10·227	103,953 27
3	8·997	110,866 36
4	8 484	133,012 06
5	8·144	78,581 39
		$462,502 88
Add for superintendence and contingencies, 10 per cent.		46,250 28
		$508,753 16

Average per mile, $12,003 71

TABLE OF GRADES,

Commencing at Harlem river, and terminating at Putnam County South Line.

Distance from Harlem, in miles.	Length of Grade in miles	Inclination. Grade per mile in feet	Inclination. Direction.	Elevation at change of grade above t de.
0·454	0 454		Level	5 000
1·022	0·568	30	Ascent	22 040
1·514	0·492	15	Descent	14·660
3·787	2·273	8	Ascent	32·844
4·772	0 985	25	do	57·469
6·439	1·667		Level	" "
8·749	2·310	9	Ascent	78 259
9·849	1·100	15	do	94 759
10·607	0·758	9	Descent	87·937
11·516	0·909	30	Ascent	115·207
13 637	2·121	11	do	138·564
15·379	1·742	27	do	185 598
17·046	1·667	9	Descent	170·571
25·909	8·863	29	Ascent	427·598
26 572	0·663	24	do	443·510
30·549	3·977	26	Descent	340·108
31·306	0·757	8	do	334·152
36·173	4.867	30	do	188·142
36·968	0·795	30	Ascent	211·992
37·668	0 700	20	Descent	197·992
39 126	1·458	15½	Ascent	220·591
40·000	0·874	20	Descent	203·111
40·556	0·556		Level	" "
42·383	1·827	30	Ascent	357·921

RECAPITULATION OF GRADES.

2·677 miles	Level,		
7·765 "	Level to 10 feet per mile,		
6·745 "	10 to 20 "	"	
1·648 "	20 to 25 "	"	
23·548 "	25 to 30 "	"	

Extent of curved line from 1432 to 6000 feet radius	3·431	miles.
" " " 6000 and over,	3·050	"
Total curvature,	6·481	"
Straight line,	35 902	"
Total distance Southern Division	42,383	"

To be continued.

Camden and Amboy Branch Railroad.

We wish every "Friend of Internal Improvement," would furnish us with a statement similar to the following, in relation to works of which they can speak from knowledge:

For the Railroad Journal and Mechanics' Magazine.

SIR:—I will take the liberty, through the medium of your Journal, to state that the Camden and Amboy Branch Railroad, between Trenton and New Brunswick, is completed, and has been in successful operation since the first instant.

This is, perhaps, one of the most important works in the Union, forming a direct Railroad communication between the two *rival* cities of New York and Philadelphia, connecting with the East Jersey Railroad at New Brunswick, and the Philadelphia and Trenton Railroad, at Trenton.

The road from Trenton to Kingston, is constructed on the south-eastern bank of the Delaware and Raritan Canal. At Kingston it leaves the Canal to the north, following the valley of Heathcotes brook, a distance of about four miles, to Long Bridge farm; here it takes the valley of Lawrence brook, following it to Dean's mill pond, a distance of about 2½ miles; it here takes the valley, and crosses the table land to New Brunswick.

The grading of this road was commenced on the 4th of June last, being only 6 months and 26 days before the entire completion of the work. This is unquestionably the shortest period ever occupied in constructing any Railroad of an equal length.

The superstructure is composed of a T rail, the same as that used on the Camden and Amboy Railroad, 16 feet long, resting on 9 cross ties, 8 of which are Oak or Chestnut, the joint tie being Locust, resting on 2 stone blocks, which are under the rail, and firmly bedded in the ground; the rails are connected together at the joints by a cast iron chair, which also prevents the rail from slipping.

The distance from Trenton to New Brunswick, by this route, is 27 miles, passing through a very pleasantly diversified country.

For the completion of the work, the public are indebted to the scientific and enterprising Chief Engineer, William Cook, Esq., by whose untiring zeal and unremitting attention the work was so speedily finished.

A Friend to Public Improvement.

American Locomotives in England.

It is with feelings of the highest gratification that we place on record the order for ten large engines, to be made by our enterprising friend, Norris of Philadelphia, for the Birmingham and Gloucester Railway.

On the receipt of one of Mr. Norris's circulars, by the distinguished Engineer of this road, a correspondence was opened, which resulted in a contract for *seven* of the class designated B, by Mr. N., and for *three* of a larger size than his class A.

We understand that the first of these will be shipped on the 15th of February, and that the others will rapidly follow, probably at the rate of two a month.

It is the intention of Mr. Norris to finish these engines in such a manner as to confirm the favorable opinion already existing of his work.

No more triumphant instance of the degree of excellence attained in machine-making, in this country, could be given, and we predict that the exportation of American Locomotives to England will soon be more common than the importation of English Engines to this country.

New Haven and Hartford Railroad.—We understand that this Road is now in successful operation as far as Meriden, 18 miles, and it is intended to be finished to Hartford by the first of November next.

The route from Hartford to Springfield is now under examination, a distance of 25 miles, making a direct line of Railroad from Boston to New Haven.

Extract of a Letter, dated Augusta, Ga. January 10, 1839.

"The Georgia Railroad is now in operation a distance of 75 miles. The cost of the portion finished is about $1,000,000. Our income from the Road last month, $16,271, which is at the rate of 18 per cent. per annum. We shall have the Road finished to Greensborough, in March, when we expect our receipts will be $24,000 per month."

The tolls collected at the Pennsylvania canals from the 31st of October, 1837 to the 22d of October, 1838, amounted to $400,441 90; on the railway and locomotive power during the same period, $524,378 68: making a sum total of $924,820 58.—*Argus.*

Railway Signal.—We have recently had an opportunity of inspecting a railway signal erected at the Grand Junction Station, Birmingham, which, from its great simplicity, and the unerring certainty with which it conveys the requisite information as to the state of the points to the drivers of locomotive engines, both by night and day, appears to be an invention highly important, not only to the proprietors of railroads, but to the public generally, as it will greatly tend to prevent those accidents which have occasionally occurred in consequence of the points (or shunts as they are called) being left in a wrong position. The invention consists of two discs, about two feet in diameter, placed at right angles, surmounted by a lantern showing four lights, but of three distinct colors, namely, two red, one blue, one white; the discs are painted to correspond. This apparatus is firmly attached to the top of the eccentric shaft employed in moving the points, and consequently turns with it with unerring certainty, and can be seen at a great distance, affording the enginemen or drivers ample time to govern the trains according to circumstances.

Railroad Switch.—A young man of Morrisville, Bucks county, Pa., has invented a mode of changing the switch on the 'turn out' of a railroad, by which it is said all accidents may be avoided. A Philadelphia paper thus describes it:—"The management is left entirely with the engineer on the engine, and *not* with a person at the lever, by which the switch is moved. So, if the railroad is in order, the engineer may direct the train of cars either way at full speed, without the least danger of accident. A small wheel, disposable at the pleasure of the engineer, touches the bar before the switch is reached, and immediately the track is opened to the direction desired."

Raleigh and Columbia Road.—The subscribers to the stock of this Road assembled at the office of the Raleigh and Gaston Company, on Monday last, for the purpose of organization. Col. Wm. Robards, of Granville, was called to the Chair, and Weston R. Gales appointed Secretary.

Judge Cameron, on behalf of the Commissioners appointed to open Books of Subscription, at Raleigh, made a written Report, stating that three hundred thousand dollars had been subscribed in the Stock of said Company; which being the amount required by Act of Assembly, to secure the Charter, and a majority of said Stock being here represented, the meeting, on motion of E. B. Freeman, Esq. proceeded to elect, by ballot, a President and five Directors to manage the concerns of the Company. The following gentlemen were found to have, each, a majority of the whole number of votes cast, and were declared duly elected, viz.: George W. Mordecai, President; Duncan Cameron, William Boylan, J. W. Hawkins, Charles Manly. and T. P. Devereux, Directors.

The Company then adjourned to meet again in this city on the first Monday in June, 1839.

☞ The Iowa Gazette mentions that Government Engineers are now engaged in surveying a route for a railroad from Milwaukie to the Mississippi river, for which purpose an appropriation of $20,000 was made by Congress at the last session.

Railroad Dividend.—The Psesident and Directors of the Richmond, Fredericksburg and Potomac Railroad Company, out of the nett profits for the last six months, have declared a dividend of three and a half per cent. We are pleased to learn, (says the Richmond Compiler) that the income for this period has been about 50 per cent. more than it was for the same period last year. A year ago, the dividend was only four per cent. for the preceding twelve months. Now it is three and a half for six months.

☞ We now present number one, of volume two, new series, of the *American Railroad Journal and Mechanics' Magazine*, to our readers, and solicit a continuance and increase of patronage.

To those of our subscribers who have punctually performed their part of our mutual contract, we return our warmest thanks, for enabling us to continue our work in an improved form. If supported, we intend continuing to add to its value, by every exertion in our power. The character of a Journal depends so much upon its general distribution, that our readers will find it as much to their advantage as to our own, to promote the circulation of the work.

To those who have *patronized* us by reading our work and not paying for it, we have only to say, that, though we do it reluctantly, we are obliged to discontinue sending to them. We have adopted the rule, and we shall not hereafter depart from it. Our means are not adequate, even if our inclination were, to a gratuitous distribution.

It may be proper to remark, that our Clerk has no other guide, than the payment, or non-payment, for the last volume, in sending or stopping the next number. It may happen that some very good friends of ours may thus be stricken off our books. We assure them that there is no unkind feeling on our part, and that they can very speedily resume their places on our books, by remitting the amount due, and for the ensuing year.

We make these remarks, because we find that in a few instances offence has been taken at our sending a bill upon the cover. When the money is due, we send the bill, and place it in as conspicuous a situation as possible. If this needs apology, we do not feel disposed to make any; but if, by any omission on our part to give credit for money received, or by losses in the mails, the subscriber is not credited on our books for money remitted, we desire to be informed of the fact, that credit may be given.

☞ Mr. E. F. Johnson's communication in reply to Mr. Detmold has been in hand several days, but it is necessarily omitted until our next number, to make room for his Report on the New-York and Albany Railroad.

AMERICAN

RAILROAD JOURNAL,

AND

MECHANICS' MAGAZINE.

No. 2, Vol. II. New Series.] JANUARY 15, 1839. [Whole No. 326. Vol. VIII.

Power of Traction of Locomotive Engines.

To the Editors of the Railroad Journal and Mechanics' Magazine—

GENTLEMEN,—It is not without a due sense of the ungentlemanly character of Mr. Detmold's last communication, in reply to mine, that he is again noticed. A regard for truth, and for whatever may serve to advance the profession of which I am a member, have prompted me to waive all considerations of a personal nature in my present determination to again trouble the readers of your Journal with an exposition of the errors which Mr. Detmold has committed, and of the misrepresentations, of which I shall presently show he has been guilty.

In my letter of April 7, to which Mr. Detmold has thought proper again to allude, I held the following language. " As to the accuracy of De Pambour's formula, *within* the limits in which it may be considered properly applicable, although I believed it to be nearer the truth than appears on a more critical examination, yet I gave it as my opinion that it was imperfect." Mr. Detmold asserts, that one of the imperfections above alluded to " consists, according to Mr. Johnson, in the fact that the formula in question ' does not designate the point at which it ceases to be applicable.' "

This statement of Mr. Detmold is untrue upon its very face. The "imperfections alluded to, we distinctly stated to be confined to the character of the formula " *within* those limits in which it is properly applicable." The allusion to the circumstance that the formula " does not designate the point at which it ceases to be applicable," was made, not to indicate a " defect" in the formula, but as an excuse, which every candid man will acknowledge a reasonable one, why in the haste in which the calculations were made, that limit should have been overlooked. It may be proper to remark here, that the errors alluded to by Mr. Detmold, were confined to the loads under the two lower velocities in the table—that they did not affect the accuracy of any conclusions which were drawn as to the expense of transportation, or as to the general principle of the operation of the locomotive engine upon railroads. I might, indeed, with propriety, have spoken of that feature in the formula as a defect, which in fact it is; although, from the circumstances of the case, it might have been one which could not have been remedied, and for which no censure could justly attach to the individual who framed it. But I did not do this, I distinctly attributed the error to inadvertence, arising from the "haste" in which the letter was prepared; and I had supposed vainly, as it appears, that Mr. Detmold's sense of justice would have dictated a correction of his unjust imputations—or, that it would at least have prevented on his part any further allusion to an error which *he* did not detect, and which had been so promptly and fully corrected.

Mr. Detmold says: "As to the fact which Mr. Johnson states, that De Pambour, in his practical table (p. 186, Phila. Ed.), has been led into precisely the same error with himself and Mr. Talcott, *i. e.*, has applied his own formula beyond its proper limits," &c.

Upon this quotation from Mr. Detmold I will simply remark, that I have never stated that Mr. Talcott had been led into the error alluded to by Mr. Detmold, neither have I stated as unqualifiedly as Mr. Detmold asserts, that De Pambour had been led into precisely the same error—I did say, however, that it was "probable" that De Pambour had been led into, at least, one error from the same cause. The existence of this error, which Mr. Detmold's sagacity had not previously discovered, is of necessity admitted by him, and his attempt to explain it on different grounds is gratuitous on his part, and may, or may not, be true. If the error is equal to the last term in the formula quoted by Mr. Detmold, then he is probably correct in his explanation of the cause, but in either case, it has nothing to do with the main question at issue, which is, the accuracy of De Pambour's formula "*within* the limits in which it is properly applicable."

Mr. Detmold further states, "that he never charged Mr. Johnson with any intention of disparaging the labors of De Pambour." It is singular that this assertion should be so boldly and unblushingly made in the face of facts as glaring to the observation of all who have perused his communications, as the sun at noon-day. The very ground on which he seized the cudgel, to make battle with myself and Mr. Talcott, was to defend from disparagement the reputation and the labors of De Pambour, under the false impression, so far at least as I myself was concerned, that both had been intentionally and wrongfully assailed.

I will not dwell longer upon this part of the subject, but will proceed to consider that part of Mr. Detmold's communication, in which he endeavours to refute the positions taken by me, in illustrating some of the imperfections of De Pambour's formula "*within* the limits in which it is properly applicable."

Mr. Detmold says, that I have endeavoured to show that De Pambour has not made the proper corrections in the use of the spring-balance, "*because*, he takes into account only 1st, the pressure produced by the lever at the place of the valve; 2d, the pressure produced at the end of the lever by the weight of the rod, screw, and spring; 3d, the weight of the disc of the valve."

Mr. Detmold here again asserts what is untrue—I assigned no such "because" as he affirms under the first and third heads; for the error referred to in the correction of the spring-balance. It is, moreover, impossible, from the nature of the case, that I should have done so—my remarks referred exclusively to the correction which designates the influence of the several parts of which the balance is composed. And Mr. Detmold has not demonstrated, neither has he adduced evidence of the probability that the view taken by me is incorrect.

Mr. Detmold next proceeds to comment upon the correction pointed out by me in respect to the atmospheric pressure upon the valve, resulting from the greater surface exposed to atmospheric than to steam pressure, in consequence of its conical shape. He says—"that the error alluded to can only exist when the valve is close to its seat, and then it can never be exactly ascertained, as in that case the spring-balance only indicates the pressure of the steam in a *negative* manner; for so long as the valve is perfectly closed, all that we know is, that the steam is of less force than the pressure of the spring-balance, added to that of the atmosphere. But the instant the valve is raised off its seat, in ever so slight a degree, we then know the pressure of the steam *positively*." There is here a pedantic display of scientific terms, without any just conception of the true sense in which they should be employed.

The spring-balance, when the valve "is perfectly close to its seat," instead of "indicating the pressure of the steam in a *negative* manner," affords no evidence, either *negative* or *positive*, that there is the least pressure exerted by the steam. So far from its indicating the pressure of the steam in any "manner" whatever, it affords, when in the condition mentioned, not the least evidence that there is any steam in the boiler!! That the pressure of the steam must exceed De Pambour's estimate, before the valve can be raised so as to permit an escape, Mr. Detmold is compelled to concede, and that it is not greater when the steam is making its escape, he has entirely failed to prove. The declaration of the contrary involves a gross absurdity. De Pambour, Sec. 4, chap. 2, illustrates the mode of estimating the pressure, on the rising of the valve, from the increased surface exposed, but he seems not to have been fully aware that the steam which passes through the most contracted part of the orifice is diffused over a greater space upon the valve; and also that the force of the steam, while making its escape, not only sustains the valve with the atmospheric pressure upon it, but overcomes in addition thereto the atmospheric pressure upon the orifice around the valve. De Pambour's view of the subject was evidently unsatisfactory to himself, for he states at the close of his remarks upon the subject, that "there still, however, remains the blowing of the valve, the *exact appreciation of which escapes all manner of calculation.*"

Mr. Detmold's assertion, that while the steam is blowing off, "the air (owing to its nature as a fluid) and the issuing steam meet upon the same point of the valve," is not true, in point of fact, and a little reflection will render manifest also the absurdity of this statement.

The declaration of Mr. Detmold, that "as in most locomotive engines the mitre is only one-fourth of an inch, the error resulting therefrom can at most be 3 lbs., or 4 per cent.," is like a previous statement, where he alludes to the mode of attaching the spring-balance "to all the engines he had ever seen," entirely foreign to the question at issue, and can at best but be viewed as an attempt at evasion.

In investigating the accuracy of De Pambour's analysis of his experiments, it is with the mode of construction and dimensions of the engines which *he* made use of that we have to do. The reasonableness and necessity of this position is so perfectly obvious, that any attempt to illustrate it might fairly be construed as an intentional insult to the understanding of the reader.

The information which De Pambour gives, as to the mitre of his valves, shows that the diameter of the two surfaces were as 2½ to 3 inches, and Mr. Detmold ought to have perceived that in the absence of further proof than is afforded by De Pambour's work, no other dimensions are admissable. There is, independent of this logical defect in Mr. Detmold's reasoning, an incongruity in his statement, since under a strict technical interpretation, when the mitre is one-fourth of an inch, the difference in the diameter of the two surfaces is one-half, instead of a quarter of an inch, as assumed by him.

Again, Mr. Detmold says, that "this error, however, could in no degree have affected the results of De Pambour's experiments, as in all cases he verified the pressure indicated by the spring-balance, by the mercurial gauge." Admitting that the mercurial gauge affords a correct measure of the pressure, how was this verification effected? The mercurial gauge was not attached to the engine, and could not be, when the latter was in motion. For all that portion of the time, therefore, during the movement of the engine, when there was no escape of steam from the valve, and the index of the balance remained unmoved, no evidence of the true pressure is afforded by the mercurial gauge, for the very plain reason that the pressure, as indicated by that instrument, is obtained *through the medium of the spring-balance;* and when the latter instrument fails to perform its duty, as in the case mentioned, the mercurial gauge becomes equally deficient, a circumstance which Mr. Detmold seems to have altogether overlooked.

Mr. Detmold says, further, that "Mr. Johnson rejects the use of that instrument (the mercurial gauge) in toto, because De Pambour says that the steam having to pass through a long and narrow tube, arrives on the mercury at a less degree of pressure than in the boiler." Mr. Detmold must have been sensible that this "because," in this, as in the preceding instance, is not in strict accordance with the truth. My reasons were based upon the fact that the spring-balance, with the corrections properly made according to the description of that instrument and the form of the valve as given by De Pambour, gave a degree of pressure a little exceeding that of the mercurial gauge, and hence must of necessity be nearer the truth. The remark of De Pambour was only alluded to as confirming results previously obtained, and was not stated as a "because." Upon this subject Mr. Detmold finding it to his interest to differ from De Pambour, does not hesitate to say, that "the pressure of the steam upon the mercury becomes *precisely* the same as in the boiler."

The impracticability of determining by the spring-balance, and consequently by the mercurial gauge, the exact pressure of the steam, so necessary in arriving at a correct experimental knowledge of the power of traction and evaporation of engines at different velocities and at given pressures, occasioned the suggestion by me of a cylindrical piston as a substitute for the conical valve.

In its construction and operation it is more simple than the manometer proposed by De Pambour, which obviates none of the defects of the conical valve, and as to its impracticability, if Mr. Detmold had observed the manner in which the graduation upon the scale of the balance is proposed to be effected, and had known how uniform is the friction or resistance when metallic packing is used, he would have observed that the friction was amply provided for, and would have hesitated not a little before he would have committed himself in so public, and positive a manner as to its success.

I now proceed to notice Mr. Detmold's comments upon that portion of my communication, which relates to the evaporating power of the engine. The remarks made by me upon this subject, and the conclusions to which I arrived, remain like the other positions unrefuted; but Mr. Detmold having exhausted his own resources, quotes largely from a recent edition of Mr. Wood, whose evidence so far as he has offered any thing *new* upon the subject, goes to support most fully all that I have advanced.

In my communication, I clearly proved that the evaporation or quantity "S," on which the relative power of the engine under different velocities mainly depends, instead of being invariable and constant, as assumed by De Pambour, at all velocities of the engine, possessed a different character. That it increased with an increase, and diminished with a diminution of the velocity, and that the variation amounted in one of the experiments from which the average value of "S" was derived, to twenty-nine per cent below, and in another to twenty-three per cent above that average, making a difference between these two extremes of fifty-two per cent!!!

I also showed that in the case of the first experiment with the Atlas engine, being the second of the experiments from which the average value of "S" is deduced, that the velocity corresponding to the maximum load as given by the formula, was at least twenty-nine per cent greater than the velocity attained in the experiment; yet Mr. Detmold having from a blind belief in the infallibility of De Pambour, committed himself in favor of the "sterling accuracy," and "close corroboration of theory by practice of his formula, as the most fastidious could require," obstinately persists in refusing to acknowledge his mistake, notwithstanding the evidence is so plain, that "he who runs may read."

Mr. Wood upon this subject says, that "as the subject of determining the relative evaporation at different rates of speed, *is of great importance* in the investigation of the power of these engines, we shall in our calculations of the useful results produced in practice, suppose the power of evaporation, constantly the same at all rates of speed, *until we have an opportunity of more conclusively determining the evaporation at different rates of speed!*"

Mr. Wood also says, in respect to the resistance presented by the escape of the steam from the cylinders, and the increased evaporation, "these two will, in *some degree*, balance each other." Mr. Detmold not appreciating the force of language, takes this to mean that they will either exactly, or so nearly balance each other, that no further investigation is desirable, or necessary.

Mr. Wood again says, that "*until therefore experiments are made to determine both these effects accurately at the different rates of speed required to form a correct conclusion*, we shall, as before stated, assume the evaporation, etc. to be constant."

Mr. Wood, in the above quotation, clearly admits all that I affirmed in relation to the importance of further experiments to determine the evaporation, and the resistance of the escape steam, and he follows De Pambour in assuming the value of "S" to be constant at all velocities, for precisely the same reason, that it was so assumed by me in the construction of my table, viz: the want of experimental evidence, which De Pambour does not furnish, to show the amount of that evaporation, and resistance at different velocities.

How it could be possible for Mr. Detmold, with the "clear conceptions," which I have a right to suppose he claims for himself, from the gentlemanly manner in which he charges me with the want of so essential a quality in philosophical investigations, should not have observed the very perfect coincidence of the views of Mr. Wood, so far as he ventured to give an opinion upon the case, with those advanced by me, I am at a loss to conjecture; and it is the more strange from the fact that the above quotations, from Mr. Wood, are contained in the very paragraph which Mr. Detmold introduced from that author into his communication!

De Pambour made no experiments, if I recollect right, upon the resistance presented by the reaction or escape of the steam. His experiments also upon the evaporation were very meagre, comprising only eleven experiments, with six engines. Yet meagre as they were, I conclusively showed in my communication, that any formula based upon the supposition that the evaporation is constant, with no provision for the resistance of the escape steam, is imperfect.

Had Mr. Wood viewed the subject more attentively, in the light in which it has been presented in my own and Mr. Talcott's communication, I do not doubt he would have spoken still more decidedly of the importance of farther experiments, with a view of rendering De Pambour's formula still more perfect.

The facts stated by Mr. Talcott, that, applying "De Pambour's formula to all his experiments, when the engine was in good order, the regulator entirely open, and the load less than a maximum by the formula, the discrepancy between the results of the formula and the experiment, falls below ten per cent. of the load drawn only in about one-fourth of the whole number, and in about one-fifth is between ten and twenty per cent.; about one fourth between twenty and forty per cent.; one-sixth between forty and one hundred per cent., and in the remainder (about one-half) the discrepancy is over one hundred per cent.!!

It certainly does not require a very acute mind to discover in the above facts sufficient evidence that the formula is to a certain extent imperfect; for let it be remembered, that the engines and the apparatus for determining the pressure, used in the experiments, were principally the same employed by De Pambour, in the experiments for determining the evaporating power; and as both were made by the same individual, the circumstances were extremely favorable to the successful application of the formula. I again repeat, that the fact of there being so great a discrepancy, is of itself *prima facie* evidence of the imperfection of the formula.

It completely confirms the justness of the conclusion to which I arrived in investigating the principles on which that formula was based; and I am fully sustained in the opinion which I advanced, and which gave so great offence to Mr. Detmold, that there are "defects in De Pambour's mode of conducting and analyzing his experiments," and that those "experiments *require to be extended and carefully revised.*" On this subject I would respectfully request that those of the readers of the Journal, who have not examined with attention my previous communication, should do so before forming an opinion, as there are some points of importance which Mr. Detmold has overlooked, and to which I have not time at present to refer. There are others, also, relating to the subject under discussion, which might be advanced, but which I have not at present the leisure, or the disposition to offer.

Correct as the position assumed by me is proved to be, it does not by any means follow that De Pambour is not deserving of the greatest credit for the very able and remarkably lucid manner in which he has treated the subject of the Locomotive Engine. I have from the first accorded him all the credit which is undoubtedly justly his due; but to suppose that he has succeeded in presenting, as Mr. Detmold asserted, when he entered upon the controversy, a "strictly accurate formula," obtained by the most "rigorous deductions" "from established principles in mechanics," and "accurate and extensive experiments," and containing no "imperfections or deficiencies," in the face of the most positive and conclusive evidence to the contrary, I am not so strongly imbued with the feeling of manworship, or so servile a follower in the footsteps of others, as to be willing to acknowledge.

Mr. Detmold evidently commenced his attack upon myself and Mr. Talcott, under the influence of prejudices in favour of all that is European, which is more peculiarly the characteristic of those who have come to our shores from abroad. This feeling, or weakness, I could have overlooked. But when I find combined with it, a temper not the most amiable, impelling to remarks not the most gentlemanly, and a disposition to evade or misrepresent facts as they exist, I must be excused for the severity of some portion of my comments, and must decline any further notice of Mr. Detmold, unless by some flagrant action on his part, a future notice shall be deemed necessary.

E. F. Johnson.

Engineer's Report to the New-York and Albany Railroad Company.— E. F. Johnson, Esq., Chief Engineer.

Continued from page 29.

Northern Division.—Report of R. P. Morgan.

Office of the New York and Albany Railroad Co.
January 7, 1839.

To E. F. Johnson, Esq., Chief Engineer N. Y. & A. R. R.

Sir:—I herewith present to you a brief statement of the result of the field operations in the Northern portion of the proposed route of the New York and Albany Railroad, during the last season. The whole period included between May and November, was employed in testing every route which might render this important line as perfect as possible.

In submitting the details of the operations of my party, it affords me much satisfaction to reflect that they exhibit not only facts which prove the unquestionable feasibility of the route, but will justly raise the character of the undertaking, in the public estimation, far beyond the most sanguine expectations that have been hitherto entertained. The various lines examined, equal in extent more than three times the distance contained between the extremes of the survey—and I am fully convinced that no important feature in the topography of the country has escaped notice. The remarkable valley which extends from the South line of Putnam County, entirely to Hillsdale, in Columbia County, offered facilities for the construction of a Railroad, greater than I had ever met with upon any survey in which I had been previously engaged.

In your own examination, you must also have been struck with the natural advantages arising from the peculiar and favorable formation of the country, particularly in the direction of the ridge constituting the Highlands on the Hudson river parallel with the Taghkanic ridge, in which the line of the survey is situated, in a Northerly direction, whilst the valley continues, with great uniformity in its surface, and with a very moderate inclination, for sixty-two miles. The highest summit upon the line surveyed, is situated in the town of North East, and is fifty-two miles from the north line of West Chester county, the point of commencement of the survey. The elevation overcome in this distance is 511·40 feet, which, added to 257·92, the height of the point of commencement above tide, gives for the elevation of the summit above the same level 769.32 feet.

In proceeding to the northward, the line descends with slight undulations, only 100 feet in 16 miles, passing at the same time through a very favorable opening to the west side of the Highland ridge.

From the south-east part of the town of Claverack, near Hoffman's, and about ten miles from Hudson, the line was continued northwardly, on the west side of the ridge, where the ground became more broken and difficult, but by no means as much so as had been anticipated. It was not necessary to increase the grades beyond 30 feet per mile, and the earth to be excavated was for the most part gravel. Nine miles beyond Hoffman's, in Claverack, the line intersects the Hudson and Berkshire Railroad, in Ghent, and continues on fine, smooth land, descending 25 feet per mile, to Kinderhook creek, near the village of Valatie. A high bridge of 100 feet span will be necessary for passing the stream—the expense of which will not be great, from the existence of rocky banks, which form natural abutments. Having crossed the stream, no further obstructions of a difficult character were encountered. We were enabled, in making a descent to the Hudson, to select the valley of Mitches' Kill, which descends gradually to the river, at Castleton, or to pursue a line, on the remarkable table land which lies between Kinderhook and Greenbush. A survey was made of both these routes; the descent upon neither exceeding the maximum inclination on the other portion of the line, of 30 feet per mile. The whole distance to the upper ferry at Bath, opposite Albany, is 98½ miles.

The survey was also extended 6·17 miles further, to Troy, on comparatively level ground, near the margin of the river. In re-examining the ground, on my return south, I omitted no point, where improvement could be made, and in many instances there exists a choice of routes which are nearly equal. At the request of the inhabitants of Salisbury, in Connecticut, and in consideration of the immense amount of freight to be obtained in Iron and Marble from that region, a branch was surveyed, extending to that village. This line was found practicable, at a maximum grade of 35 feet per mile, descending to the south. A survey was also made from the main line in Dover, to Bull's bridge, in Kent, on the Housatonic river, (distance four miles) which was found practicable, for the construction of a branch.

Annexed is an estimate of the necessary excavation and embankment, masonry, bridges, &c., which, it is believed, will be found ample in every respect, having allowed, in addition to a liberal estimate upon the several items, 10 per cent for contingent expenses. The average cost for constructing the road bed, for a single track, from Putnam county, south line, to Albany, is $9.226 62 per mile, which may at first appear a small sum compared with the cost of other Railroads; but it should be remembered that more than forty miles of this route is over smooth meadows, or table land, in which a small embankment of from one to two feet, will be amply sufficient for the road bed.

The inclination of the grade line no where exceeds 30 feet per mile, and for many miles there is a close approximation to a level. There is 65·32 miles of straight, and 32·50 miles of curved line. Few of these curves are less than 5000 feet radius, and there is one curve only, as small as 1200 feet radius. This occurs in turning a point of the mountain in Clavarack.

Your experience must at once impress you with the comparative excellence of the whole line, and I feel confident that you will join me in the opinion, that it is alike fortunate for the company, and the public, that so favorable a route has been found for connecting the cities of New York and Albany.

To my principal assistant, Mr. H. A. Gardner, and others employed in the execution of the surveys, I am much indebted for their zeal and attention in the discharge of the duties assigned them.

Respectfully submitted,
RICHARD P. MORGAN,
Resident Engineer.

Northern Division.—Estimate of Cost of Graduation.

SECTION, No. 1,

Extends north from Putnam county south line five miles.

Clearing and Grubbing Section, . . .				$ 840 00
Excavation and haulage common earth, cubic yards, ...		224·135,	*a* 20 cts.	44,827 00
Do. do. Rock,	cubic yards,	16·987.	*a* $1 00,	16,987 00
Masonry of Bridge across Croton river, cubic yards, ...		1·750.	*a* 4 00,	7,800 00
Superstructure do.	linear feet,	150,	*a* 20 00,	3,000 00
Masonry in 7 culverts, .	cubic yards,	3,200,	*a* 1 12½,	3,600 00
Fencing, . . .	rods,	305,	*a* 3 00,	915 00
				$77,169 00

SECTION, No. 2,

Extends to Dover 19 miles.

Clearing and Grubbing Section, .				$ 1,655 00
Excavation and haulage common earth, cubic yards, ...		221·850,	*a* 16 cts.	35,496 00
Do. do. Rock,	cubic yards,	7·407,	*a* $1 00,	7,407 00
Masonry of two Bridges across Swamp River, ...	cubic yards,	790,	*a* 4 00,	3,160 00
Superstructure do. .	linear feet,	100,	*a* 15 00,	1,500 00
Masonry of 6 culverts,	cubic yards,	223,	*a* 3 00,	669 00
Fencing, ...	rods,	12·160,	*a* 1 12½,	13,680 00
				$63,567 00

Section, No. 3,

Extends to the town of North East 22 miles.

Clearing and Grubbing Section.				$ 1,480 00
Excavation and haulage common earth, cubic yards,		766·250,	*a* 18 cts.	137,925 00
Do. do. Rock,	cubic yards,	6 622,	*a* $1 00,	6,622 00
Masonry of 3 Bridges,	" "	1,600,	*a* 4 00,	6,400 00
Superstructure 2 Bridges,	linear feet,	200,	*a* 20 00,	4,000 00
" 1 "	" "	50,	*a* 15 00,	750,00
Masonry 29 culverts,	cubic yards,	9·370,	*a* 3 00,	2,811 00
Masonry 1 culvert arched 6 feet span,		120,	*a* 3 50,	420 00
1 Road Bridge,				650 00
Fencing,	rods,	14·080,	*a* 1 12½,	15,840 00
				$176,898 00

Section, No. 4,

Extends to Hillsdale 16 miles.

Clearing and Grubbing Section,				$ 1,120 00
Excavation and haulage common earth, cubic yards.		860·100,	*a* 17 cts.	146,217 00
Masonry 12 culverts,	do.	936,	*a* $3 00,	2,808 00
Do. 3 culverts arched 10 feet span,		1·237,	*a* 4 00,	4,948 00
4 Road Bridges,				2,825 00
Fencing,	rods,	10·240,	*a* 1 12½,	11,520 00
				$169,438 00

Section, No. 5,

Extends to Claverack Creek 9 miles.

Clearing and Grubbing Section,				$ 1,000 00
Excavation and haulage common earth, cubic yards,		404·650,	*a* 20 cts.	80,930 00
Do. do. Rock,	cubic yards,	15 000,	*a* $1 00,	15,000 00
Masonry 1 Bridge.		400.	*a* 4 00,	1,600 00
Superstructure 1 Bridge,	linear feet,	50,	*a* 15 00,	750 00
Masonry 9 culverts,	cubic yards,	472,	*a* 3 00,	1,416 00
Masonry 1 culvert arched 10 feet span,	do.	445,	*a* 4 00,	1,780 00
1 Road Bridge,				650 00
Fencing,	rods,	5,760,	*a* 1 12½,	6,480 00
				$109,606 00

Section, No. 6,

Extends to the Hudson and Berkshire Railroad 5 miles.

Clearing and Grubbing Section,				$ 900 00
Excavation and haulage common earth, cubic yards,		339·880,	*a* 15 cts.	50,982 00
Masonry 9 culverts,	cubic yards,	1·027,	*a* $3 00,	3,081 00
Masonry 2 culverts arched 6 feet span,	do.	474,	*a* 3 50,	1,659 00
1 Road Bridge,				2,000 00
Fencing,	rods,	3·200,	*a* 1 12½,	3,600 00
				$62,222 00

Section, No. 7,

Extends to Renssalaer county south line 10 miles.

Clearing and Grubbing Section.			$ 1,300 00
Excavation and haulage common earth, cubic yards,	305·380,	*a* 15 cts.	45,807 00
Masonry of Bridge across Kinderhook Creek, do.	2·009,	*a* $4 00,	8,036 00
Superstructure do. linear feet,	100,	*a* 20 00,	2,000 00
Masonry 5 culverts, cubic yards,	382,	*a* 3 00,	1,146 00
Masonry 1 culvert arched 10 feet span, do.	400,	*a* 4 00,	1,600 00
2 Road Bridges,			1,350 00
Fencing, rods,	6·400,	*a* 1 25,	8,000 00
			$69,239 00

Section No. 8,

Extends to Bath in the town of Greenbush 12·33 miles.

Clearing and Grubbing Section,			$ 1,900 00
Excavation and haulage common earth, cubic yards,	465·600,	*a* 15 cts.	69,840 00
Do. do. Rock, do.	7 000,	*a* $1 00,	7,000 00
Masonry 23 culverts,	1·610,	*a* 3 00,	4,830 00
Masonry 2 culverts arched 10 feet span, do.	800,	*a* 4 00,	3,200 00
Fencing, rods,	789·100,	*a* 1 25,	9,867 00
			$96,637 00

Recapitulation of Sections.

Sections.	*Distance in Miles.*	*Amount.*
1.	5	$ 77,169 00
2.	19	63,567 00
3.	22	176,898 00
4.	16	169,438 00
5.	9	109,606 00
6.	5	62,222 00
7.	10	69,239 00
8.	12½	6,637 00
		$824,776 00
Add for superintendence and contingencies, 10 per cent.,		82,477 60
Total for Northern Division,		$907,253 60

Equal to $9,226 26 per mile.

Table of Grades

Commencing at Putnam county south line, and terminating in the town of Greenbush, opposite Albany.

No.	Length of Grade in Miles.	Distance from Harlaem in Miles.	Inclination of Grades per Mile.			Height above Tide at termination of grade
			Ascent.	Descent	Level.	
1	4·75	47 13	29·82			399·563
2	1·17	48·28	23·00			426·463
3	9·08	57·38			Level	426 463
4	4·00	61·38		5·00		406·463
5	1·50	62·88	5·00			421·463
6	2·50	65·38		5.00		408·963
7	2·42	67·70	8·00			428·323
8	2.30	70·70		18·00		386·923
9	3,00	73·10	10·00			416 923
10	1.60	74·70			Level	416·923
11	4.50	79·20	30·00			551·923
12	2 55	81·75	18·00			597·823
13	1·30	83·05	5·00			604·323
14	1·50	84·55		10.00		559·323
15	5·00	89·55	30·00			739·323
16	2 50	92·05	11·00			769·323
17	2·44	94·49		25·00		715·643
18	1·56	96·05		30·00		668·843
19	4·34	100·34			Level	668·843
20	0·83	101·22	18·00			682·783
21	2·00	103·22		16·00		651·783
22	1·33	104·55	20·00			678·483
23	2·35	106·90		20 00		631·673
24	1·65	108·55	25·00			672·933
25	5 15	113·70		30·00		517·133
26	3·90	117 60		28·00		407·933
27	1 30	118·90			Level	407·933
28	1·80	120 70		30 00		353·933
29	2·15	122·85			Level	353·933
30	1·30	124·15		25·00		321·433
31	2 72	126 87	10·00			348·633
32	1·88	128·75		25·00		301·633
33	1·00	129·75			Level	301·633
34	3·00	132 75		18·00		247·633
35	2·90	135·65		20·00		189·633
36	5·06	140 71		30·00		36·333

Recapitulation of Grades.

19·47	miles.	Level.
18·94	"	Level to 10 feet per mile.
19·76	"	10 to 20 " "
8 44	"	20 to 25 " "
31·72	"	25 to 30 " "

Extent of curved line from 1200 to 6000 feet radius,		4·66	miles.
" " "	6000 and over	27·84	"
	Total curvature,	32·50	"
	Straight line,	65·83	"
	Total distance Northern Division,	98 33	"

RECAPITULATION OF THE WHOLE LINE.

Estimate of Cost of Grading, &c. of the Southern Division, for a Road-bed 16 feet in width on embankments, and 8 feet added in excavations, for drainage, with 10 per cent. added for Superintendence and Contingencies, as per Mr. Shipman's Report,	$508,753 16
Do. do. do. Northern Division, as per Mr. Morgan's Report,	907,253 60
Total cost of Grading for whole line,	$1,416,006 76

Equal to $10,063 30 per mile.

GRADES.

22·147	miles	Level	
26·705	"	Level to 10 feet per mile	
26 595	"	10 to 20	" "
10 088	"	20 to 25	" "
55·268	"	25 to 30	" "

LINEAR ARRANGEMENT.

Extent of curved line,	38·981	miles, equal to	28 per cent. of whole line
" straight "	101·732	" "	72 " " "
Total distance,	140·713		

WE present to our readers such portions of the Semi-Annual Report of the Water Commissioners as may be interesting to our professional readers. We have omitted the details of the various vexatious difficulties which have been encountered.

A very important question discussed in the report we have reserved for separate notice—we refer to the subject of crossing Harlem river. We conceive that very important interests are involved in the question, and we shall enter at large upon it in our next number.

Semi-Annual Report of the Water Commissioners, from the 1*st of July to the* 31*st of December*, 1838, *inclusive.*

To the Honorable the Common Council of the City of New-York :—

The Water Commissioners respectfully report: that they have deposited in the Comptroller's office, a semi-annual account current of their receipts disbursements, from the 1st day of July, 1838, to the 31st of December thereafter. The sums total expended by them, from the commencement of the operations under the "Act to provide for supplying the City of New-York with pure and wholesome water," are as follows:

From July,	1835, to January,	1836,	$31,828	02
" January,	1836, to July,	1836,	12,070	84
" July,	1836, to January,	1837,	28,099	58
" January,	1837, to July,	1837,	62,602	85
" July,	1837, to January,	1838,	233,856	93
" January,	1838, to July,	1838,	605,766	76
" July,	1838, to January,	1839,	984 445	70
		Total,	$1,958,670	68
Add balance to the debit of Commissioners,			4,714	44
Grand total of requisitions on Comptroller,			$1,963,385	12

The following is a condensed view of the several objects for which the money has been expended; the details of which may be seen by a reference to the accounts in the Comptroller's office, referred to above:

1st.	For land required for the aqueduct and reservoirs, and for rights of way and earth for embankments,	$54,842	08
2d.	For work, &c. by contractors	904,052	64
3d.	For salaries of Engineers, and incidental expenses of the corps	20,372	35
4th.	For advertising, printing and stationery	408	50
5th.	For salaries of Commissioners and Clerk, and their incidental expenses	4,188	65
6th.	For Chancery expenses, searches in the titles of land purchased, &c.	581	48
	Total as above,	$984,445	70

The large amount disbursed during the last six months, is an evidence that the work has progressed in a manner indicating a desire on the part of the contractors, to bring it to a close within the time specified for its completion. Such an event will be gratifying to the Commissioners, and they have no doubt to the Corporation also. That the project will meet the anticipations of the public, when complete, both as to permanence, durability, and means of answering the puposes of its erection, there cannot be a doubt in the minds of any who have examined the structure, even thus far, in its progress.

We stated in our last semi-annual report, that a circular was issued by the Commissioners, on the 15th of May last, requesting proposals for furnishing the necessary amount of iron pipes that may be wanted for the syphons in crossing Harlem River and Manhattan Valley, and for uniting the receiving and distributing reservoirs. The proposals to be received until the 1st day of October, 1838. These circulars were extensively distributed both in this country and in England; and on the day appointed there were ten proposals received for furnishing the necessary castings, and from the following foundries:

From American Establishments.

1st. The West Point Foundry Association, by William Kemble.
2d. The West Troy Foundry, by Chollar & Jones,
3d. The Albany Dry Dock Foundry, by Mellen & Battel.
4th. The Albany Foundry, by William Many.
5th. The Baltimore Foundry, by John Baker.
6th. The Novelty Works, New-York, by Ward, Stillman & Co.
7th. The Foundry of Allaire, New-York, by James P. Allaire.

From Foreign Establishments.

8th. By Boorman, Johnson & Co. as agents for a British house.
9th. By Hicks & Co. as agents for an extensive Foundry in England.
10th. By J. Comrill, as agent of Reid, Irving & Co. of London.

The bid of the West Point Foundry Association was a shade lower than any of those offered, and a contract was accordingly entered into with that Corporation, protected by adequate personal security for its due performance, based upon the following provisions:

1st. That the West Point Foundry will furnish the whole quantity of pipes required, whether more or less than that designated in the circular, and at the dates therein specified.

2d. That the weight of the pipes shall not exceed one hundred pounds over and above the estimated weight; such weight to be fixed and determined by the Chief Engineer.

3d. That for the curved pipes of twelve inches diameter that may be required, the Commissioners will pay for the making of the patterns.

4th. That ten per cent. is to be held by the Commissioners as a retainer, until the close of each year, when five per cent. of the ten will be paid contractors, retaining only five per cent. until the whole contract shall be completed.

5th. That security, amounting to $30,000, shall be given, to be approved by the Commissioners.

The Commissioners issued a card on the 7th of September, soliciting proposals to be received until the 23d of October following, for constructing and furnishing the materials for that portion of the aqueduct on the Island of New-York, comprising sections 86 to 97 inclusive, part of the fourth division, and embracing the bridge to support the iron pipes across Harlem river, the work to support the pipes across Manhattan Valley, the bridge over Clendining Valley, the receiving reservoir at 86th street, and the distributing reservoir at Murray Hill.

There was a favorable competition for the work, and it has been taken by the persons named below, at what is considered fair prices.

Part of the Fourth Division.

Section	86.	Ellsworth, Mix & Co, for syphon bridge, estimated amount	$360,000
"	87.	The same contractors	39,655
"	88.	Rutter and Carmichael	60,096
"	89.	The same Contractors	68,893
"	90.	Sears & Bigham	58,170
"	91.	Robert Pettigrew, for crossing Manhattan Valley	142,195
"	92.	Francis Blair	80,205
"	93.	Clark & Christie	40,886
"	94.	Bishop & Campbell, for crossing Clendining Valley	297,980

Section 95.	Byron & Bierd	$35,017
"	96. Clark, Stone & Co. for receiving reservoir . .	565,748
"	97. Thomson Price and Son, for distributing reservoir	360,710

This completes the contracts for the whole line of work under the superintendence of the Commissioners. The distance from the source, at the Croton River, to the distributing reservoir at 42d street, Murray Hill, is about forty-one miles. The longest time allowed the contractors, in which to complete their work, is to 1841; and, counting on the progress made during the last season, provided we are not restrained in our operations, we have strong hopes that the whole work will be completed at the limited period, and accordingly the agency of the Commissioners cease.

On the 15th of October several of those owning land required for the aqueduct, petitioned the Chancellor to instruct the Appraisers to estimate the damage to their property, both probable as well as apparent. He accordingly passed an order or decree, to the following effect, viz.: "It is declared and adjudged to be the duty of the Appraisers, and they are hereby accordingly empowered, to ascertain and report the amount of compensation to be paid by the Water Commissioners to the owners of land required to be taken in fee, or for temporary use, as the case may be, for the purposes intended by the Act; and with that view the Appraisers are to examine the property so required to be taken, and to estimate the value thereof, and appraise the damage the owner will sustain, by, and in consequence of the taking of the required property in fee, or for temporary uses as aforesaid, so far as such damage can, with reasonable certainty, be ascertained and appraised." This order, or decree of the Chancellor, is entirely new, and differs, in words at least, from that under which the former Appraisers acted. It has proved embarrassing to the Appraisers, and perhaps will be very expensive to the public.

The Commissioners were in hopes of being enabled to lay before your Honorable Body, the amount to be paid for the land required for the aqueduct, in the 12th ward of the city; but the Appraisers had not completed their awards in time for this report. The enormous damages claimed by some of the owners, the pains taken to prove them, and the hearing of Counsel employed for the purpose, has been the means of much and unnecessary delay and procrastination, in bringing this business to a close. A good portion of the embarrassment results from a necessary interference with the supposed grade of some of the streets and avenues, by the course of the aqueduct: and to remedy which, as the Commissioners are informed, it is the intention of the Committee on "*Roads and Canals*," to recommend to the Common Council an application to the Legislature for authority to take, by Commissioners, a piece of ground for a public square, where the greatest difficulty occurs. In the mean time, the commissioners are experiencing serious embarrassment by the delay in not being put in possession of the required land. They suppose that, *here*, in the county where the principal benefit was to be derived, all these perplexing difficulties would cease. The appointment of the Appraisers was made on the 19th of July, as before stated; and, presuming upon the operations of those previously appointed to act on the land required in the County of Westchester, that the time necessary for making up a report in the present case would not greatly exceed that consumed in the former, the Commissioners allowed from the 19th of July to the 7th of September; on which day they issued their notice to contractors, allowing to the 23d of October for the delivery of proposals for contract; which gave rising three months for completing the awards, and for carrying the report through the necessary forms of the Court; instead of which, five months have elapsed, and the business is yet unsettled. The sections, in the mean time, have been placed under contract—the contractors anxious to proceed in fulfilling the stipulations of their several agreements, and we are compelled to refuse them permission, the land required still being out of the possession of the Corporation; and how long this state of the matter is to last, cannot be conjectured, under the embarrassing circumstances in which the Appraisers are placed.

The uncommon drought which prevailed in many parts of the United States, during the last summer, will be remembered for many years hereafter. That section of the County of Putnam and Westchester, through which the Croton River passes, has felt the effects of the dry season full equal, if not sxceeding, any other part of this State; and the river was, consequently, remarkably low. In order to test the flow of the stream, under these unfavorable circumstances, and to compare it with an unusual dry time in 1835, Horatio Allen, Esq., our principal Assistant Engineer, made a gauge of the running water, on the 16th of August last, at two different stations on the stream. At the first station there was found running 26,386,560 gallons, and at the second station 28,738,000 every twenty-four hours; averaging 27,584,780 gallons. This quantity, with the present population of the city, is nearly three times as much as will be required for its use. It may be within the memory of some of the members of the Common Council that, on the 5th of September, 1833, Major Douglass made a gauge of the river, and found running every twenty-four hours 51,522,486 gallons; and that Albert Stein, Esq., also gauged the river on the 25th of the same month, when there was running 50,077,044 gallons per diem. These gauges were not taken when the water was at its least or greatest flow, but at a medium, and may therefore be considered as a fair average of what may be depended on, as there are seasons when several hundred millions of gallons pass through the Croton to the Hudson River daily. It is estimated also, that the Croton Reservoir will contain about one hundred millions of gallons to each foot in depth from the surface. The dam may be drawn down five or six feet, say five hundred millions of gallons; and in addition to this, we have 158 millions of gallons in the receiving reservoir and 19 millions in the distributing reservoir; making a total of 177 millions of gallons, exclusive of the running water, and what may be drawn from the Croton Reservoir; providing a surplus, in cases of drought, sufficient for any emergency, either probable or possible.

The dry season, however, has been favorable to the progress of the work, and we have no reason to be dissatisfied with the quantity or execution of that which has been performed. The mason work was discontinued on the first of November, and the work secured from the effects of frost during the winter. On the 15th all the Inspectors were discharged except four, who were retained for the purpose of overseeing the laying of dry foundation wall; the progress of which may be continued, without injury, through the winter. The rodmen and axemen have also been discharged; which reduces the Engineer Corps to twenty persons, instead of thirty-six, the number employed during the summer.

In our last report, we presented a brief statement of the most prominent operations on the line of aqueduct, and we now adopt the same mode, for the purpose of conveying to the public, through the medium of your

Honorable Body, similar information; comprising the length of aqueduct complete, the extent of tunnel excavations, the number and capacity of culverts erected, and other information of a similar character.

The Commissioners had proceeded thus far with their report, waiting the required information from the Resident Engineers on the several divisions, for a statement of the progress of the work; but the Chief Engineer has saved them the labor of collating the various items, and has drawn up and arranged the necessary information, in a form that will perhaps be more acceptable to your Honorable Body than the restricted plan adopted by the Commissioners; and they therefore annex the report of the Chief Engineer, in his own words and figures, as follows:

"It has been thought expedient to make a small increase in the breadth of the foundation walls, which is the only variation from the plan that our experience has thus far indicated as desirable; and it is believed the plan of work, in the main, will give the stability and permanence which its importance demands; and has, at the same time, all the economy that is attainable consistent with these essential requisites. The principal items of work done, have been ascertained by the Resident Engineer to amount as hereafter set forth, under their respective heads.

Aqueduct.

The masonry, and mostly the back-filling over the same, has been completed for the aggregate length of 59,169 feet, or $11\frac{1}{5}$ miles.

Side walls of aqueduct are prepared to receive the brick-facing and arches for the aggregate length of 1,443 feet.

Culverts.

A tabular statement, giving the detail of culverts, is herewith annexed, from which the following summary has been made:

Completed.

	39	of	$1\frac{1}{2}$	feet diameter, aggregate length	= 2,012	feet.
	8	"	2	" "	= 488	"
	5	"	3	" "	= 353	"
	13	"	4	" "	= 1,139	"
	10	"	6	" "	= 1,040	"
	2	"	8	" "	= 223	"
	1	"	10	" "	= 80	"
	1	"	14	" farm road viaduct	= 141	"
Total	79			Total length	= 5,476	"

Culverts in progress.

	4	of	$1\frac{1}{2}$	feet diameter, aggregate length	= 192	feet.
	1	"	3	" "	= 92	"
	1	"	4	" "	= 52	"
	2	"	25	" "	= 262	"
	2	"	20	" public roads	= 54	"
Total	10			the total length	= 652	"

Ventilators.

3 Ventilators completed.
5 " in progress.

Waste Weirs.

1 Waste Weir completed.

Tunnels.

Completed through rock	1	of 166	feet in length.
" "	1	" 333	"
" "	1	" 168	"
	3	667	= total length.

Tunnels in *progress*.

	Perforated.	Length of Masonry laid.
1 in earth	98 feet	72 feet
1 in earth	12 feet	
1 in earth and rock	130 feet	
1 in rock	37 feet	
1 in rock	440 feet	
1 in rock	270 feet	
1 in rock	200 feet	
	1187	72

Total length of tunnel perforated = 1,854 feet.
" " " masonry laid = 739 "

Foundation and Protection Walls.

A tabular statement of the height of the several pieces of foundation wall is herewith annexed, which exhibits the height to which the work has been carried, and the total height required for wall and back filling.

Summary of principal items of work done.

Excavation—Earth 891,200 yards
" Rock 127,157

Total earth and rock 1,018,357 cubic yards.

Embankment 105,637 cubic yards.
Back filling 333.137 "

Total embankment and back filling 438,774 cubic yards.

Foundation wall 58,439 cubic yards.
Protection wall 36,590 "

Total dry wall 95,029 cubic yards.

Hydraulic masonry in aqueduct 102,294 cubic yards
Hydraulic masonry in culverts, &c. 13,116 "
Total hydraulic masonry 115,410 cubic yards.

There were at work on the line of aqueduct on the

25th July	3,451 men.
25th August	3,848 "
25th September	3,850 "
25th October	3,070 "
25th November	2,178 "
24th December	2,399 "

The extension of the contracts on the 4th division has been, in part, the cause of the increase in the number of men employed since the 25th of November.

An impression prevails very generally among the contractors, that the demand for men on public works next season, will exceed the supply, and consequently raise the price. This induces them to carry forward, as much as practicable, during the winter, that part of the work which admits of being done at this season, and this accounts for the continuance after the suspension of masonry, of so large a force on the line.

The work now doing consists of a small amount of masonry in the tunnels. The excavation, (mostly in deep cuts and rock,) foundation and protection walls; quarrying, dressing and delivering stone. Should the remaining part of the winter be as favorable as it has thus far been, it may be expected that the force on the line will not fall much, if any, below 2,000 men.

There have been four sections completed, and six others have their masonry completed, with the exception of a small amount that will require to be overhauled, to remedy some imperfections in the workmanship. The computations for these sections have been made out, and together with other developements, go to confirm the opinion, that the estimate of 27th December last, will be found sufficient for the accomplishment of the work. Respectfully submitted.

John B. Jervis,
Chief Engineer N. Y. Water Works."

The result of the foregoing communication is as follows:

1st. Aqueduct. The whole length of aqueduct arched and complete, is 59,169 feet, or $11\frac{1}{5}$ miles. That completed on the 1st of July last was about *two* miles. The increase, in this part of the work, since our last report, is $9\frac{1}{5}$ of miles of aqueduct complete.

2d. Side Wall. The length of side wall, ready to receive the arch, exclusive of that already arched, is 1,443 feet.

3d. Culverts. There are 79 culverts completed and in use. Their aggregate length is 5,476 feet. The number completed at our last report was *twenty-two*, and their length 1825. *Increase*, 57 culverts. The number now partly finished is ten, and their length in feet 652. The number partly finished at our last report was *seven;* length 578. *Increase* 3 culverts in progress.

Tunnels. The number of tunnels excavated throughout is three. Their aggregate length 667 feet. There are, besides, seven tunnels partly finished, measuring 1,187 feet of excavation; making an aggregate of tunnelling of 1,854 feet. The number complete at our last report was *three*, and the length 670 feet; together with *five* partly finished, measuring 610 feet in length; making a total of 1,280 feet. Increase in this description of the work 574 feet of tunnelling.

Foundation and Protection Wall. The foundation wall laid is 58,439 cubic yards, and of protection wall 36,590; making a total of 95,029 cubic yards. The quantity of foundation wall, laid at our last report, was 28,000 cubic yards, and of protection wall 13,160; making a total of 41,160 cubic yards. Increase since our report in July last, 53,869 cubic yards.

This is a very limited sketch of the amount of work performed as a whole, and is only intended to convey some idea of the structure and its progress. The immense labor in penetrating high hills, and in crossing deep valleys, can only be judged of by a personal view of the vast amount of labor performed by the physical strength of man.

All which is respectfully submitted.

STEPHEN ALLEN,
CHARLES DUSENBERRY,
THOMAS T. WOODRUFF,
SAUL ALLEY,
WILLIAM W. FOX,
} *Water Commissioners.*

Office of the Water Commissioners, December 31, 1838.

Report upon the Finances and Internal Improvements of the State of New-York, 1838

IN our previous numbers, we have devoted much space to the subject of Internal Improvements in our own State.

Reference has been, and is continually made, to the following valuable report, and as we conceive a more lucid explanation of our State resources cannot elsewhere be found, we give it for the information of our readers. The precise nature and condition of our financial affairs relating to this most important subject, are herein fully set forth, and well merit our attentive perusal. This matter is, moreover, of general importance, and other States may receive profit from it as well as our own.

STATE OF NEW-YORK.

On the 12th of March, 1838, MR. SAMUEL B. RUGGLES, Chairman of the Committee of Ways and Means, of the Assembly of the State of New-York, submitted to the House the following Report on the United States Deposit Fund, and on the recommendation of the Comptroller to levy a direct tax.

MR. RUGGLES, from the standing committee of ways and means, to whom were referred so much of the annual message of his Excellency the Governor, as relates to the surplus revenues of the United States deposited with this State, and also the annual report of the Comptroller, upon the finances, begs leave, in respect to that portion of the message, and also in respect to that portion of the Comptroller's report which recommends the imposition of a direct tax, to submit the following REPORT:

That under the Act of Congress, passed June 23, 1836, which directed the surplus moneys in the treasury of the United States, beyond the amount of five millions, to be deposited with the several States, the sum of $3,974,520 71 has been paid over to this State, being three fourths of the moneys which it was entitled to receive under that law. By virtue of the subsequent act of Congress, passed October 2, 1837, which directed the transfer of the remaining fourth to be postponed until the first day of January, 1839, the residue of those moneys, amounting to $1,338,000, has hitherto been withheld; and whether it will be paid at the time specified in that act, may for the present be regarded as doubtful. Serious differences of opinion have prevailed in respect to the expediency of thus depositing this surplus revenue with the States; and if the sentiments of those who believe it more politic for the federal government to retain it, shall happen to prevail, the fourth instalment may possibly be permanently withheld from this State.

It is not, however, reasonably to be anticipated, that the money already received will be withdrawn. The act of June 23, 1836, which directed the deposite to be made, declared that when the money, or any part of it, "should be wanted by the Secretary of the Treasury of the United States" to meet appropriations by law, it should be called for upon certain notice mentioned in the act; but the subsequent law of October 2, 1837, provided that the amount thus deposited should remain with the States, "until otherwise directed by Congress."

It cannot be deemed probable, that a majority of the States represented in the National Congress, will direct the withdrawal of these moneys. Whatever may have been the literal provisions of the law, directing these moneys to be "deposited" with the States, the intention of those who passed it evidently was to secure a permanent distribution, and not a temporary loan of the surplus revenues. In fact the doctrine on that subject, as it was first advanced by President Jackson himself, plainly contemplated an irrevocable appropriation. In his message to Congress, in 1829, he declared that "the most safe, just, and federal disposition which could be made of the surplus revenue, would be its apportionment among the several States, according to their ratio of representation:"—and in the message of the subsequent year, he removed all doubts as to his intention in that respect, by stating, that in his prior message, he had felt it to be his duty "to recommend the adoption of some plan for the *distribution* of the surplus funds among the States, in proportion to the number of their representatives, to be applied by them for objects of internal improvement."

The sentiments thus promulgated at Washington, were distinctly responded to and adopted by the Governor of this State, in his annual message to the Legislature, in the year 1830; in which, after speaking of the funds to be derived from the surplus revenue, as "applicable to the extension of our public works," he says that "there can be no valid objection to the distribution of the surplus revenue among the States, to be disposed of at their discretion." The same chief magistrate, in the succeeding year, 1831, after stating that one of his most distinguished predecessors (Governor Clinton,) had alluded to the same subject in his message in 1827, renewed the suggestion contained in his former communication; and pressed it earnestly upon the consideration of the Legislature. A committee of the Senate in the same year, reported that in their judgment, the proposed distribution was "a matter of the first importance;" and for the reason, among others, that it would enable the State, in prosecuting her works of internal improvement, "to satisfy the just claims of all her citizens." The committee fully concur in the soundness of the opinions thus expressed, in respect to the distribution of these moneys; and in their judgment, the receipt by this State, of the large sum of $3,974,520 71 thus allotted to it, whatever may be the opinions of those who doubt the expediency of the measure, ought to be a subject of unmixed congratulation.

Without pretending to question the obligation of this State to repay the money thus deposited, whenever it shall be legally demanded by an act of

Congress, it may, nevertheless, be assumed that no reasonable probability exists that it will ever be thus demanded. Of the several States which have received their respective portions, amounting in the aggregate to nearly forty millions of dollars, the greater number have already appropriated it to objects of a permanent nature, from which it cannot be withdrawn without serious injury and inconvenience. Many of the States have expended it in works of internal improvement, or in paying debts previously incurred for that purpose. In some instances it has been loaned to their citizens; while one example, at least, is presented, in which it has been actually distributed, numerically, among all the inhabitants of the State. In nearly all these instances, the repayment of the money, if called for by Congress, will become inconvenient and oppressive to the people of those States, and can only be made by incurring a debt or imposing burthensome taxes Under these circumstances, therefore, it may be safely predicted, that a majority of the representatives of the States and of the people in Congress, will hesitate long before they consent to withdraw from the States the moneys thus distributed; but on the contrary, that they will prefer (in case it should be found necessary) to replenish the treasury by temporary loans in anticipation of the revenue.

The committee, therefore, wholly dissent from the opinion expressed by the joint committee of the last Legislature, upon the subject of this deposite fund, that the pecuniary means which it has furnished to the State, should be regarded as merely "temporary," and that the period of repayment is "not far remote." On the contrary, they are well satisfied, that the sum of $3,974,520 71 thus acquired, will never be withdrawn; and they recommend, that in all measures of legislation, it should be treated as a portion of the permanent property of the State.

The amount so received, has been loaned under the law of the last session, upon mortgage, to the citizens of this State, and yields a nett annual income of about $250,000; and the question then arises—How shall that income be appropriated?

It may be used in either of three modes. First, in defraying the ordinary expenses of supporting the government; or, secondly, in paying the interest on debts created, or to be created, for works of internal improvement; or, thirdly, in providing for public instruction, and the diffusion of knowledge.

It is not the province, or the intention of the committee, to estimate the comparative merits of these important objects. The duty of providing adequately for the education of the people, and that of furnishing the means of cheap and easy intercourse between the different sections of the State, are equally pressing and imperative. If the Legislature should be satisfied, however, that the State possesses other resources for prosecuting, with vigor and effect, all its necessary works of internal improvement, no question need arise as to the propriety of appropriating the whole of this sum, (large, as it may be deemed,) to the gratifying office of diffusing more widely the blessings of education. But before such an appropriation shall be permanently made, it ought to be distinctly understood, that the other means of the State are, and will continue to be, entirely sufficient to satisfy the claims of that large portion of its population, whose welfare is depending upon the proper extension of its works of internal improvement. The original intention of the State, in procuring the distribution of the surplus revenues, evidently was to apply its portion "to the extension of our public works;" and until it shall be satisfactorily ascertained, that this great duty may be otherwise adequately discharged, it may well be doubted whether these funds ought to be wholly appropriated to any other object, however meritorious.

It is believed that an attentive examination of the pecuniary resources of the State will satisfactorily demonstrate its ability to prosecute and extend its system of public works on the most liberal scale, without resorting for aid to the fund in question: and the investigation of this point has occupied the anxious attention of the committee.

This inquiry necessarily embraces not only the present, but also the future fiscal condition of the State, as its aspect may be varied from time to time by the progress of the public works. The want of a definite and well digested system, by which to prosecute our measures of internal improvement in regular and proper succession, increases the difficulty of accurately estimating the future condition of the treasuary. The movements of the State, for the last few years at least, have been irregular and disconnected, yielding only to occasional impulses, and proceeding without much plan or method. A struggle for some time has been going on between the friends of a vigorous system of internal improvements, and those who deny its expediency or safety: and our legislation has fluctuated according to the prevalence of one or the other of these contending opinions. It is not necessary or desirable to enter at this time into the particulars of this controversy, and it is alluded to only to explain the difficulty which it occasions in predicting, with that precision which could be desired, the future movements of our fiscal system.

In order to comprehend truly the present situation of our finances, and correctly to estimate our future progress, it will be useful to revert to the condition of the treasury when the canal policy was commenced.

Our financial history, during the last twenty years, is indeed replete with instruction. Within that eventful period we behold the origin, progress, and final success of those great measures of internal improvement, which have overcome not only the barriers of nature, but the more formidable obstacles of prejudice, incredulity, and error, and which are destined, in the latter respect at least, to achieve victories yet more signal.

No fact in all that history is more striking than the remarkable failure of our distinguished men adequately to estimate the pecuniary value of the canals. The most sanguine anticipations of the most enthusiastic supporters of our policy of internal improvement, fell far short of the actual results which that policy has produced; while the doubts and forebodings of its opponents, are remembered only as curious portions of our intellectual history. The State itself seemed wholly unconscious of its latent strength. In the present plenitude of our success, the fact is hardly credible, and yet the documents of the day testify, that before commencing the canals, the Legislature by a deliberate act, directed commissioners to solicit pecuniary donations in aid of the enterprise, not only from Connecticut and Vermont, but even from the States, then in their infancy, beyond the Alleghanies: and so far was this timid and discreditable policy pursued, that the very preamble to the law of 1817, which finally directed the canals to be commenced, took care to express the humble hope, that the States interested in the work, "would contribute their full proportion of the expense."

The torrent of ridicule and obloquy which the canals encountered, during the first few years of their progress, as well as the more solemn doubts of some of our ablest statesmen, will long be remembered. Without adverting to names less distinguished, it needs but to state the memorable fact that Mr. Jefferson pronounced the undertaking utterly visionary and chimerical, and that it was "at least a century in advance of the age." Nor did the more decided friends of the canals appreciate in any just degree, their pecuniary value. In the year 1821, four years after they had been commenced, the Comptroller of the State, in obedience to a resolution of the Legislature, prepared an estimate of their respective revenues, in which he stated, that for the ten years next succeeding their completion, the tolls would amount annually to one hundred and fifty thousand dollars! The amount which was actually received during that period of ten years, exceeded ten millions of dollars. Among the names truly illustrious in the early history of our public works, few are more distinguished than that of Gouverneur Morris. His comprehensive intellect and ardent temperament, enabled him to look far beyond most of his contemporaries into the rapidly expanding future; and yet even he fell short of the realities which the Erie canal has brought within our view. In the singularly eloquent and animated memorial by which his fame is forever connected with that great work, and in which he endeavoured to enforce upon the Legislature the importance in all future time of connecting the Hudson with the western waters, after depicting the wide spread region around our inland seas, and its capacity to supply the means of a great and profitable commerce, he asked whether he could be deemed extravagant to predict that the canal within twenty years, "would annually bring down 250,000 tons?" The actual amount which reached the tide in 1836, was 697,347 tons, or nearly three fold the quantity estimated by Mr. Morris; and the total tonnage of that year, ascending and descending, exceeded thirteen hundred thousand tons.

The tolls of the canals in 1824, one year before their completion, were $340,000. In the next year, they reached $566,000, and rose in 1826 to $762,000. With the rapid progress thus strikingly exhibited, few of our citizens were inclined to believe that the canals had impoverished the treasury, or that they would prove in any way injurious to the pecuniary interests of the State. The subject was, however, presented to the public in the year 1827 in a new and unexpected light. In that year, the canal committee of the Senate, of which Mr. Silas Wright, jr., was chairman, introduced into that body a report, made avowedly for the purpose of drawing the attention of the public to the effect which the construction of the canals had produced upon the finances of the State, and of generally diffusing among our citizens a knowledge of the real situation of the public funds. It announced that "*an alarming change* had taken place in the public funds"—that the school fund was annually "charging the State with a debt of $15,000"—that the literature fund was "no longer able to answer the calls which the interests of education required should be made upon it"—that the actual income of the canals was "highly exaggerated in the public opinion"—that their gross receipts for the year 1826, without any deduction for expenses, were but $752,000, and paid an interest of only $6\frac{9}{16}$ per cent. on their total cost—that the debt of the State for the canals then made or making "would more probably be enlarged than lessened at the end of the year"—that "so long as it thus continued to increase, its final payment *was not even approaching*"—that "unless assisted by auxiliary funds, the canals would not pay their own interest and expenses, and redeem their debt within any reasonable time, *if they would ever do it*"—that "the debt, with the whole aid of those funds, could not be paid off in *a great number of years* yet to come"—and finally, that any appropriations by the State for the purpose of constructing other works, unless they should be more productive than the Erie and

Champlain canals, would "hasten the period when direct taxation must be resorted to."

The feeling of despondency which this celebrated document produced among the friends of internal improvement, not only in this State, but throughout the Union, is well recollected: and yet it is somewhat surprising, that an intelligent and sagacious people, should have permitted themselves for a moment to be misled by the financial view which the report professed to take. Its fallacy was obvious—consisting in the total omission to take into the account, the prospective, but certain and inevitable increase in the growth of the country, and the trade of the canals, and in assuming the receipts of 1826 as an immutable basis. It is needless to add, that the friends of internal improvement made a resolute, though ineffectual, struggle against the doctrines and tendencies of this report. The late Governor Clinton, on the assembling of the Legislature in the year 1828 laboured earnestly in his annual message to disabuse the public mind. He declared that "the condition of the finances had been greatly discoloured and misunderstood by inaccurate views and partial examinations"—that "fallacious statements had been mingled with the subject"—that "the constant and progressive increase of the canal revenue, and the correspondent diminution of the debt, would in a few years produce its total extinguishment"—that "the elaborate and systematic attempts to depreciate the utility and arrest the progress of internal improvements, were equally astonishing and mortifying"—that "the means of the State were ample, her resources great, and her credit equal to any emergency," and he renewed, "in the most earnest manner, his recommendations in favor of the leading objects which he had presented in his former communicatons."

The death of this great man in February of that year, withdrew from the cause of internal improvement its ablest champion, and the loss has been severely felt by the people of this State.

The predictions of his last message, as to the progressive increase of the tolls, and the extinguishment of the debt, have been fully realized. The annual tolls, which in 1826 were $672,167, (or according to the statement of Mr. Wright about $752,000,) amounted in 1833, to $1,542,695, although the rates had previously been reduced nearly 20 per cent.; and in the year 1835, to $1,485,775, although again reduced about 15 per cent.

On the 1st day of July, 1836, the tolls had accumulated in the hands of the commissioners to an amount sufficient (with the aid of the auxiliary funds previously realized from the salt and auction duties) to extinguish the whole of the outstanding debt. Previously to that time, upwards of four millions of dollars had been paid in cash directly to the public creditors; and the residue, amounting to between three and four millions, was then invested in temporary loans by the Commissioners, as trustees for the holders of the balance of the debt.

This final consummation may justly be regarded as the crowning event in the canal policy of the State, and fixes an important epoch in its fiscal history. It affords, moreover, an opportunity peculiarly fitting, not only to review the progress of our treasury since the commencement of our canals, but also to examine how far the view of the finances taken by the committee of the Senate, in the report of 1827, has been borne out by the facts.

In the year 1817, when the canals were commenced, the funds of this State consisted of,

1. Productive property in bank stocks, mortgages and other claims, amounting to		$4,779,302 70
The State then owed a debt of		1,503,685 00
Leaving a balance of		$3,275,617 70
Of these claims a portion was subsequently discovered to be worthless to the amount of		302,000 00
Leaving, ...		$2,973,617 70
The annual income of this balance was about	$180,000 00	
The State derived a revenue from auction duties of	191,123 38	
and from salt duties imposed in that year and paying in 1818, ...	48,784 27	
Making the total revenue . .	$419,907 65	

2. Unproductive property in lands and public buildings; the former containing about a million of acres. From the sales of these lands a fund had been previously established for public instruction, called the "Common School Fund," the principal of which, on the 1st January, 1817, amounted to $982,242 26

The constitution of 1821, transferred to this fund all the lands then remaining unsold, with some unimportant exceptions.

Another special fund had also been established principally for the support of academies, called the "Literature Fund," the principal of which, on the 1st of January, 1817, amounted to $26,696 10

By an act passed in 1826, the amount of $233,616 19 was taken from the $2,973,617 70 above mentioned, and transferred to the Common School and Literature Funds, leaving $2,740,001 51

To contradistinguish this amount of $2,740,001 51 from the two special funds above mentioned, it was designated in the public accounts as the "General Fund."

When the canals were commenced in 1817, another special fund was created for the security of the public creditors of whom money should be borrowed for the construction of the canals, designated as the "Canal Fund," and consisting of the salt and auction duties above mentioned, the tolls to be received from the canals when constructed, and some other items of minor amount.

The establishment of this latter fund consequently diverted from the ordinary uses of the treasury, the salt and auction duties, amounting to $239,907, and reduced the nett income of the State from $419,907 65, as above stated, to about $180,000 annually.

A tax had previously been laid on the whole property of the State, to defray the expenses of the war, which had recently terminated. That tax was continued at a reduced rate, until the year 1826, and was applied, together with the annual income of $180,000 above mentioned, to the payment of the ordinary expenses of the government.

In 1826, the rapid increase in the canal tolls began to exhibit itself as is above stated, and the State tax was then discontinued, upon the ground that the principal of the remaining balance of $2,740,001 51, would sustain the government until the debt for which the salt and auction duties and canal tolls were pledged should be extinguished, and that those revenues would then be liberated and placed at the service of the State.

Between that time and the year 1836, the whole of that balance was accordingly expended, principally in defraying the ordinary expenses of the government, amounting to $2,740,001 51
and the State also borrowed the bank safety fund, amounting to 416,532 43

Making in all, ... $3,156,533 94

Of this amount, a portion exceeding $500,000 was expended in erecting the State Hall and the State Prisons.

The aggregate amount of the salt and auction duties which were received, between the years 1817 and 1836, by the Commissioners of the Canal Fund, and paid over to public creditors, and which, if they had not been so applied, would have been used during that time for the ordinary purposes of the government, exceeds $5,000,000; so that although the above sum of $3,156,533 94 was thus expended, the salt and auction duties remain to the amount of the $5,000,000 virtually invested in the canals, and stand as a substitute for the $3,156,533 94.

In the year 1832, in order to extinguish a claim of John Jacob Astor, to lands in Putnam county, sold by the State, and the title to which had proved defective, a debt was created, called the Astor stock, to the amount of $561,000.

Since the year 1825, the State has also created debts in constructing lateral canals, which remain outstanding, viz:

For the Oswego canal,	$421,304
Cayuga and Seneca,	237,000
Chemung,	316,000
Crooked Lake,	120,000
Chenango,	2,270,000
	$3,364,304
And it has commenced the construction of the Black River canal, and the Genessee valley canal, and created debts on those accounts, for	190 920
Making the total existing debt for lateral canals,	$3,555,224

Between the years 1817 and 1837, the Common School Fund was increased from $982,242 26 to $1,916,647 68, and the Literature Fund from $26,696 10 to $268,092 87.

On the first of January, 1837, the productive property of the State, consisted of the canals:—which produced a nett revenue in the year 1836, (after deducting all expenses of collection, and of maintenance and repairs,) of $1,107,871 30; equivalent to an annual income at 5 per cent. on a principal of $22,157,742

The debts of the State now are:

To the Bank Fund,	$416,532	
The Astor debt,	561,000	
For the lateral canals,	3,555,224	
		$4,532,756

Which deducted from the productive property as above, leaves a balance of	$17,624,986

The income of the State may then be estimated as follows:

Nett revenue from the canals as above,	$1,107,871 30
The revenue of 1836 is assumed in this estimate, for the reason that the tolls of 1837 were reduced by accidental and temporary causes.	
The auction duties, which produced in 1837,	214,458 62
The salt duties do	111,516 89
Total,	$1,413,846 81
Brought forward, ...	$1,413,846 81
From which deduct interest on debt of $4,532,756 65,	226,662 83
There remains, ...	$1,187,183 98
The ordinary expenses of the government are estimated at	400,000 00
Leaving a clear annual surplus revenue of . .	$787,183 98

It thus appears, that in the twenty years from 1817 to 1837, the productive property of the State was increased from $2,973,617 to $22,157,742, (or after deducting the debt, $17,624,986); the annual revenue, from $419,907 to $1,413,846; that during the same period, $500,000 was expended upon the public buildings; that the school and literature funds were doubled; the State tax discontinued, and the people relieved from burden or expense in supporting the government.

It would naturally be supposed, that the signal success which has attended the prosecution of our canal policy, would have removed all opposition to the extension of a system which has produced such prosperous and profitable results; and yet there are still to be found within this State, individuals of respectability and influence who zealously maintain that the treasury has been impoverished and exhausted by our public works: that the extension of the system will impose grievous aud everlasting burthens upon the people:—and that "internal improvement," (in the often repeated phrase of a distinguished advocate of these opinions,) "is but another name for eternal taxation." Upon what ground this strange doctrine rests, it is not easy to discover. The State, within the last twenty years has quadrupled its productive property, relieved its citizens from taxation, and now enjoys a clear annual revenue of nearly eight hundred thousand dollars: and how, under these circumstances, its treasury can be regarded as impoverished or exhausted, is wholly beyond the comprehension of the committee. The supporters of this doctrine, however, allege that the "General Fund" is squandered, and gone;—that the State has no other fund to which it can legally resort;—and therefore, that the treasury is exhausted, and taxation has become necessary. But neither of these propositions is founded in fact. The General Fund is neither squandered nor gone, but now exists, in full vigour, invested in the canals, and in that shape yields an ample revenue to the treasury. and it is no more lost than the seed is lost, which, when sown, produces an abundant harvest. The treasury, in fact, is overflowing with the tolls derived from the canals: and to those tolls the State may now legally and properly resort, for the purpose, not only of meeting all its present obligations, but of extending the benefits of internal improvement to those hitherto neglected portions of its population, at whose common risk, and upon whose common credit, the canals were constructed.

But it has been contended, that these revenues are placed "wholly beyond the reach" of the representatives of the people; and upon the ground that the tenth clause of the seventh section of the Constitution of 1821, has declared that the tolls shall not be "reduced or diverted" at any time before the "full and complete payment" of the moneys borrowed for the construction of the Erie and Champlain canals; and it is averred, that in point of fact, those moneys have not been fully and completely paid, according to the literal requirements of that clause.

This objection, it will be perceived, if well founded, will apply equally to the reduction, as to the diversion of the tolls; and as it involves in both respects important consequences, it deserves attention.

The Convention which framed the amended constitution, assembled in 1821, and only a few months after the Comptroller had estimated that the tolls of the canals for the ten years next after their completion, would be only one hundred and fifty thousand dollars annually. From peculiar causes, not necessary now to state, a large majority of that body participated in the doubts and forebodings as to the eventual success of the canals, which then prevailed with a considerable party throughout the State; and there is good reason to believe that many of its leading members honestly feared, that the debt to be incurred in constructing those works would never be paid; and that if the tolls should be reduced or diverted, a perpetual tax to pay the interest would be imposed upon the people. It was mainly under the influence of this apprehension, and far less, if at all, for the purpose of affording a specific pledge to the public creditor, that the clause in question was inserted in the constitution.

[To be continued.]

Hydrographical Survey of the Lakes.

The late disasters on the Lake Erie coast, will not, we hope, prove a fruitless warning of the deficiency of government over the interests of commerce on our inland seas. At least a dozen vessels have gone ashore there, since the first of November; in almost every case the calamity would have been avoided had there been charts in existence, and the ordinary precautions taken. Our whole lake coast from Ontario to Superior is unknown to hydrography, and demands national care more than any other part of the country. Its claims to protection, on the score of public importance, cannot be estimated too highly.

The aid given to the lake navigation by the government, has not been commensurate to its value; long before the United States rose to their present elevation, the English had delineated and explored the shores, and sounded the depth of waters contiguous to the Canadas. A nautical survey would save annually hundreds of thousands of property, and occasionally many lives. It should be made as soon as possible, as a mere question of national economy, to say nothing of the annual loss of shipping and merchandize constantly recurring. In the months of October and November, the loss of the underwriters and owners could not have been less than $300,000. This one item for two months, shows, if not the constant rate of loss, the constant liabilities to loss, and by consequence the perpetual tax upon all trade, in the shape of increased freight and insurances. This subject demands the immediate attention of Congress, and we hope it will be promptly attended to.

It is astonishing that on lakes so much frequented, and so liable to shipwrecks, there are neither charts or sailing directions—to the strange mariner, the *eye*, assisted by judgment and discretion, is the only guide which can direct the master in the responsibility attached to the command of a vessel, with the valuable lives confided to his care and protection.

Innumerable facts can be adduced showing the great want of the maritime survey; a few, we trust, will be found interesting. Not having the official returns at hand for 1837, we will take those of 1836, for the ports of Buffalo and Chicago, the harbors at the extremities of Erie and Michigan. From the port of Buffalo there were 3,712 clearances and the same number of entrances, the tonnage of which was 642,000 tons. The lowest estimate of the passengers going to the westward alone for that year was 108,000, by many it was computed at double that number. Chicago, it should be recollected, was in 1836, just coming into existence; in that year there were 450 arrivals, (viz. 49 steamers, 10 ships and barques, 26 brigs, 363 schooners, and 8 sloops, averaging 87,550 tons. We have mentioned those two ports, conceiving that our lake commerce is not generally known, or its extent and importance as yet duly appreciated abroad. Cleaveland and Detroit both equal, if they do not exceed, Buffalo, in the number of vessels and the amount of tonnage.

By a maritime survey, we shall acquire accurate charts, the exact location and character of all reefs, shoals, rocks and islands, and an acquaintance with the currents and tides (if any), also, a full description of landmarks, and all dangers to which the shipping are now exposed. The latitude and longitude of all places would be established by astronomical and chronometric observations, the magnetic variations and dips, &c., and a mass of scientific knowledge would be gained highly creditable to the nation. It is evident that a hydrographical survey of the lakes, would be of great advantage to the country, for in the destruction of property by disasters, government must suffer as well as individuals.—*Buffalo Patriot.—Communicated.*

Improvements of the Microscope.—A German, named Van Esten, has recently produced an improved microscope, of astonishing and unheard of powers. They are made of diamonds crystalized after being dissolved, and they have enabled him to make most astonishing discoveries in the properties of bodies, some of them having an intimate connexion with health and the treatment of diseases. This animalculæ which forms the poisonous matter of certain diseases, are made distinctly visible by means of this microscope, and some of these are in the same manner to make part of some articles of our ordinary food. It has often been conjectured by medical men, that the *virus* of many disorders to which the human body is liable, has an animalcular origin, and this supposition has been fully verified by the observations through Van Esten's microscope. Those substances are found to be composed almost entirely of animalculæ, and these seem to be as various in their powers, habits and modes of life, as the large animals which inhabit the earth. The animalculæ of the varioloid virus differ from these of the small-pox virus in size rather than form and habits. A new theory and mode of treatment for diseases is likely to be the result of those discoveries. Spellanzani long since observed that the pediculous was in the habit of scratching itself and thence inferred that it was bit by some other animal. This most minute animal is now made visible. If the means of destroying the animalculæ that constitute the virus of diseases shall be found out, a vast addition is made to the means of prevention and cure of disease. No doubt the means of destroying them *in ovo* will be discovered, not only in the human frame, but in the food that we eat, from which they originate.—*Miss. Intelligencer.*

Mammoth Steam Ship.—A friend has sent us the dimensions of an Iron Steam Ship, now building in England, to run from Falmouth to Calcutta, which voyage, it is expected, will be performed in thirty days.

"The Queen of the East," which is the name of the vessel, is to measure 2617 tons—her engines are to be of 600 horse power, with cylinder of 84 inches diameter, and 9 feet stroke. Her draft of water, at the greatest immersion, 15 feet. Dimensions—Extreme length, 310 feet; length of main deck, 282 feet; length between perpendiculars, 270 feet; length of principal cabin, 128 feet; width of beam, 45 feet; depth of hold, 30 feet. There will be 16 private rooms for passengers, and 400 berths.

There is now running an iron steamboat, between London and Antwerp, the Rainbow. She has performed the distance between Blackwall, her point of departure, and the quay at Antwerp, in 16 hours and 50 minutes. Her engines are of 180 horse power, 50 inches cylinder, and 4½ feet stroke. Her dimensions are as follows: tonnage, 580; length of deck, 198 feet; length between perpendiculars, 190 feet; breadth of beam, 25 feet; depth of hold, 12 feet 8 inches.

While Europe is thus making rapid strides in Ocean steam vessels—is America, the land of the invention of such vessels, to remain forever supine? Are Government and merchants alike indifferent or inattentive to the progress making elsewhere in this new arm of maritime superiority, an arm alike potent for commerce and for war? It would really seem that we, as a nation, had no interest in this new application of steam power, or no energy to appropriate it to our own use. We hope this apathy may not last too long.—*N. Y. American.*

Syracuse and Utica Railroad.—It will give the travelling public great pleasure to learn from the Journal of Commerce, that the work on this road has proceeded with activity during the past season, and is now in a state of such progress that the whole line will be ready for the iron by the middle of May. The directors have made such arrangements as they expect will insure the seasonable arrival of the iron, in which event the road will be open for travel early in July next. They have entered into an agreement with the Utica and Schenectada Railroad company for the use of their cars and engines, which, as soon as the road is completed will run from Schenectada to Syracuse. This arrangement is mutually beneficial to the two companies, and must be very satisfactory to the public, as it in effect brings the two roads into one, from Schenectada to Syracuse. —*Buffalo Patriot.*

Canajoharie and Catskill Railroad.—It is stated in the Catskill Messenger, that twenty-six miles of this road are finished, and will be opened in the spring. The length of the road, when completed, will be seventy miles, at an average cost of about $3,571 per mile.

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[We regret extremely that the controversy between Messrs. Detmold and Johnson has assumed so unpleasant a character, as it is not our desire that profession . . iscussion should degenerate into personal disagreement. As both of the gentlemen have disclaimed any intention of continuing the discussion, and as we desire to exclude topics of an unpleasant character, we close the matter, and hope that any disagreeable recollections of it may be sunk in oblivion.]

To the Editors of the American Railroad Journal.

GENTLEMEN,—I have no intention of making the pages of your Journal the arena for personal discussion, but after the communication from Mr. E. F. Johnson, to which you gave publicity in your last number, I feel it incumbent on myself to say one word more, and the last.

The sole object I had in view, when I entered into controversy with Messrs. Johnson and Talcott, was to support the truth of the principles of action of Locomotive Engines, and the formulæ for determining their power, as deduced by De Pambour. I regret that my well-meant effort to convince Mr. Johnson of his erroneous views on this subject should have failed; he persists in his groundless, though confident, assertions of the correctness of his position, and the fallacy of De Pambour, and supports them by a profuse outpouring of personal invective against myself.

His attempt to cast upon me, in almost every paragraph of his last communication, the stigma of having stated what was not true, does not controvert a single one of the demonstrations which I have employed to show his misconception of the subject, and the correctness of De Pambour. Yet, if he can succeed, by quibbling evasions and forced constructions, in convincing any one that I have misstated his positions, he is welcome to the full benefit of such a mode of conducting an argument. My aim throughout the discussion was a higher one than to prove him wrong; all I wished was to prove De Pambour right, and in this I believe I have succeeded.

Mr. Johnson's concluding appeal for a judgment in his favor, on the ground of my being of foreign birth, is a puerility I need hardly advert to. I now dismiss the subject altogether, and those of your readers who feel an interest in the discussion, I must refer to my former communications.

C. E. DETMOLD.

(Communicated by the Chevalier Von Gerstner.)

Cost of Working Railroads compared with Canals or Turnpike Roads.

In the greater part of Treatises on Railroads, the object of constructing them is exposed with all the necessary detail, but the expenses for working a finished Railroad Line have, as yet, not been determined by experience. We have, therefore, been much gratified in overlooking the 3d edition of the "Practical Treatise on Railroads, by Nicholas Wood," lately published in London; Mr. Wood gives a very good analysis of the different items of expenses in working a Railroad, and takes, as an example, the Liverpool and Manchester Railway. This line is 30 miles long, but equal to a level Railroad of 34½ miles in length. The following table contains the cost of working this line for a period of two and a half years, during which the Directors of the Railroad Company published detailed reports:

Cost of Working the Liverpool and Manchester Railroad, from January 1, 1832, *to July* 1, 1834.

Heads of charge.	Merchandize per ton per mile		Passengers.		Aggregate cost per ton per mile.	
	of goods	Gross load	Per passen per mile.	Per ton per mile gross	Useful l'd of goods	Gross load.
	cents	cents.	cents.	cents.	cents.	cents.
Locomotive power........	0,994	0,651	0,546	1,320	1,320	0.922
Maintenance of way.......	0,555	0,421	0,172	0,421	0.555	0,421
Coaching { upholding car'ges.	—	—	0,109	0,264	0,148	0,105
conducting coac'g.	—	—	0,211	0,510	0,286	0,201
duty on passengers	—	—	0,144	0,390	—	—
Car'ng goods { upholding waggons	0,410	0,287	—	—	0,170	0,121
conducting traffic.	1,953	1,374	—	—	0,837	0,586
General expenses.........	0,640	0,448	0.184	0,448	0,640	0,448
Total cost................	4,552	3,181	1,366	3,353	3,956	2,804

In making the reduction, we took £1 st. equal to 4 dollars 86 cents, and the American ton equal to 2000 English pounds. The gross load is that of goods and waggons, or passengers and cars.

The second table contains the *cost of conveying goods and passengers on turnpike roads.*

Description of carriage	Rate of traveling in miles per hour.	Resistance per ton on a level.	Cost of haulage per ton per mile.	Cost of conveyance.
		lbs.	cents.	
Stage waggon...	2½	65	5,4	14½ cents per ton per mile
Van or light car.	4	65	8,1	21,7 cents per ton per mile
Stage coach....	9	74	18,1	6,1 cents per passeng. "

The next table contains the *cost of conveying goods and passengers on canals, at different rates of speed.*

Description of boats.	Rate of speed in mile pr hour	Resistance per ton in lbs.	Cost of haulage per ton per mile.	Cost of boat hire. &c per ton per mile	General expenses per ton pr mile.	Aggregate charges.	
						Useful load pr ton pr mile	Gross load pr ton pr mile.
	miles	lbs.	cents	cents	cents	cents.	cents.
Slow boats......	$2\frac{1}{2}$	2,44	0,33	0,58	1,55	2,46	1,84
Fly boats........	4	6,31	0,90	1,19	4,27	6,36	4,11
Swift boats.....	10	50,71	0,557 pr passeng 6,328 prton pr m	——	17,54	2.19 per passenger 23,96 per ton	18,08 per ton.

It is evident, that in every Railroad project, besides the expenses of construction, those of working the line are of the highest importance. In giving, therefore, the above statements, we wish to induce the Engineers and Superintendents of our Railroads to make similar accounts at the end of every six months, or every year. These accounts will show in a very clear way the state of their concern, and give at the same time, very important data for new projects. We would be very much pleased to receive some of those accounts for publication in our Journal.

Report from J. J. Abert, in reference to a Canal to connect the Chesapeake and Ohio Canal with the City of Baltimore.

To his Excellency T. W. Veazey, Governor of the State of Maryland.

1. In consequence of the application of your Excellency, dated the 23d of April, 1838, to the honorable Secretary of War, I was directed to receive your instructions, and to carry them into effect. These referred to a survey of a route for a canal to connect the Chesapeake and Ohio canal with the city of Baltimore and will be found more particularly expressed in two of a series of resolutions passed by the Legislature of the State of Maryland, in March, 1838, in the following words:

"*Resolved*, That the Maryland Canal Company are entitled to no subscription on the part of this State, under the provisions of this act of the Assembly, unless they will agree to locate the canal from the Chesapeake and Ohio canal to the city of Baltimore by the most northern practicable route of the routes by the valleys of the Monococy and the Patapsco, or by the route diverging from the said Chesapeake and Ohio canal, at the mouth of the Seneca river, exclusively within the limits of this State, provided such route be found practicable with due supply of water."

"*Resolved*, That the Governor be, and he is hereby authorized to direct a survey to be made of the aforesaid routes, so that the practicability of constructing the said canal, by either of the said routes, may be ascertained at as early a period as possible; and report the same to the next General Assembly."

2. From the foregoing it will be perceived that the locality of the routes of the canal is prescribed; that, whichever route should be adopted, it must be exclusively within the limits of the State of Maryland; and that it should be "practicable with due supply of water,"

3. Several surveys having already been made in reference to the same

object, by engineers of much reputation, the possibilities of the case had become determined; so that my attention was, in the outset, limited, and relieved from the vague action which would have ensued of an unknown and unsurveyed region. These previous surveys confined those possibilities to three routes, usually known as—

1. *The Westminster route.*
2. *The Linganore route.*
3. *The Seneca route.*

There is a fourth also—the route through the District of Columbia to Georgetown; but as this is not "exclusively within the limits of the State of Maryland," it could not be made a subject of investigation, as it fell without the locality of operations which the Legislature had directed to be observed.

4. Of the routes named, the first had been so unequivocally rejected by the engineers who had preceded me, that I did not consider it deserving of a survey. The second had also been rejected, from its presumed deficiency in water; but as it was the only route connecting with the valley of the Monococy that had a bare possibility in its favor, and as the Legislature evidently had this valley in their contemplation when the resolutions quoted were passed, it appeared to me proper that it should be surveyed. It has accordingly been done.

5. The third is the route by the valley of the Seneca. Upon this, and this alone, have the engineers who preceded me differed in opinion. One, Mr. Trimble, declaring it to be adequately supplied with water; the other two, Messrs. Fisk and Hughes, being equally decided that the supply was insufficient. It was this difference of opinion which gave rise to the legislative action authorizing renewed surveys, and which induced your excellency to designate me as a sort of umpire in the case, with authority to make whatever additional investigations and surveys might be considered necessary.

6. I will not deny that I felt the embarrassment of my position. With all of these gentlemen I had been for years on terms of the most friendly intercourse. All possessed great reputation. Mr. Trimble, a distinguished graduate of the Military Academy, had been, for many years, superintending highly important railroad operations, possessing and deserving the confidence of his employers. Mr. Fisk had been equally long on those of canals, and was then, and had been for some time previous, the Chief Engineer of the Chesapeake and Ohio canal. Mr. Hughes, his associate, it was well known, was a gentleman of scientific knowledge, having passed through the courses of the Military Academy, of a vigorous and inquiring mind, and had been for many years employed by the United States as a civil engineer, in which capacity his reports, plans, and estimates, on various subjects connected with his profession, bear ample testimony of his abilities. To agree with both sides was impossible; to differ with some one, therefore, must be the inevitable result of an honest opinion.

7. On entering upon the duty, it was soon found proper to extend the surveys much more in detail than had been at first contemplated, as well to gather all facts of importance bearing upon the question at issue, as from the difficulty of accurately connecting ours with the labors of our predecessors, from the deficiency of permanent marks. But I hope by this course that all necessary matter has been collected, so that the question will be satisfactorily settled.

8. Your excellency was duly apprized, in the outset, that it would not

be in my power to give much personal attention to the surveys. These were, however, committed to able hands—Mr. Thomas J. Lee being at the head of one party, and Mr. J. P. Kirkwood of the other. The intercourse between these gentlemen and myself has been frequent, personally and by letter, so that no benefit that could be derived from my advice has been withheld.

9. Recurring to your excellency's letters and instructions, and to the resolutions of the Legislature, as well as to the general principle which governs in all canal cases, it will be seen that the point at issue is "the due supply of water;" and that this is, in fact, the sole point upon which I am required to report.

10. It will involve a reasoning upon the general question of the quantity of water consumed or expended by canals, upon which it is evident that one might indulge oneself in a long essay, but of matters familiar to the profession, already treated with great ability by engineers, and which in consequence, would leave me, at most, only the subordinate duty of repeating, in my own language, that which has been so much better said by others. To the professional man, therefore, I shall probably say nothing either new or interesting; and were I writing a report for his perusal only, I should probably limit myself to a few results and deductions; but writing, as I am for the judgment of the Legislature, which is not professional, I shall, of necessity, be forced into the discussion of details familiar to the profession, but not so to those for whom I write. And to be the better appreciated by these, I shall endeavour to express myself in that simple and plain language which, if it should not convince, will at least be understood.

11. The water required for a canal ought to be sufficient to supply an expenditure on the following accounts:

1st. To fill the canal throughout its whole extent.
2d. To compensate for losses from evaporation.
3d. To compensate for losses from filtration and absorption.
4th. To compensate for losses from leakage at the lock-gates.
5th. For the uses of the locks, according to the demands of the trade upon the canal.
6th. And for the waste arising from accidents and negligencies.

12. I mean to treat of these several causes of expense of water as briefly as a clear exposition of each will admit; and shall endeavour, in that way, to establish certain general rules, which may be afterwards easily applied, by any one who has a knowledge of the rudiments of arithmetic, to the particular project under examination.

13. But, as accessory structures to canals, feeders and reservoirs have to be made, some facts and reasonings in reference to losses of water in these, and of the means of filling reservoirs, will likewise have to be submitted.

14. 1st. *The quantity required to fill the canal.*—This, of necessity, depends upon its dimensions—length, breadth, and depth, and is obtained by resolving them into the cubic unit of water used in the calculation. The result is, however, always below the truth; because, while the process of filling is going on, losses from evaporation, absorption, and filtration are taking place. In strictness, therefore, these should be taken into account, particularly in cases in which the supply not being abundant, it would be dangerous, from the delusion probably consequent, to neglect any item of loss.

15. 2d. *Losses from evaporation.*—Much has been written on evaporation by authors, as a philosophical question; but it is evident, on an examination of their experiments, that the result obtained can form no good data for calculating losses of water from a similar cause on canals. What just comparison can be made between the circumstances of experiments in a laboratory, and those which exist on a canal? The one, exposed to all the changes of temperature in different parts of its surface; to commotion in its waters; to continual variations of humidity in the adjacent bed of air; and to greater or less currents of air passing over its surface. From all these, the experiments of most writers on the subject have been comparatively free, and, of consequence, their results are not safe data in reasoning upon evaporation on canals. One can easily be satisfied of this by referring to the article on "evaporation," in Hutton's Mathematical Dictionary, and by reducing to arithmetical results the proportions which some have endeavoured to establish between evaporation and rain, and the reverse. These proportions, if true in nature, can be so only in peculiar localities: as, for instance, Dr. Brownrigg, in his treatise upon making salt, states the evaporation in some parts of England at 73·8 inches during the months of May, June, July and August; and at 140 inches for the whole year! To what conclusions would these facts lead us, were we to apply them in the proportions given by authors between evaporation and rain?

16. Also, Mr. Dalton found that from the current occasioned by merely raising a window, the evaporation of his experiments in the room in which they were made was increased fifty per cent.! Surely such results are not to be applied to the condition of water in a canal.

17. That settled proportions exist between evaporation and rain, is not what I mean to dispute; but to determine these for an extensive district of country requires numerous and long continued observations in many places, under circumstances brought as nearly as possible to those which actually exist in a state of nature. Proportions can, without doubt, be correctly established between the evaporation of a laboratory, and rain as it naturally and actually occurs. But, then, what are those proportions? Merely such as exist in the evaporation of a laboratory on the one side, and rain in a state of nature on the other! Now, for a canal, we want the evaporation of a state of nature. That determined at salt-works, where artificial heat is not used, but merely the evaporation from large and exposed vats by the air, is most probably the nearest approximation to what actually occurs on a canal, differences of climate and temperature being considered.

18. I have been furnished by my enlightened friend, Dr. Harlan, of Philadelphia, with some results of evaporation in that city. But these are liable to the objections already stated; there is no parallelism of circumstances with those of a canal, and therefore there can be no just application of results.

19. I am convinced that losses on this account on canals much exceed the laboratory rules by which engineers have been governed, and that this has been often the unexpected cause of disappointment in the quantity of water anticipated.

20. Evaporations are much influenced by climate. That of England being generally colder and more moist than the climate of France, evaporation in the latter country should be greater than in England. In our country, particularly in the Middle States, we have more hot, dry, clear, and windy weather than in France; which would justify the inference of a

greater evaporation with us than in Europe. We have also more rain in the course of the year; that is, a greater quantity falls in fewer rainy days.

21. From the considerations heretofore given, I am disposed to consider the greater part of these rates of evaporation as inapplicable to the condition of water in a canal.

22. The celebrated engineer, Gauthey, in his interesting work upon canals, appears to rely in this question upon the experiments made by Mr. Cotte, at Montmorency, near Paris.

The method pursued in making the experiments is not given by Gauthey, but the result is, that the mean evaporation per year amounts to 41,575 inches; and that, for parts of a year, (vol. 1, 266,) the results were: for November, December, and January, 1·338 inches per month; for March, September, and October, 3·189 inches per month; and for the remaining six months, 5.315 inches per month. These were probably the results of some one year, as they do not agree with the average per year above stated. The same observer also found the rain to amount to 18·662 inches per year: from which he concludes that the evaporation is to rain about as 20 to 9, or as 5 to 2·25.

23. Dr. Halley fixes the annual evaporation at London at 48 inches; and, on an ordinary summer's day at two-tenths of an inch; and the proportion between that and rain as 5 to 3. The experiments of Dalton and Hoyle make it about 4·41 to 3

24. By particular observations of the Engineer, M. Pinn, on evaporation, during the suspended navigation *(chomage)* on the Languedoc canal, (And. p. 223) he determined that the partial depression, owing to evaporation, was two-fifths of the total depression of the water held in reserve; and that, during 320 days of navigation, the mean height of the prism of water raised by evaporation from the surface of the canal was 812 millemetres, or 31·969 inches.

I understand this to refer to the actual exhaustion from the surface of the canal, exposed, at the same time, to whatever rain might fall upon it.

25. The quantity held in reserve, of which two-fifths were lost by evaporation, is not stated; but, if it were, as I suppose it to be, the full prism of water left on the closing of the navigation, the loss would then be one fifth of that prism in 20 days; which would be equivalent to one prism in one hundred days, or three and one-fifth prisms during the 320 days of navigation, from this cause alone.

26. But it was said that the total abatement of the waters in the canal, on account of evaporation, was 31·609 inches in 320 days. Now, taking the rain as given (And. p. 237) for Trebes, a central point of the canal, and for a moderately rainy year, as stated at 697 millemetres, or 27.44 inches, or 24·06 inches for the 320 days, we have the amount of rain which fell upon the surface of the canal, and restored, to that extent, losses from evaporation. But as, notwithstanding the rain, these losses were 31·969 inches, the two sums may be taken as the total evaporation, or 56·03 inches. As the time of 320 days includes that of filling, opening and closing the canal, I presume ten months may be taken for its actual navigation: this would give a sum of 5·60 inches for the average loss, by evaporation, per month.

27. We have seen that, for an ordinary summer day, for the climate of London, Dr. Halley states the evaporation to be two-tenths of an inch, which would be six inches for a month of 30 days. Now, taking our climate into consideration, where we have no cooler, and many hotter days than an ordinary summer day in England, from the middle of April

to the 1st of October, and the actual circumstances to which water in a canal is exposed, we believe but few engineers will consider the evaporation stated in the deduction just made as beyond the reality for the climate of the Languedoc canal, and still less so for the one to which our observations may be applied.

28. But further: In a table of the depth of rain from observations made by Mr. Brantz, of Baltimore, we find the mean annual fall of rain, in a series of eight years, to have been 39·89 inches, (Rep. Board of Engineers, p. 52). Applying Doctor Halley's rule of proportion (23) to this, it will give a mean evaporation of 66·48 inches. Then applying the rule resulting from the observations of Dalton and Hoyle, (23) the mean evaporation will be 58 638 inches. And now to the same quantity of rain, applying the proportion of Mr. Cotte, (22) the mean evaporation will be 88·64 inches. We have already stated our opinion that evaporation was greater in this country than in Europe. All the causes of the phenomenon are known to be more active with us, and we have seen that the results from the proportions given between rain and evaporation add their proofs to the opinion. Direct observations have been made in but few places within my knowledge.

29. Mr. Sullivan, in his report upon the Chesapeake and Ohio canal, states the annual evaporation at Salem (Mass.) at 56 inches; and the board of Engineers, in their report upon the Morris canal, in 1823, state that Mr. S. Williams had ascertained the evaporation at Cambridge (Mass.) to amount, annually, to 56 inches. Applying this result to the climate of the Morris canal, the board conclude to adopt 51 inches for its evaporation. "But, as the canal can be navigated only during those eight months of the year (from April to December) when the evaporation will be the greatest and the rain the least, and as the instruments in use for measuring evaporation must always give results below the truth, from their not being exposed to wind and currents of air, we therefore adopt the whole sum of 51 inches as expressive of the maximum loss of water by evaporation." Now, as this was for a navigation of eight months' duration, the loss by evaporation was assumed at 6·37 inches per month.

30. We have seen that the observations at Montmorency (22) gave an evaporation of 41·57; from which, if we deduct 2·66 for the two winter months, it will leave 38·91 inches for the remaining ten months. And we have also seen that the actual canal evaporation in that country amounted to 56·03 inches (26); from which one may deduce a ratio between the evaporation of the laboratory and that which exists on a canal: this will be found to be as 1 to 1·44. It will probably not be considered unreasonable to take the mean annual evaporation of the climate of Maryland, within the region of the contemplated canal, as equal to that of Cambridge (Mass.). Then, if we apply to the Cambridge evaporation (29) the proportion just ascertained, we may find the probable evaporation of the climate of our canal, for water exposed as it is in a canal. This will be 80·64 inches. Such is the mean annual evaporation, which, if we were to calculate for loss from that cause, we should use for a canal near Cambridge (Mass.) It could not, therefore, be expected that we should use less for one in the vicinity of Baltimore. The average would be 6·72 inches per month, and 67 20 inches for the ten months of navigation.

31. If our reasoning be correct, then, as a general rule for a climate like that of Baltimore, evaporation from large and exposed surfaces similar to those of a canal is to rain as 2·02 to 1.

32. We are fully aware that our reasoning upon this matter is speculative. The data being of that character, the reasoning must partake of the same. Our object is not to discredit the use of such rules, but to show the caution with which they should be applied.

33. But no rule of this kind can be relied upon: if true, it is but for some limited locality. Every proportion given by any authority is thrown into a kind of ridicule by the facts of some localities. In Cavallo's Philosophy, page 374, it is stated that, from accurate experiments made by Doctor Dobson, during four years, he determined the annual evaporation from the surface of the water at Liverpool to be 36·78 inches; and in page 378, the annual fall of rain at Liverpool is reported to be 37·48 inches. Now, taking either of these elements for calculation, we can readily perceive into what error we should fall, by the ratio or proportions given by any author between evaporation and rain. "The annual quantity of rain," says Dr. Dobson, "is a very uncertain test of the moisture or dryness of any particular season, situation, or climate. There may be little or no rain, and yet the air may be constantly damp and foggy; or there may be heavy rains, with a comparatively dry state of the atmosphere."

34. It is, then, also, a very uncertain test of the evaporation, or the evaporation of the rain. In so important a matter as a canal, the water should not be obtained by inference.

35. *Filtrations.*—These are the result of a general law of nature, acting with greater or less force, according to the peculiarities of soil, but acting unceasingly and universally; often at great depths, as is observed in mines and caves, in great force, as is known from the absorption of entire rivers; through apparently impervious strata, as has been observed through more than forty feet of the calcareous rock in which are cut the catacombs of Paris; and through carefully constructed masonry, as is to be seen on passing under our various aqueducts. The idea, therefore, of making a canal which should be exempt from this general law, would be an absurdity. The effort of the engineer is to lessen its activity, and to supply the losses which it occasions.

36. Gauthey, in his work on canals, (p. 267,) gives it as a general rule, that one may assume for filtration about double the amount of evaporation. This opinion follows immediately subsequent to his statement of M. de Cotte's rate of evaporation. But from the remarks which we have made upon losses from evaporation, and from the facts we have given, the uncertainty of such a rule must be evident. It appears to our judgment that it cannot be otherwise than incorrect. There are no acting causes common to both, so as to produce any uniform relation between them. Filtrations are the result of the soil through which the canal passes, and the greater or less care bestowed upon its construction. Now, it is clear that these have no connexion whatever with the causes of evaporation, and therefore, no rule of proportion can be assumed as existing between them. The evaporation in the same locality would remain the same, whether the canal were carefully or negligently made, or whether the soil were close or permeable. Such a rule can, therefore, be applied to a particular case only, and to that with propriety, merely because it has been found to be true from actual observation.

37. Most of the rules of French engineers have been derived from observations made on the Languedoc canal. Now, this canal, it is admitted by all who have written upon it, loses less from the usual causes of waste than any other known canal in the world, owing to the care

which had been infused in its construction, and the vigilance and intelligence with which it is superintended. Rules derived from such a source, should, therefore, be received with great caution. They led the great engineer I have just named into error in his project of the canal du Centre, and would have resulted in a complete failure if sources of supply of water, in addition to those at first relied upon, had not been at command.

38. But even in the Languedoc canal I have not been able to find in my investigations any data to justify the rule, as the annual loss from filtration given by authors much exceeds the amount which would be derived by calculation from double the evaporation. Some limited experiments on parts of the work would seem to sustain it; but these appear to me to be wanting in many facts to justify a general rule. There can be no doubt, however, that all the phenomena connected with canals have been observed with extreme care on this, the boast of France and the pride of her engineers. It is esteemed by the latter as one of the most interesting works of that kind. We shall have frequent occasion in our remarks to refer to facts connected with its history.

39. It is, among canals, perhaps the only one which furnishes distinct results of losses by filtration. The usual method is to combine these with those of evaporation in one common result, which answers all general purposes in forming a judgment of the supply of water required. But there can be no doubt, if observations on these and every cause of loss were separated and made distinctly, it would lead to a much greater accuracy, and would present in a more striking light the great saving of water which would ensue from the introduction of a better system of construction. Where canals have been made in our country, the supply of water has generally been abundant, and the demand for it on other accounts so limited, that we have been able to afford the waste of large quantites; it being a much cheaper plan than to save it at a great enhancement of cost.

40. Elements to which capital can be applied are not among our deficiencies, but rather capital in order to bring those elements into activity. This last is both scarce and in great demand; it has, therefore, to be used with the most vigilant economy. Hence has arisen with us a system of engineering, which may be emphatically called "the American system," which looks less to posterity than to our own time, and presses with extreme eagerness to an immediate and profitable result. It is a system in harmony with our condition, based upon common sense, and is the only one which, in our circumstances, can be pursued to any extent in the development of our immense but rather latent resources. While we therefore admire and learn from the more perfect structures of Europe, we must yet forbear a rigid imitation of them, as there are but few cases in which a different course would not lead to the bankruptcy of all concerned.

41. The method of engineers, generally, to combine these two causes of loss of water, and to introduce but one item into their calculations for both evaporation and filtration, will oblige us to use results of that kind, as well as distinct statements of filtration.

42. Huerne, in his History of Canals, (p. 266,) after detailed statements of the water consumed in different portions, while he admits the calculations to be but approximative, comes to the conclusion that during ten months of navigation the Languedoc canal loses by its filtrations alone (deduction being made for losses from evaporation) about eight times its prism of water, or eight-tenths of its prism per month. Now, if we were to reverse the rule of M. Gauthey, and deduce the evaporation from the

filtration, (and if the rule be correct it will admit of such an application,) the loss during the ten months, from the two causes combined, would be twelve of its prisms of water, or one and two-tenths prism per month, which would give an evaporation vastly exceeding that which engineers have used. And were we, on the contrary, to take the accredited rate of evaporation, and from that calculate the filtration, the result would be much below that which, from experience, actually takes place.

44. But the different parts of the canal observed, show great differences in the quantity lost by filtration, while there is no reason to believe there could have been much, if any, difference in the evaporation. The latter quantity, therefore, if used as a basis for calculation, would have led to great error. The rule, then, of taking twice the given evaporation to determine the filtrations, is, in our judgment, extremely unsafe. We will exemplify it farther.

44. The prism of one mile of the Languedoc canal is about 64,207 cubic yards. We have seen that it loses by its filtration eight-tenths of this per month, or an amount of 51,365 cubic yards. The surface of one mile is 48,644,893 inches. Now, the period of suspended navigation being in the winter, when the evaporations are very small, and may be supposed nothing, we will apply the whole of the mean annual evaporation of De Cotte to the ten months of navigation. This being 41·5 inches, would give for the ten months an amount of 43,269 cubic yards, or 4,326·9 cubic yards per month for the evaporation. The filtrations, being double this amount, would give 8,653·8 cubic yards. But we have seen that the amount, by actual observation, is equal to not less than 51,365 cubic yards. If, therefore, we were to rely on such a rule, it would lead us into shocking error.

45. Still less can we rely upon the rule of the engineer, Ducros, given by Mr. Sullivan in his report, (Ducros, however, quotes it as the opinion of the engineer Chausade,) of one and a half times the evaporation for the amount of filtrations. That these celebrated engineers, Gauthey and Ducros, may not have had facts on which to base their opinions, we do not pretend to dispute; but they must have been isolated facts, under some singular circumstances, and not adapted for a general rule. We can easily conceive that during periods of extremely dry and hot weather, with water very low in the canal, filtration would be much smaller than usual, and evaporation greater. The sides and bottom of the canal having been, from long use with a full volume of water, well compacted and the interstices closed, from the reduced pressure arising from a small volume of water, but little could pass by filtration, while all the causes of evaporation were acting with increased intensity.

46. But we have seen that this canal loses, during its ten months of navigation, eight of its prisms of water. (42.) We must suppose, also, that it contains a prism when its navigation is closed. Now this prism let into the canal during its period of navigation, must be lost also before the subsequent two months have passed; and these being months of little or no evaporation, it must be lost by filtration. The canal then actually consumes by its filtrations, for its ten months of navigation, nine of its prisms of water, or nine-tenths of a prism per month. The prism of this canal for one mile being 64.207 cubic yards, its loss, therefore, is 57,786·3 cubic yards per month, or 1,926·2 per day, or 80·21 per hour, or about 36·09 cubic feet per minute, from its filtrations, for every mile. The evaporations by the rule of M. de Cotte were found to be 4,326·9 cubic yards per month, (44;) which, treated in the same way, would yield 2·7

cubic feet per mile per minute. The total loss, therefore, on this canal, from evaporation and filtration combined, is 38·89 cubic feet per mile per minute. But if we take the evaporation of M. Pinn, of one-fifth of a prism in 20 days, (25,) the total loss from the two causes combined will be about 48 cubic feet per mile per minute.

47. We have gone into these details, because it was satisfactory to know what that canal, which, as is generally admitted, loses the least of any known canal, actually lost from the causes stated. But its loss being a minimum, rules derived from it would certainly be very unsafe guides to follow in judging of other cases, however valuable they may be in indicating the advantages to be obtained from a careful construction.

48. The board of United States engineers, in their report upon the Chesapeake and Ohio canal, (see Rep. p. 39, 40) assume as data for their estimate, the consumption of once its water prism per month, on account of losses from evaporation and filtration.

49. From experiments made on the Erie canal, and communicated to me by that distinguished engineer. Mr. J. B. Jervis, (to whom I am also indebted for other highly valuable communications,) it would appear that the least loss, from observatioas made at various places, was 100 cubic feet. This was not the measurement of loss from a distinct cause, but from all united—leakage of locks, evaporation and filtration The dimensions of this canal are, 40 feet water at surface, 28 at bottom, and 4 feet deep; which give for its prism of one mile, 26,595.5 cubic yards. The loss of 100 cubic feet per mile per minute is equal to 160,000 cubic yards per mile per month; or, supposing the navigation to continue for nine months, (in that climate,) the total loss would equal about 54 times its water prism per year; adding to this the loss of the prism in the canal at the closing of the navigation, gives a total loss of 55 of its prisms of water for all causes, except the demands of the locks for its trade.

50. This consumption of water is certainly very great. The commissioners, in their annual report of January, 1834, make the following remark:

"The Commissioners are inclined to the opinion, that, with proper care in guarding against the waste of water, 100 cubic feet per mile per minute for leakage, filtration and evaporation, (all causes of consumption) would be a safe estimate for the western and middle sections of the Erie canal; but it is to be believed it would be found, on a careful examination, that a much greater quantity would be necessary on many parts of the eastern section, where the soil is more open, the levels shorter, and the locks more frequent."

51. Shallow canals lose more than deep ones. This is a point now so well settled by experience, that facts need not be adduced to prove it. We mean, more in proportion to their dimensions; that is, in proportion to their filtrating surfaces. In our own country we have an example of a deep canal, (the Chesapeake and Ohio canal,) the depth of which is six feet.

52. Mr. Fisk, the chief Engineer of that canal, after repeated and careful observations over an extent of about 40 miles, represents its loss, on account of its evaporation and filtration, at 60 cubic feet per mile per miuute. Its dimensions are 60 feet at the water surface, 32 feet at bottom, and 6 feet deep, which give, for one mile, a water prism of 53,673 cubic yards. And as this canal loses 60 cubic feet per mile per minute, from evaporation and filtration, it will amount to 66,000 cubic yards per month per mile, which is more than three-quarters of a prism.

53. Now, if we suppose the navigation of this canal to continue during ten months, and add to the loss just stated, that of the prism of water left in the canal, it will make $18\frac{1}{2}$ prisms of water for its navigable year.

The observations of Mr. Fisk were made upon that part of the canal between Harper's Ferry and Seneca, which has been the longest in use. Much of it also passes through low ground, and may therefore be considered as the drain of the adjacent high grounds; and where exposed to the causes of active filtration, it was puddled with great care. On these accounts I conceive its loss may be fairly considered, under our system of construction, as a minimum; and that the safer rule for a general estimate, on account of losses from filtration and evaporation, would be two prisms per month. Its actual loss being, then, 1·85 prism, our safer rule adds 0·15 of the prism of one mile per month, which would increase the stated loss per mile per minute 2·25 cubic feet; or make the whole, exclusive of the prism left in the canal on the closing of the navigation, 62.25 cubic feet per mile per minute. This prism, left in the canal at the closing of navigation, is as has been shown, equal to 53,973 cubic yards, (52,) for one mile. As its loss is for the whole ten months, it would be 3,374 cubic feet per mile per minute, making the total loss per mile per minute equal to 65,624 cubic feet.

(To be Continued.)

Pisé Buildings.

Few details in regard to the mode of building in *Pisé* are to be found in any English work. There is no doubt that in those regions where the proper kind of earth is to be found that it presents great economical advantages. There are many, doubtless, in the Northern States, to whom the following remarks may prove useful.

From the Southern Agriculturist.

To the Distressed Inhabitants of the City of Charleston.

Seeing from the Act of the Legislature, as well as from the Ordinance of our City Council, that in future we are restricted to the use of incombustible materials in erecting our buildings, and knowing as I do the high price of such, and the difficulty of getting them at so high a price, I would suggest the use of *Pisé*, or rammed clay walls. This mode of building is of great antiquity, and brought to such perfection in the country about the beautiful city of Lyons, in France, as to appear like elegant palaces, some of which are known to have stood three hundred years. But to be concise on this subject: I have just erected the walls, and covered in a house of 48 feet long by 24 wide, containing six large rooms, and three wide passages; and though built under many difficulties which I had to surmount as I went on, yet it will bear comparison with any brick house of the same size, and was built in nine months by two men only, (who hired out at $10 per month before employed on this work) assisted by a black country carpenter for three weeks. From the experience I have gained in the erection of this house, I can with confidence recommend (if my directions are followed) the use of *Pisé buildings*; viz.—The foundation must be stone or brick, raised twelve to eighteen inches above the ground. The mould, which is very simple, must be a piece of 3 by 4 scantling, laid across the foundation, with a mortice at each end, describing the width of your wall, allowing for the thickness of the boards that are to stand on their edges, with their sides to the studs of scantling, standing in the mortices of the transverse scantling already mentioned, and capped with a piece of the same width; these studs to be erected three or four feet apart. The flooring boards intended for the house, and which require seasoning, will just answer for this purpose, and will not be the least injured from this use, but better seasoned. They must be reduced to one thickness, and cut with a mitre at one end to meet at the corners, clasped with tin or sheet iron clasps, secured with small screws. These may be taken off every other course, and used as before. In this mould so formed, lay six inches of clay, as dry as you can procure it, (I never found it too dry) and commence ramming, with a rammer beveled from a square of six inches,to one inch all on one side. The Pisadore (who is the rammer) finding it will not yield more to this rammer, then commences with a square rammer, till it rebounds briskly from the wall; he then continues filling in, continuing the same process till the boards are full, and he lays another board on the edge of that just finished, and continues this process until the story is raised to receive the joists. These are laid on a piece of scantling 3 by 4, laid along in the mould, and each end is well dove-tailed. This being effected, I would recommend that the mould be taken apart from the wall; it will be found an equal continued surface, resembling a piece cut out of a rock, of the color of the clay. If this has any blemishes (or inequalities of surface) from the clay sticking to the mould, they can be immediately remedied by a plaster made of the same clay, with a mixture of cotton or hair. This being done, lay on the whole wall a coat of linseed oil. It will immediately sink in, and form an indurator, that will convert the surface to a crust of putty, impervious to rain or any kind of moisture. After you have given the wall a coat or two of the oil, you may paint it of any color you wish, which it will show and retain with the greatest brilliancy. Then erect your mould on the next story, and continue as before, laying, (which I forgot to mention) your door and window jambs plumb in their proper places in the mould, as you go along. This mould possesses many advantages over the one which I described in my former article in the Agriculturist. It turns out the work in one continued mass, as if chiseled from a rock, and by this the work is reduced to three-fourths of the labor, and much more planished and perpendicular. In this manner, a Pisé house can be built as elegant, durable, strong and incombustible, as of any other material allowed to be used. Its expense will depend much on the locality and vicinity of the clay, to the place it is erected. Having the clay at hand, my Pisadore (or rammer) and one attendant, carried up sixteen inches of a wall, sixteen inches thick, in four days, all round a house, 48 feet long, and 24 feet wide. Now, if to build such a wall sixteen inches high, requires four days, how many days will it take to build it thirty-six feet high, the full height of a three story house? Answer 108 days; which, at one dollar per day, would be equal to $216.

A brick house of this size would require 100,000 bricks, which at $15 per M., will amount to	$1500 00
Lime at 25 bushels per M., is 2500 bushels, at 20 cents, .	500 00
Laying the bricks at $4 per M., is	400 00

Cost of the walls of the dwelling house only, ...	$2400 00
Deduct the price of building the Pisé house, ...	216 00
In favor of the Pisé house, ...	$2184 00

But this is not all, for in a brick house you have to build a wood one within to make it fit to be inhabited, plaster and studs, laths, lime, nails and stucco, will amount to $1200, making the round sum of $3384. In opposition to this, I will state, the Pisé walls require no plaster, but only to be smoothed and painted plain, or penciled, as taste may dictate. The Pisé house being painted as it comes out of the mould, is fit to be inhabited as soon as finished.

But the difficulty of procuring clay is objected to. This will cease when we are informed, that all the bluffs about our harbor and rivers, contain it in abundance, and may be wafted over in lighters, and sold at a low price. Our harbor, and the rivers and creeks around us, contain inexhaustible banks of dead shells, which, if rammed in such a mould, will produce a fine wall equal to Tabby, well known to many of us. The banks of Ashley river abound in a concretion of calcareous matter fit for such buildings. To this important hint I call your attention. The doctrine that I have been endeavouring to inculcate, admits of the clearest demonstration, *actual experiment.* Take a box of a handy size, ram it with clay as described When so filled and rammed, turn it up on a board, and lay it in the sun to dry, so as the box or mould may be lifted off without injury to the pisé'd work. When dry, indurate it with linseed oil, and when it is dry, paint it on either side with any color you please. This experiment will satisfy you of the strength of the walls, the effects of the oil as an indurator, and the beautiful appearance of the paint.

I remain, with best wishes, yours, &c.

BARTHOLOMEW CARROLL.

(Continued from page 62.)

Report upon the Finances and Internal Improvements in the State of New-York 1838.

The total amount borrowed to construct the canals, was 7,672,782, of which amount $3,326,295 has since been paid directly to the public creditors, and certificates of stock have been cancelled to that extent. The duty of receiving the money and holding it for the creditor, is by law entrusted to the Board of Commissioners of the canal fund; and this body stands between the State and its creditors, acting at the same time as agents of the State, and trustees for the creditors. The commissioners have discharged their duty so far as to receive from the State "full and complete payment" of the debt; and they are now engaged in executing the remainder of their trust, by paying the money to the creditors. They have repeatedly notified those creditors by public advertisments, both in this country and in Europe, and also by written circulars whenever their residence could be discovered, that they had received the money, and were prepared to pay it; but as the debt, according to the terms of the loan, does not fall due until 1845, the Commissioners, in order to avoid the responsibility incurred in keeping so large an amount permanently invested, have offered large premiums to the creditors to come forward and receive payment and surrender their certificates. The Commissioners have thus reduced the amount to $2,346,487; so that little more than two-sevenths of the original sum now remains unpaid. As a considerable portion of this remnant of the debt is held by persons residing in foreign countries, it is not improbable that some of them may neglect or refuse to receive payment until the year 1845, and the money must consequently remain at least until that time invested for their benefit in the hands of the Commissioners. It will be perceived, that whatever force there may be in this constitutional objection, will not be diminished by the payment of any portion of the debt, however large; so that whether five-sevenths or ninety-nine-hundredths of the debt should be paid, the position would not be varied. The pledge can only be literally performed by paying the last remaining dollar to the last remaining creditor. No middle ground exists between this extreme consequence and the position that the pledge is satisfied for all fair and practical purposes, when the amount of the debt is paid over to the Commissioners and safely invested by them in trust for the creditors.

It is under these circumstances that the doctrine is advanced, not on the part of the holders of this remnant of the debt, (for it is believed that they are wholly indifferent as to the matter,) but by those who seek to arrest the progress of our public works, that the canal tolls shall not be reduced or diverted until the last dollar shall be literally paid to the creditor. That no matter however important it may become to our commerce and general interests to revise and regulate the rates of toll; that no matter how just or pressing may be the claims of other parts of the State for works of internal improvement; the canal tolls shall be held "beyond the reach of the Legislature;" at least until the year 1845, when interest ceasing on the debt, the creditor may probably be willing to receive payment:—and the doctrine involves this monstrous consequence, that the whole accumulating amount of the tolls, which with the compounding interest, would produce, by the year 1845, at least ten millions of dollars, must be kept invested in money as a further pledge for the payment of a sum of two millions, and which very two millions already exists in money invested on safe security: and that in the meantime the public improvements of the State must be deferred, and direct taxes imposed to defray the ordinary expenses of the government!

In the judgment of the committee no such absurdity was contemplated by the framers of the Constitution, or could ever be submitted to by the people. The clause in question evidently was intended merely as a guaranty, not so much to the public creditors as to the people of the State at large, that a sum should be raised from the tolls and other revenues pledged, sufficient to satisfy the debt, and provide against the hazard of taxation for that purpose. And this was all its object. It was never dreamed that ten millions should be accumulated in order to pay two millions. The restriction was adopted upon the mistaken calculation that the revenue would not more than pay the debt as fast as it became due. Time has disclosed that error. The money is raised and ready, and upon every sound and rational principle of construction the pledge is satisfied. The State has done all that the most scrupulous good faith could require, and no reason exists why the tolls which are thus redeemed and unfettered, should not be regulated or reduced in such manner as the Legislature shall think fit, or applied to any beneficial purpose which the public interests may require.

And in this light the question has been viewed by the representatives of the people. By the act of May 11, 1835, the Legislature directed that the canal tolls should be expended in enlarging the Erie Canal to such dimensions as the Canal Board should determine, who were thereby also authorized to construct an "independent canal," in such parts of the route as they should think expedient. The canal, according to the plan since adopted by the Board, will be about three times as large in volume as the existing canal, and its location will be changed for several miles of the route. The Revised Statutes, in 1830, had explictly declared the Erie and Champlain canals to be completed: so that both legally and practically, the canal thus altered in dimensions and in location, may be considered as a new work. The tolls expended in its enlargement, to all technical intents are as much "diverted," as if employed in constructing a lateral canal, or any other of the public works of the State; and the consequences, so far as the public creditors or the people of the State at large are concerned, are in no respect different.

But the 9th section of the act placed the intention of the Legislature beyond all doubt: for it directed that the expenditures in thus enlarging the canal "should be so limited as to leave from the canal revenues an annual income to the State of at least $300,000." In other words, the Legislature appropriated that amount of the canal tolls to the ordinary uses of the government.

By a subsequent act, passed May 16, 1836, the Legislature increased this annnal sum from $300,000 to $400,000: but possibly for the purpose of quieting constitutional scruples, the phraseology of that law directed the Commissioners of the Canal Fund to "loan" that sum annually "to the treasury of this State, for the use and benefit of the General Fund;" and the Comptroller was directed to charge the General Fund "as a debtor," for such loan to the Canal Fund. It is rather to be regretted that it should have been thought proper or necessary to throw the transaction into this form. If the State owned the tolls free from the encumbrance of the public creditor, no necessity existed for this legislative fiction. If it did not, the propriety of abstracting the tolls, under the guise of a loan to the General Fund, (which fund existed only in the canals themselves) may well be questioned: while the very fact of charging the State, or the General Fund, "as a debtor," for the amount of the tolls, was calculated needlessly to perplex the public mind in regard to the true state of the finances.

It is therefore quite evident, that the tolls of the canals have been brought fully within the reach of the Legislature: and the very important question then arises, in what mode shall they be appropriated so as most effectually to promote the progress of the public works?

By the acts of 1835 and 1836, the tolls, after deducting $400,000 annually, (and of which sum about one half is applied, in paying the interest on the debt for lateral canals,) have been appropriated to the enlargement of the Erie canal. The cost of that enterprise, originally estimated at $12,000,000, will not probably fall short of $15,000,000; so that if only the nett revenues (now amounting as it is above shown, to $787,183,) shall be applied to that purpose, the work cannot be completed short of twenty years: and during the whole of that time those other works must be deferred, which could be aided by this revenue in case a proper scheme of finance were to be adopted.

The policy and the plan of enlarging the canal, have been definitely settled by the constituted authorities, and after mature consideration. Expenditures have already been incurred in prosecuting the work to an amount exceeding $600,000, and contracts have been made in addition to the extent of nearly three millions. The idea of abandoning the undertaking, even if it were desirable, is therefore quite out of the question. The committee are moreover satisfied, that the speedy enlargement of the canal is required by the best interests, not only of the inhabitants in its immediate vicinity, but of the people of every part of the State. The Canal Commissioners in their recent report to the Legislature, have estimated its annual tolls within a few years after it it shall be completed, at no less than three millions of dollars, equivalent to an annual income of five per cent. on a capital of sixty millions, and that of this large revenue at least one half will be paid upon property passing to and from other States. It is quite evident that such an income will enable the State, after making the most judicious revision of the rates of toll, to extend its fostering aid to every portion of its territory, however remote or sequestered. To secure such a result with the least practicable delay, is therefore, an object of general importance.

The canal, when enlarged, will be greatly increased in value and power, and in point of magnitude will be one of the most important works, not only of this country, but of the age. Its capacity exceeding that of the present canal, at least seven fold—being seven feet deep and seventy feet wide, with double locks of enlarged dimensions throughout the whole line,—it will furnish the means of convenient transit for not less than ten millions of tons annually. The supply of water will be abundant and unfailing, and the enlarged size of the boats by which it will be navigated, will reduce the cost of transportation nearly one half; so that if the tolls should even be retained at their present rates, the saving to the community in the aggregate expense of conveyance, would be from one-fourth to one-third of the amount now paid. It must be borne in mind however, that to effect this saving, the enlargement must be completed throughout the whole line, so as to avoid the expense and delay of trans-shipment,—and from this fact it will be obvious, that important financial consequences are involved in its speedy prosecution. By proper efforts, the enlargement may be completed and made available within five years. At the expiration of that period, the interest, at five per cent., compounded half yearly, on the work, (estimating it at fifteen millions) will amount to about two millions and a half of dollars; whereas, if the completion shall be delayed twenty years, the intervening interest alone will exceed nine millions; showing a loss of interest by proceeding at the present sluggish rate, of at least six and a half millions of dollars; a sum which of itself would go far to extend the benefits of internal improvement to every other section of the State.

In order thus to expedite the work, it will become necessary to borrow money and incur a temporary debt. That this suggestion will alarm those who regard a public debt as the greatest of all public calamities, is not improbable; and it may very possibly arouse opposition, as violent as that which was arrayed against our canals in their early stages. The hope is however indulged, that the successful example furnished by that great experiment will dispel any groundless fears, and impart to our public councils that degree of moral courage which the occasion requires.

Our fathers did not hesitate to encounter debt, even when the means of paying the interest were unascertained and contingent; and surely we may venture upon a similar effort, now that we are certain that the revenues of the State will suffice to pay the interest. The present nett annual revenue of the State, after paying its expenses and the interest on its debt, is $787,-183, as above stated. That sum alone will pay the annual interest at five per cent. on \$15,743,660; and that amount may therefore be borrowed and expended, and the interest punctually met without taxation. Any augmentation which shall be experienced (either by means of the expenditure of that sum, or from any other cause) in the revenue of the canals, will itself increase to a corresponding extent the ability of the State further to borrow and pay the interest. It is evident that every \$500,000 of revenue will serve as a basis of finance to sustain ten millions of debt. If the estimate of the Canal Commissioners is correct, (and from their well known caution their opinions in this respect are peculiarly entitled to confidence) that the enlarged Erie Canal will yield an annual revenue of three millions, equivalent to five per cent. on sixty millions, it will at once be obvious that a sum of thirty millions may not only be borrowed, and expended, but wholly reimbursed, within twenty years; or that forty millions may be so borrowed, expended, and reimbursed, in twenty-eight years.

Nor need it be apprehended, that in order to produce these immense results, the tolls of the canals must be maintained at oppressive or injurious rates. During the years 1833, 1834, and 1835, the rates were reduced in the aggregate about 35 per cent. and yet during these three years the tolls amounted to \$4,209,000; whereas in the three years next preceding the reduction they had amounted to only \$3,185,000, exhibiting an increase of upwards of a million of dollars. The responsible duty of regulating the tolls to be imposed upon the great and almost illimitable trade which our canals are to enjoy, and of fixing the rates so judiciously as best to promote our commercial and agricultural prosperity, and at the same time adequately to strengthen our fiscal resources, will undoubtedly be exercised with that prudence, liberality, and forecast, which the magnitude of the subject demands. Whatever rates of revenue may be eventually adopted, we may safely assume that the State will take care to reserve such an amount in the aggregate as the interests of its treasury and the general welfare of its citizens shall require.

The committee, therefore, have no hesitation in recommending that the State proceed promptly to borrow such moneys as are needed to prosecute most vigorously its public works, and in lieu of appropriating the revenue only of the present canals for the purpose of making such expenditures as the general interests require, they would suggest that the State should retain that revenue as a sinking fund to pay the interest on all moneys it may borrow, from time to time, to prosecute and perfect a liberal system of internal improvement.

It is not the appropriate duty of the present committee to point out those particular works which stand most in need of the efforts or the fostering care of the State. That gratifying office will devolve upon those by whom it will doubtless be faithfully and wisely discharged. The view which they have sought to take, is purely fiscal in its nature: aiming only to demonstrate the pecuniary ability of the State to proceed promptly and liberally in the great work of improving its internal condition and developing its resources. They confidently believe that the success hitherto attained in the prosecution of our system of internal improvement is but the precursor of triumphs far more important; that the results we now enjoy but faintly shadow forth the vast realities which are within our reach; and that it needs but to employ promptly and vigorously our resources to augment yet more fully and gloriously the power and prosperity of the State. Without trespassing upon the province of those whose duty it is to prescribe the particular details of those great measures of policy, by which our dormant energies may thus be roused into salutary and profitable action, the committee would observe generally, that the works which for the next few years will occupy the attention of our public authorities, are,

1. The rail-roads connecting the distant extremities of the State, and the interior portions with each other.
2. The Erie canal with its various tributaries.

On the subject of the policy to be pursued by the State in regard to the construction of rail-roads, differences of opinion exist.

On the one hand it is contended that these great avenues of travel and communication which affect so intimately the convenience and welfare of all our people, should be constructed and managed exclusively by public agents acting under public authority: and the success of those governments which have pursued that policy, not only in cheapening the cost of transport, but in avoiding the mischiefs of monopoly has been adduced as a reason why the State should possess, and at all times regulate, this important branch of our internal improvements.

On the other hand it has been urged, that the employment of the great number of persons required to conduct the manifold details of these crowded channels of transportation, would throw into the hands of the State, an undue amount of power and patronage: and it it alleged that this danger will be avoided, and the public convenience in other respects promoted, by entrusting their management to companies of individuals duly incorporated. It is also contended, and especially by those who are habitually skeptical as to the success of our public works, that the value of rail-roads has not yet been sufficiently tested, and that they will eventually fail to yield results sufficiently profitable to render it desirable for the State to construct them at the public expense.

The State has declined, hitherto, to construct rail-roads on its own account, but has preferred to commit that duty to incorporated companies; and has afforded aid, at least, in one important instance, by a loan of the public credit, taking as security a mortgage of the work. If a similar course shall be pursued in respect to all the rail-roads which may stand in need of public assistance, and the interest on the stock to be thus loaned shall be regularly met by the companies, the treasury will remain wholly unaffected by such measures of aid, and in a fiscal point of view, the State will experience neither profit nor loss.

The legislature has taken care, however, in the charters by which the rail-road companies have been incorporated, to reserve the right ultimately to take those works for public use, and the State may possibly exercise this right at some future period. The total cost of the leading lines will not fall short of eighteen or twenty millions of dollars; but the State will find no difficulty, whenever it may see fit to take these works, in making such financial arrangements as the occasion may demand.

The sum which the treasury will require for the canals now in progress, will be:

1. For enlarging the Erie canal, including damages,	$15,000,000
2. For the Genessee Valley and the Black River canals, (authorized to be constructed by laws passed in 1836,) in addition to the amount of $190,920 22, hereinbefore included as part of the State debt, not less than	5,000,000
	$20,000,000

For the two last mentioned canals, loans have been already negotiated to the amount of $2,800,000, but the proceeds, (with the exception of the $190,920, have not yet been expended.

In addition to the amount above stated, it may be observed that sundry projects for other canals of smaller extent, have been more or less entertained, including among others, an extension recommended in the Governor's message in 1836, of the Erie canal from Buffalo westward to a point on Lake Erie less obstructed by ice: the extension of the Black River canal into the mineral districts of St. Lawrence county: the continuation of the Erie canal, or the construction of a branch from it to some proper point below the Overslaugh: and some other extensions of existing works. If any considerable portion of these projects should be carried into execu. tion, the cost will not probably fall short of $5,000,000.

The connexion which it is proposed to affect by means of a ship canal between Lake Erie and Lake Ontario, has been excluded from the above estimate, under the belief, that a work so interesting and important in a military point of view, will be constructed at the expense and under the authority of the general government.

It thus appears:

1. That the amount which the State must expend under existing laws, for the enlargement and construction of canals already commenced, will be	$20,000,000
2. That the amount to be paid from time to time, for taking rail-roads for public use, whenever the State shall find it beneficial to the public interest to do so, may be from ten to twenty millions, according to the extent of the works to be selected: or say	$15,000,000
3. That the amount to be hereafter authorized for extensions of the present canals, may be	$5,000,000
Making a total of	$40,000,000

It is not, however, to be inferred that the committee intend by stating the above sums to recommend an expenditure to the amount of forty millions upon our public works. It is certain that under existing laws, at least one half of that sum must be so expended; but whether any portion of the residue will be appropriated, will of course depend upon the views of the present and succeeding Legislatures. They wish merely to be understood, that if the Legislature from time to time shall see fit to expend that sum, it may be safely borrowed, without imposing any burthens upon the people; and that if the views of the Canal Commissioners, as to the future revenues of the canal, are correct, the whole amount, within thirty years, may be reimbursed, and added to the productive property of the State. It is not improbable that those who are in the habit of decrying our public works, may assert that a debt is to be incurred to an alarming amount, to be handed down as a grievous burthen to all future generations; and yet, in truth, we shall only hand down what our fathers have tranmitted to us, public works, paid for and free from debt, and themselves affording the means of still further augmenting the power and wealth of those who are to follow us.

Nor will this event be deemed at all improbable, when we reflect that within the last twenty years the canals have come down to us free from debt, and worth more than twenty millions. Actual experience has thus familiarized us with the certain operation of an excess of revenue in extinguishing a debt created for public works,—but for the sake of presenting the subject in a more perspicuous form, an arithmetical table is subjoined, —exhibiting the progress of a debt within the next ten years, to the extent of forty millions; and then the successive stages by which it will reach its final extinguishment.

In respect to that part of the annual report of the Comptroller of this State on the finances referred to the consideration of the committee, which suggests the expediency of levying a tax for the purposes of the treasury, they are compelled to state that, in their judgement, no necessity exists for that measure. They are aware that, from the year 1827, when the report of Mr. Wright announced to the public that internal improvements could only be sustained by direct taxation, down to the present time, our fiscal officers have habitually urged upon the Legislature the necessity of resorting to that method of levying money for the use of the State. It is not without diffidence, that the committee feel themselves compelled wholly to dissent from the experienced individuals who, for the last ten years, have controlled our public affairs; but, after a laborious and careful investigation, they have been unable to discover any reason why such a mode of raising money should have been recommended. In the opinion of the committee there is no possible ground upon which a tax could be justified. The treasury is full and needs no replenishing: and ample means are provided for meeting the future engagements of the State. Under such circumstances, to subject the people to the burthen of a direct tax, would be equally unwise and unecessary.

It is stated, however, by the Comptroller, and the fact has been repeatedly urged in other official communications, that Mr. Jefferson lays down the rule that a government disposed to cherish its credit "should never borrow a dollar without laying a tax in the same instant for paying the interest annually, and the principal in a given time." But the maxim is not sound, to the extent to which it is thus attempted to be applied. It will be recollected that Mr. Jefferson lived in a period of war and wasteful expenditure; and in speaking of the consequences of public debt, he doubtless intended to refer to expenditures upon objects not of themselves yielding a pecuniary return—such as the public defence, the protection of commerce, or the expenses of the civil administration. No reason can possibly exist for extending the rule to debts incurred for public works, themselves producing an income equivalent to the interest; nor is it absolutely requisite that such revenue shall be received "in the same instant" in which the debt is created, provided that it will be realized within a reasonably moderate period. It may, indeed, be admitted, that when such result is problematical, or only to be realized at a remote period, the tax ought to be laid when the work is commenced; provided always that the government possesses no other pecuniary means of paying the interest. But then it must be shown that no such auxiliary resources are possessed, for otherwise there could be no necessity for levying money by tax for the mere purpose of preserving pecuniary funds which could be more directly and economically applied to the object in question. And this is the view which the Legislature has taken of this question, from the year 1826, when the State tax was discontinued, down to the present moment. Although annually urged to levy a tax, they have annually refused: but have seen fit to rely on the revenues from the public works, to meet the demands on the treasury. The result has shown that they were right; for although the State since 1825, has expended in constructing lateral canals the sum of $3,364,304, it has still remaining an annual surplus revenue of nearly $800,000; and its people are free from taxation.

Without pretending, therefore, to detract from the general authority of the maxim thus quoted, it may be claimed that our own experience has shown it to be inaccurate, when applied to debts created for works of internal improvement. In truth, it is hardly credible that Mr. Jefferson ever intended thus to apply it; but if he did, it only shows, what his incredulity in respect to the Erie canal had sufficiently testified, that enterprises of that character had not occupied his most deliberate attention.

It will be perceived that the very foundation upon which the financial calculations of the committee are based, is the estimate of the Canal Commissioners submitted to the Legislature, in which they state tnat the Erie canal, within a few years after its enlargement, will produce an annual revenue of $3,000,000. The importance of verifying the accuracy of this estimate will be evident, as any material error would lead to the most injurious consequences. The inquiry has necessarily embraced details of unusual magnitude, but having subjected them to a careful scrutiny, the committee state succinctly, the reasons why, in their opinion, that estimate is entitled to reliance.

The steady progress of population and wealth of that portion of our own State which is tributary to the canal, needs little remark. Whether owing to the growth of the country on its immediate borders—or to the influence of the lateral canals, in swelling its commerce,—the tables of tonnage exhibit a rate of increase which will probably be maintained for many years. Although the contribution thus furnished by the State to the revenues of the canal, at the present time is large, (for two-thirds of the whole of its tolls are now drawn from the trade of our own people,) yet the amount becomes relatively unimportant, when compared with the enormous results we are hereafter to derive from our commerce with the west. Let us then advert briefly to the present extent and future progress of that commerce, and the probable effect which it is hereafter to produce upon our fiscal affairs.

The western termination of the Erie canal looks out upon Lake Erie, the most southerly and central of the great chain of navigable lakes, which stretches far into the interior from our western boundary. Around these inland seas, a cluster of five powerful States is rapidly rising. The territory which they comprise, and which is to become tributary to the canal, embraces that great area, extending from the lakes on the north to the Ohio on the south, and from the western confines of this State to the upper Mississippi, and containing 280,000 square miles. To measure its extent by well known objects, it is fifteen times as large as that part of the State of New-York west of the county of Oneida—nearly twice as large as the kingdom of France—and about six times as extensive as the whole of England. It contains 180 millions of acres of arable land, a large portion of which is of surpassing fertility.

The productive property of this region, and its capability of supplying tonnage for export, are greatly strengthened by the facilities which it enjoys for cheap and easy transportation. In this respect, no country on the face of the globe enjoys greater natural advantages: for it is nearly encircled by navigable waters; and its broad area is intersected in numerous directions by streams furnishing ample means of conveyance, while unusnal facilities for the construction of canals, and other artificial channels of communication, are afforded by the level and uniform character of its surface.

These being its geographical advantages, it needs only the requisite number of inhabitants, to fully develope its agricultural resources. Its progress in this respect has been truly surprising. In 1816, Ohio was the only organized State government within its limits. In that year, Indiana, having obtained the requisite number of 60,000 inhabitants, entered the Union, and took its place by the side of Ohio. Illinois and Michigan were then distant and feeble territories, with a few settlers thinly scattered over their broad surface; while Wisconsin, unknown even by name, was an undistinguished portion of the great North-Western territory. In the brief period of twenty-one years, such has been the influx of population into this great district, that Ohio, the eldest member in this brotherhood of nations, now numbers 1,400,000 inhabitants; Indiana upwards of 600,000; Illinois and Michigan, (both of whom have organized their governments and come into the Union,) 700,000; while west of lake Michigan, not only is Wisconsin rapidly rising, but even beyond the upper Mississippi, 30,000 citizens have already laid the foundation of yet another State. Such is the onward march of this population, that the amount of its annual increase alone exceeds in number the white inhabitants of ten of the States of the Union. The population already embraced within the district in question, falls little short of three millions, and if the same rate of progress shall be maintained for the twelve years next to come, by the year 1850 it will exceed six millions.

The peculiar activity and energy of these people, and their power most rapidly to develope the resources of the broad domain which they inhabit, are also worthy of consideration, in estimating the eventual extent of their trade. They probably possess a greater aggregate power of production than any other portion equally numerous of the human race. Their population is made up almost exclusively of the young, the resolute, the vigourous, and the intelligent, who have gone from the more crowded communities in the eastern and middle portions of the Union, to seat themselves around this chain of waters, and there build up an empire. They have taken with them the laws, the habits, the language, and the institutions, civil and religious, of their parent States, but above all, they have carried into that vast field, an honest love of labour, and in the very act of organizing their governments, they testified their willingness to exert and rely on their own energies, by prohibiting slavery forever, throughout all their limits.

This group of inland States has two outlets for its trade to the ocean; one by the Mississippi to the Gulf of Mexico; the other through Lake Erie and the navigable communications of this State to the Atlantic. Whether it be attributable to similarity of origin, of laws, or of habits, or to ties of consanguinity, or superior salubrity of climate, this people evidently prefer the market on the Atlantic, and they are making prodigious efforts to reach it. Three great canals, (one of them longer than the Erie Canal,) embracing in their aggregate length, about one thousand miles, are to connect the Ohio with Lake Erie, while another deep and capacious channel, excavated for nearly thirty miles through solid rock, unites Lake Michigan with the navigable waters of the Illinois. In addition to these broad avenues of trade, they are also constructing lines of rail-roads, not less than 1,500 miles in extent, in order to reach with more ease and speed, the lakes, through which they seek a conveyance to the sea-board. The undaunted resolution of this energetic race of men is strikingly evinced by the fact, that the cost of the work which they have thus undertaken, (and most of which are in actual progress) will exceed forty-eight millions of dollars—a sum far exceeding all that New-York, with two millions of inhabitants, and two hundred years of accumulated wealth, has ever attempted. The circumstance, moreover, is particularly important, that the public works in each of these wide-spread states are arranged on a harmonious plan, each having a main line supported and enriched by lateral and tributary branches, thereby bringing the industry of their whole people into prompt and profitable action, while the systems themselves are again united on a grander scale, in a series of systems, comprising an aggregate length of more than 2,500 miles, with lake Erie as its common centre.

The various portions of this vast work are now in a train of rapid construction. Indiana alone has 6,000 men in her employ; and Ohio, Illinois, and Michigan are making correspondent efforts; so that it may be confidently predicted that within seven years from this time, the whole inland trade of that broad region around the lakes, will crowd the entrance of the Erie canal on its way to the Atlantic.

It will at once be obvious, that the whole of the tonnage thus to be furnished by these communities, whatever may be its bulk, will pay to our treasury a transit duty for the whole length of the canal; and will therefore yield a revenue twice as large as an equal quantity of products from the districts of our own State, mid way between the Lakes and the Hudson.

And what will be the amount of this tonnage, and by what standard shall we measure it?

If we take the area and the products, and the population of our own State as a guide, we fall far short; and even if we resort to more populous nations —if we select England or France, and compare their productive power with that of this youthful and rapidly increasing race, the parallel will not be complete; for a much smaller proportion of the inhabitants of those kingdoms is devoted to agricultural pursuits; nor is their inland commerce wholly concentrated within any single channel.

But we, fortunately, possess an adequate nnd appropriate standard in the Mississippi river, the great rival and competitor of the Erie canal, with which it is destined hereafter to hold divided sway over the vast trade of the west. The number of inhabitants who at present employ that stream and its tributaries, for the purpose of conveyance, is scarcely five millions, and yet the amount which they paid the last year for transportation on its waters, was between eight and nine millions of dollars.

The momentous question, whether the tonnage of the inland district under examination is to seek the Atlantic through the Erie Canal, or descend the Mississsippi to the Gulf of Mexico, is mainly to depend upon the comparative cost of transportation. But when we consider the circuitous course of the Mississippi, the loss of time in ascending its strong current, and the greater rapidity of communication presented by the Atlantic route; when we advert moreover to the ample volume and trifling lockage of the enlarged canal; and especially when we estimate the commercial effects of the navigable passage opened by the Hudson through the Alleghany ridge; we shall perceive that when the artificial communications thus concentrating upon Lake Erie shall be put in full operation, the cost of transporting agricultural products from the interior of this district will not materially vary, whether carried to the Atlantic or the Gulf of Mexico. The inference then, may safely be drawn, that whenever a population of five millions around these western waters shall resort to the Erie canal for the means of conveyance, they will supply it with an amount of tonnage equally great with that now transported on the Mississippi by an equal number of inhabitants.

It is estimated that the value of agricultural products which annually descend the Mississippi and its tributaries, has already reached $70,000,000. The value of the property transported on the canals of the State of New-

York, during the year 1836, is shown by official tables to be $67,000,000. Of that amount, it may be estimated that $50,000,000 consisted of property belonging exclusively to a portion of the population of this State not exceeding a million and a half in number, being at the rate of $33 33 for each inhabitant; and that the amount which they paid for its transportation, exceeded two millions of dollars. If the same scale of production and consumption shall be assumed for the population of the district in question, (and no reason is perceived why it should not be,) the six millions of inhabitants in the west who will resort to the Erie canal for the means of conveyance, will furnish tonnage, in exports and imports, of at least $200,000,000 in value. The experience of other nations will show that this amount is not over-estimated. The food alone produced in England in the year 1835, by an agricultural population of about eight millions, was valued by their political economists at $604,000,000; while that of France was ascertained by its Minister of Finance to be 5,237,000,000 of francs, or $980,000,000.

But there are peculiar reasons why the proportion of agricultural exports of this great inland population should far exceed that of other nations. The exuberance of their soil, the salubrity of their climate, and the cheapness of their lands, (arising from the vast supply within their limits) will enable them always to furnish food to every other portion of the continent, on more advantageous terms than it can be elsewhere produced. Labour there reaps its best reward, and harvests of an hundred fold repay its exertions; and such is the superior productiveness of this region, that when the completion of its great series of public works shall bring a bushel of wheat on the plains of Indiana within a few cents in price of a bushel in New-England, its production in New-England must cease. The same cause will probably operate to change the culture of portions even of our own State; for the unequalled fertility of the West will always enable it to supply those products requiring richness of soil with a less amount of labour and consequently at a cheaper rate, than they can be produced within our own borders.

The consequences then of perfecting these systems of intercommunication will inevitably be a distribution of labour, on a grand scale, throughout the whole northern part of the continent: the maritime portions engrossing the active pursuits of navigation, commerce, and manufactures, while this central group of agricultural States will become the common granary of the Union, and discharge the important duty of supplying subsistence to all the surrounding communities. Indeed they have begun even now to perform that office. The vallies of the Miami, the Wabash, and the Illnois, are already pouring out their overflowing riches upon the cotton planting States below; and, although their power of exportation has hitherto been kept in check by their rapid increase in numbers, yet it is stated, that during the last season, exports amounting in value to 15 or 20,000,000 of dollars descended the Mississippi and its tributaries, from that part of the valley north of the Ohio, and constituting a portion of the great district in question. Nor is this descending stream of trade wholly withdrawn from our own channels of conveyance, for its proceeds find their way by a circuitous course through the canals of New-York, and in that form swell the revenues of the treasury:—and the fact will stikingly illustrate the value of the Union, in binding in bonds of mutual benefit all our commercial interests, both foreign and domestic, and in animating every portion of our various industry, that the food thus exported from the inmost recesses of the West—exchanged for cotton at the mouth of the Mississippi—exported in that form to the workshops of Europe—again exchanged for their fabrics, and brought home by our shipping to the seaports of the north—is at last returned through the Erie canal to the luxuriant vallies from which it first originated; thus revolving through the whole circle of our wide-spread commerce. It is only when we view the Erie canal as one of the mighty segments of that vast circle, that we can rightly estimate the importance and grandeur of its connexions.

It is necessary also to be apprized of the course of this trade, in order to explain the disparity in value which will always exist between the descending and ascending cargoes. The amount of merchandise now sent into the Western States very far exceeds that of their products reaching the Atlantic sea-board. An additional reason exists, it is true, for this difference. The flood of emigration which has poured into that portion of the country has temporarily produced so great a disproportion between its consuming and producing classes, that they have scarcely been able to obtain an adequate supply of food even from their own exuberant soil. Population has outstripped production: so that their agricultural products, instead of seeking a market in the eastern portions of the Union, have been sent westward in large quantities into the upper lakes; and such is the movement which animates all that region, that more than four hundred vessels, during the last year, reached the port of Chicago, at the southernmost extremity of Lake Michigan. So long as this great influx of population shall continue, the capacity of these interior States to supply tonnage for the Erie canal will be necessarily diminished, but the effect will be only to augment more enormously their eventual power of exportation; and thus the present temporary check is but adding increased energy to those causes, which are operating with concentrated force to swell our future commerce.

The progress in population of that portion of this inland territory, immediately adjacent to the lakes, has been three times as great as its progress in the portion adjacent to the Ohio. The ratio of increase in the former, between the years 1820 and 1830, (as shown by the census) was 130 per cent., and in the latter, only 44 per cent.; and the comparative rates since that time have not, probably, lessened. And this circumstance explains why so large a surplus should have been furnished for exportation from the section near the Ohio, in comparison with that which has hitherto found its way from the lakes into our canals. The total amount of tolls, realized by our treasury in the year 1836, from property passing to and from the country surrounding the lakes, was only $385,000, or less than one-twentieth part of the sum paid annually for transportation on the Mississippi, and its confluents. To fix the precise period when the population, now swarming into this district, will reach the point when their power of furnishing products for exportation, will fully exhibit itself, is, of course, impracticable. The same causes which operate to diminish their exports, now that their population has reached to three millions, may not be wholly removed, when its numbers shall be doubled, but it may be confidently predicted, that before that time they will be so firmly seated on their productive soil, as to be able to supply a vast surplus of food for export.

The population of the western portion of our own State still continues to increase with considerable rapidity, but it nevertheless furnishes an annual export of at least $20,000,000 in value. By the year 1845, the States of the West, surrounding the lakes, will hold the same relative position in respect to the whole of the Erie canal, which the counties of New-York, west of the Seneca lake, now bear to that part of the line east of Utica. Our trade will then be measured, not by counties, but by sovereign States, themselves containing their fifty counties; and our revenues, no longer dependant on the villages and townships scattered along the borders of the canal, will be drawn from the wide-spread and populous communities, inhabiting the broad expanse between the Ohio and the Lakes.

We obtain, then, the following facts, by which to guide the present inquiry:—

That the value of the tonnage, annually transported on the canals of this State, being $67,634.000, and the tolls paid being $,1,614,000, the rate of toll is about $2\frac{1}{10}$ per cent on the value of the tonnage:—

That this rate increasing according to the distance from tide water, of the place from and to which the tonnage is transported, the rate paid on the western section of the Erie Canal, is probably as high as four, or even five per cent.:—(The present toll of 32 cents on a barrel of flour worth $8, passing the whole length of the canal, is 4 per cent., or 5 per cent., if valued at $6:—)

That the rate of toll, on commodities passing to and from the States west of Buffalo, may therefore be safely assumed to be equal to at least *two* per cent. on their value; and it is believed, that the interests of the State will not require a reduction of the tolls below that rate:—

That a population, within this State, of one million and a half of inhabitants, furnished a tonnage of $50,000,000 to the canals,—and that, therefore, the population of the States in question, when it shall amount to six millions, can furnish a tonnage of $200,000,000. It may, however, be allowed, that a considerable portion, and perhaps two-fifths of their exports, will continue to descend the Mississippi and its tributaries, and that one fifth of their imports may ascend that stream.

We shall then have these results:

Descending cargoes, after deducting two-fifths, . . .	$60,000,000
Ascending cargoes, after deducting one-fifth, ...	$80,000,000
Total trade, ...	$140,000,000

At a meeting of the citizens of Cooperstown and its vicinity held at the house of Isaac Lewis on the evening of the 30th of January, instant, James Stowel was appointed Chairman, and Geo. A. Starkweather, Secretary. The meeting being thus organized, Ephraim Beach, Esq., the Engineer, who had been previously employed for the purpose of making a survey of the route from Cooperstown to intersect the Catskill and Canajoharie Rail-road, presented the following Report, which being read, on motion of James Stowel, Lawrence McNamee, Henry Phinney, Robert Davis, and Harry Clark were appointed a committee for the purpose of procuring the publication of said Report, and calling future meetings relative to the contemplated improvement.

JAMES STOWEL, Chairman.

Geo. A. Starkweather, Secretaty.

Catskill, January 15, 1839.

To Messrs. Stowel, Phinney, Jarvis, Roff, and others, of Cooperstown.

Gentlemen—In compliance with your wishes I have partially examined the ground, and caused a survey to be made of the route for a Rail-road from Cooperstown to intersect the Canojoharie and Catskill Rail-road, at, or near the Village of Canajoharie.

Commencing at Cooperstown, the route follows the eastern shore of Otsego lake six miles and a half, to where it leaves it, opposite the mansion of the late Geo. Clark, Esq. For this distance the expense of grading a road for either a single or double track will be light. A perfect level can be maintained the entire distance, although by some slight elevations the expense would probably be lessened. Easy curves are necessary to conform to the shore of the lake, but none will be required of a less radius than can be traversed by a locomotive with a speed of twenty miles an hour. The excavation consists almost entirely of earth and loose rock of an argillaceous nature. The embankments are light and of short distances.

Our course from where we left the lake pursues a northerly direction, following the Springfield creek, and crossing the Great Western Turnpike at or near the toll-gate in the town of Springfield. Thence pursuing the same direction until we come to the summit at the top of Springfield hill, a distance of thirteen miles from our starting point.

From the lake to the summit there is a gradual ascent of about thirty feet to the mile. The expense of grading this section will not materially differ from that of the other. The curves, if any are necessary, will be light. Indeed the nature of the ground from Cooperstown to the summit is extremely favorable for the construction of a Rail-road. With no curves of a less radius than eight hundred feet, and the excavations and embankments all of a light nature, it will at once be perceived that this part of the road can be constructed at a comparatively small expense.

Our course from the summit, was in a south-easterly direction, keeping upon the high ridge at a distance of about half a mile from Salt Springville. In descending from the summit to the valley of the Bowman's creek, I adopted a grade of eighty feet to the mile, although I am convinced from subsequent observation, that the descent can be accomplished with a grade of seventy, and probably sixty feet per mile, with a trifling additional expense.

Commencing then at the summit with a grade of eighty feet per mile, and crossing the Cherry Valley road a short distance below the Sulphur Spring, we continued our descent on the side-hill; and after crossing numerous ravines, reached the valley of the Bowman's creek at a distance of nine miles from the summit, and three miles from Ames'.

This will be the most expensive section of your road, and the only portion of it in which any difficulty will be encountered. A number of excavations and embankments, as well as curves will be necessary, attributable to the irregular surface of the ground.

There are circumstances, however, that will tend to diminish the expense on this part of the road. The land from its sequestered position and rugged nature will probably be given to the company, and at all events, can cost but a trifle. The timber for the principal part of the superstructure, can be found on the line of the road, and thus not only save the expense of transportation, but have it ready at all times, and at the necessary points, where its use will be required.

From the point where our line strikes the valley of the Bowman's creek, we proceed in a south-easterly direction, passing at a short distance from and south of the "Bowman's creek Meeting-house," and following the course of the creek, left Ames' four chains to the south. Thence pursuing the same direction, after crossing two inconsiderable ridges, we intersected the line of the Canajoharie and Catskill Rail-road at Flat creek, a distance of sixteen miles from the summit.

From the point where the line strikes the Bowman's creek flats, to the termination, the route is feasible, and for the greater part, can be easily constructed. For the last mile or two the descent is considerable, but not so much as to render the route in any degree unfavorable.

As the survey was an experimental one, and made with a view of ascertaining the fact, whether a feasible route could be found for a Railroad between Cooperstown and the line of the Canajoharie and Catskill road, the most favorable route was not particularly sought for, and therefore but one was explored. Our object being accomplished by finding a practicable route, it must be left for subsequent, and more accurate surveys to determine upon the location of the road. For the same reason the actual cost of the road may, and probably will, fall short of the subjoined estimate. It is based upon the hasty survey of a route, which it is not probable will eventually be the line of the road, and which, for this reason, cannot claim to be accurate in its details. For the sake of convenience, I have divided the road into four sections, in the estimate of its cost.

The first section extending from Cooperstown along the lake shore six and a half miles. For grading, say about $5,000 per mile, ...		$32,500 00
Section second extending from the lake six miles and a half, to Springfield summit,		
For 65,000 cubic yards earth excavation, at 15 c	$9,759 00	
2,000 cubic yards rock excavation at $1	2,000 00	
73,122 cub. yds. embankment, at 20 c	14,624 40	
1,000 cubic yds. masonry, at $3	3,000 00	
Grubbing and clearing,	650 00	
		39,024 00
For the third section extending from the summit to Bowman's creek flats, nine miles,		
For 132,534 cubic yards excavation at 13 c	17,229 42	
144,846 cubic yards embankment at 15 c	21,726 00	
1,050 cubic yards masonry in bridges at $3	3,150 00	
843 cubic yards masonry in culverts at $2	1,686 00	
Grubbing and clearing,	4,000 00	
		47,791 42
For the fourth section extending from the Bowman's creek flats to the Canajoharie and Catskill line, seven miles,		
For 57,830 cubic yards excavation at 15 c	8,674 50	
35,032 cubic yards embankment, at 15 c	5,254 80	
1,500 cubic yards masonry, at $3	4,500 00	
Grubbing and clearing	1,500 00	
		19,929 30
Total amount for grading, ...		130,215 12
For 29 miles superstructure at $4,500 . .		130,500 00
Total for grading and superstructure		260,745 12
Add for contingencies 10 per cent.		26,074 51
Add for Engineering 5 per cent.		14,340 98
Total cost of road		$361,160 61

The above estimate is based upon the calculation for a graded surface of fifteen feet in width, with a foot to a foot and a half slope. The superstructure to be laid in the same manner as that of the Utica and Schenectada road.

Permit me, gentlemen, to offer a few remarks on the advantages of a Railroad from Cooperstown to the line of the Canajoharie and Catskill road. Within the past few years, and indeed since the permanent utility of Railroads has been demonstrated, enterprise in this species of improvement has far excelled that in any other. Since the first successful experiment in this country, applications have been made and charters granted for Railroads to an unlimited extent.

The State of New-York has taken her stand among the first as an advocate for this kind of improvement, and the roads completed, together with those in progress of construction, conclusively show that her citizens fully appreciate the value of, and are determined to reap the advantages to be derived from their successful introduction as auxiliaries to commerce, manufactures, and agriculture. That a Railroad from Cooperstown to Canajoharie would not only be of the greatest importance to the section of country to be accommodated, but would also amply remunerate those who should invest their capital in the enterprise, there is in my mind no doubt.

Cooperstown, the county seat of Otsego, is one of the largest and most respectable villages in the State. Situated upon the head waters of the Susquehannah, and surrounded by a populous and fertile district of country, it will be eminently qualified to become the market and outlet for the produce of the upper valley of the Susquehannah, comprising the county of Otsego and parts of Chenango, Delaware and Madison. The increase of trade which would naturally accrue to Cooperstown from the completion of the Railroad, would render it one of the first inland commercial towns in the State. The only barrier then to its increase of prosperity and rapid growth, is the want of an easy communication with the Erie canal or Hudson river.

To overcome this difficulty, your proposed railroad is well calculated. It will open a channel of communication with both the above-mentioned thoroughfares, and will not only greatly diminish the expense of transportation, but produce and goods can be sent to, and received from, New-York in less than one-fourth of the time that is now required.

A few individuals residing on the line of the proposed Railroad, have expressed an opinion that a hard or McAdam road would be preferable. The idea I think an erroneous one for the following reasons.

A road of this description, constructed in a workmanlike and substantial manner, would cost nearly or quite as much as a Railroad, without securing any of the peculiar advantages of the latter. Again, from the expense of its construction, the tolls would necessarily be taxed at a high rate, and thus prevent the road from being much travelled on, except at those seasons of the year when other roads are impassable, or in a very bad condition. Neither would the Stockholders receive any pecuniary benefit; the tolls collected would be barely sufficient to keep the road in suitable repair. From the above reasons I believe the project of a McAdam road to be entirely impracticable, and I believe this also to be the opinion of a large majority of those immediately interested.

That the stock of the Railroad will yield a fair per centage on the investment will not be questioned. The immense amount of transportation, now carried on by teams, together with that which will be diverted from other channels, would, of itself, warrant the construction of the road. The profits to be derived also from other sources will leave but little risk for those who shall invest their capital in this enterprise.

In conclusion, I would say, that public convenience, as well as private interest, demands the speedy construction of this road, and as an old citizen of Otsego, and one who feels a lively interest in the welfare of her citizens, their prosperity will always be cherished by me with fervent and affectionate regard. EPHRAIM BEACH, *Civil Engineer.*

The Coal Trade for 1838.

The following is the quantity of Coal shipped from the different regions in 1837 and 1838:—

	1837.	1838.
Schuylkill,	523,152	431,719
Lehigh,	192,595	152,699
Lackawanna,	115.387	78,207
Beaver Meadow,	33,617	44,966
Hazleton,		14,221
Laurel Hill,		2,001
	864,751	723,813

Decrease in 1838, 140,938 tons.

The consumption of Coal, as near as can be ascertained, was in

		Annual increase.
1831	177,000	
1832	329,000	150,000
1833	413,000	84,000
1834	457,000	41,000
1835	556,000	100,000
1836	682,000	126,000
1837	664,000	decrease.

The consumption for last year, owing to the ruinous effects of the Government experiments on the currency, causing a general depression of business, and the almost total cessation of the manufacturing operations throughout the country, being about 20,000 tons less than the preceding year. This produced a consequent dullness in the coal trade the past season, which has been almost ruinous to those engaged in it. The quantity on hand at the opening of the navigation in 1838, over and above last year's consumption at all the different depots, has been estimated at 200,000 tons; this may probably supply the deficiency of this year's trade, and allow for the resumed operation of the manufactories. For if to the supply of this year 723,813 tons, we add the 200,000 surplusage of the last, we have in market 923,813 tons to meet the demand, giving 254,000 tons over and above the consumption of last year. This quantity, should the winter continue as severe as it has set in, and the manufactories continue their operations, will probably be all consumed before the opening of the navigation next spring.—*Miner's Journal.*

The Effects of the Recent Freshet on most of our large rivers, though very destructive on our various improvements, have proved less so than was imagined. The damage was mostly done to bridges, and those portions of railroads passing over inundated swamps. From its exposure in that respect, much injury was sustained by that portion of the Baltimore and Philadelphia Railroad, between Philadelphia and Wilmington. This however, is, we understand, rapidly undergoing the necessary repairs.

The Convention of Civil Engineers is at present in session in Baltimore. We shall lay before our readers the earliest intelligence of their proceedings.

AMERICAN
RAILROAD JOURNAL,
AND
MECHANICS' MAGAZINE.

No. 4, Vol. II. New Series.] FEBRUARY 15, 1839. [Whole No. 328. Vol. VIII.

[We are under obligations to an esteemed friend and correspondent, for a description of the interesting process of gold-washing—of which he has had the opportunity of examining during a residence in the Gold Region.]

For the Railroad Journal and Mechanics' Magazine.

The Gold Region in the State of Georgia.

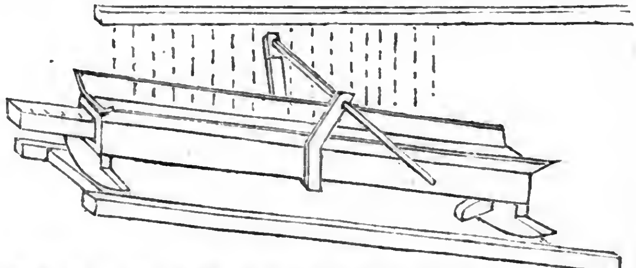
THE Gold Region in the State of Georgia, embracing a tract of country about ten miles wide, running north-east and south-west, lying just within the base of the Alleghany Mountains, (or, taking the local name, the Blue Ridge) in the centre of which, and traceable throughout its whole extent, is what is called the "Great Slate Vein." This great slate vein consists of slate rock, through which are numerous veins of auriferous quartz. The gold mines lying in, or immediately adjacent to, this vein, are the richest, and no mines of any moment have yet been discovered more than five miles north-west or south-east of it.

I am informed that the characteristics of the deposit mines are the same throughout Georgia, North Carolina and Virginia, but having been engaged solely in Georgia, I can speak positively only of the Georgian Mines. In these (deposit) mines, the gold is formed in detached particles or masses, and is entirely separated from everything else, by means of water. It is seldom more than 12 or 15 feet below the surface of the earth, and is found more or less in all parts of every valley or meadow in the gold region. It prevails, however, just below and opposite the point of a ridge terminating in the valley or meadow, apparently justifying the supposition that at some remote period of time the hills had been ruptured, and the gold contained in their bowels washed down the stream, and deposited in eddies formed by the projecting fragments of the hills. The situation of the gold would justify this opinion—and the appearance of the gold itself would declare its having been subjected to the action of an intense heat. The fanciful may combine these two phenomena, and they will find ample field for theorizing, as to the formation of the gold, and its lodging where it is found.

On removing the alluvial to the depth of six or twelve feet, a stratum of gravel is discovered of varying thickness, sometimes three, sometimes ten, but generaly four or five feet; *in* this gravel, and between it and a stratum of soft slate, on which it rests, the gold is formed. The gravel consists of white quartz pebbles, beautifully rounded and uniformly smooth, giving ample evidence of having been subjected to great friction—a yellowish earth forms the matrix of each pebble, in which it is so firmly wedged as to require loosening with the pickaxe. The slate beneath, which occurs of all colors, and is seldom more than twelve inches thick, may be rubbed to pieces with the fingers; the gold sometimes exceeds two or three inches in the slate.

The machinery used for separating the field and earth are very simple, such as can be put together by ordinary workmen They are principally the "Long Tom," and the "Rocker." The Long Tom (the simpler machine, and used exclusively for working on a small scale) consists merely of a trough made of three planks nailed together, planed at a slight inclination, the lower end rests in the end of another horizontal trough made to receive it, the bottom of which is a cast-iron plate pierced with holes. Immediately below the plate, another trough is placed at a greater inclination than either of the others, generally slanting in an opposite direction; across the bottom of this lowest trough, bars are placed dividing the "riffler," as it is called, into different apartments. A small run of water is let into the trough at A, by means of which the earth is washed. The Tom is generally placed directly along side of the pit to be worked, the gravel thrown into the machine between A and B, and, if of a clayey nature, as is sometimes the case, is rubbed backwards, until the stones are clean; the dirt from the stones is conveyed by the water down upon the plate through the holes, and is caught by the riffler underneath. The specific gravity of the gold causes it to descend to the bottom of the apartment, while the dirt being lighter, is beaten up by the water, and passes from one division to another, depositing in one chamber what gold may have been carried over from the preceding. The larger stones are slid over the plate and thrown away from C. The horizontal trough B C, is about four feet long; D should project beyond B, that all the sand may be caught; B H may be one trough, or a succession of any number. This machine is very simple, and may be easily attended to. Five hands form a full complement, but three can attend to it well. The principal objection is, that it does not wash enough earth in a day.

The "Rocker" is a somewhat different machine, consisting of a "Riffler," as in the Tom, except that the bars are concave on their upper edges, so enclosed in a frame that it may be drawn out (as a drawer) or wedged in, so as to move only with the machine. This frame is supported on rockers like those of a child's cradle, which play backwards and forwards, on four pieces of timber, placed in a parallelogram form, fixed, temporarily, on the ground so as to give the whole machine a slanting position—but to keep the machine from slipping off, each rocker plays over a pin projecting upwards from the head and tail piece of the parallelogram. Extending over the riffler, and parallel with it, are (generally three) plates of cast-iron, the head-piece solid, the rest pierced with holes like that of the Tom. On each side of the plate, to keep the earth that is washed in the machine, are placed pieces of plank. The whole machine is worked by means of a handle or lever fixed to the body of the machine. I have here represented the riffler partly drawn out.



* The engraving of the "Tom" will appear in our next number.

Water is conveyed by means of troughs directly over the machine, where it is equally distributed over the middle and upper portions of the plates. When there are four plates, the whole machine is about 10 feet long. Being brought as near the place of work as possible, the gravel is conveyed by means of wheelbarrows from the pit to a small platform at the head of the rocker, where it is "dumped." A hand, standing ready with a shovel, feeds the machine gradually, throwing one shovel full at a time on the solid plate at the head of the machine, which is hardly waist high. A man at the handle gives the machine a gentle motion—he is sometimes aided by springs, against which the ends of the rockers act—and by the jar causes the gravel to descend gradually over the plates, where it is thoroughly cleansed from the dirt; it falls from the tail of the piece upon a small platform, where a hand stands and removes it with a shovel—the earth and small stones fall through the plates with the water on the riffler. Here, the jarring aided by the specific gravity, causes the gold to settle more perfectly in the chambers, and the earth and light stones to rise and float off better than in the Tom. They are discharged through the spout represented in the cut, between the rockers under the body; a drain leads the water around the tail of the machine, and requires the constant attendance of a hand to clear away the sand that passes through. Hence, four hands at a rocker will give ample employment to two wheelbarrows, and require two other hands in the pit. Thus eight hands are required to work a rocker; but a "gang" usually consists of eleven, the remaining three being employed in "topping," that is, removing the alluvial that covers the gravel. In many mines slaves are employed, but I think the greater part of the labor is performed by whites. At night, when the day's labor is done, the riffler is drawn out, and the chambers are found nearly filled with heavier portions of the sand, they are carefully emptied into an iron pan—the gold to inexperienced eyes still invisible—and taken to a pool of still water, and gently agitated a little below the surface, which causes the gold to settle and some of the earth to glide off in the water; this operation is continued until all the sand is removed, and nothing but the gold left. It is called "panning out," and a careful hand will never lose even the smallest particle.

In deposit mines the gold varies in size considerably; it is sometimes coarse, sometimes fine, and not unfrequently both coarse and fine are found together It is uniformly of a bright color, and when coarse, its surface indicates having been in a state of fusion; when fine, it is sometimes ragged and sharp, at others smooth. By "fine gold," is understood, particles varying in size from such as can hardly be seen, to those weighing three pennyweights; when larger, it is "coarse gold." I know of one mine, and only one, where it is frequently found in the form of flakes connected with quartz rock. But here it was evidently thrown out from a vein without having been melted.

Deposit mines yield variously—sometimes just enough to say there is gold there, and in a few instances, mines have produced 1175, 1400 and 2800 pennyweights in a single day, but these are extraordinary. A person is able to pay his expenses, the wear and tear of his tools, and the price of his hands, 62½ cents a day each, *not* found—when he makes as much as one pennyweight a day for every hand he has employed. A pennyweight is worth on an average 97 cents. A tom costs from one to three dollars—a rocker about thirty. The long-handled pointed shovel is used universally. Old machines are invariably burnt up, and the ashes "panned out," for the fine gold that has lodged in the joints of the wood, and sometimes yield half the first cost.

Having turned my attention almost solely to deposit mines, my knowledge of veins is not of a character to warrant any communication to you about them—when, however, a mine is in full operation, the owner may make accurate calculations as to what his income may be for six months ahead of him. But of the deposit mines, one may exclaim in the language of the mines—they are "mighty uncertain." Respectfully, ———

Internal Improvements of Illinois.

To the Editors of the Railroad Journal and Mechanics' Magazine—

Messrs. Editors—In entering into a description of the internal improvements that this State has undertaken, and occupying as it does so broad a *base*, justice to the subject can hardly be done, when brevity and a correct delineation are the governing considerations in the composition of the communication. An approximation, therefore, in embracing the whole system, is all that I shall presume to reach at this period.

Illinois, in a topographical point of view, may very truly be said to be favorable to the economical construction of works of a public character, and this fact, in connection with the rapid settlement of the State, was, no doubt, the influencing consideration in the framing of the system by the Legislature, who in 1837 embarked in the project. Soon after which, an organization of engineering districts was made, at the head of which, agreeably to the internal improvement law, was placed a Commissioner of Public Works and an Engineer-in-chief; and since this organization, all the preliminary surveys for the various routes authorized to be surveyed, located, and placed under contract, have been finished, or nearly so, and her works are now in a rapid progress towards active completion, having nearly 300 miles now under contract, with a contemplated addition of nearly the same number of miles for contract the coming season—distributed proportionally over the various sections of the State.

To attempt a classification of the different works in the order of their importance, we would, by reference to the map of this State refer to the Illinois and Michigan Canal, as one pre-eminent over any other within the jurisdiction of the State, connecting as it does, Chicago with Peru on the Illinois river, whereby an entire water communication between the former place and St. Louis will be effected, when this new channel is completed. After this, comes the great Central Railroad, extending from Galena on the Mississippi, to Cairo at the junction of the Ohio and Mississippi rivers, crossing the Illinois river at the termination of the canal, and thence to Vandalia and Cairo, *via* several towns of importance, bordering on a general line. After this, the Northern and Southern cross Railroads; also, the Alton and Shelbyville, with its continuation to Terre Haute in Indiana, and many others as lateral branches from Peoria, easterly and southerly to Warsaw on the Mississippi river. After the completion of these works, and their auxiliaries, this State will have every means of transportation to the most remote points, affording every facility for the influx of emigration from all sources, and tending to her advancement in the arts and manufactures of the East.. And, although encountering a heavy debt in the desire to promote the public good of her citizens by the construction of these works, no one will be disposed to question their usefulness as the State advances in population, and her ability to meet these demands accruing at some future period.

The aggregate expense of this system will, in all probability, exceed, by $5,000,000, the amount estimated by the Legislature, when they passed the internal improvement bill.

Without wishing to occupy too much space in your pages, at this time, I shall reserve for a future communication a minute detail of the mode of construction and capacity of these Roads.

EDWARD S——.

New-York and Erie Railroad.

To the Editors of the Railroad Journal and Mechanics' Magazine—

GENTLEMEN,—Through the kind attention of a friend, I came into possession, a few days since, of "the Report of the Committee on Railroads; on the memorial of the President, Directors and Company of the New-York and Erie Railroad Company, and the Memorials of Petitions of citizens of sundry counties," (Assembly Report, No. 67, January 19, 1839)—I take the liberty very briefly to notice what will appear to be a very great error; see Appendix, addressed to the Hon. John B. Scoles, by Samuel P. Lyman, Esq., Commissioner of the New-York and Erie Railroad Company, it is stated—"that the Report of Mr. Johnson, which is an Appendix to the Report of Mr. Holley, of the Committee on Railroads, at the last session, so clearly demonstrates the practicability of the project, *and the superiority of this line, over all other communications, extending, or to be extended, from New-York to the Weetern Lakes, or to the Valley of the Ohio, and its vast importance to the commercial, agricultural and manufacturing interests.*" Now, that these sentiments are entirely erroneous, and this line is *very inferior*, will be readily conceded by the impartial enquirer, when compared with a line of railroads, either made, located or projected, across the State of New-Jersey, *via* Morristown, the Delaware Water Gap, into Pennsylvania, passing through an important timber district, into and over twenty miles length of the purest anthracite coal, and up the valley of the Susquehanna, along the bituminous coal fields of Bradford County, to the New-York State line north of Athens, and within a few hundred yards of the New-York and Erie Railroad, as now located.

It will, on examination, be found *vastly inferior*—because the line to Western New-York through New-Jersey and Pennsylvania is more direct, and about seventy-four miles nearer in going towards the Western Lakes *via* Elmira; because on this line there are several great coal, iron, and timber districts; because no grades exceeding 45 feet to the mile need be adopted, and stationary power is not required; because it would add a population of 150,000 people to the business community of the city of New-York, and would certainly supply the city and the Western and Southern counties of the State of New-York with coal and other supplies at the cheapest rate, to any desired extent; because it would lessen the expenditure of at least one million of dollars, and the freight and toll one-sixth on the whole business.

The charters and laws are all obtained, and the citizens of New-York will find, on enquiry, that there are no hindrances to the immediate construction of this line of Railroad to intersect the New-York and Erie Railroad, provided that the means are furnished to carry it out, by your city, and those means required will be comparatively small.

A SUBSCRIBER.

Monroe County, Pa. February 9, 1839.

Report upon the Finances and Internal Improvements of the State of New-York.

(Continued from page 92.)

At the present rates of toll, say at four per cent., this trade would yield an annual revenue to our treasury of $5,600,000; and if reduced to two per cent., it would yield $2,800,000; and even at one per cent., (equal to 2 cents only on a bushel of wheat) it would yield $1,400,000.

The evidence furnished by these facts has therefore satisfied the committee, that the estimate of the Canal Commissioners, that the tolls of the Erie canal when enlarged will, at the present rates, pay annually three millions of dollars, and that one-half of that sum will be received from property passing to and from other States, is, to say the least, not exaggerated.

It will be observed, that many of the views which are above taken of the future magnitude of our inland commerce, will be applicable to the two lines of rail-road which are to traverse our territory from the Hudson to Lake Erie. The immense effects which these wonder-working instruments of commerce are to produce in securing the trade of the West to the Atlantic States, and in binding the most distant portions of our country in bonds of beneficial intercourse, would furnish, upon the proper occasion, a subject of interesting and profitable inquiry. Nor need it be apprehended that they will affect injuriously our fiscal interests,—for so far from lessening the commerce of the canals, they will more probably serve to secure and increase it, by affording the means of rapid transportation for property and persons, during those winter months in which their navigation is impeded, and thereby preventing the diversion into other channels of those more bulky products which furnish to canals their most lucrative revenues.

Regarding the event as not improbable, that the State at no distant period will take these great thoroughfares of trade and travel as public property, and that they are eventually to become a portion of our system of public works, of which all the parts will mutually sustain and strengthen each other,—the growth of the West in swelling their revenues is by no means a matter of indifference to the public treasury.

The committee will not trespass upon the attention of the House, by expatiating upon the grandeur of the prospect which would open upon us, were we to look beyond the brief period which the present view has embraced. It is for the philanthropist and statesman, to indulge those feelings of honest hope and patriotic pride, which cannot but arise, in contemplating the mighty realities which the future has in store. The duty which the present occasion has required of the committee, has been of a more practical character. They have attempted honestly, perhaps over zealously, to show that our own noble State is neither ruined nor bankrupt,—that its treasury is neither impoverished nor exhausted,—and that, however impeded in its progress by a narrow policy which would retard its growth, undervalue its strength, and stifle its energies, it is yet vigorous and erect, and able to move onward with a giant's power. They have sought to show that the foundations of our prosperity are deeply laid; that our resources are manifold, and that they will prove adequate to any efforts which government may make, to promote the prosperity, reward the industry, or stimulate the enterprize of our citizens, whether occupying the fair and fruitful plains of the west,—the forests and mines of the north,—or the sunny slopes and fertile vallies of our southern and midland districts.

They will not attempt to measure the consequences which the completion of a great and harmonious system of intercommunication, extending into the utmost recesses of the interior, and concentrating within our borders the trade of the most populous portion of the continent, will produce, in augmenting the aggregate riches of our State;—in covering its surface with opulent cities;—in swelling its commercial marine;—in securing its political supremacy;—and enlarging, in all respects, its prosperity, power, and glory. Nor will they seek to compute the pecuniary results which this vast and ever increasing stream of inland trade, flowing through our territory for all future time, will produce in augmenting the wealth of its commercial metropolis. The history of Venice, in its palmiest days, stretching her long line of islands and colonies far into the East, and controlling by her position the commerce of Asia, presents but a feeble picture of the splendour and riches which our own great mart must eventually attain

Still less will they seek to span within their narrow arithmetic, the pecuniary value of the illimitable West. Were they to state that from an assessed value in 1798, of only 26 millions, for all the vast territory west of the mountains, stretching from the Gulf of Mexico to Lake Superior, wealth has arisen and been created within the short space of forty years to the amount of twelve hundred millions of dollars, they would have attained only the first step in that long series, by which an empire is to ascend to a height of power and dominion as yet unequalled in the history of our race.

Least of all will they attempt to compute the pecuniary consequences of these great arteries of trade, in cementing and preserving the union of these free and flourishing republics. It is not for New-York, or her sons, to "calculate the value" of that sacred bond. But if we would catch a glimpse, however imperfect, of the gigantic stake which is depending on our prudence and patriotism—if we would count the cost of ruined cities, and desolated fields,—of our lakes and rivers, obstructed by fleets and fortresses in war, and by commercial restrictions still more destructive in peace, we may contrast Europe as it is, couvulsed by centuries of strife, and broken into jarring, disunited, and discordant communities, with Europe, as it would have been, had its whole population been united like ours, at the very origin of their governments, under one common law, speaking one common language, and bound by one common constitution.

Let us then go forward in the broad path of duty which is spread before us--and in riveting, as now we may, the bonds which unite the mighty members of this glorious Union, discharge those high and solemn obligations which we owe not only to ourselves and those who surround us, but to the long line of generations who are to follow in after ages.

The committee, in order to carry out the views of this report, will prepare a bill, making the necessary appropriations, as soon as their object and amount shall be determined by the proper committees, and sanctioned by the House. In the mean time, they beg leave to submit the following resolution:

Resolved, That it is not necessary or expedient to levy a direct tax.

Samuel B. Ruggles,
Victory Birdseye,
Thomas B. Cooke,
Abner Lewis,
} *Committee of Ways and Means.*

March 12, 1838.

Report from J. J. Abert, in reference to a Canal to connect the Chesapeake and Ohio Canal with the City of Baltimore.

(Continued from page 77.)

54. *Leakage at locks.*—It is highly important that losses from this cause should be considered in every estimate of water for a canal. Unlike filtrations, these are least at first, and increase as the canal is used. The water passes under t e miter sills, between the gate-posts and the hollow coins, between the gates where they meet, from the valves, and under the bottom of the gates. All these are closer when new, and, from gradual wear and other causes, open more and more every day, until repairs, and ultimately, new gates become necessary. It is also worthy of remark, that in a series of locks, all depending upon the same source for supplies of water, it is the lock of greatest leakage which must be considered. If the second lock of a series, for instance, leaks more than the first, then the leakage from the first will not keep up the intermediate level, as more than it supplies is drawn off by the second lock. So, also, if the lock of the greatest leakage be the third or fourth. And when many locks are dependent upon the same source, it would be absurd to suppose that each was constructed, and its gates fitted with the same care. So that a slight accident to any one of a series, not sufficient to justify the stopping of the navigation for repairs, increases the leakage, which the summit has to supply. On these accounts, there can be no average of the leakage from many locks as the basis of an estimate, or as proof of what a canal loses from this cause. It must lose that which leaks from the lock of greatest leakage, and cannot lose less.

Losses from this cause, in long levels, are not so serious nor so sensible to observation as in short ones. In these last they are both soon observed and felt.

55. Andreossi (p. 223) reports the result of observations on this account, of loss experienced on the Languedoc canal, by the engineer, Mr. Pinn. These observations were made upon many locks, and the mean of the whole is stated to be 10 litres, or 610·28 cubic inches per second. The objection to this result is, that it is a mean of the whole, instead of being the loss from the lock of greatest leakage, which, as we have already shown, is the actual loss sustained.

26. Ten litres per second is equal to 30,514 cubic feet per day; or, for the two locks, one at each end of the summit, 61,028 cubic feet, (our measure); which, in a month of 30 days, would amount to 1,830,840 cubic feet, or to 67,808 88 cubic yards, (say 67,809); which for the ten months of navigation, would be 678,090 cubic yards.

57. The size of the locks of the Languedoc canal is very great, and their curved sides give an unusual cubic content. Owing to this form of construction, (bad in itself, and long since abandoned) we cannot well make a comparison of its prisms of lift with the leakage of its locks.

58. There is another reflection proper to be made. All other things being equal, the leakage must be in proportion to the perpendicular height of the water, or to the pressure to which the orifices or openings are exposed; and also the leakage surface (that is, the joints) must be in proportion to the lift of the lock and the width of the gates.

59. These circumstances render the applications of observations on canals of extremely doubtful propriety, where we are not fully possessed of a knowledge of all influencing dimensions and causes. Upon the

same canal, the width of the lock-gates must be the same, but the lift of the locks need not be, and often does vary considerably. Now, in the very canal we have named, the second lock from the summit in one direction has a lift of more than 9 feet, while that of the first is about 7½ feet; the ninth lock also has a lift of between 11 and 12 feet. It is clear, therefore, that the average from the leakage of such variable lifts must give a false result (and false to a great amount) of the absolute quantity really drawn from the summit to supply the leakage of the locks, which, as we have before remarked, can never be less than that of the lock of greatest leakage. At the opposite end of the summit, among the locks depending upon the summit for its water, there is one of more than 12 feet lift. The summit is therefore really subjected to the leakage from these two locks of so great a lift. We will take the two extremes, of 7½ and 12 feet, to illustrate our reasoning by an example.

60. The discharge under the two pressures, 7½ and 12 feet, being to each other as the square roots of the pressures, are about as 27 is to 35, or the discharge from the latter is about one-third more than from the former; which would make a loss of 004,120 cubic yards for the ten months, by taking the lock of the grestest leakage.

61. Although we cannot make a just comparison of this loss with the prism of lift of the locks of this canal, on account of the reasons heretofore stated, we will see, however, what it would be if the sides of the lock-chamber were a right line, and the chamber an oblong square instead of an oval.

62. Taking the dimensions of the first lock from the summit, and reducing its cube by straightening its sides, we shall find its lock-full, or prism of lift, to be about 346 cubic yards. The corrected prism of lift being then 346 cubic yards, (Gauthey, p. 48,) and the leakage at the lock-gates being 1,130 cubic yards per day, it amounts to nearly 3¼ locks-full (prism of lift) per day for one lock. But the increase of this leakage, on account of the lock of greatest leakage, will bring the amount to 1,507 cubic yards per day; or rather more than 4⅓ prisms of lift, or 8⅔ for the two locks, one at each end of the summit. If our views of the case be therefore correct, this uncommonly well made and carefully attended canal loses this last quantity daily from its summit by the leakage of its locks.

63. Messrs. Fisk and Hughes, in their report of March 1837, (p. 16, 17,) fix the leakage at each set of locks adjacent to the summit at 12 locks-full (prisms of lift) per day. This was the result of very careful observations upon the locks of the Chesapeake and Ohio canal, made by Mr. Fisk, its chief engineer. All the locks of this canal are about the same lift, and the same dimensions in other respects: *i. e.* 15 feet wide, with a lift of 8 feet. Now, as the workmanship of these locks is probably the best in our country, and as that of other canals ought to be as good, we may take them as evidence of the degree of perfection to which we are willing to go in such matters, or which we are able to afford. As we believe, also, that the gates are as carefully attended to on this canal as on any other in our country, its results are, on that account likewise, a good criterion. The observations, however, were made during a period of suspended navigation, when the gates were closed with great care, and kept so for several weeks, while repairs were being made. Mr. Fisk has assured me that, in his opinion, the actual leakage of the gates when in activity, exceeds the amount stated, great as it may be considered; we have, therefore, the assurance of the chief engineer of the canal, that it is less than that which really occurs to the canal when in use. 14

64. We have ourselves frequently observed the leakage at the locks of this canal, and we are satisfied that Mr. Fisk has not exaggerated the loss. Twelve locks-full per day, for each lock, is half a lock-full (prism of lift) per hour. Now, to bring this rate of leakage more within the judgment of the general reader, and to enable him to test it by what he may himself have observed on canals, we will make a comparison in a shape in which the quantity will be more readily comprehended than that of the rate of cubic feet per minute. Half a lock-full per hour is 62½ cubic feet per minute: the lock-chamber being 100 feet long by 15 wide, will give a superficies of 1,500 feet. Now, this rate of leakage would not raise the water in a lock of this size more than one foot in twenty-four minutes, or half an inch per minute.

65. This leakage is twice and a half as great as that of the locks on the Languedoc canal. We acknowledge it to be great, but, as the workmanship of the locks on the Chesapeake and Ohio canal is as good, and the vigilance of those who attend upon them as active as we have a right to expect for the canal in contemplation, we can see no other correct course than to adopt, in our reasoning upon the water for that canal, the leakage just given.

66. The locks in the two cases—the Languedoc and the Chesapeake and Ohio canals—are sufficiently similar in their dimensions to attribute much of the differerence of leakage to differences in the manner of building. One is the work of a government, the other of an incorporated company; one was built by the agents of a gorernment, the other by contractors; with one, no expense in materials or skill in execution was spared; in the other, too generally, the lowest bidder was taken, who must of course secure his own profit in the kind of work and quality of materials. In works of this character, no system is so pernicious, or in the end so costly, as that of giving work to the lowest bidder under the delusive expectation of saving. Good work cannot be done for less than a just valuation: and when bids for less are made, they can result only in the ruin of the contractor, if he be faithful, or to the prejudice of the work, if he be not. The former is avoided with extreme care; the latter more generally occurs; and its consequences are, enormous expenditures under the head of "repairs," to which our public works are so frequently subjected, always exceeding the supposed savings on the accepted bids. An intelligent and skilful contracter will not offer to do work for less than its proper value; the uninformed, the inexperienced, or the unfaithful, may; and from the system pursued, in the hands of these latter our public works are generally thrown. No boast is so replete with false reasoning, so delusive to society, as that frequently made, of having let work at prices much reduced from those of the engineer's estimate.

If the engineer be competent, his estimate is no more than a fair cost of the work; then, if that work be let for less, it can only be to the prejudice of the work.

67. Our works must also partake of the degree of skill and experience in our mechanics, which is well known to be rather below the standard required for similar structures in Europe.

68. On these accounts, therefore, as well as the necessity of economy in first cost, it may easily be conceded that our canal structures are not carried to that degree of perfection which is found in other countries. By the way, upon this matter of economy in first cost it may be well to say a word or two. It should not be understood as meaning numbers of dollars, in comparing mile with mile, or lock with lock; but in the quantum of labour

which the same amount of money will command in the two countries. In our country, the wages of mechanics and of laborers are so much higher than in Europe, that the same amount of service cannot be obtained for the same cost; and, of consequence, works of the same cost in money must be inferior, because of the less labor upon them. Unless this idea is maintained, we always deceive ourselves in making comparison with similar works in Europe. While, therefore, I readily admit that the work of the Chesapeake and Ohio canal is probably the best of that kind in our country, yet it may, however, be said that it is inferior to similar works in Europe.

69. We may, then, without violation of probability, place this difference in the leakage of the locks to differences in the quality of the structures; and we may, also, from the character of the work on the Chesapeake and Ohio canal, assume its lock-gate leakage as a fair basis for estimates in our country,

70. But to return to the subject. Twelve locks-full (prisms of lift) for the lock at each extremity of the summit, is 24 locks-full per day. Each lock being 100 feet long, 15 feet wide, with a lift of 5 feet, will give 7,500 cubic feet for its prism of lift, or lock-full of water. This will equal 180,000 cubic feet per day, or 6,666.6 cubic yards; which, for a month of thirty days, will be 199,999.8—say 200,000 cubic yards.

71. Accident may increase the leakage of a lock so much as to make the process of filling it tedious; and yet the injury may not be sufficiently great to justify the stopping of the navigation in order to make repairs.

72. The leakage arising from the defective shutting of a valve would increase the loss considerably beyond the amount we have assumed; yet, it would not, in our judgment, be fair to embrace such a case in a general estimate of leakage, while we are willing, however, to admit its probability in the course of a season with some one of the many locks that may be dependant upon the same source for their supply of water. But, at the same time, the probability of such accidents should not be disregarded by the engineer; and while he cannot fairly include them in his estimate of the quantity of water actually required, it becomes his duty to show a surplus in order to meet them, or to point out the deficiency and its consequences.

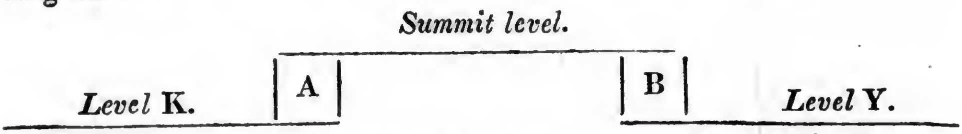
73. *Locks.*—Much has been written upon locks, the manner in which they should be arranged, and their lift, in reference to convenience and to the water they consume. The general result of the whole is, that the most favorable lift is from 7 to 8 feet; that they should be as far from each other as the nature of the ground will admit, and so far as not to impede the navigation by the abstraction, from an intermediate level, of a lock-full of water; avoiding, if possible, aggregate locks, or locks immediately adjacent to each other; and, that among a series of locks dependent upon the same source for supplies of water, the lift should never increase as they descend. It may decrease advantageously, but this is a nicety belonging to the engineer in arranging his plan. The illustration of all these positions would lead to remarks purely professional, inapplicable to the object of the report. and therefore uninteresting. We shall on these accounts avoid it, leaving what may be necessary, if any should be, to the particular case which the plan may develop.

74. The simple question upon which it may be proper to say something at present, is, on the supposition of well-arranged locks at proper distances from each other, what quantity of water will the passage of a boat require.

75. Engineers have given various opinions on this subject: one prism

of lift, one and a half, one and three-quarters, two—all depending upon the degree of presumed regularity in the trade. The matter is familiar to them. We hope they will not suppose it our object to instruct them on a subject upon which they are known to be so well informed. We desire only to make it equally plain to others.

76. To aid in the illustration, we will make use of the following diagram :—



An alternate passage means one wherein the two boats pass each other on the summit-level, or pass the locks alternately.

1st. When a boat in the level K arrives at the lock A, the lock has to be filled in order to raise the boat to the summit. The same process has to be gone through when a boat in the level Y arrives at the lock B, in order to raise this second boat to the summit also. These two boats on arriving alternately at the locks A and B find them already filled by the process we have just described, and immediately pass into them. Then, on descending to the adjacent levels, K and Y, each boat exhausts the lock-full (prism of lift) which had been used to raise the other. This is the case of two locks-full for an alternate passage, or one lock-full for each boat, and which is the least quantity can be exhausted per boat, under the most favorable circumstances.

77. One boat making the passage would consume no more. On arriving at a lock, the lock would be filled in order to raise the boat, and would remain filled after the boat had passed out into the upper level. Then, on descending at the opposite end, it would exhaust a prism of lift, or lock-full.

78. We have said that one prism of lift per boat is the least which can be exhausted under the most favorable circumstances; for, if the lock A or B were full on a boat presenting itself to be raised, the case becomes altered; then the lock must be emptied to admit the boat, before it can be raised; and after this, by which one lock-full is drawn off, another lock-full must be drawn off, to lower the boat at the opposite end of the summit. We see, therefore, that the case of one lock-full per boat is on the supposition of a regularity in the passages and attention to the locks that is hardly possible in practice; in fact, it may be considered as never occurring.

79. 2d. We will now suppose the case of two boats passing in succession. For the first the lock has to be filled; it then passes to the summit. But for the second, this lock-full has to be let off, that the boat may enter the lock; which has then to be filled again in order to raise the boat: the two boats, therefore, are raised to the summit by the exhausting of one lock-full of water. On arriving at the other end, one lock-full for each boat is exhausted, to enable the two boats to descend: in all three locks-full, or prisms of lift, for the passage of two boats in succession. This is a case of one lock-full and a half for each boat, and which also requires the most favorable circumstances; for, as in the first case, if the lock were filled when the first boat presented itself to be raised, it would have to be let off before the boat could enter; which adds another lock-full to the quantity exhausted by the successive passage of the two boats or two locks-full for each.

3d. Suppose three boats to present themselves at the same lock in succession. The first is to be raised by filling the lock; the second, by exhausting that used to raise the first, and filling again; the third, by exhausting that used to raise the second, and filling again. The three boats are therefore raised by exhausting from the summit two locks-full. But on arriving at the opposite end, one lock-full is necessary to let each boat down. The passage of three boats in succession will then require five locks-full, or six, if the lock be full on the approach of the first boat.

4th. If we suppose a passage of four boats in succession seven locks-full, or one and three-quarters to each boat, will be required; or two for each, if the lock be full on the approach of the first boat.

80. We have seen, therefore, that as small a quantity as one lock-full for the passage of a boat is scarcely a possible case; that a lock and a half for each boat is the least that can be used in the successive passing of two boats; that a lock and three-quarters is the least that can be used in the successive passing of four boats; and that, in every case, if the lock be full on the approach of a boat, two locksfull will be required for the passing of the summit by every boat.

81. To generalize the case for any number of successive passages, it is that the least quantity of water which can be used is twice as many locks-full, less one, as the number of boats, (or two locks-full for each boat,) when the first boat finds the lock full on its approach.

82. Our trade is not only periodical, but is at all times in fleets, from the nature of business and the social habits of boatmen. Who ever observed on our canals an alternate direction of every boat? They are generally—I may say universally—in groups or fleets; three, four, or five, in one direction; then three, four, or five in another. Passages may balance each other on the same day in different directions, but this does not constitute alternate passages. If five boats pass in one direction in one hour, and five in the opposite direction in the next hour, it does not constitute the alternate passages upon which the estimate of one lock-full of water for each boat is founded. These are successive passages for the whole number of boats, except one. An alternate passage is, when two boats pass in opposite directions, before either is succeeded by another boat; or, when any number of boats pass alternately, without any *one* to follow another until after a boat from the opposite direction has passed. When fleets from opposite directions meet at a lock, alternate passages are adopted by the rules of canal companies; but when they meet on a level, they pass each other in fleet, and the locks at each end in fleet. On meeting at a lock, equality of rights demands alternate passages; but on meeting on meeting on any level of the canal, equality of rights demands no such sacrifice of time; nor is it necessary, nor would the trade submit to it, nor has any attempt to exact it ever been made.

83. But the passage of fleets in different directions, or of a fleet and a boat, has its influence upon the quantity of water required. We will see what it is; (our reasoning, is applied to the passage of a summit;) but we will first, however, again explain why it is that one alternate passage, which is the passage of two boats in different directions, consumes less water than a consecutive passage, or the passage of two boats in the same direction.

84. In the first case, each boat is raised to the summit by merely filling the lock. The water has not yet been exhausted or drawn off, or let down below the summit; it has only been let into the lock. On passing to the opposite ends of the summit, the locks are found as they were left, filled with water: each boat, on descending, takes only the lock-full, which it

found ready, down with it. As these two boats, therefore, were raised without drawing off any water from the summit, and were let down with one lock-full each, the two consumed but two locks-full in the passage. This is the *alternate passage* of the engineer.

85. In any other order of passing, as has been before explained, and which must be successive, the two boats cannot consume less than three locks-full, or one and a half each. Now, as it can only be two single boats meeting each other which can make an alternate passage, it can therefore only be the two first boats of two fleets; the remaining boats of the fleet make consecutive passages. The case, therefore, of two fleets meeting on a level, or passing in opposite directions, resolves itself into that of a fleet meeting one boat; or, into one alternate passage and consecutive passages for the balance of the fleet. It matters not whether this alternate passage be with the first or any other boat of the fleet; the effect is the same.

86. 1st. The smallest fleet is that of two boats. If a fleet of two boats meets one boat, it constitutes one alternate passage and the consecutive passage of one boat. The quantity of water consumed is, therefore, three locks-full for the three boats, or one lock-full per boat.

2d. If a fleet of three boats meets one, it is one alternate passage and the consecutive passing of two. The four boats, therefore, consume five locks-full of water, or one lock-full and a quarter each.

3d. If a fleet of four boats meets one, it constitutes one alternate and three consecutive passages; or, the five boats will consume seven locks-full of water; which is one lock-full and two-fifths each.

4th. If a fleet of five boats meets one, it constitutes one alternate and four consecutive passages; or nine locks-full for the six boats; being one lock-full and a half each.

5th. If a fleet of six boats meets one, it constitutes one alternate and five consecutive passages, and will consume for the seven boats eleven locks-full of water; or one lock-full and four-sevenths to each boat.

6th. If a fleet of seven boats meets one, it constitutes one alternate and six consecutive passages; or the eight boats will consume thirteen locks-full of water, or one lock-full and five-eighths for each boat.

7th. If a fleet of eight boats meets one, or if (which gives the same result) eight boats pass in one direction while one passes in the opposite direction, the nine boats will require fifteen locks-full of water, or one and six-ninths, or one lock-full and two-thirds each.

8th. And a fleet of nine boats meeting one, or nine passing in one direction and one in another, the ten boats will require seventeen locks-full, or one lock-full and seven-tenths for each.

87. We see by the foregoing, therefore, that more than one lock-full must always be used: that the second supposition requires one lock-full and one-quarter for each boat; the fourth one and one-half; and the eighth nearly one lock-full and three quarters.

88. Now, this is all the rigid result of theory, on the supposition of the most favorable circumstances, which can never be obtained in practice. Irregularities will creep in: they are unavoidable; and, as previously explained, these irregularities soon throw every case into that of a maximum exhaustion, or two locks-full of water for each boat. We are not theorizing, but endeavouring to exhibit practical effects; we must pay attention, therefore, to such practical results as are highly probable.

89. There is another, and not inconsiderable cause of waste, which is, with most propriety, to be placed to the account of lockage, as it is occasioned by the passing of boats: we mean that of the column forced over

waste-weirs, over lock-gates, and down the feeding-flumes, by the wave from the motion of the boat. In an active trade, this will be found to be a serious cause of waste: to which may be added that arising from the fact of the lower gates, after a boat has entered, always being somewhat open until forced to by the current created by letting water in at the upper gates, by which much water is lost.

90. It is somewhat singular that, while two locks-full per boat is the maximum of theoretical reasoning on this subject, it is yet, however, the result of common irregularities of trade and of slight inattention on the part of lock-keepers. Does any one doubt that these irregularities and inattentions are of common occurrence? If so, let him pass a few weeks on any of our canals, and his doubts will be removed. The maximum of theory, then, being no uncommon result in practice, would it be proper—would it be safe for an engineer to estimate a less rate for his lockage? We think not; and we therefore adopt it as the rate by which our judgment of water exhausted from this cause will be governed.

91. A distinguished writer on this subject has introduced, in his calculations, of the water consumed in the passing of locks, a deduction of the quantity displaced by the submersion of the boat. Although we cannot dispute the correctness of the consideration, yet, when a view so rigorous has to be taken in order to prove the sufficiency of water for a canal, it becomes, in our judgment, a worse than doubtful project.

92. There is also a serious loss of water arising from a cause hardly attributable to either of the heads named, and particularly to be noticed in wide canals: we mean that occasioned by high winds, which dash the waves over the towing,paths, down the feeding-flumes, and over the lock-gates.

93. Under all these considerations, therefore, we repeat the opinion that we adopt two locks-full of water for the passage of the summit by each boat; and we cannot, without a reproach from our own judgment, adopt less.

94. *Feeders*—It is a well-known fact, attested by universal experience, that the loss of water from feeders is greatly disproportionate to that from canals: we mean simple feeders, which are small canals to pass water, and too small for the usual canal-craft. Various causes are assigned for this peculiarity: the greater velocity, by which the water being more agitated, occasions increased evaporation; the smallness of the column, which, becoming sooner and more heated by the sun, produces, on this account, also a greater amount of evaporation; the less consolidation of the bottom and sides, from the diminished volume of water causing less pressure, from which filtrations are the greater; the purer and clearer condition of the water, carrying little or no sediment or dissolved earth, by which in canals the filtrating pores of the exposed surface become gradually closed. These, and others more philosophical and abstract, are given as accounting causes. Be they, however, correct or not, the fact is as stated, and it should be taken into consideration in reasoning upon feeders.

95. The best constructed and oldest feeders known are those of the Briare and Languedoc canals of France. Of these it has been remarked, that, with the exception of covering, no other precaution to prevent losses of water can well be imagined.

96. The noted feeder of the Briare canal is called "the feeder of Saint Prive." Its length is about 11 miles, and its average dimensions about 12 feet at water-surface, 9 feet at bottom, and 3 feet deep. After frequently-repeated and most exact gauging, it was found to lose three-fourths of the water it received; or, in other words, it delivered into the canal but one-

fourth of the water which it received from its source of supply. This loss is equivalent to about 0.68 per mile of the quantity received.

97. To the Languedoc canal there are two feeders: the Plaine and the Mountain feeder. The entire developement of these is 88,225 yards rather more than 50 miles. Of this developement 32,876 yards are artificially constructed; the balance being the old beds of streams, in which, whatever may be the filtration, it has long since arrived at its minimum. Of the 32,876 yards, 20,254 yards are made through a comparatively impermeable granite: that is, about one-fourth of the whole length. Various concurring circumstances are stated by Huerne and others as well adapted to reduce the filtrations of those feeders Nor is the loss they experience alluded to as extraordinary; yet, from a critical comparison of the water received and delivered, the actual loss per year is more than 100 times the water-prism, (Huerne, p. 270,) or more than 10 prisms per month for a navigation of 10 months, Now, this loss must be chiefly on that part which is not made through the comparitively impermeable granite, and may, therefore, be charged upon 68,000 yards, about three-fourths of the whole distance, which would make about 125 of its water-prisms during the navigable year, or 12½ prisms per month.

98. The size of a feeder may be assumed at 12 feet water-surface, 8 feet at bottom, and 3 feet deep. This would give a cube or prism per mile of 158,400 cubic feet, or 5,866.5 cubic yards. Now, 12½ times this prism would be 73,332.5 cubic yards per month, or 45.8 cubic feet per minute.

99. *Reservoirs*—We shall view these under the limited aspect required by our object: their ability to retain water, and the quantity which it is probable they will receive in proportion to the rain upon a given surface. Upon this last peculiarity, climate has, without doubt, a great influence. In northern climates, the ground is longer and harder frozen; the accumulation of snow upon its surface proportionably greater, which passes into the reservoir from gradually melting by the warmth of spring, losing less by filtration, as less will pass through the frozen surface of the soil. On these accounts, there can be no doubt that more water will be collected in more northern climates, for, in more southern, a greater portion of that which falls on the surface of the soil will pass off by filtrations. These considerations would make more lakes in a northern climate, more and larger springs in a southern; which inference we believe to be actually sustained by the general physical peculiarities of the globe.

100. The point first to be established is, what proportion of down-fall-water upon a given surface can be collected in a reservoir? Upon this we have searched in vain among the works of European engineers for the result of direct observation. All is estimate, conjecture, speculation; the general result of which, however, is, that about one-third of the water which falls may be collected in a suitable reservoir. The form of the surface of the soil has not so much influence as many would suppose, except in the rapidity of the drainage. Numerous streams are found in a rolling country—extensive swamps in a flat; and the greater evaporation which water in the latter experiences from longer exposure, about compensates for the les filtration of the former from a more rapid flowing off. Of course, we have not in mind extreme cases of either.

101. Sutcliff, (p. 84,) speaking of the Rochdale canal, after a calculation on the subject, says: "which plainly proves that, notwithstanding the close texture of the soil, little more than one-third of the rain which falls upon them (the commons) can be got into the summit-level: and, were these commons cultivated, I do not think that more than one-sixth part of the rain that would fall upon them could be drained off."

102. When the Chenango canal, in the State of New York, was about being made, and which was to depend principally upon water collected in reservoirs for its supply, the engineer, Mr. J. B. Jervis, estimated one-fifth of the downfall-water as the quantity which could be collected; but, with a view of ascertaining the matter more accurately, he had experiments made in the valleys of two streams, Madison brook and Eaton brook, which will be found in the report of the New York canal cammissioners of January, 1836.

To be Continued.

Report of Hother Hage—Chambersburg and Pittsburgh Survey.

To the Board of Canal Commissioners, of Pennsylvania :

Gentlemen :—In obedience to your instructions, I have the honor to present the following preliminary reports on the exploration of a route for a rail-road from Chambersburg to Pittsburgh, and of slack water navigation from the Coal and Iron region of Bedford county, to the public works on the Juniata River, intending to submit further reports as soon as the necessary estimates, maps, and profiles shall be completed.

RAIL-ROAD FROM CHAMBERSBURG TO PITTSBURGH.

The instructions under which the present examination was conducted, required a route for a continued rail road, without inclined planes, on which stationary power would be necessary: or in the event of its impracticability, such a portion of a MacAdamized turnpike as would continue the transportation partly by this mode of communication. A wide scope of country, untrammeled by any intermediate fixed points, and only limited by the Pennsylvania improvements on the north, was granted for the exploration.

On examining the district embraced within these limits, the valley of the Potomac river by the way of one of the branches of Will's creek, near the source of Flaugherty creek, and thence by Castleman's, the Youghiogheny and Monongahela rivers to Pittsburgh, strikes the observer as a natural opening for a rout possessing certainly the advantage of opposing but a single summit between the eastern and western termination of the line. This route has already been found practicable by actual survey, and is believed to be the line adopted by the Baltimore and Ohio rail road company, but as a great portion of it would pass without the boundary of the State of Pennsylvania, it is doubted whether it could be considered as a line intended for examination.

The great length too of this route would render it objectionable, and the contemplated connexion of the Franklin rail road with the Baltimore and Ohio improvement, makes at all events an examination at present unecessary.

On the other hand, it was thought that an exploration in a direction nearly contiguous to the Pennsylvania improvements, though south of them, would be equally undesirable.

Here the great length also, the difficulty of approach to the Alleghany mountain in this quarter from the east, and the uncertainty of surmounting that barrier in the immediate vicinity of the Portage rail road, would render the exploration of the route inexpedient, excepting only in the case other lines should fail.

A route situated between these two was therefore considered most desirable, thereby aiming at the shortest practicable line, and leaving for future surveys the routes that may claim advantage in point of easy grades. With this view a thorough reconnoisance was made of this region, its topography was closely studied, and the intricate passes of the mountains explored.

The formation af the Alleghany range of mountains is generally so well known for regularity, that any one portion of it may in a great measure serve to convey an idea of the whole. Their character in counties traversed by this survey, has however peculiar features that favor the location of a rail road. By a reference to the map, a better idea of these may be obtained, than can readily be conveyed by description.

It will there be seen that the Cove mountain, Scrab Ridge, Sideling and Ray's, hills, Tussey's, Evitt's, Will's, Buffalo, and the Alleghany mountains, together with Laurel hill and Chesnut ridge, form the most prominent obstacles to be passed. The Raystown branch of the Juniata river flows however several miles in an easterly direction from the Alleghany mountain, opening a passage through or around Tussey's, Evitt's, Will's, and Buffalo mountains. Near a source of this stream, but west of the Alleghany mountain, an elevation in the ground crosses the valley between the mountain and Laurel hill, so as in a manner to connect them causing the waters in Somerset county to flow to the north into Connemaugh and south into Castleman's river.

Farther west the Loyalhanna creek forms a convenient gap in Chesnut ridge, nearly in a direct course towards Pittsburgh. Again, if we turn to the east a depression will be found in the Cove mountain, where it joins the Tuscarora, and the waters of Aughwick creek flow through the only gap in Sideling hill that can be found for many miles.

In this manner the line, commencing at Chambersburgh, passes through Cumberland Valley, crossing the west Branch of Conocheague creek some distance below Loudon, thence ascending the side of Cove mountain it reaches Couan's gap, and descending the waters of Augwick creek by the Burnt Cabins, to Sideling hill run, it turns up that stream. Passing through Well's valley it meets Rays hill, or properly a point where the Harbour mountain joins the Broad Top Mountain, where a tunnel will be unavoidable.

By these means the waters of the Raystown Branch of Juniata are attained, when the route passes through Ground hog valley, and crosses the Juniata Branch near Piper's Run, where it ascends into Woodcock valley, whereby a near cut is effected to Bloody Run. At the village of this name the line again meets the ravine of the Juniata, and passing the town of Bedford continues to ascend along the river bank until Buffalo mountain is attained. Here an increased grade in the road will take the line on high ground.

Crossing from Buffalo mountain to Dry Ridge, a spur of the Alleghany mountain is reached, and by ascending along the slope leading to Decter's run, it crosses that stream, meeting the main ridge of the Alleghany at a favorable place for the second tunnel.

After penetrating through this mountain, the line takes a southerly turn towards Berlin, thence sweeping to the west, it passes about 3 miles north of the town of Somerset, and pursuing the dividing ground between the waters of Conemaugh and Castleman's river, it meets the base of Laurel Hill.

From this point a very circuitous route, winding among the ravines of the mountain, takes the line to Laughlinston, and descending along the valley of Loyalhannah, it passes Ligonier; thence after passing through the Gap in Chesnut ridge, it leaves this creek near the mouth of fourteen mile run.

Having ascended the valley of this stream, the line was conducted by the sources of the Crab tree run to the waters of Sewickly creek, and thence near Greensburgh to the waters of Brush creek. By descending this stream and Turtle creek, it meets the Monongahela river, and by its bank finally reaches Pittsburgh, terminating at the outlet of the Pennsylvania canal into this river.

The following tabular arrangement will more fully illustrate these points, their distances apart, and levels above the place of commencement, at Chambersburgh.

	Intermediate distances.		*Total distance fm Chambersb'g.*		*Levels in ft. above Ch'bg.*
	miles	chs.	miles	chs.	
From Chambersburgh to Cowan's Gap,	29	36	29	37·69	609·00
Thence to Burnt Cabins,	6	34	35	70·69	242 80
do Mouth of Sideling Hill Run,	9	78	45	68·69	80·70
do Gap in Sideling Hill,	10	28	56	16·69	248·80
do Tunnel through Harbor Mountain,	9	9	65	26 05	888·70
do Raystown branch of Juniata,	6	78	72	24·05	268·50
do Bloody Run,	9	50	81	74·05	400 00
do Bedford,	8	10	90	4 53	446·40
do East end of Alleghany Tunnel,	32	47	122	51·77	1854.82
do Top of Alleghany Mountains,	0	20	122	71·77	2329 76
do Near Berlin,	7	36	130	27·77	1672·74
do Somerset (town being 1492,35 a)	12	24	142	51·77	1704·25
do East base of Laurel Hill,	10	59	153	30 79	1605·19
do Top of Laurel Hill,	8	78	162	28·79	2081.69
do Turnpike at Laughlinstown,	27	29	189	57.79	718.97
do Where line crosses Loyalhanna creek,	3	33	193	10.79	545.63
do Ligonier,	9	53	202	63.79	375.69
do Merkle's summit,	4	55	207	38·79	675·21
do Barnhart's summit,	1	72	209	30·79	562·95
do Barclay's,	4	79	214	19·79	619·10
do Mouth of Brush Creek,	12	59	227	8 79	150 92
do Mouth of Turtle Creek,	5	66	232	74 79	147 49
do Outlet Lock of Pa. Canal at Pittsburgh,	9	78	242	72·79	94·20

Whilst the operations incident to the survey of this line were carried forward, it became sometimes doubtful whether by deviating from the line at certain points, and again intersecting it at some distant station, a more eligible location might not be obtained.

The extent of the survey and a desire to prove the practicability of the route for an uninterrupted rail road communication, before the field operations should be closed, by the severity of the approaching season, prevented in several instances their examination. The most important of these would change the entire location a distance of about twenty miles.

Two portions of the line offer opportunities of this character, and are too important to be neglected. The first would leave the present route about four miles west of Bedford, and ascend the valley of Deeter's run on the opposite side. Passing in the vicinity of Schellsburg, it would meet the main ridge of the Alleghany sooner, and attain a depression in this mountain, situated about a mile and a quarter to the north of the present tunnel. This point was found to be 368 64·100 feet lower than the summit of the mountain over the tunnel, or 106·29 feet higher than the grade of it. Thus perhaps the necessity of a tunnel here might be avoided, and as this pass appears to be the lowest attainable, its examination is strongly recommended.

The other part of the line that may be much improved, by further examination, is situated on the Western slope of Laurel hill.

On the summit of this mountain a favorable depression was discovered, where the road may cross without even any considerable depth of cutting; but in descending the Western side, serious difficulties were encountered. These consisted not so much in the expense that would attend the construction of the work, as in the unfavorable curvature that was necessarily adopted, particularly in two instances, where the radius would not exceed four hundred and seventy feet, and in some others, where it was below one thousand feet, thereby also increasing the distance materially. The impenetrable nature of the woods, and the intricate position of the ravines, permitted the party that was engaged on this part of the line during three months, only to get an accurate knowledge of the topography of this part of the mountain, which resulted in the location made. More extensive surveys would by all means be advisible, before the construction of this part of the line is commenced, and the survey now made will materially facilitate their successful execution.

Among the deviations from the main line, which underwent examination by survey, one only is worthy of notice. This departs from it at the western base of Chesnut ridge and turns in a southerly direction, passing through Youngstown, and ascending along the Nine Mile run, it has a favorable summit near Pleasant Unity. Thence by the valley of Sewickly creek, the line is carried over good ground until it approaches near to Youghiogheny river, where some short bends in the creek confined by abrupt hills, render a location more difficult.

After joining the River the line was taken along its bank past McKee's Port to the Monongahela river, and continued to the mouth of Turtle creek, where the other route is met.

The only advantage possessed by this line consists in its passing through one of the most fertile and highly cultivated parts of Westmoreland county, offering but few natural obstacles to a cheap construction. The line will however be materially increased in length, if this route is adopted; if the meanderings of Sewickly creek near its mouth are pursued, the length would be 20 miles and 73 chains greater than the Brush creek route; and if the line should be carried on the high ground across these bends of the creek, the distance would still exceed by 16¼ miles the route first recommended. In the latter instance also, some expensive work and steep grades in the inclination of the road, would operate seriously against its adoption.

Other detours from the line first spoken of have been suggested, these have not been examined, but it is believed that they would all have a tendency to lengthen the line, however advantageous they may be in point of grades and cheapness of construction. It is of great importance to have some of these thoroughly surveyed, in order that accurate comparison may be formed among them; one in particular is important, as it would change almost the entire line west of Bedford.

It would leave the present line at the Buffalo mountain, and by the waters of Will's creek join the location of the Baltimore and Ohio rail road, thence by Flaugherty creek, Castleman's and Youghiogheny rivers, it would intersect the line run at the mouth of Sewickly creek.

Between the towns of Bedford and Chambersburg, it is believed that no material change in the route can be made.

The bold and unbroken character of the mountains in this quarter, offers no openings that would favor an attempt at reducing either the length or the cost of the road; should it therefore be deemed expedient to commence the construction of this important work, that division could be at once prepared for contract.

Taking finally into consideration the whole line as now established, independent of anticipated improvements by future surveys, it will perhaps appear, that its length of nearly two hundred and forty-three miles would hardly justify calling it the shortest practicable route for a road of the description required, when a communication between the eastern and western *cities* is the object.

In that case it would appear that the distance by rail roads from Philadelphia to Chambersburg, now in operation, being stated at

	157	miles,
and the present line from Chambersburg to Pittsburg being	243	"
making	400	"
and by the state improvements the report of the Canal Commissioners of December, 1836, stated it at	395	·43
which makes a difference in favor of the latter, of	4	·57

It would seem therefore that a rail road extending in a parallel line along the present improvements, would be so much shorter. But if it is recollected that 439·100 of the Portage rail road are occupied by inclined planes overcoming an elevation in ascent and descent of 2,007,02 feet; it will be seen that a road uninterrupted by inclined planes, overcoming this elevation even at a grade of sixty feet inclination in a mile, necessarily would add (if localities would render it at all possible) about twenty-nine miles to its length, thereby making that road about twenty-four miles longer than the one here recommended.

The Canal Commissioners, in their report, make the following remarks upon this survey:

The act of the 14th April, 1838, authorized the Commissioners to have a survey made by competent engineers, of a route for a continous rail road from Chambersburg to Pittsburgh, without inclined planes, or for a McAdamized road and rail road in connexion. They were also required to have a survey made of the Raystown Branch of the Juniata, for canal, rail road or slackwater navigation, so as to connect the coal and iron region of Bedford county with the public works.

The Board appointed Hother Hage, Esq. to the discharge of this duty, with instructions to detail at least two corps of engineers for that purpose; and at the solicitation of citizens of Westmoreland county, authorized the formation of a third, with a view of having the surveys completed this season.

The survey has been so far completed as to enable the engineer to report, that a continuous rail road may be made without inclined planes from Chambersburg to Pittsburgh. The distance by the route surveyed is 243 miles.

* * * * * * * *

The distance of this route over the present turnpike is about 90 miles, winding as it does among the mountain passes. The tunnels will each be about 2,500 feet in length, the highest grade about 60 feet to the mile. A further report of the graduations of the road, with a profile and an estimate of the cost, will be furnished by the engineer, and laid before the legislature. No survey has been made of a McAdamized road and rail road in connexion.

The cost of a continuous rail road will be large, from the increased distance over the present turnpike. The cost of a McAdamized road would be so much less than the rail road, that it becomes an important question which mode of improvement would be the most beneficial.—Economy in the construction, saving in distance, and the facility of keeping open the road in the winter months, are all in favor of a McAdamized road. Saving of time, avoiding all transhipment, economy in the price of transportation, are in favor of the rail road. The relative merit of the two plans can be best determined by accurate surveys and estimates.

The Board would recommend a more thorough examination of the route of a continuous rail road, and a survey and estimate of McAdamizing the present turnpike road, reducing the grades, wherever practicable, or the survey and estimate of a McAdamized road and rail road in connexion.

Extract from the Report of W. G. Williams, United States Engineer.

PRESQUE ISLE—ERIE.

This harbour, which lies in the State of Pennsylvania, and the only one of value owned by that State on the shore of the lake, is unquestionably the best in regard to natural advantages upon its southern shore. It is formed by a peninsula, which appears to be the result of some accidental accumulation of sand, and encloses a space of about three thousand acres, with an average depth of from ten to thirty feet; at present, however, owing to the unusual elevation of the lake, the low neck connecting it with the main land on the western side is covered with water, and the trees on that part have been destroyed by it, leaving the neck exposed to the violent action of the waters. The portion of land thus insulated is covered with trees, and with very little care may be rendered permanent against all encroachments of the lake. Government has already paid attention to this object, and furthermore, by modifying the circumstances of ground, projects an arrangement affording great facility to the ingress and departure of vessels.

The harbor thus enclosed is from four to five miles long, and about one mile in width, and vessels are now obliged to enter and return by the same channel, which to those proceeding to a continuation of route necessitates a detour of several miles, and often under unfavorable circumstances of wind creating great delay, if not, for the time being, an absolute interruption to the prosecution of their voyage.

The project referred to, is to open a channel at the west end of the harbor, by fortifying the neck in such a manner as to resist the action of the lake, leaving only a sufficient width for the ingress and departure of vessels. By this means the ebb and flow produced by the frequent and sudden changes of elevation in the lake, dependent upon winds, as already explained, would effect a channel of sufficient depth for all the purposes of commerce. A deepening of the channel at the eastern extremity of the harbour has been already produced in this way. Reference to the accompanying sketch of the harbor will show the advantages of this arrangement; it will likewise serve to illustrate further discussion of the subject in my report.

As a military depot, few places are more favorably situated than Erie; and it is in this point of view that Erie recommends itself to the protecting care of the United States Government with additional force.

By throwing up an extensive system of temporary works, the harbor would be quite inaccessible to an enemy from the side of the lake; whilst the great channels of communication by the canal and rail-road to the interior, of which this point will become the common terminus, impart to it a degree of support sufficient to set at defiance every species of hostile incursion to which it could at any time be subject. From the report of P. S. V. Hamot, Esq., local agent at Erie, it would appear that, during the year 1837, about five hundred and forty-seven steamboats cleared at Erie, from the opening of navigation in the spring to the 30th of September following; and that tonnage amounted to about one hundred and eighty-one thousand seven hundred and ninety-one tons; and the number of passengers to seventy-nine thousand three hundred and forty-nine, and that the number of clearances of ships, schooners and sloops was one hundred and seven, whose tonnage amounted to seven thousand eight hundred and sixty-seven. Mr. Hamot has not been enabled to procure the official statement in regard to the last year, but estimates that the probable amount was nearly the same. The portion of breakwater extending from the western extremity of the island to the proposed channel is considerably advanced, and five hundred and seventy feet of it has been executed during the preceding summer; three hundred and sixty feet of this developement is by cribwork eight feet high; and two hundred and ten feet four feet high, filled with stones; a good deal of stone was also laid on the outside to give additional stability. This work will require to be continued eastwardly, to secure the head of the peninsula from the encroachments of the lake. Besides which, of the southern portion of this breakwater, extending towards the channel-piers, four hundred and sixty-five feet have been laid down, secured with stone, and partly completed; two hundred and twenty feet of the portion constructed last year has been raised one log higher, filled with stone, and completed, with one exception of bolting it down with iron. At the eastern end of the harbor, the portion of breakwater on the south side of the channel has been repaired, and it was found necessary to extend it by the cribwork to an extent of three hundred feet, laid down where the storms of last fall and winter had made a breach of upwards of two hundred feet in width, with a depth of water upon it varying from three to sixteen feet. These cribs have been filled with stone, and an embankment of stone has been thrown against either side, nearly to the level of the water, to give permanency to the work; repairs have also been made to the northern extension of the breakwater, as well as to the channel piers; also, in consequence of the high water at the commencement of operations, a dock was found necessary in front of the work-sheds and quarters, of three hundred and forty-two feet long, and three logs high, of about one foot each in diameter. The works have thus far answered the object intended, and an accumulation of sand has taken place at the western breakwater, tending to restore the firm condition of the peninsula, with the exception of the channel projected to remain open as a western entrance to the harbor.

The plan that remains to be effected in regard to Presque Isle harbor is to remove the work now above water, and in a state of decay, by sawing off the woodwork below the surface of the lowest water, and placing upon the old cribs a solid superstructure of stone. This is necessary to secure the work already executed, and is eventually the most economical method that can be adopted; for the woodwork above water, by the constant and varied action of the elements in this exposed situation, is subject to immediate decay, and the repairs constitute a never-ending source of expense.

[The following bill has been reported, and is now under consideration in the Legislature of this State.]

An Act to provide for the Construction of the New-York and Erie Railroad, by the State.

The People of the State of New-York, represented in Senate and Assembly, do enact as follows:

Section 1. It shall be lawful for the New-York and Erie Railroad Company, on or before the first day of July next, to surrender, grant and convey to the people of this state, all the rights, liberties and privileges of the said company, including all the property, real and personal, of the said company, and all the rights and interest which the said comdany may have acquired by contract or otherwise, of, in or to, any lands or other property; and the necessary conveyances, after having been approved by the attorney-general, shall be recorded in the office of the secretary of state; and thereupon, all the rights, liberties, privileges, property and effects of the said company of every kind and description, shall be vested in the people of this state.

§ 2. The said company, at the time of delivering the said conveyances, shall deliver to the comptroller, to be deposited in his office, all the deeds, contracts and conveyances made to or with the said company, or in which they have any interest, and all the maps, surveys, estimates, books of minutes, and other papers of the said company, together with a full and accurate account of all their acts, proceedings and expenditures, which shall be verified to the satisfaction of the comptroller.

§ 3. On complying with the preceding sections, it shall be the duty of the commissioners of the canal fund, as soon thereafter as the money can be procured by the issue of stock in the manner hereinafter mentioned, to pay to the said company all such moneys as they have expended on account of the said work.

§ 4. When the purchase of the rights and property of the said company shall be completed in manner aforesaid, the New-York and Erie rail-road, from some point or place on the Hudson river in the county of Rockland, to some point or place on Lake Erie, in the county of Chautauque, shall be a public work, and be constructed by the people of the state, and for their benefit.

§ 5. For the purpose of paying the said company as aforesaid, and the expense of constructing the said road, the commissioners of the canal fund shall borrow on the credit of the state three millions of dollars, at an interest not exceding five per cent. and the commissioners shall contract for the whole loan at one time, or at different times, as they shall deem most advantageous to the public interest

§ 6. All loans made for the purposes aforesaid, shall be payable at such time or times as the commissioners shall prescribe; and for such loans, certificates of stock shall be issued in the manner now authorized by law in relation to other public works; and so much of the public revenues derived from auction and salt duties, as may be necessary to pay the interest on the stock authorized to be issued by this act, is hereby appropriated and pledged to that object.

§ 7. There shall be two additional commissioners, and

and

are hereby appointed such commissioners, but they shall hold their offices by the same tenure, and may be removed in the same manner, as other canal commissioners, and in case of vacancy or removal the place may be supplied in the manner now authorized by law.

§ 8. It shall be the duty of the canal commissioners to proceed with all reasonable diligence, to cause full and accurate surveys, maps, plans and estimates, to be made of the whole line of the said rail-road from the Hudson river to lake Erie, and lay the same before the legislature as soon as shall be practicable, together with the plan on which they propose to construct the said road, and the probable cost thereof; but it shall not be necessary to re-survey any part of said road which has already been surveyed with sufficient accuracy to enable the said commissioners to make the necessary maps, plans, and estimates. And the said canal commissioners shall proceed the present season, with the grading of such parts of the said road as they shall deem proper, and for the interest of the state; and they shall grade and prepare the said road for a double track, and lay down and complete a single track, with all necessary turns-out, and make all necessary erections and works connected with the said rail-road; and for all purposes of laying out and constructing the New York and Erie rail road, the canal commissioners shall have and possess all such powers as have been conferred on them by law for the construction of the canals of this state; and the canal commissioners hereby appointed shall be the acting commissioners on the said rail-road.

§ 9. The canal commissioners, on behalf of the state, shall assume all contracts made by the said company at the time of the passage of this act, and which shall be in force at the time of the surrender of the charter of said company to the state as aforesaid, and shall carry the same into effect in all cases where no change in the location or manner of constructing the said road shall be deemed necessary.

Recent Experiments at Paris on Raising and Heating Water by Savery's Atmospheric Engine. By M. M. Colladen *and* Championniere.

The note which I present to the Academy of Sciences (says M. Colladen) is a summary of the experiments I made with M. Championniere, civil engineer, with the steam engine on *Savery's construction.*

In these very simple machines, the steam raises the water by its immediate action. The steam is introduced into a vessel, then condensed, and produces a respiration or flowing in of water.

A second admission of the steam drives the water up into the reservoir.

These machines were the first steam movers employed in large works. They were afterwards abandoned for the machines of Newcomen and Watt.

Several manufacturers, especially Manoury D'Hectol, nevertheless have employed them.

As our experiments may serve to fix the value of these engines, and the conditions under which the employment of them may be preferable, we think it may be useful to publish them.

We possess very few estimates of the power of the Savery Machine:— Bradley, Smeaton, Menoury and Girard, have published some memoirs on its effects; but we find in no publication on the subject, the measure of increase of heat in the water elevated, nor of any other element needful to the theory of these motive powers.

But a very small number of the Savery machines are in existence. We know of but five in operation, three are in the department of the Seine, the fourth in Loire Inferieure, and a fifth at Lyon. We believe there are none remaining in England.

We have experimented with the three of the department of the Seine. The oldest is at the *abattoir de Grenelle*, and was constructed by Manoury. The two others are in the Vigier baths; they were made by Gingembre.

The following numbers were obtained from these three machines in three series of experiments:—

Experiment of the 26th of March, 1833, on the bath machine of Pont Marie.

Temperature of the water of the Seine, $6\frac{1}{4}°$
Mean tension of the steam, 3 atm.
Water raised per hour, 12·213 m.
Height of elevation, 6·6 m.
Temperature of the water raised, $10\frac{1}{4}°$
Dry wood burned during one hour, 30·4 k.
Duration of a period, 26·0″

Experiment of the 10th of July, 1833, with the same machine.

Temperature of the water of the Seine, $19\frac{1}{4}°$
Mean tension of the vapor, 3 atm.
Water raised per hour, 12·724 m.
Height of elevation, 6·10 m.
Temperature of the water raised. $23\frac{1}{2}°$
Dry wood burned in an hour, 46 kil.
Duration of a period, 26″

Experiment with the machine of Manoury D'Hectot.

Temperature of the water of the well, $12\frac{1}{2}°$
Mean tension of the steam, 00
Water raised per hour, 15·400 m.
Height of elevation, 14 m.
Temperature of water raised, $16\frac{1}{2}°$
Charcoal burned in an hour, 13 kil.
Duration of a period, 90″

Agreeably to the first and second tables, the machine of Pont Marie gives 2·595 dynam to a kilogramme of wood.

This is about eight times less than the effective force of a small piston machine of the same force which would work pumps. But the water raised would have to be afterwards heated, so that we must take into account the increase of temperature, which was four degrees Cent. ($=7\frac{1}{5}$ F.) in the first series in the month of March, and three quarters in the second in July. Thus, in the first case, each kilogramme of wood sent up to the reservoir, by the action of the machine 1702 portions of heat (caloric), and the second 1255. With a more complicated machine than that of Savery, an additional heating apparatus would have been necessary, and this addition would have required the same expense.

Thus, whenever water is to be both raised and heated (and this frequently occurs in manufactories) the almost forgotten machine of Savery is the most advantageous motive power. It is the least costly at first, the least subject to accidents, and to wear and tear, and the most easily managed.

We will add a few words on the comparative effect of the three machines. In all of them the accession of heat was about four degrees, although the Manoury machine differs essentially from the two others.

The last machine performs more than double the work of those of Gingembre, at the same cost. Agreeably to the public report of M. Girard, in the 21st Vol. of *Annales de Physique et de Chimie*, the Manoury machine gave 20,202 dynam for each kilogramme of charcoal. This result surpasses that obtained by us, whence the increase of temperature of the water must at that time have been at a maximum of 2·8° instead of 4°. This measure is wanting in the memoir referred to.

From the foregoing experiments it results:

1. That the Savery Machine is a very valuable motive power which may be advantageously employed in many of the arts.

2. That the use of it ought to be limited to those cases in which water is to be heated as well as elevated.

3. That the machine of Manoury is the best model for imitation.—*Ann. des Pontes et Chaussees, trans. in Frank. Jour.*

Experiments with Captain Ericsson's Canal-boat Propeller.

We are glad to find that the success which attended the first experiment with Ericsson's Propeller, (noticed in our 721st, 751st, and 781st numbers) has induced some American canal proprietors to build a steam tow-boat, fitted with it, for the purpose of putting it to a complete practical test. The boat is called the *R. F. Stockton*, and has lately arrived in the Thames from Liverpool, where she was built last summer by Messrs. Laird, under the superintendence of Mr. Ogden, the American consul for that port. Several experiments have been made, the results of which appear very satisfactory, both in relation to the application of the propeller to inland and to ocean navigation; and these experiments derived additional weight from the fact of their having been performed and approved of in Liverpool, the grand emporium of shipping and of commerce.

Respecting the speed which it has been asserted may be attained by the new propeller, we have to notice a trial made below Blackwall on the 12th inst., in the presence of about thirty gentlemen, many of whom were scientific and practical men. The result was, that a distance of nine miles (over the land) was passed in thirty-five minutes, with the tide: thus proving the speed through the water to be between eleven and twelve miles per hour. The propeller was only 6 feet 4 inches in diameter; the dimensions of the boat are given in the account of the next experiment.

An experiment proving the great power of this propeller, with an account of which we have been supplied, was made on the 16th instant, between Southwark and Waterloo bridges, the result of which was as follows:—Four coal barges, with upright sides and square ends—

Nep, 15 feet beam, drawing 4 ft. 6 in. water.
Joseph, 15 ft. 7 in. beam, drawing 4 ft. 6 in. water.
Mary, 15 ft. 2 in. beam, drawing 4 ft. 6 in. water.
Ugie, 13 ft. 4 in. beam, drawing 4 ft. water,

were made fast to the steamer, which is 70 feet long, 10 feet beam, and draws 6 feet 9 inches water. Steam being set on, full speed was attained in about one minute, and the whole distance between the bridges, precisely one mile, was performed in eleven minutes, the time chosen for the experiment being high water. The number of strokes made by the engines was 49 per minute—the cylinders 16 inches in diameter with 18 in. stroke. The difference in the speed of the propellers being as 9 to 10, and the outside one, revolving at the greater speed, and being attached to the crankshaft directly, it follows that the inside propeller made only 44·1 revolutions per minute. Now, although the circumference of the propeller is nearly 20 feet, the spiral planes are placed at such an angle that, *were resistance of the water perfect*, the boat could only proceed 14·04 feet for each revolution; hence the distance passed over in one minute could only be $44{,}1 \times 24{,}04 = 619$ feet per minute with such *perfect* resistance. The distance actually passed being $\frac{5380}{11} = 480$ feet, it follows that a distance of 139 feet was lost out of 619, which amounts to only 22½ per cent. loss of speed. Considering the *square* form of the barges towed, and that they presented together 59 feet 1 inch beam, with an average draught of 4 feet 4 inches, besides the sectional area of the steamer which is 43 square feet, and, considering that the propeller is only 6 feet 4 inches diameter, occupying less than 2 ft. 6 in. in length behind the stern of the boat; the result we have now recorded may, in a mechanical point of view, be considered of great importance.

The *R. F. Stockton* is an iron steamboat, and has been constructed as a tug-boat for the Delaware and Raritan canal in the United States, whereto she will shortly proceed.—*Lond. Mech. Mag.*

On Foundations upon Sand, and on Coatings of Mineral Tar: by M. Olivier, *Engineer.*

1. *Foundations on sand.*—At the school *des Pontes et Chaussées*, in 1830, it had been pointed out, that foundations on sand might be laid, wherever the earth was compressible, and in no danger of being carried away by floods. The canal of St. Martin was given as an example. I have several times applied the system thus indicated, and always with success. The following are examples: M. Dupuis, one of the conductors in my district, an architect of the town of Pont-Auderner, was employed to erect a building for the mayoralty. Its situation required that the edifice should be founded on the natural soil. This was well, for there is, in the valley of the Rille, a little below the soil, a bed of solid stones, mixed with sand, of about 31½ inches thick. M. Dupuis, feared that the ground under the bed of gravel was not good, and he had it sounded. It proved to be compressible, and when the gravel was removed, it became impossible to lay a good foundation on the earth which it covered. The architect deemed it needful, in consequence, to resort to piles, and these, it was ascertained, must be very long to reach solid ground. I went to see the work as they were beginning to drive the piles: it was a very expensive undertaking, which I proposed they should avoid, by substituting a bed of water sand, well watered with cream of lime. M. Dupuis, being responsible for the work, could not decide upon taking this advice, and continued the piles sufficiently for the whole front wall; but he adopted for the other walls the plan I had recommended. These were all, of course, united, though resting on different foundations, but they have all remained firm without any movement, or at least it has been uniform.

This furnishes a new proof of the safety of foundations on sand; 1st, since all the erections in the valley of the Rille, founded on the bed of gravel before mentioned, stand very well, though the ground underneath is compressible; 2d, since the walls placed on the sand, resting on soft ground have not sunk more than those built on piles, driven with the greatest care to a solid foundation.

Another fact. M. Fauquet Lemaitre, is a proprietor at Bolbec of several cotton factories. One of them being burnt down, he extended the other, which made it necessary to connect the new with the old walls; these walls, situated at the foot of a hill, were partly on a mass of chalk and partly on a bottom of green sand, in spaces where no chalk existed. This sand was moistened by infiltrations of water, which could not however wash it away. When a weight was placed on this sand and left at rest, the mass remained firm; but if a little motion were given to it, it became pasty and almost liquid. The builder thought he must have recourse to piles, and several foundations were prepared for their being driven, when M. Fauquet spoke to me about his buildings, and of the position in which he found himself. At this time, the experiment before cited had been made, and I advised him to lay his foundations on sand. I requested him to converse with M. Frisard, chief engineer at the Port of Havre, and he did so. The latter coincided with me, and added that all the masonry of the steam-engine of 60 horse power, was founded on sand and nothing had moved it. It was not so with the structures on piles; a side wall, connected with the foundation of the engine, placed on piles driven as deep as possible, had moved so much that the connecting stones were broken, so that they had to saw them off from the engine walls, the level of which had not changed. This accident, it was believed, occurred from the water contained in the sand, having collected more abundantly around the piles; and the friction of the latter against the ground, being diminished, they sunk until the masonry rested on the sand.

As other walls erected on sand or on rocks, have not moved, this experiment proves that foundations on sand are as safe as those on rocks, while we cannot rely upon the stability of an edifice constructed on piles and driven into sand; the friction which they encounter induces the belief that they have gone as far as possible, or necessary, and when any cause diminishing this resistance from friction occurs, an accident follows which proves the contrary.

The first experiment was made under my own eyes; the second I did not witness, but have every reason to believe that a true account was given me.

2. *Employment of mineral tar in structures of masonry.*—It has for a long time appeared to me that mineral tar, which does so well upon wood and iron, might also be used for covering stone and brick work, as a defence against moisture. Four experiments were made which confirmed this apprehension. But it will be well to premise that as mineral tar is obtained by distilling vegetable materials, it would be more suitable to call it pyroligneous tar.

Without touching upon all the cases in which pyroligneous tar may be employed, which we believe to be very numerous, we shall simply cite a few in which we have tried it.

The light house of Quillebuef had become much degraded by north-east storms. The rains were very copious, and the water passing into the brick tower, caused the bottom of the staircase to rot. We repaired the masonry, and in the month of May, 1833, painted the tower with pyroligneous tar, which so far has perfectly answered our expectations; except that a few of the pilots pretend that the light-house being now black, is not so well seen as when it was white.

M. de Cachelu painted with the tar an earthen wall, exposed to the rains so much as to become very wet inside of the building. When I saw these walls, the tar had served as a complete defence against dampness.

Walls much exposed to storms of rain, are commonly defended by a coating of slate or cement, but the above experiments show that these two modes of defence may be advantageously replaced by a coating of pyroligneous tar.

The joints of the wall being well filled up and smooth, the tar is spread over it, and it penetrates the wall. When dry, a second coat is applied and immediately powdered over with sand. This, when solidified, is covered with lime white-wash, as thick as can be put on with the brush. This acting on the carbonic acid of the atmosphere, forms a crust of limestone which exists for a long time, and once in two or three years the wall may be re-white-washed.

We have employed this treatment on bridges very successfully.

In courts, and yards, and terraces, the tar-coating is now employed with great advantage. When worn or broken it is easily repaired.—*Translated from Annales des Ponts et Chaussees.*

[The following letter appears to contain an intelligent description of Railroad affairs in France.]

European Correspondence of N. Y. American.

PARIS, Nov. 21, 1838.

We have at Paris two papers for the Steamboat and Railroad communications exclusively,—*Le Chemen de Fer*, and *La Vapeur, Journal des Pequabots and des Wagons.* The occurrences and questions relating to them are, besldes, introduced into a number of other journals, 'consecrated' to all questions of mechanical industry and *material interests.* Let me give you the titles of the principal:—Le Moniteur Industriel; L'Europe Industrielle; La France Industrielle; Le Phare Industriel; Le Capitaliste; La Bourse; L'Office de Publicite; L'Actionnaire; L'Egide; La Boussole; Le Negociateur.

The French are not inattentive to the British projects of steamboat lines to India and to South America, which, doubtless, will be, ere long, accomplished. American politicians and merchants should not overlook the prospectus of the London "Pacific Steam Navigation Company," (that is, Mr. Wheelwright's pamphlet,) wherein it is calculated, that "the presence of a number of large English steamers on the coast of South America will be certain to add to the influence (political) of England;"—that "the establishment of a regular line of steamboats between Valparaiso and Panama, calling in at all the intervening ports of any importance, will be of material benefit," and that, on the realization of the plan, "Jamaica will once more become an entrepot of supplies for the northern ports of the Pacific, and will be enabled, to a great extent, to resume that lucrative trade, by which her prosperity was formerly so much promoted." In perusing the reports of the proceedings at Newcastle, of the British Association for the Advancement of Science, I was struck with the following instance of the occasional fallibility of the luminaries and oracles of science. ("August 26,) Dr. Lardner spoke at considerable length on the subject of steam navigation. He acknowledged that he had been in error in expressing his opinion with respect to the practicability of navigating the Atlantic by steam vessels, but expressed his opinion that they could not be profitably carried on." The case of the Great Western seems to prove that the great Cyclopædist was, a second time, in error.

Not only the journals styled *industriels*, of which I have mentioned the titles, but all the political and literary, discuss or notice the present situation of the Railroad enterprises. It continues, with small variations at the Exchange from day to day, such as I indicated in my last communication. The Companies and Stockholders are in the utmost perplexity and dismay. Numberless writers propose many different remedies or expedients. Some do not hesitate to advise paying off and entire abandonment in the case of the great lines, as to which nothing more has been done than surveys and estimates, and the choice of routes. Last winter the railroad fever or mania was at its height. The success of the work between Paris and St. Germain—the first, and quite peculiar—contributed largely to turn the heads of the small capitalists, and promote the designs of the very rich. Several of the principal prints were highly bribed to feed the fever; on the other hand, sagacious and earnest warnings were issued, and several pamphleteers ran to the opposite extreme, denouncing railroads as the nation's folly and scourge, the malediction of Heaven, &c.

In fact, the whole scheme of Internal Improvement, which party snatched from the Ministers, and committed to companies much less responsible, degenerated into mere *agiotage*, stock-jobbing—a game wholly abstract from all ulterior public action and good. There are upwards of eight hundred joint stock undertakings in Paris, all *speculative*, so that you may imagine what a profligate and desperate competition has resulted, to the enrichment of a multitude of the *knowing ones*, including great bankers, and the impoverishment of a host of small and honest dupes. The *Journal du Peuple*, of the 18th instant, presents an editorial article on the subject of a more candid tenor, than I would have expected from so violent an oracle of radicalism. In enumerating the causes of the general explosion, it admits, "the narrow calculations of a teasing, harrassing Opposition, which sacrificed what it knew to be the interest of the nation, to the desire of overthowing a Ministry." "*Les droits calcules d'une opposition triacassiere qui a sacrifi ce qu'elle savait etre l'interest de la nation au desir de renverser un Ministere.*

In the same article, the ensuing facts are stated. "A great number of Associations which promised the finest dividends, and possessed millions in the beginning, are now either setting up or dragging on, by means of loans, a precarious existence, and the stockholders are summoned to meet; only to vote the sacrifice of the capitals which were to bring them so glorious an interest. A mortal discredit has befallen all joint stocks and sleeping or limited partnerships. It is impossible to say when the public can be reclaimed from its present absolute distrust and aversion, to a reasonable confidence, touching any public enterprise. The railroad speculations attracted to themselves the capital which nourished the regular branches of industry. Three or four hundred millions of francs were called for at once,—a larger sum than was disposable. The discovery of the insufficiency of means; new and sounder views of the probable gains; and the sudden depreciation of the stocks, all happened simultaneously. The holders of stock groan and complain; the really useful labours of business suffer severely; the railroad companies have little hope of realizing their funds; we hear of settlements, compromises, mergings; and it seems doubtful whether the large bankers, who are so deeply involved in the lines of Havre and Orleans, will be able to resist much longer the downward torrent. France will be brought back to the condition of merely envying the great lines of internal communication which constitute the prosperity of her neighbours."

Not a few of the public writers have declared unequivocally, that the spirit of association for general benefit, as contradistinguished from the spirit of speculation or *gambling* for individual and speedy profit, does not exist in France. The French, they say, know not what it is to club their moneys, primarily, for an object of general advantage; and in their directly selfish, individual speculations, they lack patience to await slow or distant returns. When any thing is to be done for the weal of a district, or city, or any interest beyond the immediate adventure, they look to the public authorities. In the railroad undertakings, as soon as the opulent bankers, who made a mighty flourish in subscribing millions of francs, quietly and almost furtively sold out, in order to realise a little profit in time, and thus occasioned an overflow of stocks into the market, all the small holders who had so eagerly petitioned and battled for shares, became quite as anxious and active to get rid of them. All rushed together, and the bubbles burst on every side. Capital turned in a vortex, as it were, but has finally stagnated. There is no real circulation—nothing is fertilized—no scheme of improvement can be safely pursued. I repeat compendiously what is published, and appears to me exact for the most part.

[To be continued.]

Important Invention.—At length woollen cloth has been produced from the stocking frame, which has all the appearance of loom wove cloth; but its texture and form of the threads cannot be discovered by the most powerful microscope. The process of milling has caused it to shrink into a mass of coagulated wool, resembling the felt of a hat, but its elasticity was not destroyed. Many able mechanics speak highly of the invention, which is excellent for trowsers, but too thick for coats. It is 8*s* 6*d* per yard, 10 per cent. cheaper than loom wove cloth of the same quality.—*Nottinghom Review.*

Great Improvement in Gun Locks.—An Italian named Kosaglio, who resides in England, announces a gun-lock, constructed upon such new and curious principles that it acts without any exterior combustion, needs no priming, and frees the discharge from all flame or smoke but what is emitted at the mouth of the barrel.

☞ We have not yet received an official account of the proceedings of the convention of Engineers. We have received an intimation of their nature, but abstain from giving it, as official minutes are now in preparation.

☞ The friends of Internal Improvement will rejoice in the appointment of Samuel B. Ruggles, of this city, as Canal Commissioner in the place of the late Stephen Van Rennsellaer.

AMERICAN RAILROAD JOURNAL, AND MECHANICS' MAGAZINE.

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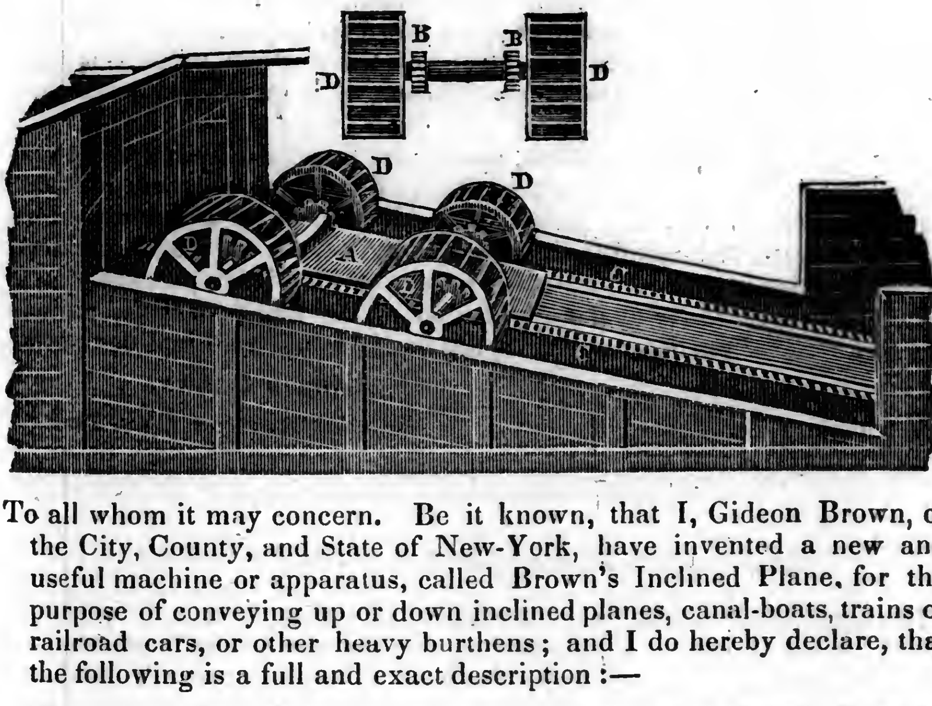
Brown's Inclined Plane.



To all whom it may concern. Be it known, that I, Gideon Brown, of the City, County, and State of New-York, have invented a new and useful machine or apparatus, called Brown's Inclined Plane, for the purpose of conveying up or down inclined planes, canal-boats, trains of railroad cars, or other heavy burthens; and I do hereby declare, that the following is a full and exact description :—

The object of this invention is to convey up or down inclined planes, where there is a small stream of water on a canal, a train of cars, a canal-boat, or any other burthen. The nature of the invention consists in applying a downward stream of water to water-wheels, or paddles, upon whose axle-trees pinions are attached acting upon a rack running beside the rails, by which means the paddles are turned in the direction of the stream, and the carriage, by means of the rack and pinion, is carried up the ascent. It is constructed in the following manner :—A sluice or rail is made upon the inclined plane, true and even in the sides and bottom, of depth and width sufficient to accommodate the paddles. Two sluices, or one only, may be made; when two sluices, as is most proper, the railway is laid between them, upon which there is a rack, also between the rails which support the carriage; or two racks, if desirable, one upon the side of each rail. When this inclined plane is intended for conveying canal-boats, a lock is made at each end of the plane, one at the bottom to raise the boat upon the carriage, and one at the top to raise the boat to the level of the canal above. When it is intended for conveying a train of cars, no locks are necessary, the sluices run so far beneath the railroad at the bottom, that the cars can be run upon the carriages, and at the top they are taken off the carriage in the same manner.

A A, &c., in the annexed drawing, is a representation of the carriage. It is generally made with four wheels, or paddles, like those of a steamboat; but two, or even one, will answer the purpose for light burthens.

B B, &c., the pinions which run in the rack and move the carriage.

C C, &c., the racks which are laid beside the rails, and are made either with cogs or sockets.

D D, &c., the paddle-wheels made of any appropriate form and dimensions.

E E, &c., Locks for placing on, and letting off a canal-boat.

When a burthen is to be taken down the plane, it is put on the carriage at the top, and only enough water let upon the wheels to prevent the carriage running down too fast.

By the plan above described, a canal-boat, or train of cars, may be conveyed safely and expeditiously up or down an inclined plane, of any length; and when the ascent is steep, or the burthen great, it is only requisite to diminish the size of the pinions, and less speed and more power will be attained.

What I claim as my invention, and desire to secure by letters patent, is the means and method above described, of applying a stream of water running down an inclined plane to paddle-wheels, to whose axle-trees pinions are attached running into racks, by which the burthen placed upon the axles is carried up the ascent, or retarded in its passage down. My claim is specifically to the application of the paddle-wheels, pinions and racks, to the purposes of conveying burthens upon an inclined plane.

GIDEON BROWN,

Witnesses, &c. 62 *Stanton-street, New-York.*

An Important Discovery connected with Railroads.

During the last month or six weeks, crowds of persons, evidently of a superior class of society, have, to the great surprise of the inhabitants of the quiet neighborhood of Soho, been seen bending towards, and enquiring their way to an obscure house, No. 6 Carlisle-street, Soho Square. In the course of the past week the excitement has greatly increased by a vast assemblage of the nobility, members of the administration, fellows of colleges and of scientific institutions, eminent engineers, naval architects, surveyors, railroad directors, painters, and a whole host of the patrons of the arts and sciences, all of whom were (as we fonnd out by following in the wake) attracted thither by the exhibition of a model of a locomotive steam-engine, which with other new and apparently simple inventions acting and harmonizing therewith, are destined to work the following wondrous changes and improvements in the present system of steam carriage conveyance—a desideratum and a "consummation devoutly to be wished."

'The engines and trains cannot possibly go off the railway or upset.

'They can run on any required curve with speed, safety, and a minimum degree of friction.

'They can ascend and descend all acclivities that can be required in railways, with speed and convenience.

'They are relieved of all the dead weight rendered necessary by the present system, and are no heavier than is required to bear the load of goods and passengers.

'The carriage bodies and weight will be almost on the ground.

'They will be less expensive than those at present in use; and the immense expenditure of tunnelling, embankments, cuttings, &c. will be entirely avoided.

'The repairs of the railways, the 'wear and tear' of the engines and trains, will be much less expensive than those now in use.

'The inconvenience and enormous outlay of cutting through parks or other peculiarly situated property is avoided, by the power of giving the line any desired direction.'

The ingenious inventor and patentee of this new system, which he illustrates with great clearness, is a Mr. Kollman, a gentleman well known and much respected and admired in the scientific circles. He attends in Carlisle-street, three days a week, for the purpose of exhibiting his models and engine, the latter of which has been beautifully manufactured at an expense of £300; and is on the scale of one and a half inch to a foot. It is worked by steam, and performs various and speedy evolutions upon a model railway, formed in the shape of the figure 8, which demonstrates practically its capability of moving round a circle of fourteen feet radius, besides its wonderful power of ascending a hill of one mile in fourteen acclivity. This revolution is effected by an additional forewheel on either side of smaller diameter, and concentric with the large driving wheel, the tire of which is roughened to give it necessary hold on the surface of the rail, which is elevated at the commencement of the acclivity, so as for the smaller wheel to act upon it, being also just sufficiently elevated to raise the larger wheel from the line of rail on which it previously acted.

To prevent the possibility of the engine being diverted from its course, there is a centre rail with two horizontal wheels in front of the engine which acts as a pole in the carriage, and makes its direction completely subservient to the middle or centre rail, the outward wheels running upon a plain and unconfined surface of iron. But description is almost superfluous—it must be seen to be properly appreciated: and Mr. Kollman, having protected his invention by taking out letters patent in this and other countries, is too liberal a minded man to withhold any information calculated to enliven and elevate the human mind, and too much of a philanthropist to refuse to elucidate a system which, according to present appearances, will be destined to confer permanent advantages and improvement on the present and future generations.—*Lond. Observer.*

Report from J. J. Abert, in reference to a Canal to connect the Chesapeake and Ohio Canal with the City of Baltimore.

(Continued from page 115.)

103. Arrangements for gauging were established in each brook, and the results of the daily gauging at each place, and also that of the rain which fell at the same time, will be found in the following tables.

TABLE No. 1.—EATON-BROOK VALLEY.

1835.	Rain gauge.	Falling water on an area of 6,800 acres.	Am'nt of same passing sluice fm same area.	Pr cent of dr'ge to fall.
Months.	*Inches.*	*Cubic feet.*	*Cubic feet.*	
June,	6·72	165,876,480	59,407,394	·358
July,	2·74	67,634,160	27,994,240	·414
August,	2·86	70,596,240	13,547,058	·192
September,	1·34	33,076,560	9,586,513	·29
October,	3·	74,052,000	20,694,551	·272
November,	2·20	54,304,800	23,772,620	·438
*December,	·96	23,696,640	36,525,544	1·541
June to Decem., inclusive,	....	489,236,880	191,528,020	·392
June to October, inclusive,	....	411,235,440	131,229,856	·319

TABLE No. 2.—MADISON-BROOK VALLEY.

1835.	Rain gauge.	Falling water on an area of 6,000 acres.	Am'nt of same passing sluice fm same area.	Pr cent of dr'ge to fall.
Months.	*Inches.*	*Cubic feet.*	*Cubic feet.*	
†Snow on ground, which fell in Nov. and Dec., 1834.	....	87,120,000		
January,	2·17	47,262,600	23,192,079	·491
February,	2·50	54,450,000	35,377,594	·649
‡March,	1·03	22,443,400	43,284,656	1·928
‡April,	5·	108,900,000	80,776,974	·741
‡May,	1·98	43,124,400	58,013,177	1·345
§June,	8·05	175,329,000	20,138,006	·115
§July,	3·87	84,288,600	23,141,302	·274
§August,	3·06	66,646,800	23,725,060	·356
§September,	·88	19,166,400	19,158,957	·999
§October,	3·86	84,070,800	19,544,880	·232
§November,	2·10	45,738,000	18,232,372	·399
§December,	·76	16,552,800	19,401,364	1·172
	35·26			
January to December inclusive, and snow.	....	855,002,800	383,986,420	·449
January to May, do do	....	363,300,400	240,644,479	·662
June to October, inclusive	....	429,501,600	105,708,205	·246

104 The foregoing are the only tables of observations of the kind that I have met with. They exhibit, in a striking degree, the remark previously made, that greater quantities of water can be collected in a cold than

* Drained the snow of November.

† Shows the quantity of water furnished by the snow on the ground when the gauging commenced.

‡ With melting snow.

§ Drainage equalized by reservoir.

in a warm climate, or in a climate having a longer winter or a greater number of months, with the ground so frozen as to lessen the filtration.

105. On examining the first table, we find that, during the months of November and December, the whole quantity of falling-water could have been collected to within two hundredths. It is also evident, from the second table, that the month of May must be taken as the latest of the months affected by the winter collection. The drainage of this month and the one preceding exceeds the falling water of both months; the latter must therefore, evidently, owe its great drainage to the accumulated deposite of the winter. These facts justify us in placing for the summer drainage of that climate, or for the drainage period in which the deposites and other effects of winter are not felt, only the months of June, July, August, September, and October. By the first table, the average drainage of these five months is 31·9 per cent.; and by the second average drainage for the same month, is 24·6 per cent.

106. Then, taking the two winter months of the first table, the average drainage is 98.9 per cent.; and again, using the same winter months of the second table, we have an average drainage of 75 per cent.

107. Although we feel bound to say that these tables are too limited to justify the establishing of any general rule, and that, for such a purpose, observation extending through many years, with the most exact measurements, can alone justify such a course; yet, at the same time, we must acknowledge the facts to be highly interesting, and deserving the confidence due to such limited observations from the just eminence of the engineer under whose directions they were made.

108. There is another remark due to the subject. The valley of a stream is not only the drain of the quantity of downfall-water, which runs into it from the surface, but also of that proportion which filtrating through the soil, finds its outlet in the bed of the stream. A deep valley, therefore, must always collect a greater proportion of downfall-water than a shoal one, although the extent of drainage be the same, as more is caught by filtration before it passes below the bed of the valley. Hence, the depth of the valley, in comparison with the edge of the drained basin, becomes an essential element in such a question. Nor can the running water of a stream be included in the result of drainage, because the stream itself is the result of the drainage; and to calculate the stream and the drainage also, is to involve the same quantity twice. It is only, therefore, at points where streams come in beyond the limit of the basin of which the drainage is included, that quantities discharged by streams can be included in or added to the quantity of water obtained.

109. We have found that in the first table the drainage per summer month was les than one-third; and, by the second table, during the same period, rather less than one-fourth. Then, taking the two winter months of the first table, or all the winter months of the second, the mean exceeds these proportions.

110. The tables of Mr. Jervis, therefore, plainly indicate a difference in the quantities collected during the summer and winter months; they also evidently show that seven months of the year is the number in which the quantity collected may be considered as influenced by the winter condition of the soil for the climate in which the observations were made. For the climate in which the canal is situated that is to be the subject of our report, if we were to allow four months as the number influenced by the conditions of winter, we presume that we will meet the case rather above than below its reality.

111. Before we go farther, it will be proper to consider the rate of rain to be accepted. Through the politeness of my friend, Dr Harlan of Philadelphia, I have been supplied with an extensive collection of rain-tables for various parts of the country; but, after giving to these the most deliberate consideration, I have come to the conclusion that the most appropriate table for our subject is the one nearest the locality of the contemplated canal, which is that of Mr. Brantz, of Baltimore.

112. The usual method of taking the average of several years' rain does not appear to me deserving of imitation; because it is well known to every engineer that, during abundant years, a vast amount of water is allowed to run to waste, that is, is discharged by wastegates from the reservoirs. To introduce this in the average of quantities collected, would be to introduce a quantity never preserved, never applied to any of the uses of the canal, and which must therefore lead to erroneous conclusions. It was probably owing to similar reflections that the board of engineers, in their report on the Chesapeake and Ohio canal, used only from Mr. Brantz's tables the rain of 1822. Under these considerations, we shall adopt for our object the rain of 1822 of Brantz's table; but, that those who differ with us on this point may have the means of calculation on a different basis, we give the entire table for nine years.

113. TABLE OF THE MONTHLY DEPTH, IN INCHES, OF RAIN AT BALTIMORE.

[*From Mr. Brantz's Tables.*]

Months.	1817.	1818.	1819.	1820.	1821.	1822.	1823.	1824.	Mean
January - -	2.25	0.90	0.70	2.80	3.30	1.80	5.60	2.30	2.85
February - -	2 80	2.00	1 90	2·20	5.40	4.80	0.70	5 90	3.225
March - -	4 50	3.00	4.55	3·30	1.70	1.30	7.10	4.30	3.71
April - -	1 50	2.10	2·70	1·10	2.10	2.10	1 80	4.70	2.20
May - -	2.60	6.45	4·10	4·40	5.10	1·50	2.10	2.95	3.65
June - -	9.10	1.15	1·30	4·60	1 80	1.50	1.60	5.03	3.66
July - -	3.50	4 10	2·20	2 20	7 50	4 35	3.60	3.37	3 85
August - -	10.40	2.00	4.30	8·00	0.30	0 80	4.10	4 50	4.30
September - -	3.30	3.20	3 00	1·50	10.70	2.25	5.80	2.94	4 45
October - -	1 80	3.10	0.70	7·80	3.40	2.50	2.80	1 77	2.975
November - -	3.70	2.00	1.10	2.70	5.60	5.10	3.10	2.27	3.20
December - -	360	3.60	2.20	1.90	3.30	1.20	6.25	2.25	2.90
Amount -	48.55	32.60	28.75	42.50	50.20	29.20	44.55	42.28	39.84

114. By the foregoing table it appears that, in 1822, the fall of rain was equal to 29.2 inches, say 29 inches; which would give for one acre 3,898 cubic yards. We have before remarked that the general opinion among engineers is, that one-third of the downfall-water can be collected; but, by the tables of Mr. Jervis, about two-fifths can be collected; and, in his opinion, two-fifths may be counted on with safety. The point, therefore, upon which one's judgment may hesitate, is in the adoption of one-third or two-fifths. We acknowledge that the facts in Mr. Jervis's tables have more weight with us than conjecture. It is only that his observations were of so limited a period, and that the excessive drainage of some months induces us to suspect error in the observations, that we do not at once adopt them; as, for instance, table 2—while the drainage of February and March exceeds the whole downfall-water of these two months; that of April and May, immediately succeeding, nearly equals the downfall-water of those two months: the drainage of these four months exceeds the downfall of the four; and the downfall of the two or three preceding months is not, taking the months of the same year as stated, so excessive beyond the drainage satisfactorily to account for it, with a reasonable allowance for evaporation and filtration. There may be no error; the facts may be as stated; but, being very singular, and certainly new, we do not think they would justify the adoption of a general rule until verified by repeated subsequent observations. Now, excessive drainages are involved in the average result of both tables, which in No. 1 is 0.392, and in No. 2 is 0.449, the mean of which is 0.4205, or say two-fifths. Treating the table of Mr. Brantz, for 1822, according to our reasoning about summer and winter months, allowing four for the latter, the result wouldaalso be about two-fifths, or forty per cent.

115. But, from the remarks which we have made on the tables of Mr. Jervis, we feel unwilling at present to adopt what they would justify. Observations are now being made, in reference to the same subject, on the summit-pass of the Chesapeake and Ohio canal. These will probably confirm Mr. Jervis's results, or, in conjunction with them, furnish the profession with more positive data than it has hitherto possessed in reference to this highly interesting question. Until then we feel some doubt about the propriety of deviating from the rule hitherto generally received, that one-third or 33 per cent. of downfall-water can be collected in well-arranged reservoirs. Mr. Jervis's tables would justify the assumption of two-fifths, or 40 per cent. After all, the difference between the two is no more than seven-hundredths.

116. Applying the rule, then, which we have decided to adopt, viz: one-third of the downfall, to the rate of rain of 1822, it will give, as the quantity which can be drained into a reservoir from each acre of its basin, 1,299 cubic yards.

117. The next question refers to the loss which water experiences from evaporation and filtration, after having been collected into reservoirs. Sutcliff, on this subjeet, and referring to the reservoirs of the Rochdale canal, says, "In the summer months, they sink one inch per day when the cocks are shut close, and yet I think no reservoirs are more water-tight than they. But I will only estimate uponthe reservoirs wasting half an inch per day, and confine it to those on Blackstonedge, as that at Hollingswork gives a certain quantity of water constantly to the mill-owners, which makes it difficult to ascertain how much it wastes," &c. It is really to be regretted that this question had not been more nicely determined, the opportunity being very favorable, as the quantity which the mills consume admits of accurate calculation. We must, however, under the circumstances of the case, be contentwith his rate of loss of half an inch per day, or fifteen inches per month.

118. For the same object, Andreossi applies to the reservoirs of the Languedoc canal twelve millemetres per day, equivalent to 0,472 of an inch. The coincidence between the two is sufficient to justify us in adopting for the reservoirs a loss of half an inch per day. These rates are given by both authors as actual states of loss from exposed surfaces, under the effect of rain upon them.

119. We have collected much information upon reservoirs in our own country, but it was not of a kind, either in the character of its facts or their accuracy, to be of use in the points which we have been discussing; and a reference to it would, in consequence, merely extend the volume of our report without elucidating its object.

120. Having concluded that an average rate of one-third of the downfall-water can be collected into suitably arranged reservoirs; having shown that the drainage between winter and summer months varies considerably; and having also decided that for the climate of the contemplated canal four months may be assumed as the number affected by the condition of winter, it now becomes necessary to ascertain the effect of these considerations upon the rain assumed.

121. By the second table of Mr. Jervis, which extends through the whole number of months in the year, it appears that the summer drainage was equal to 0.246; say 0 25, or one-fourth of the downfall-water. Applying this qnantity to eight summer months, and involving the remaining four for the balance of the remaining average of one-third, it will justify for these latter (the winter months) an amount of drainage equivalent to 50 per cent. of the downfall water; rather more than the correct fractional quantity. Now, applying these considerations to Brantz's tables for 1822, we have the following results.

Months.	Fall of water.	Drained.	Quantity drained.	Quan. dr'd. per. sqr. acre
	Inches.	Per cent.	Inches.	Cubic feet.
January - - -	1.8	0.50	0.9	3267.0
February - - -	4,8	0.50	2.4	8712.0
March - - -	1.3	0.50	0.65	2359.5
April - - - -	2.1	0.25	05.25	1905.7
May - - - -	1.5	0.25	0.375	1361.2
June - - - -	1.5	0.25	0.375	1361.2
July - - - -	4.35	0.25	1.0875	3947.6
August - - - -	0.8	0.25	0.2	726.0
September - - -	2.25	0.25	0.5625	2041.9
October - - -	2.5	0.25	0.625	2268.8
November - - -	5.1	0.25	1.275	4628.2
December - - -	1.2	0.50	0.6	2178.0
Total - - -	29.2	0.333	9.575	34757.1

124. The total quantity which, by the foregoing table, may be collected in one year from one acre, is 34757.1 cubic feet, or 1287.3 cubic yards; and of this quantity it appears, that during the four months of December, January, February and March, there may be collected 16516 5 cubic feet, or 611.72 cubic yards; and during the summer months of April, May, June, July, August, September, October, and November, 18240.6 cubic feet, or 675 57 cubic yards. From which it will be perceived that the four months of winter drainage, being nearly equal to the whole drainage of the eight summer months, shows the necessity of so planning and arranging the reservoirs that the winter drainage may be collected and preserved to meet the deficiencies of the summer supply.

123. These remarks naturally lead us into considerations of the dimensions of the reservoirs—a matter, however, which more properly belongs

to the plan of the canal after its practicability has been determined. But, generally speaking, these dimensions should be adopted to fill the canal on the opening of navigation, and to maintain its trade and waste by supplying any deficiency from the summer drainage and probable drought.

124. The dimensions of reservoirs have great influence upon their usefulness. Deep and narrow valleys should always be selected for such purposes. The losses they experience are in proportion to the surface; the less the exposed surface in which the same quantity of water can be confined the better. The reader will the more readily appreciate this remark, when he understands that the surface of one mile square is sixteen times as great as a surface of one-quarter of a mile square; and if, therefore, by the fortunate position of a narrow and deep valley, a reservoir could be constructed that should not expose more than a quarter of a mile square of surface, and contain as much as under other circumstances would have to be spread over one mile square, the same mass of water would in the one case lose only one-sixteenth of what it would in the other. From which it may also be inferred, that, ftom the want of suitable positions for reservoirs, a canal may be impracticable, although the extent of surface drained would yield a sufficiency of water.

125. *Dimensions.*—As the contemplated canal is, in fact, an extension of the Chesapeake and Ohio canal to Baltimore, which would make that city one of its great terminations on navigable waters, it appears to me that there can be but one opinion in reference to its dimensions, trunk, and locks; and that these should be the same as those of the canal of which it forms so important a part. But, in consequence of the new summit to this part, the lift of the locks may be reduced, in order to adapt them the better to the probable supply of water. Such, also, appears to be the opinion of engineers Trimble, Fisk, and Hughes. The first adopts a lift of 5, the two others of 4½ feet. Preferring, of the two, the lift of 5 feet, we shall assume that in our calculations Accordingly, therefore, our reasoning will be applied to a canal 60 feet at water surface, 32 feet at bottom, and 6 feet deep; to locks, 100 feet by 15, with a lift of 5 feet, the prism of lift of which will be 7500 cubic feet, equal to 277.7 cubic yards. In adopting, however, this reduced lift, it is solely from the consideration that it may be necessary in order to accommodate the canal to the supply of water—experience having proved that, in most points of view, the best lift for a lock is from 7 to 8 feet.

126. *Practicability.*—The question of practicability, with due supply of water, depends upon the quantum of trade. A canal may be made, and there may be water enough to fill it; but if there should not be enough to sustain a reasonable degree of trade, we believe the common sense of mankind would at once decide that such a canal was impracticable.

127. For the probable extent of this trade we will refer to the extremely interesting remarks, under the head of "general considerations," in the report of the board of engineers upon the Chesapeake and Ohio canal; and a slight observation upon the facts daily developing is sufficient to demonstrate that the views of the board will soon be realized. These, however, embrace the great trade East and West, in which this canal cannot participate until the great communication is completed; but whenever completed, the extension to Baltimore must come in for a share. Its practicability, therefore, should have reference to its capability.

128. But, although participation in the great trade to the West may not soon be realized, yet we know that the line to the great mineral region of

the Alleganies is now within a year or two of being completed, and that it will be in full operation by the time the contemplated extension to Baltimore can be made. This extension will, therefore, have in the outset to subserve an extensive and established trade; in reference to which, its capability should be tried.

129. The Alleghany is the great bituminous coal region of our country with which this canal has to communicate. It would be superfluous to reason upon the amount of trade from such a region. Our periodicals are full of facts upon the subject, with which every one who can read has already been acquainted. That the demand for this mineral will soon bring the canal to the maximum of its capability, no one can doubt: and, using that principle as data, we may determine its practicability with due supply of water. The maximum of the ability of a canal depends upon the number of boats which can be passed through its locks. A medium, we shall place at half that number; a minimum, at one-fourth; and, in our judgment, the canal that does not possess a minimum ability is impracticable. Our remarks have no reference to profits. We will admit at once that a minimum ability would not furnish a profitable income upon the investment—that it would be a mere barren practicability; but there may be cases in which it may be to the advantage of the State to construct a canal, there being no other route practicable, regardless of any probability of profit from its revenue. This is a matter for the State to decide. I have to do only with the question of "practicability, with due supply of water."

130. Bare barren practicability, then, might be considered as possessed by a canal which could supply with its water all causes of waste, and be able to sustain a minimum trade. Bare practicability is not, however, the question to be decided; it is "practicability, with due supply of water." "Due supply" can have no other meaning than "adequate supply," and adequate supply must have reference to the probabilities of trade. If we suppose, then, that the commercial advantages of Baltimore would enable her to direct about one-half of the entire trade of the Chesapeake and Ohio canal to her own stores—and, without doubt, the object of the canal is to give Baltimore all that it can command of its trade—it will then be necessary to show that the canal will be able to pass at least that quantity, or we shall fail in proving an adequate supply of water. The point, then, of "practicability, with due supply of water," depends upon the question whether or not the supply will be adequate to what we have previously distinguished as a medium trade, or half the entire power of the locks with a full supply of water. Half the number of passages of a full supply, will therefore, be taken as the test of "practicability, with due supply;" and if it should appear that there is water enough for such a number of passages, adding thereto allowances for waste, I shall not hesitate to give it as my opinion that the canal "is practicable, with due supply of water."

131. Now, we will suppose that 12 boats per hour may be passed through a lock of 5-feet lift, and that the average of daylight during the ten months of navigation is 12 hours. As there is a lock at each extremity of the summit-level, there would be 24 passages per hour, or 288 per day, for the maximum ability of the extension to Baltimore. A medium ability, or that which I have considered "practicable, with due supply of water," would then be 144 passages both ways, or 72 passages each way. We will, however, for greater security, and for facility of calculation, assume 80 passages each way per day. The engineers who have previously reported on this matter, have assumed 100 passages each way; in taking

but 80 for our guide, we may be considered as treating the question with great liberality. Our reader will bear in mind that we assume 80 passages per day as no more than half the ability of a lock of 5-feet lift, with a full supply of water; and that we consider it necessary to show water enough for this number of passages in each direction, or 160 in the two directions, or we shall fail in proving the "practicability of the canal, with due supply of water," and which, we have said, should depend upon its ability to direct about one-half (rather more) of the trade of the Chesapeake and Ohio canal to Baltimore, which trade we have considered equivalent, or that it will be, to the full ability of its lock for twelve hours.

132. We have now terminated our remarks upon what we consider the preliminary questions of the case They have extended themselves, however, into greater length than we had anticipated. We shall therefore endeavor to generalize them, and to reduce them, so that their application will be more convenient.

133. We have shown that the Languedoc canal, during ten months of navigation, loses by its filtration more than eight times its prism of water. It will not, we believe, be considered unreasonable to suppose that the prism which the canal contains at the closing of its navigation is lost during the remaining two months, and, of consequence, on the opening of navigation, this prism has to be supplied from the feeders; which will make more than nine prisms of water for the ten months of navigation. To this item must yet be added the losses from evaporation, and the leakage from the locks.

134. With such facts, we presume the inference will not be disputed, that this canal, the one which loses the least from all causes of waste of any known canal, cannot lose less, during its ten months of navigation, than ten prisms of water, or one prism per month.

135. But would it be wise to adopt, as an estimate for another canal, the losses which one of the character of this experiences? We should answer in the negative. Moreover, if our views of its evaporation be correct, as previously explained, (25,) to the nine prisms stated (in 133) as its loss from evaporation, should be added three and one-fifth prisms. Then, if we suppose the leakage from the lock-gates, and all other causes of waste, merely adequate to make up this last fraction the whole will give, for its total loss from all causes, thirteen prisms of water for its ten months of navigation, or one and three-tenths of a prism per month. We have seen (44) that the cube of this canal, for one mile, is 64,207 yards; which, treated for the losses we have just enumerated, will make the same equal to 52.2 cubic feet per mile per minute, which, in our judgment, is not beyond the reality. The evident disposition in all the authorities to which we have referred to vaunt the advantages and lessen the defects of this canal, is continually involving the latter in minimum considerations, and, consequently, unsafe rules.

136. The board of United States engineers, in their report on the Chesapeake and Ohio canal, supposed the losses from filtration and evaporation will be one prism per month—less than what we have already seen actually takes place with the Languedoc canal. The opinion of the board appears to have been founded upon observation in reference to the Narbonne canal, which, after a use of six years, lost one and two-thirds of its prism of water; and considering the summit of which they were treating, (more tenacious in its soil than that of the Narbonne canal,) the inference drawn was, that the former would lose once its prism per month.

137. The Narbonne canal may be supposed to have reached its mini-

mum loss in six years; and the rates given are for filtration and evaporation only; that of leakage at lock-gates is not taken into account. Nor is there in our canals that care of construction, and extent of excellence in puddling, which the board evidently took into consideration in the estimate of loss of water which they gave.

138. Moreover, in the second report on the same canal, (page 54,) the board, reasoning upon a different summit, much more abundantly supplied with water than that taken into consideration in the first report—not requiring so close a calculation to show its bare practicability, and which they recommend to be adopted in preference to the first—take great pains to show that there will be 120,000 cubic yards per mile per month for the various causes of loss, exclusive of lockage. Now, as the prism of the canal of which they were treating is no more than 39,785 cubic yards in a mile, we see that the summit which they ultimately and unequivocally recommend, and for which they furnished a plan and estimated the cost, had a supply of water, exclusive of lockage, of between three and four times its prism per month, "destined (as the board themselves express it) to feed the canal, exclusive of lockage;" or, in other words, to supply water for all other causes of consumption.

139. Also, in the general opinion given in the first report of the loss of one canal prism of water for each month of navigation, consideration does not appear to have been given to the prism left in the canal, and lost while the navigation is suspended, or for the lock-gate leakage.

140. On these accounts we cannot forbear expressing it as our opinion that an allowance of one prism of water per month of navigation for all causes of exhaustion except lockage, will prove to be insufficient, and is, therefore, an unsafe rule.

141. The loss on the Erie canal, which we have found, at the least of the ascertained rates, to exceed five times its prism per month, is, without doubt, singularly great. The observations were made in 1834, when its losses should have approached a minimum. It would be considered out of place to discuss, in this report, the probable causes of so great a loss of water; nor have we, in fact, that accurate knowledge of the canal which would justify the attempt; but, as a mere opinion, we feel disposed io place much to the account of defectiveness in the original construction. Be that as it may, however, we should not hesitate to pronounce a canal as practicable that should possess a less supply: nor should we feel ourselves as doing justice to the profession of the engineer if we were to require resources of water to equal the standard of the Erie canal before we would give an opinion in favor of their sufficiency.

142. The loss for filtration and evaporation on the Chesapeake and Ohio canal has been found to be about twice its prism of water per month of navigation. Now, as this canal is the same in its dimensions as that to which our remarks are to be applied, the climate also similar, and in some degree its soil, we consider it the fairest guide for our opinion, and shall therefore adopt the results it has yielded.

143. Our reasoning, then, will furnish the following data for calculating the quantity of water that will be exhausted:

1st. The canal has to be filled.

2d. Twelve locks-full per day should be allowed for the leakage of each lock at the end of the summit-level.*

3d. Two prisms of the canal per month for losses from filtration, absorption, and evaporation.

* Annales des Ponts et Chaussees Vol. 10, p. 162.---Eight locks-full per day is allowed for losses on this account.

4th. Two locks-full of water per boat, for the passage of the summit.

5th. Twelve and a half prisms of the feeders per month for loss in feeders. I feel less confidence in the adequacy of this, than of any other item. It is taken from the experience of the Languedoc canal, in which particular care has been bestowed upon the construction of the feeders. I desire it, therefore, to be distinctly understood, that I contemplate well-constructed feeders, carefully puddled throughout.

6th. One-third of the downfall-water as the quantity which can be collected in the reservoirs.

7th. To allow a loss of half an inch in depth for each day for the water when collected. The loss on this account will extend through the whole year.

8th. And, for the locality of the canal in contemplation, to adopt a rate of rain of 29 inches per year.

144. But, after all, every candid and experienced engineer must acknowledge that these rates can be viewed only as a minimum; less would be inadequate to the object. Any unforeseen event, therefore that creates additional loss, at once throws the supply into a state of inadequacy, and produces a comparative failure in the canal. On these accounts it is the duty of every engineer, after having stated all the causes that can be appreciated which consume water, to show a proper surplus to meet unforeseen contingencies.

145. In matters admitting of much greater accuracy, because founded on more correct data—for instance, the expense of constructing the canal—does not every engineer, after having included every item which experience has suggested, then add his twelve or fifteen per cent. for accidents and unforeseen contingencies? Yet, in a matter of that kind, the error of a short estimate involves no greater evil than the expending of more money than had been at first contemplated. But, in the water for a canal, the error for a short estimate may probably make the whole expenditure of money useless. How much more important is it, then, that surplus water should be at command. The reflection becomes of greater weight when we bear in mind that, in every instance, the water consumed by canals has exceeded the amount anticipated. Even after the long considered and most cautiously pursued measures in reference to the Languedoc canal, the additional reservoir of Lampey had to be added.

146. The engineer should, therefore, show that his arrangements will procure a large surplus of water, or that a surplus is at command, by additional and appropriate arrangements, should it be required.

147. Having now completed the preliminary remarks, which appeared to me to be essential to a correct understanding of the subject, I shall proceed to apply them to the particular cases of the survey.

148. For the reasons already given, (4,) the field operations were at first confined to two routes, namely, the Linganore and the Seneca routes. These were the two upon which reports had already been made, and in reference to which the Executive of Maryland had founded a decision upon their "practicability, with due supply of water." No other survey south of these, and exclusively within the limit of the State of Maryland, had then been made; and the impression was general, that no pass existed south these and within the limits specified, the characteristics of which would vary in advantages over those which had been previously surveyed. But, from a knowledge of the country acquired by a summer's residence there, I was induced to entertain doubts of the correctness of this impression, and accordingly directed the engineers that, in addition to the renewed surveys

of the routes in question, they should also carefully examine the ridge of highland elsewhere, and determine positively whether or not any better way of passing it existed. The result exceeded my expectations. I was early informed by Mr. Kirkwood, that a route existed passing the ridge a few miles south of the former surveys, and much lower. He was required to bestow his best attention upon it. We were thus involved in the survey of three distinct lines, instead of two, as had been at first contemplated. In fact, it may be said that four lines were surveyed, as the data for two suppositions of the original Seneca route were collected.

149. I had also required the engineers to limit their operations to what might be considered the summit-section of each route; by which I mean that section which would receive its supply of water from the summit, and which includes the summit-level, and the extension of the canal each way, to points at which ample secondary supplies would be received. By this plan all the debatable ground was covered; and, by thus limiting the field-work, it would be terminated soon enough to make a report upon the point of principal interest—in fact, upon the sole point involved by the resolutions of the Legislature—in the time anticipated by the Legislature. Had the field-work been extended this season to the canal on one side, and the city of Baltimore on the other, it would have been a mere repetition of matter upon which no difference of opinion exists in reference to the practicability of the route; and which, from the delay it would have occasioned, would probably have put it out of my power to have made a report in time for any action of the Legislature at its next session.

150. Of the three lines mentioned, I shall give but a summary description, referring for a more detailed knowledge of them to the joint report of the engineers, Kirkwood and Lee, herewith appended, and from which the following facts are taken. The map attached to this report will enable the descriptions to be the better understood.

THE LINGANORE ROUTE.

151. This route passes the ridge through the valleys of Middle run and Grimes's Spring branch. Its summit is 236,076 feet below the ridge at Grimes's tobacco-house, and 530,179 feet above tide, according to the survey made by the engineer, J. Trimble. The length of the summit-section is 12 miles 714 yards, and it will first derive its secondary supplies of water from the Patapsco on the one side, and from Talbot's branch on the other. It would require a tunnel 3 miles 197 yards long, and will command a drainage of 26.98 square miles. It will admit of an arrangement of three reservoirs, namely: 1. One on Gillies' falls, with a dam 48 feet high, a surface of 71.81 acres, containing 3,475,470 cubic yards of water, and receiving the drainage of 11,202.7 acres. 2. One on Warner's branch, with a dam 38 feet high, a surface of 26.24 acres containing 1,072,056 cubic yards of water, and receiving the drainings of 3,346.447 acres. 3. One on Beaver dam, with a dam 40 feet high, a surface of 20.707 acres, containing 890,851 cubic yards of water, and receiving a drainage of 2,718.89 acres. It will also require three feeder lines, in all 3,437 yards long.

152. The total quantity of surface drained being 17,268.05 acres, at the rate of 29 inches of rain, and supposing one-third to be collected, it will yield 22,441,394 cubic yards of water, which is the extent of the supply which can be commanded for the summit-section of this route. We will now ascertain its adequacy to the wants of the canal.

153. There will be required—

1st.	To fill the canal . . .	669,575.96	cubic	yards.
2d.	For lock leakage . . .	1,999,995.00	"	"
3d.	For filtration and evaporation	13,391,519.20	"	"
4th.	For the trade of the canal	26,666,640.00	"	"
5th.	Loss in feeders . . .	1,432,183.725	"	"
6th.	Loss from reservoirs . .	1,896,180.000	"	"
	Total quantity required .	46,056,093.885	"	"
	Total quantity available .	22,441,394.298	"	"
	Deficiency,	23,614,699.587	"	"

154. This route is, therefore, impracticable. It will be seen that the supply is even inadequate to the wants of the locks for the trade, exclusive of every other consideration.

THE SENECA ROUTE.

155. The course of the survey led to two surveys in reference to a part of this route, varying its termination in the valley of the Seneca.

1*st case.*—It will require a tunnel 547.66 yards long; the summit-level will pass 122.47 feet below the ridge at H. Griffith's; will be 41.26 feet above the Patuxent river, at Etchinson's mill; and will be 496.26 feet above tide, according to the data of the engineer's (Trimble) survey. Our operations, as before remarked, not extending, in any route, to the termination of the canal, we have to avail ourselves of the labor of our predecessors, in order to ascertain the reference to tide-water.

The secondary supplies will be derived from the Wild-cat branch of the Seneca, and the Seneca itself, as the canal progresses, on one side; and the Cat-tail branch of the Patuxent, the Patuxent itself, and so forth, on the other. The total length of the summit-section will be 14 miles 1,193⅓ yards. It admits of the arrangement of two reservoirs.

1st. On Cabin branch, with a dam 30 feet high, with a surface of 31.253 acres, containing 1,008,420 cubic yards, and having the drainage from 2,903.68 acres.

2d. On the Patuxent, with a dam 42 feet high, with a surface of 58.05 acres, containing 2,622,312 cubic yards, and having a drainage from 8,452,080 acres. The feeders from these reservoirs will be 2,485 yards long.

156. The total quantity of surface drained being 11,445.76 acres, it would yield, at the rates stated, (152) 14,875,247.7 cubic yards of water for the available supply of this route.

157. The demands for water will be—

1.	To fill the canal . . .	792,211.971	cubic	yards.
2.	Lock leakage . . .	1,999,995·	"	"
3.	Filtration and evaporation .	15,844,239·	"	"
4.	Canal trade	26,666,64·0	"	"
5.	Loss from feeders . . .	1,763,313·250	"	"
6.	Loss from reservoirs . .	1,345,095.	"	"
	Total quantity required . .	48,415.494 221	"	"
	Total quantity available .	14,875,247.700	"	"
	Deficiency	33,540,246.521	"	"

158. This route is, therefore, impracticable. The available quantity

amounts to but little more than half the amount required for the locks, exclusive of every other consideration.

159. 2*d case.*—The summit-level in this is the same as in the first case; the secondary supplies also the same, with the difference that Darby's branch is the first used in the valley of the Seneca. The reservoirs are also the same. The summit-section is 11 miles $73\frac{1}{3}$ yards in length; the difference between this and the summit-section of the first case being the sole cause of difference in the demand of water between the two, it is not necessary to repeat the statement, in reference to water, in detail.

The total quantity required is .	44,295,172.107	cubic yards.
Total quantity available . .	14,875,247.700	" "
Deficiency . .	29,414,924,407	" "

160. This route is, therefore, impracticable; and, as in the first case, it will be perceived that the quantity of available water is but little more than half the quantity required for the mere use of the locks, in passing the trade.

161. I have now applied the general rules which have been determined, to the peculiarities of those lines which had been the subjects of previous report, and in reference to which the decision of the Executive of Maryland had been given, that they were impracticable in reference to due supply of water. It will be seen that I agree with that opinion, and consider them impracticable also. Whether I am right or wrong, is for others to decide. I believe myself to be right, and have fairly exposed all the reasoning upon which my opinions are founded. The facts to which my reasoning has been applied were not collected by myself, as before remarked, (8;) this duty was committed to the engineers Kirkwood and Lee, and without interference beyond general directions, and a reference to former reports on the same subject. The preliminary observations which have governed my opinions were digested and written out before the surveys were completed, and, of course, before I could have any anticipation of the opinion they might induce in reference to these surveys. My object was, to establish certain general principles, and, being satisfied with their correctness, to follow them out, no matter to what conclusions they might lead, or with whom they might compel me to differ. Difference of opinion with some one was inevitable, as engineers of deservedly great fame had already given diametrically opposite opinions on the same subject. With both, it was impossible to agree. But such differences are not unusual. In matters which, like these, do not admit of mathematical precision, they are difficult to avoid. We find accounts of them in the works of foreign engineers; and, therefore, the less surprising in our country, where a more limited experience has done so much less in settling rules for practical operations. If I have had any advantages over those who have preceded me in this matter, it has been solely in the more time at my disposal, and the greater means in my power to apply to the execution of the surveys, which have probably enabled me to collect more, and with greater care, the facts upon which an opinion can be founded.

162. It was remarked (148) that three distinct lines had been surveyed. Having reported upon two, it now remains to bring the peculiarities of the third and last to notice: we shall call this, by way of distinction, "the Brookville route," as it passes near that village.

BROOKVILLE ROUTE.

163. The summit-section of this route is 16 miles $1,506\frac{2}{3}$ yards long, connecting, on the one side, with the Seneca, at the mouth of Whetstone

branch, and on the other with the Patuxent, at the mouth of Hawling's river. Referring to a bench-mark of Mr. Trimble's survey, near Mr. Griffith's, with which the survey of this line was connected, its summit-level is 375 feet above mean tide, and 120 feet below what has been heretofore denominated "the Seneca route," and between 8 and 9 miles south of it. The greater depression over any other surveyed route, by which this line (the Brookville route) is made to pass the intervening ridges, gives to it great advantages, particularly in reference to supplies of water. It will require two tunnels: one in passing the Rockville ridge, 2,800 yards long; and another in passing the Mechanicsville ridge, 2,600 yards long; after which it enters the valley of Reedy branch, a tributary of Hawling's river. The total length of tunnelling will, therefore, be 5,400 yards, or 3 miles, 120 yards.

164. The line will admit of an arrangement of six reservoirs, viz.:—

1st. One on the Seneca, with a dam 40 feet high, a surface of 152·66 acres, containing 4,214,955 cubic yards, and receiving the drainage from 10,908·16 square acres.

2d. One on Goshen branch, with a dam 20 feet high, a surface of 94·123 acres, containing 2,065,266 cubic yards of water, and receiving the drainage from 4,613·12 square acres.

3d. One on Hawling's river, with a dam 45 feet high, a surface of 96·618 acres, containing 2,548,450 cubic yards of water, and receiving the drainage from 6,515·2 square acres

4th. One on the Patuxent, with a dam 50 feet high, a surface of 336·685 acres, containing 11,039,352 cubic yards of water, and receiving the drainage from 21,863·04 acres.

5th. One on Cat-tail branch, with a dam 40 feet high, a surface of 331·382 acres, containing 7,444,741 cubic yards of water, and receiving a drainage from 17,648 square acres.

6th. One on Big branch, with a dam 30 feet high, a surface of 40·404 acres, containing 900,453 cubic yards of water, and receiving the drainage from 2,497 92 square acres.

165. The dams in some of these reservoirs will admit of being raised higher, if necessary, so as to contain more water without any unfavorable extension of surface.

166. The total development of all the feeder-lines of the reservoirs amounts to 15 miles 903 yards. The feeders, however, so unite as to form but two points of connexion with the summit level

167. The total extent of drained surface being 64,045·44 acres, it will yield at the rate of 29 inches of rain; and, on the supposition that one-third of the same can be collected, an amount of 53,229,611·09 cubic yards of available water.

168. We will now see what amount of water will be required, on the supposition of 10 months or 300 days of navigation.

1st. To fill the canal, - -	909.774·500	cubic yards.
2d. Leakage at locks, - -	1,999,995·000	do
3d. Filtration and evaporation -	18 195,490 020	do
4th. For the trade, - - -	26 666,666·666	do
5th. Loss from feeders, - -	11,376,199·999	do
6th. Half an inch per day loss from reservoirs, for 365 days, -	17,206,399·020	do

Total required,	- -	76.354,523	cubic yards,
Total quantity available	.	83,229,611	do
Surplus	- - - -	6,875,088	do

169. The Brookville route may therefore be pronounced "practicable, with due supply of water." In this, as well as in the other cases, the rate of loss from the reservoirs was not applied to the maximum surface when full, as given in the preceding description of the several routes, but to a reduced average surface, on the supposition of a proportionate reduction of the water in the reservoirs from the use of the canal.

170. In the investigation of the peculiarities of this route, some facts were collected leading to the probability that, from 6 to 8 miles still further south, a route might be ascertained that would reduce the tunnel length. These facts developed themselves only in the plotting of the experimental lines, and at a time when it was not possible to pursue further investigations in the field, which would have required an entire survey of a new line, with an entire new arrangement of reservoirs and feeders, and a survey of all their numerous details.

171. It will be seen that I have limited my report to the single question involved in the resolutions of the Legislature—"practicability with due supply of water." An estimate of probable cost can be made if desirable.*

172. These surveys having cost more than had been anticipated by myself, it is proper that I should explain the causes of it. In the first place, it was not contemplated that it would be necessary to survey any other than the Linganore and Seneca routes; but, in the prosecution of these, a third (the Brookville route) manifesting itself, and with such advantages over either of the others, it was also surveyed. This last route involved as many details, and as much labor nearly, as the other two; so that the actual cost will be found not to have increased beyond the original estimate more than in proportion to the actual increase of labor beyond what had at first been anticipated.

173 In conclusion, I consider it a duty to acknowledge my obligations and thanks to Messrs. Kirkwood and Lee, the principal engineers under me, and to whom the surveys were committed, for the intelligence, the zeal, the industry, and economy with which their operations were characterized. Respectfully submitted, J. J. ABERT.

December 10, 1838.

First Annual Report of the Board of Directors, to the Stockholders of the Housatonic Railroad Company.

The Report, of which we give the greater portion below, has been some time on hand, but from a want of space we have been obliged to defer its publication. We particularly commend to the attention of our readers that portion which developes the immense resources of a district as yet unprovided with any means of communication to a market. We are pleased to hear that great progress has already been made on the inspected work.

* The estimate is now being made.

OFFICERS OF THE COMPANY.

William P. Burrall, PRESIDENT.

DIRECTORS.—William P. Burrall, Edwin Porter, Samuel Simons, Stephen Lounsbury, Charles DeForest, *Bridgeport;* Anan Hine, Asa Pickett, *New Milford;* Alpheus Fuller, *Kent;* Peter Bierce, *Cornwall.*

William H. Noble, SECRETARY.

Jesse Sterling, TREASURER.

REPORT.

To the Stockholders of the Housatonic Railroad Company:—

THE Board of Directors of this Company were requested, by a resolution passed at the annual meeting of the stockholders, holden on the 3d of October inst., to publish such parts of the reports and statements submitted to that meeting, as in their discretion they should deem expedient. No official report, or statement of the affairs of the Company, from the Board to the stockholders, having ever been published, and it being difficult to select any particular items of information as being more interesting and important than others, we have deemed it advisable to present a concise history of this project, and of all the operations of the Board, from the granting of the charter, up to the present time; and at the same time to submit a few remarks upon the subject of the resources on which the road must rely for its support when completed; so that not only the stockholders may be able to form an opinion in regard to the manner in which those having charge of their interests have discharged the duties of their trust, but that also they, and all others who feel any interest in this subject, may be enabled to judge, each for himself, in regard to the present condition of the work, its future prospects, the time when its completion may be expected, and the probable productiveness of the stock, when the work shall have been completed.

The charter, under the authority of which this Company is organized, was granted by the General Assembly of this State, in May, 1836, investing the Company with all the powers usually granted to incorporated institutions of this character, and giving them authority to construct a rrilroad, with a single, double, or triple track from the north line of this State, adjoining the town of Sheffield, down the valley of the Housatonic river to a certain point, described in the charter, in the town of Brookfield, and thence either to tide water at the city of Bridgeport, or to the northern termination of the Fairfield County Railroad, at Danbury, or through Danbury and Ridgefield, to the western line of the State of Connecticut, to meet a contemplated railroad from Harlem, through West Chester County;—thus contemplating not only the furnishing of facilities for transportation to tide water of the immense amount of heavy articles originating in the Housatonic Valley, but also a communication, by means of railroads, between New-York and Albany; the importance of which communication, during that portion of the year when the Hudson is closed by ice, it is believed all are able to appreciate.

No active measures were taken in reference to obtaining subscriptions to the stock of the Company, till the winter succeeding the passage of the Act of Incorporation. During the latter part of that winter a careful survey of the whole route was made, together with estimates of the expense of constructing the road, by R. B. Mason, Esq., the present Engineer of the Company; and the whole expense of constructing the road on the plan finally adopted by the Board of Directors, was by him estimated at about $1,040,000—or a little more than $14,200 per mile; the whole distance from Bridgeport to Massachusetts' line being seventy-three miles. After the completion of this survey, a proposition was made to the Commissioners appointed to receive subscriptions to the stock of the Company, to construct the whole road, as surveyed by the Engineer, for the gross sum of $936,000, and to subscribe to the stock of the Company $300,000, to be paid out of the work done and materials furnished, as estimated monthly by the Company's Engineer, the monthly estimates to be made proportionate to the above mentioned gross sum. The Commissioners were of opinion that this proposition was one deserving their serious consideration, and deemed it their duty forthwith to open the books for subscription to the Stock of the Company, although the monetary affairs of the whole country at that time were in such a condition, that even the most ardent friends of the project had but faint hopes of obtaining subscriptions to a sufficient amount to justify the organization of the Company. But they were agreeably disappointed. The city of Bridgeport, in its corporate capacity, subscribed $100,000; and, with a very limited notice, and a very short time spent, individual subscriptions were obtained in Bridgeport, and in the towns north, in the immediate vicinity of the line of the road, amounting to about $200,000 more; making in the whole a subscription of something over $600,000, inclusive of the $300,000 subscribed by the contractors. This amount, obtained almost without notice or effort, wholly within this State, and in the immediate vicinity of the line of the road, from those best acquainted with the route through which it was to pass, and with the resources on which it must depend for support, and this too at a time of pecuniary distress almost unexampled in the history of the country, furnishes a most gratifying, as well as conclusive evidence, of the confidence reposed in this project by those best qualified to judge of its merits.

The Board of Commissioners resolved, with the above-mentioned amount of subscription to the stock of the Company, to call together the subscribers and organize the Company in pursuance of the provisions of the charter, so that the stockholders, by their own agents might take upon themselves the management of their own affairs, and to postpone any further solicitation of subscriptions to the Stock of the Company, till the pecuniary affairs of the country should assume a more promising aspect.

The Company was accordingly organized, and the first Board of Directors chosen, on the 5th day of April, 1837.

The first subject which demanded the attention of this Board, was the proposition before alluded to for the construction of the road. This proposition the Board, after due deliberation and enquiry, determined to accept; and, after having taken advice of several Engineers standing in the first rank in their profession, they proceeded to make and execute a contract with Messrs. Bishop and Sykes, being aided by two Engineers of distinguished reputation, and by the most competent legal counsel, for the purpose of guarding at every point, the interests of the Company. This contract is long and minute, containing specifications in regard to the grades and curves, and defining, particularly, the manner in which all parts of the work are to be done, and the kinds of materials to be used, and providing for all contingencies which should be anticipated, out of which difficulties might arise. In substance, however, it binds the contractors to build from the city of Bridgeport, northerly, by the route specified in the charter, to Massachusetts' line, a good, substantial and permanent Railroad, with a single track, and with *turnouts* in addition, of sufficient number and length to accommodate the business to be done on the road. The whole work is to be done under the supervision and direction of the Company's Engineer, and to be finished, with the superstructure complete, ready to receive the cars, for the sum of nine hundred and thirty-six thousand dollars, which is to be paid as follows, to wit:—the Company's Engineer, on the first of every month, estimates the amount of labor and materials furnished upon the road by the contractors during the preceding month, and the amount of this estimate is so apportioned, that such proportion thereof as their stock bears to the whole contract price, is applied in payment for their stock, and the balance is paid them in cash. This proportion varies very little from one-third; so that one-third of the monthly estimates are applied to their stock, and two-thirds are paid in cash. Two-thirds of this stock are, by the terms of contract, not transferable till the road is completed, and the contract fulfilled; so that every month adds to the security which the Company holds in its own possession for the fulfilment of the contract. We would remark in addition, that it has been of course necessary to make frequent reference to the contract, and we have never seen, nor do we now apprehend, any reason to doubt that its stipulations are such as abundantly to guard every interest of the Company. It is also due to the contractors. Messrs. Bishop and Sykes, one of whom is a man of much practical experience in works of this character, and the other an Engineer of high reputation, to say, that in all our dealings with them thus far, they have shown a disposition honorably and fairly to fulfil both the letter and spirit of their contract, and to do all their work in the most faithful manner.

It was the intention both of the Board of Directors and the contractors, at the time of the execution of the contract, that the work should be forthwith commenced, and pushed forward with all practicable energy during the then ensuing season, but almost immediately after this time, (early in May, 1837,) it will be recollected by all, that the general suspension of specie payments by all the monied institutions of the country, occurred. This state of things seemed to call upon those having charge of the interests of this Company, to pause and consider well their situation, before embarking at such a juncture so deeply as to endanger, not only the interests of the stockholders, but also the ultimate success of the road—as any one can appreciate the difficulty of resuscitating a project of this nature, after its pecuniary affairs should have become involved in embarrassment and loss. The Board, therefore, convened under these circumstances, with (it is believed) a due sense of the responsibility resting upon them, and of the vital importance of so determining as not to prejudice the best interests of those whom they represented. They at length determined, with the assent of the contractors, that the work should be commenced upon a few of the most difficult and expensive sections, as being those which would require the longest time for their completion—(one of these being a tunnel through a rock, and another an embankment of seventy feet in height, and of considerable length,)—anticipating that, by adopting such a course, the time of the ultimate completion of the road would be but little, if any, delayed, while at the same time the greater part of the work might be postponed to another season, and then be graded, ready for the reception of the rails, at as early a period as those more heavy sections could, under any circumstances, be placed in the same condition; and that thus the necessity of making immediate and frequent calls upon the stockholders would be avoided, while the then disordered state of the business of the country should continue. We are happy to say that the course then taken has been fully justified by the result, and that the whole line of the southern section of the road is now in a condition to be graded, ready for the superstructure, by the first of July next, which would not have been practicable had not operations been commenced as they were, upon the heavy sections during the last year. The work was commenced, as above suggested, July, 1837, and was continued upon those sections first commenced upon, during the autumn and winter next ensuing.

During the last winter, it was thought advisable to again offer to those interested in this work, a further opportunity to subscribe to the stock of the Company, though the state of the money market, and the pecuniary affairs of the country generally, was such, that no one anticipated any great amount of subscriptions, yet, as the notices given when the books were first opened were very limited, and as the information in possession of the people in this region, in regard to works of this character, was, at that time, also limited, it was supposed to be due to them, as well as to the interests of the Company to again open the books along the line of the road. They were accordingly opened at Bridgeport, and along the valley of the Housatonic at several points, in the immediate vicinity of the line of the road only. And this effort resulted in an additional subscription by the city of Bridgeport of $50,000, and individual subscriptions to the amount of about $50,000 more; so that the whole amount of the capital stock now subscribed on the books of the Company, varies very little from $705,000.

* * * * * *

The charter constituting Bridgeport a city, gave to its freemen a very liberal authority to tax themselves, for any legal purpose for which they might wish to raise money, but did not provide any specific mode by which any obligations which they might assume upon themselves, should be enforced in favor of the person or corporation to whom they might become obligated. The freemen of the city, therefore, for the purpose of placing the legality of their acts, regarding the stock of this Company, beyond a doubt, and also for the purpose of giving perfect credit to any obligations they might see fit to issue, in payment of their subscription, made their application to the legislature, setting forth all the proceedings of the city in regard to this road, and asking for the passage of an act which should effectuate their objects Upon this application an act was passed, providing that all the previous proceedings of the city, in relation to the Housatonic Railroad, be ratified, confirmed, and established, and made obligatory on the city and the citizens thereof; and also granting to the city, authority, at any future meeting, to adopt such other measures, as, in their opinion, should be necessary and proper to carry into effect their previous proceedings; and that all obligations, of any nature which they might issue for that purpose, should be binding and conclusive on the city and citizens thereof, and might be enforced and collected in the same manner, and to the same extent, that debts lawfully contracted by towns are enforced, under the laws of this state. This act, in pursuance of a provision contained in it, was submitted to a city meeting, held for that purpose, and, with great unanimity, adopted and confirmed by them.

Soon after this, the city of Bridgeport, with a liberality truly praiseworthy, and with a just sense of the importanee of this work, as connected with the interests of the city, made, through its agents, a proposition to the Company, offering to issue the bonds of the city, and deliver them forthwith to the Company, to the amount of $50,000; and when the Company shall, by the estimates of their Engineer, have expended on their road the sum of $100,000, to deliver to them the bonds of the city for the additional sum of $50,000; and when the Company shall, in like manner, have expended $200,000, to deliver to them bonds for the further sum of $50,000, being the whole amount subscribed by the city to the stock of the Company;—conditioned, that the Company should agree to receive the bonds, and apply them, in the first place, to the payment of instalments then due on the stock owned by the city, and the balance, to the payment of future instalments, as they shall from time to time fall due; allowing to the city interest on all sums in the hands of the Company at any time exceeding the amount then due for instalments, till such sums shall be exhausted in the payment of instalments.

This proposition was accepted by the Company, and they have received from the city fifty bonds, for the sum of $1,000 each, payable to the Company or its assigns, ten years from date, with interest payable semi-annually, at six per cent., in the city of New-York. Of this sum, $30,000 have already been made available to the Company in raising money to carry on their work; and the Board of Directors see no reason to doubt their ability to negotiate the remainder, so soon as they shall be entitled to receive them, in pursuance of the terms of arrangement between the city and the Company above-mentioned, as it would seem hardly practicable to devise a better form of security for the capitalist, on which to loan his money, these bonds being payable with interest semi-annually, in the city of New-York, and having for their security, not only the pledged faith of the city, but a lien on all the property therein; and in addition to this, a power in the holder to enforce a fulfilment of their engagements by suit at law, in the same manner that an obligation can be enforced against an individual or a town.

It appeared from the reports made to the meeting of the stockholders, holden on the 3d of October inst., that the account of the receipts and expenditures of the Company then stood as follows, viz.:

The amount received from stockholders, in cash, was....	$33,986 32
The amount received from the city of Bridgeport in bonds,	50,000 00
The amount received from Bishop and Sykes, in labor done on the road and applied on their stock, according to the provisions of the contract,......................	15,105 85
Profit and loss,..................................	2 00
	$99,094 17

The expenditures were, up to that time, as follows:

Cash paid Bishop and Sykes, for work done in construction of road,................	$25,378 59
Bonds of the city, delivered to Bishop and Sykes, as cash,......................	10,000 00
Applied on the stock of Bishop and Sykes, as above,............................	15,105 85
Due Bishop and Sykes on their estimates for work done for the month ending 1st October, 1838,......................	4,504 68
Cash paid for right of way,................	644 17
Cash paid for engineering, including salaries of Chief Engineer and his assistants,....	3,099 25

Cash due for engineering,..................	1,799 88	
Cash paid for incidental expenses, including expenses of obtaining the charter, organizing the Company, preliminary surveys, services of Commissioners and Directors, salaries of the officers of the Company, printing, stationery, &c..................	3,606 50	
		$65,038 92
Leaving in the treasury a balance, in cash and bonds of the city of Bridgeport, of..........................		$34,055 25

Since the above report was presented, (as has been before remarked,) considerable sums have been paid for instalments, one of which had fallen due a short time previously. The avails of a portion of the city bonds have also been realized in cash, and the amount then due to the contractors and Engineers have been paid, and the treasury is now in a condition to meet all the present obligations of the Company.

During the last summer the contractors, Messrs. Bishop and Sykes, have put under contract to sub-contractors, the whole line of the road from Bridgeport to New Milford, a distance of thirty-five miles; and the report of the Engineer, which is appended to this report, will exhibit the condition of the work on the first of October inst. It appears that, at that time, a portion of the sub-contractors were then on the line, and had commenced their work, and that another portion had *not* then commenced. Since that time, all these contractors are on the line, and at work, but all are not furnished with the full number of hands which they expect to employ. The whole force now at work on the road is equal to 450 men, and is daily increasing. These sub-contractors are all bound by their contracts to have their respective portions of the road completely graded by the first of July next, which will leave ample time, during the remainder of the season, for laying the superstructure, and fitting the road to receive the cars, from Bridgeport to New Milford; and we confidently anticipate seeing the road in full operation between those places during the winter of 1839–40; and before that time, the contractors intend to put under contract, and commence the work, upon the northern section of the route, and to push forward that portion of the work with all practicable vigor.

It will be remarked that the uncertainty in regard to the total cost of construction, which usually attends works of this character, is avoided in the case of this road, in consequence of the fact that a contract is made with a single firm for the construction of the whole road, for a gross sum; which contract, by its own terms and provisions, affords to the Company abundant security for the faithful performance, by the contractors, of all their stipulations. This leaves to be estimated, only the cost of the right of way, and the ordinary contingent expenses; and with regard to the right of way, so much has already been done, by way of both arrangement and appraisal, at different points along the road, that we feel confident of our ability to estimate that item with a very great degree of accuracy. The Engineer, for the purpose of making his monthly estimates with accuracy, proportionate to the whole contract price, has divided the whole road into two sections, the northern from Massachusetts line to New Milford, and the southern from New Milford to Bridgeport, and has apportioned the whole contract price between these two sections, being guided in this apportionment by his original estimates; and by this apportionment, the grading and superstructure complete, from Bridgeport to New Milford, are to cost the Company $450,000; consequently, the grading and superstructure of the northern division will amount to $486,000.

When. therefore, the road shall have been completed from Bridgeport to New Milford, and the cost of the right of way and all contingent expenses paid, engines and cars purchased, and the road in actual operation, the Company, without any addition to their present stock, will have at command something more than $200,000 due from the contractors and stock-holders, which will be applicable to that part of the road north of New Milford. The Company are bound by the specific provisions of their charter, after the road shall be put in operation as far north as New Milford, to proceed northerly, and construct and put in operation, at least fifteen miles thereof annually, until the whole shall have been completed.

[To be continued.]

PROCEEDINGS OF THE INSTITUTION OF CIVIL ENGINEERS, FOR THE FORMATION OF A SOCIETY OF CIVIL ENGINEERS OF THE UNITED STATES.—*Held in Baltimore, February* 11, 1839.

In pursuance of a call from Augusta, Ga., a meeting of Civil Engineers was held at Barnum's Hotel, in the city of Baltimore, on Monday, February 11th, 1839.

On motion of Mr. J. Edgar Thomson, of Georgia, Isaac Trimble, Esq. of Baltimore, was called to the chair.

The chairman having called the convention to order, laid before it the following letter from the curators of the Maryland Academy of Science and Literature.

"To Isaac Trimble, Esq.

Dear Sir:—The undersigned having been informed that a number of gentlemen, from various parts of the Union, are now in the city, for the purpose of forming an Association of Civil Engineers, beg you, in the name of the Academy, to offer their rooms for the use of the gentlemen interested in a project so intimately connected with the advancement of science. Yours, with great respect, JAMES GREEN,

For the Curators of the Md. Academy of Science and Literature."

Whereupon, on motion of Mr. C. O. Sanford, of Virginia, the convention adjourned, to meet at that hall, to-morrow morning at 11 o'clock.

Hall of the Md. Academy of Science and Literature,
11 *o'clock, Tuesday, February 12th,* 1839.

The convention met according to adjournment, forty gentlemen of the profession being present, from the States of Massachusetts, New-York, New-Jersey, Pennsylvania, Illinois, Maryland, Virginia, Missouri, North Carolina, Georgia and Louisiana.

The convention being called to order by the chairman of yesterday, Mr. J. F. Houston, of Pennsylvania, was appointed Secretary.

The chairman then read a letter from Wm. G. McNeill, Esq. expressing regret at not being able to be present at the meeting of the convention.

A letter of similar import from Jonathan Knight, Esq. was read by Mr. Latrobe.

The chairman having announced that the convention was prepared to go into election, on motion of Mr. Miller, Mr. Latrobe was unanimously chosen President.

The President having announced that the convention was organized, Mr. Kneass offered the following resolutions:

1. *Resolved*, That the convention now proceed to the election of a committee of *seventeen*, to prepare and adopt a constitution, and form a Society of Civil Engineers of the United States.

2. *Resolved*, That the committee meet at the Hall of the Franklin Institute in Philadelphia, at such time as they may deem convenient; and that five of them shall constitute a quorum for the transaction of business.

The first resolution being before the convention, Mr. Pickell proposed the following amendment to be added:

"And that in the selection of the members of the committee, not more than *two* be taken from each State or Territory in the Union."

At the request of Mr. Sykes, Mr. Pickell withdrew his amendment, to give way to an amendment by Mr. Trimble, which was "to strike out the number *seventeen* and insert *ten*; which was lost. The yeas and nays being called for, stood yeas 14, nays 22.

Mr. H. A. Wilson then proposed to amend by "striking out *seventeen* and inserting *five*;" which amendment was lost.

Mr. Trimble moved to amend by "striking out *seventeen* and inserting *twenty*;" which was also lost.

Mr. Pickell then renewed his amendment.

Mr. Miller proposed to amend the amendment so as to read:

"And that, in the opinion of this convention, the said committee should be so selected, that all the different portions of the Union may be represented in it, so far as is practicable;" which was concurred in, and the amendment so amended adopted.

The question being on the first resolution as amended, it was adopted.

The second resolution being before the convention, an amendment was proposed by Mr. Miller, and accepted by Mr. Kneass, specifying "the second Wednesday in April as the time of meeting."

Mr. Trimble proposed to amend by striking out all after the word "Philadelphia," and inserting, "at as early a day after the adjournment of this convention, as will suit their convenience; and that ten of their number constitute a quorum for business," which amendment was not agreed to.

Mr. Harrison then moved to amend by adding, "but that a majority of the seventeen, expressing their assent by letter or otherwise, be required to adopt the constitution," which was concurred in, and

The question being upon the second resolution as amended, it was unanimously carried.

The convention then went into the election called for by the first resolution, pending which, the convention adjourned to 4 o'clock, P. M.

Afternoon Session.

The President announced to the convention the result of the balloting, being the election of the following gentlemen.

Benjamin Wright,	of New York,
William S. Campbell,	of Florida.
Claude Crozet,	of Virginia.
W. M. C. Fairfax,	of do.
C. B. Fisk,	of Maryland.
Edward F. Gay,	of Pennsylvania.
Walter Gwynn,	of North Carolina.
J. B. Jervis,	of New York.
Jonathan Knight,	of Maryland.
Benjamin H. Latrobe,	of do.
W. G. McNeill,	of South Carolina.
Edward Miller,	of Pennsylvania.
Moncure Robinson,	of Virginia.
J. Edgar Thomson,	of Georgia.
Isaac Trimble,	of Maryland.
Sylvester Welsh,	of Kentucky, and
G. W. Whistler,	of Connecticut,

It was then, on motion of Mr. S. W. Roberts, unanimously resolved,

"That in recording the minutes of the proceedings, the secretary be directed to place the name of Benjamin Wright, at the head of the list of the committee, he having been elected by an unanimous vote of the convention; and that the names of the other gentlemen be made to succeed in alphabetical order."

Mr. Kneass laid before the convention the following letter from the President and Managers of the Franklin Institute of Pennsylvania.

Hall of the Franklin Institute,
Philadelphia, January 2d, 1839.

"To Benjamin Wright, William Strickland, Samuel H. Kneass, E. H. Gill, Esquires, and other Civil Engineers.

Gentlemen:—Your communication of the 24th ult., addressed "to the President and Managers of the Franklin Institute of the State of Pennsylvania," was read at a special meeting of the board of managers, held on the 31st ult., and was referred to a committee consisting of the undersigned, who were instructed to confer with you, in relation to the project entertained by you, of forming an "Institution of American Civil Engineers." The committee were authorized to take order on the subject referred to them; and to express the anxious desire of the Institute to promote any plan, that might appear to you best calculated to insure the success of your undertaking.

"After the free conference, which our committee had yesterday, with several of your number, we think we will best attain the objects you had in view in your application, and best consult the wishes of our own board, by the following answer to your letter:"

"Should the Civil Engineers of the United States concur in the formation of a society such as you propose; and should they decide to meet in this city, the Franklin will agree.

"1st. To furnish them all the accommodations they may desire, for the meetings of their society, or of its committees, and for their collections of books, drawings, models, &c. The details of this arrangement will be entered into, whenever it is known what extent of accommodation may be required, and a joint committee of the two bodies will have power to carry into execution all the regulations, in regard to the arrangement, disposal, and care of your books and collections, which your society may adopt.

"3d. The Franklin Institute will authorize their Actuary to accept any appointment, as secretary and treasurer, librarian, or curator, which the Society of Civil Engineers may choose to bestow upon him. Any arrangement made by the Society with the Actuary, which will be satisfactory to both, will be concurred in by the Institute. Should the duties thrown upon him, as the executive officer of the new society, consume too much time, he may (while he remains the responsible officer of both institutions) take such assistants as may be necessary.

"3d. The journal of the Franklin Institute will be open to the Society of Engineers as a vehicle of information to their scattered members; and the committee on publications will cheerfully avail themselves of the privilege of selecting, for publication in our journal, any memoir of interest, or any communication which you may not be able to include in your annual volume of Transactions.

"4th. Should the society of engineers deem it desirable, to entrust any part of their business, such as the selection of materials for their Transactions, or the superintendance of their publications, to a committee of the managers of the Franklin Institute; such a committee will be appointed by our board, and will freely give you any assistance, advice and services, that may be required.

"The charter, under which the Franklin Institute is organized, is one of a most liberal character. The objects of the corporation are stated to be, (among other things) the promotion and encouragement of the useful arts, by all such measures, as they may deem expedient," and the corporation has all the powers necessary to justify the adoption of any measures, conducive to the objects of your society, which you may be disposed to request of them.

"We have pleasure in adding, that admittance to our rooms and collections, and, indeed, all the privileges of membership are cheerfully extended, on all occasions, to strangers visiting our city, and that therefore any engineers, arriving here, would be always welcome visiters at the Franklin Institute.

We know the views of our board, and feel ourselves authorized to pledge to you the fullest and most friendly co-operation on the part of the institute, should you select Philadelphia as the location of your society.

William H. Keating,
Samuel V. Merrick,
John C. Cresson,
Robert M. Patterson,
Charles B. Trego.
Committee.

Whereupon, on motion of Mr. Griffin, it was resolved, that the thanks of this convention be tendered to the President and Managers of the Franklin Institute, for their liberal proposition.

Mr. Roberts then introduced the following resolution:

Resolved, "That the thanks of this convention be tendered to the Maryland Academy of Science and Literature, for their courteous offer, to the convention, of their rooms in Baltimore,"—which was unanimously concurred in.

Mr. Trimble then moved, that the President be requested to notify the members of the committee not present at the convention of the proceedings; which motion was adopted.

On motion of Mr. Thomson, of Georgia, it was *Resolved*, that the President appoint a committee of five to draft an address to the Civil Engineers of the United States, and to superintend the publication of such portions of the proceedings of this convention as they may deem expedient. The President appointed Messrs. Fisk and Trimble, of Maryland, S. W. Roberts, of Pennsylvania, J. B. Jervis, of New York, and G. W. Whistler, of Connecticut.

Mr. C. O. Sanford then moved, that the thanks of this convention be tendered to the chairman of the preparatory meeting, and to the president and secretary of the convention, for the able and efficient menner, in which they have discharged their duties; which was concurred in; and the convention adjourned sine die.

BENJAMIN H. LATROBE, *President*

John Frederick Houston, *Secretary*.

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On the 20th of October last, it was correctly stated that in the project of the road from Paris to the sea, a tenth (9 millions of francs,) of the whole capital was then lost;—of the road from Basle to Strasbourg, ten millions, &c. I have related to you heretofore that the shares in the Paris and St. Germain Road, which rose last summer above a thousand francs, had fallen nearly one-half. I offer you a brief outline of the history of the Railroad from Paris to Versailles, on the left bank of the river. Inasmuch as a million of passages were made annually, in the public carriages between the capital and Versailles for the average price of twenty sous, it was thought that by railroad, at the same charge, there would be four millions of passengers, so that each bank of the Seine might enjoy the convenience of a road with adequate profit to stockholders.

The immense increase of travelling between Paris and St. Germain, since the opening of the railroad; the same in Belgium and England; the new attractions of the Palace at Versailles; the difference of thirty or forty minutes, instead of two hours; and other considerations belonging to the great probable increase of the prosperity of that noble city, all seemed to warrant even a higher estimate of the quadruple. But dismal mistakes were committed in the professional reports concerning the cost of the left bank road. Ten millions of francs were fixed as the capital, two of them a reserve; what was deemed the most probable estimate of the whole cost gave four millions—the very highest was eight millions. One half of the road only has been finished, and the Company find that they have expended nearly eight millions, and that from five to eight millions more would be necessary to complete the undertaking. It is the common impression that the whole road would cost twenty millions. A fruitless attempt was made to dispose of the concern to the Company of the right bank. Last week, a meeting of the stock-holders was held, and the resolution adopted to seek a loan of five millions. The case has served to frighten the stockholders in the greater enterprises that have not yet broken ground;—they infer from it, that, in the long routes, the disparity between the present estimates and final expenditures would be enormous, and preclude all interest on their capitals for an indefinite term. *Sauve qui peut.* If the fall of these stocks has not been rapid of late, or if they have been stationary, this, according to the journals, means simply that no sales can be effected.

Among the best essays on the subject is one in the *Moniteur Industriel* under the title *Medicine of the Railroads.* There being a complication of maladies, the causes are explored, and the chief of these is pronounced to be the want of *election* and *publicity.* The nature of the associations is that of anonymous partnership: the stock-holders in general have not the choice of Directors; periodical and full expositions of the condition of the undertakings have not been rendered obligatory. In the case, for instance, of the Strasbourg road, the greater part of the share-holders know not the names even of the seven directors. Twenty millions of francs have been paid to the latter, and they call for half the capital; yet it is not revealed what has been done with the twenty millions. On Friday last, a meeting of a minority of the stockholders in the road just mentioned, assembled to consult, and finally appointed a committee to request the Directors to communicate information of the real situation of the enterprize, and to call a general meeting. They are understood to wish for a prompt settlement, and some of the journals blame them for acting irregularly, as the law constituting the company does not authorize voluntary or partial meetings for any purpose. The suspension or paralysis of the undertaking is the more remarkable, as it was deemed *national* and all-important for the province of Alsace. In both Chambers, last winter, the Ministers urged the immediate adoption of the law, in order that it might be executed with the least possible delay, and anticipate the road projected on the right bank of the Rhine.

In the official report of the Directors of the left bank Road to Versailles, the excess of expenditure beyond the estimates is represented to have arisen from the very exorbitant prices which the richer class of the proprietors of the land on the route compelled them to pay. Coalitions of several hundred were formed at different points; their cupidity had no bounds. The greatest owners, to whom in the end the road would be most profitable, attempted to exact from twenty to thirty thousand francs the French acre (*arpent* ;) and at Versailles, the mean price paid for the *arpent* was eleven thousand francs ; that commune, or district, extorted altogether the sum of eleven hundred and forty thousand francs. I narrate these facts in order to show you how little there is here of *public spirit* in these matters. You may compare them, with the conduct so opposite of the proprietors whose donations and offers are recited in the Reports of the New York and Erie Rail Road Company. By the wey, the difference between valuations of property by owners and those of neutral parties is signally exemplified in the decision of the juries of assessment in and near this capital, and in Great Britain, as to the claims for Rail Roads. In collating them, I have remarked that the former have been, commonly, four, five and six times higher than the prices fixed by the juries.

One of the most influential Democratic journals of Paris is called *Le Bon Sens*. The chief editor and his seven coadjutors have just quitted it because they could not, as "honest men," execute arrangements concluded by the proprietors of the paper with certain bodies of speculators and jobbers, to write *up* on every possible occasion several of the worst managed and least promising of the rail-road enterprises, and write *down* Lafitte and the operations of his bank. The exposition of the seceders appeared in the *National* of the 18th inst., Sunday last. They thought combinations of the kind, however usual, to dupe the public and commit direct injustice against individuals, were not perfectly consistent even with *political* rectitude. For the year past, I have seen that many of the journals were similarly enlisted, and the notoriety of this circumstance has contributed to the public distrust and the decline of the stocks. Some of the proprietors and writers of the journals are said to have demanded a heavier *douceur* of shares than the prime undertakers could venture to grant.

The *Journal des Debats* has taken from the outset, a large and intelligent part in the main question of the Railroads—with impartiality and independence, in my humble opinion. It recommended to the government the encouragement of Companies, and laboured to excite and enlighten the *spirit of association*. Now, while it acknowledges the deplorable pass to which they are reduced,—the extreme severity of the *crisis*, and most of the causes upon which I have touched, it vehemently repels the opinions and instances of other papers in favor of *liquidation* or abandonment, in any case. It complains of the onerous conditions to which the Companies were subjected by the Legislative acts: suggests plans of alleviation; and advises liberal appropriations in aid, by the State. See its elaborate articles of the 14th and 19th inst. I have conversed, on the whole matter, with the heads of two great Paris banking houses, who possess the best opportunities of knowledge. They concur in the explanations of the re-action, which I have detailed. They believe that the government prescribed rates of interest too high and tolls too low for the Companies, and that the temperament and habits of the country are yet too repugnant, too distant and slow, or merely general gain.

I doubt that the Companies will be able to proceed, unless they throw themselves upon the public treasury and into the hands of the executive government; but I am sanguine that most of the enterprises will be executed in the course of a few years. The Journal *Des Debats* of the 20th inst. exclaims—"The Railroads will not perish; neither the Government nor the Chambers will allow it." The importance of them for political and commercial interests is diffusely and deeply felt; the Government may avail itself of the general impression and the really strong impulse which all the circumstances, good and bad, have produced. It is already calculated, on one side, how far, by the extension of the Railroad and Canal communications, France may be the more effectively and easily ruled; and, on the other, how much less difficult it will be for the people to render themselves truly *sovereign.* I found, however, in traversing France, the notion widely spread, that all that is projected or shall be accomplished is intended and will operate, exclusively, or in far the greater measure, for the prosperity and supremacy of Paris.

It is rather too early to travel in France, or on this continent generally, with a view to cheapness and despatch. Five or ten years hence, present schemes of railroads, canals, steamboat lines, will have been executed, with a marvellous reduction of present obstacles, and much too tempting a multiplication of facilities for journeys through every part of Europe and to the old East of Asia and Africa.

Proposed Ship Canal across the Isthmus of Panama.—The following resolution, accompanied by a report and voluminous appendix, interspersed with sundry maps and diagrams, was presented to the House of Representatives from the Committee on Roads and Canals, by Mr. Mercer, on Saturday, the 2d instant. The resolution was adopted by the House, and the report, &c. ordered to be printed:

Resolved, That the President of the United States be requested to consider the expediency of opening or continuing negotiations with the Governments of other nations, and particularly with those, the territorial jurisdiction of which comprehends the Isthmus that connects North and South America; and to which the United States have accredited ministers or agents, for the purpose of ascertaining the practcability of opening a communication between the Atlantic and Pacific Oceans by the construction of a Ship Canal across the Isthmus; and of securing forever, by suitable treaty stipulations, the free and equal right of navigating such Canal to all nations, on the payment of reasonable tolls.

Representation of the "Tom," alluded to page 98.

AMERICAN

RAILROAD JOURNAL,

AND

MECHANICS' MAGAZINE.

No. 6, Vol. II.
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Vol. VIII.

[The following communication, containing the substance of a paper presented to the Common Council of this City, is published by request. It is hardly necessary for us to say that we do not present it as containing our views of the subject, but the information concerning similar works in Europe may not be uninteresting to our readers.]

Brooklyn, February 4, 1839.

GENTLEMEN,—The subject of this paper embraces the question—whether the works in progress, under the direction of the Water Commissioners, cannot be easily improved, with great credit to the Corporation, and the saving of a vast sum of money ?

I have arrived at this opinion, from examining the various plans, and the arguments adduced in support of the course pursuing by the Water Commissioners—by examining the works performed—the intended head of the aqueduct, and the natural capacity of the Croton River to supply an immense future population with water—and by comparing the aqueduct with the principal works for supplying London with that essential element.

The first of these is the New River, constructed in 1613, by Sir Hugh Middleton, which now supplies the central and northern parts of London with spring water, rising at the distance of twenty miles, led circuitously thirty-nine miles in an open aqueduct, on the sides of hills or over raised embankments of earth—passing over more than two hundred bridges or culverts, and one navigable canal—formed in various soils, clay, gravel, loam, sand or peat—of a sectional area, and bottom so closely resembling yours as to constitute it the most useful and efficient object of comparison imaginable.

If you bear in mind its particular characteristics, and compare it with your superior work, formed of cemented good stone walls, lined with cemented brick walls—an artificial continuous rock, protected from all weathers by several feet of earth covering—you must be conscious of its superior strength, of its durability and security from accidents, which the London aqueduct might seem liable to from its inferior construction—formed only of earth of such various qualities, exposed to all weathers, it might be presumed to have occasioned incidental interruptions in its important office of supplying seventy-three thousand houses with water. But experience has shown its stability, for more than two centuries, to furnish a constant supply to the river head, or distributing reservoir, in capacity less than a million gallons—whence the water is distributed in sixty main pipes, for which purpose this reservoir has been found all-sufficient, and therefore would be all-sufficient here for the same office.

But the Water Commissioners are about constructing two most enormous and unnecessary reservoirs, you will soon perceive. The smaller to have a capacity of 19, and the larger a capacity of 158, and jointly of 180 million gallons, or two hundred times the capacity of the London reservoir, which has been found ample for more than two centuries; and the only reason given for these extravagant, these useless constructions, is, they are intended to furnish a supply of water during occasional fractures in your superior aqueduct, formed of the choicest materials and at unlimited cost.

Now, when you consider how strong, how enduring it must be, as compared with the London, and which, notwithstanding its inferior construction, has answered its purpose so long a period, you may consider this reason to be wholly unfounded and ridiculous.

But it is said, it has been found necessary to construct reservoirs at Philadelphia, and to extend them with every increase of machinery there, and they have probably thus been considered necessary here because they were found useful there. Let us calmly enquire why reservoirs are really needed at Philadelphia. That city is supplied by means of machinery with turbid water from the Schuylkill, the reservoirs there are required for purifying this turbid water, and for securing a continuous supply of pure water, and as the Croton water will also require purifying it has been too hastily assumed that it is equally necessary to have large reservoirs here as at Philadelphia. As the head of the Croton aqueduct is elevated many yards above the bed of the Croton, that river is being dammed to a great depth to supply the aqueduct with water, which is being collected into a head of several hundred acres; now, as any required portion of this head may be converted into a purifying reservoir of still water of great depth, at a small expense and a trifling alteration of the presnnt dam, the water may thus be better purified from all sedimentary matter, previous to entering the aqueduct, and thus the corporation would be spared the great cost and inconceivable inconvenience of these immense reservoirs; and as an inconsiderable shallow basin or head may be advantageously substituted therefor, as in London, and which will better answer every necessary purpose of distribution, because no portion of the head or altitude of the stream above tide will be sacrificed thereby, as it evidently must be by drawing off the water from reservoirs of great and unnecessary depth.

To convert any required portion of the elevating reservoir into a head or purifying reservoir, or large basin of still water, it will be necessary to construct the waste weir (just commenced) on the left hand side of the Croton, instead of the right hand side, as now located by the Water Commissioners, and to build a party wall of stone a few feet in height on the table land opposite to the aqueduct, and which is naturally adapted to the purpose, so as to divide the current or running water of the Croton from the main body of the head, which thus becomes the most efficient purifying reservoir imaginable, at little trouble or expense, and of any required extent.

You may now perceive these two enormous reservoirs are needless, as you will have one much more efficient ready made, free of expense for construction or for maintenance, of any capacity you may at any time prefer, requiring no attendance or repairs, subject to no accident, occupying no space useful for other purposes, supplying the water to the aqueduct perfectly purified—and thus saving the time, trouble, and expense of cleaning the aqueduct and reservoirs of offensive mud—saving you forty acres of land in the centre of your future metropolis for useful or ornamental purposes, wherein the projected reservoirs would form the most inconvenient, monotonous, disagreeable, and dismal spectacle imaginable —hateful and dangerous to the neighbourhood, if any should ever be formed near such insidious structures—which sometimes suddenly give way, and the larger the more liable they are to do so. The dreaded anticipation of such a possibility must be a perpetual bar to any improvement in their neighbourhood, or on any ground subject to their visitation ; add to this, their inconvenience, their interruption of communication between extensive neighbourhoods. Imagine the extent of the larger,—thirty-three acres enclosed by a dead wall near thirty feet high—and you will have an ideal picture of such a monstrosity as was never seen, nor can ever be endured in the centre of any civilized place.

A review of the works for supplying the Eastern and Western portions of London with water, will also confirm and illustrate the foregoing positions. The Western Water Works, supplying 27,000 houses with turbid water from the Grand Junction Canal, and from the Thames, has a large distributing reservoir for purifying the water. While the Eastern Water Works, supplying 46,000 houses with pure water from the river Lee, has only a small distributing reservoir on an artificial conical hill of eighty feet in height, and little more in diameter at its summit ; thus showing that a small distributing reservoir is only needed at New-York, and that the immense contemplated receiving reservoir is wholly useless and unwarranted.

The climate, also, and the purposes to which the water is to be employed, offer unanswerable objections to these immense animalcular ponds—in which the water will stagnate to waste by evaporation and filtration, and to poison the surrounding atmosphere with noxious exhalations in the fervent summer heat, and be lowered to the point of congelation in winter, and rendered wholly unfit to supply the fire engines, one of the most important and imperative purposes for which it is needed—and this evil will be also severely felt in the incessant fracture of the various pipes of supply.

In the reports for December, 1838, the Commisioners estimate the distributing reservoir................	$360,700 00
Receiving reservoir..........................	565,748 00
	$926,458 00

Add to this the unmentioned contingent works, the expense of maintenance, the value of the vast space they will occupy, and endeavour to conceive the property injured or destroyed by contiguity with these gloomy erections, the damages the corporation will be ultimately liable for—if you add all these considerations fairly into a sum, no doubt you will find it onerous beyond your previous anticipation---though immense, yet much worse than useless.

The great dissatisfaction generally expressed at the low bridge proposed for conveying the Croton Aqueduct over the Harlem river, first attracted my attention to these subjects; and the Commissioners' statement of cost, so much more than double for a high than for a low bridge, of the same extent, and for the same purpose, seemed so singular as to be doubtful---and having found their statements very erroneous, I shall endeavour to show you the fact.

A careful inspection of the two plans will exhibit much irrelevant and useless workmanship, much unnecessary expense in their high bridge, and which contained errors of magnitude, with which you ought to be acquainted; while it was equally apparent that much essential work was omitted in their plan for a low bridge, and thus the comparison of these two plans was unfair, and the excessive cost of the high bridge was unfounded.

The aqueduct has a regular sectional clear area exceeding fifty feet superficial, and this area was maintained in the plan for the high bridge. But in the plan for a low bridge, the Commissioners propose to carry the water of the aqueduct over the Harlem River in four iron pipes, each three feet in diameter, and to construct a Bridge (or causeway rather) just sufficient to receive and protect these four iron pipes.

Now, the superficial area of a pipe three feet diameter being only seven feet, four such have an area of only twenty-eight feet---seven such pipes would not carry the volume of water brought by the aqueduct, nor near that quantity, when the pipes have been twice deflected in their descent and twice in their ascent, as proposed.

The unfairness, then, of the comparison of these estimates is now apparent, and that the full supply of the aqueduct will be needed in a few years you may perceive by comparing your growing population with that portion of London supplied by the New River, and you will find this diminished capacity of the aqueduct is miscalculated and erroneous, and that the full supply of it ought undoubtedly to be carried over the Harlem river, and at the established grade.

A high bridge of gneiss stone with granite arches wholly laid in cement, divested of all unnecessary, but retaining all necessary and useful workmanship, well and faithfully executed, supporting and perfectly protecting a cast-iron aqueduct of fifty feet available area or water course, constructed in a superior manner so as never to leak, capabln of easy replacement, always subject to inspection, with iron waste weirs to discharge any superfluous water into the Harlem river, protected and surmounted by a double covered bridge, may be erected for the sum of six hundred and fifty thousand dollars.

If the foundations of said bridge were laid to low water mark with concrete, and which is the best and easiest mode in that situation, and in which coffer dams are of difficult construction, the bridge may be built, in all other respects alike, for six hundred and ten thousand dollars.

To ascertain the exact cost of the low bridge is difficult, from the Commissioners' report, as their estimates are so varied and indistinct.

The first estimate of low bridge given in their report, December, 1837, and for four iron pipes three feet diameter, with influent and effluent pipe chambers, was......................................	$426,027 00

In this estimate the low bridge and pipe chambers were estimated at the sum of..........................	$266,057 00	
In their estimates published in December, 1838, the low bridge is estimated at..............................	360,000 00	
Carry out difference..............................		93,943 00
I have shown that seven pipes of three feet diameter are required to carry the volume of water; but as four pipes of four feet diameter would carry it, and as the bridge might carry them, and as it is favorable to their estimate so to consider it, we will take the increased cost of four four-feet pipes, and add one-third to thickness to obtain equal strength.........		93,964 00
		$613,934 00

An amount so corresponding with the cost of a high bridge, while so many allowances have been made in favor of the low one, as to show that in expense they are equal. You will thus see what a miserable bargain the Commissioners are so imperiously driving—what disgrace the Corporation must incur by having this miserable structure forced upon them. To call it a bridge is to abuse the term, as it cannot be travelled over, nor can it be navigated under except by inconsiderable vessels, and by them only for a short period during slack water, as is plainly evidenced in the rapid current at Macomb's Dam. What a curious anomaly it thus would exhibit in one of the first seaports in the universe---preventing or immeasurably delaying the improvement of a river equal in size to the Seine at Paris, so intrinsically valuable from its proximity to the ocean---preventing the proper improvement of a long line of water frontage of this great metropolis, and of the neighbouring county of Westchester, on which it will inflict such injury and disgrace as will and must be insupportable.

Having thus discusssed two of the prominent errors in the Croton Works, and having made plans and models to explain and confirm the foregoing statement, I beg to submit them to your attention, with the observation, you are not to consider the subject exhausted of interest, but that other matters equally interesting and equally deserving your serious consideration remain untouched.

I have the honor to be, Gentlemen,

Your very humble servant,

JAMES FROST.

Substance of a Report to the Common Council of the City of New-York. } *Brooklyn.*

Massachusetts Railroad Reports.

[We commence the re-publication of the Reports presented to the Massachusetts Legislature by the various Railroad companies in that State. The condensed statements of their expenses and income, will prove useful to members of the profession.

We are indebted to John M. Fessenden, Esq., for a copy of this valuable paper.

Third Annual Report of the Andover and Haverhill Railroad Corporation.

The Directors of the Andover and Haverhill Railroad corporation do hereby make their Fourth Annual Report, of their acts and doings, receipts and expenditures, under their act of incorporation.

In their last annual report, it was stated, that the road had been completed to the bank of Merrimack river, in Bradford, opposite to Haverhill, and opened for use.

For the extension of the road from this place to the line of the State, the most westerly of the three routes, authorized by the Legislature, has been adopted by the directors.

This route crosses the Merrimack, about two hundred feet to the east of the present depot in Bradford, thence along the bank of Little river, to its junction with the Boston and Maine Railroad, at the line of the State, being about three miles in length.

The grading of the first division of this last mentioned road, from the line of the State to Exeter, was commenced in October last, about five miles of the work is already completed, and it is understood, that the remaining portion of this division will be finished without delay.

At a meeting of the stockholders of the Andover and Haverhill Railroad, held the seventh instant, they voted to request the directors to proceed immediately in the erection of a bridge across Merrimack river, and in the construction of the remaining part of the road to the New Hampshire line.

To build the Merrimack River Bridge, the necessary depot buildings in Haverhill, and to finish the road to the line of the State, will require an addition to the present capital. of one hundred thousand dollars.

The Andover and Haverhill Railroad Corporation have contracted with the Boston and Maine Railroad, to do and perform all the transportation of persons and freight upon and over said Railroad, when completed to Exeter, on such terms and conditions as appear by their contract, which is hereto appended.

It appears from the books and accounts of the treasurer, on the first of January instant, that the total amount of capital paid in, was two hundred and seventy-five thousand six hundred and forty-one dollars.

The total amount of expenditures the last year, was ninety-six thousand eight hundred and forty dollars and ninety-one cents.

For the repairs of the road, five thousand one hundred and fifty-two dollars and eighteen cents.

For repairs of engines and cars, one thousand eight hundred and forty-one dollars and seventy-eight cents.

Interest paid on State scrip, four thousand five hundred and eighty-three dollars and fifty-three cents.

All other miscellaneous expenses, including the toll paid to the Lowell Road, thirty-four thousand six hundred sixty-one dollars and two cents.

Also for unsettled accounts of the last year, for the construction of the road and unliquidated land damages, fifty-five thousand one hundred and eighty-five dollars and ninety-three cents.

The amount received the last year, for the transportation of passengers was forty-two thousand nine hundred and fifty-two dollars, and seventy nine cents. For freight, twelve thousand six hundred and sixty-four dollars. Other miscellaneous receipts, one thousand seven hundred and eighty dollars and five cents.

The amount received for stock was, forty-two thousand one hundred and eighty-five dollars and ninety-one cents. For State scrip, fifty thousand dollars.

The amount divided the last year, was nine thousand dollars; being three per cent. on three thousand shares, paid in October last.

All of which is respectfully submitted.

HOBART CLARK,
EN. SILSBY,
THOMAS WEST,
AMOS ABBOTT,
SAMUEL A. WALKER,
Directors.

ANDOVER, *January* 29, 1839.

At a meeting of the Directors of the Andover and Haverhill Railroad Corporation, held September 7th, A. D , 1838,

Voted. That the agreement with the Boston and Maine Railroad of this date, be accepted, and that Hobart Clark, Esq., President of the Corporation, and one of the directors, be authorized to sign the same.

Said agreement is in the following words, to wit:

Whereas, at a meeting of the stockholders of the Andover and Haverhill Railroad Corporation, holden at Brown's Tavern, in Haverhill, on the twenty-fifth day of August, in the year of our Lord, one thousand eight hundred and thirty-eight, specially called for the purpose, it was voted, that the directors of the Andover and Haverhill Railroad Corporation be authorized to contract with the Boston and Maine Railroad, to transport all the passengers and freight over said Boston and Maine Railroad, for a term not exceeding five years from and after said road is completed to Exeter. Provided the same can be done, by paying said Boston and Maine Railroad a sum not exceeding six per cent. interest, per annum, on a sum not exceeding two hundred thousand dollars.

And whereas, at a meeting of the stockholders of the Boston and Maine Railroad, holden at Tucker's Tavern, in Plaistow, on the fifth day of September, in the year of our Lord one thousand eight hundred and thirty eight, it was voted,—That the directors of the Boston and Maine Railroad be and hereby are authorized to make such contract with the directors of the Andover and Haverhill Railroad Corporation, for the transportation of passengers and freight, upon such terms and conditions as they shall deem expedient, or the interests of the corporation shall require.

Now, therefore, this agreement made and entered into by the directors of the Andover and Haverhill Railroad Corporation, of the one part, and the directors of the Boston and Maine Railroad, of the other part, witnesseth:

That when said Boston and Maine Railroad shall be fully completed, in all respects, and ready to be opened for use with convenient depots, from the line of the Commonwealth of Massachusetts, at Haverhill, to some convenient place in the town of Exeter,—in consideration of the sum hereinafter mentioned,—the directors of the Andover and Haverhill Railroad Corporation shall take and hold full possession thereof for and during the term of five years from the time of taking possession, as aforesaid. That the said Andover and Haverhill Railroad Corporation, shall pay, for the use of said Boston and Maine Railroad, the sum of twelve thousand dollars annually, after taking possession of the same as aforesaid, to the treasurer of said corporation, and keep the same in good running repair during the term aforesaid, and give possession of said Railroad to the directors of the Boston and Maine Railroad at the expiration of said term, in such repair, the necessary wear and decay of materials only excepted.

It is agreed, that the Railroad shall be constructed in the same manner and style, and shall be laid with the same kind of iron rail as the Andover and Haverhill Railroad.

It is farther agreed, by the parties aforesaid, that in case of failure in any part of the construction of the Boston and Maine Railroad, by reason of defect in the original construction of the road, the same is to be repaired at the expense of that corporation.

Provided, nevertheless, if the said road shall be constructed to any town beyond Exeter, the above contract is to be void.

Dated at Andover, the seventh day of September, A. D., 1838.

HOBART CLARK,
Director of B. & M. Railroad, J. BURLEY.
Director of A. & H. Railroad, ENOCH SILSBY.

Seventh Annual Report of the Boston and Lowell Rail-road Corporation.

To the Honorable the Legislature of the Commonwealth of Massachusetts:

The Directors of the Boston and Lowell Rail-road Corporation do hereby make their Seventh Annual Report of their acts and doings, receipts and expenditures, under their act of incorporation.

The total amount of capital paid in, is	$1,500,000 00
The amount expended the past year, exclusive of amount spent and charged to the cost of the road, is—	
For repairs on the road, including $4,295 90 for extra repairs and improvements, and removing snow,	15,734 90
For repairs on engines and cars,	10,945 77
For fuel, oil, salaries and other miscellaneous expenses,	48,917 27
	$75,595 94
The amount received the past year, is,—	
For transporting passengers between Boston and Lowell,	$94,569 10
For transporting merchandise " " "	76,236 47
" transporting United States Mail,	1,000 00
" transporting passengers for the Andover and Haverhill Rail road Corporation over our road,	14,514 21
For transporting merchandise for the Andover and Haverhill Rail-road Corporation over our road.	3,482 55
For transporting passengers on the Nashua and Lowell Railroad as per agreement with that corporation,	1,976 24
	$191,7 77 85

The amount divided during the past year is $90.000, being six per cent. on the capital paid in—two dividends of three per cent. each.

Since the last annual report, in which an account was given in detail of the cost of the road up to that time, there has been expended towards the completion of the road, as follows:

For five miles second track, now complete from Boston to Wilmington, fifteen miles,	$26,284 10
For land and buildings needed for merchandise at the Boston depot,	25,694 76
For locomotive engine, and ten new merchandise cars,	9,290 00

For sundry miscellaneous expenses,	$1,881 38	
" superintendence;	2,400 00	
" land damages, &c.,	321 00	
" rail iron,	689 18	
" interest account	708 33	
		5,999 89
		$67,263 75
Whole amount expended on cost of the road, and appurtenances, at the time of the last annual report,		1,508,399 75
Whole cost of road to Nov. 30, 1838,		$1,575,663 50
The amount of debt due from the corporation,		$55,380 00
The balance of profits on hand, from which a dividend of four per cent., or $60,000, is declared, and will be paid on 11th Feb. next, is		128,769 72
		$184,149 72
The corporation have land on hand, for sale, cost, as appears by the books,	$48,635 58	
Cash balance on hand,	23,339 27	
Notes and debts due the corporation,	36,511 37	
		108,486 22
Balance,		$75,663 50

The corporation having accepted the act of our Legislature of April 9th, 1838, it is now contemplated to increase our capital stock in a sum sufficient to pay off our debts, and for such other expenditures on the road as may be required.

All which is respectfully submitted.

JOSEPH TILDEN,
WM. APPLETON,
JOHN BRYANT,
P. T. JACKSON,
GEO. W. LYMAN.

Seventh Annual Report of the Boston and Providence Rail-road Corporation.

To the Honorable Legislature of the Commonwealth of Massachusetts :

The Directors of the Boston and Providence Rail-road Corporation do hereby make their Seventh Annual Report of their acts and doings, receipts and expenditures, under their Act of Incorporation.

During the past year they have incurred a considerable expense, in repairing, strengthening, and widening their bridges, in the erection of a new engine-house in Roxbury, of passenger-houses in Dedham and Canton, and in laying a second track from Boston to the Roxbury depot. They have also settled several claims for land and damages. The only remaining claim of much consequence is that for passing across the lands which are partially covered by water west of Boston Neck. This they have long been endeavoring to compromise, and they trust it will be settled during the current year.

They have modified their contract with the Taunton Branch Railroad Corporation, for drawing their passenger and freight cars over our road, in conformity to the wishes of that Company. They have rescinded their contract with the Boston and New York Transportation Company in relation to the steam-boats, by mutual agreement.

The whole amount expended for construction of the road, buildings, and appurtenances during the past year, is		$21,948 33
The total amount of capital stock of this corporation paid in, is		$1,782,000 00

The expenses of the company the past year, exclusive of those mentioned in relation to construction, have been as follows.

For repairs of road, exclusive of bridges,	$11,211 00	
" repairs of bridges,	5,645 69	
		$16,856 69
" repairs of engines and cars,		19,953 02
" amount paid to the Rhode Island Rail-road Company for the lease of their road, bridge, and depot, under contract sanctioned by the Legislature,		6,468 10
" other miscellaneous expenses,		76,766 47
		$120,044 28

The receipts of the company during the past year have been as follows:

Cash received for transportation of passengers,	$196,974 73
" " for transportation of merchandise,	64,148 92
" " for transportation of mail,	2,250 00
" " for rents,	1,741 50
" " from the sale of 981 shares of new stock, at an advance of $3,303 23-100 beyond the par value, amounting to	$101,403 23

The above advance is carried in the treasurer's books to interest account, leaving the balance of that account $661 8-100 against the corporation.

The amount divided during the past year is $136,312, being in two dividends.

The first dividend was declared in January, 1838, of 4 per cent. on the amount of capital stock then paid in, viz. on $1,683,900, amounting to	$67,356 00	
The second dividend was declared in July last, of 4 per cent. on the capital stock then paid in, viz. on $1,723,900, amounting to	68,956 00	
Total,		$136,312 00

All of which is respectfully submitted.

JOSIAH QUINCY, Jr.,
JOSEPH W. REVERE,
JNO. F. LORING,
BENJ. R. NICHOLS,
Directors of the Boston and Providence Rail-road Corporation.

Seventh Annual Report of the Boston and Worcester Rail-road Corporation.

The Directors of the Boston and Worcester Rail-road Corporation respectfully

REPORT:

That during the past year the passenger and freight trains of cars have run regularly between Boston and Worcester.

There has been, within the year, no loss of a regular trip of the passenger train arising from obstructions by snow or any other cause. There have been several instances of detention of the trains by snow storms or accidents, but of the 1366 trips, eight only have occupied more than four hours.

There has been no accident which has caused any personal injury to any passenger on the rail-road, either within the past year, or since the opening of the road.

Some small expenditures have been made within the year, in the erection and completion of buildings at the freight depot in Boston, and also in improving and securing some parts of the Road.

The whole amount of capital stock paid in, is		$1,700,000 00
The expenditures within the year, exclusive of the amount charged to the construction of the road, amounted to viz:		85,572 97
For repairs of engines and cars,	$15,672 24	
" repairs of road,	12,521 35	
" fuel used in engines,	12,854 28	
" oil and tallow for engines and cars,	1,985 82	
" clearing road of snow,	43 96	
" salaries and wages of officers, agents, and laborers of every description, taxes, insurance, and all other expenses,	42,495 32	
The receipts of income from January 1, 1838, to January 1, 1839, amounted to viz:		$212,325 03
For passengers,	$112,032 43	
" freight, hauling gravel and mail,	94,827 31	
" rents and storage,	5,465 29	
The amount of dividends declared within the year was viz:		$102,000 00
July 1, 1838, 3 per cent.,	$51,000 00	
January 1, 1839, 3 per cent.,	51,000,00	

Before declaring the last dividend, the directors reserved for deterioration of perishable materials in the road, and depreciation of engines and cars, beyond the repairs, the sum of $15,000.

NATHAN HALE,
DANIEL DENNY,
ELIPHALET WILLIAMS,
NATH'L HAMMOND,
WM. STURGIS.

BOSTON, January 17, 1839.

Third Annual Report of the Charlestown Branch Rail-road Company.

To the Honorable Senate and House of Representatives of the Commonwealth of Massachusetts, in General Court assembled:

The Directors of the Charlestown Branch Rail-road Company, do hereby, respectfully, make their Third Annual Report of their acts and doings, receipts and expenditures, under their act of incorporation:

During the past year, the road has been completed from the junction with the Boston and Lowell Rail-road to Gray's Wharf, so called in Charlestown, and the location from Grey's Wharf to Sweet's Wharf, being the whole line of the road, has been filed with the commissioners for the county of Middlesex.

By a statement of the treasurer, made up to the 1st instant, it appears that the receipts of the company have been,—

From assessments,	$50,125 00
" loan,	5,000 00
Total,	$55,125 00

The expenditures to the same date, as appears by the statement, have been,—

For engineering, surveying and other expenses,		$2,600 03
" land purchased,	$1,618 00	
" damages for land taken,	2,000 67	3,625 67
" construction of road,		47,496 49
Total,		$53,722 19

In compliance with the fifth section of the act passed on 19th April, 1837, the directors further report :

The total amount of receipts from the date of the last annual report to 1st instant,—

From assessments,	$29,825 00
" loan,	5,000 00
Total,	$34,825 00

The total amount of expenditures the same period,—

For miscellaneous expenses,	$1,008 43
" damages for land taken,	2,007 67
" construction of the road,	30,671 83
Total,	$33,687 93

All of which is respectfully submitted.

Charles Thompson,
Thomas C. Smith,
Abijah Goodridge,
Eben'r Barker,
S. Varney.

Charlestown, Jan. 12, 1839.

Annual Report of the Petersburg Railroad Company.

PROCEEDINGS AT THE ANNUAL MEETING OF STOCKHOLDERS OF THE PETERSBURG RAIL-ROAD COMPANY.

At an annual meeting of the Stockholders of the Petersburg Railroad Company, held at the Bollingbrook Hotel in Petersburg, on Monday, the 4th March, 1839.

Present, in person or by proxy, 4092 shares, entitled to 1159 votes, constituting a quorum of the entire stock, which is 6055 shares, entitled to 2001 votes. The meeting was organized; Robert B. Bolling, Esq., Recorder of the town, was called to the chair, and Sam. Mordecai appointed secretary.

Charles F. Osborne, Esq., President of the Company, presented, and read to the meeting, the Annual Report of the Board, accompanied with various accounts and statements, which were received, and ordered to be printed for the use of the Stockholders.

The meeting then proceeded to the election of a President and Directors for the ensuing year; whereupon Charles F. Osborne, Esq., was unanimously re-elected President; and Joseph Bragg, Benjamin Jones, and Robert B. Bolling, Esq., were elected Directors on the part of the Stockholders. Samuel Mordecai and Thomas N. Lee, are Directors on behalf of the Commonwealth.

The meeting then adjourned.

ROBERT B. BOLLING, *Chairman.*

REPORT OF THE BOARD OF DIRECTORS.

The Board of Directors now present to you the result of their proceedings, during the last twelve months, exhibiting the present condition of the Company and its future prospects. They discharge this duty, on the present occasion, with more than ordinary satisfaction, because at no period have your affairs generally been more prosperous, than at present.

The road is now in fine order, the locomotives, cars and coaches, are in good repair, we have been entirely exempt from accident, and the revenue greatly exceeds that of any previous year. Nor do we discern any thing in prospect which should diminish the pleasure arising from these considerations.

The road to Raleigh, and that from Fredericksburg to the Potomac, we are led to believe, will both be finished before we again assemble, and these improvements cannot fail to enhance your general interests. All that will then remain to be accomplished, to consummate our most extended plans, and to realize the hopes we have hitherto indulged, are the establishment of a continuous connection with the Wilmington and Raleigh Railroad Company, and the extension of the road from Raleigh to Columbia. With these links, or with either one of them completed, (though we look sanguinely to the completion of both at no remote period,) the prosperity of this Company will be so well secured, that we believe it can neither be destroyed or impaired by any antagonist interests whatsoever.

The statements now submitted to you, show that the income for the year ending 31st January last, is $121,440 50. Of this amount $68,410 47 was received for freight, $38,692 46 for travel, and $14,337 58 for the mail and incidental transportation. The total receipts of the Company, for the year ending 31st January, 1838, was $103,939 48, of which $58,423 68 was for freight; $30,305 45 for travel, and $15,210 35 from the mail and other sources, showing a total increase in the past over the preceding year of $17,501 3, of whieh increase $9,986 89 is in freight and $9,824 13 in travel and other transportation. From the Post Office Department we have received 2,309 89 less than in the preceeding year.

The Board are of opinion that the income for the current year will not be less than $140,000.

We find the trade on the Roanoke annually becoming larger, and the transportation of goods, produce, and persons, already greatly increased by the extension of the Raleigh and Gaston road, will be constantly augmented as that road is advanced, and stage-lines to the south and south-west established in connexion with it. The facilities afforded by the Wilmington and Raleigh Railroad, now rapidly approaching to completion, and on which route a daily route to Charleston is established, insures to us a large increase of travel. No plan heretofore adopted can compete with this for safety, expedition and comfort. The traveller from New York can reach Charleston by this route in 66 hours, and from Baltimore to Charleston will require less than 42 hours, a shorter time than it can be performed in by steamboats, and without the hazard attending them. Such a line as this, and another continuous line by Railroad from the north to the capital of North Carolina, must possess the great travel north and south, and secure to us important advantages.

We lay before you detailed statements of the charges incurred the past year, as well as statements of all other expenditures. The charges, you will perceive, amount to $92,744 6; last year they were $80,736 28. You will observe that the repairs of engines, &c., and the expense of running them, amount to more, and the repairs of road to less than last year. When you consider that we now run twice the length of line we ran heretofore, that the business requires two daily passenger lines on each division, going over 328 miles of road daily, and that all our other engines, not under repair, are constantly employed in the transportation of goods and produce, you may readily account for the addition to our expense in these items. The expenditures, have however, been mainly increased by repairs to the road, consequent to the storm in November last, the rebuilding of several bridges, a stationary engine, lathes, and other machinery in the work-shops, (which might properly be charged to capital,) and the decree against the Company in the case of Hinton. To these may be added, the expenses incident to our contracts on the Greensville and on the Raleigh and Gaston roads, from the last of which we received until recently no equivalent for our expenditure, as must be the case in the commencement of business on all roads. A portion of the Raleigh and Gaston road was opened at a dull season of the year, as the statements before you show, and it is only since the road was extended to Henderson, that we have been partially indemnified for our expenses. This evil, however, we consider as temporary, and one which we could not avoid without creating great dissatisfaction.

On reference to the accounts submitted at your last meeting, you will find the amounts to the credit of transportation and profit and loss to be $43,543 81. Since then there has accrued a profit of $28,696 45—making in all $72,240 26. In June last, we divided among the stockholders $24,220, and in November, $21,192 50; leaving to the credit of transportation and profit and loss on the 1st of February last, $26,827 76.

We estimate the expenses of the current year at $89,542. In this are included the cost of three new bridges, which it is absolutely necessary to erect, and the expense of running on the roads with which we are connected. This increased distance increases, of course, the amount of charges, which will be compensated by our additional receipts.

Since your last meeting, one locomotive, three coaches, and thirty cars, have been bought or built, and paid for; the total cost of which amonnted to $20,300 46. This increase of motive power, &c., is insufficieut for our trade and travel, as the murmurs of the community testify. The Board have ordered two more locomotives, and twenty sets of wheels and axles for cars. The locomotives will be on the road in the course of the present month, and the wagons will be constructed as speedily as practicable, with a due regard to economy. With this additional power, we hope to effect the transportation satisfactorily. Onr means, however, are insufficient to meet the demands of the country at the most pressing seasons of business, or when the quantity of produce accumulates for a few weeks, after having been suspended by the previous impracticability of wagoning on the common roads, or navigating the river. As, however, the Raleigh and Gaston Company will ere long prepare to do their own transportation, our means will then be sufficient to effect our own.

The accounts and statementa now exhibited, present a full view of the affairs of the Company; they are as clear as the most systematic arrangements can make them. The loan granted by the state has, as the accounts exhibit, been but partially and temporarily availed of. Under the act of the last session, the Board of Public Works did not feel authorized to issue other than a five per cent. stock, and unable to dispose of it, either here or abroad, at par, we deemed it advisable to retain it, and to ask of the legislature, at its present session, to convert it into stock bearing six per cent. This we have reason to believe they will readily assent to, and thus enable us to make a ready disposition of it and discharge our obligations.

The Board deem it proper to remark, that an erroneous opinion generally prevails, as to the profit on the transportation of goods and produce. An irregular business, sometimes excessive, and at other times inconsiderable, is attended with small profit. The charges necessarily incurred are at all times heavy. The wear and tear of the road, of locomotives and cars, is considerable; and the agencies, &c. incident to the business are numerous and expensive. If we relied on this branch of our transportation alone for income, we should be left, after paying the current expenses properly chargable to it, with a small surplus. The expense of haulage on the best constructed level roads, with ample custom and most economical management, is estimated at 4½ cents per ton per mile. Where the grades are heavy, as on portions of our road, and of those connected with it, the expense is greatly increased; because an engine on such grades cannot do one-half the work which it can on a level. Assuming, however 4½ cents per ton per mile as the cost, it would amount to $2 70 on 10 bbls. flour from Gaston to Petersburg. Our charge is $3 50, which would leave a profit of 8 cents per barrel to pay interest on capital, dividends, &c.

So much has been said in the public prints, and elsewhere, respecting the mails, our proposals for its transportation, and the course which the board deemed it advisable to pursue, that they omit for this, and other reasons, further explanation on this unpleasant subject. Believing that their conduct, which has been freely canvassed, has been approved by you, we content ourselves with laying before you the correspondence held with the department. We asked but a fair compensation. We were driven into the present contract by circumstances beyond our control. In the position we occupied, no other safe alternative, in our opinion. was presented, than the one adopted. The Board also submit a copy of their memorial to Congress, in reference to the express mail pay, unjustly, as they conceive, with-held from them by the Post Office Department. Accompanying this, is a letter from the Postmaster General to the Committee of the Senate, and its report adverse to the claim. We must bend to power, when we have no other resource; but we retain the opinion that our claim is just, according to the letter and spirit of the contract, and we shall not relinquish the hope of obtaining a verdict in our favor, until we have exhausted the remedies enjoyed under our laws.

The Board applied to the last legislature of North Carolina for permission to form a permanent, direct connexion at Weldon, with the road of the Wilmington Company, and presumed from the reasonableness of the request, it would have been granted. In their wisdom, the privilege was denied; the right, however, is possessed by the Wilmington Company.

The Board regret that the committee appointed at your last meeting, (as required by the Board of Public Works,) have not performed the duty assigned to them. We earnestly desire that the subjects with which they were charged, should be thoroughly investigated and a comparison made of the business and expenses of this road with other Railroads in the United States and elsewhere. In the absence of this investigation and report, we have only to assure you that every proper economy and responsibility has been introduced and effected, which can, in our opinion, be made with a just regard to the interests involved.

Appended to our report and accounts, is a statement recently furnished by the auditor under a resolution of the legislature, to which your attention is respectfully invited. You will perceive from it, the relative value of your investment, with others in the state to the present period. Comments would be superfluous.

Upon a review of the past, and in regard to the future, we see every thing to encourage us, and nothing to apprehend. We believe the day is not far distant when our stockholders will be amply remunerated, and the income of the Company sufficient, after satisfying them, to create a fund for laying down a permanent iron track, which our increasing business even now requires.

All of which is respectfully submitted,

By order of the Board of Directors,

CHARLES F. OSBORNE, *President.*

Transportation for the year ending January 31, 1839.

Amount received for produce and merchandize, 30,876,049 lbs. - - - - - - -	$68,410 47
Do Passengers, 16,030, - - - - - -	38,692 46
Do The mail, - - - - - - - - -	12,768 10
Do Sundries, (timber, iron, &c.) - - - - -	1,437 12
Do Storage, - - - - - - - - - - -	132 36
	$121,440 51

Charges on Transportation for the year ending January 31, 1839.

General Superintendance, - - - - -		$6,500 00
Agents and labor at Petersburg and at other depots, -		11,759 15
Pay of engineers and train captains and hands, with their board upon the line, - - - - - -		6,416 57
Oil and fuel, - - - - - - - -		9,736 31
Repairs of engines, including labor and materials, and the cost of a stationary engine, with lathe and fixtures, -		17,059 38
Materials for repairs of road, overseers, negro hire and tools,		32,515 59
Other charges not embraced in the above, - -		3,170 24
Agencies on Greensville and Raleigh and Gaston Roads, and losses, (in this sum is included a judgment obtained by Hinton for $2100, and charges for a house burned near the road,) - - - - -	5,586 82	-$72,724 6
		$28,696 45

First Annual Report of the Board of Directors, to the Stockholders of the Housatonic Railroad Company.

Continued from page 153.

Whether it will be most advisable for the Company to again open their books for subscription to their stock, or resort to a loan for the purpose of raising the necessary amount to complete the road to Massachusetts line, will be a question worthy their serious consideration. We feel entirely confident of the ability of the Company to procure a loan on favorable terms, of sufficient amount, added to their own means, to complete the northern division of the road. When they shall have completed and put in operation the southern division, at an expense of nearly $600,000, and shall be in possession of means, in addition to the amount of more than $200,000, with which to commence the construction of the northern division, and if we are not grossly deceived in our estimation of the value of this stock on the completion of the road, it will be much to the advantage of the Company to raise, by loan, the necessary amount, rather than again to offer their stock to the public. It is unnecessary, however, to decide this question at present, as the Company is now in possession of all means necessary for their present purposes; and events may hereafter transpire, of such a character as to leave no doubt in the minds of any, as to the answer this question ought to receive.

It is probably known to most of the stockholders, and the community generally, that a company was incorporated some two years since, by the legislature of Massachusetts, called the "Berkshire Rail-Road Corporation," with power to construct a Rail-Road from the south line of that state at Sheffield, in the valley of the Housatonic, northerly to the village of West Stockbridge; at which place it will intersect with the "Western Rail-Road," leading from Boston to the west line of that state at West Stockbridge, which is now in course of construction; also with the Hudson and Berkshire Rail Road, leading from West Stockbridge to Hudson, now completed and in operation; and also with the Albany and West Stockbridge Rail-Road, for the construction of which, a company is incorporated and organized.

The Berkshire Rail-Road Corporation has been regularly organized, and an arrangement has been entered into between that Company and the Housatonic Rail-Road Company, fixing a certain determinate point on the line between Massachusetts and Connecticut. at which said Company have agreed to terminate their respective roads, thus ensuring to this Company, a continued line of communication from Bridgeport to West Stockbridge, and thence to Boston, Albany, or Hudson.

* * * * * * * *

In order to appreciate correctly, the advantages to the community, which will result from the construction of this road, and to estimate with some degree of accuracy the business that will naturally fall on to it, we should, in the first place, examine its location with regard to navigable waters, and to means for transportation to market. Looking upon the map, we find on the east, at an average distance varying but very little from forty miles, the Connecticut River, one of those natural avenues contrived by the Author of nature to facilitate intercommunication and the interchange of natural and artificial products between different portions of the country. On the west, at a distance averaging between thirty and forty miles, we find the Hudson, whose waters are literally burdened by the incalculable amount of freights borne upon their surface. Midway between these noble rivers, is the Housatonic, stretching far away into the north, affording, not the means of transportation upon its waters, but what is perhaps equally important to the manufacturing and mechanic arts, water power almost without limit, capable of being applied to the propulsion of machinery, at an expense comparatively trifling. We find a valley extending north from tide water at the city of Bridgeport, with an ascent very gradual, and over a soil of such a character as to render the construction of a Rail-Road extremely cheap and easy. We find in the same valley, a mineral wealth exceeding in variety and extent that of the same amount of territory in any part of New England. Indeed, any one looking upon the map, and seeing the location of this valley, as compared with the Hudson and Connecticut rivers, and then being made acquainted with its vast resources in water power and mineral wealth, can hardly resist the conclusion, that this was intended by nature as the site of one of those improvements which art has invented for overcoming those obstacles to transportation and intercommunication which exist in a state of nature. Let us next see what is the character of this road in respect to grades and curves. There is to be no grade exceeding 40 feet elevation to the mile, and only one exceeding 36 feet, and but three or four exceeding 30 feet In going towards tide water, which will be in the way of the greatest heavy transportation, there will be no ascending grade exceeding 26 feet of elevation to the mile. It will not be necessary to make any curve of less than 1,000 feet radius. Consequently this road, in these respects, will bear a favorable comparison with almost any road in the northern states. Another question of still more importance, is next presented, which is, what is to be the cost of this road, and how does it, in *this* respect, compare with other roads in this part of the country? We have been furnished with a statement of the cost of several important Rail-Roads in the northern states, which we suppose to be correct, which is as follows.

Cost of the	Boston and Worcester road,	per mile . : . . .	$37,000
"	Boston and Providence,	"	42.000
"	Norwich and Worcester.	"	22,000
"	Western Rail-Road,	"	34,500
"	New Jersey "	"	45,000
"	Camden and Amboy,	"	40,000
"	Columbia and Philadelphia,	"	40,600
"	Alleghany and Portage,	"	45,000
"	Albany and Schenectady,	"	61,000
"	Utica and Schenectady,	"	19,000
"	Stonington,	"	52,000
"	Hartford and New Haven, about		20,000

These roads are not all completed, but the cost of those which are not, is taken from estimates made by their friends or engineers, and is supposed to be correct. Their *average* cost will be found to be more than $38,000 per mile. While the whole cost of the grading and superstructure of the Housatonic road, will be less than $13,000 per mile; and adding the right of way, and all contingent expenses, the cost will not exceed $15,000 per mile. The result, then, is, that less than one half the amount of net receipts required to pay six per cent. profit on the same length of road of the average cost of those named in the above list, would pay the same per centage on the stock of this road.

We might easily make up a statement, showing in dollars and cents an *estimated* amount of receipts for business to be done on this road, which would show a net profit to the company of 6, 10, or even 20 per cent. on the cost of its construction; but this we do not propose to do, for the reason, that the *public*, as well as ourselves, know *how* easily such statements are made, and how little reliance is generally placed on estimates of that character. We prefer, rather, to state facts, and leave each one who reads, to draw his own inferences. We propose, therefore, merely to enumerate briefly, some of the principal items from which we suppose the road will derive its principal revenues.

And first, of the iron. This has, for many years, been one of the most important items in the business of this valley, (notwithstanding the distance from market, and the consequent expense of transportation,) because of the abundance of the ore, and the excellence and high reputation of the material manufactured from it, known under the general name of Salisbury iron. There are, in the valley of the Housatonic, nine blast furnaces for the manufacture of pig iron, the farthest of which is within five miles of the line of this road. There are also two more very near the line of the Berkshire Rail Road, which connects with this in Berkshire county. There are also in Litchfield county, within the same distance, a great number of forges, and at Canaan Falls one very large puddling furnace, which manufacture wrought iron. The Salisbury iron, from this valley, is now exclusively used in the national armories at Harper's Ferry, Springfield, and also, in various private armories in different parts of the country. And for axes, crowbars, picks, Rail Road and carriage axles, and for Blacksmiths' use, and for various other purposes, is preferred to any other iron. Almost the whole of the iron made in this valley, is now transported to navigable waters at an expense of from five to seven dollars per ton. The whole transportation connected with, and growing out of the iron trade of the valley, is estimated, by those intimately acquainted with the business, at 20,000 tons annually, and we believe that this estimate is none too high. This Rail-road can afford to do all this transportation at half the present prices, and still realize a fair profit on the business. Several of the furnaces, on and near the Housatonic, now transport their ore a distance of ten or fifteen miles, at an expense varying from \$1 50 to \$2.75 per ton. Ore can be delivered to these furnaces by the Rail Road, from inexhaustible beds in Berkshire county, at much less prices, and consequently, we suppose that large quantities will be transported on the Rail Road. Each furnace requires from 1500 to 3000 tons annually. Mineral coal is now used to some extent in the establishments for the manufacture of wrought iron. Its transportation costs about six dollars per ton, when it can be delivered by the Rail Road at \$3 per ton. There is every reason to suppose that it will be transported in very great quantities, for the use not only of the iron manufacturers, but for heating rooms and various other purposes. We have no doubt that such will be the result.

Marble, of a quality perhaps unsurpassed in the country, and in quantity wholly inexhaustible, exists on almost the whole line of this road, in the county of Litchfield, in Connecticut, and Berkshire, in Massachusetts. Great quantities of marble are now being transported from Berkshire county, by land, to the Hudson River, and thence to Philadelphia, to be used in the construction of the Girard College. The contracts for marble from that quarry, for that single edifice, are said to amount to more than \$300,000. The marble of the City Hall, New York, is from the same range. Its use in those two cases, is supposed to be sufficient evidence of its quality. The same range extends down the valley of the Housatonic, through the county of Litchfield, and in the immediate vicinity of the line of this road. It is now quarried and sawed, to considerable extent, at several points in Litchfield county, and transported, in wagons to great distances, for tombstones and for ornamental purposes; while the expense of transportation prevents its being carried to market in blocks, or for purposes of building; we know of no other reason to prevent the quarrying and carrying to market of this article, to almost any extent.

Granite, in massive blocks, unlimited in quantity, and of a quality to compare, in color and texture, with the best eastern granite, is to be found in New Milford, within fifty rods of the line of this road. This, when the Rail Road is completed, can be delivered at New York, or any of the Atlantic cities south of it, and sold at a profit, at prices much less than those at which the eastern granite is now sold.

The well known stratified granite of Mine Hill, (within a short distance from this road, and to which a branch can be easily extended,) is already distinguished, in consequence of its singular formation, and its excellence as a fire stone. This latter quality is so extraordinary, that it has been almost exclusively used for hearths and jambs in the town where it is found, and those adjoining, for a great number of years. This stone lies in layers nearly parellel to the horizon, the layers varying in thickness from two inches to five or six feet; each separate layer, however, being of uniform thickness, so that stone of any size, shape or thickness, from the thinnest flagging to the most massive block or column, can here be obtained. The expense of quarrying is trifling, in consequence of the horizontal position of the strata, and the perpendicular fracture with which they always split. This range of stone covers an area of 2,000 acres—the supply is therefore inexhaustible. We suppose that this stone, for fortifications and public works; for platforms, blocks, and columns; for flagging and curbstone; indeed, for almost any purpose for which flat or hewn, hammered, or cut stone, can be required, can, upon the completion of this road, be delivered in the markets at rates much cheaper than any species of stone now in use; and that, consequently, there is no practicable limit to the business that may be done in this article alone.

The *lime* of this region, under the general name of Canaan lime has long borne the highest reputation for purity and strength. Masons, and all persons in the habit of using this article, concur in saying, that the lime of this range, which is found on the line of this road, through almost the whole county of Litchfield, will bear at least twice as much sand to the bushel of lime, as the common lime used in New York and the southern markets. As an evidence of its quality, the fact may be mentioned, that great quantities of it are annually transported to Hartford, a distance of forty miles, in wagons; and that, at the prices it must necessarily bear, it is still sold in preference to any other. We have no doubt that, with this Rail Road built, this article would compete successfully with any lime now offered in the market; and that consequently, great quantities of it would annually pass over the road.

A very singular and valuable deposit of porcelain clay exists in New Milford, near the line of this road. This clay is highly valuable for the manufacture of all those articles which are to be exposed to intense heat; such as fire brick, portable furnaces, stove linings, crucibles, &c.; and for these purposes, is found to be of the very best quality. All these articles are now manufactured at New Milford, to considerable extent, and trasported to market where it is found that, in consequence of their excellent quality, they can now compete successfully with the imported articles. The effect of a Rail Road communication, which would reduce one half the cost of transportation on this manufacture, will be readily appreciated.

The *water power* of this valley is an item of the first importance in connection with this subject. From the head of Canaan Falls to New Milford, a distance of about thirty-three miles, the Housatonic River falls four hundred and sixty feet; almost every foot of which fall can be improved at a very moderate expense. At two several points, more than 100 feet of fall can be accumulated within a distance of half a mile. It is computed by those well acquainted with both rivers, that the volume of water in the Housatonic at Canaan Falls, is fully equal to, and the fall considerably greater, than that of the Passaic, at Patterson. The water in the Housatonic is considerably increased between Canaan Falls and New Milford, by tributary streams. It has been well ascertained that these powers may be purchased and improved, and water power rented at less than half the prices at which equal powers are now held at Patterson and Lowell, and still an immense profit made by the operation. It will be recollected that this company has the authority to purchase, improve, and rent these powers, if they see fit to avail themselves of that privilege. No reason can be assigned for the fact that this water power has not long since been improved, and applied to manufacturing purposes, except the discouragement to manufacturers to locate any establishment at so great a distance from market, without facilities for transportation. When such facilities are furnished by this road, can any one doubt that the improvement of the water power, and, consequently, a vast increase of the trade, travel, and transportation through the valley, will necessarily follow?

But, in addition to all this, it should be borne in mind, that the region through which this road is to pass, contains an *agricultural*, as well as mechanical and manufacturing community; and that, after going up from Bridgeport, a distance of perhaps fifteen or twenty miles, we find a section of country of *at least* ten miles in width, on each side of this road, extending through its whole length, which must of necessity throw its whole transportation to and from market, of every description on to this road;—we say *of necessity*, because we know that any articles going to market, situated within ten miles of this road, can be brought on to it, and thus delivered in the market, *cheaper* than by any other mode; and we know further, that all articles of trade, seeking a market, do, (in consequence of the competition which always exists in this country,) *of necessity*, follow those avenues which are the cheapest; and hence, all the transportation to and from this section, of ten miles in width, on each side of this road, we suppose will as naturally fall on to it, and pass over it, as they would pass up or down the Housatonic River, if that were navigable like the Hudson and Connecticut; and the territory that will thus become tributary to the road, is not entirely confined to this state, because the trade and business of an important section of Berkshire county, will also naturally seek an outlet in this direction.

Let us mention the single article of *plaster*. It is well known that (with the exception of a short distance in the immediate vicinity of tide water) the farmers, through this whole region, use from one to five tons each of plaster annually, and that its transportation now costs them from four to seven dollars per ton, varying with the distance; these prices can be reduced fully one half, and probably more, by the Rail Road. Such a reduction in price, will naturally increase the quantity used; what an amount then will be paid to the Company annually for transporting this article alone! It is not *plaster* alone, however, but every article which an agricultural, mechanical, and manufacturing community, require *from* market, or send *to* market, which will be transported over this road. Let any one undertake to estimate the amount of this transportation, and he will surprise himself with the result of his calculations.

In addition to all these items, we must also take into the account the receipts from the transportation of passengers. This is a more difficult item to estimate, than either of the others. We can surely rely, at all seasons of the year, not only upon all the *way* travel, to wit, that of persons passing up or down the valley from one point to another; but also upon all the travel of persons going to and from any portion of the valley, including a considerable portion of Berkshire county, to New York, or the south, or indeed to almost any part of the country, from the well known fact, that since the modern improvements in travelling facilities, the traveller, going in any direction, (almost as a matter of course,) seeks the nearest navigable water or Rail Road. Added to this, all the communication from a very important section of the New England states, will, in the winter season, by means of the Western Rail Road, naturally fall upon this road, and pass over its whole length, towards New York, or indeed any section of the country south of Bridgeport. All this travel we suppose, beyond a doubt, will fall upon this road, independent of any travel from Albany to New York.

Such, then, are some of the more important of the sources from which we suppose this road will derive its revenues; and we can freely say, that we have the utmost confidence that these revenues will be abundant to pay a very liberal profit on the investment, immediately on the completion of the work. What will be added to this amount after the effects consequent upon the opening of such a communication shall have been produced, in increasing the business and population of the valley, we leave to each one to conjecture. We look upon this as being *literally* a project for *internal improvement*, the object of which is to afford facilities for transportation and travel, to the interesting section of the country through which it is to pass, and which has been so long (as it were) shut out from the enjoyment of its natural advantages, by the want of some facilities of this description. As such an improvement, this road was originally projected; as such, it has been thus far prosecuted; and as such, we fully believe it will be continued to its full completion, independent of any ulterior considerations. If indeed this should in the event prove to be the avenue through which the winter travel from Albany and the west shall pass to New York and the south, as many of its friends have believed it would, this circumstance would unquestionably add somewhat to the value of the stock of this Company, (though we are aware that the mere transportation of passengers by Rail Road, during the most severe weather of winter in this northern climate, is not so profitable as many have supposed.) Still, no one engaged in this work, has ever dreamed that the prosecution or completion of it was in any manner dependent upon the course which New York and Albany travel would ultimately take. The stockholders of this Company reside, almost without exception, on the line of the road; they are composed of the active business men of the city of Bridgeport, and of the farmers, manufacturers, and business men of the country, and they have embarked their means in this project, not with any speculative intentions, but for the purpose of opening a communication between the city and the country, from which they expect to derive mutual benefits. This object, it is believed, they will steadily pursue, until they shall have the satisfaction of seeing it fully accomplished.

By order of the Board of Directors,

WILLIAM P. BURRALL, *President.*

Bridgeport, 31*st October*, 1838.

ENGINEER'S REPORT.

Engineer's Office, Bridgeport, October 1st, 1838.

To the President and Directors of the Housatonic Railroad Company:

GENTLEMEN,—I have the honor to submit the following brief statement of the progress of the work on the Housatonic Railroad, from its commencement to the present time.

On the twentieth of May, 1837, the survey and location of the line was commenced about three miles north of Bridgeport.

Since that time several routes have been carefully surveyed from Bridgeport to the south line of the state of Massachusetts. On the route selected, the centre line from Bridgeport to New Milford, is now permanently fixed, and divided into 35 sections, of one mile each; the whole of which, except the superstructure of the road and bridges, has been relet by Bishop and Sykes, the original contractors, to the different persons or companies, who have now employed a force equal to about 300 men, to which they are constantly making additions.

On the twentieth of July, just two months from the commencement of the location, the grading was commenced on section No. 13, and is now in progress on seventeen sections. No. 12 will be completed during this month. No. 14 is now ready to receive the superstructure, and Nos. 15 and 17, will be completed, or nearly so, next month. Several other sections are in a very forward state.

Thirty-three culverts, varying in size from one to four feet, are completed. Two of 10 feet span are now being constructed, and one of 16 feet, and 166 feet in length, is nearly finished.

The culverts are all constructed in a permanent and substantial manner, and, I think, will bear comparison with such work on any other road. The contractors are generally doing the light work on their sections, reserving the deep cutting and rock, for winter. By this means they will be enabled to employ a large force during the winter, and generally, to finish their grading in the early part of next summer.

Should nothing occur to retard the progress of the work from this time forward, I feel no hesitation in saying, that the road may be put in successful operation from Bridgeport to New Milford, during the next year.

In April last, by request of the Commissioners of the Berkshire Railroad Company, I made an examination of a route for their road in Massachusetts. The country was found to be extremely favorable for its construction. This road will unite with the Housatonic on the south, and with the Hudson, Albany, and Boston roads, on the north, near West Stockbridge. This will make a continuous line of Railroad from Bridgeport to each of those cities.

I am, very respectfully, your obedient servant,

R. B. MASON, *Chief Engineer*

Hudson and Berkshire Railroad.

From the Report of the Hudson and Berkshire Railroad Company, just published, we collect the following:

The Road from the Public Square in this city, to the State line at West Stockbridge, was completed the latter end of September. The Company commenced business with one locomotive, and the first train of cars passed over the road on the 29th of that month. In consequence of the accumulation of freight at each end of the road, it became necessary to procure an additional locomotive. From the 1st of November to the close of river navigation, two trains were in operatton, making a trip each day. The freight and passage money for that short period (two months) amounts to $7,482 39. The road from the State line to the village of West Stockbridge, was completed about the middle of November. In regard to the prospects of future income, the Report says: "that the receipts upon the Road during its operations last fall, must not be assumed as any data upon which to calculate its future income. During a large part of that time the Company had but one engine, and after the second was put upon the road, the Superintendant was obliged to refuse a large amount of freight, for want of a sufficient number of cars to accommodate the same. A portion of the cars were occupied during all the time of running, in transporting their iron and timber from one end of the line to the other, and in distributing wood to the different stations along the road.

"From the experience already had, the Board believe it safe to estimate for the next season, 20 passengers and 25 tons of freight for each train, making 80 passengers and 100 tons per day, and that the several trains may be run 250 days. Upon this basis the estimate of income will be as follows:—

80 Passengers per day for 250 days at $1 each, - -	$20,000
100 tons per day for 250 days, at $2 50, - - - -	62,500
Total estimated income, - - -	82,500
From the experience of last fall, it is estimated that the expense of running the road for the season will not, at most, exceed the sum of - - - - - - -	20,000
Leaving for interest upon the capital, -	$62,500

"This estimate is made without reference to the benefits expected from a connexion of this road with the Great Western Railroad, now under construction from Worcester to the line of this State. That road is now located throughout the whole line, and the grading in progress: the portion between Worcester and Springfield is nearly completed, and that portion between Pittsfield and its connexion with our road at the State line is to be completed during all the next season. The completion of this last mentioned portion will greatly increase any previous estimate of income, both in passengers and freight; and the completion of the whole line of the Western Railroad, which will shortly be accomplished, it is believed, will more than double the results of any calculation previously given."—*Republican and Advertiser.*

The Steamboat.

The House of Representatives recently adopted by unanimous vote, a Resolution that the President present to the only surviving son of *James Rumsey*, "a suitable gold medal, commemorative of his father's services and high agency in giving to the world the benefits of the Steamboat."

When this resolution was before the House, Mr. Rumsey, of Kentucky, a nephew of the deceased James Rumsey, in an unpretending, but clear and touching speech, detailed the evidence which establishes—conclusively, as it seems to us,—the fact, that as early as 1786, James Rumsey did succeed "*in propelling his boat against the current, by steam alone, four or five miles an hour.*" The experiment took place on the Potomac, near Shepardstown, Va., in the presence of hundreds of spectators, and among the witnesses surviving, is *Dr. Alexander*, of Baltimore, a gentleman of the highest character, and who was on board Rumsey's boat.

Finding, however, little encouragement in his own country, Rumsey went to England, and there, with the perseverance of genius, confident in the results of its own clear apprehensions, and not to be discouraged by the doubts, the coldness, or the sneers of the world, he labored to perfect his invention, and had all but finished his new boat of between one and two hundred tons, and named a day for the trial, when, in 1792, death arrested his hand.

Hungry creditors seized upon his little property, and with him died, until revived and perfected by Fulton, the Steamboat.

While thus vindicating the priority of Rumsey's claim, his honorable relative does full and ample justice to Fulton, from whose fame he seeks not to detract a single ray. To Rumsey, whom Fulton knew in England, and to Fulton conjointly, he justly ascribes the character of "the highest benefactors of their species," and thus eloquently and forcibly depicts the immeasurable value to America, and to the West especially, of steam navigation:

"Sir, you have no arithmetic of powers vast enough, by which to estimate the benefits of the Steamboat in a pecuniary point of view alone. Their labors, too, have tended, in no small degree, to the preservation of human life. I am aware that the truth of this last assertion may not be universally admitted; but it will scarcely be questioned, at least by a Western or South-western man, who recollects the old mode of conducting our commerce. Small as the commerce was before the introduction of the steamboat, it drew off a larger portion of the population than is now necessary to transact it, although so immensely extended. Even then, more died in the long and exposed and laborious voyages in keels and barges, or the exhausting return by land under a vertical sun, than now perish from steamboat explosions. But they dropped off one by one; they sank obscurely into the grave by the wayside; or, after reaching their homes, fell victims to disease incurred by a long sojourn and travel in southern climes. The consumption of life, though known to be great in the aggregate, happening so much in detail, made no impression. But now, every steamboat accident creates a sensation, and is proclaimed in the universal press of the country. If the mighty commerce now in progress on the Western waters had to be conducted in the old way, it would require the agency of so many individuals, that it would not be long before the sides of the public roads, from New Orleans to the upper States, and the banks of the great river which pours into the Gulf the congregated waters of nearly half a continent, would be almost continued graveyards."

We have heard of the clear apprehension of results, which is one of the elements and powers of genius. The following extract from a letter by *Brissot de Warville*, Mr. Jefferson's friend and correspondent, presents an extraordinary instance in point. Rumsey anticipated in 1789, what, at the distance of half a century, the Great Western, in 1838, has proved. We quote from Mr. Rumsey's speech:

"In a work published by *De Warville*, in 1789, which will be found in your library, he states that, being in Philadelphia in September, 1788, he attended by invitation, and witnessed Fitch's experiment. In a note written in the February following, in London, he says:

"'I have just become acquainted with Mr. Rumsey, of Virginia, a gentleman of great ingenuity, who proposes building a vessel in which, without sails, and by steam alone, he will cross the Atlantic in fifteen days.'

"This sublime conception, this bold undertaking of Rumsey, the accomplishment of which in the last year has created so vast a sensation was not unknown to me and others of his family; but without the high authority of De Wardle, I would not have ventured to have named it."—*N. Y. American.*

From the United States Gazette.

A Successful and Extraordinary Experiment—Steam Locomotives and Railroads—M. W. Baldwin's Steam-Engines.

We are enabled to spread before our readers this morning, the official details of what may justly be described as one of the most successful and extraordinary experiments that has yet been made by locomotives on Railroads. The facts possess the deepest interest, as well for scientific men as for the friends of internal improvement. Indeed nearly the whole community cannot but feel some concern in a matter of this character, nineteen-twentieths of our citizens being interested, either directly or indirectly in the coal trade, or at least in every measure calculated to increase the facilities of transportation, and hence to decrease the price of that valuable product. The engine made use of on this occasion was one of Mr. Baldwin's second class. The weight drawn was that assumed by the engineers of the road in their estimate of the cost of transportation over it, as the load of an engine of twelve tons weight and twelve inch cylinders—or one fourth more powerful than the engine which appears to have been used on this occasion. Thus it will be perceived that the anticipation has been more than realized by the results of this experiment—results every way gratifying, and without precedent, if we are not mistaken, in the history of enterprizes of this character. But to the details:

"The Philadelphia and Reading Railroad is one of the most interesting works of internal improvement in the United States, when regarded either with reference to the skill which has been exercised in its location and construction, or the numerous interests it is calculated to promote. No improvement in the country possesses superior resources, and but few Railroads can compare with it in capacity for economical transportation. The public may, therefore, look forward to it as an instance which will exhibit the maximum advantages of Railroad transportation.

On the 11th inst. we were indebted to the politeness of Wirt Robinson, Esq., Civil Engineer, &c. for a favorable opportunity of viewing that portion of the Railroad which has been completed, and of witnessing the day after, one of the most successful performances in the way of locomotive transportation, that has fallen under our observation, either in Great Britain or the United States, or, that we remember to have seen authentically reported.

On Tuesday the 12th instant, on reaching the depot at Reading, we found the locomotive "Never-Sink," (constructed by M. W. Baldwin Esq. of Philadelphia,) preparatory to starting with her train for Bridgeport (opposite Norristown,) consisting of 45 cars laden with nails and hoop iron from the factory of Messrs. Keim and Whitaker. We took seats on the tender, and accompanied the train throughout; and it is believed that the details of the performance will prove interesting to those engaged in Rail-road enterprises, we venture to place them before the public.

The weight of the Locomotive '*Never-Sink*' is 10¼ tons, with water and fuel; single geared with driving wheels 4½ feet in diameter, sustaining 5½ tons pressure, the remaining 4¾ tons of the engine being supported by a truck adjusted to comform to the curvatures of the road: cylinders 10½ inches in diameter, with a piston stroke of 16 inches; steam gauge adjusted to 120 lbs. to the inch.

The tender with fuel and water weighs 6 tons, and is so arranged that from 1 to 2 tons of its weight may be transferred to the driving wheels of the engine. In this instance the tender was so adjusted as to add about 1¼ tons to the adhesion of the engine.

The train in question consisted of 44 single cars and one double car, the former weighing 1½ tons each, empty, and the latter 5 tons; cars all mounted on springs, with wheels 3 feet in diameter, and outside journals 1 3-4 inches in diameter. The entire weight of the cars was 71 tons; the freight, consisting of nails in casks, and hoop iron, 150 tons; 28 men, say 2 tons, making the gross weight of the train 223 tons of 2240 lbs. The length of the train, including engine and tender, measured 595 feet.

At 10½ o'clock, A. M. the engine was attached to the train, with the steam blowing off at 120 lbs. to the inch; the road was in good order and the weather clear and calm. The train rested on an inclination of 9 feet to a mile, the profile changing however to a level, within 50 feet in front of the engine. With the valves in gear, the engine, when the steam was admitted to the cylinders, proceeded, without slipping or any other interruption, to put the whole train in motion; and after passing over a level of 800 feet, entered a grade descending 3 7-10 feet per mile, performing the 1st mile in 6 minutes; the 2d mile in 4½ minutes; the 3d mile (the grade having changed to 18 feet per mile) in 3¼ minutes; the 4th mile in 3¼ min.—when the road being perfectly straight, and still descending at the rate of 18 feet per mile, the steam was shut off with the view of ascertaining the influence of gravity on the velocity of the train. In this manner the 5th mile was performed in 3 minutes, showing an accelerated velocity, and that the resistance of the train, even at a velocity of 20 miles per hour, was less than 8 lbs. to the ton.

The resistance from friction, when a train is equilibriated, on an inclination of 18 feet per mile, would be about 7·64 100 lbs. per ton; but as the train was accelerated, it is obvious that the resistance to traction on the Reading road is less than 7.64 100 lbs. and probably not more than 7 lbs per ton. The distance from Reading to the station at Pottstown, 18 miles, with an average descent of 6½ feet per mile, was accomplished in one hour and 23 minutes, or at an average speed of about 13 miles per hour. Having replenished the tender, with fuel and water the engine moved off with the whole train, from a state of rest, on a perfect level, with as much ease as in the former instance, and reached the Phœnixville Depot in 59 minutes; travelling from 9 to 15 miles per hour, over a road, one-third of which was level, and the remainder in no instance descending more than 12 feet in a mile, and not averaging more than 5 feet per mile.

At the Phœnixville station it became necessary to pass from the left to the right track. The engine was stopped, with the centre of the train resting in the turn-out, and the forward and after portions occupying respectively the right and left tracks. The road, as in the last instance, was perfectly level. Notwithstanding these disadvantageous circumstances, the engine put the train in motion with comparative ease, and reached Bridgeport, ten miles distant, in 47 minutes, travelling at an average speed of $12\frac{3}{4}$ miles per hour. More than half of this stage is level, while the grades on the remaining portion do not exceed $10\frac{1}{2}$ feet, or average more than 8 feet per mile.

The total distance from Reading to the Bridgeport station is 40 miles; time consumed in performing the trip, 3 hours and 56 minutes, including stoppages; time in motion 3 hours and 9 minutes; average speed, about $12\frac{3}{4}$ miles per hour—1 3-10ths corde of oak wood consumed, and 995 gallons of water evaporated, lowest pressure indicated by the steam gauge, 80 lbs.; highest, 120 lbs. The performance of the "Never-Sink," where the road was straight and level, appeared to be about $10\frac{1}{2}$ miles per hour; the average throughout, owing to the resistance from curvature, when reduced to a level, would indicate about nine miles per hour.

William S. Campbell.
Ross Winans.

(From the U. S. Gazette.)

Fare on the Rail-roads.

I do hope that in granting charters hereafter to Rail-road companies, the Legislature will look closely into the question of what provisions are necessary to guard the citizens from imposition. At present, the rates of charge appear to be most unreasonably and oppressively high, as I will now proceed to show.

From Philadelphia to New York, the fare has been five dollars a head. It is now reduced to four dollars. Fifteen passengers, on an average, make a ton. The late charge, therefore, was equal to seventy five-dollars a ton. The present one is sixty dollars a ton.

From Philadelphia to Baltimore, the fare is four dollars, which makes sixty dollars a ton.

From Baltimore to Washington (40 miles) the fare is 2 dollars 50 cts., a ton, of which 50 cents are paid to the State of Maryland, leaving $2 to the company. This is at the rate of seventy-five dollars a ton for one hundred miles.

The Reading Rail-road Company, I perceive from their advertisement, charge $2 a head from Reading to Norristown. The distance may be about forty miles. This is at the rate of seventy-five dollars a ton, for one hundred miles, on the same rate that is paid on the Baltimore and Washington road.

These rates *appear* to be excessively high and extravagant. I have no knowledge of my own upon the subject. I never built a rail-road nor was concerned in one, and am not now; but sometime ago there was a report published by the Reading Rail-road company, signed by two Engineers, of the name of Jenkinson, or some such thing, and endorsed by two Directors, both gentlemen of high respectability, which I remember to have read at the time, with curiosity and interest. What I am about to state is derived from that report, which it is to be supposed was deliberately and fairly made, for the information of the public, and not for any purposes of speculation. As one of the public, for whose instruction it was published, I examined that report attentively, and the lesson it imparted, is what I am now about to apply. If my memory deceive me, of course the Engineers and Directors, in the same spirit of considerate and disinterested kindness which prompted them to incur the trouble and expense of the report, will not hesitate to furnish a correction of any error, I may fall into. My object, like theirs, is to enlighten, and not to deceive our fellow-citizens. We ought therefore to work together.

Well, if my recollection be correct, the report proposed to give the actual cost of transportation upon the road. It went carefully and minutely into all the details, which were reduced to figures and arithmetical results. Figures, every one knows, cannot lie, and such a statement. in figures, which any one acquainted with the common rules of arithmetic can go over, is worthy of all reliance. The process, I will not undertake from memory to set forth, but the final conclusion, I think, I well remember.

According to the report, the actual cost of transportation on the road to the Company, is, or is to be, (which is the same thing) fifty-three cents a ton for rather more than one hundred miles.

Fifteen passengers, as before stated, make a ton. The cost of transporting a passenger one hundred miles, therefore, is the 1-15th part of 53 cents, or 3 8-15ths of a cent a head. For forty miles, say from Reading to Norristown, it is 2-5ths of 3 8-15th cents, or say about one cent and 30 hundredths of a cent.

But the actual charge, as has been seen, is two dollars for forty miles for each passenger. Deduct the above cost, say 1 cent and 30 hundredths of a cent, and it leaves for clear gain to the Company on each passenger, one dollar ninety-eight cents and seventy hundredths of a cent.

Probably some allowance is to be made for the difference between the cost of passenger cars and burthen cars, but it cannot be much. There may be some other small allowances to be made besides, and then there is to be interest on the capital. Still, it seems to me quite clear, that the rate of charge permitted by the charters of Railroads is far too high, and I hope that in any new ones which may be granted, the Legislature will correct the error. It is very material to travellers, and also to the U. S. Mail.

I may, perhaps, at some future time, trouble you with a few more words on this subject. Z.

From the United States Gazette.

Fare on the Railroads.

An article appeared in the U. S. Gazette of March 27, under the above head, and over the signature of Z. complaining of the "unreasonably and oppressively high" rates of charges for passengers on Railroads in general, and on the Philadelphia and Reading Railroad, in particular.

It is somewhat singular that a person of the writer's evident ignorance on the subject of Railroads, should attempt, either by a wilful or unconscious perversion of facts, to persuade the public of being so grossly imposed upon as would appear from Z's conclusion, viz., that the Reading Railroad Company make one dollar ninety-eight cents and 7-10 of a cent "clear gain" on each passenger transported over their road.

Z in a most uncourteous allusion to the Engineers of the above road, says that the cost of transportation on the road is 53 cents per ton for about one hundred miles, and that, *therefore*, at 15 passengers to a ton, the cost of transporting one passenger the same distance is 1-15 of the above sum or 38-15 of a cent a head.

Had Z read the report as attentively as he asserts, or been as candid as he ought, he would have observed that the above 53 cents, is stated as the cost of transporting a ton of *coal;* and that 15 passengers, the number he estimates to a ton, would cost $3.975, transported to the same distance, at 26½ cents per head, the cost as stated by the Messrs. Robinson, Engineers of the road, thus sparing himself the ridiculous assertion that the cost of transporting a ton of coal and ton of passengers is the same.

The first cost of a passenger car, capable of containing 3 tons of passengers, is about 8 times that of a burthen car holding the same weight of *coal;* it weighs four times as much; and when the car required to keep the former in order, the rapidity of its motion, and the greater *proportional* quantity of fuel consumed in its transportation be considered, it is certainly not surprising that it should cost more to transport 15 passengers 20 miles, than a ton of coal 10 miles per hour.

Z establishes a comparison between the charges on the Reading road, and those on the Camden and Amboy, the Philadelphia and Baltimore, and the Baltimore and Washington.

The charges on the 3 latter roads, are at the rate of $4,17, $4,00, and $6,58 per 10 miles, respectively. The present charges on the Reading road, between Reading and Norristown, 41 miles are $2 in No. 1 cars, and $1,50 in No. 2, making an average of $1,75, or at the rate of $4,27 per 100 miles. The charges from Philadelphia to Harrisburg, via the Columbia Railroad, are at the rate of $4,63 per 100 miles, and on the Harrisburg and Lancaster Railroad $6,25 for the same distance.

It will be conceded, that the comparative rates of charges upon Railroads should be proportioned to their original cost and quality of construction, their amount of travel, and their management and the expense of accommodation to the pnblic on each in keeping the track, cars, &c. in good repair and order.

In original cost, the Reading Railroad cars exceed any of those mentioned above; the amount of travel over that portion, between Reading and Norristown has been as yet but one half of that over the *least* travelled of the above roads, and one-fifth of that over the greatest; and whether the present condition and management of the road will allow its charges to bear comparison with those on the above roads, and others, it is for the travelling public to determine.

It is respectfully suggested, that the same "spirit of considerate and disinterested kindness," Z praises in others, may prompt him to give the public an explanation of the causes which have produced the present depression in a certain canal stock. It may prove interesting, until a more vulnerable point than "high charges," be found on which to attach a rival improvement. Y.

Railroad Dinner—Illumination.

Natchez, February 26.

Yesterday was a glad day for Natchez. At four o'clock P. M. more than two hundred guests sat down to a sumptuous dinner at the Southern Exchange. Hon. Edward Turner, Chancellor of the State, President, and Messrs. A. L. Gaines and Andrew Brown, Esq'rs. Vice Presidents.

Every circumstance connected with the dinner went off in the most pleasant manner, and the regular toasts, which we publish, were received with ardent enthusiasm. The fourth toast called out Gen. Quitman, who responded in a warm-hearted practical address of considerable length.

The fifth toast called out the distinguished guest of the city, Gen. Robt. Y. Hayne, of South Carolina, who made a speech which thrilled the auditory for the space of half an hour. We shall give this eloquent production, as well as the other addresses at large, as soon as we have time to write them out.

The other gentlemen called out by the regular toasts were, Messrs. Bingaman, Armat, Murchison and Mellen, each of whom responded in handsome and appropriate addresses.

Hon. Robert Josselyn, of La Fayette county, replied most eloquently to a complimentary toast given by the President, Chancellor Turner. Gen. Huston was also called out in a speech by a toast, and made a fine reply.

The following are the regular toasts:

1st. Internal improvements.—The talisman whose magic influence will call into active exertions the giant energies of our youthful State; hers is the charm to make the wilderness glad, and the waste places to blossom as the rose.

2d. Our Country.—Blessed with the rich heritage of civil and religious liberty; she is doubly blessed in her sons, whom no toil can tire, no danger appal, no enterprise however great or wonderful can stay. Her course is ever onward. [Tune—"Hail Columbia."

3d. Our State—For a long lapse of years like a troubled sea, tossed by the storms of faction and sectional jealousy, has at length sacrificed these heart burnings upon the altar of Internal Improvement.

4th. The President of the Mississippi Railroad Company.—The projector of this grand scheme of internal improvement: he has by his untiring exertions in its behal, and by the zeal and ability which have characterized his course in every station, built up for himself a temple in the heart of every true son of Mississippi.

[Tune—"Here's a health to thee Tom Breeze."

5th. South Carolina.—Our elder sister of the South: we hail with pride and pleasure the distinguished individual who represents her on this occasion; the living personification of her chivalry, her talents and her enterprise.

"Here's a hand my trusty friend,
Then gie's a hand o'thine."

[Tune—"Auld Lang Syne."

6th. The Senator from Adams County—He has ever been found where duty called him; the able representative in time of peace, the ready defender in the hour of trial. [Tune—"Jackson's Morning Brush."

7th. Our Representatives—"Good men and true."

8th. The day we celebrate—In all after time may it ever be one of the greenest among memory's green spots.

[Tune—"Oft in the stilly night."

9th. The Sister Cities of the Mississippi—Rivals only in their efforts to advance the interests of the whole State.

10th. The fair—Day stars of creation, lights of life's darksome wilderness.

There was a number of volunteer sentiments given, which we shall collect and publish in a future paper. We only subjoin a toast sent in by a Natchez lady, which was drank with the gallant enthusiasm of the Mississippians:

"The Marriage of the Waters—By the exertions of the President of the Railroad Company, by the act of the Legislature, and by the acceptance of the company this day, a marriage has been contracted between the ancient and wealthy "Fathers of Waters," and the amiable and lovely Pearl river. What God shall join together, let no man put asunder!"

The illumination was general and most splendid. The "City of the Bluffs," was alive with pyrotechnics, and thousands of smiling faces thronged the streets. At half past eight, the illuminated Railroad Car, filled with a dense crowd of passengers, departed for Washington.

The Railroad for ever!

Baltimore and Ohio Railroad.—A warm debate occured some days ago in the House of Delegates, as to whether the State should guarantee the payment of the three millions of dollars which were subscribed by the city of Baltimore to the Baltimore and Ohio Railroad. After having passed the bill and sent it to the Senate, it was again sent for and returned to the House, as required by a vote of 35 to 34. The Senate in the mean time originated and rejected a similar bill, only two members voting for it. We have seen no notice of the grounds upon which so decisive a vote was given.

Nashville Railroad.—The House of Representatives of Mississippi have unanimously passed the bill authorizing the construction of the Nashville Railroad, The bill provides for a subscription on the part of the state for $1,250,00 of stock, which is to be paid for as required by the board of directors, by the Exchange Bank, as a bonus to the state for having increased its capital to five millions of dollars.

Railroad Travelling.—The Martinsburg Gazette states the fact that the accidents which occur in travelling on Railroads are much fewer than those which take place from any other kind of conveyances, and in proof of the fact adduces the Returns which have been made by two Railroad Companies in England, of all passengers transported on their Roads between 1831 and 1838, and all deaths and accidents that have happened upon them during that time. From this it seems that the number of passengers was *forty millions*, and the number of deaths by accident on the Roads only *ten* and but *four* of these were passengers. In the United States the proportion of accidents are larger.—*Frederick Herald.*

How they do Down East.—The following paragraph, will inform the reader in what manner the old Bay State orders things, when she happens to have on hand an important work of improvement, in an unfinished state. As Massachusetts is not in the practice of indulging in rash, unwise or thriftless disbursements, perhaps her action in this particular may tend to point out, in the case of other States, similarly situated with regard to great public improvement, the path of interest and duty.

Massachusetts Legislature.—The committee on the Western Railroad reported in the House, yesterday afternoon, a bill authorizing the Treasurer of the State to borrow $1,200,000 for the completion of that great work of internal improvement.

AMERICAN
RAILROAD JOURNAL,
AND
MECHANICS' MAGAZINE.

No. 7, Vol. II. New Series.] APRIL 1, 1839. [Whole No. 331: Vol. VIII.

Address of the Committee appointed at the Convention of Civil Engineers, which met in Baltimore, Md. February 11, 1839.

AT A CONVENTION OF CIVIL ENGINEERS OF THE UNITED STATES, which met in Baltimore on the 11th of February last, in pursuance of a call from a highly respectable meeting of members of the profession in Augusta, Ga., the following resolution was adopted:

RESOLVED, That the President appoint a Committee of five to draft an address to the Civil Engineers of the United States, and to superintend the publication of such portions of the proceedings of this Convention as they may deem expedient.

The President appointed Messrs. Fisk and Trimble of Maryland, S. W. Roberts of Pennsylvania, J. B. Jervis of New York, and G. W. Whistler of Connecticut. Mr. Whistler having declined the appointment in consequence of his inability to attend; Mr. Edward Miller of Pennsylvania was subsequently appointed in his place.

A majority of the Committee met according to appointment at the Hall of the Franklin Institute in Philadelphia, on the 20th of March. 1839, and adopted the following Address.

The Committee believe that they will best perform the duty assigned to them, of preparing an address to their professional brethren upon the subject of the proposed society of American Civil Engineers, by confining their remarks to what they deem the objects and advantages of such an Institution.

Forty members of the profession from eleven States of the Union, composed the Convention at Baltimore, and a number more expressed through their friends who were present, their approbation of the object in view, and their regret at being unable to attend.

The principal business transacted by the Convention, was the election of seventeen Engineers, from different parts of the Union, as delegates to frame a Constitution and form the Society. The time fixed for their meeting was the second Wednesday in April next, and the place the Hall of the Franklin Institute in Philadelphia. A gratifying degree of unanimity characterized the proceedings of the Convention, and a confident hope was generally expressed that the delegates elected, (many of whom

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Public works are now so extended in our country, and the mass of experimental knowledge to be gained from those in use is so great and so peculiarly applicable to our circumstances, that it is even more valuable to the American Engineer than what he can learn in Europe, where larger means have permitted greater expenditures. In this country it is of paramount importance to obtain the greatest amount of useful effect at the smallest cost; and of attempts to attain this end, the Union now contains a multitude of instructive examples. Some have been eminently successful, and others less so; but of either kind, the student or the more advanced engineer, too often seeks in vain for any satisfactory written or printed description, and is unable to obtain any thing more than vague, doubtful and often incorrect information. This evil can only be removed by the exertions of the Engineers themselves. They are now established as a distinct class, and have long felt the want of such an association as that proposed, but it has hitherto been supposed that the proper time for its organization had not yet arrived.

The success which has attended the labors of the London Institution of Civil Engineers, its high standing and great usefulness, prove that such societies may be of great public utility when properly conducted, and are incentives to induce us to imitate so excellent an example.

It is admitted, however, that a society in this country must differ somewhat in its plan of operations from the British Institution, which can readily give utterance to its opinions elicited after frequent and full discussion, since a large portion of the members during the winter season have their residences within the limits of London. Here, however, owing to the vast extent of territory over which are scattered the members of our profession, the usefulness of the society must (for the present at least) depend more upon the facts and experience of its members made known in written communications, than upon their opinions orally expressed in public discussions.

The very fact that our improvements are so widely spread, that few, if any, members of the profession are able to give even the most important of them a personal examination, affords, perhaps, the strongest argument in favor of a Society that shall, by a concert of action, bring the experience of the whole country within the reach of each member.

The difficulty of meeting at any one point, caused by the time and expense required in travelling from distant portions of so extensive a country as the United States, is a serious obstacle, but it has been much diminished by the facilities afforded by the Railroads already in use, which are among the valuable results of the labours of our Civil Engineers.

Though our Society may be less favourably situated than the one in London for frequent and public discussions, we nevertheless anticipate many important advantages to be derived from a personal intercourse and interchange of information among its members, and from the establishment of a permanent repository of the results of experience obtained from the most authentic sources.

The standing of the profession in our country, is fortunately such, that its importance need not be dilated upon; it is therefore the more necessary, that every thing in the power of the members should be done to add to its respectability and increase its usefulness. We look forward to the formation of the Society, as a valuable means of advancing these desirable ends.

We think, that the preliminary steps have been well taken; and as the late Convention has given the whole matter into the hands of the seventeen delegates, who were elected to frame the Constitution and form the Society, we hope that each of those gentlemen will feel, that an important and complimentary trust has been reposed in him, and exert himself to fulfil it in such a manner, as to advance the permanent interests of the profession of which he is a member. We trust, also, that each may appreciate the importance of attending at the time and place appointed for forming the Society, and will be willing to make some sacrifice for effecting that object; or if prevented from attending by uncontrollable circumstances, that he will express his views in writing, upon the subject of a suitable Constitution.

The Committee will close this communication by a quotation from the inaugural Address of the distinguished Thomas Telford, the first President of the London Institution, which appears to them peculiarly appropriate.

"In foreign countries, similar establishments are instituted by government, and their members and proceedings are under its control, but here a different course being adopted, it becomes incumbent on each individual member to feel that the very existence and prosperity of the Institution depend in no small degree on his personal conduct and exertions; and the merely mentioning the circumstance will, I am convinced, be sufficient to command the best efforts of the present and future members, always keeping in mind, that talents and respectability are preferable to numbers, and that from too easy and promiscuous admission, unavoidable, and not unfrequently incurable, inconvenience perplex most societies."

Signed by order of the Committee,

CHARLES B. FISK, *Chairman*

Third Annual Report of the Eastern Railroad Corporation.

To the Honorable the Legislature of the Commonwealth of Massachusetts:

The Directors of the Eastern Rail-road Company do hereby respectfully make their Third Annual Report of their acts and doings, receipts and expenditures, under their act of incorporation.

At the date of their last report about twelve miles of the road between Boston and Salem was mostly graded, and the bridges, culverts and other superstructures, on this part of the road nearly completed, and the iron rails and chairs, and other materials for the superstructure or railway, for the whole distance from Boston to Salem contracted for, and excepting the iron, mostly delivered.

The timely aid of the credit of the state, granted by the munificence and enlightened policy of the Legislature of the last year, to the amount of $90,000, enabled the Directors, on the opening of the spring, notwithstanding the embarrassed state of the business of the country to proceed vigorously in the completion of the road, and it was confidently expected that it would have been opened early in July—an unexpected delay in the arrival of the iron rails and chairs disappointed this expectation, and the road was not opened until the latter part of the ensuing month.

On the 27th of August, the road was experimentally opened, and the stockholders and invited guests transported over it.

On the 28th, the road was opened for public travel, since which time, however, considerable additional work has been done in finishing the road-way, principally in cutting the side ditches, and other works for the effectual draining of the cuts, and in widening in some cases the embankments, and in covering exposed parts of the marsh embankments with rubble, and in laying down additional turn outs, switches, &c. So that the directors believe the road to be in an excellent condition.

Allusion was made in the last annual report to the selection of the form of rail and chair, which provides for a greater elevation of the rail above the road bed, than has been usual in other roads. The experiment thus far has been very successful, the rail has proved to stand very firm, and the chairs have resisted the shocks of the engines and trains without failure, except in a very few instances. Considerable advantage is also anticipated from the greater elevation of the rail in case of deep snows, although from the favorable state of the winter, in this respect, thus far this advantage has not been tested.

The directors consider this a proper opportunity to express their conviction of the enlightened policy of former legislatures of the Commonwealth, in granting the credit of the state in aid of individual enterprise, in carrying on and completing the great chain of internal improvement, in the state of which the Eastern Rail-road forms in their opinion an important link. Commencing as it does upon the navigable tide waters of Boston harbor, below all bridges or other obstructions, and united by said waters with the depot of the great Western Rail-road, at the South Cove, and passing in its course directly upon the tide waters of the harbors at Lynn, at Salem, at Beverly, at Rowley, at Parker's river, and at Newburyport, and on its way near to the harbor of Ipswich ; and after passing the Merrimack, when it shall be continued according to the original intention of its projectors, and of the Legislature, who granted the charter, coming upon the deep and navigable waters of the Piscataqua, always accessible to steamboat navigation from the far East, it is destined to form through its whole length, the important channel of communication between the great Western Rail-road, and the extensive and fast improving East.

There is also another and important fact connected with the Eastern Rail-road, which the directors believe adds much to its importance as a great public work, which is the density of the population immediately along its line. This circumstance alone, according to the experience already had on other rail-roads, similarly situated, will, it is believed, ensure it an ample income. Wherever there are large masses of population whose occupation leads them to travel, increased facility for travelling acts as a stimulus to the increase of communication, to a degree not anticipated even by the most sanguine, and such has been the result on the Eastern Rail-road, so far as it has been completed. And the directors feel justified in expressing the opinion, that it has rarely, if ever, happened that so great an amount of public convenience has resulted from the completion of a line of rail-road communication, as has resulted in the opening of the road between Salem and Boston.

An act was passed by the Legislature on the day of April, 1837, extending the time for the completion of the road below Salem, for five years from the 30th of Sept. 1840, and soon after the opening of the road to Salem it became a question, whether the company should avail themselves of this extension, and delay the work upon that part of the road. To determine this question a very full meeting of the stockholders was held at Salem, on the 22d September last. At this meeting, the question was very fully considered, and the following resolves, proposed in a report of the directors were adopted with great unanimity, viz :

Resolved, That the Eastern Rail-road Company are pledged in good faith to go on and complete their rail-road as far as Newburyport.

Resolved, That the present time is the best time to proceed with the work of the road to its completion.

Resolved, That it is the wish of the stockholders, that the directors proceed with all the despatch consistent with due economy, to construct and complete the road to Newburyport.

Resolved, That whenever satisfactory assurances are given that the rail-road from Portsmouth to the Massachusetts line will be built, the directors be requested forthwith to put the road from Newburyport to the line of the State under contract.

Under these resolves, proposals were issued for the work of grading, bridging and masonry upon the line from Salem to Newburyport, and contracts have been entered into for nearly all this work, at prices within the estimates of the engineer, with persons who, it is believed, are amply competent to complete their contracts. Under these contracts, the work is progressing with all the despatch consistent with due economy, and it is expected, that it will be completed and the road bed be ready for the superstructure or railway within the present year.

From a statement of the accounts of the treasurer, exhibited by that officer, it appears, that the cost of the road, as per his books, posted to Dec. 31st, 1838, including expenditures eastward of Salem, and cost of surplus lands, has been as follows, viz:

Preliminary survey,	$6,570 59
Engineering account,	28,915 77
Expense account,	7,322 75
Purchase at Lewis' wharf,	23,215 84
Land damages and fencing,	34,506 60
Salaries,	12,062 98
Depot wharves at East Boston,	69,648 50
Depot at Salem,	8,340 38
Cars and engines,	51,840 95
Grading, bridges, railway, East Boston Ferry, &c.,	589,478 94
	$831,903 30

And the receipts have been as follows, viz:

Received from the State of Massachusetts,	$290,000 00
Interest account and premium on State scrip	3,549 36
From assessments,	470,575 00
	$764,124 36

From a report of the superintendent exhibited by that officer, it appears, that the income arising from the business of the road, since it was opened up to the 31st Dec. 1838, has been as follows, viz:

Income from passengers,—

From Boston to Salem,	26,155½	tickets sold, at	50 cts.	$13,078 75
" do. 2d class,	635	"	37½ "	238 12
" Boston to Lynn and Marblehead,	11,303	"	31 "	8,503 93
" do do 2d class,	109	"	25 "	27 25
" Salem to Boston,	25,748	"	50 "	12,874 00
" do 2d class,	175	"	37½ "	65 62
" Salem to Lynn,	4,614	"	25 "	1,153 50
" Lynn to Boston,	9,787½	"	31 "	3,032 87
" do 2d class,	24	"	25 "	6 00
" Lynn to Salem,	4,493½	"	25 "	1,123 37

From Marblehead to Boston,	1,723	tickets sold, at	31 cts.,	$534 13
" do 2d class,	16	"	25 "	4 00
" Marblehead to Salem,	24	"	25 "	6 00
Way passengers, received, from them, $1,510 91 which sum averaged, equals,	3,595	"	42 57-1000	1510 91
Military companies, rec'd from them $263 91 which sum averaged, is equal to	628	"	42 57-1000	263 91
	89,032½	"		$37,422 36

And that the current expenditures arising from the business of the road for one hundred and eight running days, from the opening of the road to Dec. 31, 1838, inclusive, (Sundays being excluded,) have been as follows, viz :

Repairs on the road, ...	$1,795 20
" of engines and cars, and work done in machine shop	1,925 88
Fuel, ...	3,154 76
Salaries, wages and other expenses, including ferriages,	10,942 35
	$17,818 19

$2,000 of this extraordinary, and which will not occur again.

The whole income of the road has arisen from the carrying of passengers and their baggage, no merchandise trains having yet been run.

The foregoing account is made up to December 31st, 1838. Since that time up to this time, January 18, 1839, 11,069 passengers have been carried, making a total since the opening of the road, of 100,101 passengers.

All which is respectfully submitted.

GEO. PEABODY,
ROBERT G. SHAW,
AMOS BINNEY,
FRANCIS J. OLIVER,
STEPHEN A. CHASE,
DANIEL ADAMS, 3d,
B. T. REED,
L. THORNDIKE,
ISAIAH BREED,
Directors.

BOSTON, *January* 18, 1839.

Third Annnal Report of the Nashville and Lowell Rail-road Corporation.

To the Honorable Legislature of the Commonwealth of Massachusetts :

The Directors of the Nashua and Lowell Rail-road Corporation respectfully submit this, their *Third Annual Report* of their acts and doings, receipts and expenditnres under their charter of incorporation.

Since our last annual report, the work upon the road has been steadily progressing, notwithstanding the many pecuniary difficulties of the times, and on the eighth day of October last, the road was opened for the transportation of passengers to a temporary depot within about three-fourths of a mile of the terminus at Nashua. Since that time, the track has been completed, and on the twenty-fifth day of December, the permanent depot was prepared and the road opened through its whole extent. The road, however, is not fully completed. nor the arrangements for freight and passengers perfected, so that neither the total cost of the construction of the road, nor its present receipts and expenditures can now be given.

The following statement will exhibit a correct view of the financial affairs of the corporation, as they now appear from the books of the Treasurer, in those particulars required to be specified in the annual report.

The receipts have been as follows :—

Amount received for stock to date, . .	$236,275 21
" " for interest. &c., . . .	2.991 85
" " on loan of State scrip. . . .	50,000 00
" " on other loans, ...	17,823 55
	$307,090 61
" " for transportation of passengers, from October 8th to January 1, 1839 .	6,114 21
Total receipts to date, ...	$313,204 82

The expenditures have been as follows :—

Amount paid for land and fencing, .	$42 558 30	
" " for grading and bridging .	95,534 14	
" " for superstructure and rails,	91,898 11	
" " for depots and fixtures, .	7,775 64	
" " for engineering and expenses,	16,589 76	
" " for engines and cars, .	25,583 49	
		$279,939 44
" " for transportation of freight and passengers, ($807 64 being for fuel,) .	4,185 34	
" " for repairs of road, .	645 33	
" " for repairs of engines and cars,	282 15	
		5,112 82
Total expenditures to date, . . .		$285,052 26

It will be observed, that the above statement contains the *expenditures* up to this date, and the *receipts* to the first day of January only. Since that day there has accrued for the transportation of passengers and freight, a further sum estimated as follows :

Amount accrued from passengers from January 1, to January 22, about . .	$1,400 00
" " for freight from November 23, to date,	1,325 00
	$2,725 00

Up to December fifteenth, an arrangement existed with the Boston and Lowell Railroad Corporation, by which they were to do all the transportation, and receive one-half of the gross receipts, until our engines and cars were in readiness for use. The amount so paid is included in the above statement. Since the road was opened, about 18,000 passengers have passed over it, being an average of 60,000 yearly. This number greatly exceeds the estimates heretofore offered by us, although the trade during the last three months has been less than the average of the year. The freight cars commenced running November twenty-third, and, although not in full operation, on account of the season, want of depot, and suitable accommodations, and other embarrassments, the freight now averages about thirty-five tons per day. Application has been made to your honourable body, to fix the rate of tolls to be paid by us for the use of the Boston and Lowell Railroad, by which it is expected that some inconveniences under which we now labor may be remedied, the amount of transportation much increased, and the public greatly benefitted.

Not a share of the stock of the corporation has yet been sold for the non-payment of assessments, and the whole amount now due on the shares of delinquent stockholders is only about $3,600.

The cars now run in connexion with the trains upon the Boston and Lowell Railroad, making three trips each way daily for passengers, and one trip each way daily for freight. No accident to the passenger cars or passengers has occurred since the opening of the road.

Pursuant to the provisions of the act of your honorable body at the last session, to aid in the construction of this road, scrip or certificates have been received by the Treasurer of this Corporation from the Treasurer of the Commonwealth, to the amount of *fifty thousand dollars.* Being desirous of repaying the amount before the expiration of the period limited, we have thought it advisable not to make a sale of the bonds, but to borrow money upon their pledge, which has been done accordingly.

The road is not in such a state of completion at present, as to render a compliance with the requirements of the act of April 19, 1837, practicable on our part. We indulge the hope, however, that it may be effected, as well as the apportionment of the cost of construction of the separate portions of the road lying within the two States, (commissioners for that purpose having been appointed in both States,) at some period during your present session.

The act passed by your honorable body at its last session, and reenacted by the Legislature of New Hampshire, at its session in June last, authorizing the union of the two corporations in New Hampshire and Massachusetts, known by the name of the Nashua and Lowell Railroad Corporation, in one body corporate, has been duly accepted, and such union effected. The act of your honorable body extending the time for the completion of our road, for the period of one year from the first day September last, has also been accepted.

All which is respectfully submitted.

Daniel Abbot,
Jesse Bowers,
Peter Clark,
Adin Holbrook,
Joseph Greely,
C. H. Atherton,
Henry Upham,

January 23, 1839. Directors.

Third Annual Report of the Norwich & Worcester Railroad Company.

To the Honorable Senate and House of Representatives of the Commonwealth of Massachusetts, now in Session:

The Directors of the Norwich and Worcester Railroad Company respectfully present their Third Annual Report, as follows:

Since their last annual report, the work upon the graduation, masonry and bridges of the Railroad has proceeded without interruption, and the road is entirely graded for the whole distance from Norwich to Worcester, with the exception of a few hundred feet, which will be finished at a small expense, in about a month from this time. The amount of funds received into the treasury of the company from all sources, up to the 31st Dec. 1838, as appears by the books of the treasurer, amount to the sum of seven hundred, eighty-three thousand six hundred and seventeen dollars; and the whole amount expended up to the same date is seven hundred forty-two thousand, six hundred sixty-seven dollars forty-one three-fourths cents.

The company have adopted an edge rail of fifty-four and one half pounds weight per yard, with a chair of approved construction.

A contract has been perfected for the iron for the entire Railroad, to be delivered as soon as it can be manufactured and shipped to this country.

With the exception of one or two miles, contracts have been made for the delivery of the timber during this winter and spring, and unless there is some delay not anticipated in the manufacture or delivery of the iron from Europe, the road will be in operation for the whole distance in the ensuing autumn.

The timber adopted for the superstructure are sleepers of white oak, chesnut or cedar, seven feet long, faced on two parallel sides to a width of five inches, and to measure not less than six inches in depth or thickness, the ends to be cut square and the bark removed. The sills of chesnut, hemlock or pine, eight by four inches, in lengths of eighteen feet or upwards. Under pieces of the same eight by four inches.

On such portions of the road, where the soil was not good, it has been removed and gravel put on to the depth of about two feet.

The connexion of the Railroad with the Boston and Worcester Railroad, at Worcester, will be convenient to both corporations; and will be so arranged, that the cars may readily pass from one road to the other; and at Norwich, the depot is at the steamboat wharf, and will be so constructed as to facilitate the transhipment of goods and passengers between the cars and the steamboat.

The act uniting the corporations in the states of Massachusetts and Connecticut requires that the accounts of the company shall be annually examined by the commissioners appointed by the governors of the states. Accompanying this report, and constituting a part of it, is the report of the commissioners on this subject.

It is, perhaps, proper to remark, that the directors have increased confidence in the value of this Rail-road as a public work, aswell as a private enterprise. They are persuaded that the business which they have in their previous reports anticipated, has not been over-estimated.

That it will furnish a desirable route between Boston and New York, will afford important advantages to a densely populated and manufacturing section of country, and will afford a mutual benefit to city and country, by restoring, in no small degree, to the city of Boston the business from Connecticut, which has been for many years withdrawn.

From the small amount of work to be done on the masonry, bridges and dressing the road-bed, the directors are enabled to estimate with considerable accuracy, that the expenses for the graduation, masonry, and bridges, for the entire Railroad, will be $526,545 85, being for fifty-eight and one-half, (the length of the road) $9,000 78 per mile

The following statement, by the engineers of the company, presents an estimate of the expenditures and receipts of the company for one year after it is in full operation.

The estimate of expenses is deemed too high; at the same time, it is believed that the calculations of the probable business on the road is by no means overstated.

Estimate of the annual expenses, renewals, repairs, &c., on the Norwich and Worcester Railroad:

1	Superintendant,		$2,000 00
2	Masters of transportation, at	$1,200	2,400 00
2	Clerks, at	800	1,600 00
50	Depot laborers and brakemen, at	350	17,500 00
8	Attendants at way depots and ticket offices, at	500	4,000 00
2	Termini ticket office clerks, at	800	1,600 00
3	Conductors, at	800	2,400 00
5	Enginemen, at	700	3,500 00
5	Firemen, at	350	1,750 00
78 men.			
	Secretary, treasurer, and other officers, say,		5,000 00
	Office expenses, advertising, &c.,		2,000 00
			$43,750 00
	Depreciations, renewals, and repairs of engines, cars, buildings, &c., $125,000, at 20 per cent.,		25,000 00
	Repair of road, renewals, &c., 60 miles, at $350,		21,000 00
	Fuel and oil,		20,000 00
			$109,750 00

Estimated annual receipts:

Say, 60 Boston and New York passengers each way, per day, equal to 120 passengers, at $2,	$240 00	
Say, Worcester and way travel, equal to 60 passengers over the road each way per day, or 120 passengers, at $2,50,	300 00	
Say 50 tons of freight, each way, per day, equal to 100 tons, at $3,50,	350 00	
	$890 00	
Receipts per year, 313 days, at $890,00 per day,		$278,570 00
Deduct annual expenses,		109,750 00
Balance,		$168,820 00

Equal to 12½ per cent. on one and a half million of dollars capital. Three times the amount of business estimated would add very little to the annual expenses.

All which is respectfully submitted.

John A. Rockwell,
Jno. Breed,
J. G. W. Trumbull,
Russell Hubbard,
A. F. Gilman,
Thomas Robinson,
G. S. Perkins,
Directors.

Norwich, *January* 31, 1839.

We, the subscribers, Commissioners of the Norwich and Worcester Railroad Company, appointed by the Governors of the states of Massachu setts and Connecticut, having examined the foregoing, believe it to be correct, and approve of the same.

JOHN DE WITT,
Commissioner for the State of Connecticut.
CHARLES HUDSON,
Commissioner for the State of Massachusetts.

At a meeting of the Commissioners of the Norwich and Worcester Railroad Company, at Worcester, in the Commonwealth of Massachusetts, on the 31st day of January, 1839, for the purpose of investigating the accounts and expenditures of said company, and for deciding what sums of expenditures made by said company are applicable to that part of said road lying in the state of Connecticut, and also what part is chargeable to that part of said road lying in the state of Massachusetts.

And having examined the accounts of said company, we do find that since the last settlement of the accounts of said company, which were brought up to Dec. 1st, A. D. 1837, up to the 31st Dec. A. D. 1838, embracing a period of thirteen months, there has been expended by said company, in the engineer department, \$12,367 85, of which sum we apportion to that part of the Railroad lying in the State of Connecticut, the sum of \$8,245 23; and to the portion lying in the State of Massachusetts, \$4,122 62. In the carriage department, for cars, &c., there has been expended the sum of \$2,189 14; of which, we put to Connecticut, \$1,459 43; and to Massachusetts, \$729 71. For salaries the sum of \$5,872 49¼; of which, to Connecticut, \$3,915 00¼, and to Massachusetts, \$1,957 49. For contingent expenses, the sum of \$3,424 73; of which, to Connecticut \$2,283 15; to Massachusetts, \$1,141 58. For office expenses, \$737 82; of which, to Connecticut, \$491 88; to Massachusetts, \$245 94. And we find, by the books of said corporation, that there has been expended for real estate and land damages in Connecticut \$45,198 22; for graduation, masonry and bridges in Connecticut, \$102,607 38¼. For real estate and land damages in Massachusetts, \$23,963 42; for graduation masonry and bridges in Massachusetts, \$69,180 19, making the sum total expended by said company, during the above period of thirteen months in Connecticut, to be \$.64,200 20¼; in Massachusetts \$101,340-95, making a total expenditure, during said period, of \$265,541 24½

To which, if be added the sums expended as by our last annual report, viz: in Massachusetts, \$115,276 89; in Connecticut, \$361,849 28¼, will show a total amount as expended by said company, up to the 31st Dec. A. D., 1838, of \$742,667 41¾

Said Commissioners also find, upon examination of the books of said company, said corporation have kept distinct and separate accounts of the expenditures in Connecticut and Massachusetts respectively, agreeably to the acts of said states, creating the present Norwich and Worcester Railroad Company.

All which is respectfully submitted, by CHARLES HUDSON,
Commissioner for the State of Massachusetts.
JOHN DE WITT,
Commissioner for the State of Connecticut.

WORCESTER, *Jan.* 31, 1839.

Third Annual Report of the Seekonk Branch Rail-road Company.

To the Honorable General Court of the Commonwealth of Massachusetts, begun and holden at Boston on the 1st Wednesday of January, A. D., 1839:

The Directors of the Seekonk Branch Rail-road Company respectfully report their acts and doings during the preceding year.

They have received the sum of	. . .	$19,993 09
They have expended the sum of	. . .	$21,235 06

The surplus of expenditure, and about three thousand dollars of the receipts, have been furnished by two of the building committee, and the remainder has been furnished by the share-holders of the company.

All which is respectfully submitted.

TRISTAM BURGES,
JOHN W. RICHMOND,
MOSES GILD,
JONATHAN BLISS,
Directors,

Fourth Annual Report of the Taunton Branch R. R. Corporation.

To the Honorable the Legislature of the Commonwealth of Massachusetts:

The Directors of the Taunton Branch Rail-road Corporation do hereby make the Fourth Annual Report of their acts and doings, receipts and expenditures.

On June 5, 1838, a new contract was entered into between this corporation and the Boston and Providence Rail-road Corporation, by which it is provided, that the passeng·r and merchandise cars of this corporation shall be transported, between the junction of the two rail-roads, at Mansfield, and Boston and Providence, respectively, by the locomotives of the Boston and Providence Railroad Corporation; and that the latter corporation shall be entitled to receive the sum of fifty cents for each passenger, and the sum of one dollar for every ton of merchandise. This contract is to be in force for three years.

The total amount of capital paid in, is - -	$249,825 00
The expenditures during the year ending November 30, 1838, have been as follows:—	
Repairs on the rail-road, - - - -	$1,799 09
Repairs on the engines and cars, - - -	986 36
Miscellaneous expenses, including the amount paid to the Boston and Providence Rail-road Corporation for their proportion of the receipts, the cost of fencing the rail-road, interest, &c., - - -	32,180 60
Total amount of expenditures, - - -	$34,966 05

The receipts during the year ending November 30, 1838, have been as follows:

Amount of capital paid in, - - -	$21,600 00
Amount received for the transportation of passengers,	32,860 62
" " " merchandise,	12 876 78
" of other miscellaneous receipts, - - -	2,999 59
Total amount of receipts, - - -	$70,336 99

Two dividends of three per cent. and two per cent., respectively, have been made in the course of the year, amounting, in the aggregate, to the sum of $12,500.

All which is respectfully submitted.

THO. B. WALES,
JNO. F. LORING,
WM. A. CROCKER,
SAM. FROTHINGHAM,
Directors.

Boston, Dec. 11, 1838.

Some Remarks on the Internal Improvement System of the South; by John C. Trautwine, Engineer-in-Chief of the Hiwassee Railroad.

For some time after the introduction of railroads into our Union, their construction was confined almost exclusively to the northern States. To Pennsylvania is due the credit of having been foremost in the cause of State railroads, as she had before been in that of State Canals. She has, through either her Legislature, or chartered companies, expended the heavy sum of thirty millions of dollars, in works more or less intimately connected with internal improvements. Large expenditures had also been made in Maryland, Delaware, New Jersey, New-York, the New England States and Virginia, for a considerable time before the importance of the internal improvement system appeared to manifest itself to the more southern portion of the Union; and with, I believe, the single exception of the South Carolina railroad in 1830, but little or nothing of importance had been done to further its advancement, until within the last three or four years.

The river Ohio, in connexion with the improvements of New-York and Pennsylvania, has hitherto been the great thoroughfare along which merchants of the west and interior have sought the markets of New York, Philadelphia, Baltimore, and other northern Atlantic cities; and along which they have in return transported to their several States, the goods purchased in those cities. South of the Ohio, they have never had offered inducements to visit the southern ports. Five or six hundred miles of miserable roads, nearly impassable in winter, have effectually shut out all intercourse between the merchants of the west and the Atlantic seaports of the south. The only rival of the northern cities in the trade of the north-western states, and of the interior, has been New Orleans; to which an easy access is had down the Mississippi river. But even there the trade has been confined principally to groceries, of which the sugar and molasses manufactured near New Orleans, constitute the principal items. As respects merchandize, the sales there are principally made to retailers living along the banks of the river, who send down produce to New Orleans, and receive return loads of groceries and merchandize in exchange. The *wholesale* merchants even along the Mississippi river, and of the states of Mississippi, Alabama, Georgia and Tennessee, as well as those of the north-western states, make their purchases in the northern cities; which in the sale of all articles of European manufacture, enjoy almost an exclusive monopoly. This is owing in a great measure to the superiority of the navigation between them and Europe, over that between New Orleans and Europe. Not only is the voyage to New Orleans the longer by more than 1000 miles, but it is rendered comparatively dangerous by the intricate passages, and obstructed navigation of the Bahama banks and capes of Florida.*

This objection, however, does not apply to the cities of the southern Atlantic seaboard. The navigation from Europe to Charleston and Savannah, is at least as good, if not better, than that to the northern cities. Moreover, the south would have a very important advantage over the north, in the mildness of her climate, which would allow merchants to

* Might not this difficulty be remedied in some measure, by the construction of a ship canal across the Isthmus of East Florida? Its length would probably not exceed 80 miles, and the country is very favorable for its construction. That common objection to canals, viz. their liability to obstruction by ice, would not apply here, owing to the mildness of the climate; the voyage would be greatly shortened and the most difficult and dangerous portion of it entirely avoided. This is one of the few instances in which we consider a canal infinitely preferable to a railroad. Writer.

transport their goods at all seasons, without fear of obstruction from ice. Serious delays occur annually in the northern canals, from this cause. Let the south then open for the merchants of the west and interior, as good avenues to her seaports, as the cities of the north have done to theirs, and the monopoly of the latter must at once cease, and the south become a heavy importer. This she has finally resolved to do.

Within the last few years, the confidence which had been awakened in the south, by the increasing number of our northern projects, gradually became stronger; and as the success of these projects by degrees revealed itself in the realization of handsome profits, finally was confirmed. Thus experimentally convinced of the immense benefits resulting to the Atlantic cities of the north, from their numerous channels of intercourse with the west, she determined that she also would enjoy them.

This determination was promptly followed up by suggestions for various lines of railroad, stretching from the principal Atlantic cities of the south, to the interior of our Union; where their upper extremities are to be united to the lower termini of other lines, now being constructed in the north-western states of Indiana, Illinois, and Ohio, by which they will be extended even to the great lakes.

Through these connected lines of railroads, the merchants of the west will have as easy access to the seaports of the south, as to those of the north. The former will thus be enabled to effect an extensive importing system, and the heavy trade now monopolized by the north, will be distributed more equally along our entire seaboard.

A strong impulse has been given to the southern improvements by the lively interest taken in many of them, by the several states through which they pass; the consequence of which judicious policy is, that almost every individual state south of the Potomac and west of Pennsylvania, is at this moment engaged in forming its respective link in the grandest chain of internal improvements ever suggested; and one which will in less than six years from this time, effect an almost magical change in the commercial relations of the various sections of our country.

Fortunately for the south, she has conducted her operations thus far, with a spirit of unity and concert, much more marked than that which characterized the northern projects. Her several districts sensible that the prosperity of each depended on its means of ready intercourse with all the others, are constructing their respective lines with a view not only to the effecting of *local* considerations, but to the accomplishment of a magnificent project of *national* importance.

The most striking feature in the commercial aspect of the south, is her *Cotton growing.* The cotton country includes South Carolina, Georgia, Alabama, Mississippi, Middle and West Tennessee, and large tracts west of the Mississippi river. The great demand for this article over the whole globe, renders its cultivation far more profitable to the southern landholders, than that of the common agricultural products would be. Consequently the cotton country is devoted almost exclusively to its culture; a small proportion of rice constituting nearly the only exception. The cotton is pressed and put into bales at the place where it is grown; and thence sent by land to the nearest navigable stream, down which it is transported, principally in steamboats, to the various southern ports.

The business of most of the flourishing towns of the south, depends very essentially upon the receiving and exporting of cotton; all other things remaining as at present, many of them would probably cease to exist, with the demand for that article.

It follows from this general neglect of the farming interest, that the southern population must depend upon other sections for supplying them with provisions. These they receive from the interior and north-western states; but especially from Kentucky and East Tennessee, both of which districts, in point not only of agricultural, but of mineral and manufacturing resources and facilities, are excelled by no other portions of the Union.

From them, immense droves of live stock, and heavy amounts of provisions are annually sent to the cotton country, where the great distance and the wretched condition of the roads cause them to sell very high. On this account provisions command greater prices in the southern seaports than in any other part of the United States; and as the badness of the roads and the great length of hauling necessary, will not admit of an exchange for merchandize, the sales are almost always for *cash;* of which large sums are thus annually transferred from the south to the interior and north-western states. When the southern railroads shall be completed, this draining of cash from the cotton country, will in a great measure be counteracted by the sales of merchandize to the western merchants.

As before remarked, the universal demand for the staple product of the south, enables the southern seaports to do an immense *exporting* business. The raw cotton is from them shipped principally to Liverpool; and in England, that great manufacturing district for the whole globe, it is made up into goods, and in that state sent to every quarter of the earth.

A great quantity returns to this country; but not as one might at first suppose, to the *southern* seaports, from which the raw material was exported; it returns to the seaports of the *north;* because there the merchants of our immense interior congregate to make their purchases; and thus ensure a constant market.

But *why*, it will be asked, do the merchants of the interior prefer the seaports of the north, to those of the south? The answer is simply this, *because the roads are better.* The cities of the north have by a judicious system of internal improvements, opened for the western merchant, easy routes to reach their markets; and safe and speedy ones for carrying his purchases home. While Baltimore, Philadelphia, and New York have been contending with each other, for the supremacy, by each trying to excel the other in her channels of intercourse with the west, the south has stood idly by and done nothing. She has been content to permit not only the merchants of the interior, but even *her own, those residing in her own seaports,* to purchase their goods in the northern cities.

She forgot that the opening of every fresh avenue to the *north*, was the obstructing of one to *her;* and heartily joined in congratulations at the increasing prosperity of her sister, unmindful that it was secured at her own expense. "Better late than never," is a good old saying; and upon its inculcations has the south at last begun to act. She has commenced, and is now energetically pushing forward, a system of railroad improvements, which will soon present to the merchant of the interior, inducements to visit her seaports, as well as those of the north; and by purchasing his goods there, enable her to open a direct *importing* as well as *exporting* trade with the other continent.

But even with the manifold benefits which must result to Charleston and Savannah, from the completion of their railroads to the interior, we cannot, with many of our southern friends, look for those cities ever to attain the size and commercial importance of New York or Philadelphia.

From the very nature of the staple (cotton), which requires comparatively few landholders, it appears to us impossible that the population of the south can ever become so dense as that of the north; and the magnitude of a market must depend upon the number of purchasers. A large cotton grower can easily cultivate 1500 acres; while our wealthy northern farmers rarely hold more than 500; and perhaps the majority do not exceed 250. Besides this, the inexhaustible mineral resources, the manufacturing and agricultural advantages, the more equal distribution of wealth, and I may add, the more stirring and industrious business habits incident upon the colder climate of the north, all combine to render her cities more affluent than those of the south.

Still shall the south have attained that great desideratum, a termination of her mercantile dependance on the north. Her railroads will enable the merchant of the interior to purchase his goods alike in New-York, Philadelphia, Charleston or Savannah, as either may, from fluctuating causes, offer the best market. Instead of the heavy cash purchases of stock and provisions now necessary, an exchange of these articles for merchandize will be effected, and Savannah and Charleston will in a few years have attained an importance, with which their present condition will admit of no comparison.

But shall we permit the foreboding politician to predict from this termination of commercial dependence, a cessation of national dependence, of national feeling? Far from it. Community of intercourse will annihilate our local prejudices, will bury in oblivion the differences of by-gone times, and draw the bonds of union more close than ever.

We will now pass on to the consideration of the several lines of railroad by which the south hopes to accomplish the grand object in which she has embarked.

Illinois, Indiana, and Ohio are constructing several railroads from their respective interiors, to the Ohio river, and they are constructing some of them in such directions, that by uniting, they will form a continuous and very direct line of railroad from the "Far West," passing through Cincinnati to the Northern seaports. From Cincinnati to Philadelphia, by this line of railroad, is a shorter distance than from Cincinnati to Charleston, by way of the Charleston and Cincinnati railroad.

We wish these facts to be distinctly borne in mind by the reader, as we shall soon have occasion to bring them forward in support of some opinions of ours, which are opposed to those of many persons in the south, and therefore require strong arguments to sustain them.

First in importance, magnitude, and splendour of conception, of the several projects for benefiting the south by the effecting of an importing system, is the great Charleston and Cincinnati Railroad. Commencing at Charleston, this road occupies the line of the old South Carolina Railroad, as far as Branchville, 62 miles, thence it continues to Columbia, a further distance of 66 miles; thence to the North Carolina line, by a route not yet finally determined on, about 150 miles more; thence to Ashville, N. C., 41 miles; thence to the Warm Springs, 36 miles; thence along the valley of the French Broad River to Knoxville, 100 miles; (or 455 miles from Charleston to Knoxville;) from Knoxville it passes on through Lexington to Cincinnati by a route not yet finally adopted, about 265 miles; in all about 720 miles.

The company for constrncting this road, is chartered by the four states through which it passses; viz. South and North Carolina, Tennessee, and Kentucky. Three of them, viz. North and South Carolina and Tennessee, have also granted banking privileges; Kentucky has not yet, but probably will do so this winter. South Carolina and Tennessee have also rendered pecuniary assistance to the road; North Carolina and Kentucky have not.

Independently of the tendency of this project, considered merely as a *Railroad*, great and beneficial results are to be hoped for, from its *banking powers.* The late derangement of the money market, has plainly pointed out the necessity for a circulating medium, based on other than restricted local credit; and such a mediumthe Charleston and Cincinnati Company will certainly effect, *in case the Railroad be completed.*

But if this be not done, we cannot see how the interest of the states through which it is to pass, can be enlisted in its cause; the circumstance alone of its *being chartered* by four states, cannot, it appears to us. prevent it from dwindling down into a mere South Carolina bank, with an influence and credit far less extensive than those of the present United States Bank, of Pennsylvania. To prevent this it will be necessary for Tennessee and Kentucky to lend themselves freely to the work. What has already been done is too trifling, in comparison with the magnitude of the project, to deserve a moment's consideration; it is for all practical purposes only *nominal.* We hope soon to see those two states awakened to a due appreciation of the utility of the undertaking, and embark largely in it.

From the city of Knoxville in Tennessee, there are laid down *two* continuous lines of Railroad to Charleston, S. C., one of these may be called the *northern or upper route*, and the other the *southern or lower route.* The upper one is that selected by the Charleston and Cincinnati Railroad and Banking Company; its length (as just now shown) from Knoxville to Charleston is 455 miles. The lower route consists of a chain of several distinct Railroads, commencing with the Hiwassee Railroad, 98½ miles in length, which extends from Knoxville to the dividing line of Tennessee and Georgia; where it unites with the Western and Atlantic Railroad, which continues 118 miles, to near Decatur in Georgia; thence the line runs to near Crawfordville 58 miles; thence by the Georgia Railroad to Augusta, 65 miles, thence by way of the South Carolina Railroad to Charleston, 136 miles, in all 475½ miles. From Crawfordville to Charleston 201 miles is already completed and in full operation; and between Crawfordville and Knoxville the line is now being graded with great energy. These two lines (the upper and lower) differ very materially in their characters, the upper route being the shorter by 20½ miles; but the lower possessing so great a superiority in point of levels and curves, as will, by admitting of greater speed, enable the trip to be made on it in less time than it can on the upper route.

The lower route affords the entirely unprecedented fact of a continuous chain of Railroad, nearly 500 miles in length, carried principally through a mountainous country, yet nowhere presenting a grade exceeding 36 feet to a mile; and at the same time unincumbered by tunnels or inclined planes.* Its shortest radius of curvature is 1000 feet; and even *it*, if we mistake not, occurs only on the Western and Atlantic Railroad; on the Hiwassee Railroad the minimum radius is 1400 feet, and occurs but twice; both being at

* There is. it is true, one inclined plane on the South Carolina Railroad, a few miles from Augusta; it was incurred when that road was first constructed, to gratify the inhabitants of the little town of Aiken. The extension of the road, as now taking place, was not, at that time, thought of; and as the business incident on the extension gradually increases, the plane will no doubt be dispensed with. Fortunately this can be very readily done.

the crossing of heavy ridges, and at the same time stopping places; on the other sections of the lower route, there is no radius under 1900 feet.

Even the minimum radius of 1000 feet, will with proper attention to details, admit of a speed of 20 miles per hour, with perfect safety; and this may, without fear of error, be assumed as *the least average speed* of the passenger trains, on the lower route; one of from 25 to 30 miles an hour, could readily be attained if necessary.

Each section of the lower route also presents nearly the same maximum grade, varying in none more than 3 or 4 feet; the maximum rise, as before remarked, being but 36 feet in a mile. This uniformity will admit of extreme regularity in the business operations of the several sections.

The wonderfully favorable character of the lower route is incident on the fact, that it occupies a series of vallies, running parallel to the immense mountain barriers, which nature has stretched as if in defiance of the efforts of art, almost uninterruptedly, from New York to the northern parts of Georgia. At the latter point we are enabled to curve round their lower extremities, and thus reach the sea board without crossing them.

On the other hand, the upper route is necessarily carried *across* these barriers, and must therefore encounter the heavy grades incident upon approaching them, and either the deep cutting, inclined planes, or tunnels, required for overcoming their summits.

Again, certain portions of the upper route, such as the deep valley of the French Broad River, and various mountain passes of the Blue ridge, are annually obstructed for several weeks by snow, ice and frost. This will create serious, if not *unsurmountable*, obstacles to regularity in the winter business; especially as the thinly scattered population of those parts, will not admit of the collecting of large forces of men to clear the road, as is frequently found necessary in the north.

On the lower route, ice and snow rarely occur at all; and *never* in sufficient quantity to cause a moment's interruption to Railroad travelling.

Again, the cost of the lower route will be so small in comparison with that of the upper, that it will be absolutely impossible for the latter to maintain a competition with it. Thus we see that in point of all the desiderata of Railroad travelling, in speed, safety, certainty and cheapness, the lower route is, by far, preferable to that selected by the Charleston and Cincinnati Railroad Company.

I have been thus particular in comparing the upper and lower routes from Knoxville to Charleston, that I might with the more apparent reason, urge upon the advocates of the Charleston and Cincinnati Railroad, the *immediate* construction of that portion of their road which lies *between Knoxville and Cincinnati.* The present intention of the company appears to be to construct the road gradually from Charleston upwards towards Knoxville, and thus on to Cincinnati; leaving, of course, the part between Knoxville and Cincinnati, some years behind the portion through South Carolina. Now it is very evident that a Railroad from Charleston, through the centre of South Carolina, even if it stop at the northern line of the state, will be of immense benefit to South Carolina, and particularly to Charleston; it will furnish an excellent communication between the interior of the state and her sea board; and this is very important to *her;* but is it important to the *stockholders?* Is it calculated to excite in Tennessee, Kentucky and the whole Union, the confidence which a Railroad from Charleston to Cincinnati was designed to effect? Why should a merchant, residing at a distance from the line, prefer a note of the South Carolina Railroad bank, to that of any other Railroad; and into a mere South Carolina Bank must the whole scheme degenerate (at least for several years.) if the present intention be persisted in. And pray of what benefit is a line from Charleston to Knoxville to be at any rate, toward effecting an importing system, even supposing both the upper and lower routes to be completed thus far? Let us imagine for a moment that such were the case, and that the interval between Knoxville and Cincinnati remain as at present, traversed only by miserable common roads; can any man suppose that either route, or even their combined attractions, would operate to the value of one farthing, in diverting the trade of the "Great West" from along the Ohio river to the northern sea-ports, and turning it towards Charleston? Can he suppose that one merchant more would come from Illinois, Indiana, or Ohio, in consequence of it? Assuredly not. What is to induce the western merchant to exchange the splendid and cheap accommodations, the speed and comfort of his steamboat as he passes up the Ohio, for a rough, unsafe and expensive stage ride of some 200 or 300 miles by day and night, at 2½ miles per hour to Knoxville? Is it the love of adventure, in risking his life over the perilous mountain passes of Kentucky and Tennessee? I trust not, yet can I conjure up no better reason.

I hesitate not to predict that if the Charleston and Cincinnati Railroad Co. delay the construction of their road from Knoxville to Cincinnati, until after the completion of the remainder, the trade of the Great West will have become so fixed in its channel of the Ohio, and the line of Railroads before alluded to, parallel to that river, that the South will endeavour in vain to change it. Let her even *do her best*, the lines through Indiana, Illinois, Ohio, Pennsylvania and New York, will be completed before she can make the road from *Knoxville to Cincinnati.* What madness is it then to delay. While we are hesitating and discussing whether the upper or lower route *from* Knoxville to Charleston, be the better, we seem to forget that we have provided no means for bringing passengers and merchandize *to* Knoxville; and while, like the wolf and the bear, we are disputing for the prey which lies before us, a third party steps in and carries it away from both.

The course pursued in this matter by South Carolina, upon whose movements the whole machinery of the scheme depends, is by some ascribed (it appears to us uncharitably) to an existing jealousy between her and Georgia; by which South Carolina is supposed to be actuated to such an extent, as to decline all interference in any project in which Georgia should take part; and consequently prefer making an expensive road through her own territory, to availing herself of one of far superior character, through her rival State. Thus we see the upper end of the Charleston and Hamburg Railroad, and the lower end of the Athens and Augusta Railroad, like the two ends of a horse-shoe magnet, exercising a repulsive influence on each other, which bids fair to neutralize the otherwise general and beneficial action of this noble scheme.

To us it appears that the policy for South Carolina would be to enter into an amicable arrangement with the various companies constituting the lower route from Knoxville to Charleston, (of which route she already possesses 136 miles, in the Charleston and Hamburg Railroad.) and then construct the line from Knoxville to Cincinnati. By concentrating all her energies upon this interval, she would beyond all doubt, enlist both Tennessee and Kentucky deeply in the enterprise; for to both of those States, it is one of great importance; but so long as the present policy of working from Charleston upwards through South Carolina, is adhered to, the benefits of the undertaking are far too prospective, to induce any active interference in its behalf, on their part.

To adopt the course we propose, would probably lose to the company the charter of North Carolina; as the line would, in that case, not enter her territory. But of what importance is that consideration? Of what benefit is the Charleston and Cincinnati Railroad to be to North Carolina, in any event? It passes only through one of her counties, and that her extreme western one, and of a more sterile and mountainous character. Surely that is not sufficient to induce a hope that North Carolina will render any important aid to the project; whereas in the other case, as before said, both Tennessee and Kentucky would assuredly assist it to a very efficient degree; for both these States would need it for the exportation of their live-stock and provisions to the cotton country; and that alone, independently of any considerations of a southern importing system, should be a sufficient guarantee of profit, to warrant the immediate construction of the road through those two States.

We cannot anticipate much difficulty in procuring from the Legislatures of Tennessee and Kentucky, permission so to alter the charter, as to admit of the changes we propose. Legislative bodies, like private individuals, are influenced by *interest;* convince them that their present course is detrimental to their interest, and they will assuredly change it.

Perhaps the greatest real difficulty in way of the change lies in the company itself, not being willing to have its concerns divided into two branches, as would be the case if our ideas of uniting the Charleston and Cincinnati Railroad with the *lower route*, should be carried into effect. The Charleston and Cincinnati Railroad Company would then own only the road already constructed from Charleston to Augusta, and that, yet to be commenced, from Knoxville to Cincinnati; the interval between Augusta and Knoxville being in possession, as already stated, of several distinct companies.

Could the Charleston and Cincinnati company purchase this interval from the various companies now holding it, the difficulty would be at once removed; but we consider such an arrangement so utterly impracticable, that it is useless even to suggest it.

Great as the objection certainly is, to the division of the concerns of the Company, still it is obviously not an insuperable one. The case seems to us, nearly parallel to that of a merchant possessing flourishing business houses in two different cities.

Be that as it may, however, we cannot view the construction of the upper route from Knoxville to Charleston in any other light than that of a useless expenditure of money, unless it be looked upon as politic to purchase the good will of the districts through which it passes, by circulating among them at the expense of the company, the sums requisite for its construction. Even if finished, it can never sustain a competition against the superior merits of the lower route.

We are somewhat surprised at the course pursued by Kentucky in relation to the Charleston and Cincinnati railroad. She has lent no pecuniary aid to its construction, although she must necessarily derive great advantages from it. Her merchants will be provided with new markets for making their purchases; and the facilities for conducting her heavy exports will be greatly increased. The road will certainly not be made through Kentucky, unassisted by her pecuniary means; it is therefore to be hoped, not only on *her* account, but in a *national* point of view, that her opinions on the subject may assume a more favorable direction. We cannot but suppose that the adoption of the lower route would lead to such a change, and enlist Kentucky strongly in the cause.

We have hitherto spoken principally of *Charleston*, as striving to carry out measures for diverting part of the trade of the west, from the northern to the southern seaports by means of her railroads; we must now speak of her enterprising and spirited rival, Savannah. In point of magnitude Charleston is greatly superior to Savannah, containing a population of 43,000; while that of Savannah is but 10,000. The principal descriptive feature however between the two cities, as regards their importing facilities, consists in the superior harbor of Charleston; which is, we believe, confessedly the best along the Southern Atlantic seaboard.

There will however be no means left unresorted to, for rendering that of Savannah, in every respect perfectly eligible, and this its natural position admits of the more readily, since constructions in that branch of engineering are no longer involved in the uncertainty, by which, until the discoveries of late years, they were characterized.

Savannah is determined to be by no means behind Charleston, in her facilities of intercourse with the interior and north-western states; indeed if Charleston persevere in her scheme of the upper route from Knoxville, and insist upon conducting her transportation along it, Savannah will have the advantage of a far superior road; which, in our opinion, will much more than counterbalance any disparity which may exist between their respective harbors.

The *great Central Railroad of Georgia*, from Savannah to the city of Macon, near the centre of Georgia, is about 200 miles in length and is exclusively a company work. About 80 miles of it are already finished and in use; and the remainder is being rapidly progressed with. Like the lower route from Knoxville to Charleston, it is characterized by its unusually favorable features; and indeed the same remark may be applied to all the railroads in Georgia.

From the city of Macon the railroad is continued to the town of Forsyth, by the Monroe railroad, twenty-four miles in length; which will soon be (if it is not already) in operation.

From the city of Macon, is also to be constructed another railroad to the town of Talbotton; at which point it will branch off into two lines; one to West Point, to meet the Montgomery and West Point railroad; and the other to Columbus. Another branch from the Central railroad is also being surveyed, through the town of Waynesborough to Augusta, by which a union will be effected with the lower route from Knoxville. It will be forty-eight miles in length. Thus it will be seen that Savannah possesses quite as favourable avenues to the interior, as Charleston does; and if a bridge be not built across the Savannah river at Augusta, by which the South Carolina railroad may unite with the lower route from Knoxville, Savannah must receive the preference from western merchants. We are fully convinced that the want of a bridge at Augusta, and the selection of the upper route, by the Charleston and Cincinnati railroad company, will do more to decide the question of superiority between these two rival cities, than any other consideration possibly can.

About 70 miles south of Savannah is the seaport of Brunswick; at present a place of comparatively little importance; but destined, on account of its remarkably fine harbour, and its contemplated railroad connexion with Savannah, to become in a short time one of the most important of the southern ports.

Besides these Atlantic ports, others on the gulf Mexico, such as Appalachicola, Pensacola and Mobile will become termini of railroads from the interior; and will all be more or less similarly affected with Charleston, Savannah and Brunswick; with, however, this great difference, that the dangerous navigation of the Bahama banks, at the mouth of the Gulf of Mexico, which must be encountered in a voyage to or from Europe, will always keep them secondary to the Atlantic ports. As before remarked, we think this might be obviated by a ship canal across East Florida; or, more imperfectly, by a railroad.

Appalachicola is at the mouth of the Appalachicola river, formed by the confluence of the Flint and Chattahoochie. The latter is navigable for steamboats for 200 miles, as far as Columbus; from which point, are lines of railroads to Cincinnati, by way of Knoxville; and also to Savannah and Charleston. At this time, Appalachicola is but a small town; it receives considerable amount of cotton from the upper parts of Georgia, by way of the river, but its importance will be increased greatly by its railroad connexions.

Similarly conditioned with Appalachicola, are Pensacola and Mobile. We have not in our possession, any very definite information respecting the railroad from Pensacola to Montgomery; we believe, however, that some progress has been made in its construction. From Montgomery, or rather from Fort Mitchell, (a point some distance above Montgomery) to West Point, is a railroad in a state of rapid progress. The reason for delaying the construction between Fort Mitchell and Montgomery is, that the river navigation between those places, although very circuitous, is sufficiently good for present purposes. The prolongation to Montgomery, will be made, as soon as the progress of the Pensacola railroad renders it advisable.

Through West Point passes also the Columbus and Chattahoochie railroad, leading from Columbus, to the Western and Atlantic railroad, near Decatur. This latter road will, like the Montgomery and West Point railroad, be rapidly pushed forward to completion.

The intercourse of Mobile with the interior, will be both through the same channel as that to Pensacola, and also through the Selma and Tennessee railroad, now under construction from the town of Selma to the Tennessee river, above Huntsville. This road is 170 miles in length. A branch is contemplated from near its upper terminus, along the valley of the Coosa river, to join the Western and Atlantic railroad, near New Echota. This branch will open to Alabama a communication to East Tennessee, by way of the Hiwassee railroad, to Knoxville; and thence by way of the Charleston and Cincinnati railroad to the Ohio; it is very important to all Alabama. We have heard of no contemplated branch from the Selma and Tennessee railroad to Tuscaloosa; but such a one will assuredly soon urge itself upon the public notice, in that section. The harbor of Mobile bay at the town being too shallow for large ships, and gradually becoming worse, it has been found necessary to construct a railroad 28 miles in length to Cedar Point on the Gulf, where the largest vessels lie in safety.

From the town of Wetumpka, above Montgomery, a railroad, is in progress, along the valley of the Coosa to Fort Williams; by which the obstructions in the river between those points, will be avoided. It is called the Coosa and Wetumpka railroad; and will be extended to unite with the Selma and Tennessee railroad, and with the lower route from Knoxville to Savannah and Charleston.

All these roads are constructed with the triple intention of expediting the carrying of cotton from the interior, to the several ports at which they terminate; of procuring provisions more readily from the agricultural districts of Tennessee and Kentucky, &c. and of effecting an *importing system in the South.* The rivers of the South answer the purposes of intercommunication in but a very imperfect manner. In the summer they generally become unnavigable, for want of water It is well known that the Ohio trade is interrupted more or less every summer, from this cause; but in the streams still further South, the deficiency is felt to a much more serious extent. Thus the Tennessee river, *even in the most favorable seasons*, is rarely navigable for steamboats, even of moderate draft, for more than two or three months a year, as far up as Knoxville; and we have known intervals of very nearly a year to elapse, without a sufficient rise of water, for a single arrival. Pretty much the same, only not to so great a degree, may be stated of the river Cumberland, and the city of Nashville. The delays thus occasioned are extremely vexatious, and frequently productive of great inconvenience to the merchant.

We will remark, while speaking of Nashvillo, that we expect soon to see her interesting herself in the construction of a railroad, to meet the Western and Atlantic railroad near Ross' Landing, on the Tennessee river. The Western and Atlantic railroad branches into two lines, near its northern terminus; one going directly north, to meet the Hiwassee railroad; and the other passing in a north west direction, to the Tennessee river, near Ross' Landing. A communication between the latter branch and Nashville, would relieve that city from the embarrassments of the obstructed navigation of the Cumberland. Such a road, in connexion with the Hiwassee railroad, would constitute the best route between Nashville and Knoxville; it would be but a very few miles longer than the present stage road between those places. Its length would be about 100 miles.

Again, in order fully to perfect the importing system of the South, a ready communication is obviously necessary between her seaboard and the region west of the Mississippi river; as well as with the north-western States. Such a communication is in progress. It will extend from the upper terminus of the Selma and Tennessec railroad, to Memphis on the Mississippi. Of this very important line, the portion between Decatur and Tuscumbia (43 miles) has long been in operation; and that from Lagrange to Memphis, constituting the Memphis railroad, 50 miles in length, is in progress. The intervening spaces have not yet been commenced; but undoubtedly soon will be. It will be one of the most useful and lucrative lines in the Union. We look for much more of the Illinois trade with the Southern Atlantic ports to take this channel.

Before closing this paper, we cannot refrain from making a few remarks respecting Virginia and East Tennessee.

It is a common observation, that Virginia is behindhand in her internal improvements, and that she is not equalling her sister States in energy, and foresight. For ourselves we cannot subscribe to that opinion; the remark appears to us an unjust one. Virginia has already done much, and is still steadily progressing in a very extensive and costly system of improvements. To enumerate them would be foreign from our present purpose; we will only urge upon her the necessity of one more. We allude to a railroad from either Winchester, or Richmond, passing through the State in a south-western direction, through Wythe Court-house and Abington, to meet an extension of the Hiwassee railroad, at the Tennessee line near Blountville. This will form part of the *shortest and most eligible route from Maine to New Orleans, that can be obtained in the Union.*

Surveys have been made for the line from Richmond, and were favorably reported on; but unfortunately the requisite appropriations were not made for prosecuting the work. There can, however, be little doubt that the efforts which will be renewed at this session of the Legislature, will be successful. We consider the question one of immense interest to Virginia. Her fertile and far-famed valley has long been retrograding, for want of an outlet to markets, which would permit it to enter into competition with more successful candidates.

This portion of Virginia has depended very much for sales of produce, upon travellers, and upon the wagoners who haul into the interior the merchandize purchased in the northern cities. The travelling has gradually been diverted into other and better channels; and even the hauling of merchandize, is at the moment we are writing, about to give way to more expeditious and economical channels opened by the Railroads, constituting part of the lower route from Knoxville to Charleston; and which is now finished from Charleston northwards, upwards of 200 miles. By this route goods may be shipped from the northern cities to Charleston, and thence forwarded by railroads and waggons to East Tennessee, at a less expense than they can be hauled for across the valley of Virginia. No further reasoning is necessary. (though much more could be adduced) to convince Virginia of the necessity of prompt measures in relation to this road. Tennessee will readily co-operate with her, by filling up the interval between Knoville and Blountvile; and thus opening an *uninterrupted line of railroad from Maine to New Orleans.*

In East Tennessee, the reader will perceive that the Hiwassee railroad occupies a position peculiar to itself, and one of the utmost importance to all interested in it; viz. it is at the same time a portion of the great line from the N. E. to the S. W.; and of that from the S. E. to the N. W.; in other words, it is the *great cross road of the Union.*

The numerous mountain ranges which occupy the region extending for 200 miles on each side of it, forbid the construction of a rival road; and ensure to the Hiwassee rail-road two sources of income, either of which would alone be sufficient to warrant its construction.

This is the case, we believe, with no other rail-road in the country; and it offers to the stockholders, the best inducements to believe in the full success of their project.

We must now call the attention of capitalists and farmers, to the eastern section of Tennessee. We are certain we are within bounds, when we say that no portion of our Union presents more flattering prospects of a profitable investment in every department of manufacturers and agriculture, than East Tennessee.

She is the *nearest competitor* to the cotton growing country, in the sale of provisions and stock; her fertile vallies ensure abundant returns to the husbandman; her delightful climate is the most healthy in the Union; avoiding alike the extreme warmth of the South, and the extreme cold of the north. Her mineral resources of iron, lead, lime, gypsum, salt, coal, marble, &c., are inexhaustible. Her water power is unlimited and scattered over every part, to a most unusual degree; and finally a dense population is ready to insure success to the establishment of every kind of manufactory, and full employment to the mechanic in every department.

East Tennessee has hitherto held a peculiar position; hemmed in on all sides by mountains which almost preclude access, her merits have been overlooked. In other parts of the Union she is almost unknown;

we may freely venture to say that no portion of the Union is so little known to all the others, as East Tennessee; yet she occupies the very centre of them all. The same cause which has operated so powerfully to retard the growth of Charleston and Savannah, has exerted the same influence on East Tennessee, viz. *the want of good roads.*

These she is now engaged in making, and in a very few years she will burst upon the notice of her sisters, with almost as strong claims to novelty as a newly discovered country. JOHN C. TRAUTWINE.

KNOXVILLE, Nov. 1838.

Note.—The above is to be regarded as but a very cursory and imperfect sketch of the Southern Improvement System. Our object being merely to lay before the reader, some of its most important bearings.—*The Writer.*

(From the London United Service Journal for March.)

Civil Engineering in America.—By Captain Basil Hall, R. N.

For similar reasons to those which we used when speaking of the lake and river navigation of America, we should advise not only our civil engineers but our professional brethren of the United Service, to keep their eyes closely fixed on the state of steam navigation in that country. Force of all kinds, well disciplined and well directed, is no doubt the chief agent in war; but celerity of movement, combined with certainty, is the next most powerful principle in military matters, and therefore deserving of our constant attention. We have not adequate space to give any account of the various contrivances by which so vast a speed as 16 miles an hour is obtained in some parts of America; nor indeed could we, without drawings, render them fully intelligible to practical men. The arrangements, too, by which an immense number of persons can be stowed away without inconvenience, both below and above the deck, are highly worthy of the attention of officers whose duty it may become to transfer bodies of troops from place to place. By having the whole of the machinery, including the boilers and the furnaces, above the deck, the whole of the space below is left free for the accommodation of the passengers. In most of the American boats, Mr. Stevenson tells us, (page 135) 400 berths are made up. The principal cabin, he tells us, of the Massachusetts, a vessel running between New York and Providence, is 160 feet in length by 22 feet in breadth, and 12 feet high! "I have dined," says he, "with 175 persons in this cabin; and, notwithstanding this numerous assembly, the tables, which were arranged in two parallel rows, extending from one end of the cabin to the other, were far from being fully occupied." On the Mississippi and Ohio, the means of carrying numbers are greatly augmented by the erection of huge upper works, as high, in some cases, as the poop of a line-of-battle ship, in which several hundreds of additional passengers find accommodation—an arrangement which may be of vast consequence in war; for we have frequently seen steamboats on the western waters capable of conveying a whole regiment, baggage and all, either with or against the stream, at the rate of many miles an hour!

It is rather curious, that while the Americans adopt with avidity every new invention of ours, even when the advantages are questionable, we should be so very slow in availing ourselves of these discoveries of theirs which have been tried and found to answer well in practice. We are ready enough to accuse Jonathan of national vanity: but we believe he might with equal justice charge us with a stupid degree of false pride and imaginary superiority, which too often makes us slow to appropriate the discoveries of other nations.

We could quote many examples of this, but we shall confine ourselves to two. The first relates to the American mode of steering their steam boats in the bow, wherever they have to pass amongst crowds of shipping, or other impediments which render a straight course impossible, and which render it a matter of difficulty and often of danger, and always of delay, where the helmsman is so placed as not to see his way before him. In spite of the full knowledge of the many advantages arising from this method of steering in such a narrow and crowded river as the Thames; in spite of the perfect facility of fixing the apparatus; and in spite of the complication, trouble, noise, confusion, and risk which attend the present mode of steering abaft, and in spite of the plan of steering forward having been already tried and found to answer, all our boats, (except, we believe, a single vessel, the Royal Adelaide, plying between Loudon and Leith,) are still fitted with the absurd plan of steering from the stern!

The other contrivance, which we ought long ago to have adopted from the Americans, relates to the form of the paddle-wheels. "The float boards," says Mr. Stevenson, "do not extend across the whole breadth of the paddle-wheel, as is always the case in this country; they are divided into two, and sometimes three compartments." This construction, we learn from Dr. Renwick's Treatise on the Steam Engine, was introduced by Mr. Stevens, of New York, "and may be described," he says, "by supposing a common paddle-wheel to be sawn into three parts, in planes perpendicular to the axis. Each of the two additional wheels thus formed is then moved back, until their paddles divide the interval of the paddles on the original wheel into three equal parts. In this form," continues Dr. Renwick, "the shock of each paddle is diminished to one-third of what it is in the usual shape of the wheel; they are separated by less intervals of time, and hence approach more nearly to a constant resistance: while each paddle following the wake of those belonging to its own system, strikes upon water that has been but little disturbed."

We have lately seen with much satisfaction a modification, and we believe, an improvement of this plan, has been hit upon by Lieut. Hall, who has devised a diagonal set of float-boards, for the paddle-wheels of steam boats, and which, we understand, entirely does away with the disagreeable tremor caused by the ordinary float-boards striking the water. In Lieut. Hall's wheels the paddles are placed in such a manner, that they enter the water at one end, and glide through it, as it were, without producing any blow, or concussion.

It may be mentioned, that from the immense diameter of the American paddle-wheels, about 25 feet, and the circumstance of their having always, or almost always, smooth water in which to work them, the cycloidal paddle of Mr. Galloway, or the eccentric paddle of Mr. Morgan, which have been so successfully used in this country, are not required on the American rivers.

We are unwilling to quit this branch of the subject without calling the attention of the rising generation of our naval officers to the importance of their turning their attention to steam, not merely as a matter of curiosity, but as a matter of duty. We should say, without qualification, that at this moment we know of no way so likely to lead to an officer's advancement as that which this subject affords. Let any officer of proper zeal and good capacity, who is willing to work out his promotion, set to work in earnest to study steam machinery, and its adaptation to navigation. Let him take his jacket off, and put on a paper cap, be regardless of soiling his fingers or scorching his face, and submit to the companionship of thorough bred workmen in Maudslay's works in London, or those of Napier in Glasgow, until he has made himself completely master of every one of the multifarious details upon which the merits of this wonderful contrivance depends. Let him take a trip or two as assistant-engineer in a steam boat. Let him also read such books as will give him a theoretical knowledge of the chemical and mechanical principles of the agency of steam, and we will guarrantee him his eventual promotion, whether the peace continues or not. We should be disposed, certainly, to make such knowledge in a greater or less degree a requisite to every officer's passing; and hold no one to be eligible to a commission who should not be able to prove his acquintance, at all events, with the elementary principles of the steam-engine, which now-a-days are to the full as important for him to know as the elements of navigation, seamanship, or gunnery.

Mr. Stevenson's chapter on fuel and materials, though chiefly interesting as a picture of a state of things widely different from any which is to be found in Europe, contains one or two things which are incidentally deserving of our notice. Ship building and carpentry have been brought to high perfection in America, and, as we may suppose, the trade in wood, or as it is called, the lumber trade, is carried on to a great extent on most of the American rivers, and affords employment to a vast number of persons. We have often thought, when looking at the raft, constructed by these people, how important, under some circumstances, they might be made in a campaign; at all events the following sketch of their constuction will probably be new to most of our readers:—

"The chief raftsmen are generally persons of intelligence, and possessed of considerable capital. They often purchase a piece of land, which they sell again after they have cropped the timber off it, and sometimes for more than they paid for it originally. The chief raftsman, aud his detachment of workmen, repair to the forest about the month of November, and are occupied during the whole of the winter months in felling trees, dressing them into logs, and dragging them with teams of oxen on the hardened snow, with which the country is then covered, to the nearest stream. They live during this period in huts formed of logs. Throughout the whole of the newly cleared districts of America, the houses are built of rough logs. The logs are arranged so as to form the four sides of the hut, and their ends are half-checked into each other in such a manner as to allow their coming in contact nearly throughout their whole length, and the small interstices which remain are filled up with clay. About the month of May, when the ice leaves the rivers, the logs of timber that have been prepared and hauled down during winter, are launched into the numerous small streams in the neighborhood of which they have been cut, and floated down to the larger rivers, where their progress is stopped by what is called a "boom." The boom consists of a line of logs, extending across the whole breadth of the river. These are connected by iron links, and attached to stone piers built at suitable distances in the bed of the stream. The boom is erected for the purpose of stopping the progress of logs, which must remain within it till all the timber has left the forest. After this, every raftsman searches out his own timber, which he recognises by the mark he puts on it, and having formed it into a raft, floats it down the river to its destination. The boom is generally owned by private individuals, who levy a toll on all the wood collected by it. The toll on the Penobscot river is at the rate of three per cent on the value of the timber; and the income derived from the boom is about 300*l* per annum.

"The rafts into which the timber is formed, previous to being floated down the large rivers, are strongly put together. They are furnished with masts and sails, and are steered by means of long oars, which project in front as well as behind them. Wooden houses are built on them for the accommodation of the crew and their families. I have counted upwards of 30 persons working the steering oars of a raft on the St. Lawrence; from this some idea may be formed of the number of their inhabitants.

"The most hazardous part of the lumberer's business is that of bringing the rafts of wood down the large rivers. If not managed with great skill, they are apt to go to pieces in descending the rapids; and it not unfrequently happens, that the whole labor of one, and sometimes of two years, is lost in a moment." p. 179. "The safest size for a raft," Mr. Stevenson tells us, "is from 40,000 to 50,000 square feet, which requires five men to manage it. Some rafts extend to the enormous size of 300,000 square feet. These huge floating islands are brought to Quebec from distances varying from 100 to 1200 miles! and it often happens that six months are occupied in making the voyage."

There has been so much written already about the canals and railways of America, that we are scrupulous of occupying so much of our readers' time as would be requisite to give any detailed view of these operations. But we have been greatly interested in reading Mr. Stevenson's work, with the marvellous energies and ingenuity by which so many undertakings have been carried through; and we should say, that in a variety of important professional points of view, a study of their details cannot fail to be useful to officers, and particularly to our military engineers, to whose operations in the field. it is curious to remark, not a few of the works alluded to are closely allied. A simple enumeration of some of the principal objects which the Americans have had in view will make this apparent; while the result is highly encouraging, and we should say strictly in military character.

"Their purpose has been," says Mr. Stevenson, "to remove all obstructions in navigable rivers; the junction of different tracts of natural navigation; the connexion of large towns; and the formation of levels of communication from the Atlantic Ocean to the Great Lakes, and the valleys of the Mississippi, Missouri, and Ohio.

"The aggregate length of the canals at present in operation in the United States alone amounts to upwards of 2,700 miles; and that of t e railways already completed to 1600 miles. Nor are the labors of the people at an end; for even now, there are no fewer than 33 railways in an unfinished state. whose aggregate length, when completed, will amount to upwards of 2500 miles. Now, although we are well convinced that many of these undertakings, like many similar projects in this country, will prove ruinous to the speculators and entirely abortive as works of public utility, yet it shows an ardor in the pursuit of improvement well worthy of being closely watched by those whose duty it may become to establish lines of communication between place and place."

It must be recollected however, in considering these matters, that the Americans have extremely few roads, and these very bad; so that their railroads and canals are intended to do the work of exclusive roads, not to supersede their use, as is proposed with us in many cases. With us the Railroads are intended as an accelerated mode of communication between places already open to one another; in America, in most instances, they are the first and only highways; and what renders these operations more wonderful, is, the circumstance of many of them being carried for hundreds of miles in a trough, as it were, cut through thick and heretofore impenetrable forests, where, as Mr. Stevenson adds, "it is no uncommon occurrence to travel for a whole day, without encountering a village or even a house, excepting perhaps a few log huts inhabited by persons connected with the work." The fudamental principles by which the engineers of America and of this country are guided, are of course the same; but the nature of the materials employed by them respectively, and the climate and other circumstances of the two countries, are so dissimilar, that a considerable variety must exist in the practice of their civil engineers. From not attending to these distinctions, we have known many people run into material errors in judging of American affairs; and we conceive that for the purposes of instruction in habits of resource—on which account chiefly we call the attention of officers to such details—it is essential that these differences of circumstance should be kept constantly in view.

The following account of the canal travelling in the backwoods is not very tempting:—

"The canal travelling in many parts of America is conducted with so little regard to the comfort of passengers, as to render it a very objectionable conveyance. The Americans place themselves entirely in the power and at the command of the captains of the canal-boats, who often use little discretion or civility in giving their orders; and strangers, who are unaccustomed to such usage, and would willingly rebel against their tyranny, and are in such cases compelled to be guided by the majority of voices, and quietly to submit to all that takes place, however disagreeable it may be. About eight o'clock in the evening, every one is turned out of the cabin by the captain and his crew, who are occupied, for some time after the cabin is cleared, in suspending two rows of cots or hammocks from the ceiling, arranged in three tiers, one above another. At nine the whole company is ordered below, when the captain calls the names of the passengers from the way bill, and at the same time assigns to each his bed, which must immediately be taken possession by its rightful owner on pain of his being obliged to occupy a place on the floor, should the number of passengers exceed the number of beds, a circumstance of very common occurrence in that locomotive land I have spent several successive nights in this way, in a cabin only 40 feet long by 11 feet broad, with no less than 40 passengers; while the deafening chorus produced by the croaking of the numberless bullfrogs that frequent the American swamps was so great, as to render it often difficult to make one's-self heard in conversation, and of course, nearly impossible to sleep. The distribution of the beds appears to be generally regulated by the size of the passengers; those that are heaviest being placed in the berths next the floor. The object of this arrangement is partly to ballast the boat properly, and partly, in the event of a break-down, to render the consequence less disagreeable and dangerous to the unhappy beings in the lower pens. At five o'clock in the morning, all hands are turned out in the same abrupt and discourteous style, and forced to remain on deck in the cold morning air while the hammocks are removed and breakfast is in preparation. This interval is occupied in the duties of the toilette, which is not the least amusing part of the arrangement. A tin vessel is placed at the stern of the boat, which every one fills for his own use from the water of the canal, with a gigantic spoon of the same metal: a towel, a brush, and a comb, intended for the general service, hang at the cabin door, the use of which is fortunately quite optional."

We have already slightly alluded to the *Slackwater* navigation of America, but as we can easily imagine cases in which the principle might be brought into great play in war, we shall give a word or two more respecting the method. "It consists," says Mr. Stevenson, "in improving the navigation of a river by erecting dams or mounds built in the stream, which have the effect of damming up the water and increasing its depth. If there be not a great fall in the bed of the river, a single dam often produces a stagnation in the run of the water, extending for many miles up the river, and forming a spacious navigable canal. The tow-path is formed along the margin of the river, and is elevated above the reach of the flood-water. The dams are passed by means of locks, such as are used in canals."

The river Schuylkill, from Philadelphia to Reading, a distance of upwards of 100 miles, is made subservient to this purpose by means of 34 dams thrown across the stream, together with 29 locks, which overcome a fall of 610 feet.

On soms of the American canals, the boats are moved from different levels by means of inclined planes instead of locks. The whole rise and fall on the Morris canal is 1557 feet, of which 223 are overcome by locks, and 1324 feet by 23 inclined planes. The boats are 8½ feet wide, by 60 or 80 long, and vary from 25 to 30 tons burden; but the greatest weight ever drawn up the planes is about 50 tons.

The chapter on road-making offers but little from which we can derive much direct instruction of a military kind; but there are many useful hints in it, of which any officer might avail himself, such as those which relate to the readiest way of forming a roadway out of timber laid either corduroy fashion, across the path, or in billets inserted perpendicularly, like a tesselated pavement.

No people have worked more at the science of wooden bridges than the Americans, and we should gladly have said a good deal on this point, so important to military engineers, could we have made our comments intelligible without the assistance of drawings. We recommend therefore, Mr. Stevenson's eighth chapter to the attention of those who are curious in civil engineering, and especially to that section of it which describes 'Town's Patent Lattice Bridge,' which is much employed on the American railways. This construction is sometimes used for bridges of so large a span as 150 feet, and it exerts no lateral thrust tending to overthrow the piers on which it rests. A small quantity of materials also, of very small scantling, arranged according to this plan, possess a wonderful degree of strength and rigidity.

The railways of America occupy nearly as much of the public attention as those of England do with us; and we confess that we are not without great fears that the rage for this description of speculation will end in disappointment. Be this as it may, we are sure that many of the details which Mr. Stevenson gives us respecting the method of fixing the rails, and other particulars respecting the American lines, may be profitably studied by the engineers on this side of the water. What has struck us with most admiration, is the cheapness of the American Railroads, which is caused, first, by their being exempted from the heavy expenses often incurred with us by the purchase of land, and the compensation damages. The poor Indians and the wild beasts are more readily dealt with than our sturdy land-owners; and to drive a Railroad through an American pine-barren (as the vast forests of that timber are called.) is quite a different affair from intersecting an English country gentleman's pleasure grounds. Secondly, the works themselves are seldom, if ever, executed in as substantial or costly a style as with us; and thirdly, the wood, which is their principal material, is obtained at a very small cost. The first six miles of the Baltimore and Ohio Railroad, which is said to be formed "in an expensive manner, and on a very difficult route," has cost on an average about 12.000*l.* a mile. The Railroads in Pennsylvania cost about 5000*l.* a mile; and the Albany and Schenectady line, upwards of 6000*l.*; the Schenectady and Saratoga Railroad, 1800*l* a mile. And it appears that the average cost of the Railroads throughout the Union, is about 4942*l.* per mile. "This," observes Mr. Stevenson, "contrasts strongly with the cost of railways constructed in this country. The Liverpool and Manchester railway cost 30,000*l.* per mile; the Dublin and Kingston 40,000*l.*; and that between Liverpool and London is expected to cost upwards of 25,000*l.*" Mr. Stevenson gives an account, in very workman-like and satisfactory detail, of the great Pennsylvania canal and Railroad, one of the most wonderful works any where existing in the world. The whole distance from Philadelphia to Pittsburg is 395 miles; 118 of which are on Railroads, and the remaining 277 on canals. The average rate of travelling is indeed rather slow, being not quite four and a half miles per hour, owing to the numerous inclined planes, and other sources of delay, described at length in Mr. Stevenson's book. The charge made for conveying each passenger is 3*l.* or about 2*d.* per mile! In concluding the subject of railways in America, we only remark, that there seems to be much going on at this moment in that country more worthy of our attention, as military engineers, than upon almost any other branch of their industry. And we ground this observation upon the peculiar nature of the circumstances, which resemble not a little those of an army acting in a country where the grand object was to get along at all hazards. It may seem, at fiist sight, a very simple affair to cut a track through a forest, but experience shows it to be one of considerable labor and expense. "This operation is called 'Grubbing' in America, and is scarcely at all known to the engineers of this country, who are as tender of other people's trees as of their own children, and costs from 40*l.* to 80*l.* per mile; according to the size and quantity of timber to be removed. The whole topic, too, of inclined planes worked by stationary engines, is one of great novelty and interest; and we have been much surprised with the working capabilities of some of these apparently cumbersome devices for gaining level. On the Pennsylvania canal, Mr. Stevenson tells us, "that the longest plane is about 3000 feet; the time occupied in moving up and down is five minutes; the time occupied in attaching is two minutes and a half, making seven minutes and a half, or eight drafts per hour of three loaded cars carrying three tons each, making twenty-four cars, or seventy-two tons per hour." There appears to be as yet only one railway in the British dominions in North America, viz., between St. John's on Lake Champlain and the village of La Prairie, on the St. Lawrence. It is sixteen miles in length, and is worked by locomotive engines. This is rather strange, and we think somewhat disgraceful; but we trust that when the affairs of the Provinces are duly settled, and that men's minds have had time to return to the consideration of real business, in contradistinction to political excitement, this subject, amongst others, will not be longer neglected by the inhabitants of those magnificent countries. We do not see, indeed, how the Nova Scotians, for example, can escape from the unanswerable arguments of the Clock-maker, who, if he succeeds (as we think he will,) in rousing his countrymen to a sense of their own best interests, will render the name of Sam Slick as justly renowned in the Provinces, as that of Benjamin Franklin in the adjacent States.

Trinidad.—Lake Pitch.

The Trinidad papers contain some interesting particulars, relating to an experiment recently made at that Island, on board the steamer Pluto, Lieut. Lunn, in the use of Pitch from the Lake, as a substitute for coal, in generating steam. The Bermuda Gazette, in transcribing the particulars, offers the following remarks:

"The trial, though made under many disadvantages, proves that this pitch will form a most excellent fuel, and that when used with coal, the proportions should be about two thirds of the former to one of the latter. We learn from a gentleman lately arrived here from Trinidad, that several of the estates, particularly those in the neighborhood of the lake, have for several months past, been using the pitch as fuel, in the boiling houses, and that they have found it a most valuable and economical substitute for coal, which article has occasionally, in that island, it seems reached the enormous price of twenty dollars per hogshead.—We also learn that there are at the present period, agents at London and Paris, who are actively engaged in collecting the pitch for transportation, and that several large vessels have already been despatched to England and France, laden with this novel article of commerce. One of these Companies, we believe the Parisian, has offered the Colonial Government the sum of 20,000*l* for the exclusive privilege of working the mine; but this offer was, it seems rejected; the Government deeming it more advisable that it should, for the present at least, be free to all, than be monopolized by any trading company. Guthrie, in his Geography, says that "there is in Trinidad a remarkable production of nature, being a bituminous lake, or rather plain called Tar Lake, about three miles in circuit. The substance which is here found has the consistence and aspect of pitch coal; it breaks into glossy fragments of a cellular appearance; a gentle heat renders it ductile, and mixed with grease or common pitch it is used for smearing the bottom of ships. In many parts of the woods it is found in a liquid state.

The Governor of Trinidad has recently ordered a topographical survey of the pitch lake, as also its elevation above the sea, to be ascertained. Although immense quantities of the pitch have been shipped, still there does not appear to be the least diminution in the size of the lake, and it is asserted that there is a sufficiency of it "to supply a whole navy of steam vessels for centuries with fuel."

This pitch, for the most part, we are told, is shipped in bulk; that which is obtained in a liquid state is, however, put into barrels; but the utmost care is requisite in packing it, as it dilates much.

At a period like the present, when the attention as well of the Governments of Europe and America, as of the commercial and speculative interests of both continents, is particularly directed to the use of steam navigation, the discovery of the properties of this pitch will, we conceive, be of the utmost importance, not only to Trinidad, but to the whole of the West Indies, and could it not, we ask, be also turned to the advantage of Bermuda? The favorable position of these islands as a general rendezvous for crossing the Atlantic, either to British America or the United States, is on all sides admitted; and now that the facilities for obtaining fuel are increased, and as our vessels trading with fish to Trinidad, could at a very trifling charge make extensive deposits of the bitumen here, we trust that the attention of Government, as well as of steam navigation companies, will be directed to the circumstance.

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AND
MECHANICS' MAGAZINE.

No. 8, Vol. II.] New Series.] APRIL 15, 1839. [Whole No. 332. [Vol. VIII.

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WITH

PROCEEDINGS IN REFERENCE TO THE SAME.

APRIL, 1839.

At a Convention of Civil Engineers of the United States, which met in Baltimore on the 11th of February, 1839, in pursuance of a call from a highly respectable meeting of members of the profession in Augusta, Ga., the following resolutions were adopted.

1. *Resolved*, That the Convention now proceed to the election of a committee of seventeen, to prepare and adopt a Constitution, and form a Society of Civil Engineers of the United States; and that in the opinion of this Convention, the said committee should be so selected, that all the different portions of the Union may be represented in it, so far as is practicable.

2. *Resolved*, That the committee meet at the Hall of the Franklin Institute, in Philadelphia, on the second Wednesday in April next, and that five of them constitute a quorum for the transaction of business, but that a majority of the seventeen expressing their assent by letter or otherwise, be required to adopt the Constitution.

The following gentlemen were then elected to form the committee. The name of Benjamin Wright, who was unanimously elected, being, by a resolution of the Convention, placed at the head of the list, and the remainder in alphabetical order.

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The following gentlemen were then elected to form the committee. The name of Benjamin Wright, who was unanimously elected, being, by a resolution of the Convention, placed at the head of the list, and the remainder in alphabetical order.

BENJAMIN WRIGHT,	of New York.
WILLIAM S. CAMPBELL,	of Florida
CLAUDE CROZET,	of Virginia.
W. M. C. FAIRFAX,	of Virginia.
C. B. FISK,	of Maryland.
EDWARD F. GAY,	of Pennsylvania.
WALTER GWYNN,	of N. Carolina.
J. B. JERVIS,	of New York.
JONATHAN KNIGHT,	of Maryland.
BENJAMIN H. LATROBE,	of Maryland.
W. G. M'NEILL,	of S. Carolina.
EDWARD MILLER,	of Pennsylvania.
MONCURE ROBINSON,	of Virginia.
J. EDGAR THOMSON,	of Georgia.
ISAAC TRIMBLE,	of Maryland.
SYLVESTER WELCH,	of Kentucky.
G. W. WHISTLER,	of Connecticut.

In pursuance of the above proceedings, the committee met at the Hall of the Franklin Institute in the city of Philadelphia, on the 10th of April, 1839, and was organized by calling BENJAMIN WRIGHT to the Chair, and appointing EDWARD MILLER, Secretary.

After much interesting discussion and deliberation, two-thirds of those present approved of a form of Constitution, and signed the following paper.

HALL OF THE FRANKLIN INSTITUTE,
Philadelphia, April 12th, 1839.

The undersigned, members of the Committee of Seventeen appointed at the Convention of Civil Engineers, which met in Baltimore on the 11th of February last, assembled at the appointed time and place, and duly deliberated upon the subject of a Constitution for the proposed Society.

They recommend to the remaining members of the committee who were not able to attend the meeting, the adoption of the form which accompanies this circular, and respectfully request them, as soon as practicable, to notify the Secretary of the meeting of their approval or disapproval of the same.

BENJAMIN WRIGHT, of New York.
WILLIAM S. CAMPBELL, of Florida.
CHARLES B. FISK, of Maryland.
EDW. MILLER, of Pennsylvania.

It is believed that the provisions of the Constitution proposed, meet the views of Mr. Moncure Robinson, who was consulted in regard to them, although circumstances prevented him from being present at the meetings of the committee.

Letters from Sylvester Welch of Kentucky, B. H. Latrobe of Maryland, and John B. Jervis of New York, were then read, approving of the objects of the committee, and regretting the circumstances which prevented their attendance.

Resolutions of thanks to the Managers of the Franklin Institute, and to the President and Secretary of the Committee were adopted, after which the meeting adjourned sine die.

BENJAMIN WRIGHT, *Chairman.*

EDW. MILLER, *Secretary.*

CONSTITUTION.

SECTION I.

1. This Association shall be entitled "THE AMERICAN SOCIETY OF CIVIL ENGINEERS."

2. It has been instituted for the collection and diffusion of professional knowledge, the advancement of mechanical philosophy, and the elevation of the character and standing of the Civil Engineers of the United States.

SECTION II.

1. The Society shall consist of three classes, viz. Members, Associates, and Honorary Members.

2. Members shall be persons who are or have been engaged in the practice of a Civil Engineer

3. Associates shall be Architects, eminent Machinists, and others, whose pursuits constitute branches of engineering, but who are not Engineers by profession.

4. Honorary Members shall be persons who are not engaged in the practice of a Civil Engineer in this country, but are men eminent for science. The number of this class shall be limited to twenty-five.

5. The officers of the Society shall be a President, Vice President, Corresponding Secretary, Recording Secretary, Treasurer, and a Council, consisting of seven members.

6. The President, Council, Recording Secretary, and Treasurer, shall be elected annually by the Society, and shall be re-eligible.

7. The Vice President and the Corresponding Secretary, shall be annually chosen by the Council from its own number.

8. All the officers of the Society, with the exception of the Recording Secretary and Treasurer, shall be chosen from the class of members only. These officers need not belong to any of the classes. The duties of the Recording Secretary and Treasurer may be united in the same person, if the Society think proper.

9. If the elections should not occur at the time specified by the Constitution, the officers of the preceding year shall be continued until an election takes place.

Section III.

1. All elections shall be determined by ballot.

2. In order to become a member or associate of the Society, it is necessary to be proposed by three members, agreeably to a form given in the by-laws, wherein must be inserted the christian name, surname, and usual residence of the person proposed. His qualifications shall also be distinctly specified in such a manner, as to enable the members and associates generally to judge of his eligibility. The three members proposing him, shall also certify their personal knowledge of the candidate.

3. Every person proposed as an honorary member must be recommended by at least five members, who shall certify that he is a person eminent for science.

4. Every recommendation of a candidate must be delivered to the Recording Secretary at least four months before the session, and it shall then be the duty of the Recording Secretary immediately to inform each member of the Council, by letter, of all the nominations which have been made, in order that due inquiry may be instituted, whether the individuals proposed are suitable persons to be ballotted for, and also for which class of membership they should be presented to the Society.

5. When the Council approves the recommendation of any candidate, the proposition shall be signed by the chairman of the Council, and it shall then be read at the first meeting of the annual session.

6. The ballot shall take place on the next day but one after that on which the candidate is proposed, and the proportion of votes requisite for the election of any person into either class, shall be at least three-fourths of the persons present having a right to vote. Five black balls given in person, or in virtue of a written proxy, specifying the particular case under consideration, shall at all times be sufficient to prevent a person from being elected to any class of membership.

7. At the request of two members present, a ballot shall be postponed until the following session, but not longer.

8. In case of the non-election of any person ballotted for, no notice thereof shall be taken in the minutes.

9. At the election of members, none but members shall be permitted to vote. At the elections of associates and honorary members, both members and associates may vote.

10. A second ballot shall be granted at the same meeting, if immediately requested by three of the members present.

11. Whenever any person is elected a member or associate, the Recording Secretary shall immediately inform him of the same by letter, according to the form given in the by-laws. The election of honorary members shall be communicated to them as soon as possible, by a letter from the Corresponding Secretary, suitable to each particular case; and no person shall be considered as an honorary member, unless he signifies within twelve months his acquiescence in the election, after which he shall have all the rights and privileges of a member not forbidden by this Constitution.

12. Every person elected a member or associate, shall pay his admittance fee and first annual contribution within three months of the day of his election, otherwise his election will be void.

13. Every member and associate elected, shall be required to sign this

Constitution, at the first meeting of the Society which he shall attend, subsequently to paying his admittance fee and first annual contribution. He shall then be introduced to the Society by the President or chairman of the meeting; and from that time shall be entitled to all the privileges of membership appertaining to the class to which he has been chosen.

14. If at any time there shall appear cause for the expulsion of any member, associate, or honorary member, a proposition to that effect signed by two members, shall be handed to the Council, who may lay it before the Society if they think proper, at any time during the session, with a report on the subject. At the next meeting but one after that on which the report of the Council has been read, the question with regard to the expulsion shall come before the Society; and if one-half of the members present agree that such member or associate be expelled, the President, or other officer or member in the chair, shall announce the fact accordingly, and the Recording Secretary shall forthwith communicate the same to such member or associate, according to the form given in the by-laws.

Section IV.

1. The President, Council, Recording Secretary and Treasurer, shall be elected on the second Wednesday in September, and a majority of the members present shall be necessary to elect any officer.

2. All persons to be eligible as officers of the Society, must be nominated on the preceding day, i. e. on the first day of the session.

Section V.

1. The contribution of each member shall be twenty dollars per annum; of each associate, fifteen dollars per annum. The first contribution shall be payable at the time of election, and every future payment shall become due in advance, on the first day of September.

2. New members and associates shall pay the sum of twenty dollars as an admission fee.

3. Every member and associate, is required to produee to the Society, at least one unpublished communication in each year, or present a scientific book, map, plan or model, not already in the possession of the Society, under a penalty of ten dollars.

4. Every member and associate shall be considered as belonging to the Society, and as such, liable to the payment of his annual contribution, until he has either forfeited his claim, or has signified to the Recording Secretary in writing, his desire to resign, when his name shall be erased from the list of members, provided his dues have been fully paid up.

5. Whenever any member or associate shall be two years in arrear in the payment of his annual contribution, the Recording Secretary shall send to such member or associate a letter of the form specified in the by-laws. And if the arrears shall not be paid within six months after the forwarding of said letter, the name of the member or associate so offending shall be publicly suspended in the hall of the Society, together with the amount of contribution due by him; and such member or associate shall not enjoy any of the privileges and advantages of his membership until his arrears be fully paid.

Section VI.

1. The President shall take the chair at all meetings of the Society, at which he shall be present, and shall regulate and keep order in the proceedings. He shall likewise state and put questions according to the sense and intention of the meeting, and carry into effect the regulations of the Society.

SECTION VII.

1. In the absence of the President, it shall be the duty of the Vice-President to preside at the meetings; but in case of the absence of both President and Vice President, the members present may elect any one of their number to take the chair at that meeting.

SECTION VIII.

1. The direction and management of the affairs of the Society shall be confided to a Council

2. The Council shall meet at the hall of the Society, at 7 o'clock P. M. on the first Tuesday in September, and hold adjourned meetings at such times as they please throughout the session. At any meeting of the Council, three members thereof shall constitute a quorum. All questions shall be decided in Council by vote; but at the desire of any two members present, the determination of any subject shall be postponed to the succeeding meeting.

3. It shall be the duty of the Council to draw up an annual account of the state of the funds of the Society, and of the receipts and expenditures of the past year, which, together with a report on the state of the institution, in which shall be given an abstract of all the proceedings, shall be read at the first meeting of the annual session.

4. The Council shall have the power when a majority of their number consider the enactment of any new by-law or the alteration or repeal of an existing one necessary, to propose the same to the Society, and if, after three days' notice given, a majority of the members present approve of the proposition, it shall be considered cnnfirmed.

5 No by-law shall be made, altered or repealed, except in the manner above designated.

6. It shall be the duty of the Council to appoint special committees to investigate subjects of professional interest, and report at or before the next session of the Society. They may also request a member or associate to furn sh to the Society a description or drawings of any important work executed by him.

7. When the Society determine to publish their Transactions, it shall be the duty of the Council to select from the materials in the possession of the Society, such as they deem most suitable for the purpose, to arrange and edit them, and superintend the progress of publication.

SECTION IX.

1. The Corresponding Secretary shall hold such correspondence as Council may deem necessary, (either with members of the Society or others,) in order to elicit facts and advance the objects and interests of the Society.

SECTION X.

1. The duties of the Recording Secretary shall be to attend the meetings of the Society and Council, to take minutes of all their proceedings, and enter them in their proper books; to read the minutes of the preceding meeting; to announce any donations made to the Society; to give notice of any candidate proposed for admission or to be balloted for; to read the letters and papers presented to the Society, in the order of time in which they were received, unless the Council shall otherwise determine; to keep the accounts of the Society; to take care of their books, papers, plans and all other property; to collect all moneys due to the Society, and deposite them in bank, to the credit of the Treasurer; to pay all dues of the Society; and to lay all accounts of the sums so paid and received before the Council.

2. During the sessions of the Society, the Recording Secretary shall have assistance in the performance of his duties, if the Council shall deem it necessary.

SECTION XI.

1. The Treasurer shall be a resident of the City of Philadelphia All moneys belonging to the institution shall be deposited in his hands. No sum of money shall be paid by him except in pursuance of an order from the Recording Secretary, and if amounting to twenty dollars and upwards, the draft must be endorsed by two members of the Council.

2. All surplus funds in the hands of the Treasurer, shall be under the direction of Council, annually invested as an increasing fund for the use and advantage of the institution.

3. The Treasurer shall furnish a correct statement of all his accounts to the Council, at their first annual meeting.

SECTION XII.

1. The Society shall hold one session in each year in the City of Philadelphia. Twelve members shall constitute a quorum at any meeting. Until the Society obtains a hall of its own, the Council shall designate previously to each session the place where the meetings shall be held.

2. The annual session shall commence on the second Tuesday in September, at seven o'clock. P. M., and be adjourned, from time to time, until the business before the society is completed.

3. The first business of the session shall be to receive and deliberate upon the Report of Council on the state of the Society, to nominate and elect officers for the ensuing year, and to ballot for the candidates approved by the council.

SECTION XIII.

1. No alteration of this Constitution shall be made except at a special general meeting, at which only the class of members shall be present. At any time during the session of the Society, a meeting shall be called for such purpose by the Council, upon the written requisition of ten members or associates, specifying the nature of the proposed alteration. Three days' notice of such meeting shall be given. No other business shall be transacted at such special meeting than that for which it was called, and two-thirds of the votes of all the members of the Society, given affirmatively either in person or by proxy, shall be necessary, in order to alter, amend, add to or diminish, any part of this Constitution.

SECTION XIV

1. The whole of the property and effects of the Society, of what kind soever, shall be vested in the Council for the time being, to be held in trust for its use.

2. Every paper, map, plan or drawing which may be presented to the Society, shall be considered the property thereof, unless there shall have been a previous arrangement to the contrary.

3. No person shall publish any communication belonging to the Society, without the previous consent of the Council, given in accordance with such regulations as the Society may from time to time adopt.

4. No books, papers, plans, maps, models, or other property of a similar character, belonging to the Society, shall be taken from the hall; but every member, honorary member, and associate, shall have a right at all seasonable hours to inspect the same, and to make extracts and copies therefrom at his own expense, for his own use.

5. Every member, associate, and honorary member shall have the privilege of introducing visiters to be present at the public business of the

Society, and of taking them into the hall while the Society is not in session, on writing their names and his own in a book to be provided for that purpose: and these persons shall be permitted to read and examine the papers, books, plans, &c. of the Society, in the presence of the Recording Secretary, but they can on no pretence be permitted to make copies of the same.

Section XV.

1. The Secretary of the preliminary meeting, at which this Constitution was drawn up, shall remain the Secretary of the Society until the first meeting fixed by the Constitution, or until an election of officers takes place; and it shall be his duty to have this document, and the proceedings of the meeting at which it was prepared, printed, and sent as soon as possible to all the members of the committee of seventeen appointed at the Baltimore Convention, accompanied by letters, requesting an early acknowledgement, and an approval or disapproval of the same. If a majority of the committee approve, it shall be considered adopted.

Section XVI.

1. The Society of Civil Engineers which is to meet under this Constitution, in the City of Philadelphia, on the second Tuesday in September, 1839, shall be composed of such of the following forty gentlemen, as on or before the 1st day of September, signify their acceptance, and pay to the Secretary their admttance fee and first annual contribution. As soon as possible, after it shall be ascertained that a majority of the committee of seventeen have adopted the Constitution, it shall be the duty of the Secretary to notify all the members of the fact, and to urge their attendance at the September session.

Original Committee of Seventeen.

Benjamin Wright,
William S. Campbell.
Claude Crozet,
W. M. C. Fairfax,
Charles B. Fisk,
Edw. F. Gay,
Walter Gwynn,
John B. Jervis,
Jonathan Knight,
B. H. Latrobe;
W. G. M'Neill,
Edward Miller,
Moncure Robinson,
J. Edgar Thomson,
Isaac Trimble,
Sylvester Welch,
G. W. Whistler.

Members added.

Horatio Allen,
Benjamin Aycrigg,
William Cooke,
A. A. Dexter,
E. A. Douglass,
Charles Ellet, Jun.
John M. Fess,
C. F. Mt Garnett,
D. Griffin,
John H. Hopkins,
James Hunter,
S. H. Kneass,
S H. Long,
S. W. Mifflin,
S W. Roberts,
Wirt Robinson,
C. B. Shaw,
Antes Snyder,
M. R. Stealey,
A. Talcott,
Ashbel Welch,
W. Hassel Wilson,
W. C. Young.

Third Annual Report of the Western Rail-road Corporation.

To the Honorable the Senate and House of Representatives of the Commonwealth of Massachusetts:

In presenting to the Legislature their *third* Annual Report, the Directors of the Western Rail-road Corporation deem it due to the Commonwealth, as a principal stockholder, and a guarantor of the credit of the corporation, to exhibit a *detailed* account of their operations during the past year,—of the present condition of the work which they have in charge,—and the prospects of its future advancement.

At the date of the last Report, the whole line of the road, eastward of Connecticut river, a distance of 54 miles, had, (with the exception of about two miles adjoining the river,) been put under contract for grading; the graduation of 27 miles of the lighter part of it had been completed; and the work was in progress upon the remaining 25 miles.

An opinion was then expressed, that, should no unfortunate obstacle interpose to delay, the whole of this part of the line would be graded and ready for the superstructure, by the spring of 1839.

Soon after that time, the two miles adjoining the river were put under contract, and the work of graduation upon all the unfinished sections, has since been vigorously prosecuted. At the present time there are about 52 miles fully graded; and, excepting at four points upon the line, the grading is already nearly finished. The excepted points are, at New-Worcester—at the summit in Charlton—at Twelve Mile Brook, in Wilbraham, and on the sections near Connecticut river. At all these places, excepting at the Charlton summit, for six or eight months prior to the grant by the last Legislature, the work was much retarded by the uncertainty which existed, whether funds would be provided for the prosecution of the enterprise. They are now, however, so much advanced as to justify the belief, that they will be ready for the rails in the month of May next. The lighter intermediate sections, upon portions of which the grading is yet unfinished, may easily be completed during the winter.

Of the masonry, little remains to be done, excepting the construction of a few road bridges. and these will be forwarded at an early day.

The rail-road bridges upon this part of the line were contracted for in May last. About half of them are constructed, and the materials for the residue are delivered, and they are now in preparation.

The tables and schedules annexed hereto will exhibitit, more in detail, the quantity of work which has been done east of the river, up to the 30th of November, 1838, and that which then remained to be done. These embrace the quantity of earth, loose rock and solid rock excavated and remaining to be excavated; the masonry and bridging executed and remaining to be done; the number of rail-road bridges, road bridges and culverts; and schedules of the grades, curves, and of some of the larger cuttings and embankments; with a specification of the distances, by the road, between some prominent known points.

The attention of the Board has been seasonably directed to providing materials for the *superstructure* of the road east of the river. They have adopted the *edge rail* of the T pattern, weighing about 56½ pounds to the yard. This is laid upon transverse sleepers of 7 inches, placed three feet apart from centre to centre; and these have their bearings, under the rail, upon longitudinal sills 8 inches by 3, which are wholly imbedded on a road-way of gravel or sand.

The timber for the superstructure has all been contracted for, and that for about 38 miles is already delivered. The residue will be received in season for early operations in the coming spring.

The *Iron* for about 17 miles of the road was purchased early the past year,—it has arrived and is principally delivered on the line; and that for the residue is contracted for, with orders for its shipment in season for the spring and summer operations.

In the mean time, about six miles of the track have been laid, ready for use, commencing 2½ miles from Connecticut river and extending eastward. The laying of the residue of the rails will be commenced in the spring, and completed at the earliest practicable period.

The *Engines* and *Cars* necessary to put this part of the road in full operation, are under contract,—the former to be built at Lowell, and the latter at Worcester and Springfield; and it is believed they will be fully equal to any now in use in the country.

Suitable and convenient *Depot Lands* for the Stations have been secured at Worcester, Charlton, South Brookfield, West Brookfield, Warren, Palmer, Wilbraham and Springfield, and negociations are in progress for lands for the same purpose, in the village of Clappville. These are all the points at which the Directors have, as yet, decided to locate the stations—thus providing for the trains to stop seven times between Worcester and Connecticut river, a distance of 54 miles. These lands have all been procured at the inconsiderable expense of $4200.

The *Damages* for *Land* and *Fencing*, for the road way, have all been settled, with the exception of less than one mile at different intervals.

And the few remaining claims are liquidated by agreement, or by adjudications of the county commissioners. The average cost, exclusive of half a mile in Worcester village, was formerly estimated at $1240; and it proves to be about $1250 per mile, including all incidental expenses of commissioners, referees and one jury. The number of separate claims thus adjusted, is about 350.

The directors have not been unmindful of the importance of persevering effort to open this part of the road for use at an early day. They have for some months directed the particular attention of the executive officers of the corporation to this object; and it is believed, no exertion has been wanting to accomplish it.

Although a great part of the road has been graded, and contracts have been made for the materials for the superstructure, and for the engines and cars, yet the undersigned beg leave to remind the friends of the enterprise, that much remains to be done, before the road can be efficiently opened for public use. In addition to the remaining part of the grading, masonry and bridging—the delivery, preparation, transportation, and proper distribution of the iron, plates, spikes, sills and sleepers for the superstructure—the laying down of 48 miles of track with the necessary turnouts—the preparation of the Depot grounds—the erection of the buildings at nine stations—the delivery and trial of the engines and cars—the means for the supply of water at the several stations—the erection of signs at the road-crossings—the purchase of fuel for all the stations—and the employment and organization of the various subordinate officers required for the moving power, and for superintending the business of the road—will demand much time and labor on the part of all the officers of the corporation. It must also be borne in mind, that, although the various contracts are believed to be made with the most responsible men, yet the punctual fulfilment of their engagements is not within the control of the corporation; and a failure to perform any of them, may cause serious embarrassment, and a delay of the work. It will be recollected, also, that while these various branches of labor are in progress, much of the attention of the officers must be directed to the whole line of 62.6 miles westward of the river.

In view of these considerations, the undersigned think it would be hazardous to name, now, with certainty, any particular date at which the road east of Connecticut river will be in successful operation. It will be done at the earliest period, consistent with the great object in view. And if no unforeseen obstacle interposes, they flatter themselves, that that event will not be postponed beyond the month of September next.

At the time of presenting our last Report, the field-work for the location of the road *westward of Connecticut river*, had just been completed, and the maps and estimates were in progress. The line of definite location passed through the towns of Westfield, Chester,—through the Pontoosuc valley, to the summit in Washington, and thence through Hinsdale, Dalton, Pittsfield and Richmond, to the State boundary. The order of the Board directing this location, had reserved, however, three points for subsequent decision, viz. the direction of the lines through the villages of Westfield and Pittsfield, and the western termination of the road—either at the Canaan Gap, in West Stockbridge, or at Hatch's Gap, in Richmond. It was then uncertain at which of these terminations, the friends of the Albany road would prefer to connect with our line. At the presentation of the Report upon our final location, it was, however, ascertained, as far as was then practicable, that their preferences were for the union at the Canaan Gap; and the Board established their location directly to that point; leaving the village of West Stockbridge about one mile south of the line. At the same time, the route passing a little north of the Common in Pittsfield, was also established. Farther information was required respecting the lines through Westfield, and a definite decision will, probably, now be made upon them in a few weeks.

The act of the last Legislature, in aid of the Corporation, required them, during the year 1838, to "commence the construction of such part of the road, lying between Springfield and Pittsfield, as would require the longest time for its completion; and to prosecute the same in such a manner, as to secure the completion of the whole road from Springfield to the western line of the State, as early as was practicable, with a due regard to economy." This provision accorded with the judgment and wishes of the Directors; and in pursuance of it, they, in March last, ordered about 34½ miles of the western part of the road to be put under contract, extending from near Henry's tavern in Chester, to the State line, and including the heaviest part of the work, with a *proviso*, that upon about 11½ miles of it, between the village of Pittsfield and the summit in Washington, the work should not commence until it should be necessary, in order to ensure its completion by the more difficult sections should be graded. Under this order, the grading upon the remaining 23 miles was commenced in June last, and it has been prosecuted with as much efficiency as was practicable, to the present time. About five miles of it are already graded.

The stockholders in the western part of the State were early encouraged, and the part of the road west of Pittsfield, would be put in operation as soon as the part of the line eastward of Connecticut river. And the Board have always been strongly desirous to fulfil this expectation. The limited means of the treasury, however, during the latter part of the year 1837, and the winter of 1838, rendered it impossible for them to commence that work, without incurring obligations, which they had no means of meeting. But as soon as was practicable, after funds were provided by the liberality of the last Legislature, that division was let to efficient and responsible contractors, with express obligations in the contracts, to complete the grading by the 1st of July, 1839. And they have ever since been required to keep upon the heavier sections of it, as large a force as they could employ, without greatly disproportioned expense. And the Directors have, heretofore still indulged the hope, that the whole might be completed by the desired time. As the work has advanced, however, the character of the cuttings upon some of the heavier sections, has proved much more difficult than had been anticipated. And the Resident Engineer is now of opinion, that there are two of those sections which it will be impossible to finish, within the time specified in the contracts. But, no exertions will be spared to expedite this work, and to place the superstructure upon it, as soon as is practicable.

The work upon the 11½ miles between Pittsfield and the Washington summit will probably be commenced in the coming spring.

The Division from the summit to near Henry's, in Chester, a distance of about 11½ miles through the Pontoosuc valley, embraces much very heavy rock excavation, and extensive embankments, with a large quantity of expensive and heavy masonry. The two summit sections have a long rock-cutting, a part of which is 58 feet deep, and two large embankments of 49 and 37 feet in height. The contractors for grading these, stipulate to finish them by the 1st of July, 1840; but in one contingency, they are to be allowed till the close of that year to perform the work. They are now proceeding with it very satisfactorily. But in the present state of the work no definite opinion can be formed, as to the time when it will be completed. The other sections of this Division may be graded somewhat within the time allowed for those at the summit.

The character of the country between Henry's and Connecticut river, being 28 miles, is such, as to need much less time for its grading than the summit Division, though there are points in the former which may require some 15 months. The Directors, therefore judged it impolitic to commence upon it during the past year. But it is now their wish to put it under contract soon, and to begin the work in the spring of 1839.

The time of commencing this work, and the mode of conducting it afterwards, may depend somewhat upon the question, whether an attempt should be made to open it for use, before, and independently of, the heavier summit Division. This question, again, depends upon the time when the summit sections will probably be graded. And it is supposed that *this* point cannot resasonably be ascertained before late in the next season, when the character of the rock cutting there, may be more clearly developed. If this should then forbid the hope of grading the summit sections before the close of 1840, the Directors would. probably, desire to have the 28 miles east of Henry's, then so far advanced, as to enable them to finish the grading of them in the Summer of 1840, and to open that part of the line for use in the course of that year.

If, on the contrary, it should, during the next season, appear, that the summit Division might all be prepared for the superstructure, by July, 1840, it would then be about as much advanced, as the work east of it could well be, and the whole might probably be opened for use at the same time.

In thus setting forth the condition and future prospects of this Road, it may not be improper to state briefly, the condition of the enterprises of a similar character, with which it is proposed hereafter to connect it.

At its western termination, the Hudson and Berkshire Road has been completed and opened for use, within the last year, under prospects of business flattering to the friends of it. And that road has been extended to the village of West Stockbridge, a distance of 2¾ miles within this State.

Within the last month, a very large meeting of the friends of the Albany and West Stockbridge Rail-road has been holden at Albany, and energetic measures have been adopted to secure the prosecution of that work during the year 1839.

A Rail-road is also now in grading, which is to extend from the Sound at Bridgeport, in Connecticut, through the Housatonic valley to West Stockbridge.

One half the New Haven and Hartford road is now in use, and the grading upon all the residue of it is advancing rapidly. Surveys are also now in progress for a rail-road from Hartford to Springfield, with a view to unite that with the Western road.

And the friends of the Worcester and Norwich road give strong assurances, that it will be in full operation before the close of 1839.

Soon after the passage of the act of February 21, 1838, authorizing the issuing of the scrip of the State, for two millions, one hundred thousand dollars, to aid the construction of the road, the Corporation, at an adjournment of their last annual meeting, assented to the provisions thereof, and they subsequently gave to the Commonwealth the security required thereby. And they have since that time made the collections npon the assessments due from the private Stockholders, which were prescribed by that act, to entitle them to receive *the whole of the scrip* thus authorized to be issued.

At the annual meeting of the Corporation in February last, all the Stockholders, Directors of the previous year, were re-elected.

OF THE FINANCES.

Within the last month, a full report has been made to the Board, upon the subject of the *Finances*, embracing the estimated cost of the whole work,—and the whole means provided therefor,—an account of past expenditures and present resources—and the amount necessary for the future. The following is an abstract of that document.

ESTIMATED COST OF THE ROAD.

First. *East* of Connecticut river.

For graduation, masonry, bridging, superstructure, engines, cars, depot buildings, and Engineer Department,		$1,739,163 30
Miscellaneous expenses, including salaries, printing, stationary, rent of offices, expenses of Directors and Committees and all incidental expenses from Jan. 1836, to Dec. 1839, including $8,000 for surveys in 1835,		$34,652 72
Depot Lands,		4,000 00
Land damages and fencing 54 miles,		86,913 10
Total cost east of the river,		$1,864,729 12

Second. *West* of Connecticut River.

For graduation, masonry, bridging, superstructure, engines, cars, depot buildings, and Engineer Department, (the latter to December, 1840,)	$2,213,493 47	

Miscellaneous expenses to April 1, 1841, (including as before,)	28,497 12	
Land damages, fencing and Depot lands,	84,452 02	
Total cost west of the river, 62.6 miles,		2,326,442 61
Total cost of the Road—116.6 miles,		$4,191,171 73

RESOURCES OF THE CORPORATION.

Six assessments, being $30, on 30,000 shares and interest available thereon, deducting probable losses,	$910,643 30	
Proceeds of State scrip of 1838,	2,100,000 00	
Total resources,		3,910,643 30
Balance, to be provided for,		$1,180,528 43

PAST EXPENDITURES, AND RESOURCES FOR THE FUTURE.

On Dec. 1, 1838, there had been expended and paid	1,259,619 11
Which left of available resources applicable to payments after that date,	1,751,024 19
Amount estimated necessary to complete the road east of the river and put it in full operation,	755,027 66
Balance amount applicable west of the river after Dec. 1, 1838,	$995,996 53
If the residue of the road *west of the river*, should be put under contract, and the work on the whole, be commenced by the first of March next, and be prosecuted in the same manner, as that *east* of the river has been heretofore conducted, viz., by pushing the heavier sections, as far as is consistent with a prudent economy, and the lighter ones only in such manner, as that the whole may be completed together, it is estimated that there will be required west of the river, by March 1, 1840, for graduation, masonry, bridging and engineer department for the *whole line*, and for superstructure and buildings for stations, *between Pittsfield and the state line*, the sum of	778,770 64
Leaving on hand, March 1, 1840,	217,225 89
If the whole, including the lighter work, is advanced to completion as early as is practicable, consistently with economy, there will be required by March 1, 1840, an expenditure of	898,770 64
Leaving on hand at that date	97,225 89

Both of these latter estimates are based upon the supposition that the contracts to be now made for grading the 28 miles, must be made, on condition that the Corporation shall have a right to suspend the work in the winter of 1840, if farther funds are not provided for completing the same. And it is supposed, that as favorable terms cannot be had for such contracts, as would be obtained, if no such contigency were to be provided for.

And it may not be amiss to add, also, that the contracts already made for grading the summit Division, being made when adequate funds were secured for their completion, may, if those funds are divested in part to the grading of the 28 miles, be suspended also in the winter of 1840, if additional funds are not then provided.

It should be borne in mind also, that, as before stated, the 28 miles east of Henry's, can probably be graded ready for the superstructure, by July 1, 1840. And to provide against serious delay in opening that part of the road, the iron and other materials for the superstructure, and the engines and cars should be contracted for prior to 1st of July, 1840. These upon the estimate heretofore made, will cost about	$300,000
And if it should be found that the summit Division can also be ready for the rails by July, 1840, provision should be made for the superstructure, and the engines and cars for the 23 miles between Henry's and Pittsfield before January 1, 1840—which will require about more.	250,000
Under the act of February last, the Treasurer has received the scrip of the State amounting to the sum of	900,000 00
Of this, there had been sold in England, at the date of the last advices, the amount of at an advance above the par value of from 2½ to 4 per cent.	524,444 44
And the Treasurer of the Corporation has paid over to the Treasurer of the Commonwealth, the sum of on account of monies received by him, from the premium on sales of scrip, and the proceeds of Exchange; to be, by the Treasurer of the Commonwealth, placed at interest, as a part of the *Sinking Fund*, created by said act for the final redemption of the scrip.	65,550 35

The whole scrip thus far issued, is made payable—both principal and interest—at the House of Baring, Brothers & Co., in London, who are constituted the agents of the Corporation therefor.

The Receipts and Expenditures of the Corporation for the year past, as stated by the Treasurer, are as follows, viz:

RECEIPTS.

Balance on hand, as per last Report, January 3, 1838,		$69,889 67
Amount since received on 3d Instalment,	11,875 00	
" " 4th "	68,870 00	
Amount since received on 5th Instalment,	112,270 00	
" " 6th "	138,950 00	
		331,950 00
" for sale of State scrip	524,444 44	
" Exchange drawn against State scrip,	202,226 02	
		726,670 46
" on account of Contingent Fund,		6,115 00
		$1,134,640 13

EXPENDITURES.

Amount paid for incidental expenses,	12,420 41	
" for Engineer department,	31,184 57	
" for Land damages,	67,322 11	
" Timber lands,	4,642 73	
" Construction including Iron,	659,024 16	
" Depot lands,	2,286 00	
" Balance of Interest on loan,	3,704 59	
Balance,	*354,055 56	
		1,134,640 13

*The balance consists of the following items:

Balance of cash account,	262,346 07	
" in hands of Wm. H. Swift, Resident Engineer,	6,788 84	
" in hands of George Bliss, Agent,	1,415 92	
Cash loaned on collateral,	81,000 00	
Notes receivable,	80,158 11	
		431,708 94
Less Exchange account or sinking fund,	76,868 05	
" bal. due Baring, Brothers & Co. Liverpool,	785 33	
		77,653 38
		$354,055 56

The following is a statement of the whole collection upon the six assessments laid on the Stock, up to Dec. 31st, 1838.

No. of Assessment.	Time when Payable.	Amount of each Assessment.	Amount collected.	Amount now due.
First, .	Feb. 1, 1836,	150,000	150,000	
Second, .	April 15, 1836,	150,000	150,000	
Third, .	Jan. 16, 1837,	150,000	145,860	4,140
Fourth, .	Sept. 25, 1837,	150,000	143,970	6,030
Fifth, .	Nov. 15, 1837,	150,000	141,100	8,900
Sixth, .	June 11, 1838,	150,000	139,670	10,330
Totals, .	. .	900,000	870,600	29,400

The undersigned from their first connexion with this enterprise as Directors, have felt that onerous duties and a heavy responsibility were developed upon them, in the care of so extended a work. In the discharge of these duties they have ever been solicitous to watch, vigilantly, the expenditure of the funds of the Corporation. The active operations, which spread along a line of over 116 miles, necessarily require the employment of a considerable number of executive officers, directly or indirectly responsible to the Board. Through the agency of these officers the work is constructed, and all the disbursements are made. And the Board have felt it to be incumbent upon them, from time to time, to examine their proceedings, scrutinize their accounts, ascertain the manner which their several duties were discharged, and personally to inspect their operations, both in the offices and in the field.

In furtherance of these objects, the Directors, in April last, appointed Messrs. Hudson and Walker, two of their number, " a committee with instructions to make a personal examination and inspection of the several lines located westward of the river, and of the work upon the line of the road, between Worcester and Springfield; to examine the mode of making contracts, and the terms of them, and the manner of their fulfilment; to inquire into the nature and extent of the duties devolving upon the agent and his assistant, and upon the engineers and their assistants, and the manner in which those duties are performed—including an examination of the mode of doing business, and keeping accounts in the offices of the agent and engineers; to inquire into the titles procured for the track of the road, and the mode in which they are secured, and the propriety of the prices paid therefor; and, *in general*, to make a thorough inspection of all the business and affairs of the corporation, connected with the location and construction of the road."

After spending several days upon the line and in the offices, in the discharge of the various duties assigned to them, the Committee made a detailed report to the Directors, which was accepted by them. A copy of that report is hereto annexed, for the inspection of those who may desire to know the extent of the examination, and the results at which the Committee arrived.

The Directors have now made to the Legislature a full exposition of all the concerns of the corporation. The work which they have in charge is one of great interest and importance; and they were therefore desirous that information respecting it should be spread freely before the community. It is a *public* work—a work for posterity—one in the success of which the Commonwealth, and all its citizens, have a deep and permanent interest. And it was therefore due to the people, that its condition, its progress, its future prospects and wants, and all its varied relations, should be frankly exhibited to the *representatives* of the people. Without their *further aid*, the work cannot be completed. To their care and protection the undersigned commend it. If the enterprise has merits, they have no doubt that these will be duly appreciated. If it has wants, they have entire confidence that they will be provided for.

THOS. B. WALES,
EDMUND DWIGHT,
JOHN HENSHAW,
JOSIAH QUINCY, Jr.
ROBERT RANTOUL, Jr.
AMASA WALKER,
CHARLES HUDSON,
GEORGE BLISS,

Boston, January 1, 1839. *Directors.*

Statement, exhibiting the amount of Earth, Loose Rock, and Solid Rock excavated, the number of perches of Masonry (of 25 cubic feet) laid, and the number of feet of Bridging completed, between Worcester and Connecticut River, on the 30th of November, 1838.

No. of Division.	Earth. Cubic Yards.	Loose Rock. Cubic Yards.	Solid Rock. Cubic Yards	Masonry. Perches.	Bridging. Feet.
1	772,196	4,321	69,012	15,894	270
2	545,500	1,019	16,025	9,398	120
3	252,176	3,638	1,710	8,633	312
4	857,555	7,645	14,504	10,128	
Totals,	2,427,427	16,623	101,251	44,053	702

NOTE.—On the 1st Division, and on part of the 2d, the contracts were made for earth and loose rock together. The quantity of loose rock cannot, therefore, be exhibited separately upon the sections which were contracted for in the above manner.

Statement exhibiting the amount of Earth, Loose Rock, and solid Rock, to be excavated, the number of perches of Masonry to be laid, and the number of feet of Bridging to be put up, between Worcester and Connecticut River, on 30th November, 1838.

No. of Division.	Earth. Cubic Yards.	Loose Rock Cubic Yards.	Solid Rock. Cubic Yards.	Masonry. Perches.	Bridging. Feet.
1	112,800	.	6567	1500	71
2	12,554	.	106	700	174
3	58,194	900	1000	600	600
4	126,307	.	.	500	135
Totals,	309,825	900	7673	3300	980

Schedule of Grades, East of Connecticut River.

No. of Planes.	Inclination per mile Feet.	Length of line on each Grade—Miles	No. of Planes ascending—West.	No. of Planes descending—West.
5	Level.	2,071		
15	0 to 10 ft.	11,800		
11	10 to 20 ft.	8,317		
6	20 to 30 ft.	5,127		
8	30 to 40 ft.	11,375		
6	40 to 50 ft.	11,545		
1	51½ ft.	1,432		
1	60 ft.	2,500		
53		54,167	22	26

Schedule of Curves, East of Connecticut River.

No. of Curves.	Amount of Curvature—Degrees.			Length of Radius—Feet.		
13	½ degree	to	1 degree	11,459	to	5730
22	1 degree	to	2 degrees	5730	to	2865
21	2 degrees	to	3 degrees	2865	to	1910
4	3 degrees	to	4 degrees	1910	to	1432
1	–		5 degrees	1146		——
61						

Whole length of straight line—about 35 miles.

Schedule of Bridges, Culverts, and large Cuttings, and Embankments, East of Connecticut River.

There are 24 rail-road bridges, from 12 to 175 feet long,
11 road and farm bridges,
110 box and open culverts,
8 arch culverts, from 8 to 35 feet span, and from 32 to 191 feet long.

Of the larger Cuttings, there are
10 of from 24 to 30 feet deep,
9 " 30 to 35 "
3 " 35 to 40 "
1 each of 43, 47, 52 and 80 feet deep.

Of the larger Embankments, there are
9 of from 24 to 30 feet high,
7 " 30 to 35 "
2 of 38 "
1 each of 48, 60, 63 and 63 feet high.

Schedule of Distances by the line of the Railroad, from the Passenger Station House, on the east side of Grafton Street, Worcester, (which is 812 feet west of the junction of the Boston and Worcester Rail-road,) to sundry places on the line.

From the Passenger Station House, Worcester, to	Town.	Distance Miles.	Difference. Miles.	Distance between Stations. Miles.
The Oxford road, ...	S. Leicester,	8 74		8 74
Leicester & Charlton road (near Jones')	Charlton,	11 98	3 24	
Summit, ...	do.	12 96	0 98	
Road by Hall's Charlton station,	do.	13 24	0 28	4 50
Road near Nathaniel Bemis, .	Spencer,	17 50	4 26	
Five Mile River, . . .	E. Brookfield,	19 78	2 28	
Brinfield road by Station land, .	S. Brookfield,	22 60	2 82	9 36
do. do. . .	W. Brookfield,	25 32	2 72	2 72
Road by do. . .	Warren,	28 22	2 90	2 90
Blair's saw mill, . . .	do.	31 69	3 47	
Road by Alonzo V. Blanchard's, .	Palmer,	37 69	6 00	
Road by Palmer Station, (J. Shaw's,)	do.	39 10	1 41	10 88
Do. near Glover's store, . .	Monson,	42 43	3 33	
Do. by Station, (N. Stevens,) .	Wilbraham,	46 96	4 53	7 86
Crossing Chicopee Falls road, .	Springfield,	51 93	4 97	
Station land, Main street, . .	do.	53 98	2 05	7 02
East Bank of Connecticut River,	do.	54 16	0 18	
Add from junction of Boston and Worcester road, to Station House Worcester, ...		0 15		
Whole length of line east of River,	.	54 31		

WESTERN RAIL-ROAD OFFICE,
Worcester, July 24, 1838.

The Committee appointed by an order of the 12th of April last, "to examine the mode of making contracts, and the terms of them, and the manner of their fulfilment; to examine into the nature and extent of the duties devolving upon the agent and his assistant, and upon the engineers and their assistants, and the manner in which their duties are performed, including an examination of the mode of doing businesss and keeping accounts in the offices of the agent and engineers; to examine into the titles procured for the track of the road, and the mode in which they are secured, and the propriety of the prices paid therefor; and in general, to make a thorough inspection of all the business and affairs of the corporation connected with the location and construction of the road," ask leave to summit the following

REPORT:

The Committee in the discharge of their duty, passed over the road from Worcester to the line of the State at West Stockbridge, and viewed particularly all the principal points on the road; and found that the work was generally progressing as rapidly as is consistent with economy. The Committee turned their attention particularly to the duties devolving upon the agent and his assistant, and the engineer and his assistants. They called upon each of these officers, inspected their books, and inquired into the character and amount of the labors they had to perform; and the examination resulted in a full conviction, that the labors were sufficient to employ those officers every hour of their time. As these duties were more numerous and arduous than the Committee had anticipated, they will give a brief description of them; and if the information is not needed by others, it will at least show that the Committee were somewhat particular in their inquiries.

The resident engineer it is well known, has the general supervision of the location and construction of the road. As a great part of his duties are connected with those of his assistants, we will not enlarge upon them here; believing that a description of the assistants' labors, all of which pass under his inspection, will give some view of the amount of labor he has to perform.

The assistant engineers have each a division of the road of from eight to twenty miles in length. Their labors are various. As some of them have been upon the road from the first, we will begin with the trial surveys. After a general view of the country, a line is run, and the courses, distances, and altitudes are carefully noted. After these field labors are performed, a computation is made, and if the result does not come within the limits prescribed by the resident engineer, that line is abandoned, and another is sought. Much time and labor are necessarily spent in fixing upon the approximate location. This is required by the strictest economy. A few days or even weeks spent in avoiding a deep cut, a heavy embankment, a sharp curve, or a high grade, might save the corporation more than a year's salary of one of these officers. When the approximate location is agreed upon, the line is carefully run in stations of 100 feet, and the curves together with the rise and fall noted. In addition to this, cross sections are taken at every station, noting the rise and fall of the land on the right and left of the centre line, and if the surface of the ground changes as it frequently must between the stations, cross sections are taken at such intermediate points. The field labor being thus accomplished, the assistant makes a plan and profile of the route, ascertains the grade, plats the cross sections, and estimates mathematically, the grade, deflection, and the amount of cutting and filling, the number of bridges, and the amount of masonry. In some cases of course, two or more lines present themselves, so nearly equal in their claims, that a preference cannot be given until all this process is gone through with, and the results compared. Other examinations must be made out of the line of the road. If earth is to be wasted, reference must be had to the place for its deposit; if earth is to be borrowed, a place must be selected from which to obtain it, swamps must be sounded and hills bored, and the nature of the soil and materials ascertained with as much accuracy as possible. After all these surveys and estimates are made, they are recorded by the assistant in a book kept for that purpose. The result of all these are submitted to the resident engineer ; and during the progress of the surveys, his advice and personal attendance are frequently required.

When the location is fixed, and the road put under contract, the assistants have to go over their divisions ranging in length from ten to twenty miles, and mark the number of feet of cut or fill at each station, and also erect the slope stakes. The work is commenced and the centre stakes of course removed on that part of the line, and the slope stakes, by design or accident, are frequently pulled up. If left to themselves, the workmen would be likely to get out of the line, or below the grade. It is necessary therefore, that the assistant or some one under him, should be upon the ground almost daily. These stakes must be frequently replaced, and the centres run.

Another important item in the construction of the road, and the labor of the assistants, is the masonry. This requires almost constant inspection. The value of masonry must depend very much upon the character of the materials used ; and in the absence of an inspector the contracter might use improper materials ; and inspection here is more necessary during the progress of the work, as a fraud could not, in many cases, be detected after the work is completed.

The labors of the assistants in relation to the masonry is heightened by the fact, that the foundation for all bridges and principal culverts is not included in the contracts, but is laid by the day. This renders the presence of the assistant the more important, as he has not only to inspect the work, but to see that the hands labor industriously. Another important field of labor for the assistants is this : the contracts for grading are made for a specific sum for excavating every cubic yard of earth ; another and greater sum for every yard of loose rock, and a still greater sum for every yard of solid rock. All rocks up to a certain size are, by the contract, deemed to be earth ; from that size up to another given size, they are deemed to be loose rock, and all above that, solid rock. In some sections, where rocks abound, the presence of the assistant is required almost hourly, to examine the stone and decide to which particular class they belong ; otherwise, the contractor might pass off for loose rock what ought to be considered earth, and for solid rock what should be deemed loose rock.

In the progress of the work, unforeseen obstacles frequently present themselves, rendering it expedient to change the grade or the location. This requires the time and the attention of the assistant. There is also a class of periodical labors which devolve upon these officers. The contractors are paid every month ; this renders it necessary that the work done on the whole division should be measured and estimated once in thirty days, and the amount painted upon the profile and transmitted to the office of the resident engineer. This throws a large amount of labor upon the assistants in the short space of a few days. Add to this, when the work is completed the whole is accurately measured and estimated, section by section, to furnish the basis for the final settlement with the contractors.

There is also a large amount of office labors to be performed. Accurate plans must be made to file with the County Commissioners; every land owner has a right by statute to demand a plan of his land before it is entered upon. This is furnished by the assistant. The agent rebuires a plan or an accurate description of the location by which to frame his deeds and settle the land damages. The working plans for the masonry form a considerable item. There is another branch of labor connected with the masonry. The contractors took the stone where they could get them easiest, without any reference to the cost to the Corporation for damages to land. This system entailed upon the assistants the labor of settling the damages for taking stone. This system is now generally abandoned, and it is made the duty of the assistant to select the stone and negotiate with the land owners for the damages. In some cases of land damages it is found expedient to buy the farm or lot crossed by the road; in such cases, the assistant has to survey the land and make out a plan for the agent. These labors, miuute as some of them may appear, cannot well be dispensed with economically. In various respects, in ways almost innumerable, these officers can save the Corporation more than the amount of their pay. Take a section where there is, by estimate, an excess of excavation over the embankment of, say, 500 yards. The contractor might find it for his interest to waste this amount before he completed his embankment. But it may so happen that some part of the earth under the embankment may give way, and let the embankment settle, and this supposed excess may be needed to bring it up to grade. An engineer on the spot, seeing an indication in the earth under the embankment to give way, will immediately arrest the wasting of earth, and order it to be carried and placed upon the embankment which is settling. In this way the Corporation may be saved from the charge of land damages, by borrowing earth out of the line of the road and perhaps from land damages by wasting earth upon it; and also from the expense of paying for double excavation.

Of nearly the same character is another saving that may be made by the constant inspection of the assistant. Different kinds of earth shrink in different ratios by being removed. This shrinkage may vary the supposed balance of cut and fill so as to affect the borrowing or wasting. The assistant, by observing the nature of the soil, may give directions to the contractor, so as to have the excavation and embankment balance each other; and thus save the expense of wasting and borrowing. Whereas the contractor, whose interest is different from that of the Corporation, might answer his end better by borrowing in one place and wasting in another, though it might subject the Corporation to an extra charge.

These labors, or something like them, devolve upon each assistant or master of a division. The assistants have generally four persons under them, who aid them in the performance of their labors, and who receive from one to two dollars per day for their services, and find themselves. We have remarked before, what every one knows, that the Resident

Engineer has the general supervision of the whole road. All the business of the Assistant Engineer passes under his inspection, and all difficult parts of the road receive his personal examination. He is also liable to be called unexpectedly to distant parts of the line. When any thing of a difficult character presents itself, the Assistant immediately calls upon the Resident Engineer, who must immediately, either in person, or by letter, give the information needed. The Resident Engineer is also associated with the agent in putting the road under contract, and in obtaining the necessary materials for bridges, superstructure, &c. Perhaps we cannot better describe the labors of the Resident Engineer in this respect, than by giving a brief account of the manner in which the contracts for grading are made. The road is divided into sections, so as to have the excavations and embankments balance each other as nearly as practicable. They then advertise for proposals for each section. When the proposals have come in, they are all arranged and recorded by the Engineer. If the proposals are reasonable, they close with the lowest responsible bidder; if the proposals are not reasonably low in any case, that section is reserved for a future contract. When the proposals are closed with, a written agreement is entered into, and signed and delivered in the presence of witnesses, by which the Corporation, by their agent, agree to pay so much per cubic yard for excavating earth, so much for loose rock, so much for solid rock, and so much for masonry, &c. And the contractor agrees on his part to do the work in a given time, to the acceptance of the Engineer. One distinguishing feature in these instruments is, that the Engineer has almost unlimited power over the contract, and may change, modify or annul it, at his pleasure.

This throws great responsibility upon the Engineer, together with no small share of labor. All the money expended for the graduation and masonry is disbursed by the Engineer. The oversight of more than 100 miles of road, and the labors connected therewith, must necessarily employ the time of one individual. The manner in which the contractors are paid, is attended with some extra labor. We have before said, that the assistants measure and estimate the amount of work done on each section every month. These returns are made to the Engineer, and from these data the monthly pay is made out; but to ensure the completion of the work, or to save harmless the Corporation in case of failure, a certain amount is retained by the Engineer. There is necessarily a large amount of clerical labor devolving upon the Engineer. Correspondence must be had, copies of which are retained in his office; accounts of all money received and disbursed there must consume considerable time. His extended line of road requires him frequently to be from home, and hence much time must be expended in travelling.

The Committee also inquired into the character and amount of labor devolving upon the agent and his assistant. Their principal duties relate to land damages, though these are not by any means their only duties. The general plan of operations in relation to land damages is this. The agent goes over the line, and ascertains the names of the land owners, and obtains a release of the land in all cases where it is practicable before the location is made. But in most cases this cannot be done; in which event the agent goes over the road, measures the length of each man's land on the line of the road, ascertains the width of the location at all parts, and then commences a negotiation with the land owner. This requires much time aud patience. The first attempts to negotiate generally prove abortive. Land owners, for the most part, are unwilling that their farms or lots should be cut up, and it generally so happens that the road, in their estimation, crosses their land just where they are the most unwilling to part with it. It is a new subject to them; they are not prepared to act then; they want a little time to consider of it—to see how they are to be affected by the road, or to ascertain what damages their neighbor obtains. Their tale of grievances must be listened to; the descent of the property, the productiveness of the soil, the richness of the corporation, the arbitrary character of the law by which the Corporation are authorized to take the land of the citizen without his consent—all these and many other things must be related, and heard to, with a great degree of patience; and then, after spending an hour or two, the agent is told that he will do nothing at that time; if he will call again he will talk with him on the subject. Or, if terms are offered by the land owner, they are generally so high that they cannot be complied with. Visit after visit must generally be made before the negotiation can be closed.

In this way much time must be spent, and but little is brought to pass. If some are more reasonable and agree at once, others are more unreasonable and will not agree at all. In such cases, after a fruitless negotiation, the County Commissioners must be called upon to appraise the damages; this, perhaps is followed by an appeal to a Jury. In all such cases the agent, or some one authorized by him, must be present, and to present the case to the Commissioners or Jury. It also frequently happens, that the owner lives at a distance, or that the land is held in common by a number of individuals, or is in the hands of Guardians, or Administrators, or Trustees; all of which circumstances impede the negotiation, and increase the labor of the Agent.

Another no inconsiderable amount of labor connected with this business, relates to the titles of the land. The Agent, in all doubtful cases, examines the records to see if the land is free from incumbrances, and to ascertain in whom the fee is. After he is satisfied on these points, and the negotiation is closed, the Agent makes out a Deed of the land taken, and has it recorded in the Registry of Deeds for the County where the land is situated. These deeds are very minute, describing the land by the foot, and occupy two or three times the space of ordinary Deeds.

This branch of the Agent's business is of the most perplexing character, and must necessarily consume much time. It is also important to the Corporation, that it should be managed with great caution and prudence, and, consequently, with much delay. The saving to the Corporation of a cattle culvert, or a farm bridge, will generally more than compensate for weeks of time spent in negotiation. And experience has shown, that negotiations, though protracted, are to be preferred on the ground of economy, to the calling out of the Commissioners.

The crossing of highways, in some cases, imposes considerable labor upon the Agent. When the highway is to be raised or lowered, or its location to be changed, the Selectmen or Commissioners are to be called upon, and the case is to be decided after a hearing of the parties. The Agent performs the professional duties for the Corporation,—such as appearing before the Commissioners, Juries, and the like. The negotiation which has been going on in relation to the Pontoosuc Turnpike, has occupied some of the Agent's time. He also, as we have before remarked, makes in connection with the Engineer, all the contracts for the grading of the road, and the purchase of lumber for bridges and for the superstructure of the road. The contracts for lumber have, in most cases, been made at a distance. The inhabitants on the line of the road, supposing the Corporation to be within their power, have generally, it is thought, been somewhat exorbitant in their demands for lumber. This has subjec-

Rail-road, and that this union would be effected within one year from the time of our first organization, it was expected that it would be unnecessary to render any report at this time. Our charter was obtained for the purpose of extending the Hudson and Berkshire Rail-road to the village of West Stockbridge, so as to complete the line of communication from the Hudson river to the county of Berkshire. From the first, it was apparent to all that the West Stockbridge Rail-road, in order to be profitable to the stockholders and useful to the public, must ultimately be united with the Hudson and Berkshire road, and resolutions were early passed by both boards declaratory of the intention of the companies to form this union, so soon as permission could be obtained from your honorable body. We have consequently purchased no cars, engines, or other appurtenances for our road, but have permitted the Hudson and Berkshire Corporation to run their engines and cars over it, without any definite arrangement as to its use, except that the whole matter stands referred for the action of a committee from both boards of directors, when permission is granted to unite the stocks. We entertain the hope, that your honorable body will consider the above *reasons* why a more detailed report could not be rendered as satisfactory.

The whole amount of our subscription in Berkshire county, is	$13,900 00
A bond obligating the Hudson and Berkshire R. R. Co. to subscribe	7,500 00
	$21,400 00

The directors have received from the Berkshire subscription, ...	$6,595 00
Advanced by the directors, ...	2,981 25
	$9.576 25

The Hudson and Berkshire Rail-road Corporation have furnished the whole superstructure, and have laid down the same. They have also commenced a stone building, now nearly roofed in, 100 feet by 50, intended for the depot. They have, in addition, commenced filling in some low grounds around the eastern terminus of the road, in order to render it more commodious.

No account has been rendered by the Hudson and Berkshire Railroad Corporation of the expense of these several operations, and we can therefore give no statement in regard to it.

We have expended for grading and bridges, . . .	$8,695 85
" " for land damages, fencing, engineering, and incidental charges, . .	868 91
	$9,564 76

The length of the road is 2 3-4 miles nearly. The roadway is graded to a width of 14 feet at top. The superstructure consists, first, of a subsill, 10 in. by 4 in.; second, of ties about 6 in. by 7 in.; third, of rails 6 in. square; fourth, the iron bar; 2 1-2 in. wide by 5-8 of an inch thick. The timber is principally chesnut, the production of the surrounding country.

The chief engineer, who resides at Hudson, has, within a few days, sent for the maps and plans belonging to the company, and we cannot, therefore, at this time, comply with the statute in regard to the planes and ted the Agent to the necessity of seeking supplies at a distance. He has, also, in several cases, purchased land with wood standing thereon, for the purpose of obtaining lumber cheaper than it could be bought of individuals.

The office labors of the Agent are very considerable. His correspondence must be somewhat extensive, all of which is a matter of record; the receipts and expenditures of the department, must all be recorded; abstracts of all contracts are entered in a book kept for that purpose, and copies of them are furnished to the Engineer and to his assistant on the part of the road to which they relate. These, together with the deeds, releases, &c., make a large amount of clerical labor. The Committee examined the books and papers in the Offices of all the Departments, and found them neatly, and, as far as they could judge from a very cursory examination, correctly kept.

On the whole, the Committee are fully satisfied, that there is business enough in each of the Departments, to engross the whole time of the several Officers employed, and in the Agent's Department, extra labor, at times, is indispensable.

Nor are the Committee aware, from any thing they could discover, or learn from others, that any of these Officers were neglectful of their duties. They were, on the contrary, pleased with the active business talents exhibited by the different Officers. And, from inquiries made of individuals on the line of the road, they learned that there was an impression among those who had done business with him, that the Agent was active and shrewd, and managed the business of his Department wisely for the Corporation. The committee believe, from what they have been able to discover, that they can congratulate the Board and Corporation, upon their good fortune in selecting wise, judicious and faithful Officers in all the Departments of their business.

One branch of the order required the Committee to examine the manner of the fulfilment of contracts. We are not exactly aware of the import of these instructions. We have already stated, that the contracts for grading and masonry, are to be fulfilled to the acceptance of the Engineer. The contracts for sleepers, &c., require that they should be certain kinds of wood, and of a given size; the contracts for land are fulfilled by the giving of a deed. If this is what was contemplated by the order, we have complied with its provisions. But if it is intended that the Committee should examine, personally, the work in the one case, and the materials in the other, they have not done it to any considerable extent; nor can it be done until the work is accomplished, and the materials delivered. Wherever the work was finished, it appeared to be of the most substantial kind, and executed in the best manner.

Having stated thus minutely the result of their inquiries, the Committee submit the whole subject to the consideration of the Board.

CHARLES HUDSON, } *Committee.*
AMASA WALKER, }

First Report of the West Stockbridge Railroad Corporation.

To the Honourable the Legislature of the State of Massachusetts:

The Directors of the West Stockbridge Railroad Corporation do hereby make their First Report of their acts and doings, under their act of incorporation, so far as their peculiar position will admit.

This company was organized, under its charter, on the twenty-sixth day of April, 1838, and, supposing that your honorable body might give us permission to unite our stock with that of the Hudson and Berkshire curves. The road, however, is nearly level, and fhere is probably no curve with a radius less than two thonsand feet.

All which is respectfully submitted.

CHA'S. B. BOYNTON,
ERASTUS CROCKER,
DANIEL SPENCER, JR.
SYLVESTER SPENCER,
HUBBARD FOX.

West Stockbridge, January 28,1839.

The Genesee Valley Canal—Report of the Canal Board.

The Canal Board, who were directed by the resolution of the Assembly passed the 12th of April, 1839, to report whether any and what alteration can be made in the plan of constructing the Genesee valley canal, which will lessen its cost, without impairing its usefulness, respectfully report—

The subject of enquiry is naturally divided by the terms of the resolution into two branches—the one embracing the cost, and the other the usefulness of the Genesee valley canal. The object of that work is to connect the Erie canal at Rochester with the Allegany river at Olean, and to accommodate the business of the country intervening between those points. To obtain a proper understanding of the cost and of the usefulness of the canal, it will be requisite to take into view some of its leading physical features.

The main line from Rochester to Olean is 106 miles long, and it has a branch nearly 11 miles in length, which diverges to the village of Dansville, from a point in the main line near Mount Morris, and distant about 40 miles south of Rochester. The route pursues, for the greater part of its length, the valley of the Genesee river and one of its tributaries, but its different divisions are singularly diversified in their topographical character.

The head waters of the Genesee, gathered in the mountain districts of the upper part of Pennsylvania, flow into this State in a northerly direction, and across the elevated lands in the county of Alleghany at a height varying from 1000 to 1500 feet above tide-water. After passing with a gradual descent nearly through that country, its waters are suddenly precipitated upon the lowland district traversed by the Erie canal, through a succession of cataracts and rapids which extend northwardly for 17 miles from Portageville, and terminate at Mount Morris. From that point northwardly to Rochester, the descent of the river again becomes gentle, so that its bed at Mount Morris is not elevated more than seventy-five feet above the level of the Erie canal at Rochester.

The Genesee Valley Canal partakes of the irregularities which are occasioned by these abrupt transitions in the character of the river. For the first 36 miles after leaving Rochester, it passes through the rich level low-land district lying in the valley of the Genesee, between the Erie Canal and Mount Morris, and it attains the latter point by a lockage of only 95 feet divided into ten locks. But immediately on leaving Mount Morris, the character of the canal undergoes a great and sudden alteration. For nearly 17 miles south of that place, the bed of the river is confined within a precipitous and rocky defile, varying from one to four hundred feet in depth, which has been worn by the stream in its rapid descent from the upper country—and it becomes necessary to overcome this abrupt change of level, by very numerous locks, and by a tunnel and other expensive excavations. After surmounting this gorge, the canal finally attains its summit level upon the elevated table land in the county of Alleghany, which separates the waters flowing Northwardly into Lake Ontario, from those descending Southwardly into the Alleghany river. The summit is 11 1-2 miles long, and from its Southern extremity the canal descends, for 10 miles, down a gentle declivity to Olean. The Northern extremity of the summit is distant some 50 miles South from Mount Morris, and it is elevated 978 feet above the level of the Erie Canal at Rochester.

From this sketch of the line, it will be apparent that the principal physical difficulties which the work is obliged to encounter, are found on the middle division of the canal, of fifty miles in length, lying between Mount Morris and the summit. The lockage of the whole canal (excluding the 83 feet on the Dansville branch) is 1063 feet, and exceeds the total lockage of the Erie Canal by 395 feet, and of this amount, 889 feet are contained on the middle division.

The cost of the canal (excluding $314,520 43 for the Dansville branch) is estimated by the Canal Commissioners in their recent report, (Assembly Documents of 1839, No. 360,) at $4,585,602 36, and of this amount $2,928.046 is the cost of the middle division.

The question now presented by the resolution of the Assembly, is whether the cost of this canal can be lessened without impairing its usefulness?

The usefulness of the work will consist either in affording tolls to the public treasury, or in cheapening the cost of transportation. The terms of the resolution of the Assembly will, therefore, virtually exclude any plan of alteration which would materially lessen the revenues of the canal, or enhance the expense of using it.

The canal board are not possessed of all the facts necessary to enable them to estimate with sufficient certainty the future revenues of the canal. They fully appreciate its value to the interesting section of the State whose resources will be developed by its completion. In respect, however, to the tolls to be derived from it in the present state of the navigation of the Alleghany river, the board would observe, that in the year 1835, Frederick C. Mills, Esq., the engineer who surveyed the route, submitted an estimate to the canal commissioners of its probable revenues, (Ass. Doc. of 1835, No. 264, page 42,) in which be computed the tolls, independent of its probable contributions to the Erie canal, at $39,129 60. Of this amount, $13,207 was estimated for the tolls on the finer quantities of lumber and other products of the forest, which, it was supposed, would seek the New York market in preference to that on the Ohio and Alleghany rivers. A majority of the canal commissioners, (including the late acting commissioner on that canal,) in the report above referred to, have expressed their belief that the amount of $39.129 60, thus estimated, is "greater than will be realized for at least the first few years after the canal is completed."

Although the other members of the Board are not prepared to dissent from the opinion thus expressed, yet for the purposes of the present inquiry they will assume that this estimate of revenue is not exaggerated, as it will afford some criteron by which to judge of the quantity of transportation which the canal may be expected immediately to accommodate. The table of annual tonnage from which the above mentioned estimate of revenue was deducted, exhibits a quantity varying not much from 75,000 tons. being about one-tenth of the tonnage of the Erie canal, and one-fourth of that of the Champlain canal.

The probable amount of transportation to be expected on this canal becomes important to the present inquiry, because it will affect the question as to the degree of durability necessary to be given to the locks and other mechanical structures. It will readily be perceived that in constructing a work like the Erie canal, upon which the lockages last year were 25,962, being an average of 114 daily for the 228 days of navigation and where every interruption, even for the purposes of repair, is to be carefully avoided, it would be expedient and proper to impart much greater strength and solidity to the locks and other structures, than upon a lateral canal, like that under consideration, where, if the above estimate of its business be correct, not more than 10 or 12 boats would daily pass the locks.

By inspecting the profile of the Genesee Valley canal, it is apparent that a large amount must necessarily be expended in constructing its locks, which are 114 in number. To this branch of the work, the Board have therefore directed their particular attention, and they have inquired whether some change may not be made in the plan heretofore prescribed for the canal, which will lessen the heavy expense in which the State must otherwise be involved. A letter has been addressed by the present acting commissioner on that canal to the chief engineer, Mr. Mills, and a copy of his answer is hereunto subjoined, from which the following facts will appear, to wit:

1. The total cost of the 114 locks upon the present plan will be $1,574,095 50, or $13,807 86 each.

2. The 10 locks between Mount Morris and Rochester, will cost $171.901 10, or $17,190 11 each; and it is ascertained by the Board, that the 17 locks next south of Mount Morris will each cost somewhat more than the sum last named.

3. Of the 114 locks, 81 are to be built of stone, and the remaining 33 are to be of the kind termed "composite" being composed of stone faced with timber.

4. The locks on the Chenango canal, which are 114 in number, are (with the exception of five stone locks) all of them composite. They were built under the direction of Mr. Bouck, one of the present Canal Commissioners, and their average cost was $3,808 50 each.

5. The 35 composite locks on the Genesee Valley canal, will cost $8,684 60 cents each. But the engineer accounts for the difference between their cost and that of the locks on the Chenango Canal, by stating that they have three feet more lift than the latter, that they are to be more perfectly constructed; and that there has been a general enhancement in the price of provisions and labor, since the completion of the Chenango Canal, varying from 40 to 50 per cent.

6. The timber work of a composite lock will not need to be replaced more frequently than once in twelve years—and the annual repairs in the meantime will be small, amounting, in the opinion of the engineer, to twenty dollars for each lock; although he states that the actual cost of repairing the composite locks on the Chenango canal during the last season did not exceed five dollars each.

The total cost of replacing the timber portion of a composite lock will be about $900—and an abundant supply of timber suitable for the construction and maintenance of composite locks can be found near the line of the canal.

7. It is believed that stone of the proper quality for stone locks is only found on that portion of the canal between Mount Morris and Rochester, upon which the ten locks above mentioned are situated, and the canal commissioners, in their report (No. 360) above referred to, express an opinion that "between Mount Morris and Portageville there is no stone suitable for the face of locks, and that the same remark applies to the line at the summit level to Olean."

The locks being 114 in number, and surmounting an aggregate elevation of 1146 feet, their average lift is 10 feet. The average lift of the locks on the Chenango canal is only nine feet; so that in comparing the cost of the locks on the canals, one-tenth must be added for the increased lift of them on the Genesee Valley Canal.

Upon these facts the Canal Board think it must be apparent that a material reduction can be made in the cost of the locks on the Canal in question.

The average cost on the composite locks on the Chenango Canal was	$3,808 50
To which add one-tenth for one foot additional lift,	380 85
	$4,189 35
Add for enhancement of prices of labor and provisions since the completion of the Chenango Canal, say 45 per cent	$1,884 60
	$6,073 95
At this rate 114 composite locks on the Genesee Valley Canal would cost ($6,073 95 by 114,)	$692,430 30
But upon the plan now in progress of building 83 stone locks and 32 composite locks, (the latter costing $8,684 60 each,) the expense will be	$1,574,095 50
Showing a difference of	$881,665 20

In case, however, it should be deemed expedient to build composite locks on this canal, of a quality superior to those on the Chenango canal, and similar in plan to the 33 composite locks now under contract, then the cost

of 114 such locks would be ($8,684 60 by 114,)	$498,044 40
Cost of continuing the present plan as above	$1,574,095 50
Difference of outlay,	$584,051 10

In respect to the future cost of maintenance, the account would stand:

To replace the timber work of 114 composite locks at $900 each,(although the Board are inclined to think this charge too high,)	$102,600
But the saving of simple interest at 5 per cent for 12 years, on the difference first above stated of $881,665 20, would be	$529,067
Or on the difference secondly above stated, of $584 051 10, it would be	$370,430
Leaving a gain, after replacing the timber work in the first instance, of	$426,400
And to the second instance, of	$267,830

It is proper, however, to state, that the ten stone locks between Mount Morris and Rochester, (and now in progress at a cost of $17,190 11 each,) are already so nearly completed that they cannot be changed with advantage; and some of the Board are of opinion that on this section of the line, where stone of proper quality is easily obtained, stone locks should have been constructed in any event. The saving, therefore, which is to be effected by changing the plan of locks, will not include the ten locks north of Mount Morris, and the total amount to be saved will thereby be diminished from 90 to 110,000 dollars. But as to the remaining 94 locks south of Mount Morris, the Board are of opinion that the change should be made which is above recommended, although it is the opinion of some of the members that if stone of a suitable character could be obtained near the work, stone locks even on that portion of the line, might be constructed with advantage.

(To be continued.)

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THE GREAT WESTERN RAILWAY.

INTRODUCTORY LETTER OF NICHOLAS WOOD, ESQ.

Killingworth, October 3, 1838.

To the Directors of the Great Western Railway :

GENTLEMEN,—In compliance with your request of the 26th July last, communicated to me by your Secretary (Mr. Saunders,) I have visited and minutely inspected that portion of the works of the Great Western Railway between the London terminus, at Paddington, and the bridge across the Thames, at Maidenhead; and I now beg to submit for your consideration, the progress I have made in that survey, and the additional inquiries and information which appear requisite to fulfil the important task imposed upon me, either with satisfaction to myself, or with advantage to the interests of the great work confided to your management. To place before you more clearly the present state of the inquiry, and the objects requiring further investigation and elucidation, I beg to refer to my instructions for the survey, of which the following is a copy:—

Great Western Railway.

PRINCE STREET, BANK, 4th Sept., 1838.

Sir,—The Directors of the Great Western Railway are desirous of obtaining your assistance in coming to a sound and practical conclusion as to their future proceedings, with which view they have to request that you will undertake an examination of that portion of the line now completed, and investigate the result of the whole system which has been adopted.

Your attention is more particularly to be directed to those points which may be said to constitute the peculiar feature of the Great Western line as contrasted with those other railways, and this will, of course, bring under your consideration the construction and efficiency of the engines, as well as every matter connected with the locomotive department of the Company. The Director will thank you at the same time to give your attention to the bridge over the river Thames, at Maidenhead, for the purpose of communicating your opinion as to the construction of it generally, as well as to the efficiency of the means proposed to remedy an existing defect in one of the arches.

They will also be glad to receive from you any suggestions or information which you may be able to afford them as to experiments made, and general results obtained on other railways.

I am desired to assure you, that every facility or convenience will be given to enable you to form your judgment in any manner which you may suggest to me, as most conducive to that end.

I am, Sir, your most obedient servant,

CHAS. A. SAUNDERS, Secretary.

Nicholas Wood, Esq., Killingworth.

It is scarcely necessary for me to allude to the very important interests, the immense capital, and the great controversial questions involved in the inquiries comprised within these instructions. Two gentlemen, eminent in their profession, had it appears, been applied to by you to undertake and assist in the inquiry, and had declined; it would have afforded me the greatest satisfaction to have been associated with, and to have had the benefit of these gentlemen's talents and practical experience in the inquiry, and it likewise would have been no trifling consideration to have been relieved from a portion of the responsibility attached to the great and imposing interests connected with the investigation.

In the same degree, however, as I should have been relieved from responsibility, had I had the assistance of these gentlemen, is that responsibility increased by the task being confided to myself alone, and it therefore became of the utmost consequence, that the inquiry should be conducted in such a way, if possible, as that the conclusions should carry with them the confidence of yourselves, that of the Proprietors of the great work entrusted to your management, and also that of the other interests which might be affected by the comparison alluded to in your instructions.

Duly impressed with the importance of these considerations, it appeared to me, there were only two modes by which the inquiry could be conducted, either, that I should have paid a personal visit to the works, minutely examined them in all their features, and relying upon the information thus obtained, to have contrasted this with the existing knowledge which I possessed, or which I could obtain, of the capabilities, powers, &c., of other railways, and to have reported to you my opinion, founded upon these data of the comparative merits of your system as contrasted with that of existing railways constructed in the ordinary manner; that I should institute such inquiries and make such experiments as would fully and decisively develope all the minutiæ, properties, and capabilities of your system; and if the existing information as to others railways did not afford similar conclusive data for comparison, to institute corroborative experiments on other railways; and thus by a comparison of experimental data, practically conducted, to determine the relative capabilities and powers of the two systems in all their bearings.

To have conducted the inquiry according to the former of these modes, however carefully and minutely the inspection had been made, would not have amounted to more than conclusions, founded to a very considerable extent upon individual opinion; and it did not appear to me that any conclusions resting upon such a foundation alone, could either be satisfactory or decisive to yourselves, or to the Proprietors.

It appeared to me, that unless the inquiry was conducted in such a way as to elicit by incontrovertible and practical experiments, the relative capabilities of the two systems of forming and constructing railways; and that the comparison could be made from these data, it would be of no utility whatever that a survey terminated and founded on mere opinion alone, even if conducted by gentlemen more experienced and capable than myself, would not only be a waste of time, but would be attended with perhaps still worse consequences, viz: that of exciting controversial discussions, with rival interests involved in the question, without furnishing materials for arriving at any satisfactory conclusion.

It was with these impressions, therefore, that after I had consented to undertake the inquiry, I solicited from you permission to conduct the investigation by experimental data; and I cannot withhold my testimony that such a proposition met your ready concurrence, and that in conducting these experiments I have uniformly received all the assistance in your power, and also of those connected with the establishment.

With these observations as to the principle of conducting the inquiry, I shall now proceed to give you in detail the progress I have made, and to point out what, in my opinion, is yet required to solicit the requisite information to enable me to comply with your request to the extent which appears to me really necessary, and to which it ought to be carried, to be productive of practical and useful results.

The system of constructing the Great Western Railway differs from that of the other extensive railways of the country, by the increased width of gauge and in the description and plan of laying the rails, with all the subordinate alterations consequent upon such a departure from the ordinary width of railways.

The increase of gauge has been from 4 feet 8½ inches to 7 feet; and the prominent reasons assigned for such a departure from the common width is, the attainment of a higher rate of speed—increased lateral steadiness to the carriages and engines—a diminution of the friction by the use of wheels of a larger diameter—and a greater space afforded for the works of the locomotive engines.

The deviation from the ordinary mode of constructing the railway has been, the substitution of continuous longitudinal timbers, with piling at certain intervals, and cross transomes; with iron rails of a particular form screwed down upon their longitudinal timbers.

The additional width of gauge has increased the breadth of the entire track of the railway between the outside of the rails of the two lines (including the breadth of the rails) from 16 feet 3 inches to 20 feet 10 inches; consequently all the works connected with the formation of the road will be increased to a certain extent, but not in proportion to the above figures. The plan of continuous wooden timbers and piling also involves an additional cost beyond that of forming railways according to the ordinary method.

The questions submitted to me for consideration, therefore, appear to me to be shortly these—are the advantages professed to be obtained by this departure from the ordinary plan of construction of railways and increased width of gauge, realized? To what extent—at what additional cost—and are the advantages an equivalent for the increased cost of forming the railway according to this plan, viewing the whole subject in connection with the present state of the works?

Acting upon the principles hereinbefore explained as to the mode of conducting the inquiry, it was my object, as much as possible, to subject all, or as many as could be, of the properties of this railway as contrasted with others, to direct experiment; certain advantages are stated to be derived from this departure from the ordinary width and plan of constructing railways; and the circumstance of 23 miles of this railway having been opened, and having been in operation since the 4th of June, appeared to me to afford an opportunity of subjecting to the test of experience, and of obtaining correct and indisputable results by carefully-conducted experiments, *that which rested on conjecture, or casual observation.*

It is perfectly true, that a daily opportunity has for some time existed of observing the rate of travelling with the passenger trains on your railway, by which some result of the rate of speed accomplished, or likely to be realized when a greater length of line was opened, might be obtained, but the engines on the Great Western differ in many respects from those employed on other railways, and also from each other; if, therefore, extended observations had been made on the rate of travelling, it was necessary to distinguish what was due to the road, and what to the engines—and if any increased speed or greater performance was accomplished, whether such was applicable to the railway itself, or to the particular construction of engine only, and whether, by the application of similar engines to other railways (if practicable,) the same results would not accrue.

If this had been done, no doubt important and valuable information would have been obtained; but that would have been, in fact, the very sort of inquiry, by your own people, which you have determined to entrust to others; and it may be remarked, that if the inquiry had been conducted by yourselves, it could not have been at all conclusive or satisfactory in the comparison with other railways, and without such comparisons it would have been useless.

At the first outset of the inquiry, it therefore appeared to me necessary to institute a set of experiments, to ascertain the actual performances of the locomotive engines upon your own railway; with this information carefully obtained, we then had the real working powers of the railway; by employing heavy loads we obtained correct data for determining the maximum weight which the engines then upon the railway could drag, at determinate rates of speed; and by subjecting the engines to very light weights, we likewise determined the maximum rate of speed with certain known loads; and by recording the quantity of coke consumed and water evaporated in each trip, we also ascertained, with considerable accuracy, the comparative cost of motive power in dragging different loads at different velocities.

These experiments appeared to me to be highly necessary and valuable, inasmuch as whatever difference of opinion might exist (in the absence of correct experiments to ascertain the fact) as to the friction of the carriages, or resistance of the road, as compared with others, these experiments, by determining the real practicable expense of working the rail-way, would at once ascertain what increased rate of speed could be accomplished, and at what additional cost of motive power such higher rates of speed was attained. These experiments would, in fact, anticipate, so far as the powers of the engines reached, the experience of some years of regular work upon the railway, and with more correct results. On my arrival upon the line on the 17th instant, I therefore commenced a series of experiments on the working powers of the engines, which were continued under my own observation during the ten days I remained there, and are now in operation, and will shortly be completed by persons in whom I have perfect confidence.

It would be premature, to say the least, at this stage of inquiry, to give any results derived from experiments not yet complete; but it may be some gratification to the Proprietors of this great work to state, that one of the engines, the North Star, accomplished an average performance from London to Maidenhead and back, of dragging 180 tons, including engine and tender, at the rate of nearly thirty miles an hour, and that on some occasions for short distances a rate of forty-five miles an hour was attained.

When the powers of the locomotive engines and capabilities of the Great Western Railway are thus obtained, in order to comply with your instructions, and contrast this information with the capabilities of other railways, it will be necessary, in order to arrive at correct and conclusive results, that we should have the result of a similar set of experiments made upon railways of the ordinary construction. Although isolated experiments have been made by different individuals on several railways, and although I have made several myself, it does not appear to me that a set of experiments have yet been made sufficiently extensive and varied to fully develope the capabilities and powers of other railways, so as to form indisputable data for contrasting with the experiments made upon the Great Western. The Directors of the London and Birmingham Railway, in the most liberal manner, grated me full permission to make any experiments on their railway, consistently with the uninterruption of their traffic, and Mr. Robert Stephenson, the Engineer in chief, kindly assisted me all in his power, and furnished me with some experiments he had made on that railway on a former occasion. I deem it my duty, however, to state to you, that I do not think the information I am in possession of is sufficiently extensive or conclusive, as regards other railways, to enable me to make a comparison with the performances of the engines on the Great Western, so as to arrive at an incontestable conclusion; nor do I think it right that I should go into a comparative statement at all, unless the data be equally conclusive or carefully deduced on both sides. The information I at present possess does not enable me to go further than report to you the performances of your engines on the Great Western Railway; and if it be your wish that I should comply fully with your request, and contrast their powers with the performances on other railways, it will be necessary that some experiments, similar to those performed on your railway, should be instituted on some of the ordinary railways of a different width of gauge. It will not be necessary that the experiments on those railways should be equally numerous, as the engines on the other railways are generally of one description, and consequently one or two sets carefully conducted will be sufficient. It may be asked, what practical advantage will result from all these experiments to the interest of the Proprietors of the Great Western railway? The answer is shortly this—it is admitted that the construction of that railway involves an increased capital; it is, therefore, quite necessary to determine what are the additional advantages, in a practical point of view, resulting from this mode of construction, and whether the advantages are greater or less than are equivalent to the increased cost of construction.

These observations apply more particularly to the plan of construction of the Great Western Railway generally, and to the capabilities of the entire system or to the increased gauge, and the mode of construction combined; but it is not necessary to the adoption of an increased gauge, that the railway should be constructed on the plan adopted by Mr. Brunel; it may be constructed on some modified plan of that system, or it might even be constructed on the plan of the London and Birmingham, or Grand Junction Railways. Neither is it absolutely necessary, if an increased gauge be deemed advisable, that such increased gauge should be precisely seven feet: all these are separate and distinct questions, requiring different and distinct investigation; and, therefore, the simple acquirement of correct information of the comparative capabilities of the Great Western Railway in its present state, with the other existing railways, does not appear to me to comprise the whole question. It appears to me to admit of inquiry whether the width of gauge adopted by Mr. Brunel is or is not that which conduces most to accomplish all the objects for which its departure from the more established width was deemed advisable, and also whether the mode of construction of the railway is the best that can be devised, or in what way it can be improved, consistently with the objects required to be attained, and with due regard to economy.

The plan adopted by Mr Brunel, as previously stated, consists of longitudinal timber bearings, secured by piles at proper distances, with cross transomes, double at the joinings of the longitudinal timbers, and single at the intermediate piles; and upon these continuous bearings, iron rails of a particular form are fastened by screw bolts.

It has been alleged, that one of the objects of the increased gauge was a greater stability to the carriages, and consequently less vibratory; or greater smoothness of motion to the passengers. It appears to be, therefore, one of the subjects of inquiry, how far this is realized—whether such a desideratum is accomplished, and to what extent. Keeping in view the principle set out with in this inquiry, of, if possible, subjecting to experiment mechanically every minutiæ, rather than to rely on opinion, or the more fallacious evidence of our senses, I had constructed an instrument for measuring and recording upon paper all the oscillations or vibrations of the carriages, from one end of the line to the other; and by transferring this instrument to the carriages of the ordinary railways, incontrovertible evidence is obtained, and such as can be appreciated by any one, of the relative vibratory motion of the carriages on the Great Western Railway, compared with the motion on other railways.

We have thus produced a diagram upon paper, showing the number and extent of the vibrations of the carriages—and hence it can not only be ascertained if there does exist less motion on this railway than on other of a less width of gauge, but to what extent; and this is thus made capable of being a subject of arithmetical determination.

It was soon found, however, and this shows the importance of this mode of investigation, that the motion of the carriages on railways was a compound one; that besides a vertical motion, it was composed of an horizontal oscillatory motion, and of a transverse undulatory motion combined; and it appeared, so far as we could depend upon observation, that less of one description of motion existed on the Great Western Railway, and more of the other, than upon the ordinary railways; it therefore became necessary, and of some importance, to measure and determine each of these motions distinct from the other—not merely for idle curiosity, but for the purpose of ascertaining the causes of each—and having done so, to attain the first step towards accomplishing a remedy. All this applies to the compound action of the rails and the carriages; and it will be seen that such a complication of motions required not only time, but extreme labour and attention, to investigate.

We now come to, perhaps, the most important consideratum, that of the construction of the railway; this is, the substitution of longitudinal continuous bearings of timber, with piling, instead of isolated stone blocks, or transverse timber sleepers, or, indeed, continuous timber bearings, without piling.

The investigation of this part of the subject, according to the principles laid down in this inquiry, was attended with extreme difficulty.

The first subject for investigation was, the relative firmness or solidity of base exhibited by the continuous bearings of timber with piling, and compared with stone blocks, or continuous bearings without piling; to determine this, I had an instrument, or deflectemeter, made, which being placed underneath the rail, measured the amount of deflection when the rails or known weights passed over; and the more accurately to determine the precise action of the load in passing over the rails, I employed three deflectometers at the same time. The motion of one with the other was effected by a rod between each instrument: one was placed underneath each of the supports or transomes opposite the piles, and one in the middle of the rail; and by a similar contrivance to that employed in the instrument for measuring the oscillations of the carriages, I got a tracing of the deflection of the rails recorded upon paper, and thus obtained correct diagrams of the deflection, at each of the places, at the same moment of time.

By subjecting the rails with piling in all their varieties, and also continuous bearings of the same scantling of timber without piling, to the deflectometer, I obtained a measure of the relative firmness or solidity of base of these two varieties of construction; and by likewise employing the same instruments to measure the deflection of the rails and depression of the blocks, or cross sleepers, on other railways; I thus obtained the relative firmness of base of all these different modes of construction; and these diagrams being capable of being transferred to, and embodied in a Report, and measured with undoubted accuracy, will enable any one to pass their own judgment upon the relative firmness of base of those different plans. It will at once, however, be seen, that admitting we have obtained the relative firmness of base of the existing plan of construction of the Great Western Railway compared with that of known plans of construction of other railways; the degree of stiffness developed by the former, comprehends both the section of the timbers, and that of the rails; and that such a plan of continuous bearings either with or without piling, does not necessarily imply the use of that particular form of iron rails. It was, therefore necessary to determine what part of the deflection was due to the timbers, and what to the particular form of rail. To accomplish this, I purpose having these rails removed, and the same rails which were subjected to experiment on other railways, where stone blocks or cross sleepers were used, substituted; when the deflection will be again measured. By a combination of these experiments in all their varieties, I expect to arrive at results which, not being matter of opinion, but facts, deduced from carefully conducted and self-recording experiments, cannot fail of producing the most important, if not conclusive, results.

Independently of those experiments, to elucidate all the minutiæ of action of the different parts of the system of railway mechanism, and others, which it is not necessary at this time to enumerate, I subjected to experiment, so far as the means and circumstances afforded me, the resistance and friction presented by the Great Western Rails to the passage of the carriages and engines along them; and by pursuing a similar course of experiments on other railways, we shall thus have valuable corroborative evidence to that of the experiments made with the engines, of the relative resistance of the Great Western Railway, compared with that of railways of the ordinary width.

With the exception of some experiments on the London and Birmingham railway, made on my survey, and which were not sufficiently varied or sufficiently numerous to afford conclusive results, we still require further evidence of the resistance of the carriages and engines on other railways, to compare with those made on the Great Western Railway, in order to arrive at conclusive results, or indeed to enable me fully to comply with my instructions for this inquiry.

After the previously detailed account of the mode in which I have deemed it necessary to conduct the investigation of the important task entrusted to me, it will scarcely be necessary for me to say, considering the immense interest involved in the inquiry, the time required, and the care requisite to conduct so extensive a course of experiments with a proper regard to accuracy, that there is not sufficient time either for a careful consideration of the subject, or for completing the necessary experiments or investigations, so as to enable me to report to you, previously to the meeting of the Shareholders on the 10th inst.; I regret that a pressure of other business prevented me from applying myself to this inquiry until the middle of last month. Since then the requisite experiments have been unremittingly prosecuted, and are still in operation. To properly digest and arrange so extensive and complicated a course of experiments, comprising so many subjects of inquiry, has occupied considerable time; and when it is further considered, that to properly elucidate and develope experimentally all the various properties of the system, it required instruments to be contrived and constructed during the progress of inquiry, as the different modes of action were developed, it will not be wondered when I say that the inquiry is far short of being so completed, as to enable me to report fully to you in accordance with my instructions.

Notwithstanding all my anxiety and desire to subject to the utmost possible extent all the features of this system to experiment, there will still remain many parts of the duty you have imposed upon me which cannot be subjected to experiment, and on which it will be necessary to exercise the judgment; particularly with regard to the probable cost of working the system permanently, and those parts of the inquiry which experience alone can conclusively determine; in approaching this part of the inquiry, I am desirous of having all the experience which the short period since the opening has afforded, and all the information possible to be obtained. Even if the experiments had been concluded, and even if the question had not been that of a comparison with other railways, I do not think there existed sufficient time between my entering upon the survey, and the period fixed for the meeting of the Shareholders, to enable me to investigate with sufficient minuteness, or consider with sufficient attention the important question of the capabilities of your works alone, so as to report upon them without contrasting them with the capabilities of other systems of railways.

It would, no doubt, shorten the inquiry considerable, were I only required to report upon the capabilities of the Great Western Railway alone, without contrasting it with other railways; but I consider it incumbent on me to state to you distinctly on this head, that such a limitation would preclude me from answering that portion of your request which imposes upon me the task of advising you in arriving at a "sound and practical conclusion as to future proceedings."

It will be necessary, therefore, that you should determine whether the inquiry is to be conducted in the more extended plan, which I have pointed out in this communication, or that it shall be conducted in the more limited mode of reporting to you the capabilities of your own works; if the latter, the present state of the experiments will enable me, in the course of three or four weeks, to report to you in that limited view; but if the investigation is to be extended to that of a comparison with other railways, in order to arrive at incontrovertible results, it will require a further time before the necessary experiments can be made, and the requisite information obtained to enable me to draw out my report.

Notwithstanding the disappointment which the Shareholders must feel, at not being furnished with the report, for which it appears to have been the object of the meeting on the 10th instant, I feel quite confident that at this stage of the inquiry they will consider it quite imprudent and improper in me to offer any opinion whatever on any of the many important questions submitted to me for investigation. I have approached the inquiry with the utmost determination of impartiality, and of arriving at no conclusions except such as are deduced from facts, or from incontrovertible experiments. It is my intention to embody in my report all the facts and experiments on which any conclusions are founded; and aware of the important interests involved in the comparison proposed to be made between the system of the Great Western and that of other railways, I think it would operate prejudicial to the inquiry if the result of any part of the experiments or investigations, except those already alluded to, should be given, however anxious the Shareholders may be for information.

In arriving at this conclusion, I have been guided by a firm conviction that the interests of the great concern entrusted to your management will not suffer by such a proceeding, or by any delay occasioned by a more minute investigation than the Proprietors probably originally contemplated; for the result of the investigation must be a developement of a more conclusive nature than has yet been elucidated of the system of construction adopted on the Great Western, as well as all the other different plans of construction of railways; which cannot fail of being productive of considerable advantage not only to your interests, but also to those of every one connected with that system of internal communication.

I am, Gentlemen, your obedient Servant,

(Signed) NICHOLAS WOOD.

Report of John Hawkshaw, Esq.

To the Directors of the Great Western Railway:

Gentlemen,—Your instructions of the 5th September are to the following effect:—That you are desirous of obtaining my assistance in coming to a sound and practical conclusion as to your future proceedings, directing my attention to those points which may be said to constitute the peculiar features of your railway, as contrasted with others, including the construction and efficiency of your engines, as well as every matter connected with the locomotive department.

My attention is also called to the bridge at Maidenhead, as to its construction generally, and as to the means proposed to remedy an existing defect in one of the arches. To arrive at an opinion, I am desired to undertake an examination of that portion of the line now completed, and investigate the result of the whole system which has been adopted.

To come to a proper conclusion, it appeared to me to be necessary that I should make myself acquainted with the general character of the whole line, and consequently I have been over its whole length to Bristol. It seemed also desirable that I should inform myself, as accurately as possible, as to the traffic to be expected upon it, generally, and in the aggregate, for this certainly forms one of the most essential features of all lines.

The question seems also to require a still more extended view than this; the district into which it goes has to be glanced at; the area and extent of population, which may be looked to for collateral traffic, has to be seen; and these have to be compared with districts through which other lines have been made, and where other lines are at work.

The necessity for such a view of the question became apparent to me, because, on coming first upon your road, that which immediately strikes is, the enlarged capacity of all things, engines, carriages, and road. And the existence of such an arrangement pre-supposes, in my view, an equally enlarged traffic; trains of much greater weight, and of a greater number of passengers than elsewhere. In short, though not to an equal degree, the difference between your arrangements, and those of other railway companies, is something like the difference between a canal for barges and a canal for ships; and this comparison will not be extraordinary, should it appear, that taking your gradients into the question, your locomotives have twice the power of those on other lines; and the contrast will not have been useless, should it be shown, that it would be a parallel case to build a ship of 200 tons burthen, when there was no probability of ever obtaining cargo of half the weight.

Further, I may extend these preliminary remarks, by observing, that the object which I presume you have in view is, (after paying a due regard to the accommodation and convenience of the public,) to carry out your measure in such a manner, as shall be most conducive to the interests of those who have invested their property in it. That this should be your object there can be no doubt, and I wish to place it here as *the desideratum*, because it is one thing to design that which shall be pleasing in outline, and grand in dimensions; and it is altogether another thing to design that which under all the circumstances shall best answer the end in view; one of those ends being to obtain a return for the capital invested.

I am desirous that it should not be thought that I am here prejudging the question. To all questions there are conditions, and I only wish it to be clearly understood what are the conditions of the question, which, as I understand it, this report professes to consider. And they may be repeated; that in carrying out the measure, there is to be *the fullest regard to the wants and conveniences of the public;* but also a constant regard to the prospects and expectations of the Shareholders.

Now, it will not be difficult to show, that the legitimate interest of these two parties are one.

The profits of a railway are determined by the ratio of the proceeds to the cost; if the latter be greatly increased, it becomes almost imperative on the proprietary to increase the former; either by curtailing the accommodation, or by increasing the charge to the public. The public, therefore, is interested as much in the economy of railroads, as in the economy of manufactures; in the one case, if it be in fabrics, it will cause a reduction of the price per yard; in the other case, it will cause a reduction in the rate per mile. And if the public, in the extended sense of the word, is to be benefitted by economy being exercised in the construction of a railway, the public, in a more limited sense of the word, or the more immediate district through which the line passes, will derive still greater advantage.

Suppose for instance, that the problem to be solved was, to give the greatest impetus to the trade, and the greatest advantage to the town of Bristol. The way to solve this problem, I think, would be, to connect it with the Metropolis by a road on which parties could be carried for the smallest sum, and at a velocity not inferior to that at which they can be carried in any other direction. Now the cost at which a party can be carried will be, as the interest on the *capital expended*, added to the cost of working the road.

For instance, call the gross revenue of a road paying 10 per cent., 100; and call the cost of working 50 per cent.; 50 will then be left to pay 10 per cent.

The capital ought not to be doubled advisedly, therefore, unless one of these two things is to be accomplished by it; either that the cost of working be reduced to nothing, or that the gross proceeds be doubled. Should the capital be increased without affecting any material reduction in the cost of working, the consequence will be, that, to increase the proceeds, the rates must be raised; and this may or may not be effectual; for an increase of charge beyond a certain limit will not increase the proceeds. If it should not be effectual, the Shareholders will suffer. If it should be effectual, the public will suffer, by having to pay the higher rates.

If, supposing in the case of a railway only partially constructed, it should turn out that the traffic has been as much under-rated, as the cost of the line had been increased, and that still a profit of 10 per cent. will accrue; yet it proves only this, that though in one case, by good fortune, a profit of 10 per cent. will be obtained; in the other case a profit of 20 per cent. would have been secured.

It would not apply this species of illustration to cases where the cost is increased of *necessity;* I would only apply it to cases where the increased expenditure is for some *specific object;* such as the attainment of much flatter gradients, or of very high velocities, or of much greater dimensions; which may, or may not be desirable, according to the result when tried by this rule.

Now supposing this species of test be applied to one great object which you appear to have in view; the reduction of a great portion of your line to a practical level, for the ostensible purpose of obtaining higher velocities, or diminished resistance.

Between your maximum parliamentary gradient, which was 1 in 528, or 10 feet per mile, and your present proposed gradient, which is 1 in 1320, or only 4 feet in a mile, the question stands thus:—

Calling friction, resistance from the atmosphere, &c., 10·2lbs. per ton, and adding gravity, the resistance on 1 in 528 will be 14·2lbs. per ton, on 1 in 1320 it will be 11·7lbs. per ton, making a diminution of resistance, when ascending, of 17 per cent. Now, supposing your railway was one inclination throughout between the extreme termini A and B; in rising from A to B the increased resistance of 17 per cent. would be felt, and a corresponding increase of steam would have to be expended; but in descending from B to A there would be a diminished resistance in the same proportion, and a smaller quantity of steam would be required; and in such a case, as it regards *cost* of working, there would be very little advantage in one gradient over the other. The maximum load that an engine could draw on an incline of 1 in 528, would be less than on 1 in 1320; but on an incline of 1 in 528 all average loads could be taken.

On an incline of 1 in 528 also, to carry *the same load*, an engine would have to be a trifle heavier than on 1 in 1320; but on 1 in 528, to carry full average loads, an engine could be made of as light weight as they ever are, or perhaps can be made, consistent with the requisite strength.

If, instead of having one inclination, the line consisted of a series of inclinations greatly undulating, the advantages of the flatter line would approach nearer to 17 per cent.; not but that it would still follow, that in going up the steeper gradients there would be increased resistance, and in gowing down there would be diminished resistance in equal proportion; yet in practice it has been found, that unless the inclines be of very great length, advantage cannot be taken of the diminished resistance in going down as regards *steam;* for though it is not wanted to an equal extent, yet a great portion is wasted by blowing off at the safety valve.

But your line corresponds to neither the latter nor the former of these cases; it is neither composed entirely of one plane, nor of a series of planes *greatly undulating;* but, in result, it will approach nearer to the former case than the latter; for it may be said to be composed of two great planes, one rising up to the summit, the other descending from it; one upwards of 70 miles in length, the other upwards of 40; and dividing your line at the summit into two parts, it would then be analagous to the former case; in which it appears that practically, and as regards cost of working, there would be no very material difference between the inclination of 1 in 528, and of 1 in 1320, *when so circumstanced.* If in your line, therefore, the advantage of one gradient over the other be put at 8·5 per cent., it will, in my opinion, be the *full* equivalent.

Now, if the whole cost of working a railway was expended on locomotive power, by reducing the gradient from 1 in 528 to 1 in 1320, a saving of 8·5 per cent. would be effected; and therefore an increase of 8·5 per cent. to the capital to obtain it, would not be expended uselessly.

But the expense of working railways does not consist entirely of the cost of locomotive power. There are other expenses that remain constant, whatever saving be effected in the locomotive department; and this fact should be kept constantly in view during the remainder of this report.

Taking the Liverpool and Manchester Railway as a standard, it will there be seen that the cost of power does not form one-third of their half-yearly expenses. It is upon this item only, therefore, that an alteration of the gradients of the nature I have been describing would effect a saving of 8·5 per cent.; and 8·5 per cent. upon one-third of the annual expenses, will be only 2·8 per cent. on the whole of the annual expenses; and therefore a company would do wrong in increasing their capital more than 2·8 per cent. to effect such an alteration.

But the small saving to be obtained in many cases by reducing gradients below a certain inclination, may be proved by an appeal to actual practice; not experiment only, but the every-day results of lines in operation, which is far better; for it is upon the every day business that the saving must be effected, if it is to be.

Contrasting your line with one which opened about the same time, which also has continuous bearings; upon which an equal velocity has been maintained, and which, as will appear from the statement below, has very different gradients, it will be seen, that in a case like yours I have put the advantage of a gradient of 1 in 1320 over 1 in 528, high enough.

Gradients on Great Western.

Miles.	Chains.				
"	16		level		
2	1	rises	1	in	1760
7	43	"	1	in	1320
"	40	"	level		
2	48	falls	1	"	1760
"	40	"	1	"	1320
1	72	"	level		
"	30	falls	1	"	1980
1	40	"	1	"	1320
"	20	"	1	"	4640
1	40	rises	1	"	2640
1	"	"	1	"	2112
"	20	"	1	"	1320
"	30	"	1	"	1980
2	"	"	1	"	1320

Gradients on Manchester and Bolton Railway.

Miles.	Chains.				
"	10	level			
"	26	1	falls	in	1312
"	28	1	rises	"	160
"	16	level			1034
"	35	1	rises	"	1834
1	50	1	"	"	544
4	61	1	"	"	200
1	32	1	"	"	274½
"	62	level	"		

The following are the results of four weeks' traffic on each of these Lines, ending the 13th September.

Great Western Railway.

Average number of trains per day		14
On Sundays		12
Times of running		8, 9, 10, 12, 4, 5, 6, 7
Average number of carriages per train		6 . 5
Average number of passengers per train		111
	Tons.	cwt.
Average weight per train	40	5
	lbs.	
Average consumption of coke per mile	51 . 00	
Average consumption of coke per ton per mile	1 . 26	
Average consumption of coke per passenger per mile	0 . 45	
Length of trip	22½ miles	

Average time, 55 minutes, with two stoppages.

Manchester and Bolton Railway.

Average number of trains per day	20
On Sundays	4
Times of running	7, 8, 9, 10, 12, 2½, 4, 5, 6, 7
Average number of carriages per train	6

Average number of passengers per train . . .		72
	Tons.	cwt.
Average weight per train	24	1
	lbs.	
Average consumption of coke per mile . .	27 . 00	
Average consumption of coke per ton per mile .	1 . 16	
Average consumption of coke per passenger per mile	0 . 36	
Length of trip	10 miles	
Average time of making it, without stoppages .	27 minutes	

Average time, 35 minutes, with 5 stoppages.

From the foregoing statement, it would appear that the consumption of coke is considerably less on the line with steep gradients. But the average weight per train is in each case exclusive of the engine and tender.

The average weight of engine and tender, in working order, on the Great Western Railway, will be 27 tons.

On the Manchester and Bolton Railway, the engine and tender, in working order, weigh 16 tons 4 cwt.

Adding these to the respective trains, the average weight of the Great Western train, including engine and tender, will be 67 tons 5 cwt.

The average weight of the Manchester and Bolton train, including engine and tender, is 40 tons 5 cwt.; and

Consumption of coke per ton per mile on the Great Western, including weight of engine and tender, is 0.75 lbs.

Consumption of coke per ton per mile on the Manchester and Bolton, including weight of engine and tender, is 0.67 lbs.

And on the Leeds and Selby Railway, with the following gradients, the results of a month's working, ending 13th September, are as under:—

Gradients.

1½	Miles	rises	1	in	210	3	Miles	falls	1	in	135
1	"	"	1	"	176	3	"	"	1	"	152
2	"	"	1	"	852	6½	"		level		
3	"	"	level								

Average number of trains per day, 7—2 on Sundays.
One train extra on two market-days per week.

Average number of passengers per train - - -		57
	Tons.	cwt.
Average weight per train, exclusive of engine and tender	32	5
Average consumption of coke per mile - - -	36 . 00 lbs.	
Average consumption of coke per ton per mile - -	1 . 1 lb.	
Average consumption of coke per passenger per mile -	0 . 63 lbs.	
Length of trip - - - - - - - -	20 miles.	

Average time 1 hour 7 minutes, with four stopages.

The next subject for consideration is the increase of gauge. In examining this question, it will be necessary to put aside useless and erroneous objections, for the enquiry is one on which I am not only anxious to arrive at a proper conclusion myself, but I am desirous of enabling others to do so also: and throughout this Report I shall rather aim at developing the process by which the opinions it contains are arrived at, even at the risk of being tedious, and aware, though I am, that this will be laying it more peculiarly open to any who should be disposed to cavil at it; yet, on such a subject, it is better that it should partake more of the nature of demonstration than of mere assertion.

It may be observed here, that much that is absurd has been applied to the question of gauge: some have looked for advantages so great as would have left them little less than magical; they seem almost to have expected that on *such a gauge* the carriages would run of themselves. Others, on the contrary, seem almost to have expected that on such a guage carriages could never be made to run at all. It has been applauded to the skies as being wonderful; it has been decried, and cried down, as being little less than nonsensical. Now, it is neither the one nor the other of these; it is simply a railroad of greater dimensions than those hitherto constructed, and the only question is, is such an increase of dimensions judicious or not? And the next question will be, if injudicious, considering the amount in money to which you are committed to it, is it better for you to proceed or to make the alteration?

In the first place it may be stated, for there can be no doubt about it, that just as good a road can be made 7 feet wide as 5 feet wide; it is simply a question of cost. There are some, no doubt, who have connected the effects of the malformation of your road in the first instance, with the width of way, but of course eroneously so.

In the next place, in determining on the question of gauge, it should be considered quite independently of anything that may have been done upon your railway, which is not absolutely consequent on the increase of gauge; and I shall class among the non-essentials the peculiar mode of laying with piles, engines of 16 tons weight, and tunnels of 30 feet diameter.

It may be premised that determining the question of gauge in this country, is a very different question from determining it with regard to countries where the railway system is scarcely introduced. In England, what may be termed the great trunk, connecting the north with the south, has already been formed, or is in progress. Under the superintendence of men who were earliest connected with the Liverpool and Manchester railway, and with railways even prior to that, it has been constructed on a gauge of 4 feet 8½ inches. They had had more experience than others in railway matters; and their continuing the same dimensions as to width of way proves that they had found no occasion for altering it. Moreover, it is indisputably true, that they who have had the most experience, and who have been brought most into contact with the working of railways, see the least occasion for an alteration as to width, and are the most satisfied with the present gauge.

In addition to this main trunk, another line crossing it at right angles, and of which the Liverpool and Manchester, and the Leeds and Selby railways form a part, and which will connect the eastern with the western seas, is already constructed, or in progress, to a similar gauge; and other lines of great extent, some of them surrounding and piercing into the district into which your railway goes, are also formed, or are rapidly forming to the 4 feet 8½ inch gauge.

And it will not be too much perhaps to say, that three-fourths of England is already being traversed by railways to the narrower gauge.

It follows, then, that any Company deviating from this gauge will be isolating themselves to a certain extent; if not as regards their main line, yet as regards their branches; if not as regards their direct traffic, yet certainly as regards their collateral traffic

But, in the present early stage of railway traffic, it yet remains to be seen whether or not it may not become a great evil for a main line to be thus isolated and rendered impossible of connection with the great lines in its neighborhood; that it will be an evil in this sense as it regards the branch lines, there can be little doubt; for they or some of them, in course of time, will of necessity run into the neighbourhood of other lines of different gauge; but with these, however vital the connection may be, all connection will be impossible.

In this point of view only, it has become a serious matter for any Company in this country to make their line to differ as to dimensions from the majority of lines around them. It is to a certain extent as if a Canal Company in a country of canals should construct a new navigation so, and with locks of such a character as would totally shut out the boats of all the canals that surround it.

Still it is possible that there might be, coupled with the deviation, improvements of such a nature as would counterbalance the inconvenience, as would even compensate the loss. They might consist of arrangements that would effect a ***great and important saving in time and money***, and in a better conservation of the property to be conveyed: and it will be necessary to enquire if such will be the result of the deviation in your case as to the width of way.

If the 7 feet gauge is to effect a saving in money, it must be in one of two ways; either by calling for less capital in the first instance, or by reducing the cost of working afterwards. The first of these it cannot do. On the contrary, the capital will be increased certainly: to how great an extent it would be impossible for me without more time for calculation to say. But contracting the dimensions to the smallest limit; two ways of 7 feet must of necessity require a greater width than two ways of 4 feet 8½ inches. I should say to make a line equally as convenient, this increase of width would amount to 4 feet; for the width between the ways is not to be governed entirely by the maximum width assigned to the load. A certain width is found convenient for repairs and other purposes; and too great a proximity of the ways is dangerous; as by it an accident occurring on one line may be productive of disastrous consequences on the other, as I have seen. And the width outside the ways will also be nearly a fixed quantity whatever be the gauge; for a certain width is requisite for safety, and for allowing proper consolidation to the outer rail on the embankments, and to give room for drainage in the cuttings; and, therefore, the width of the road generally, to make as convenient a road, would have to be increased by the extra width given to the ways. And besides this increase of general dimensions as to earth work and land, the locomotives would of necessity have to be heavier, (I do not say to an equal extent to those you now have), and they would therefore be more costly to some extent. The permanent road will also cost more of the larger dimensions than if of the smaller; for it avails nothing to compare a light rail on the larger gauge, with a heavier rail on the smaller gauge! such comparisons must be made when other things are the same, or they amount to nothing.

If then the capital will of necessity be increased, the next enquiry is, will the cost of working be diminished? The cost of working will depend on the first cost of the engines; for though, in the first instance, they may be charged to capital, afterwards they will have to be charged to current expences. It will also depend on the repairs of the engines, the consumption of coke, and the maintenance of way; and on other matters which are in nowise connected with the gauge.

As it regards the cost of the engines, it will be greater on the wide gauge; as it respects the repairs of the engines, should it prove in favor of the wide gauge, it can only be in a small degree. For the repairs of locomotives on lines where passengers are carried at great velocities, have been found to be incurred chiefly on the wheels and axles, tubes and fire boxes, which cannot be affected by the gauge, excepting that if the wheels and axles be made larger, the repairs will be increased. And, at all events, the common repairs of a larger machine, necessarily so, in consequence of the larger way, but not necessarily so in consequence of any greater traffic, it is probable, will counterbalance any saving that might be effected in the repairs of the smaller gearing, in consequence of having more room to arrange it. Besides, a great portion of the repairs of locomotives is not for common wear and tear, but is on account of accidents. And in proportion as the machine is made larger and more expensive, so will the cost of repairs consequent on accidents be increased.

The maintenance of way will of course be *fully* as great on a wider way, and with heavier engines, as on a narrower way, with lighter engines; for perhaps it would not be advancing too much to say, that the engines and tenders do more harm to the superstructure of railways than all the rest of the traffic put together; excepting perhaps loads of long timber.

And, lastly, if the consumption of coke is to be reduced on the wider gauge, it can only be by the friction being diminished, or by what has been called the mechanical advantage of large wheels.

It would have been highly desirable if, before using this as an argument, the Irish Commissioners had clearly determined that there was an advantage in larger wheels. For there are some experiments and several reasons for doubting that any such advantage will be derived from increasing the size of wheel. As it regards the friction of attrition, or that caused by the rubbing of the axles, it may be supposed to remain constant, however the wheel be enlarged; if it be allowed that with an enlarged diameter of wheel, and especially when attached to a longer axle, there must be a corresponding enlargement of journal; and in practice I think this would be the case. And as regards the friction of rolling, it is not likely to be diminished by increasing the size of the wheel, for the rolling friction on rails is very different from the rolling friction on common roads, where obstacles are met with that have to be surmounted by raising the vehicle over them. Small wheels on turnpike roads have been found to create much more resistance. But on a railway, unless the wheels be very small, the obstacles to motion from causes of this nature must be nearly imperceptible. And there is another species of rolling friction, caused by the grinding of the flanges of the wheels against the rails, which will be more felt in large wheels than in small wheels, and especially round curves.

But to arrive at something more definite on this subject, I will give the result of some experiments made on your line on the 20th September.

A large train, consisting of 9 carriages, 1 six-wheeled waggon, and 11 trucks, laden with iron and stone, was got into motion up and down a long and perfectly straight inclination of 4 feet per mile. The experiment was first made upon the whole train, which gave a result of 6.22lbs. per ton friction.

The experiment was then made so as to ascertain the friction of the trucks and the carriages separately, one truck only being left attached to the carriages, and the result obtained was a friction of 6 5lbs. per ton for the trucks and waggons, which weighed together 79 tons 8 cwt.; and a friction of 8.15lbs. per ton on the carriages and one truck alone, which weighed in the aggregate 74 tons 12 cwt.

On the 26th September, I took 5 waggons on the Manchester and Bolton railway, each laden with $3\frac{1}{2}$ tons of iron, and experimented in the same way upon them, by getting them into motion, and noting the velocity and the distance run, from which the friction was determined to be 6.3lbs. per ton. The plane on which this experiment was made was terminated at each end by curves, one of 111 chains radius, the other of 67 chains radius. In the experiment up the plane the distance run was 2950 feet, the waggons having run 330 feet into the curve of 111 chains radius before they stopped. In the experiment down the plane the distance run was 3825 feet, 1980 feet of which was in the curve of 72 chains radius in which the waggons stopped. The same train of six waggons was then brought to an inclination where gravity alone was sufficient to get it into motion. This portion of the line had previously been divided by stakes into lengths of 100 feet, and the rails opposite each stake accurately levelled.

From the starting point to the ninth stake the line was straight, but at this point a curve of 42 chains radius commenced, and extended beyond the point where the waggons came to rest.

The result of this experiment, repeated twice, gave a friction of 7 32lbs. per ton; but it should also be observed that besides passing for 1300 feet along a curve of about $\frac{1}{2}$ a mile radius, the whole distance run being about 2200 feet, the train had to pass through three shunts before coming to rest, which will probably account for the friction being higher than in the previous experiments.

This line, as well as the Great Western, has continuous bearings of wood. Though for a short distance in the curves in all the experiments on the Manchester and Bolton railway, the motion was continued on continuous bearings of stone. The Manchester and Bolton line has a heavier rail of (53lbs. per yard).—And in the Great Western experiments, 3 of the carriages and 1 waggon had 6 wheels each, which have rather more friction than those of 4 wheels; but in such a large and heavy train, no great difference could be caused by this.

The whole of the wheels in the Great Western experiments were 4 feet in diameter, the journals 2 11-16 inches in diameter. In the experiments on the Manchester and Bolton railway the wheels were of 3 feet diameter, and the journals of 2 inches diameter: and 4 feet : 3 feet : : 2 11-16 inches : 2 1-16 or 2 inches nearly. But supposing that neither the foregoing experiments nor reasonings are to be decisive as to the mechanical advantage of increasing the size of the wheels, and I do not mean to say that they are, for to determine the question clearly the experiments should perhaps be made on the same road; yet still as a general question there will be several drawbacks on the theoretical advantage of the larger wheel, such as the greater resistance on curves with the wider way; more rubbing of the flanges against the rails, not only in consequence of the larger wheel, but of the greater breadth of way; for I think it is probable that friction would be reduced to a minimum by concentrating the whole momentum of one rail, and that friction will be increased in some train degree, as the distance between the wheels, or as the width of way is enlarged.

The next inquiry respecting the gauge is as to the matter of safety. If the gauge is to be altered on this account, it should only be because of a want of safety in the present gauge. If A be safe, there cannot be the smallest advantage in making B safer.

Now the question is, is the narrower gauge safe? It might have been reasoned a *priori* that the width between the railway wheels being equal to those of turnpike-road carriages, and from the very great weight of railway wheels and the under carriages, the centre of gravity being in all cases much lower on a railway coach than on a stage coach; and the railway itself being infinitely more smooth and perfect than the common road; that though the velocities are much greater, yet still there is no danger of overturning. And the fact is, I have never heard of a case of overturning, or of any accident that I should attribute to the narrowness of base, occurring. And from what experience I have had on railways, I believe it would be a most difficult matter to overturn the carriages upon them, with the present gauge, even if the object was purposely to do so, and an experiment should be made for the purpose. But having heard it urged that there was greater safety on the wider base, which may be granted, but which amounts to little if there is quite enough of safety on the narrower base; and being unable to call to mind a single instance of an accident or overturning in consequence of a narrower base, I addressed a letter to Mr Booth, the Treasurer of the Liverpool and Manchester Railway on the subject, to know if he had ever known an accident that could be attributed to the narrowness of base; I also wrote a similar letter to Mr. Smith, Engineer on the Leeds and Selby Railway, and I received the following replies:—

" *Liverpool and Manchester Railway, Lime-street Station,*

21*st Sept.* 1838.

" Sir,—I have to acknowledge the favor of your communication of the " 19th, inquiring whether or not, in my experience, there is any want of "safety in the present gauge, 4 feet 8½ inches, as to the chance of overturn-"ing; and also if I have known any case of overturning in consequence of " narrowness of base, or am aware of any accidents having occurred, which " I would ascribe to the the narrowness of the 4 feet 8½ inches base.

"In reply, I beg leave to inform you, that in my opinion there is not any " want of safety in the 4 feet 8½ inch gauge, and I am not aware of any " accidents having occured that I should ascribe to the 4 feet 8½ inch " gauge. The only case of overturning which I recollect occurred some " years ago, when, owing to the breaking of an axle, the engine (which " had only four wheels,) quitted the rails, and drew several of the carriages " over the embankment, near Bury-lane.

" Whether in such a case a broader base would have prevented the " carriages overturning, I will not pretend to say; it might depend on the " relative height of the carriages, and other circumstanees.

" I am, Sir, &c.,

(Signed) " HENRY BOOTH.

" John Hawkshaw, Esq."

Leeds, 21*st Sept.*, 1838.

" DEAR SIR,—In reply to yours of the 19th inst., we have had but one "accident (during the experience of four years) that was not occasioned " either by tongues being wrong or some obstacles in the way. The one " excepted, was caused by the repairers raising some wood sleepers too " much at once on a new-made embankment. I do not consider there is " any want of safety in the gauge, (4 feet 8½ inches,) nor do I know of any " accident or overturning which can be attributed to that gauge.

" I am, dear Sir, yours, &c.,

(Signed) " GEO. SMITH, R. E.,

" Leeds and Selby Railway.

" John Hawkshaw, Esq."

Besides there is no difficulty in lowering the centre of gravity on the present gauge very considerably, were such a thing desirable or called for. For by making the coaches omnibus fashion, the passengers in each coach could be made to sit a foot lower than at present. That this is not done goes a great way to prove that it is unnecessary. Or by keeping the centre of gravity as it is, it is quite easy and practicable with the present gauge to increase the size of the wheels from 3 feet to 3 feet 6 inches, or larger, if any thing was to be gained by it.

Having gone into question of gauge abstractedly from what has been done upon your line in connection with it, and debiting the system of a 7 feet rail with such an increase of cost only as appears to me to be absolutely consequent on its adoption, I feel compelled to come to the conclusion, that there are no advantages to be obtained by adopting it, at all commensurate with the evils that will be consequent on the deviation; and for the reasons which follow, it is not desirable in my opinion to proceed with it, unless you were already committed to it in a pecuniary sense, to an amount that will outweigh all the objections to it, but which will be seen hereafter.

The additional reasons for not proceeding with it are these:—first, considering the great cost and the comparatively small profits of railway lines generally on the smallest dimensions, and the great difficulty there is, and the corresponding increase of outlay that is incurred, in obtaining curves of sufficiently large radius to be workable at the present narrower gauge; I cannot conceive that there is a single practical man in England who could recommend the 7 feet gauge as a general system for this country.

If unfit as a general system for the whole country, it will be unfit as a partial system for a portion of it; unless that system is of necessity to be very much confined; its ramifications into other districts impossible from natural barriers, such as seas, or lakes; and the nature of the country, such as to undulations, that the cost of obtaining curves of larger radius will be trifling.

Even admitting that the latter condition is true of your line, and that from its general flatness curves can easily be obtained of large radius, yet this cannot be predicated of the whole of the branches and extensions to which you will have to look for collateral and extended traffic. And even if it could, still the system is unquestionably more expensive to some degree, and though you with your large traffic *might not* be totally crushed by it, it has yet to be seen what the effect will be on smaller and less favourable lines; which, to get into yours, will be compelled to adopt similar dimensions, and involving of course similar expenses. At the same time, the prosperity of your line will be affected in no small degree by the prosperity of the tributaries to it; and, in fact, a probable result of doing things on such a great scale will be to drive traffic, which otherwise would come upon you, in some other direction. For in railway lines generally, in the same country, there will come to be a mutual dependance one upon another. And surely it must be rather an untenable doctrine to hold, that the gauge of each line is to be determined only by reference to its curves and gradients, for by such a rule it would follow that no two lines could be alike.

Finally, it may be said of railway lines, that they will not bear any additional expense. It may perhaps be said of every railway formed in this kingdom, that if the company had to begin again, their object would be to economise, and to diminish their first outlay, not to increase it; or if there be a railway company, and such are rare cases, that has already devoted its attention to the utmost in keeping down the expenditure in the first instance, that railway company would not do otherwise if it had to begin again; and that railway company will feel that for the course that has been pursued there is every cause for congratulation.

I could not advise you to take the London and Birmingham as your model, and feel satisfied if you exceed them as to cost in only a few particulars; their line was necessarily through a country very different, and far more expensive than yours; and their line is in a position in which, if a great expenditure is to be repaid any where in this country, it will be to them. For I cannot conceive that your line that I am acquainted with can expect an equal amount of *thorough* traffic; for into their line a great portion of the north of England, and a still larger portion of Scotland, besides the great manufacturing and commercial districts of Birmingham, Manchester, and Liverpool, must of necessity converge before arriving at the Metropolis.

Still, though I do not see that the aggregate of your traffic can ever be expected to equal that of the London and Birmingham; yet, considering the *much more favorable* country through which your railway passes, and that the traffic upon it will be unquestionably very large, I think your line presented equally as good features for investment, and perhaps may do so still; it will depend, in my view, upon the course you pursue.

That course as far as my opinion goes, is not to go forward on your present system. Knowing that railways hitherto, and on the smaller scale, have been found greatly expensive, so much so, as scarcely in any case to leave an ample dividend, when the great risk of such investments is considered, I cannot advise you to proceed on a plan which, in all human probability, will materially diminish that dividend.

It cannot be necessary for the attainment of safety, when in the present gauge their is no danger.

It cannot be required for the attainment of high velocities, because on the narrower gauge velocities can be attained with perfect safety, greater than could be maintained by any railway company in England perhaps, without absolute ruin to themselves in a pecuniary sense.

The Liverpool and Manchester Railway, by increasing their speed from 20 to 26 miles per hour, have increased their locomotive expenses about 15 per cent. Much higher velocities than this are attained, and with perfect safety, on the narrower gauge; but there is no company that could bear the increased expense of maintaining such velocities constantly, or if there be, it will be found to be that company which has expended the least in the first instance. For example: the Grand Junction would feel the effects of increased expenditure to maintain a very high velocity, less than would the London and Birmingham; not that their gradients are better, they are worse; but simply because their first outlay is much less, and therefore their annual expenses might be much increased, and still leave as large a revenue: in short, for very much the same reason that 21s. for carrying a passenger 97½ miles on their line, will probably pay them quite as well as 30s. will pay the London and Birmingham company for carrying a passenger 111 miles on their line.

But in advising you not to proceed in constructing your line on the larger scale, it is necessary to take a review of the consequences.

You are, to a certain extent, committed to it in a pecuniary sense. This amount can be ascertained and contrasted with the saving to be effected by contracting the *dimensions*, if there be a saving; if there be no saving as to first cost, in making the alteration, yet as I believe there would be a material saving in the expenses afterwards, and other advantages of greater magnitude still, such as the avoiding the introduction of an expensive system into districts which can ill afford it, the consequent re action from which would be felt by your own line, I feel bound to recommend you to make the alteration.

That which will go to the debit of making the alteration will be as follows:

22 Miles of road to be taken up and re-laid, the same materials being used, £1,500 per mile		£33,000 0 0
14 Locomotives & tenders received (adapted for wide gauge) £1980 each	£27,720 0 0	
7 Engines and tenders, constructing, say same price	13,860 0 0	
42 First-class carriages at £544	22,848 0 0	
40 Second-class carriages at £351	14,040 0 0	
118 Trucks and waggons at £106	12,508 0 0	
		90,976 0 0
		£123,976 0 0

On the rails, I do not consider there would be any loss, for though I think them too light, yet they will be much less objectionable in this respect on the narrower way.

That which will go to the *credit* of making the alteration will be as follows:—

£1000 per mile to be saved on 100 miles of permanent way yet to be laid	£100,000 0 0
£400 each less upon 60 engines and tenders yet to be obtained to make full stock	24,000 0 0
£200 per mile less on earthwork, &c., yet to be completed, say 60 miles	12,000 0 0
Say 20 per cent. on tunnelling yet to be done, by the narrower gauge, requiring 4 feet less width, say 2000 yards at £10	20,000 0 0
	£156,000 0 0

It is useless to push this inquiry further. It is clear that even considering the question as if your present stock of engines, carriages, &c. would be valueless, if you alter the gauge; and contrasting this loss with the saving that would be effected by adopting the narrower gauge, supposing that in prosecuting the 7 feet gauge you were only in future to do that which is barely necessary, still, taking such a view of it, the advantage in a pecuniary sense is decidedly in favour of an alteration of the gauge.

But if the comparison were made on the supposition that in carrying out your system as to gauge, you were to continue the large dimensions you have begun with, the pecuniary advantages in favour of reducing the gauge would be very much greater.

Further, there is no necessity for considering all your present stock of engines and carriages as valueless: for supposing you should decide upon altering the gauge, it could be done as follows.

It would be necessary in the first place to curtail the dimensions of all the works yet remaining to be done, and to proceed with taking up one of the lines between London and Maidenhead, and to relay it to the narrower gauge. In the mean time your present traffic in passengers could be carried on very well on one line. On the Railway between Antwerp and Brussels, greater numbers are carried on a single line of way. This would of course afford employment for your present stock of engines and carriages for probably a year and a half, and would therefore go to diminish the sacrifice that ultimately would have to be made; that sacrifice would be still further diminished, by the value of such part of the carriages, trucks, and engines, as could be applied in the construction of others for the narrower gauge.

Of course the traffic would have to be transferred to the line of narrower gauge before the second seven feet way between London and Maidenhead could be taken up; it might then be relaid to the narrower gauge, and could be got ready by the time that an extended portion of your line should be prepared for opening.

Having come to a conclusion that so great an increase of gauge as to 7 feet is to be avoided; the question will arise, is 4 feet 8½ inch exactly the thing? No one, perhaps, will pretend to say that it is so precisely, or that an inch or two in addition could make much difference as to cost. Of course the objections to increasing the width of way, on the score of expense, become less as the increase to be made is diminished; the *main reason* in my view for abiding by the 4 feet 8½ inch gauge in this country is, that it has been greatly adopted, and that there are no very substantial grounds for altering it. I have never heard any one, whose opinion I should esteem of great value from their experience of the working of locomotives on railways, wish for more than a few inches of additional width, five or six inches at the utmost; and even as to this increase, just in proportion as the parties had had much to do with the working of the locomotives on railways, so in the same proportion did they esteem even it to be of minor importance.

Perhaps, if railways were just commencing in this country, an addition of a few inches, five or six inches at the most, might be made; but the advantage to be gained by making it now, in my opinion, would in no manner compensate the evil that will arise from a variety of gauges in the same country.

Impressed with the importance of having other opinions on this subject than my own, I addressed a letter to two of the largest manufacturers of locomotives in this country, requesting from them to know what in their opinion were the practical disadvantages of the 4 feet 8½ inches gauge as affecting the manufacturer.

The opinions of both these parties in my view are peculiarly valuable, for they were not only amongst the earliest locomotive manufacturers, but have also had much more experience as to the working of their engines on railways than any other manufacturers I know; and without this latter kind of experience, manufacturers are, to a certain extent, only theorists, as to the question in hand.

Their answers are below.

"Liverpool, Sept. 29th, 1838.

"DEAR SIR,—In reply to your letter of the 27th inst. referring to the question of the right gauge, which at this time is so much agitated,

"I beg to state that though we do not labour absolutely under great difficulties, in consequence of the want of breadth, yet there is no doubt an addition to the present width (4 feet 8½ in.) of a few inches would enable us to make a more perfect engine. The addition of 6 inches would be ample, and I consider any thing beyond that would tend to increase the difficulties beyond what we now experience, rather than otherwise.

"Yours truly,

(Signed) "EDWARD BURY.

"John Hawkshaw, Esq."

"London, Oct. 1, 1838.

"Mr. John Hawkshaw.

'Sir—The extent of inconvenience we experience in the construction of locomotive engines of moderate power (say 14 inch cylinders (for a gauge of 4 feet $8\frac{1}{2}$ inches, is very small indeed. In our early engines an additional width of 3 or 4 inches would have facilitated the arrangement of the working gear and eccentrics; but this has since been simplified, and our latest arrangement of those parts leave scarcely this small increase of width to be wished for.

"The construction of engines for Russia for *a six feet* gauge, leads us to believe that a considerable increase of expense is attendant upon increased width; more especially if the power of the engine is considered to bear any relation to the width of the gauge. If the power or dimensions of the engine be kept the same, the additional expense consequent upon increase of gauge will not be very considerable.

"We are, Sir, &c.,

(Signed) "Robert Stephenson & Co."

With respect to Mr. Bury, it may be observed, that if any manufacturer in England has felt inconvenience from the 4 feet $8\frac{1}{2}$ inch guage, he must have done so; for, from the peculiar construction of his engines, it is a principle with him to use inside bearings only, which necessarily leave less room for the working gear than when outside bearings are used.

BRIDGE AT MAIDENHEAD.

I have carefully inspected this bridge, and find that at the crown of the eastern arch, and for 12 or 14 feet on each side of it, there is a separation between the first, second, and third rings of whole bricks, counting from the soffit of the arch; these separations generally are about half an inch wide, and extend three or four yards each way from the crown of the arch: the dislocation appears to be less towards the interior, for on making a hole quite through the brickwork in the centre of the arch, it was found that there was a separation only between the second and third ring of whole bricks, but this separation was about an inch in width.

There is nothing any where that I could perceive like crushing of the bricks, or dislocation in direction of the thrust.

I think it probable, therefore, that if a few iron bolts were put through the arch, so as to prevent any further separation, and the crown of the arch loaded with additional weight, that the bridge *might* stand, and perhaps be quite strong enough for any thing that ever may be required of it. But I cannot say that I should advise such an experiment to be made on such a structure, especially as putting its stability beyond all question will not be a very serious matter.

I should recommend, therefore, that from 25 to 30 feet of the crown of the eastern arch be taken out, (the precise quantity will be seen as the arch is opened,) and replaced with stone, the facing of the elevation may still be of brick, so as not to destroy the appearance of the bridge. The stone will give greater weight to the crown of the arch, which I think is wanted; and I should also recommend an additional weight to be placed on the crown of the western arch: a couple of courses of 8 or 9 inch landings would do; for I find difficulty in accounting for the appearanees presented, otherwise than on the supposition, that the haunches of the arches have had more than their full share of load; and at all events, I am of opinion that some additional weight on the crown of both arches will be of service, and will add to the general stability of the structure.

(*To be continued.*)

Genesee Valley Canal—Report of the Canal Board.

Continued from page 256.

It is not perceived that the proposed substitution of composite for stone locks will materially "impair the usefulness" of the canal. The transit of boats in either case will be equally cheap and expeditious, and the necessary annual repairs can be made with equal facility. At the end of the twelve years, when the timber portion of the lock is to be replaced, the work can be completed in a short time, and before the opening of navigation in the spring. It may possibly occur, however, that during the latter period of the existence of a wooden chamber, repairs would be more frequent, and at times might occasion some interruption to the navigation—and it may be proper also to add, that the expense of replacing the timber from time to time will gradually increase with the gradual advance in the price of lumber.

It is doubtless desirable that all our public works should be constructed in a manner as solid and durable as may be consistent with the permanent interests of the State; but upon a canal so costly, in proportion to its immediate revenues, as the present, it is more desirable to exercise a judicious economy, which will accomplish all the public objects sought by the completion of the work, without burthening the Treasury with a great and unnecessary outlay in the first instance. The fiscal interests of the State may be promoted by sustaining hereafter some additional expense in maintaining the present canal, rather than to incur an immediate and certain loss of capital, with its consequent loss of interest, by expending more money in constructing the work in the first instance, than the exigencies of the trade will require.

By a farther examination of the particulars of the work in question, the Board have perceived that the plan originally recommended by the Chief Engineer, for crossing the Genesee river at Mount Morris, has been materially varied. By that plan it was proposed to pass boats through the mill-pond above the dam, which affords a deep and safe navigation, and capable of being adapted with little expense to the purposes of the canal. The Engineer was directed, however, during the last season, to scuttle the dam and build an aqueduct over the river, at an elevation of 22 feet above its surface. The estimated cost of the aqueduct, exclusive of the damages for scuttling the dam, is $122,660.

One of the reasons assigned for building the aqueduct, was the apprehension that the freshets of the river might occasionally render the mill-pond impassable for boats. But the interruption which would thus be experienced in passing the river could only be temporary, and would not exceed five or six days in a year—and any apprehension in this respect are fully counterbalanced by the danger that the aqueduct may be swept away by some of the heavy inundations to which it would be subject. The breaking up of the Genesee river, carrying with it large masses of ice, must be attended with hazard, but when burthened, as it frequently is, with floating trees and drift wood, it would greatly endanger any structure which should impede its course; and it need hardly be stated, that the destruction of the aqueduct would occasion much more serious interruption to the trade of the canal, than would ever be realized from all the embarrassments which can be anticipated in passing through the pond.

It should however, be observed, that if the aqueduct could be maintained, it would furnish a more perfect and convenient navigation than to cross in a pond above the dam; and it would also disconnect the canal from the hydraulic power now drawing its water from the pond. But the Board entertaining doubts of the security of the aqueduct, and considering the difference in expense and other circumstances, they recommend the abandonment of the aqueduct.

In proposing those changes in the plan of constructing this canal, it should, however, be stated, that it has now become somewhat difficult to carry them into execution. The 10 stone locks between Rochester and Mount Morris, as is above stated, are so far completed that they cannot now be changed with advantage. Of the remaining 104 locks, 78 are already under contract—but it is believed that not much progress has been made in their construction. The aqueduct at Mount Morris has also been put under contract, and some expense has been incurred in preparing the foundations of the pier.

The hope is, however, entertained that if authority shall be promptly given by the Legislature to settle with the contractors, it may be accomplished upon reasonable terms. Important savings may therefore yet be made, by changing the plan in the particulars above suggested. But the work is now in rapid progress, and whatever changes are to be made should be commenced immediately. So pressing, in the opinion of the Board, is the exigency of the case, that they have felt bound to lose no time in communicating the facts to the Legislature; and they have therefore answered the resolution of the Assembly, without waiting to investigate more minutely those particular details of the work, which might have enabled them to state whether any other alterations than those above suggested could be made in the plan of the canal, which would "lessen its cost without impairing its usefulness."

All of which is respectfully submitted.

Samuel B. Ruggles,
W. C. Bouck,
Jonas Earll, Jun'r.
Bates Cooke,
Jacob Haight,
O. L. Holley,
J. C. Spencer.

Albany, April 15, 1839.

Chemical and Optical Discovery.—At the last sitting of the Academy of Sciences, M. Arago announced one of the most important discoveries in the fine arts that have distinguished the present century, the author of which has already acquired universal reputation by his miraculous diorama—M. Daguerre. It is well known that certain chemical substances, such as chloride of silver, have the property of changing their color by the mere contact of light; and it is by a combination of this nature that M. Daguerre has succeeded in fixing upon paper prepared with it the rays that are directed on the table of the camera obscura, and rendering the optical tableau permanent. The exact representation of whatever objects this instrument is directed to is, as every body is aware, thrown down with vivid colors upon the white prepared to receive them, and the rays of light that are thus reflected have the power of acting in the way above alluded on chloride of silver, or certain preparations of it. In this manner an exact representation of light and shade of whatever object may be wished to be viewed, is obtained with the precise accuracy of nature herself, and it is stated to have all the softness of a fine aquatint engraving. M.

Daguerre had made this discovery some years ago, but he had not succeeded in making the alteration of color permanent on the chemical substance. This main desideratum he has now accomplished, and in this manner has been able, among other instances, to make a permanent chemical representation of the Louvre, taken from the Pont des Arts. M. Arago, in commenting upon this most extraordinary discovery, observed, that a patent would be by no means able to preserve the rights of the discoverer sufficiently to reward him for his efforts; and he therefore urged the propriety of an application being made to the legislature for a grant of public money as a recompense. M. Biot, on the same occasion, compared M. Daguerre's discovery to the retina of the eye, the objects being represented on one and the other surface with almost equal accuracy.

What is the secret of the invention? What is the substance endowed with such astonishing sensibility to the rays of light, that it not only penetrates itself with them, but preserves their impression; performs at once the function of the eye and of the optic nerve—the material instrument of sensation, and the sensation itself. In good sooth we know nothing about it. Figure to yourself, says a Parisian contemporary, a mirror which, after having received your image, gives you back your portrait, indelible as a picture, and a much more exact resemblance. Such is the miracle invented by M. Daguerre. His pictures do not prodnce color, but only outline, the lights and shadows of the model. They are not paintings, they are drawings: but drawings pushed to a degree of perfection that art never can reach.

One has heard of writing by steam, but *drawing by sunshine* (or moonshine) is a novelty for which the world is indebted to M. Daguerre, of Paris, the diorama painter. M. Arago and M. Biot, who have made reports to the Academy of Sciences of the effects of M. Daguerre's discovery, have given up all attempts to define its causes. The complaisance of the inventor has permitted us to see these *chefs d'œuvre*, where nature has delineated herself. At every picture placed before our eyes we were in admiration. What perfection of outline—what effects of *chiaro oscura*—what delicacy—what finish! But how can we be assured that this is not the work of a clever draughtsman? As a sufficient answer, M. Daguerre puts a magnifying glass in our hand. We then see the minutest folds of drapery, the lines of a landscape, invisible to the naked eye. In the mass of buildings, accessories of all kinds, imperceptible accidents, of which the view of Paris from the Pont des Arts is composed, we distinguish the smallest details, we count the stones of the pavement, we see the moisture produced by rain, we read the sign of a shop. Every thread of the luminous tissue has passed from the object to the surface retaining it. The impression of the image takes place with greater or less rapidity, according to the intensity of the light; it is produced quicker at noon than in the morning or evening, in a summer than in a winter. M. Daguerre has hitherto made his experiments only in Paris; and in the most favorable circumstances they have always been too slow to obtain complete results, except on still or inanimate nature. Motion escapes him, or leaves only vague and uncertain traces. It may be presumed that the sun of Africa would give him instantaneous images of natural objects in full life and action.—*Paris Constitutional.*

Railroads—Many persons have a dread of travelling on Railroads, and in steam boats, being impressed with the idea that they will be dashed to atoms against the earth, by running off the track, or be blown 'sky high,' by the explosion of a boiler. Scarcely any fear could have less foundation in reason. These are the safest of all modes of travelling; and considering the vast multitude that are conveyed through the land, the small number of accidents is wonderful. We have no general report of deaths on Railroads in this country, but returns from ten Railroads in England, show more than forty millions of passengers have been carried in seven years, and that of that number and in that period of time, only ten persons were killed by accidents, and but four of these were passengers.

We think it a great error in public prints to record every little accident which occurs in steam travelling. For the purpose of 'getting up' exciting news, the most trifling incident is ushered forth with some marvellous caption, and embellished, magnified, and exaggerated to some dreadful occurrence, and we are thus shocked with 'narrow escapes,' 'serious accidents,' 'shocking calamities,' and 'dreadful loss of life.' Such alarming phrases and amplified accounts tend to impress the timid and unthinking with the most painful dread, and through the whole course of a journey they suffer intense misery. It is time the public journals had reformed this practice—for they are inflicting, by these aggravated details, a heavy amount of misery on travellers. There is scarcely any other mode of conveyance upon main routes than by steam, and it is wanton cruelty to fill the hearts of such multitudes, who are forced to adopt such conveyance with unecessary fears.—*Delaware State Jour.*

Action for Damage by the Railroad.—A case of general interest so far as it involves the general question of liability of the corporation for damage snstained on their road, or through the negligence of their agents, was tried last week in the Baltimore county court. It was a suit brought by Philip Uhler, against the Baltimore and Ohio Railroad Company, for damages in consequence of injury done to the plaiutifs wife, who, in crossing Howard street in September, 1837, was struck down by an empty railroad car, brought there for the purpose of being loaded, and so much injured thereby as to result finally in her death.—The damage was laid at $20,000. The injury, it appeared, was the result of an accident, which, not being likely to be forseen, was hardly to be guarded against. And so far as may be learned from a report of the testimony, the unfortunate collision which resulted in such fatal injury to the wife of the plaintiff, did not occur through any direct agency or remissness of duty on the part of the Railroad Company or its agents.

The car had been placed in a position on the Howard street Railroad and there secured. It was removed thence a small distance by persons not in the employ of the Company, for the purpose of greater facility in loading. The removal brought it upon the verge of an inclined plane; and the car unexpectedly and insensibly, as it were, acquired an impetus, that put it beyond the control of those who had effectd the removal, and carried it with a rapid motion into the plane at the intersection of Howard and Lexington streets, where the deceased was passing at the instant, and where the injury was done. From these and other "mitigating" circnmstances in the case, the jury gave a verdict of $500 for the plaintiff.—*Baltimore paper.*

The Brunswick and Florida Railroad.—The first meeting of the Stock holders of this company upon the 6th inst, was numerously attended at Thomasville. About two hundred were present, representing stock to the amount of a half million of dollars. The first instalment of five per cent. was paid up with great spirit, and much urgency that the work should immediately proceed to its accomplishment, of the great importance and success of which, no one could entertain a doubt. Of the amount of stock not represented, many of the holders had not received notice of the meetng, and others, of the western counties, were at such distances that they could not attend. The collection of their assessments is now going on, and we shall soon be able to announce its complete payment. The election of the officers of the Company is such as to give the public still further confidence in the good conduct and speedy completion of this great work. Their names are as follows:

THOMAS BUTLER KING, of Brunswick, President.

General James Hamilton, of S. C.
General Jones, of Stewart Co.
Colonel Jones, of Lowndes Co.
Rev. Mr. James, of Lee Co.
Col. T. E. Blackshear, of Lee Co.
Duncan Ray, Esq. of Lee Co.
} *Directors.*

T. J. Johnson, of Thomas Co. *Treasurer.*
A. L. King, of Brunswick, *Secretary.*
MONCURE ROBINSON, of Philadelphia, Chief Engineer.
William Parker, of Boston, Principal Assistant Engineer.

New York and Erie Railroad.

At a meeting of citizens held pursuant to public notice, at the Merchants Exchange, on Tuesday, the 16th April, W. W. Todd was appointed President, and James Lee, Secretary.

The following resolutions were unanimously passed:—

Resolved, That the New York and Erie Railroad, which will connect the commerce of the Great West with that of the City of New York, is calculated to foster the best interests of our citizens, and to develope the resources of thisCommercial Emporium,—while it will augment the wealth and power of this State.

Resolved, That the Company to whom has been committed this great Enterprise, having signified that they cannot, with their own means, carry forward to completion, this work with such rapidity as its importance demands,—and that they are ready to surrender their charter upon just and equitable terms, whenever the State shall assume the construction of this Railroad:—Therefore

Resolved, That the unrivalled extent of the work, stretching from the Atlantic to the Western frontier, and yet lying wholly within the limits of this State—the magnitude of its commercial capabilities—the rapid transmission of the public mail, and of the military forces and munitions of the republlc, and the strength which it adds to the bonds of the Union,—entitle this work to be considered as of such vast importance as to be adopted by the State, and to be carried onward witn the utmost speed.

Resolved, That the delay in constructing this work—is to be fairly estimated at an annual loss in money, of millions of dollars to this community and the southern tier of counties,--and that the completion of successful rival enterprizes, which are promoted by our supineness, is dangerous to our trade and commerce—and requires the immediate action of all by whom the pre-eminence of our commercial position is justly valued.

Resolved, In the opinion of this meeting, that there is nothing in the fiscal condition of this great State to require any pause in carrying into effect this most important branch of Internal Improvement through the Southern tier of Counties, hitherto deprived of the fostering aid of the Government, and at a cost which, from the best sources of information, will not exceed from seven to eight millions of dollars, to be expended in the course of the next five years.

Resolved, That the Representatives of this City in the Senate and Assembly of the State, should be furnished with a copy of these resolutions, signed by the officers of this meeting, with a request that they would present the same and enforce the views contained in them, in the Legislative bodies to which they respectively belong.

W. W. Todd, Chairman.

James Lee, Secretary.

Rail Road Engine.—The following grand description of this new and mighty animal, that is now careering through our land, is extracted from the Quarterly Review:—

There are no doubt many of our readers who have yet to receive those common place impressions which are made upon the mind of the traveller, when for the first time he sees and hears the ENGINE, as from a point in advance on the railway it retrogradingly approaches in order to be looked on to a train composed, as on the London and Liverpool line, of eighteen or twenty huge cars, besides private carriages on runners, caravans full of horses, wagons of heavy goods, &c., &c., &c. The immense weight, upwards of 80 tons to be transported at such a pace to such a distance, when compared with the slight neat outline of the ENGINE, the circumference of whose black funnel would not twice go round the neck of an antelope, and whose bright copper boiler would not twice equal the girth or barrel of a race horse, induces the stranger to apprehend for a moment that the approaching power must prove totally inadequate to its task; but the tearing and deafening noise with which this noble animal of man's creation advances to his work satisfactorily demonstrates that it has itself no fear, but comes as a bridegroom out of his chamber, rejoicing like a giant to run his course.

If the character of this noble creature be considered for a moment with that of a horse, the comparison is curious. With sufficient coals and water in his manger, which, it must be obeerved, whenever he travels he takes with him, he can, if the aggregate of his day's work be considered, carry every day for years at the rate of sixteen miles an hour, the weight of an army of 21,404 men, of 10 stone 10 lbs. each; whereas a good horse could not at the same pace and for the same distance continue to carry every day more than one such man. For a distance of eighty miles he can carry the weight of 2788 men at a rate (sixteen miles an hour,) that neither the hare, the antelope, nor the race horse could keep up with him.

No journey ever tires him; he is never heard to grumble or hiss but for want of work; the faster he goes the more ravenously he feeds; and for two years he can thus travel without medicine or surgery. It requires, however, 2000*l.* a year to support him. We might to these observations add a graver reflection, that, as by the invention of the telescope man has extended his vision beyond that of the Eagle, so by the invention of the locomotive engine, he has now surpassed in speed every quadruped on the globe. We will, however, detain the engine no longer, but for a few moments will, with our readers, accompany the train with which it has now started.

The dashing at full steam speed into the small black orifices of the tunnel—the midnight darkness that prevails there—the flashes of light that occasionally denote there air shafts, the sudden return to the joyous sunshine of the world—the figures of the company's green servants, who as the train whisks past them, stand all in the same attitude motionless as statues, with white flags, (the emblems of safety,) in their extended hands —the occasional shrill, plaintive whistle or scream, by which the engine, whenever necessary, scares the workmen from the rails—the meteor like meeting of a return train, of which *in transitu* no more is seen than of the coloured figures on one of the long stripes of painted glass; which, after slow exhibition before children, are by the showman rapidly drawn across the lens of his magic lantern;—all these sensations unite in making the traveller practically sensible of the astonishing velocity with which not only he and his fellow-passengers, each seated in his arm chair, but heavy goods can now be transported.

From the Newark Daily Advertiser.

The Morris and Essex Rail Road has adopted a new improvement recently invented and patented by Stephan Vail, Esq., of Morristown, for the purpose of supplying the Locomotives with water. By a simple and substantial fixture, the engine is made to work a pump at the depot, which fills the boilers from a well, while the firemen are taking in wood, without the intervention of any other agency than the steam, which would otherwise be "blown off." The adjustment is made in a moment by the engineer. This ingenious and economical contrivance not only saves the expenses of a hand at each watering place, but supersedes the necessity of the usual cisterns, which are liable to freeze in winter, and furnishes water of the same temperature through all the seasons of the year. Thus is experience and skill constantly increasing the value and perfectness of this wonderful instrument of human power and ingenuity, now almost instinct with rational life.

The trip to Morristown is now reduced to a little more than an hour and a half by the entreprise of this useful company; and we need scarcely say to our readers in this vicinity that it is among the most attractive and agreable excursions for parties of pleasure in the vicinity of the commercial metropolis. Passengers may now leave New-York at 9, and Newark at 10 A. M., reach Morrisville before 12, and have abundant time for dinner or social intercourse, and be returned early in the afternoon without the slightest inconvenience or fatigue—traversing, in the meantime a highly picturesque country, more remarkably diversified than any rail-road route within our observation.

The cars wind their way through a mountainous region for near 20 miles, in such a way as to afford a succession of rich and constantly varied views, embracing almost every variety and attribute of grand and beautiful scenery. There is nothing like monotony on this route. We passed over the road yesterday, and never saw the country more verdant or beautiful. The company have just placed a new eight-wheel car on the line, which is calculated to accommodate 90 passengers. We advise the reader, in search of health or pleasure, to give it a trial.

Ohio Rail Road Meeting.—A general meeting of the stockholders of the Baltimore and Ohio Rail Road Company was held yesterday morning in conformity with public notice, for the purpose of considering the act of Maryland, passed at the late session of the Legislature, in reference to this company. The meeting was organized by the appointment of Robert Gilmore, Esq., as chairman, and J. J. Atkinson, Esq., as secretary. After the reading of the act by the secretary, Mr. McLane, the President of the Company, explained, in a short address, the reasons which had determined to approve of the act, and which, he believed, would influence the stockholders to come to the same conclusion. He adverted, in his accustomed lucid style, to the advantageous position in which the company was placed by the provisions of the present act, when compared with its trammelled condition under the practicable requirements of the act of 1836. The act under consideration rendered the State's subscprition of $3,000,000, available for the operations of the company in its progress westward,'and left it to the company to determine when and where the money should be expended. At the conclusion of Mr. McLane's remarks, a resolution was offered by H. W. Evans, Esq., expressive of the acceptance of the act by the stockholders. This resolution was unanimously adopted, and the meeting then adjourned *sine die.—Baltimore paper.*

THE PORTAGE RAIL ROAD.—Like every other portion of the public works under the management of the new officers, the Alleghany rail road, is doing a handsome business. We have seen a statement of the number of cars passed over it during the present and two previous springs up to the 30th of April in each year, and is as follows:—

1837.	From opening of the road to the 30th April, there passed,			6,413 cars.
1838. do.	do.	do.		7,423 "
		Increase 1010 cars.		
1839. do.	do.	do.		9,724 "
		Increase 2,301 cars.		

And the cars this season average much heavier loads than they carried the previous seasons. It is thought that the expense of the Motive Power department will not exceed that of 1838, and if so the department will be able to pay its own expenses, and leave a balance in favor of the commonwealth.—*Blairsville Record.*

BOSTON AND ST. LOUIS RAILROAD.—We received this morning a pamphlet, from Boston, entitled "Letters on the subject of a line of Railroads from Boston to the Mississippi." Connected with this is a circular from a committee of the Western Railroad Corporation, requesting information "on the subject of a continuous line of Railroads from Boston to St. Louis, from all persons who are friendly to the internal improvement of the country. The committee consists of Wm. Savage, P. P. F. Degrand, Amasa Walker, E. Copeland, jr., and Henry Cutler.

It is stated that the chain of railroads from Boston to Buffaloe are all graded for more than half the whole distance, and are in rapid progress towards completion.

The largest steamboat on this western waters is said to be the St. Louis of *eleven hundred tons* burthen, and 130 feet long. She has two engines and eight boilers, and runs between St. Louis and New Orleans.—*Annapolis Republican.*

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THE GREAT WESTERN RALWAY.

(Continued from page 230.)

PERMANENT WAY.

The mode adopted in laying the rails is, I think, attempting to do that in a difficult and expensive manner, which may be done at least as well in a simple and more economical manner.

LOCOMOTIVE POWER.

Beyond what may have been said on this subject generally in the preceding parts of this Report, the length to which it has already extended forbids my saying much more. Generally, I should say, that the power of your engines should be proportioned to your loads.

Employing engines capable of drawing 200 tons to drag loads averaging 50 tons, will be very much like fastening eight horses to a post-chaise.

The great weight of locomotives is a positive evil. It is so, because they have to be carried about for nothing. It is so, because they do more harm to the road than any thing else, and a railway has to be made stronger and more costly on account of them. But to a certain extent, it is a necessary evil, but only to a certain extent. And if the weight be increased beyond this limit, it will be so much thrown away.

The weight of the engine should be determined by the average load to be taken, and the nature of the gradients.

Moreover, the engines will work economically, or otherwise, in proportion as their power approximates to their loads.

The average of your passenger trains cannot be expected to be greater or heavier than on the Grand Junction Railway. Supposing them to be the same, as to weight; from your flatter gradients, engines of little more than two-thirds the power of those on the Grand Junction, and, therefore, of considerably less weight, would be sufficient for you to travel at equal velocities. If you wish to travel at double the velocity, of course you must have more powerful engines; but it should not be forgotten, that you can only travel at double the velocity, by pretty nearly doubling the cost.

Finally, I should say of your line, that the country is favourable, and the gradients good; naturally so, or in so far as they are dependent on the undulations of the country.

Further, with such a traffic as you may expect, and such a country, your line holds out great inducements for the investment of capital.

But the advantages of country will be lost sight of and nullified, if, for the sake of a system, the cost of the road be greatly increased; and even the good gradients will be rendered of non-effect as to economy, if the speed be greatly increased: for greater speed will entail greater cost, and will be tantamount to steep gradients.

And though the *same results* may perhaps be obtained on railways of better gradients, with more dead weight than on railways of bad gradients, yet this seems to be merely bringing down the good line to the standard of the bad.

I am, gentlemen, your very obedient servant,
(Signed) JOHN HAWKSHAW.
Manchester, 4th October, 1838.

REPORT OF I. K. BRUNEL, ESQ.

TO THE DIRECTORS OF THE GREAT WESTERN RAILWAY COMPANY.

Gentlemen,—In compliance with your request, I beg to submit to you the following observations upon the only Report which you have laid before me; that expected from Mr. Nicholas Wood not having yet arrived.

Knowing that I should be called upon to express an opinion upon the subject of these two Reports, and that the time allowed me would necessarily be very short, I had proposed to class, as far as possible, their contents under two heads,—viz., first, *facts*, including under this head the statement of actual results ascertained upon the Great Western or other lines, and general principles, or rules, laid down and assumed as axioms, whether of mechanics, mathematics, or of the practical working or economy of railways; and secondly, of the *arguments* founded upon these facts or axioms, including the inferences drawn from them and the opinions expressed.

I proposed, in the next place, to consider how far the former were applicable to the case, and, what is of great importance, how far they constituted *all* the facts that it was necessary to state for the purpose of arriving at a fair conclusion. I intended then to have discussed the correctness of the latter, and thus to have arrived, by a clear and satisfactory process, at the object I had in view, which was, to give my opinions and my views on the same subect as that of the Reports; to compare them with those of the writers; to show wherein I agreed with them and where I differed, together with the reasons and grounds for the differences between us.

This would, I think, have laid before you a business-like view of the case, and such as I should have wished to have submitted to you. I regret that the peculiar nature of the only Report as yet received puts it out of my power to pursue this course; for having carefully read it, I found, that by confining myself to the division or classification which I had proposed, I should have passed over in silence a very great portion of its contents, unless I formed a third division, including neither such facts or arguments as I have described, but consisting of general remarks and hypothetical cases, and even the opinions of others founded upon hypothetical cases. It is true, there are many remarks and comparisons made which are not applied directly to the Great Western Railway, nor are they in terms stated to be strictly revalent: neither are the cases hypothetically put afterwards proved to have any practical existence *or* made to throw light upon any of the existing circumstances of the railway; but being interwoven with a Report, specially made, upon the Great Western Railway, they are calculated, however inadvertently, to mislead, unless their irrelevancy is pointed out.

I regret very much the necessity of considering these portions of the Report, as it involves the tedious process of referring almost to each page, and of frequently entering into long explanations to remove a misapprehension, produced. perhaps, only by a single word; but no alternative is left to me. The utmost extent to which I can venture to depart from the line pursued by the Report which I have before me, will be to consider the subject, in the first place, in what appears to me the engineering and business-like view, and then, subsequently and separately, to consider the particular manner in which the writer has treated the question.

The Report, after a few preliminary remarks, is divided under the following heads, and they are considered in the order stated,—namely, the objects to be obtained, the construction of a railway, or what are very properly called, "the conditions of the question;" the comparative advantages of good gradients; the width of gauge; Maidenhead bridge; the construction of the permanent way; and the locomotive power. I shall now consider the subjects in the same order, and for the sake of perfect accuracy, refer to the pages and paragraphs of the printed copy before me. As the opinions expressed, and the conclusion arrived at, in this Report, are generally, if not wholly diametrically opposed to those which I am known to entertain, and which I am now quite prepared to support, it is but just to state at the outset, that I differ altogether from the general principles laid down, which appear to me to be unsound, and, indeed, to be incorrectly and insufficiently expressed; and I must say, that I consider the reasoning fallacious and defective, and that many of the calculations are incorrect or erroneous from the omission of quantities or conditions which must affect the results.

In the Report, (p. 3), the conditions of the question are stated to be, "that there is to be the fullest regard to the wants and convenience of the public, but also a constant regard to the prospects and expectations of the shareholders," in which I concur. But the observations which follow, I entirely dissent from, for which I will shortly state my reasons. It is said that the "profits of a railway are determined by the ratio of the proceeds to the cost; if the latter be greatly increased, it becomes almost imperative on the proprietary to increase the former, either by curtailing the accommodations or by increasing the charge to the public."

In noticing this paragraph, I wish to premise that I deprecate, as much as any one, all *useless* expenditures, every increase of the capital of any company not justified by a fair probability of return, either by economy in the management of or in the maintenance of the work, or by increase in the income to be derived from traffic:—and I must distinctly say, that no departure from a sound and wise economy would ever receive my sanction. Having said this, I now, in answer to the observation I have quoted, would beg leave to remark, that at whatever cost a railway may have been constructed, the only way to increase its proceeds is the same in all cases: you can only induce the public to travel upon a railway by holding out better accommodation or lower charges, or both, than they can find elsewhere,—by, in fact, *reversing* the means recommended —by increasing the accommodation or curtailing the charges. Expedition, comfort, and cheapness, are the temptations to railroad travelling, and according to the degree in which they exist and are made manifest, will the public use the railway. The object is to get the largest income by these means,—the income must depend upon the numbers carried,—the numbers carried, upon the facilities afforded. Let the railroad cost what it may, it by no such process as that recommended that "proceeds" can be increased, but by one just the reverse, which is and must be the common object of all companies,—viz., to obtain the maximum of traffic and income; and no curtailing of the accommodation, no increase of charge to the public, can do this.

It is stated in the succeeding paragraph (p. 4), that "the cost at which a party can be conveyed will be as the interest on the capital expended, added to the cost of working the road;" *and inversely, as the number carried*, should have been added. But this important condition, which totally alters the arithmetical result of the cost of transport, is altogether omitted. Again, in what immediately follows it is said, that if "capital be increased without effecting any material reduction in the cost of working, the consequence will be, that to increase proceeds the rates must be raised." May not the number of passengers and the traffic be increased by such additional outlay, and thereby the proceeds also?

Such are the principles of railway economy which are laid down. I might perhaps avoid the necessity of further discussing them, by dropping them as suddenly and as completely as they are dropped after this last-quoted paragraph in the report, but as an impression is produced (although no direct inference is drawn), by their assertion, I will examine what I conceive to be the views of the writer on their intrinsic merits.

The theory of trade advanced in this part of the report may be stated thus: that the only mode of increasing the gross profits is to incease the profit upon such article by raising the price, or by reducing the original outlay. No doubt this is one method, if it can be effected; but I believe it would be difficult to point out any one great branch of trade which has thriven in this country by such a course. But, on the contrary, in every branch of manufacture, each year the necessary machinery and plant become more costly, the price of the articles manufactured is reduced, and the profits upon any given quantity diminished; but the gross profits are at the same time maintained and increased by the great increase of consumption consequent upon diminished prices or improved quality.

In railways, the same principle applies, and, if possible, in a still greater degree; yet in the report it is assumed throughout that the consumption, or in the case of railways, the number of passengers and the traffic is a *constant quantity*, which, on the one hand, is secured to the railway, whatever may be its comparative inconveniences or defects, and, on the other hand, cannot be increased by any additional accommodation, or by any other inducement held out to the public.

It is upon these views that all the arguments adduced in favour of reduction of first cost are founded in this report: in no single instance is any allusion made to the possibility of increasing the number of passengers by improving the means of conveyance. The great argument of all the promoters of railways, the striking results of experience in every railway—namely, the increased number of travellers consequent upon the increased facilities of conveyance, is totally lost sight of.

It is unnecessary to dwell any longer on this point, more particularly as I shall have occasion to refer to it hereafter; but it appears to me clear that no conclusion founded upon this reasoning can be safely relied upon.

The next question—namely, the effect or value of gradients, is one so susceptible of calculation, that it might be supposed to be a point upon which no great difference of opinion could exist; and when the calculations are exactly made, and the simple results clearly stated, no difference will be found to exist.

In the comparison between gradients of 10 feet per mile and 4 feet per mile (p. 5), in which a diminution of resistance when ascending the latter, as compared with the former, of 17 per cent. is admitted, data are assumed different from those generally given by the best authorities on the subject, and conditions most essential to an accurate comparison are omitted. Ten lbs. per ton are assumed as the resistance on a level; eight lbs. have generally been taken as nearer the truth, and, upon a railway in good order, with carriages also in good order, may safely be taken ar the total resistance of a train. The effect of gravity in inclinations of 4 feet, and 10 feet will be 1.7 lbs., and 4.25 lbs, which, with the constant of 8 lbs., makes 9 7 lbs., and 12.25 lbs. per ton; this, or 100 to 126, gives the ratio of the resistance on the two gradients, being already 26 per cent., instead of 17. But if the maximum load that an engine can draw (of course at the regular speed of the trains) up the incline be taken, the weight of the engine and tender must be deducted, in either case, to obtain the effective load. In fast trains, such as those running on the Liverpool and Manchester line, the engine and tender will be about 30 per cent. of the gross weight, in the three cases cited by the writer at p. 8 & 9, the proportion is even greater, being two-fifths, or 40 per cent.; but I will admit even one-fourth to be the proportion, which would be allowing a fast passenger-train to weigh nett 60 tons, with an engine and tender, such as those of the Grand Junction, weighing 20 tons. From 100 and 126 is therefore to be deducted one quarter of 100, or 25, leaving 75 and 101, which are as 100 to 134, being *an excess of* 34 *per cent.* instead of 17 in the nett load which the same engine will be capable of drawing at the same velocity up the incline of 4 feet over that which it would draw on an incline of 10 feet; but the writer, after making the calculation, proceeds to sink all comparison by the simple assertion, that "an inclined plane" of 1 in 528 (10 feet per mile) all average loads "coulp be taken." Undoubtedly they can, but at a proportionate sacrifice of power or speed, which ought to have been added: without it the statement is incorrect, and with it I do not understand the object of the observation. The naked result of the above calculation is not altered by the omission, although certainly it may in consequence escape the recollection of the trader.

In the next paragraph the same thing is asserted in a different shape. It would have been desirable to have had explained what was meant by a "full average load." It appears to be assumed as a fixed or constant quantity for all railways, and quite independently of the gradients, or even of the power of the engines. I do not understand how any such fixed quantity can exist. Several of the present trains on the Grand Junction Railway require two engines; should they increase so as to require three, it will probably be necessary to divide them; the capabilities of the line, or of the engines, will then have influenced the load. In the cases of the three different railways before referred to as quoted in the Report, the average nett loads of the trains referred to are, 24 tons, 32 tons, and 40 tons, respectively; and the average load in once case is therefore nearly double that in another.

Whatever may be the results on other railways, we know from experiment on the Great Western, that our best engines, which are considered so unnecessarily powerful, have been barely sufficient to take the loads which, under certain arrangements of trains, we are obliged to carry, and that intermediate or half-hour trains become necessary. That many such inconvenient arrangements would have been required if the loads had practically been increased 34 per cent., with gradients of 10 feet per mile, I need not tell you who are familiar with the details of our traffic. I regret the necessity of devoting so much space to an attempt to render more clear that which appears to me to be self-evident,—namely, that a load of 134 tons cannot be carried at the same speed and with the same power as one of 100 tons, or, in other words, that the addition of a useless load of 10 or 15 tons to one of our ordinary trains would not be unimportant; but the paragraph I have referred to implies this, and there being no argument advanced in support of it which could be examined, it becomes the more necessary to take notice of it.

The particular argument of the gradients on the Great Western Railway and their effect upon the traffic are then gone into; and at the end of the paragraph p. 6, the advantage of 17 per cent., before alluded to, is reduced one half, or $8\frac{1}{2}$ per cent. How this is done I have not been able to perceive, as I find neither argument nor calculation to justify it. It is, truly, very fairly given, as *an opinion;* but as there are many figures and quantities given in the course of the preceding paragraph at the conclusion of the paragraphs, the word "therefore" would lead a cursory reader to suppose it proved by some preceding calculation or reasoning. As some allusion is made to supposed savings of the power in one direction which is expended in the other, and as $8\frac{1}{2}$ is half of 17, it is barely possible that it is arrived at by a system of averaging the power required in the two directions; but in the first place, no such average can be taken; the maximum power that is required in any one part of the line must be provided, and must be carried at all times, even if no power at all be required on other parts of the line; and secondly, if the expenditure of power is to be averaged, then the increase of gradients makes *no difference* in the average power, as the decrease of power in descending is said to be equal to the increase in ascending, and therefore balances it. The fact is, that there is no ground whatever for halving the 17 per cent. (which I have shewn to be 34 per cent.) *as a measure of the effective power of the same engines under the two circumstances,* and consequently none whatever for fixing it at $8\frac{1}{2}$ per cent.

After this the $8\frac{1}{2}$ per cent is reduced to 2.8 per cent., in so far as relates to the value, in money, of such reduction in locomotive power; and the assertion is made, preceded again by the word "therefore," that a company would do wrong to increase the original capital more than 2.8 per cent. to effect a saving of 2.8 per cent. in the annual expenditure. Can it possibly be mean that if the capital be a certain sum, say 1000*l.* and the annual expenditure 150*l.*, leaving 150*l.* of nett profit, that a company would do wrong to add $2\frac{1}{2}$ per cent., to their original outlay, unless this secures $2\frac{1}{2}$ per cent saving, or 3*l.* 15s. on the annual expenditgre, or 15 per cent. for the money? This is evidently a great mistake, arising from the total confusion of the capital with the annual expenses. as if they were the same sum, and the apparent accuracy and proof are produced only by the repetition of the same figures in the two cases, although, in fact there is no such identity. The way in which a man of business should proceed would be to capitualize the annual sum likely to be saved at some given rate of interest, which in his opinion would cover all risk, and leave a profit, perhaps, of 6, 8, or ten per cent., according to circumstances, but having no reference to the particular per centage which the annual expenditure might bear to the capital; and this amount a wise man would expend, not only to increase his future profits, but also to *secure permanent advantages to the concern.*

The calculations, erroneous as I think I have shewn them to be, do nevertheless make out a case in favour of good gradients. But upon turning to a statement given of actual results upon three railways, these very calculations are annihilated. These experiments, if they prove any thing, prove an actual advantage in favour of gradients, not of four feet per mile, nor of ten feet but of very steep gradients of thirty feet per mile. The naked result, gives a less expense of power on two lines, on one of which half the length consists of gradients above twenty-six feet per mile, and on the other, eight miles out of twenty consist of gradients upwards of thirty-four feet per mile, over a line the maximum gradient of which is four feet per mile. No explanation is given. The question here is not one of the comparative perfection of the lines, in other respects, or of the carriages, or of the probable effects of circumstances not mentioned: it is adduced expressly as a practical measure of the value of gradients, and is left, without comment or explanation, to produce its effect on the mind of the reader. As such it does appear to me, and I think must to any impartial man, that the proof is overmuch, and becomes valueless: that the result cannot be correct, and that there evidently must either be an error in the data, or there must be circumstances quite independent of the gradients which require separation, otherwise we ase driven to the conclusion, that *steep gradients are the best.*

I have nothing betore me but the results, and therefore I cannot pretend to discover all the sources of error; but I know that some of the data are such as must introduce error; for instance, the consumption of coke given as that of the Great Western Railway, includes all that had been used in raising and keeping up the steam in the engines, which, in the first working of a portion of a line, and while the arrangements are not matured, is necessarily great; it includes also the coke expended in ballasting trains and experimental trips.

In fact, during the four weeks ending September 13th, which are referred to by the writer, I find that there were generally seven engines in use, and of these, two were employed upon the line, (not on the passenger traffic), and one was kept with the steam up, as a spare engine. How can the results of consumption per ton per mile be correct with such sources of error?

I must beg, however, to keep your attention to the 34 per cent. at which I have arrived, as the advantage, in actual *effective power*, of a gradient of 4 feet over one of 10 feet.

The gradients must ultimately govern the power of your engines, their speed (at all events in one direction), the size of each of your trains, and consequently their number; and it must always be remembered, that their operation is a *permanent* one, which nothing can remove or even alter, and the effect of which nothing can diminish. On the contrary. I am prepared to show, that the value of low gradients will, in all probability, be much increased.

I have assumed 8 lbs. per ton as the resistance of a train, but as the greatest part of this resistance depends upon the workmanship, the form, and the mechanical construction of the carriages, and other causes, and may be reduced by various contrivances already known, it would be contrary to all experience to suppose that it will not be materially reduced when there is an object to be gained by its reduction.

In many experiments, with all the circumstances favourable, the resistance has been as low as 6 lbs.

In some made by Mr. Hawkshaw, on the Great Western Railway, the resistance of a train, consisting partly of trucks and partly of carriages, only gives 6.22 lbs.

It may therefore be assumed, that we have now within our reach improvements by which the resistance may be reduced to 6 lbs.

With this datum, and making the same calculations as before, we obtain 100 and 144 as the comparative loads which the same engine would take at the same speed up the two gradients of 4 feet and 10 feet per mile.

Such an increase in the capabilities of engines must be of immense importance in passenger traffic. But how undeniably important it must be, even according to the principle laid down in the Report, in the conveyance of goods; in this service the maximum power of the engine *is* brought in operation, and *does* constitute the limit; and if the engine in such case only forms one-eighth of the gross load, the proportion will still be as 100 to 135.5.

The advantage, large as it is, is a highly probable one, and I venture to predict it as a certain one; but, confining ourselves to the results which may be obtained with the existing rails and carriages, I will consider what is the practical working of an increased useful effort of 34 per cent. by the same engine, or an increased resistance of 26 per cent. with the same load. According to the view of the writer, in page 5, of there being a fixed standard or average power of engine which will be the same in either case, the former,—namely, 34 per cent. of increased effect, would be the correct mode of considering the comparison. I will assume, however, the latter, as being the least advantageous, and I will suppose the engines, although different in power, to be of the same weight. Now, the resistance in ascending and descending a plane of four feet per mile will be 100 and 66; with the 10 feet per mile, it will be 126 in ascending, and actually only 39 in descending.

In the case of the Great Western Railway, from London to Slough, Maidenhead, Reading, and to the point of departure to Oxford, the maximum rise is 4 feet. Had it been 10 feet, as I must infer would have been the recommendation of Mr. Hawkshaw, the resistance going and coming would have been 126 and 39. Now, of what avail would it have been, that in returning to town the resistance was small? No more passengers or carriages could be brought one way than must be conveyed the other, or, to apply one of Mr. Hawkshaw's own similes, the eight horses required to take the post-chaise out must return with it, though two might be enough. I quite agree with the opinion very strongly expressed in another part of the Report, that for the economical working of locomotive engines, their power should *be well proportioned* to the load they have to draw. It is remarked, apparently in allusion to one which we consider the best engine in our establishment, that to use an engine *capable* of drawing 200 tons, to drag loads averaging 50 tons, will be very like fastening eight horses to a post-chase. Although the remark savours of ridicule, I quite concur in it. It is a forcible description of the practical working of a line with gradients of 10 feet per mile, such a line as the imaginary one (A B) described in p. 5, of the Report.

Now, on this line (A B), the engines going in one direction would have to exert a power of 126, and this at full speed, and in the other of 39, or as 200 to 62—a proportion not very different from the 200 to 50, which is mentioned only as something that would be very absurd.

Again, at another part of the Report (p. 30), it is stated, that engines of little more than two-thirds the power of those on the Grand Junction Railway, and therefore of *considerable less weight*, would be sufficient on our line *from our flatter gradients* Such an admitted reduction of 25 per cent. in locomotive power seems to me no mean economy to be obtained by these gradients, the effects of which are treated so lightly at other times; but these contradictory results are the necessary consequences of an attempt to argue against the simple facts, that the inclination of the line increases the resistance, and that if a regular speed is to be maintained, you must have power in proportion to that resistance.

All the foregoing calculations upon gradients have been limited to two cases of 10 feet and 4 feet per mile. These are both unusually favourable, and their comparison therefore is not calculated to render the advantages so striking; but had the gradient of 4 feet per mile been compared with the more ordinary ones of 16 feet and 20 feet, the superiority would have told much more in the discussion of the general question of the value of good gradients. To supply this deficiency I subjoin a table of the comparative effects of the same engine, with the same consumption of fuel, and travelling at the same speed on the level, and on the four gradients of 4, 10, 16, and twenty feet per mile, with a resistance of 8 lbs. for friction, &c.; and for the sake of uniformity with the previous calculations, I take the same standard of 100 as the useful effect, or nett load, up the plane of 10 feet.

	Comparative Effective Power.	
Gradients.	Ascending.	Descending.
Level	170	170
4 feet per mile	134	226
10 feet per mile	100	400
16 feet per mile	77	1305
20 feet per mile	66;	the load once in motion would *run* of itself.

The discrepancy between these results and those given in the Report does not arise merely from different data being assumed, and upon which there might be a difference of opinion; but from errors in the treatment of the calculation of the latter. I subjoin a similar table, calculated upon the basis of 10 lb. per ton, being the total resistance on a level.

	Comparative Effective Power.	
Gradients	Ascending.	Descending.
Level	156	156
4 feet per mile	129	195
10 feet per mile	100	297
16 feet per mile	80	556
20 feet per mile	69	726

By these tables the great superiority of a line approaching to the level is made apparent; not only is the effective power of the engine in that direction of the line which limits the load much greater, but the average work of the engine is performed more economically by the greater regularity of the resistance. On an inclination of ten feet per mile, as I have before shewn, the engine, during half the time is barely performing a quarter of the work which it is capable. On gradients of 16 feet per mile, the engine during half the time is barely doing more than driving itself.

These are incontrovertible facts; whether the total resistance arises from friction, from the resistance of the atmosphere, or from whatever cause, the amount is about as stated, and the increase caused by the gradients is in the ratio stated in the above table.

It appears to me almost to weaken the strength and obscure the clearness of a demonstration which is mathematical in its correctness and certainty, to attempt to support it by reference to certain experiments in which other causes might have operated; but on the Great Western Railway we have every day, and with every train, such evident and striking proofs of the effect of gradients, that I should have thought it must be conclusive to any one who has had an opportunity of witnessing them.

With powerful engines and light trains, running at a good speed of 30 to 35 miles per hour, the changes of gradients (which only vary from a level to 2 feet per mile, and to 4 feet per mile,) are perfectly perceptible in the increased or diminished speed, even without the assistance of a watch, and have been frequently detected by persons previously unacquainted with the levels.

It must always be borne in mind that the resistance arising from the gradients is a *permanent* evil, which, once established by the completion of the works, cannot be remedied, and the probable future effects of this must therefore be seriously considered. In the course of a few years, as railway travelling becomes general throughout the country, and there are opportunities of reaching every part of England by different roads, the usual results of competition will follow; prices will gradually be lowered; the number of travellers will become immensely increased; and the gross profits and expenditure become proportionably large; bearing then, particularly the latter, a much greater ratio to the original outlay than at present. The profits will then depend mainly upon the economy of transport, and then any saving in the current expenses will be felt in a far greater degree.

I shall now consider the subject of the width of gauge. The question of the disadvantage of differing in point of gauge from other railways, and the consequent exclusion from communication with them, is the first. This is undoubtedly an inconvenience; it amounts to a prohibition to almost any railway running northwards from London, as they must all more or less depend for their supply upon other lines or districts where railways already exist, and with which they must hope to be connected. In such cases there is no alternative.

The Great Western Railway, however, broke ground in an entirely new district, in which railways are unknown. At present it commands this district, and has already sent forth branches which embrace nearly all that can belong to it; and it will be the fault of the Company if it does not effectually and permanently secure to itself the whole trade of this portion of England, with that of South Wales and the south of Ireland; not by a forced monopoly, which could never long resist the wants of the public, but by such attention to these wants as shall render any competition unnecessary and hopeless. Such is the position of the Great Western Railway. It could have no connexion with any other of the main lines, and the principal branches likely to be made were well considered, and almost formed part of the original plan; nor can these be dependent upon any other existing lines for the traffic which they will bring to the main trunk.

At the London extremity, from the moment the junction, as originally proposed, with the London and Birmingham Railway was obliged to be given up, there existed no possibility of a connexion with any other line. London will always be the terminus of those main lines now established, and which approach it from distinct quarters, and the traffic of each will cease at this point; and, unless when two such lines unite to form a common entrance into the town, they will have no connexion with each other at this extremity.

The Great Western was therefore free to adopt its own dimensions; and none of the difficulties which would entirely prevent such a course in the north of England had any existence in the west; and consequently, all the general arguments advanced, and the comparisons made, on the supposition of such difficulties occurring—all excellent in case they did—are totally inapplicable to the particular case of the Great Western Railway, to which they have no reference whatever.

The reasons for adopting any increased width of gauge, and the particular dimension of seven feet, have been so frequently before you, that it is unnecessary for me now to repeat them. The principal positive objection urged against it in the report is the increased cost, while the mechanical advantages are doubted, but not disproved.

As regards the cost, I have repeatedly shewn that this amounts at the utmost to a slight increase in the quantity of earthwork, and that the bridges, tunnels, &c., are not necessarily affected. Mr. Hawkshaw seems to be of the same opinion, as at p. 11 he classes the "tunnels of 30 feet diameter" among "the non-essentials," as "not absolutely consequent on the increase of gauge;" and at p. 13 he clearly limits the increased expense of construction to the earthwork, land, and permanent way. There is some inconsistency in these remarks, when compared with the estimate in page 24, where the width of tunnels is considered a consequence of the wide gauge, and a saving is estimated of 20 per cent. "in the tunnelling yet to be done, by the narrower gauge requiring four feet less width."

I have only here to repeat, what is really capable of the clearest proof—viz., that the greater width of tunnels, proposed by me for special reasons, which I have explained on more than one occasion, has nothing whatever to do with the wide gauge, inasmuch as tunnels of the ordinary width could be adopted, and the saving pointed out would not, therefore, be necessarily the result of the return to a narrower gauge. But the arguments advanced at p. 13 in the report, to show the necessity of increasing the *earthwork* by four feet, are subsequently, without observation, applied to the tunnels. This error is occasioned by neglecting to give precise dimensions to quantities quite capable of it.

Arguments are founded upon the assumption that a certain width is necessary between the centre rails for repairs. This is true, but the width should be stated in feet and inches. On the Liverpool and Manchester, this space is four feet eight inches; and, even with stone blocks, this is found ample for all purposes of repair: indeed, it is the width which is so perfect in Mr. Hawkshaw's estimation. Four feet eight inches, with stone blocks, (which does not leave more than two feet eight inches between the blocks), are not equal to four feet with longitudinal wooden sleepers, which would leave from two feet nine inches to three feet between them. Suppose four feet, however, to be necessary, then, with a seven feet gauge, the distance from centre to centre of the two lines is eleven feet, which is the same as on the London and Birmingham, Grand Junction, and other lines, and which has been adopted to give a general increase of space. The width of tunnels, viaducts, &c., are *therefore not necessarily affected* by the seven-feet gauge. Neither do I understand how the cost of the permanent way can be sensibly increased. The weight of rail would be the same. The engines, in other respects similar, would be, at the utmost, only a few hundred-weight heavier, consequent upon the increased length of axles and breadth of frames—the boilers, fire-box, wheels, cylinders, and working gear (about nine-tenths of the whole) remaining exactly the same; and even with our present heavy engines, the greatest weight upon one pair of wheels is not greater than upon the driving wheels of Mr. Bury's engines on the London and Birmingham Railway.

If the strength of the rails be not increased, the mere distance between them cannot affect the expense of construction beyond the cost of a few cube feet of ballast per yard forward, and about eight loads of timber to the mile in transoms. If 150*l.* per mile is allowed for these sources of expence, it is far more than enough. This, with the 200*l.* assumed by Mr. Hawshaw for the earthwork, and 50*l.* for one quarter of an acre of land, which he has not allowed for, makes 400*l.* per mile as the outside of the additional cost incurred in the first construction of the road on the seven-feet gauge. As to the consequent increased cost in the engines and increased expense of repairs, they are treated in so general a way that it is difficult, if not impossible, to meet what is said; but certainly, actual experience satisfies me that eventually there will be no material difference in the first cost. The opinion of Messrs. Robert Stephenson and Company, as quoted page 28, is, that it "will not be very considerable." The wear and tear, I am equally satisfied, will be diminished.

The whole subject of the diminished resistance arising from the increased diameter of wheels, and the opinion of the Irish commissioners in favor of it, is then disposed of in a summary manner. It is assumed that the bearings of the axles must be increased in the same ratio as the diameter of the wheels, and that hence no advantage would be gained, in so far as the friction was concerned; but such is not intended to be the case.

It is asserted that the grinding of the flanges against the rails must be more felt with a large wheel than a small one. No reason is given for expecting such a result, nor why this resistance should not be, as one might naturally expect, inversely as the square root of the diameter, and therefore diminishing with an increased diameter. As in the case of the gradients, however, the whole is set aside by one experiment; this experiment (page 15, 16, 17,) gives nearly the same result for wheels of three and four feet diameter. This is not surprising, as the difference in diameter was too small to be detected by the very uncertain and unsatisfactory mode hitherto adopted for ascertaining the resistance. It appears to me, also, that they were not made under similar circumstances, or even on the same road, and the ratio of the bearings to the wheels seem to be *rather in favour of the small wheels.* The experiment, therefore, appears to be perfectly useless and unavailable, and the writer says that he does not think it conclusive. Nevertheless, these are the only experiments adduced, whilst the point is assumed to be proved.

The next inquiry made is on the question of safety. I certainly never thought of the danger of *upsetting* from the narrowness of base, as a stage-coach occasionally does; and therefore I need not occupy your time in discussing the manner in which this imaginary argument has been advanced and then demolished. But I must call your attention to the extraordinary and contradictory general assertion (page 17) that "if A be safe, there cannot be the smallest advantage in making B safer." This is a confussion of words. If safety commonly speaking, meant a total absence of the possibility of danger, then the statement is contradictory;

and is not even sense; for if B is made safer than A, A cannot be perfectly safe. But safety is a term, after all, only used comparatively, and then the statement assumes this extraordinary shape—that if A be tolerably good, it is useless to seek any thing better. Now, although no man I believe, ever supposed that ordinary railway carriages were much exposed to the danger of being upset, yet no man could witness, as I have had the opportunity of doing, numerous accidents on railways of both dimensions, without being struck with the great difference in the susceptibility of the engines and carriages to being thrown off the rails on the 4 feet 8 inch gauge and on the 7-feet gauge. The reason is obvious enough: the oscillation and the velocity of the angular motion, or, in other words, the jerk caused by any departure from level in the rails, or from any open joint or obstacle, or from collision, must be much greater when acting on a 4 feet 8 inch base than on a 7-feet base, and I have seen many accidents on the 4 feet 8 inch rail arising wholly from this cause, while on the 7-feet gauge I have seen the same causes operating to a greater extent without producing any serious results. I believe, also, that at high velocities much of the resistance from the friction of the flanges, as well as the strain upon the carriages and liability to accident, arise from the lateral motion, which is imparted to the carriage by angular motion, or rolling, and which must be lessened in the direct proportion as the base is extended. The great difference in the rolling motion of the engine chimneys, when running at high speeds upon the 7-feet gauge, as compared with the same effect on 4 feet 8 inches, was remarked at once by the engine drivers sent by several of the manufacturers to erect their engines, and is familiar to all now engaged on the line, although the rails themselves were at that time undeniably in a bad state. Safety, therefore, may, and indeed must, be increased by the width of gauge. As to the effects of the adoption of the wide gauge by the main trunks upon the branch lines likely to emanate from it, as I said before, these branches have all formed part of the general plan, and were considered originally; and therefore the assumption of the writer, that there is uncertainty or danger upon this point, is not correct. The Bristol and Exeter Railway, which is the extension of the Great Western to the southwest of England, is well fitted to this gauge. A great extent of it will be the most level line in England, and is nearly straight. On the Cheltenham Railway, for four-fifths of the length it is free from any objectionable curve; and on the remainder there will be no curves of so small a radius, even in proportion to the 7-feet gauge, as there are on the Grand Junction and many other lines. The objections taken, therefore, are not applicable; and it seems to me that none of the grounds on which the writer founds his somewhat startling advice to alter all that has been done, are tenable. In fact, they are none of them brought forward in a clear and tangible shape, except the debit and credit account in page 26.

I will begin with the last, or the credit account. The first item is the largest, and considering that it constitutes two-thirds of the whole, it is a very important one; yet there is no proof, there is not even one single reason given for supposing any such increase; the only reference to it that I can find is in the middle of p. 13, where these words occur:—"The permanent road will also cost more if of the larger dimensions than if of the smaller; for it avails nothing to compare a light rail on the larger gauge, with a heavier rail on the smaller gauge, such comparisons must be made when other things are the same, or they amount to nothing." The assertion here made is unsuported by a single argument or proof. What is meant by the truism contained in the allusion to the light rail and heavy rail, I am unable to comprehend. I have quoted it lest it should have some reference to a wide and narrow gauge, which I may not perceive.

I have shown, I think clearly, that 150*l.* per mile instead of 1,000*l.* is the excess: this makes a reduction of 85,000*l.* in the assumed saving. The 400*l.* excess on the engine and tender I equally dispute; it is also unsupported by any thing except the letter from Messrs. Stephenson, and their opinion is even much qualified: their concluding remark is—"If the power or dimensions of the engine be kept the same, the additional expense consequent upon an increase of gauge will not be very considerable." In fact, the same engine in all its material parts, and the same quantity of workmanship, answers for the one as the other; to widen the frame and lengthen the axles is all that is required; and even making no allowance for any increased facilities in the construction, 100*l.* will amply cover this,—say 150*l.*, as the increased expense consequent upon the wide gauge. This, of course, has no reference to any peculiar construction of the engine, such as greater evaporating surface or larger driving wheels, which are not, in fact, consequences of the width of gauge, but have been adopted with a view to economy of fuel and wear and tear.

In the next item I should add 50*l.* per mile of land, although neither upon earthwork, and still less upon land, have we 60 miles upon which we can effect the saving. The tunnelling, as I have shewn by actual calculation of the measurement required, is not affected by the gauge. The account, therefore, stand thus:

£150 per mile on 100 miles of permanent way - - - -	£15,000
£150 less on 60 engines and tender - - - - - - - -	9,000
£250 per mile on 60 miles of earthwork and land - - -	15,000
Tunnelling—nothing.	
	£39,000

Instead of £156,000 as given in the Report.

I now proceed to consider the debit account, in which I find an important omission. The change recommended from the 7-feet gauge to the 4-feet 8-inch, is supposed to occupy a year and a half; during this time no advantage could be taken of the extension of the line to Twyford, in the neighbourhood of Reading, which, if the opinions expressed in this Report are to be adopted, must be laid down with the narrow gauge, and it therefore would be useless until one of the lines of the same gauge was open. By this delay at least a year would be lost.

But besides this loss, another would be experienced by the confinement of the traffic to a single line. I believe it would be found impracticable to carry on our trade on a single line; there can be no doubt that it would be materially diminished, which, together with the loss of twelve months traffic between London and Twyford, cannot fail to make a difference of upwards of 50,000*l.* The gross receipts upon the present line are about 80,000*l.* per annum; the extension of the line from 22½ to 32 miles, (thereby securing all the long traffic, which is now only partially obtained,) and the natural progressive increase of the traffic which would take place on the present line, cannot be estimated to produce less than 60,000*l.* more, or 140,000*l.* per annum. Supposing the expenses to be increased by 25,000*l.*, there remains, as increased nett profits, 35,000*l.*; to this add 15,000*l.*, as a very moderate allowance for the reduction, to which I have alluded in our receipts, unavoidably consequent upon the working of only a single line, which would certainly not diminish our expenses.

The debit account, therefore, will now stand:—

Expenses of alteration and loss upon stock, as stated in Report (page 24) - - - - - - -	£123,976
Loss of profits on the extension to Twyford - -	35,000
Ditto on the traffic to Maidenhead - - - - -	15,000
	£173,976

Instead of £123,976.

And deducting the amount to be saved, 39,000*l.*, it shows a sacrifice of 134,976*l.* as the result of the proposed alteration. Even if the assumed increase of 400*l.*, on the engine were admitted, it would still leave 121,976, as the balance clear loss, it should also be remembered, that after the conversion of the one line to Maidenhead from the broad to the narrow gauge, the other still remains to be altered. During the whole of this operation, let me repeat, the total traffic to Reading must travel on a single line, which, even admitting it to be possible, must necessarily cause a continued loss of traffic, with great additional in convenience and expense, and serious risk of accident,—all so much in *addition* to the amount of sacrifice already calculated.

MAIDENHEAD BRIDGE.

On this head it is unnecessary to say more than the defective part of the work has been condemned by me, and the contractor called upon to replace it, which he is now engaged in doing.

PERMANENT WAY.

The question of the construction of the permanent way appears to have been thought a very unimportant one: three lines of the Report are devoted to it, and these consist of the expression, in rather strong language, of an opinion unfavourable to the mode in which the attempt has been made; but whether the writer approves of the ultimate object sought to be attained—of the plan of continuous support—or not, does not in any way appear. This is to be regretted, as the writer has lately had some experience on this particular point, and it was supposed might have been able to give some useful information upon it.

LOCOMOTIVES.

The question of locomotive power is treated also very concisely; nothing whatever is stated, under this particular head, of the engines of the Great Western Railway. A few general principles are laid down, in almost all of which I perfectly concur,—viz., the necessity of proportioning the power of the engines to the loads; the advantage of keeping down the weight; the circumstance that the weight of the engine will depend on the average load to be taken, and the nature of the gradients. The comparison between the locomotive power supposed to be necessary on the Great Western and on the Grand Junction lines, is a powerful argument in favour of good gradients. On the whole, these principles are precisely those on which I have founded my arguments in the course of these observations, and I think they fully bear out the views I have taken, but the concluding observations of the Report appear to me to be the most strikingly erroneous views that I have yet had occasion to call your attention to, and still arising from the same mistake—that of omitting all consideration of increased profits to be derived from increased accommodation or improved conveyance—objects at which I have aimed.

In the last paragraph but one, after condemning, very properly, any great increase in the cost of a road for the sake of a system, it is asserted that "good gradients will be rendered of non-effect, as to economy, if the speed be greatly increased, for greater speed will entail greater cost, and be tantamount to steep gradients."

It seems to me, on the contrary, that the attainment of a greater speed at the same cost is economical, just as it is to make a better and more saleable article at the same price. And the next and last paragraph exposes still more strongly this fallacious principle, and may be taken as a fair sample of the theory of railway economy advanced in this Report. The words are—"And though the same results may perhaps be obtained on railways of better gradients, with more dead weights, than on railways of bad gradients, yet this seems to be merely bringing down the good line to the standard of the bad;"—that is to say, if "more dead weights," or greater loads, are carried with "the same results," or at the same cost, no advantage is gained; so that, if natural or artificial means enable you to carry greater loads, and, in fact, *perform more work*, or in other words, *carry on a greater trade with the same capital*, you are not to avail yourself of these advantages to extend your business, but merely to withdraw so much capital from a thriving concern. If the sole object were to reduce the out-goings to the lowest possible scale, without reference to the comparative receipts, such a maxim might be good. If the construction of the railway, and the maintenance and working of it, were compulsory tax levied on the proprietors for the use of the public, without benefit to them, then indeed the only advantage of good gradients would be the diminution of exertion and of expenditure of power. To the beast of burden a good road is certainly of little consequence, if he is proportionably laden; but his owner would be surprised at being told that he could gain nothing by being able to carry more goods, because his horse would be worked *as much*, and worn out *as soon*, as when he carried less.

I shall now make a few observations on the remarks and the hypothetical cases which I before referred to, and I think when I have called your attention to them, you will agree with me that they ought not to pass entirely unnoticed.

In p. 2 of the Report, the difference between the Great Western Railway and other railways is compared to the difference between a canal for barges and a canal for ships—a most exaggerated comparison, and one by no means diminished in effect by the qualification introduced by the words which follow, "though not to an equal degree." A ship-canal is a totally different thing from a barge-canal; it is most costly, and if considered as a mere channel for the conveyance of goods, is very ill adapted for the purpose. It is intended solely for the transport of the ships to some inland port. The only change introduced in the Great Western Railway is in the dimension of one of the parts, not for the purpose of carrying larger *individual cargoes*, but for the purpose of carrying the ordinary cargoes more advantageously. If a comparison be made with canals, it should be simply with the case of a canal which, being intended for quick service, or fly-boats, is made rather wider, to allow the boats more free passage through the water, and thereby diminish the resistance. The comparison apparently is thought to require some apology, as it is said *not* to be *extraordinary* "*should it appear* that the locomotives have twice the power of those on other lines;" and "*should it be shown* to be a parallel case to build a ship of 200 tons burthen, when there is no probability of ever obtaining a cargo of half the weight." This certainly is tantamount to the statement in a subsequent part of the Report, that the engines have this excess of power, and that we have, in fact, provided for a traffic four times as extensive as we can hope to obtain; yet, after producing this impression, the subject is dropped, and no attempt made in any part of the Report to prove it.

In the next paragraph (pages 2 and 3) there is a remark that "it is one thing to design that which is pleasing in outline and grand in dimensions, and it is altogether another thing to design that which, under all the circumstances, shall best answer the end in view, one of those ends being a return for the capital invested."

I must deny altogether that such a distinction necessarily exists. To make that large, *for the sake of appearance*, which ought to be small, is, unquestionably, very different from studying the right size and adopting it; but I think that when a work is evidently well adapted to the object for which it is intended, it is generally satisfactory to the eye; and that then there is rarely any difficulty in making it "pleasing in outline;" the distinction exists only with those who, like a bad archi ect, commence by designing the exterior of a building, and then make the interior arrangements subservient.

At the end of p. 3, a case is put which is strictly applicable, and which is solved in a manner to assist the subsequent arguments; but the solution seems to me to have no other merit, certainly not that of correctness.

It is supposed (what is indeed the actual case) that it is desired "to give the greatest impetus to the trade, and the greatest advantage to the town of Bristol;" and the way to do this is said to be, as if incontrovertible, "to connect it with the metropolis by a road on which parties could be carried for the smallest sum, and at a velocity *not inferior* to that at which they can be carried in any other direction." This is the first time I ever heard that to win the race it was sufficient to be *not behind* your competitor. If such were the rule in trade, why was the Liverpool and Manchester Railway made? The means of communication were not merely *not inferior* to, but probably superior to any in England. Why were railways introduced at all, and the capital embarked in the general means of transit so enormously increased by the *addition* of totally new work? Stage coaches and canals left all towns exactly in the position which is here said to ensure *the greatest impetus to their trade.* Besides, are there no points of inferiority in the case of the port of Bristol which have to be compensated for, in consequence of the superior local advantage of other ports? Bristol has, for some reason or other, fallen far believed Liverpool. Will it be of no advantage to the trade of this port, and thereby to the revenue of the railway, that it should have superior facilities of communication with London? Whether Liverpool continues at eleven-hours' or is reduced to eight-hours' distance from London, it may be said by some to be still a day's journey, while Bristol will be brought within four hours or four and a half hours' distance; and if this is reduced to three hours, which is undoubtedly practicable, letters and orders may be transmitted and replied to during the business hours of the day; and precisely the same change introduced into the transactions of business that was effected by the Liverpool and Manchester railway, and a great increase in the trade of the place and in *the traffic of the railway* must necessarily follow.

This doctrine of the all-sufficiency of *a railway*, without reference to its quality, and the inutility of attempting to influence the amount of traffic by increasing the advantages, appears, under different forms, in other parts, and I shall not again refer to it, but shall proceed to another part of the Report.

The adoption of a different gauge is compared, at p. 12, to the construction of a canal "in a country of canals, with locks of such a character as would totally shut out the boats of all the canals that surrounded it." Now, in the first place, as I have shown, the west of England is not a country of railways; and, in the next place, there is no similarity in the mode of conducting the carrying department of a railway and canal. A barge, with its master and his family living on board, may go, and does occasionally go, without inconvenience, far out of the usual beat. Railway carriages and waggons must belong to the particular line on which they run; and, except in such cases as the Grand Junction and Birmingham Railways, which form, in fact, one line, although they happen to be made by two companies, it will never pay to trust them in the hands of others.

On the subject of the wide gauge, the opinions of Mr. Booth, of the Liverpool and Manchester Railway (which had been previously expressed in a letter to the Irish Commissioners), and of Mr. Smith, of the Leeds and Selby Railway, are quoted in favour of the 4 feet 8 inch gauge, and their answer in the negative, given apparently to the direct question whether they thought there was any *want of safety*, or danger of *overturning*, on their *own railways*. The case is purely hypothetical. I never heard of the danger of overturning being advanced as an objection to the narrow gauge, although I have seen such a thing happen; and whether the objection be real or imaginary is the question to be decided by such a reference? At any rate, the Directors of the Great Western Railway were quite competent to select the referees for its decision.

I have the pleasure of being personally acquainted with both these gentlemen, and entertain the greatest respect for them; but I should never have thought of asking them such a question. If before building the Great Western steamship, we had written to some of the highly respectable and talented gentlemen who command the New York liners, and asked them if they considered there was any danger or inconvenience in the use of sails, and whether they should prefer steam, I think we might have anticipated their answers.

I shall here close my observations with the expressions of my regret that the manner in which the important questions at issue have been treated in the Report, has of itself prevented the discussion leading to any very satisfactory or useful conclusion. It has been almost impossible to do more than to show that, whatever may be the state of the case, the views taken in the Report, and the arguments advanced, are incorrect, and prove nothing. Another opportunity will probably occur of entering more fully into the real merits of the question, and for that I shall be prepared.

I am, gentlemen, your obedient servant,

London, 13th December, 1838. (Signed) I. K. BRUNEL.

REPORT OF NICHOLAS WOOD, ESQ.

Killingworth, Dec. 10th, 1838.

To the Directors of the Great Western Railway.

GENTLEMEN,—Having in my introductory letter to you of the 5th of Oct. last, entered at considerable length into the mode in which I had deemed it necessary to conduct the inquiry intrusted to me, of reporting on the Great Western Railway, and the experiments which I found it necessary to make, to arrive at a decisive conclusion; it will be unnecessary again to repeat them in this report, especially as I understand you have determined, that the letter should be printed and laid before the shareholders, at the same time that this is presented to them.

In the preliminary report, I pointed out the necessity of subjecting as many of the important branches of the inquiry to experiment as possible, and enumerated, so far as I then could, the particular part of the system which appeared to me capable of being so subjected to experiment. In the prosecution of these, as in all experiments of this nature and description, innumerable and unforeseen difficulties have been met with, and, although as I have stated previously, every assistance has been rendered by every person connected with your establishment, yet the numerous obstacles unavoidably met with on such occasions have been in this instance so formidable, that it has been deemed advisable, and indeed necessary, to curtail the experiments as much as possible, and only to perform those which were absolutely necessary to elucidate the system in a practical point of view. Still a body of facts has been obtained, which although perhaps not sufficiently comprehensive to embrace every subject connected with the inquiry in a scientific point of view, yet are of such extent and value as to enable me to enter upon the important task with much greater confidence, and certainly upon infinitely more secure grounds, than if I had merely confined myself to a personal inspection of the several works involved in the inquiry. And I likewise trust that, independently of the utility of these experiments, for the purposes of this inquiry, that the time, labour, and expense of performing them will be amply repaid by the information elicited by them, as a foundation for future operations; and by the additional, and in some cases, new, most important, and unexpected light thrown upon the whole system, which is now shown to be yet far from being fully developed, and which could only have become known by such like investigations. And this mode of investigation of the system is peculiary applicable to the case upon which I am called to report, the plans of construction and working of your railway being to a certain extent new, or, at any rate, different from those of a great majority of other railways, and having been adopted to remedy supposed defects of the old system; any experiments, therefore, which would not only exhibit the capabilities of your plans, but elucidate and develope all the properties, defective or otherwise, of the old system, must be of the greatest importance, as bringing before you in a tangible and more prominent and conclusive shape, than mere opinion, all those defects or properties of that system which it has been your object to improve and modify.

These experiments have been unremittingly prosecuted since the date of my last report, with the exception of the suspension of a few days, occasioned by a most melancholy accident; still the late period at which they have been terminated, (only on the 6th instant) and the early day which you state it is necessary you should receive my report, leaves me much less time than is necessary to properly compile and disgest all the various and complicated results and information elicited in the course of this extensive inquiry. This will render it necessary that I should confine myself as much as possible, to applying the result of the experiments and of my inquiries to the determination of the questions submitted to me, in a practical point of view; and shall not, more than is absolutely necessary for the proper elucidation of the subject, in that respect, enter upon or distract your attention, by any theoretical or speculative results arising out of these experiments.

I shall therefore have to omit the consideration of some very important theoretical, and in some respects, practically useful considerations arising out of these experiments, which though necessary in a scientific point of view to elucidate the system of railways generally, yet which being applicable alike to railways of the ordinary description, and of that adopted by you, does not necessarily force itself upon my notice at this time; and which could not be properly considered within the period allowed me for making out this report, even if it had been advisable that such investigations should have been attempted.

With these remarks, I shall at once proceed to consider, the important questions embraced in your request, and the objects which appeared to me to be involved in the inquiry, and shall in detail point out the mode which I have adopted of determining the questions submitted to me; and the conclusions which, in a practical point of view seem, so far as my judgment enables me to pronounce an opinion, to result from these experiments and inquiries.

Your instructions were, that I should undertake an examination of that portion of the Great Western Railway now completed, and investigate the result of the whole system which has been adopted; and my attention is particularly directed to these points which may be said to constitute the peculiar features of the Great Western line, as contrasted with those of other railways, including in such inquiries the construction and efficiency of the engines, as well as every matter connected with the locomotive department of the company.

The Great Western Railway differs from the ordinary railways, in the width of gauge adopted, in the construction of the rails employed in framing the road, and in the adoption of much larger driving wheels than ordinary in the locomotive engines.

The subjects for consideration are therefore comprised under the following heads of inquiry,—viz. the width of gauge, the mode of constructing the road, and the efficiency, power, &c. of locomotive engines.

The increased width of gauge might have been adopted, and engines of the same description as those used on other railways might have been used, and it does not necessarily imply that the adopting an increased width, should render necessary the particular mode of construction adopted by Mr. Brunel, except in one point of view in which Mr. Brunel has put,—viz:—"That the increased width of gauge was necessary for the accomplishment of a high rate of speed, and that he believes continuous timber bearings to be a most essential improvement where high speeds are to be obtained." Still, as the two questions are in some degree distinct, we shall in the first instance consider them separately, and shall afterwards consider them in their connection with each other, as advanced by Mr. Brunel; and as the elucidation of these two heads of inquiry, includes that of the power of the locomotive engines, we shall not in this place make their consideration a distinct question.

In order, therefore, to bring the subject clearly before you, I shall first of all point out the *objects*, so far as I can learn from the published documents of your body, and from the reports of Mr. Brunel, which have been expected to be realized by these departures from the more general plan of constructing and working railways, I shall then state some of the most prominent objections which have been made against the system, after which I shall give, in detail, the inquiries and experiments which appeared to me necessary, to ascertain how far these benefits have been, or appear likely to be realised, and to what weight the objections appear to be entitled. The result of these inquiries and experiments will be next considered, and, with these materials, in obedience to your instructions, the system of construction of the Great Western Railway will be contrasted with the most improved railways of the ordinary construction and width of gauge.

Width of Gauge.—The width between the rails of all the public railways in England, is four feet eight and a half inches, the width of the Great Western Railway is seven feet; the difference is therefore nearly one-half more or two feet three and a half inches. From the documents previously alluded to—from a careful perusal of Mr. Brunel's reports—and from personal communications with that gentleman, the following appear to have been the prominent advantages expected to be derived from the increased width of gauge, and which induced the adoption of the width of seven feet.

Attainment of a high rate of Speed.—On this point Mr. Brunel remarks, "with the capability of carrying the line upwards of fifty miles out of London, on almost a dead level, and without any objectionable curves, and having beyond this, and for the whole distance to Bristol, excellent gradients, it was thought that unusually high speed might easily be attained; and that the very large extent of passenger traffic, which such a line would certainly command, would ensure a return for any advantages which could be offered to the public, either in increased speed, or in increased accommodation." For Mr. Brunel remarks—"I shall not attempt to argue with those who consider any increase of speed unnecessary, the public will always prefer that conveyance which is the most perfect, and speed within reasonable limits is a material ingredient in perfection in travelling," and the attainment of high speed appeared to involve the question of the width of gauge.

Mr. Brunel also considers, "that it would not have been embracing all the benefits derivable from the favourable gradients of the Great Western Railway, unless a more extended gauge was adopted, for if carriages and engines of a certain weight have not been found inconvenient upon one railway, greater weights may be employed, and the same results obtained on a railway with better gradients; and to adopt a gauge of the same number of inches on the Great Western Railway, as on the Grand Junction Railway would, in fact, amount practically to the use of a different gauge on similar railways, for the gauge which is well adapted to the one, is not well adapted to the other."

Mechanical advantage of increasing the Diameter of the Wheels, without raising the Bodies of the Carriages.—This comprehends what is deemed by Mr. Brunel, the most important parts of the advantage of an enlarged width of gauge, viz., the reduction of friction by the increased diameter of the wheels, which at the same time by being enabled to place the body of the carriage within the wheels, the centre of gravity of the carriage is kept low, and greater stability and steadiness of motion is expected to be obtained. Four feet wheels have been put upon the carriages at present in use upon the line, but Mr. Brunel states "that he looks forward to the employment of wheels of a larger diameter; and that he has been influenced to a considerable extent, in recommending the increased width of gauge, by its capabilities of prospective improvements, which may take place in the system of railroads." He states "that though there are some causes which in practice slightly influence the result, yet practically the resistance from friction will be diminished exactly in the same ratio that the diameter of the wheels is increased," and "considering that the gradient of four feet per mile, only presents a resistance of less than two lbs. per ton, and that the friction of the carriages on ordinary railways amount to eight or nine lbs. per ton, being 8-10ths of the entire resistance, any diminution of the friction operates with considerably more effect upon a road with favourable, than one with more unfavourable gradients; and he further says "I am not by any means, at present prepared, to recommend any particular size of wheels, or even any increase of the present dimensions. I believe they will be materially increased; but my great object would be in every possible way to render each part capable of improvement, and to remove appears an obstacle to any great progress in such a very important point as the diameter of the wheels, upon which the resistance which governs the cost of transport, and the speed that may be obtained, so materially depends."

Admits all sorts of Carriages, Stage-Coaches, &c. to be carried within the wheels.—Presuming that the adoption of wheels of a large diameter is found beneficial, to the extent expected by Mr. Brunel, it became necessary that the carriages to be conveyed should be placed upon platforms within the wheels, to keep them as low as possible, which could not be done with carriages on railways of the ordinary width, a wider gauge seemed therefore necessary for this purpose.

Increased facilities for the adoption of larger and more powerful Locomotive Engines, for the attainment of higher rate of speed. Much stress has not been laid upon this by Mr. Brunel, although it has been alleged that great difficulties exist and that considerable expense is incurred by being obliged to compress the machinery into so small a space; and consequently, that a greater width of gauge would enable the manufacturer to make a more perfect machine, and by having more space for the machinery, the expense of repairs would be lessened.

Increased stability to the Carriages, and consequently increased steadiness of motion, not from any danger to be apprehended. by the centre of gravity being higher in carriages of a less width; but that higher carriages are more liable to oscillate upon the railway, than carriages of a greater width and less height, and that a considerable part of the friction is occasioned by the oscillation of the carriages, throwing the flanches of the wheels against the rails.

These appear to be the more prominent advantages set forth by Mr. Brunel, as consequent upon the adoption of an increased width of gauge. I have taken the extracts from the report to the Bristol meeting, in preference to quoting from Mr. Brunel's communications to the directors, inasmuch as that report is before the shareholders; and also in that report of Mr. Brunel enters somewhat minutely into details on the subject, and gives in a more determined and explicit plan the substance of all his communications to the directors on the subject. It would have increased the bulk of this report unnecessarily to have given all Mr. Brunel's reasons for the adoption of the increased width set before in that document, and this is also unnecessary, as the report itself is before the shareholders and can be referred to. These representations and recommendations of the engineer, appear to have been the principal reasons which had induced the adoption of an increased width of railway, as stated in your report to the shareholders, at the half-yearly meeting of the 25th of August, 1836.

The objections which have been advanced against the adoption of this departure from the ordinary width of railways, have been principally the following, viz:

The increased cost of forming the road track of the Railway, in consequence of a greater width of base required for the superstructure of the rails, and upper works. That the carriages were required to be larger and heavier. That the increased width of gauge caused additional friction in passing through the curves. That it entailed a greater expense of constructing the engines and carriage, increased liability to the breakage of axles, &c. That it prevented a junction of the Great Western with other railways; and above all, that there were no advantages gained commensurate with the increased expense, and inconvenience of such a departure and disconnection from railways of the ordinary width, and several other objections which have been urged by different persons against the system, which it is not necessary to enumerate.

Previously to entering upon the consideration of the presumed benefits and objections incidental to the width of gauge, it will be advisable to bring before you the second part of the system of Mr. Brunel, viz: *the mode of constructing the Railway*, and in doing so I shall pursue the same plan as in the case of the consideration of width of gauge; first of all to point the reasons which seem to have influenced Mr. Brunel in the recommendation of this particular plan, and the improvements over other plans which he anticipated from its adoption; I shall then briefly state some of the principal objections which have been urged against it; and lastly, detail and report to you the mode I have deemed advisable to investigate, and determine all these conflicting questions, and then give the conclusions, which appear to me to result from the enquiries and experiments I have made.

Construction of the Road.—It will not be necessary for me to enter into a detailed description of Mr. Brunel's plan of constructing the Great Western Railway, further than what is absolutely necessary to explain principles of construction, and in what respects it differs from that of other railroads

The plan adopted by Mr. Brunel is that of a continuous bearing of timber with piles, upon which the iron rails that constitute the track of the wheels are placed.

The construction may be thus shortly described,—Longitudinal timbers of a scantling of from five to seven inches in depth, and twelve to fourteen inches in breadth, and about thirty feet long are placed along the whole line. Then these timbers are bolted to cross sleepers or transoms at intervals or every fifteen feet; double transoms each six inches broad and nine inches deep being placed at the joinings of each of the longitudinal timbers, and single transoms of the same scantling being placed midway between the joinings. These transoms stretch across, and are bolted to all the four lines of rails. Within the two lines of rails of each track piles of beech are driven from the upper surface of the railway into the solid ground, so as to retain a firm hold thereof, and the transoms are bolted to the heads of these piles.

Sketches Nos. 1 and 2, Note A, Appendix, show this plan of constructing the railway. A B C D, and E F G H, are the longitudinal timbers; *a b a' b'*, the double transoms; *c d*, the single transoms; and 1 2 3 4 the piles. Upon the longitudinal timbers, as shown at *r s*, in Sketch No.

3, a piece of hard wood is laid upon which the rail rests, A B being the longitudinal timber, and *c f* the transom. No. 4, D, shows the section of the rails on a larger scale, which is fastened down to the timbers and hard wood by iron screws.

The principal construction is this, the longitudinal timbers and transoms being held firmly down by the piles, gravel, or sand, is beat or packed underneath the longitudinal timbers, for the purpose of obtaining a considerable vertical strain upon the timbers upwards, and consequently to effect a corresponding firmness of foundation of packing underneath them. Without piles, the longitudinal timbers could not be packed in this manner, as there would be nothing to resist the pressure of the packing except their own weight, and the piles were therefore introduced to hold down the longitudinal timbers, and to render it practicable to introduce a force of packing underneath.

This plan is pointed out very clearly by Mr. Brunel in his report to you on the 22d of January, 1838, and presented to the Shareholders at the half yearly meeting on the 27th of February, 1838, and which, as it contains the reasons for its adoption, I give below:—

"The peculiarity of the plan which has been adopted, consists principally of two points; first, in the use of a light flat rail, secured to timber, and supported over its entire surface, instead of a deep heavy rail supported only at intervals, and depending only on its own rigidity. Secondly, in the timbers which form the support of this rail being secured and held down to the ground, so that the hardness and degrees of resistance of the surface, upon which the timber rests, may be increased by ramming to an almost unlimited extent.

"The first, namely, the simple application of the rails upon longitudinal timbers is not new; indeed, as mentioned in a former report, I believe it is the oldest form of railway in England, but when lately revived and tried upon several different railways it has not, I think, succeeded as fully as was anticipated, and I believe this is very much owing 'to the want of some such means as that which I have adopted for obtaining a solid and equal resistance under every part of the timber, and a consistent close contact between the timber and the ground.' As I believe this to be entirely new, and to constitute an essential part of the plan,' I trust I shall be excused dwelling upon it for the purpose of fully explaining it.

"In all the present systems of rail-laying, the supports, whether of stone blocks or wooden sleepers, simply rest upon the ground, and, consequently, only press upon the ground with a pressure due to their own weight; this is trifling compared either to the weight which rolls over them, or the stiffness of the rail which is secured to them. The block or sleeper must lie loosely upon the ground; if you attempt to pack under it beyond a certain degree, you will only raise it, and for the same reason, it is impossible to pack under the whole surface of a block or sleeper; one corner or end is unavoidably packed a little more than another, and from that moment the block or sleeper is hollow elsewhere. If this block yield as the weight rolls over, the rail itself resting on the two contiguous supports, is sufficiently stiff to raise it again, and the support becomes still more hollow; such is the operation which may frequently be observed by the eye, more or less, in the best laid railways.

"Where contiguous longitudinal sleepers have been tried they have also been laid loose upon the ground; having no weight themselves, their length has rendered it impossible that they should be well supported by the ground underneath, or that they should continue so, even if it were practicable to lay them well in the first instance.

"It will be perceived at once that two lumps or two hard places in the round may leave such a timber unsupported for the interval of twenty or thirty feet in length, and, under the weight of an engine running rapidly over, it must in such a case yield and spring from the ground.

"In the present plan these timbers, which are much more substantial than those hitherto tried, are held down at short intervals of fifteen to eighteen feet, so they cannot be raised; gravel or sand is then rammed and beat under them, until at every point a solid resistance is created; more than sufficient to bear the greatest load that will come upon it; as the load rolls over, consequently the ground cannot yield; the timber which was held tight to the ground cannot yield, neither can it spring up as the weight leaves it; and the rail be securely fixed every where in close contact with the timber, that also is immoveable. Such was the theory of the plan, and the result of the experiment has fully confirmed my expectation of its success.

"The experiments have been made under several disadvantages, and I am glad that it has been so, as we are more likely to perceive at once, and to remedy any defects, which might otherwise have lain concealed for a time. The packing, upon which it is evident every thing depends, was effected during long continued wet, and while no drainage at all existed; looking forward to the necessity of repacking once or twice, the timbers and packing were left completely exposed. The severe frost which immediately followed converted the wet sand into a mass of stone, which we in vain attempted to disturb, and the continued dry frost has gradually evaporated the water it originally contained. The packing has shrunk considerably, and the exposed surfaces crumbled away, while the mass is still so hard within as to resist the pick-axe, and has been with some difficulty broken through at some points with a smith's cold chisel and hammer. Under these circumstances, with an engine weighing 14 or 15 tons, (and from want of adjustment, with more than half of this occasionally thrown upon one pair of wheels), constantly running over the rails, the timbers have stood most satisfactorily."

At the subsequent meeting (Oct. 10th, 1838), of the Great Western Railway Proprietors, Mr. Brunel thus gives his reason for the adoption of this plan of constructing the road.

"The mode of laying the rails is the next point which I shall consider. It may appear strange that I should again in this case disclaim having attempted anything perfectly new, yet regard to the truth compels me to do so. I have recommended in the case of the Great Western the principle of a continuous bearing of timber under the rail, instead of isolated supports, an old system recently revived, and as such I described it in my report of January, 1338; the result of many hundred miles laid in this manner in America, and of some detached portions of railways in England, were quite sufficient to prove that the system was attended with many advantages, but since we first adopted it these proofs have been multiplied; there need now be no apprehension. There are railways in full work upon which the experiments has been tried sufficiently to prove beyond doubt, to those willing to be convinced, that a permanent way in continuous bearings of wood may be constructed, in which the motion will be much smoother, the noise less, and consequently—for they are effects produced by the same cause—the wear and tear of the machinery much less: such a plan is certainly best adapted for high speeds, and this is the system recommended by me and adopted on our road. There are, no doubt, different modes of construction, and that which I have adopted as an improvement upon others, may, on the contrary, be attended with disadvantages. For the system, I will strenuously contend, but I should be sorry to enter with any such determined feeling into a discussion of the merits of the particular mode of construction. I would refer to my last report for the reasons which influenced me, and the objects I had in view in introducing the piling: that part which had been made under my own eye answered fully all my expectations."

These appear to have been the reasons for the introduction of this system of railway construction, and the objections raised against it have been—The increased cost of constructions beyond that of other modes,—the additional expense of keeping it in repair; and, that it does not accomplish the objects proposed by Mr. Brunel, in recommending it to your notice,—that the motion of the carriage is much greater than upon ordinary railways of the best construction,—and, that there is a considerable increase of resistance of the carriages.

The professed advantages to be derived from the increased width of gauge, and the construction of the road by continuous bearings and piles, are so extensive and numerous, while on the other hand, the objections alleged agaist them are equally so, that it appeared to me, as stated previously, with the exception of awaiting the result of the test of time, there was only one mode of determining these complicated questions with any degree of satisfaction,—viz.: to endeavour to investigate as many of the points as possible, by experiments instituted for the express purpose, and to ascertain, if by this mode such a number of facts could be obtained as would, with the aid of the experience already obtained of the working of the system, enable me to arrive at conclusions which would, to unprejudiced persons, determine the important questions submitted to me.

On a review of all the proposed advantages and above-enumerated objections, the most important points to be determined by experiment, appeared to me to be comprehended within the following heads of inquiry:—

1st. The question of the attainment of a higher rate of speed than on other railways; whether the increased width of gauge is, or is not, either necessary or best adapted for the accomplishment of this object, and to what extent.

2nd. The mechanical advantage or diminution of friction, by being enabled to increase the diameter of the wheels, without raising the bodies of the carriages; and in what respect, and to what extent, the friction or resistance of the carriages is effected by, or bears upon the peculiar construction of the road.

3rd. The comparative advantage or firmness of base, or road track of the Great Western Railway, with continuous timber bearings, either with or without piles, and if it does, or does not, produce a greater steadiness and smoothness of motion to the carriages, and to what extent.

These were the questions which appeared to me could not be determined in any other way than by experiment, but which appeared to be capable of solution by that method, and which likewise appeared to constitute the foundation of the entire system; for if the plan was not either necessary for the realization, or did not effect a greater rate of speed than ordinary railways;—if no diminution of friction was accomplished, and if no increased steadiness of motion to the carriages was produced, at least, a very considerable portion of the inducements for a departure from the ordinary plan would be destroyed; but if, on the contrary, the whole or some part of these desiderata were accomplished, then it remained to be determined whether the advantages did, or did not, counterbalance the disadvantages, or objections to the system.

Attainment of Speed.—The first question to determine was, therefore, that of the attainment of speed. The most conclusive manner of effecting this appeared to be, to subject all the different descriptions of engines upon the line to experiment; to ascertain at what rate of speed they could travel, the loads they were capable of dragging at different rates of speed, and the comparative power required to accomplish these different performances. Having thus obtained the power of the Great Western Railway engines upon that railway, by instituting a similar set of experiments on other railways; we then had the comparative result of the [engines as to speed, and performance upon the railways of the ordinary width and plan of construction, and upon the Great Western Railway.

A set of experiments for the purpose of ascertaining the performances of the several engines on the Great Western Railway was therefore commenced, and were conducted as follows:—

A certain number of first and second class carriages were selected and weighed; they were then loaded with such a weight as would equal that of their full complement of passengers, with their luggage. A certain number of trucks were also selected, weighed, and loaded with the weight which they were calculated to carry.

The engine selected for the experiment was weighed, and also the tender; the quantity of coke in the fire-grate of the engine was carefully observed at the commencement of the experiment, and also the quantity of water in the tender. The engine was then attached to the carriages fixed upon for the experiment, put in motion, and proceeded to the end of the stage without stopping. The coke having been previously weighed into bags, the quantity put into the fire-grate during the journey was recorded, and at the end of the trip the fire-grate was filled up, as nearly as could be estimated, to the same height above the fire grate as it was at the commencement of the trip, and the quantity thus consumed correctly ascertained. The quantity of water at the beginning of the trip being known, the boiler was kept to the same height during the journey, the quantity of water left in the tender at the end of the journey was gauged, and thus the quantity evaporated in the trip was obtained.

The mode of conducting the experiments was this:—Commencing at Paddington, the engine dragged the train from the depot to the first half-mile post, when it was stopped; the steam was then applied to the cylinders, and the time noted; for the first mile the time was recorded at every 110 yards, for the purpose of ascertaining the progress of obtaining the average speed, and afterwards at every quarter mile. The train then proceeded until it arrived at the twenty-first mile post, when the steam was shut off from the cylinders, and the train allowed to come to rest of itself. The quantity of coke consumed, and water evaporated, during each journey, was ascertained as previously explained; and the rate of speed being taken at every quarter mile, the rate of velocity was also obtained, not only during that part of the journey at which a maximum rate of speed was kept up, but also the time occupied in getting up the speed, and also of bringing the train to a state of rest. The same process was observed in the return trip from Maidenhead to Paddington; the engine, and train was brought up to the twenty-second mile post, and stopped, the steam thrown upon the pistons, and the time, coke, and water ascertained in the same manner as in the former case.

Note B. Appendix, is a list of the names and dimensions of the engines subjected to experiment.

Note C, is a section of the gradients of the line, with the length and radius of the curve.

Note D, from No. 1 to No. 80, is an account of the experiments on the Great Western Railway, shewing the consumption of coke, water evaporated, and the time occupied in each trip with the different engines, with varying loads, and at different rates of speed.

Note E, from No. 1 to No. 3, is a summary of the experiments on the Great Western Railway, shewing the maximum and mean rate of speed attained in each experiment, the quantity of coke consumed and water evaporated during the trip, and also the quantity of ceke consumed per ton per mile, both exclusive of, and including the engine and tender, also showing the powers of the several varieties of engines in use upon that railroad.

On attentively considering the result of these experiments, we find that the extreme mean maximum rate of speed accomplished by these engines, has been 41.15 miles an hour, with the North Star engine, but the load which was taken at that rate of speed was only 15 tons. It may here be observed, that the rate of speed shown in these tables is the mean rate from the time the engine obtained its full speed, until the steam was shut off at the end of the experiment, and comprehended a distance generally of 19 miles, as may be seen on inspecting the tables in note E, Appendix. A greater rate was accomplished for a short distance during some of the experiments, as much as 45 miles an hour.—The above expression of the maximum mean rate of speed is therefore the average rate of travelling from one end of the stage to the other, after the engine had got into full speed, and until the speed was again checked at the end of the stage.

A rate of 40½ miles an hour has, it will be seen, been accomplished by another engine, the Apollo, but with a load of only nine tons: when the load was increased, both with this engine and with the North Star, the speed was correspondingly reduced. The result of these experiments show that to effect a mean rate of about 40 miles an hour, exclusive of the time of getting up the speed and stopping at the termination, between the two ends of a stage, about twenty miles in length, the load cannot be more than from 15 to 20 tons, with engines of the power of the North Star.

It may be here remarked, that unless very large and heavy tenders are conveyed with the engines, the stages cannot be of a much longer distance than twenty miles; the quantity of water evaporated in this distance, by the North Star engine being upwards of three tons.

The performance with the North Star was with a six-wheel, and a four-wheel passenger carriage, capable of containing 56 passengers; the experiment with the Apollo engine was with a six-wheel carriage capable of containing 32 passengers, the full completment of luggage in both cases being allowed.

It is scarcely necessary to state, that this is a load which cannot be considered a profitable or advisable one, to be fixed upon as a standard for the weight of the trains; or such a load to be considered the weight of the trains on this Railroad for permanent adoption. It is only necessary to refer to the experiments, to see at what a sacrifice of power and consumption of coke this rate of speed has been accomplished, to arrive at once at the conclusion, that if such a rate of speed cannot be kept up except at such a sacrifice, the rate must be reduced.

The Æolus engine with 24 tons, realised a rate of 37 miles an hour, and the twelve-inch cylinder engines with 18 tons, accomplished a similar performance; there are likewise loads below that which it will be necessary to provide for the regular traffic of the railway.

We come now to the next load, on which experiments were made, viz. 32 tons; this would provide accommodation for about 112 people with their luggage, with 2 six, and 2 four-wheel first-clases carriages; and with this load the North Star accomplished a rate of nearly 37 miles an hour, and the other engines about 34 miles. This is likewise a less load than can be reckoned upon for the permanent working of the line, as it does not allow for the conveyance of private carriages, which must always be calculated to accompany the swift or first-class trains.

With a load of 50 tons the speed realised by the Northern Star is nearly 35 miles an hour;—with the Æolus 32 miles;—but with the other engines only 26½ miles an hour.

When the load is increased to 80 tons, the North Star engine performs a rate of nearly 33 miles an hour; but the performance of the Æolus engine is diminished to 24¼ miles an hour; and we see that a rate of 22½ miles an hour is the performance of engines such as the Venus, Netptune, and Apollo, with 12 inch cylinders, and with 8 feet driving wheels; and with the Premier and Lion engines, with 14 inch cylinders, and 6 and 7 feet driving wheels respectively.

It does uot appear, therefore, that with the best of engines at present upon the Great Western Railway, a greater velocity can be calculated upon; at the mean maximun rate of speed than 35 miles an hour, with such loads as may be expected to constitute a first-class train. For extraordinary purposes, with a diminished load, a rate of 40 miles may be attained, but looking at all the circumstances incidental to railways, with engines and trains travelling at the maximum rate of speed, it does not appear to me, that any standard equal to 40 miles an hour can be depended upon practice. The weight of two first-class carriages, one with six wheels, and one with four wheels, and of two second-class close-carriages, one with six wheels, and one with four wheels, with their complement of passengers and luggage, will weight about 31 tons; but this does not allow of any trucks for the conveyance of gentlemen's carriages, or for horse box. Upon the London and Birmingham Railway, since it has been opened throughout, the average weight of the trains, including passengers, passengers' carriages, carriage trucks, horse boxes and luggage vans, has been about 65 tons; this includes both first class and mixed trains, the former being upwards of 50 tons and the latter about 70 tons. Taking this as a standard for the Great Western Railway, it does not appear that, for the first-class trains a less weight than 50 tons can be calculated upon; and with this weight the experiments show that a mean rate of 35 miles an hour between the stages, after getting up the speed, and before its being checked may be accomplished, under circumstances similar to those experienced during the time these experiments were in being performed, and with engines of the power of the North Star. And it will be seen that with a load of 80 tons, which would not much exceed the weight of a second class train, a velocity of nearly 33 miles an hour can be maintained, during the time the engine is at the full rate of speed.

Taking 35 miles an hour therefore, as the mean maximum rato of speed between the stages, it will have to be considered what general average rate can be kept up between one end of the line and the other; in this calculation we have to take into account, the time lost in getting up the speed, and in stopping the train, the time lost at each station, and all the vicissitudes of wind, weather, and incidental casualties. On the other hand, I think it my duty to explain, that these experiments, which are here brought forward as a standard for the assumption of this rate of speed on the Great Western Railway, though it is not expected that more weight should be placed upon them than upon experiments generally, which must be considered as exhibiting more favourable circumstances than the every day practical result; yet it must be taken into account, that the road for three or four miles from one end of the line was under repair, and would not therefore present what may be considered an average result, or what may be expected to be the permanent result when the road is in the best possible order. We shall see afterwards to what extent this may be supposed to influence the general results; I thought it my duty, however, to mention it in this place, that every circumstance connected with the inquiry likely to operate, in any degree whatever upon the general result, should be brought into consideration.

On a mere inspectiou of these Tables, every person must be struck with the enormous increase of power required to effect a high rate of speed, or a rate of 40 miles an hour, compared with that which is required to propel a load at the rate of about 20 miles an hour. We see the North Star engine, dragging 166 tons at the mean rate of 23¾ miles an hour; while the same engine under similar circumstances is only capable of dragging 15 tons at the rare of 41·15 miles an hour. Again the Æolus engine, drags 104 tons at the rate of nearly 23 miles an hour; and only 24 tons at the rate of 37-28 miles an hour. The engines of less power exhibit precisely the same results, we see them dragging 50 tons at 26½ miles an hour, and only nine tons at 40½ miles an hour.

If this had been the result of theoretical deduction, some suspicion might have existed of its accuracy, but the above is the result of carefully conducted experiments, made under precisely similar circumstances.

Mr. Verplanck s Report on the Revenue, Debt, and Financial Policy of the State of New-York.

The committee on Finance have had under consideration the several resolutions on which they were instructed to inquire and report to the Senate. The inquiries to which their attention was directed, involve the consideration of the whole financial condition and prosperity of the State, and of the cost, revenue and general policy of the great works of internal improvement, which are either actually in progress, or seem demanded by the wants or the will of the people. Instead therefore of answering singly to several points of the resolution in the precise order in which they are proposed, it is thought that the objects of the inquiry may be more satisfactorily obtained by a succinct exposition of the results of this examination, and of the views of finances and state policy which they suggest.

The first point of inquiry to which the attention is naturally directed is—

1. What is the probable cost of the great public works now actually in progress, and how much of this amount yet remains to be raised and expended?

These Works are,—*First*, and by far the most important, the Enlargement of the Erie Canal; *second*, the construction of the Genesee Valley Canal; *third*, the Black River Canal.

Whatever may have been the errors or the variations of former estimates of expense on these works, or the causes of such variation or errors, there seems to be every reason to rely upon the estimates last submitted by the Canal Commissioners, and the engineers in the service of the State, in answer to the inquiries of this committee, as well as more formally, in their recent reports to the Legislature. A large portion of the whole line of the Erie Canal is now actually under contract, amounting to about one half of the whole cost of the work, and embracing its most expensive and difficult parts. About ten per cent. of the whole estimated cost has been actually expended on various points and in different kinds of work. New surveys and measurements of the remaining parts having been made, with new estimates founded upon the prices of the actual payments and existing contracts, the results furnish materials for an estimate of the whole cost entitled to as full confidence as any estimate whatever can claim, and cannot, in all ordinary probability, be far from the truth.

The exyenditures, contracts and re-surveys of the Black River and Gedesee Valley Canals, afford materials for a similar and equally satisfactory approximation to a precise estimate of the final cost of these works—more than four-fifths of the whole estimate of the Genesee Valley Canal, having been expended or contracted for, and more thau half that of the Black River Canal.

The entire cost of the enlargement of the Erie Canal, as estimated by

the Commisssioners on these data, is	$23,402,800
The Genesee Valley Canal, if finished accoreing to its original plan, four-fifths of which are now under contract, will cost	4,900,000
The Black River Canal, (also including damages,) will cost	2,431,700
	$30,734,500
Of this amount there has already been expended up to the 1st of February, 1839—	
For the Erie enlargement,	$2,374,300
For the Genesee Valley,	436,500
For the Black River,	237,800
Amounting in all to	$3,048,600
Leaving to be expended,	$27,685,900
But of this amount there was provided from loans already made, and drawing interest in the banks until used, on February 1st, 1839,	$1,916,800
Leaving to be raised and applied for the construction of the canals on the plan and scale now under operation,	$25,760,100

Connected with the question of the probable amount of expense yet to be incurred for these works, is another presented by the resolution of inquiry—Whether or no any important economy can be obtained, consistent with the successful future operation of the system, by altering and contracting the plan of the canals?

It has been stated by some, who have the best means of information, that economy and retrenchment in details may be effected to a considerable amount, and probably sufficient to balance any contingent increase of the aggregate expense from other unforeseen causes. But these relate to matters of detail, and do not touch the greater question of diminishing the scale of the enlarged Erie Canal—or of stoppiug that enlargnment, in its present dimensions, at Utica or Syracuse; and of retrenching the lateral canals in a similar manner.

It is not necessary here to enter into any discussion of the policy of constructing the enlarged Erie Canal, on the ample scale adopted, and with very expensive, but durable and solid workmanship and materials. Some of the reasons for this are to be found in the reports of the Canal Commissioners. Whether these outweigh the additional expense, it would be the duty of the Legislature to inquire, if this were presented as an entirely new question. But whatever may have been the wisdom of that policy, (if it be doubtful,) it now seems neither wise nor easy to attempt economy by an essential alteration or contraction of the plan of the great canal.

In answer to the inquiries on this point by your committee, the acting Canal Commissioners replied, "that they are not aware of any advantageous change which can be made in the plan of the public works. They have added no specific reasons; but when it is considered, that above three millions had been already applied to the construction of these works on the present plan, on the first day of February last, and probably amounting to five millions paid or due before the first day of May—that about eleven millions worth of work on the Erie, and four and a half millions on the other canals, are already under contract, and in progress of execution or preparation of material—that the constructions already executed, or in progress, would be often either inconvenient or useless for a canal diminished in size in other parts,—it will be perceived, that now to contract or materially change the whole plan, would be to throw away much of what has already been expended, and would subject the State to very heavy damages upon the contracts already made, and in part acted upon —perhaps not less than twenty per cent. on the amount. The result then would be the obtaining an inferior, less useful, and less durable work, at very nearly the same cost with the completion of the present plan. It is probable that such a change could not be effected without a loss of five or six millions of dollars. Indeed, the loss might be nearly as great as any saving that could be effected by abandoning the present large dimensions and solid constructions, and substituting a smaller and cheaper work, which would certainly be always more expensive to the public in the cost of transportation, and less capable of meeting, in future years, the wants of the augmented population of the west,or of yielding to the State the increased revenue which the commerce of such a population would tender to our acceptance

If these views be appoved by the Legislature, there must be raised for the works in progress the sum of abou twenty-six millions, in such annual amounts as the means of the State, prudently administered and applied, may conveniently supply, and as the interests of commerce, as well as of the canal revenue, may hereafter require.

To be continued.

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Mr. Verplanck's Report on the Revenue, Debt, and Financial Policy of the State of New-York.

(Continued from page 320.)

There are also various other plans presented the Legislature, for Railroads, and other works of internal improvement. These are urged alike upon high and broad considerations of general policy, for the welfare, the commercial intercourse, and prosperity of all, and upon specific grounds of equal justice to the various parts of the State demanding something like a proportional distribution of the general credit and capital for the common good, in effecting objects of too great magnitude for the private means of those principally and most immediately interested in them.

The selection of those objects, and the means to be applied to them, depending wholly upon legislative discretion, cannot be predicted. The ultimate amount of such appropriations, whenever the State was free from other burthens, might be very great. But a limited appropriation only could be made during the five or ten years (as the case may be) required to complete the present works. A sum not exceeding twelve millions distributed during those years, diminished or increased annually, according to the revenue of the State, would, it is presumed, effect many of the most valuable of these objects. This would impose the obligation of raising, including the cost of the canals, about *thirty-eight millions*, for such objects, and in such a period of time, as the Legislature may deem advisable. If, however, more time, or a more cautious policy should prevail, that sum might be lessened some millions. It is stated, however, at a sum which, (it is believed,) will be shown in the remainder of this report, to be within the probable fiscal means of the State, without *direct taxation.*

11. Can these several works be completed within a few years, and a large consequent state debt be contracted, with any reasonable prospect of meeting the interest without imposing heavy taxes, or with any reasonable, well grounded hope of the gradual diminution and ultimate extinction of the debt?

To answer this satisfactorily, it will be necessary to ascertain what are the real present debts of the State—what our necessary and usual current expenses, and our actual and probable income.

Throwing aside the fictitious charges against the "General Fund" which appear in our books, but are not real debts against the State, that real debt may be thus stated :

The debt called the Astor stock at 5. p. c.	$561,000
That of the fund belonging to the Safety Fund Banks and used for State purpose,	586,530
There is an old outstanding debt of the Canal Loans, not yet due,	2,259.834
The Oswego Canal Loan	421,304
Cayuga and Seneca Loan	237,000
Chemung Canal Loan	316,000
Crooked Lake Canal Loan	120,000
Chenango Canal	2,362,530
Stock issued for the Black River Canal	591,446
Genesee Valley, &c.	2,000,000
Erie Canal Enlargement	1,000,000
Total debt	$10,455,640

From this gross amount, the sum of $1,916,846, being the unexpended balance of the Genesee and Black River Canal Loans remaining at interest in the banks, might be deducted, but that sum having been already deducted from the cost of the construction, cannot again be brought into the account.

There is however a fund provided, for the purpose of paying the old canal debt, when due, part in bank, part secured on bond and mortgage, amounting to	2,702,682
Exceeding by $444,000 the amount of the old canal debt not yet redeemable	
Real debt of the State	7,742,982
If to this be added the estimated sum to be raised, for completing the works in progress	25,769,100
The whole amount of debt present and future will be	$33,512,082

If additional enterprises, as above estimated, should be added to an amount not exceeding twelve millions, this would swell our ultimate responsibility to *forty-five millions and a half.* There are besides these present debts and prospective loans, some contingent responsibilities of the State, by which her credit in shape of a State Stock has been advanced to incorporated companies for different Internal Improvements, these companies being responsible with their whole means in the first instance for the payment of the interest, and the final redemption of the principal. The chief of these is the pledge of an advance of three millions to the New-York and Erie Railroad on certain conditions not complied with beyond the first advance of $100,000. If this form of aiding this great work should be persevered in, it will just so far diminish the amount above calculated as being likely to be demanded for such subjects. If the Road should be made by the State, the advances of course will not be claimed. In either view this sum should not a second time enter into the account. The credit of the State is pledged to the Delaware and Hudson Canal Company for $800,000; for this, the canal itself, and all the property of the company is mortgaged. The interest had been regularly paid by the company, and occasional dividends to its stockholders out of surplus profits above that interest. The stock of the company fluctuates in the market, but at its lowest price indicates a considerable value above he amount of the debt for which the State is answerable.

The same is the case in relation to the several loans made or pledged by law to railroad companies—i. e. the Ithaca and Owego, $280,000; the Catskill and Canajoharie, $100,000, with future payments to $200,000 more. All these loans, (except the first instalment to the last named company) are secured by a much larger expenditure upon the work itself, as to guard against any serious loss. If any doubt, however, should be entertained, an allowance might be made in the calculation of our responsibilities of ten per cent. as a guaranty against loss, which on the whole would be $150,000.

2d. What are the annual expenses of our State Government, not including the appropriations for our great works of internal improvement, nor the interest on actual debt—as well as exclusive of all local charges and all the payments for the support of education, defrayed by the funds devoted to that purpose? Whht means have we to meet them?

The ordinary expenditure for salaries, pay of Legislature, military charges, printing, state annuities, and contingencies, amount to		$245,000
Add for miscellaneous charges		55,000
		$300,000
There are besides temporary charges, as at present for the geological survey,	$26,000	
Building State Hall,	25,000	
" Lunatic Asylum, say	50,000—	$101,000
Some of these expenses, as for building the State Hall and the geological survey, will soon cease. Others, as the Asylum, or new objects of benevolence, will take their place. The average ordinary expenditure for State purposes, will thus be		$400,000
The average income from the Salt duties, and on sales at auction, taking the last six years together, was $312,000. They may be fairly assumed at		$300,000
Thus leaving, of the ordinary expenditure for the support of the State Government, to be supplied from other sources,		$100,000

The only other considerable source of revenue, under our present system, is the Canals. That, however, we find sufficient not only to meet all charges for repairs and superintendence, with interest on our debt, but to leave a surplus.

In 1838, a year of so extraordinary business, the income of the Erie and Champlain and lateral Canals was	$1,481,600
Expenses to repairs, collection of tolls, &c.	639,700
Clear income,	$841,900
This leaves a surplus, applicable to the interest of debt of	$742,000

And after paying the interest of the present debt, gives a surplus of about $360,000, applicable to the expenses of the constructing the Canals, and to meet the interest on about seven millions more of loans when needed—supporting by the present income the charges on a total debt of fifteen millions.

How then is the State to meet the interest upon any larger debt, especially such a one as that consequent upon the steady production of the great works, the cost of which has been above estimated? If the canal income were fixed and stationary, the increased interest, after two or three years of annual loans could be met only by direct taxation. Were that result necessary to accomplish any great desirable object, as it appears to be in some of our sister states, there is nothing in that idea that would possibly effect the permauent credit on the State. A debt voluntarily created by a free State, for the public improvement, adding more than equal value to the productive property of the State itself, whilst it augments the prosperity and the comforts of all, presents to the capitalist, at home and abroad, looking for a safe investment for his funds, far more perfect security than can be offered the most powerful monarch who has lavished borrowed capital in desolating war, or in unproductive demoralizing pomp. Nor could the interest met by taxes for such purposes ever become so burdensome to the great and wealthy state, as to diminish, in any perceptible degree, the value of its real estate, or induce any considerable number of the people, or of its legislature, even for a moment, to entertain the notion of the breach of the public faith. Public credit is the peculiar, the cherished, and the precious possession of every free people—more valuable, and more valued, iu precisse proportion to the share of civil liberty they enjoy. It is the inexhaustible treasury of every well-governed community, its sure resource in the day of peril and necessity, its most powerful agent in every effort it may be called to make, to protect the liberties, or to increase the happiness of its people.

Were such resort to taxation ever to become necessary to meet demands to the amount of the whole cost of our projected improvements, it would require the raising, upon the increased wealth of this State some years hence, then enjoying all the benefits of those improvements, and upon a population of three millions or more, about one millions and a half of dollars annually, which would add to the general taxation from a fourth to one-third additional to the charges now imposed by law for city, county, and road taxes—a burden never to be imposed without great and adequate reasons, but still having no approach, even remotely, to that grinding taxation which, on the other side of the Atlantic, depresses the value of all property, dries up the sources of wealth, and paralyses industry and enterprise.

But these considerations are chiefly important in their bearing on the value of our stocks in the forsign and domestic msrket, and as giving just confidence to the capitalist, under any and the most gloomy views he may take of the credit of the stocks of any of our States. They may be important, too, in relation to some wild extravagant opinions and predictions of evil which have been entertained and expressed. Since by assuming the worst probable result, they show how far from the truth the assertions thus loosely made, could prove to be, even if the most gloomy prediction, of disaster and disappointment, in relation to the public works of any of our great States, should be realized, contrary to all probabilities founded on long experience.

But the prudent and conscientious republican legislator will look upon this subject in another point of view. He will feel that it is his duty to be provident of the future, to guard against the imposition of any tax, however small, not necessary for some publie use; and rather refrain from expenditures, otherwise laudable and beneficial, than to incur the necessity of burdensome, or even of inconvenient taxation.

But the financial affairs of New-York as viewed by the lights of our own history and experience, do not impose the necessity of any such alternative.

The increased population and business of our State will, as the experience of the old canals has shown, add a good deal to the tolls of the lateral canals now made or in progress. But neither these nor the transportation of our own State on the enlarged Erie canal, though that too must continue to increase with our increasing numbers and capital, can be relied upon for such in increase as to support, and finally extinguish, the debts created by our projected public enterprises. For this purpose we may look with confidence to the trade of the western States passing through the Erie canal. The calculation for the future here rests upon results actually attained, and every day repeated. The property from other States passing into the Erie canal by Buffalo increased as follows in the last four years:

1835,	22,124 tons.
1836,	36,273 "
1837,	42,229 "
1838,	68,187 "

The merchandize passing to the west from Buffalo was

In 1835,	18,466 tons.
" 1836,	30,874 "
" 1837,	22,236 "
" 1838,	32,087 "

The amount of wheat and flour, those great articles of western produce, increased steadily from 15,835 tons, in 1835, ta 57,979 in 1838. An analysis of the reports for tolls in 1838, leads to the conclusion, that of the $380,000 of tolls on wheat and flour arriving at the tide water, about $190,000 was contributed from the western states, either directly or else indirectly, by supplying the place of our own grain, which would otherwise have been consumed in the State. The tolls on merchandize passing out of the state in the same way, amounted to $21,000. These sums, with the addition of tolls upon some other articles (as salt) passing a less distance, making an aggregate of $500,000, drawn from the trade of the western states, or more than one third of our gross tolls. On this amount a steady and regurlarly accelerated increase of not less than from twenty to thirty per cent. annually, may be inferred, from our past statistical evidence. When we consider the rapid influx of population into Michigan—the increasing population and production of Ohio, Indiana, Illinois, and Wisconsin—the connexion of the Wabash and Erie canal, and the other works of the same nature, with our own trade, bringing within its reach an immense region, as fertile as our our own Genesee Valley—when to this we add the new inducements to transportation through our canal, offered by the greatly diminished expense of transportation on our improved work, (in many cases one half,) it would be in contradiction to all evidence from the past, to doubt of the long continuance of a proportional increase of business from the lakes to the tide water. All former calculations as to the augmentation of population, trade and revenue in this country, under similar circumstances, have fallen short of the reality. Thus reason, not imagination, will teach us the probabilities here. But we may refrain from any bold calculation—we may place a prudent and practical limit even upon the most moderate estimates—without shaking our confidence in the financial means of the state to proceed in her works, without fear and without taxation.

Nor will the increased gross income of our canal be similarly reduced by increased expense of repair and superintendence, corresponding to the enlarged dimensions of the works. On the contrary, we have not only the reason of the thing itself, but the evidence of the past, furnished to the committee by the Canal Commissioners, of the expenses of the Chenango Canal, built on an improved style of construction, (yet still much inferior in durability to those of the Erie Canal,) that such expenses will be diminished. They certainly will be so throughout, if not actually in amount yet very much so in proportion to the gross income, thus leaving a larger proportion of net revenue.

Under all these circumstances, there is little reason to doubt a rapid but a regular increase of our canal income for many years. The calculation of the Canal Commissioneers cannot be accused of exaggeration, when they say, in the special report of March 30th, 1839, reiterating their estimate of 1837, that "it is not extravagant to suppose that in a few years after the completion of this great improvement, the tolls on the Erie Canal would exceed $3,000,000 annually." This would leave a net revenue of two millions and a half from this source in addition to the whole revenue from all other works.

Yet a cautions, and perpaps timid, prudence, not unbecoming the faithful legislator, will suggest that unforseen circumstances, while they may accelerate, may also delay, the income of travel and transportation on our public works. Our financial policy then, if wisely provident, should guard against any embarrassement that might be caused by too confident a reliance on increased revenue, arising from causes too deeply rooted to be prevented from working out their ends, but which, nevertheless, may be possibly retarded in their operation for a time.

To avoid, then, the necessity of resorting to taxation, however small, the obvious and sound rule of our financial policy will be, *to adjust the loans of each year, so that the annual interest of the whole debt may always fall within the clear income of the state*—the average income of the last two or three years being taken as the measure of the total amount of interest on the loans. Such a rule rigidly applied, would furnish a self adjusting check upon expenditures either too great or too hasty, and yet would admit accelerated speed in the works, and increased approprioation, whenever they are demanded by the wants of business; of which wants, the first and clearest evidence would be, the very income furnishing the means of relieving them.

Such an arrangement of loans would conduce to another incidental advantage, not to be neglected in so large a financial plan. It would enable capitalists here and elsewere, and those who by purchasing whole loans supply the demands of persons seeking smaller permanent investments, to make regular calculations on the probable amount of loans required in each year. Such knowledge experience has shown to conduce to a much more regular and steady demand and better prices for new loans than they command when thown into the market quite irregularly and unexpectedly.

Thus assuming our clear income from our State works to be augmented in a ratio corresponding to the probable increase of our external Western trade, till it reaches three millions in 1849—a calculation which may fall short as to the present, or is to any other year, but of the highest probability as to the average increase—in that case, all the public works now in contemplation or existence would be accomplished in ten years, the interest of the debt contracted for that object regularly paid without resort to other funds or taxes, and a large surplus income left for the early extinction of the loans.

A more rapid progress of canal income, such as would reach a clear income of two millions and a half in 1846, would enable that year to see the State works completed, and the future increase of revenue left free for a sinking fund of great efficacy.

According to either of these estimates, there would be generally some surplus of income above interest and expenditures which would go so far to lessen the amount of loans to be raised and of the debt due at the end of the term, or it may from the first be considered as a sinking fund. It may also be considered as an allowance for unforeseen contingencies beyond the estimates, or for any temporary falling off of revenue to meet interests, in any unprosperous year. The annual loans, under the aspect of things, would be from three to five millions, according to the income of the works themselves—and the amount might be still further increased or diminished. Some tabular views and calculations of expenditure, debt, income and reimbursement, founded upon these probabilities, and stated in round numbers, have been prepared, and are herewith submitted. These are of course presented as probabilities only, so as to show the operation of the system. But whether they may be thought to exceed or fall short of the real future result, there is the best evidence of our canal and financial experience, that the general principles on which they are founded are correct.

These views of the financial means, engagements and prospects of this State, would be imperfect, if they did not include some mention of another great and productive, though contingent resource. The immense national domain of the *Public Lands* presents a vast and productive fund, to which many of the States have looked as the common property of the whole United States, affording, in the distribution of its proceeds, an abundant supply for the liberal support of their various plans of internal improvement for very many years. A bill, providing for the distribution of the proceeds of these sales, (as might accrue) among the States, in the ratio of their several populations, formerly passed both houses of Congress by large majorities, but did not then become a law. The proposition has been since urged again by many States, and is daily assuminng a more general and more intense interest and importance. It is accordingly becoming very probable that this measure, in some form, or under some modification or other, will be carried into effect.

Whenever this is done, and in whatever form or rate of distribution, the revenues of this populous State will receive a large augmentation from this source. This may either be applied directly to the works in progress, and so far lessen the amounts borrowed, or may be regarded as the means of meeting interest on large loans, and so hastening the completion of the works—or it may be reserved as a sinking fund for the early reimbursement of the loans, according to the amount received, and the needs or the policy of the State hereafter.

All which is respectfully submitted.

We are much indebted to our correspondent for the following notice, and invite them to do the same.

Messrs. Editors,—In a late number of your Journal, you invite Engineers and others, engaged on Railroads to send you some accounts of what may be doing in their neighbourhood. This notice has induced me to forward you the few following remarks in relation to the Monroe Rail Road of Georgia.

This Road intended to form a link in the chain of improvements that is now being constructed between the Atlantic Ocean and the Tennessee, River, will extend from the city of Macon, to a point five miles west of the village of Decatur in Dekalb county.—At this place, it meets the Western and Atlantic or State Road, which last extends to a point at or near Rossville on the Tennessee River.

Of the Monroe Rail Road, that portion between Macon and the town of Forsyth, a distance of 24 miles, is complete, and has been in active operation since early in December last.—A corps of Engineers is now engaged on that portion about Forsyth, locating and preparing it for the contractors as fast as possible. Six miles are now under contract, and the farmers along the line of Road feel such an interest in the work, that they stand ready to commence the grading of the remainder so soon as it can be staked out.

The grading of the first Division of 24 miles has been heavy for this section of country, costing when complete near $20,000 per mile.

This is owing in a great degree to its contiguity to the Ocmulgee River, causing the line of Road to be very tortuous and winding in its course, and frequently requiring shorter radii than that adopted as the minimum to fit the ground to the best advantage.—The minimum radius was fixed at 1,910 feet, and the maximum grade a 36,96 feet to the mile; consequently, increasing the cost of grading in many.

The Road will be constructed for a single track, being 16 feet wide in the excavations, and 14 on the embankments.—Like most of our Southern Roads the superstucture of the Division between Macon and Forsyth consists of string pieces of burnt pine 5 × 8 inches, and on them a flat iron bar.—The cross ties are 4½ feet from centre to centre and 8½ feet long, with substantial mud sills under them in every instance.—Width of track is 5 feet—That part of the Road above Forsyth will be laid with an edge rail of 45 lbs to the yard.

Connecting with this road at Macon, the central Rail Road of Georgia, extending to Savannah, a distance of 200 miles..—About 70 miles of this road is now complete and in operation.—The whole of the State Road will be put under contract during the next summer, so that in less than three years from this time, there will be a connected line of Rail Roads between the city of Savannah and Rossville, a distance of more than 400 miles, thereon by the Hiwassee Road, some 90 miles into the interior of Tennessee.

April, 18th 1839. W.

Annexed are the proceedings of a public meeting, held in this village on the 24th inst., and you are respectfully requested to submit the same to the appropriate committee of your county, having in charge the subject of the *New-York and Erie Railroad.* A prompt response to the meeting in Orange, was deemed by our citizens to be in accordance with duty, as well as with their own feelings. A later day for the meeting of the proposed Convention, (the *eleventh* of July,) has since been designated, in conformity to the views of other counties interested, by the central committee at Owego. In this the people of Tompkins county will cheerfully acquiesce; and cordially co-operate with their fellow-citizens throughout the southern section of the state, in any measure calculated to promote the ultimate and speedy attainment of their common subject.

Ebenezer Mack,
Charles Humphrey,
William H. L. Bogart,
Corresponding Committee for Tompkins county.

At an adjourned meeting of the inhabitants of the county of Tompkins, the Hon. AMASA DANA was called to the chair, and WILLIAM H. L. BOGART, appointed secretary.

The meeting was ably addressed by Messrs. G. G. Freer, Levi Hubbell, and E. Mack.

Mr. Robert Halsey, from the committee appointed at the preceding meeting, consisting of James B. King, Jacob M. McCormick, Robert Halsey, Henry Ackley, and Henry Ingersoll, reported as the unanimous report of that committee the following resolutions, and list of delegates:

Resolved, That we have read with gratification, and approve the proceedings of a convention of the citizens of Orange county, called for the purpose of devising means to prosecute the construction of the New-York and Erie Rail-road by the state, and recommending among other steps to that end, that a convention of delegates from the southern tier of counties, and from the city of New-York, be held on the 4th day of July next, at Ithaca, in the county of Tompkins.

Resolved, That the citizens of those counties bordering on the Cayuga and Seneca lakes, Lake Ontario, and our neighboring county of Cortland, have a direct interest in the construction of the New-York and Erie Rail-road, affording to them, as it will, an avenue of trade and travel, to and from the Atlantic seaboard, at all seasons of the year, we therefore respectfully invite their attention to the subject, and that they may be represented in the proposed convention.

Resolved, That situated as we are in relation to the New-York and Erie Rail-road, we have no peculiar interest to be promoted by, nor any partialities or prejudice, for or against any particular location of the line, or any point of termination either upon the Hudson or Lake Erie; these are questions which may safely be left to the result of surveys and estimates, and a due regard for the public faith. We earnestly recommend to the friends of the road to refrain from agitating them at the present time, and to present an undivided front in the contest upon the main question.

Resolved, That the New-York and Erie Rail-road is worthy of being supported and sustained upon its merits, not for its local importance merely, but as a great work of public improvement, consistent with the spirit of the age and the character and resources of the Empire State. We therefore recommend to the public press of both political parties in the southern counties of the state, to advocate it on that ground, and to refrain as far as practicable from intermingling the question with the party politics of the day—a measure of such magnitude and importance, is worthy the united efforts of a whole people, and its success ought not to be hazarded upon a precarious issue.

The 4th resolution was opposed by Messrs. Spencer and Bogart, as inexpedient, unnecessary, and implying a censure upon the conductors of the press, and by Mr. B. Johnson on the ground of its being useless to offer advice to editors. It was advocated by Messrs. Ingersoll, Halsey, Eddy, E. Mack, and C. L. Grant, as being both right and expedient, and not implying any censure upon the press. Mr. Humphrey, Mr. Freer, and Gen. Hubbell, deemed the resolution correct, but as it was opposed, the latter gentleman advised its withdrawal at this time, in order to be presented to the general convention.

Mr. H. Ackley and Mr. R. Halsey, as members of the committee, explained in relation to it.

The question was then taken, and the resolution passed by a small majority.

Resolved, That the following gentlemen compose the delegation from the several towns of this county, to attend the convention:

Hector.

Peter Hager,	Calvin Treman,
Robert Swartwout,	Henry Fish,
Caleb Smith,	Aaron Hanley,
John Saylor,	Thomas B. Sears,
Daniel Jackson,	G. G. Whitman.

Enfield.

P. A. Williams,	Obadiah Chase,
C. C. Applegate,	Henry Brewer,
Moses Lovell,	Chester Rolfe,
B. V. Gould,	J. Corey Hall,
James Bagley,	S. Marsh.

Ulysses.

Nicoll Halsey,	Nathaniel Ayres,
David Bower,	Hermon Camp,
H. D. Barto,	G. W. Nexsen,
E. S. Palmer,	James McLallen,
J. M. Miller,	F. G. Dumont.

Newfield.

Charles M. Turner,	John Jessup,
W. T. Lawrence,	Isaac L. Smith,
A. Dudley,	Hobert Estabrook,
M. C. Kellogg,	John Ford,
George Bailey.	H. D. Blakesley.

Danby.

Elbert Curtis,	Peter Yaple,
J. B. Gosman,	Josiah Beers,
Lyman Bradley,	Lewis Fortner,
Benjamin Jennings,	C. C. Howell,
J. C. Mandeville,	Miles C. Mix.

Dryden.

Thomas Hance,	Joshua Phillips,
Casper Miller,	Amos Lewis, 2d,
Eli Hamblin,	Henry B. Weaver,
George B. Guinnip,	H. G. Dusenbury,
W. B. Goddard,	William Cobb.

Caroline.

Bartholemew Green,	Isaac L. Bush,
William Mott, 2d,	David Slater,
Joseph Spsed,	Nathaniel Toby,
James Ridgway,	Abram Boyce,
George Blair,	Leroy W. Kingman.

Groton.

Sylvanus Larned,
John Boynton,
A. C. Marsh,
Joel Cooper,
S. J. Noyes,
John D. Devoe,
R. C. Reynolds,
F. Willoughby,
Nathan Benson,
T. F. Sherman.

Lansing.

Jesse McKinney,
Daniel D. Minier,
Lewis A. Morrell,
Charles Davis,
Benjamin Joy,
W. R. Fitch,
Calvin Burr,
J. E. Bogardus,
R. J. Ives,
Thomas Robertson.

Ithaca.

Horace Mack,
J. S. Beebe,
Jacob M. McCormick,
Augustus Sherill,
Charles Humphrey,
B. G. Ferris,
Amasa Dana,
W. H. L. Bogart,
C. L. Grant,
W. T. Huntington,
L. S. Eddy,
William R. Collins,
Robert Halsey,
W. A. Woodward,
Cyrus Beers,
D. Hanmer,
Ebenezer Mack,
D. D. Spencer,
W. G. Grant,
Henry Ackley,
N. T. Williams,
J. J. Speed, jr.
Samuel Love,
E. Cornell,
J. Ackley,
Jehiel Ludlow,
George D. Beers,
Levi Williams,
James B. King,
William Andrus,
George McCormick,
Levi Hubbell,
Henry Ingersoll,
George P. Frost,
John Stevens,
Samuel Giles,
T. S. Williams,
William Bacon,
F. A. Bloodgood,
John Teers,
Jacob Puff,
Thomas Vincent,
D. C. Hazen,
Augustus Phillips,
Ben Johnson,
Alexander Simpson,
D. T. Tillotson,
Philip Kline,
D. L. Bishop,
James Tolfree.

Messrs. Ebenezer Mack, Charles Humphrey, and William H. L. Bogart, were appointed a corresponding committee.

On motion, the proceedings of the meeting were directed to be published in all the papers of this county, the papers of the southern tier of counties, and those of the city of New York and Albany.

AMASA DANA, Chairman.

W. H. L. Bogart, Secretary.

We have been permitted to copy the following letter from a gentleman of extensive practical knowledge in the use of railways. It was not originally designed for the press, but the information it contains is too valuable to be witheld from publication.

BOSTON, Feb. 8, 1839.

SIR:—In conformity with your request, I now proceed to communicate some remarks in relation to the Western railroad.

1. With regard to the character of the road, the work done, and materials used and prepared for use, all which I have carefully examined, having, about the first of January last spent nearly four days on, and about the road for that purpose.

The excavations for the road are all made with a slope 1 1-2 to 1; a more liberal allowance for the prevention of slides than is made in many other roads, involving a considerable addition to the cost of grading.

Depth of the rock excavations, unusual, but not unnecessary—it being at least one foot below the grade of other parts of the road affording an opportunity for a gravel foundation, on which the frost, by acting equally, produces little or no unfavorable influence upon the track.

The stone masonry is of large and uncommonly good kind of stone, apparently laid with skill and great faithfulness, and unusually thick. The size of the timber used for the bridges is larger and the bridges stouter and more permanent, than on any other road I have examined. The sleepers are large and of the best material that can be obtained in this part of the country—the rails are of the heaviest kind used on any of the railroads in this country, and in my judgment of the best pattern. So much of the track as is already laid is as perfect as any I have seen. The importance and necessity of a heavy rail will be more fully shown in my remarks on the engines for this road.

2. The engines. The same evidence of good judgment in the means resorted to for overcoming the great obstructions on this route, and securing the important ends of this enterprize, are noticeable in the kind of engines proposed, as in the mode of structure.

The high grades to which the engineers have been compelled to submit, have discouraged some of the early advocates of this enterprize, and much diminished their expectations as to its utility. The maximum inclination is 78 feet to the mile—that of the Worcester 30—and that of the Lowell, except in one place for a very short distance, is 10 feet.

It is true that the value of a railroad, so far as merchandize is concerned, depends much upon its maximum inclination, and makes the kind of engine to be used upon it, also a very important matter.

You are already aware that immense excavations and embankments at and near the summits have been made to reduce this maximum as low as 78 feet to the mile.

In my judgment outlay has done all that prudence will justify for conquering these summits. The remainder must be done by engines, and of course they must be of the kind and character adapted to the work which they have to perform.

The power of an engine if properly constructed is measured by its weight. That is, the *adhesive power* depends upon the weight of that part of the engine which rests upon the *driving* wheels, which generally, is about 2-3 of its whole weight, 1-6 part of which is considered the measure of the engine's power. To enable you more easily to comprehend my meaning, I will try to illustrate it practically.

The smallest engine on the Worcester road weighs 5½ tons, equal to

11,000 lbs. Two thirds of this weight is on the driving wheels, say 7,333 lbs.; 1-6 of which, say 1222, is its power, provided the steam apparatus can work up to that amount. Now 8 pounds suspended over a single pulley, by a line attached to a car, for each ton which that car and its load weigh, is found to be sufficient to move it forward on a well-laid level railway. Of course the number of times which 8 is contained in 1222, shows the number of tons which such an engine can draw over such a road, it having nothing but friction to overcome. And so far as cars, tender and goods are concerned, the amount of friction remains the same whether the road be level or inclined. On the upward inclination the engine has the resistance of the gravity of its own weight, and that of its load to overcome, besides this 8 lbs. per ton friction. This latter being on an inclination of 19 feet to the mile, also equal to 8 lbs. it will require a power equal to 16 lbs. per ton on such a road.

By this rule of calculation the following table is made, which will show what the first and smallest engine on the Worcester road could do on the various grades of the Western road.—

1222 divided by 8 gives the maximum load which that engine can draw on a level, tender and cars included, say

	frict.					
Level	8 lbs.	gravity,	153 t'ns	equal to	83	tons mdz.
10 ft inc.	8	4 21.100	98 "	"	58	"
20 "	8	8,42	72 "	"	42	"
30 "	8	12,63	56 "	"	32	"
40 "	8	16,84	45 1 2	"	25 1.2	"
50 "	8	21.05	38 "	"	20	"
60 "	8	25 26	32 1.2	"	16	"
70 "	8	29.45	28 "	"	14	"
78 "	8	32,81	25 1.2	"	11 1.2	"

The maximum load with the engine, therefore, on the Western road would be but 11 1.2 tons.

The large engines now used for merchandize on the Worcester road weigh 17,350 lbs., two-thirds of which, say 12.900 lbs. is on the driving wheels, which sum, divided by six, gives 2150 lbs. as the adhesive power. The following table shows the load of this engine for the various grades on the Western road—

Level	269	tons gross.	168	tons merchandize
10 feet incl.	172	"	105	"
20 "	126	"	75	"
30 "	98	"	57	"
40 "	80	"	47	"
50 "	66	"	38	"
60 "	57	"	32	"
70 "	50	"	27	"
78 "	45	"	24	"

The maximum load of merchandize for this engine on the Western road would be but 24 tons.

The engines first put upon the Liverpool and Manchester road were much smaller than either of ours; the maximum load of which, on the Western road, would not be more than 6 or 7 tons. This too when the rails are in the best order. When wet the power of an engine is diminished—still more by snow, and nearly one half by a heavy frost. While the

Worcester corporation were using engines with which they could carry but 24 tons, their merchandize gave them little or no nett income. Those gentlemen, therefore, who have come to the conclusion that the Western road with its high grades does not afford a facility of much value for the transportation of merchandize would have been right about it, if the engineers of that road had ordered no heavier engines than the heaviest used on the Worcester road.

I understand it to be the intent of the Directors of that road, to use engines weighing 14 tons for merchandize, with all wheels geared; which, of course, will gain one-sixth part of the *whole* weight, as the measure of their adhesive power. The load of such an engine on the various inclinations, will be as follows:

Level.	583	tons gross,	367	tons nett.
10 feet incl.	377	"	235	"
20 "	277	"	171	"
30 "	217	"	133	"
40 "	178	"	108	"
50 "	150	"	90	"
60 "	129	"	77	"
70 "	113	"	67	"
78 "	103	"	59	"

The maximum load for such an engine on the Western road 59; that of the heaviest engine now in use on the Worcester road, for that road 57 tons.

The additional expense of running an engine of 14 tons over a distance of 116 miles, on such a road as the Western, to that of running a 10 ton engine the same distance, with similar load on a road of only 30 feet inclination, allowing six breakmen to a train on the former, and more needed on the latter, according to the best calculation I can make from the every day practical demonstrations of the work of the latter, on the Worcester road, is but $27,04—equal to 46 cts per ton.

From the foregoing tables will be perceived the influence which the maximum inclinations have upon the value of the road for merchandize, and in view of this, and the character of the country through which the Western road is carried, will be found the justification of the immense expense which has been and must yet be incurred for the purpose of reducing this maximum as low as possible.

And from the high grade, which, after all this expenditure, will remain to be overcome by steam-power, will be perceived the necessity of the heavy engine; and the latter proves the necessity of the heavy rail, and expensively permanent superstructure. The Western rail weighs, 56 1-2 lbs. per yard—the Worcester, 40 lbs.

With such an engine as is proposed to be introduced upon the Western road, the weight upon each wheel will be 7000 lbs. The weight upon each of the driving wheels of the heaviest Engines now used upon the Worcester road is 6450 lbs.

The Western Rail, therefore, is as adequate to sustaining an Engine of 18 tons, with all the wheels coupled, as the Worcester rail is to sustaining the heaviest Engines now running upon that and geered as they now are.

By the foregoing it is seen that the diminution in the value of this road from its high grades for merchandize is less than 50 cts. per ton. For passengers there is almost no practical difference, unless there are many more passengers, than the most sanguine friend of the road has ever ventured to anticipate, a ten ton Engine may pass the highest of these grades without diminishing speed, materially adding to the expense of running.

3. As to the probable value and income of that part of the road which is expected to be opened for use next summer, I present the following data and calculations.

The cost of this part of the Western road as appears by the Report just now submitted, will be $1,864,729. If we add to this $35,271 we have in round numbers a capital of $1,900,000.

I ought however to say that in looking at the items which make up this $1864,729, I discover no omission, nor any other particular which justifies the addition of the $35,271.

With regard to the amount of the business which the necessities of the country in the vicinity, will bring to this Road, my opinion which can now be formed must be speculative and somewhat uncertain.

In 1829 the Rail Road commissioners after a laborious and careful examination, estimated the amount of merchandize from the county of

Hampden	at	12855	Tons.
Hampshire	"	13689	"
Franklin	"	4989	"
Vermont and Connecticut	"	1000	"
		41.533	
County of Worcester		14,000	

They also estimated the probable number of Passengers at 23,475.

Assuming this to be the amount of business between Springfield and Worcester,—and assuming that $5 per Ton will be charged for freight (common freight on the Worcester road is 3,50 for 45 miles—Providence $5 and by teams from Worcester to Springfield 8 and $10), and that 2½ dollars will be the fare for Passenger, the gross receipts are shown as follows:

41543 Tons Merchandize	$5	$207,665
23475 Passengers	2 1-2	58,687
		266,352

All the expenses incurred by the Boston and Worcester Rail Road Corporation in the transaction of their business, including an allowance of $15,000 for deterioration of Road, Engines, &c. was—$100,572,97 to which I add for the increased distance and the additional amount of Merchandize $30,000 which, I have no doubt, is a large allowance—130,583 equal to more than 7 per cent nett income 135,779.

The Worcester Road carries the mail for which is paid 3,500.

The Western Mail will undoubtedly be carried on the Rail Road to Springfield—the great Southern Mail ought to be, and if it is, and as much paid for it, as there ought to be, it will make an addition to the income of the road of nearly $10,000.

Can the estimate of business for the Hampden, Hampshire, Franklin, Vermont and Connecticut be too high?

Subsequent investigation by other Boards, and Committees, have put it a great deal higher.

This Board, as before stated, estimated the business for Worcester County at the same time at 14000 tons.

The whole amount of Merchandize actually transported over the Worcester Road in 1883 was 24650 tons.

Of this quantity of Merchandize 1551 tons were for the County of Middlesex and about 3000 for Counties west of Worcester County. There is one circumstance however, which is important, the Iron and Timber for the Western road. This of course is not, and should not be counted as a part of the regular business of the Road. It amounted in 1838 to 1500 Tons. The exact amount of Merchandize for Worcester County cannot be certainly ascertained, because itis somewhat uncertain what amount of that brought to Worcester went to Hampden, Hampshire, &c. but there cannot be a doubt but that it exceeded the amount estimated by the Commissioners to the extent of several thousand tons, and I think the amount for 1839 will be full 50.

With regard to passengers, the amount received on the Worcster road for 1836, was equal to a full fare from Boston to Worcester for

78,088 passengers,
1837 for 61,666 "
1838 for 56,016 "

A part of the amount was received for way passengers, the exact number of which cannot be ascertained. This however, can make but a very small part of the whole receipts, and the amount received for this kind of passengers between Springfield and Worcester may, and probably will, be equal to that now received between Boston and Worcester.

Another important consideration, which was not thought of, and, of course, could have had no influence with the Board in forming the estimate for 1839, is the travel between Boston and New-York by the way of New Haven and Hartford, and Hartford and Springfield railroads; both of which will, without doubt, soon be completed, and when done, will offer a route for this travel, varying very little in point of time or expense from the best that can be found by any other way.

There is, also, now, a very strong probability of a railroad at an early day up the Connecticut river to Northampton, Greenfield, and perhaps Brattleboro'.

It seems to me, in view of all the circumstances which deserve to be considered in relation to this qnestion, that there must be more than double the number of passengers, probably treble, that of the estimate which I have assumed as a basis of the foregoing calculation.

I am, very repectfully,
Your obedient servant,
William Jackson,

Enlightened Policy of Russia.—Warsaw and Vienna Rail Road.

A railroad is projected, under the special patronage of the Governments of Russia and Austria, from Warsaw to Vienna. The liberal terms on which this enterprise is promoted by the Emperor of Russia show the enlightened interest which he takes in the introduction of this improvement, the effect of which to ally his empire more closely with southern and western Europe. This railroad consists of two parts, one under the authority of the Government of Austria, extending from Vienna to Bochnia, on the frontier of Poland, and the other under a charter from the Emperor of Russsia, beginning in the centre of Warsaw, and extending to Niwka, and to be extended thence to join the road above mentioned.

To encourage the enterprise, the Emperor Nicholas has granted a charter authorizing the forming of a company, with a capital of 21,000,000 Polish florins—equal to two and a half millions of dollars—divided into 5,000 shares. On this capital, from the time it is paid into the Bank of Poland, or to Harman & Co., London, the Emperor guaranties an interest of 4 per cent. per annum, payable from the treasury of the Government, at the Bank of Poland. The railway, however, is to be the exclusive property of the shareholders, until it shall be redeemed by the produce of the sinking fund, in the manner provided in the charter.

The Emperor, besides, grants to the company, wherever the railroad shall pass over the domains of the state, or of its feudatories, the free use of the land for the road, and also for depots, buildings, and courts, and also timber from the Crown lands, free of cost, for sleepers, bridges, &c. If proprietors of lands shall refuse to grant their lands on reasonable terms, they may be proceeded against according to the laws which regulate the appropriation of lands for the public service. If the company shall not find it advantageous to use for the road such articles as can be manufactured in the country, proof thereof may be given to the Bank of Poland, and, in that case, a license shall be granted, allowing the importation from England of such rails, engines, and waggons as they may require, free from duty. The Government guaranties to the shareholders, whatever political event may arise, as well in time of war as in time of peace, that the interest guaranteed and the dividends shall be punctually paid, as well to the inhabitants of the country as foreigners. No attachment of these funds will be permitted, either by Government or by individuals.

The nett income of the railroad is to be appropriated first to the payment of 4 per cent. guaranteed by the Government. One-tenth of the excess is appropriated to form a reserve fund. The whole nett income, to the amount of 10 per cent. per annum, belongs to the shareholders. If the nett income shall exceed 10 per cent. the excess, as far as 3 per cent. is to be divided between the shareholders and the sinking fund.

The sums forming the sinking fund are to be appropriated from time to time in redeeming shares, either by purchase in the market or by lot, as the directors of the company shall determine. If redeemed by lot, the shares are to be paid off with 10 per cent. premium, together with the part of the reserved fund appertaining to the shares.

A degree of the emperor Nicholas, dated January 19, 1839, declares his approval of the statutes of the company, and insures to the shareholders the dividend of 4 per cent. until the shares, with the premium of 10 per cent shall have become paid off, when the railway shall become the property of the Government. The Government of the kingdom of Poland is charged with the execurion of the decree.—*Boston Daily Advertiser*

From Harris's Pittsburgh Price Current.

A Talented Family—Steam Power.—We had, a considerable time ago, the pleasure of an acquaintance with Mr. Oliver Evans, the great engineer and mechanic in Philadelphia. Mr. Evans was the first to establish a steam mill in Pittsburgh or the West, and who not only prophesied so many interesting results that steam power would produce within fifty years, but spoke prophetically of the future greatness of Pittsburgh, from its many advantages for testing that power, that seems fast destined to revolutionize the commercial destinies of the world. His sons seem to inherit his great talents. The late George Evans, Esq., of this city, a son of Mr. Oliver Evans, was for a long time at the head of the extensive establishment here, and established the extensive plough factory, now greatly enlarged and extended by Mr. Caldwalder Evans, who has succeeded to the establishment, and who is referred to in the annexed excellent article from Alexander's Messenger:

"It is hoped that the steam boat owners will avail themselves of the benefit of this invention without delay, as it would no doubt much increase the travelling by steam boats, by restoring entire confidence in that mode of travelling. Mr. Evans' invention to prevent explosions of steam boilers has received the highest recommendations from the most competent judges, and the offer he makes of $5000 to produce an explosion, we would suppose conclusive of its utility, or such an offer would not remain long without being taken up.

AN IMPORTANT DISCOVERY.—An advertisement appears in several daily papers, which is calculated to excite considerable interest. We allude to that in which Mr. Evans of Pittsburgh, offers $5000 to any individual who may succeed in exploding a steam boiler, to which the new apparatus, the invention of Mr. E. may be attached. The advertisement is accompanied with strong testimonials from gentlemen thoroughly acquainted with the subject, and the invention appears to be the best thing of the kind ever submitted to public consideration. If wholly adequate to the object in view, its usefulness and importance cannot be overrated."

At a meeting of the Directors of the Auburn and Rochester Rail Road company on Saturday, Henry B. Gibson was elected President of the board, and Charles Seymour, Secretary and Treasurer. A call of five per Cent is about to be made on the stock, payable in two instalments. It is intended to progress steadily with the work, and expedite its completion as fast as circumstances will permit. The contractors have had a large number of men, for several months, employed in grading and fencing the roadway between this town and Rochester.—*Canandaigua Rep.*

Important Work.—A railroad of vast importance south, will be that across the Florida Peninsula, from Brunswick, Geo., to the Gulf, the other side. The Engineer reports no less than 120 miles a dead level track, and the rest of easy curves. Gen. Hamilton, the substantial friend of every enterprise, is engaged as one of the commissioners to effect a loan. A branch is to connect at Columbus.—Much of the commerce of New-Orleans, and all that region destined to the North, will eventually take this route to escape the dangers of the Florida and Bahama reefs. Brunswick, if it have the harbor reputed, may be another great emporium.

The navigation of the Passaic river, above the city of Newark, which has hitherto been confined to the smaller sort of fresh water craft, has been opened to steamboats. One of the beautiful barges that formerly were employed in conveying passengers up the Hudson river has been transformed into a steamboat of considerable size and elegant accommodations, and now plies daily between this city and Aquackanonk, a few miles below the town of Paterson. The barge is propelled by means of a horizontal engine attached to a wheel at the stern, and moves through the water with great rapidity and force. The obstructions occasioned by reefs of rocks are avoided by taking advantage of the changes of the tide. We can scarcely conceive a more delightful trip than one which takes in the New-York harbor, the Kills, Newark Bay, and the many graceful windings of the Passaic river.

At a general meeting of the Stockholders in the Richmond Fredericksburgh, and Potomac Railroad Company, held on Monday, the 27th day of May, 1839.

The Report of the President, and Directors having been read, on motion of Mr. Conway Robinson.

Resolved. That so much of the report as relates to the extension of the railroad from Fredericksburg to the Potomac, and the act directing the State's guarantee to be given to a loan for that purpose, be referred to a committee to examine terms and conditions upon which the guarantee is authorized, and report such measures as in their opinion it may be proper for the Company to adopt in relation to the said act, and the extension of the road. The chair appointed Conway Robinson, James Lyons, and Samuel Marks, Esq., the said committee.

And at an adjourned meeting of the Stockholders aforesaid, held on Tuesday afternoon, May 28th, 1839, Mr. Conway Robinson from the Committee on that part of the report of the President and Directors which relates to the extension of the railroad from Fredericksburg to the Potomac, and the act directing the State's guarantee to be given to a loan for that purpose, made the following Report:

The Committee to whom was referred so much of the report as relates to the extension of the Railroad from Fredericksburg to the Potomac, and the act directing the State's guarantee to be given to a loan for that purpose, respectfully submit the following report:

At an early period the Stockholders declared that they deemed it advisable to extend the railroad from the point of termination in Fredericksburg to the Potomac river, or some of its creeks, so as to form a complete railroad and steamboat line. Before, however, the extension could be made, the Commonwealth, who was herself a large Stockholder, indicated by her legislation a doubt as to the policy of the measure. It is gratifying to find from the act above mentioned, that no such doubt any longer exists, and that the Commonwealth is now willing to co-operate with the individual Stockholders in carrying on the work. In this point of view, independently of any other, the act affords cause of gratulation, and whether or no the Stockholders shall give their assent to the change in their charter which the act contemplates, it should serve to confirm them in their purpose, and lead them to take such measures for prosecuting the work as are authorised by the existing charter, and may be found practicable.

Upon examination of the act in question, it is found to contain the following proviso: That before the guarantee shall be given to the Treasurer, "the Stockholders in general meeting shall direct their President and Directors to pledge the profits upon the stock of the Company held by subscribers, other than the Commonwealth, or so much thereof as may be necessary to the punctual payment of the principal and interest on the certificates of debt issued under authority of this act." If the proviso be construed according to its literal interpretation, it is certainly objectionable. There is no distinction known to our charter between the stock raised for the work from Fredericksburg to the Potomac. Every Stockholder is interested in the income upon the whole line from Richmond to the Potomac, and the benefit of the improvement from Fredericksburg to the Potomac will be felt by the Commonwealth more than by any individual Stockholder. For she will feel the benefit in increased dividends, not only upon her stock in this Company, but also upon the large amount of stock held by her in the railroads south of us, from Richmond to the Roanoke. In no point of view can it be right that Commonwealth should enjoy this benefit in common with the individual Stockholders, without sharing the burthen which they are to bear. If the income to arise from the work from Fredericksburg to the Potomac, is to swell the Commonwealth's dividends, it can never be right, that the interest upon the cost of that work should be exclusively paid out of the profits upon the stock of individuals. It being plain, that it would work manifest injustice to construe this act according to its letter, we are inclined to think that the intention of the Legislature must have been different. Our impression is, that if the act should be accepted, the money borrowed, and the road built, the proper course would be to pay out of the income upon the whole line from Richmond to the Potomac—1st. The expense of conducting the business: and 2dly. The interest upon all loans, whether those loans should be for constructing one part of the line or another; and then 3dly. To divide the nett profits remaining amongst all the Stockholders, as well individuals as the Commonwealth, in proportion to the amount paid upon the stock of each Stockholder. Believing this to have been the real intention of the Legislature, it seems to us, that there will not probably be any serious difficulty in obtaining from the General Assembly at its next session, a suitable emendatory act.

Under the present charter, the Company is allowed to charge for the transportation of the mail such sum as it may agree for.

If the Company accept the provisions of the act, it is then to be subject to the 36th section of the act prescribing regulations for the incorporation of Railroad Companies, which provides that "it shall be competent to the General Assembly to provide by law for the transportation of the United States' mail over any Railroad, for a fair and adequate compensation, and to provide means of ascertaining such compensation." The whole income which has so far been received from the mail, passengers and freight, has yielded but moderate dividends to the Commonwealth upon her stock, and to the individual Stockholders upon theirs. In regard to the mail service, we are informed by a report of the President and Directors, that the Company has not yet been able to obtain from the Post Office Department for carrying the mail at any hour, which may be prescribed by the department, whether day or night, a compensation equal to that paid the companies North of Washington City, for carrying the mail in the day time, at certain specified hours agreed upon between those companies and the department. That it ought to receive equal service, seems but just and reasonable; and if the condition had this qualification annexed to it, that the Company should not be compelled to receive less, we do not perceive that there would be any just ground of objection to it.

By the present charter, all machines, wagons, vehicles, and carriages, purchased with the funds of the Company, and all other works constructed under the authority of the act, and all profits which shall accrue from the same, are exempt from any public charge or tax whatsover. But if, at any time hereafter, the rates of toll allowed shall enable the President and Directors, after the payment of all necessary expenses, and after setting apart a fair and reasonable sum for the renewal and repairs of the road, warehouses, depots, and other constructions, and of the machines, cars, and other vehicles for transportation, to divide more than fifteen per cent. on their capital stock invested, then the rates of toll are to be so reduced by the President and Directors, as to enable then to divide fifteen per cent. and no more.

If the Company accept the provisions of the act in question, it is on condition that the Legislature shall have the right to tax the stock and property of the Company—but with this limitation, that no tax shall at any time be imposed on the stock of the Company, exceeding on each share of stock the sum that, at the time of leying the tax, shall be imposed on each hundred dollars worth of land in this Commonwealth, according to the *ad valorem* taxation of lands, nor on any other property of the Company, except its lands, houses, slaves, and horses, upon which the tax assessed is in no case to exceed that assessed upon like property held by individuals. The reservation of a right to tax lands, houses, slaves and horses, as well as to tax the stock, may very properly be objected to in this, that the money paid by a stockholder upon his shares of stock, is applied to the purchase of the lands, houses, slaves and horses; and if the same individual is charged a tax upon his stock, and also upon the subject procured by it, he is taxed twice upon the same thing.

If the terms and conditions of the act in question, affected only the citizens of the Commonwealth, our anxious desire to see the improvement made, and our confidence that the Legislature would afford relief against such provisions of the act as operate harshly, might have great influence upon our course. But there are Stockholders to a large amount, residing out of the State, and chiefly in the city of Philadelphia. These residents of Philadelphia, invested their capital under a charter of a particular character, and it is understood, that they are unanimously opposed to the changes in the charter which the late act contemplates. We do not think it would be correct in principle, or consistent with sound policy, even if we had the power to compel them, after getting a large amount of their money under one charter, to accept another of a very different character. We do not think it would be right to compel them to this, when we are distinctly informed, and perfectly satisfied, that, if at the time of their subscription, the charter had contained such provisions as are introduced into the late act, they never would have become subscribers.

Under such circumstances, the wisest and the best course seems to us to be, not at this time to act finally upon the question of accepting or rejecting the act, but to leave the subject open, under a hope that the General Assembly will, at its next session, make such modifications of its provisions, as will remove the strong objections to the act which are now felt by the Stockholders out of the Commonwealth, and make it more satisfactory also to our own citizens.

In the mean time, it seems to us, that the present season ought not to be entirely lost.

At the last annual meeting, the President and Directors stated in their report, that it did not seem to them, that it would be advisable to commence the work, until the land owners, who would be benefitted by it, should have given relinquishments of damages on fair terms. We are informed that, during the last Summer, notices were given to all the land owners for the appointment of commissioners to assess the damages on the route from Fredericksburg to Aquia Creek; and that in the Fall, damages were assessed on the whole route; but that the aseessments then made, have not yet been acted on. We think the President should have them acted upon, and this part of the business brought to a close as soon as practicable. Besides doing this, we think that to ensure the completion of the bridge across the Rappahannock, as soon as the graduation can be done upon the line, the Board should cause the piers to be erected for the bridge during the present season; and if there be any other work that will require more than the average time, and not involve a large expenditure, should cause such work to be done. It seems to us, there can be no difficulty in effecting this much, at all events—because, if the means should be wanting, the money that would otherwise be applicable to the fall dividend, can, if necessary, be temporarily used for the purpose, and scrip issued for the payment of the same to the Stockholders, with interest, at such time as would suit the convenience of the Company.

We would not, however, be understood as desiring to restrict the President and Directors to this fund. They have power under the act of incorporation to borrow money for the purpose of carrying on the work, and to issue certificates, or other evidence, of any loan which may be made. Should they find it practicable to borrow to the extent requiaed, on fair terms, they will no doubt deem it more expedient to do so, than to appropriate the dividend fund.

And the question being taken upon agreeing to the said report, the same was adopted by the vote of the individual Stockholders without division or dissent; the proxy for the Board of Public Works having declined to vote on the question.

Extracts from the minutes.

HILARY BAKER, *Secretary.*

A Treatise on Roads, their History, Character and Utility. By S. Dewitt Bloodgood, Albany: Oliver Steele, 1839.—This most useful Treatise is the substance of two Lectures, delivered by the Author before the Young Men's Association of the city of Albany, and with its appendix, contains a summary of all the most valuable information on the subject. The importance of facility of intercommunication, whether by common roads, canals, or railroads, is not easily estimated. It is not too much to say that it is one of the greatest means of civilization. The exchange of the products of labor, the gratification of curiosity in search for information, the rapid transmission of intelligence, are become so common as not to enter into our estimate even of necessaries; they are things of course, and yet are almost as important in making up the sum of human comfort as food and clothing. By roads, and in this general name we include the highways of rivers, the plenty of one country ameliorates the horrors of starvation in another, and the intelligence of an improved community is sent forth to improve and civilize the more barbarous. The contrast between the want and the enjoyment of these means of intercourse, is happily shewn by many startling illustrations in the work before us, from which we shall make such extracts as may shew how much we enjoy in the luxury of locomotion. Let us contrast Sicily and Spain with England. In what is such a difference observed as in the facility of transportation?

"On a recent occasion, when a supply of grain was required by the government of Madrid, it took 30,000 horses and mules to transport 480 tons of wheat from Old Castile to that city.—On a good turnpike road, this would easily have been accomplished by one sixth of that number of animals; on a canal at a speed of four miles an hour, by about fifteen, on a railway by the exertions of two locomotive engines of the first class."

A very interesting account is given of the history of roads.

"The early history of roads is somewhat obscure. In tracing it out, we naturally turn to the oldest records in the hands of men, to see what is there said of them. The commerce of the East appears to have been carried on by means of ships and caravans, and allusions to these are frequent in the early writers. We find that the Egyptians pursued the retreating Israelites with chariots, which is perhaps the most ancient notice we have of their general use.

In the time of Solomon, immense numbers of these chariots were imported from Egypt. The numbers are stated with precision by the early historians, and the fact of their use, in default of other evidence, would be conclusive as to the existence and maintenance of public roads. Two great routs from Palestine to Egypt, the one along the Mediterranean from Gazi to Pelusium, and another from the same place to the Arabian Gulf, are spoken of as being constantly thronged by travellers.

There is evidence of the existence of regularly constructed roads in Asia of great extent, divided into stations, at which the most spacious inns were erected for the security of travellers. That from Suza a sea port of Tunis, to Sardis, a town a little east of Smyrna, traversed a distance of 312 miles, and had no less than 113 of these caravanseras.

The routs now followed in Africa are no less than seven in number, occupying from 30 to 119 days, and traversed frequently by as many as 2000 camels.

The states of Greece, which are always the favorite haunts of the classical antiquarian, do not furnish the same field to the utilitarian, as to the lover of the fine arts.

Tournefort, says however, that he found in the island of Cos, now Stanco in the Egean Sea, a road that ran from Iolis to Carthea, paved with regular polygons, supported by a strong wall, and this again protected by immense blocks of coping. He succeeded in tracing it for three miles.

The Roman roads are almost as familiar to the moderns as those of their own times. When the whole world, as then known, was tributary to Rome, and her Eagles had been planted on the confines of Europe, Asia, and Africa, she took care to construct and maintain roads in every country she had conquered.

To maintain that supremacy, roads were esteemed essentially necessary, and by them was kept up a constant communication with the remotest outposts. They were built at a vast expense, and kept up with unremitting care.

The supervision of these roads was entrusted to men of the highest rank. Augustus made those about the capital his particular care; and prætors attended by lictors superintended the paving in person.

The roads of modern times find able historians from the pack-horse path of England to the railways of our own day.

In 1706 the stage coaches went from London to York in four days, and now they perform the distance in twenty-four hours. In 1712 it took thirteen days to travel by coach from London to Edinburgh, and now it requires but forty hours! In 1760 travellers were two whole days in going from London to Brighton, now they are only about five hours.

The subject of railroads is fully discussed, and a notice given of the improvements on the Scotch canals, by substituting light gigs at a speed of ten miles an hour, for ordinary canal boats.

The Appendix contains much information of great value to the practical engineer, as well as to the general reader, and will secure the work a welcome reception in a country where correct information on this subject is so absolutely necessary as it is with us.

To be continued.

REPORT

Of Edwin F. Johnson, Chief Engineer, in relation to the survey of the Ogdensburgh and Champlain Rail Road.

To John A. Dix, Esq.,

Secretary of State for the State of New-York.

Sir—By virtue of a commission received from the Hon. William L. Marcy, late Governor of the State of New-York, dated Albany, June 17th, 1838, directing me to make a survey for a railroad from Ogdensburgh, on the St. Lawrence river, to Lake Champlain, under the act of the Legislature of New-York, of the 18th April last, I have the honor to state, that such survey has been made, the report and maps, &c of which are herewith respectfully submitted.

EDWIN F. JOHNSON.

Albany, January 26th, 1839.

REPORT.

The portion of the State embraced between the St. Lawrence river and Lake Champlain, traversed by the survey, is distinguished in a topographical view by very marked features.

Lake Champlain, forming the eastern boundary, lies in a direction nearly north and south. Its elevation at Whitehall, above the Hudson river at Albany, as ascertained from the surveys upon the Champlain canal, is 93 feet.

The River St. Lawrence, which forms the western boundary, lies in a direction northeast, and southwest. The elevation of this river above tide at Ogdensburgh, the termination of navigation from Lake Ontario, is not correctly know. The elevation of Lake Ontario above tide, is 236 feet, as derived from the Erie, Oswego, and Niagara-Falls canal surveys. *Assuming* the descent from the lake to Ogdensburgh at 7 feet, (the distance being about 50 miles,) the elevation of the river at the latter place is 229 feet.

Lake Champlain at Plattsburgh, has been ascertained by the present survey, to be 142* feet lower than the St. Lawrence at Ogdensburgh. It is, therefore, 229—142=87 feet above the tide at Albany, and the descent from Whitehall to the broad portion of the lake, is 93—88=6 feet, being equal nearly to the descent *assumed* in the River St. Lawrence, from the level of Lake Ontario to Ogdensburgh. The distance from the river at the latter point to Lake Champlain, measuring in a *direct* line, does not probably vary much from 100 miles.

At the distance of 20 to 25 miles west from the Lake Champlain, and paralled with it, is a range of mountains, the most elevated point of which is Mount Marcy,—so termed in the geological report 1837,—situated in the township of Keene, Essex county.

The elevation of this peak above the Lake Champlain, 4,820 feet; and above tide, 4,907 feet; and is undoubtedly the highest summit in the State.

This mountain range, in its course north through Clinton County, is divided by the Au Sable and Saranac rivers, tributaries to Lake Cham-

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* In a report of a survey of a canal from Ogdensburgh to Champlain, made in 1825, this difference in level is represented to be 155 feet; a result incompatible with the relative elevations of Lakes Ontario and Champlain, as above stated.

plain, and disappears in the Province of the Lower Canada, a short distance north of the Province line. The greatest elevation of this range above tide at the Province line, is 1,085 feet; and above the lake, 998 feet. The portion situated between the Province line and Saranac river, is termed the *Lion Mountain Range*, the highest point of which, above tide, is 3,864 feet; and is situated in the western part of Beekmantown, near the south end of the Chateaugay lake.

The portion between the Saranac and Au Sable rivers, is termed the *White-Face range*, the highest peak of which is situated in the town of Wilmington, and is elevated above tide 4,666 feet.*

The portion situated south of the Au Sable river, between that stream and the sources of the Hudson river, in which Mount-Marcy, as above stated, is situated, with several other lofty peaks, is termed, in the geological report to which I have already alluded, the *Adirondack group.*

At the points where this mountain range is divided by the Saranac and Au Sable rivers, the elevation above tide, is from 1,100 to 1,300 feet.

In tracing a line from Ogdensburgh to the most eligible point on Lake Champlain, it became obvious that only three feasible general routes could be pursued. The first passing the range between Lion mountain and the Province line, termed the *Chateaugay* route. The other two following the course of the Saranac and Au Sable valleys, and designated respectively as the *Saranac* and *Au Sable* routes.

Westward of the mountain range is a spread of table land extending to within about 40 miles of the St. Lawrence river, and elevated from 1,500, to 1,700 feet above tide.

This elevated table is broken into ridges of moderate height, and covered with numerous ponds and lakes, some of which, viz: Long lake, Racket lake, Tupper's lake, and the three Saranac lakes, are of a large size. From this table also, most of the streams which run easterly into Lake Champlain, and westerly into the St. Lawrence river, take their rise.

Among the latter may be mentioned the Racket, St. Regis, Deer, and Salmon rivers, which form their junction with the St. Lawrence near together, and not far from the Province line. One other large stream also forms its junction with St. Lawrence near the same point, viz: the Grass river, which, with the Racket river, has its source south of the region traversed by the surveys.

The face of the country intersected by these streams adjoining the St. Lawrence river from 18 to 24 miles width, and extending from Ogdensburg to the Province line, presents but very few marked inequalities of surface. The section east of this is more irregular, and is diversified with hills and valleys, the general level of the surface rising rapidly to the elevation of the table above described, presenting in the magnitude and number of the streams, and the great descent to the level of the St. Lawrence, a vast amount of hydraulic power. This latter remark in respect to the hydraulic power, applies also, with, if anything, greater force, to the streams running easterly into Lake Champlain, in

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* The altitudes here given, were deduced from the angular elevations observed from a point near Lake Champlain, whose elevation was known, and the distances, as determined from the map. I mention this to the account in part, perhaps, for the discrepancy between the results above given, and those contained in the geological report, as derived from barometrical measurement.

consequence of that lake being, as already stated, 142 feet lower than the St. Lawrence river.

In the execution of the surveys, owing to the extent and character of the section of the country to be examined, being a very considerable portion of it unimproved, it became necessary to arrange the line into two divisions.

The direction of the surveys upon the Eastern Division was entrusted to S. Whipple, Esq., of Utica, and those on the Western Division to H. Lee, Esq., of Camillus, Onondaga county, both gentlemen of experience and standing in their profession.

The results of the examinations and measurements made by these gentlemen are embodied in reports made by them respectively, which are hereto annexed, and to which I must refer for most of the details connected with the surveys.

The act authorizing the survey, established but one point in the route, viz: "the village of Ogdensburgh," situated on the St. Lawrence river, at the foot of navigation from Lake Ontario. From thence the survey was to be made "eastwardly to the most eligible point on Lake Champlain."

An inspection of the maps of the State, together with a cursory examination of the general features of the country with reference to the course of the principal valleys, induced the opinion that there would not be any very great difference in the distance by the several routes as above described. As, however, the face of the country was apparently the most regular, and the elevation of the summit considerably lower upon the northern or Chateaugay route, and also as the population was the most dense in that direction, being near the main travelled road from Ogdensburgh to Plattsburgh, it was deemed proper to direct the attention first to that route.

The survey of the Western Division was commenced at Ogdensburgh, and extended through the villages of Canton, Potsdam and Stockholm, to Malone. On the completion of this line, another was traced, pursuing a more northerly and direct course between the extremes mentioned, passing through the villages of Columbia and Norfolk. Both these lines were found perfectly feasible. The distance by the first or south line, is 66.82 miles, and by the north line 62.95 miles, showing a difference of 3.87 miles, in favor of the latter. The proportion of straight line, is somewhat greater on the north than upon the south line; the general character of the grades is nearly the same upon each, and the estimates of costs of grading, masonry, bridges and fencing, show a balance in favor of the northern line, which will be increased by the addition of the extra cost of superstructure, the expense of which is in direct proportion to the distance.

A route still more direct than the one surveyed, may be pursued between Ogdensburgh and Potsdam. This, for the want of time, was not instrumentally examined, and I am therefore unable to speak of its relative merits.

The shape of the country between Ogdensburgh and Melone, is exceedingly favorable for the construction of a rail-road. The surface is in general undulating, presenting but few abrupt changes, in level. The streams, of which there are several of considerable magnitude, already mentioned, as being intersected by the survey, are not separated by high grounds, and the crossing of them is effected without encountering any difficulties, which may not be surmounted at a reasonable expense.

Between the village of Melone and Lake Champlain, comprising the Eastern Division, but one line was traced.

Melone village is elevated 687 feet above tide, or 465 feet above the St. Lawrence. The rate of ascent, viz: 30 feet per mile, at which this point was attained, from the comparatively level district in the vicinity of the St. Lawrence, was continued with a slight increase at one or two points, $21\frac{1}{2}$ miles, to the summit of the dividing ridge, at a point about five miles from the Province line in the town of Ellenburgh, and about half a mile north of the Military turnpike. This summit is elevated 1,190 feet above Lake Champlain, and 1,048 feet above the St. Lawrence river at Ogdensburgh. From this point the descent to Lake Champlain was effected by a line terminating at Plattsburgh village, distant $34\frac{1}{2}$ miles, giving an average descent of 33 feet per miles, and a maximum inclination of 45 feet per mile for a small portion of the distance.

This line, for some distance from the summit, ranges near the Military turnpike, crossing and recrossing it twice, and leaving it near the East-Chazy river, and passing through the western part of the towns of Chazy and Beekmantown, to the lake at Plattsburgh.

From Melone to the summit, the surface is in general favorable. Several streams are crossed running northerly. The ravines in which these are situated, and which appear somewhat formidable where they are intersected by the turnpike, particularly the one in which the Chateaugay river is situated, are passed at points south of and more elevated than the turnpike, where they are diminished much in depth and breadth, and lose most of their formidable character.

From the summit to the lake, at Plattsburgh, the ground is generally regular. The points where the most irregularities occur are indicated on the map by the curvature of the line in adapting it to the surface of the ground, viz: at the north or west branch of the Chazy river, and between the east branch of the main Chazy and the little Chazy rivers, where a spur of the mountain range puts down in a northeasterly direction, termed the Flat Reck ridge.

For most of the distance from the summit to the lake, the rock lies near to the surface, but owing to the general eveness of the surface will not be encountered to a very great extent in the construction of the road. It is from this close proximity of the rock to the surface, that the streams which are crossed transversely by the line have made but a slight impression on the face of the country; presenting no deep ravines, rendering the embankments upon the road in general light, with a corresponding saving in the cost of culverts and bridges.

Notwithstanding there are few or no obstacles of a serious or very expensive character to surmount on this division, yet the general conformation of the country is not as favorable for the cheap construction of a railway as upon the Western Division, as will appear by a comparison of the estimates of cost upon both; yet taken together there is not probably another route to be found in the State of equal extent, where a railroad has been constructed, or in contemplation, which presents featuies more favorable for the construction of a cheap and permanent railway.

The summit point of the survey being 1,190 feet above the lake, is 192 feet higher than the most elevated point of the dividing ridge at the Province line, which as already stated has an elevation above the lake of 998 feet. It is obvious, therefore, that by throwing the line more to the north a lower summit may be obtained; but whether the line would be much improved by such a change, or whether it would be advisable to place it so near the Province line as would be necessary to diminish much the elevation, are considerations to which the attention will naturally be directed whenever a re-survey shall be made with a view to a final location. It does not appear very probable that any essential reduction can be made in the maximum inclination of the grade line on the west side of the summit by such a change; there would, therefore, be little or no gain in the maximum load of the engine, while at the same time the total distance would probably be somewhat increased. As it regards the influence of such a change upon the line east of the summit, a similar remark may be made.

In selecting the point upon the lake for the termination of the railroad, the village of Plattsburgh was considered the "most eligible."

By an inspection of the map, it did not appear that the distance to the lake from the summit would be much, if any, enhanced over other lines drawn to other points on the lake, between Plattsburgh and the Province line; and judging from the general appearance of the country, and the elevation of the surface, as derived from the canal survey, it did not appear, that in any other direction, the descent to the lake could be effected in so gradual and easy a manner, as upon the line surveyed.

The village of Plattsburgh was also selected, in consequence of its more southern position, being nearer to New York city, and to the prominent business point on the eastern shore of the lake. Its position likewise at the mouth of the Saranac river, the improvements in its harbor, now making by the General Government in the erection of a light-house and breakwater, and the precedence it has already acquired in population and business, strongly indicated the propriety of making it the termination of the survey upon the lake.

I would remark here, once for all, in respect to the lines as surveyed, that although the aim was to select the best ground, or that which under a view of all the circumstances, of expense, distance, and public accommodation, should be deemed the most eligible, yet owing to the difficulty of making explorations in a country, a considerable portion of which is comparatively new, and the want of time and means for a more critical examination, it is possible that the best ground was not in all cases discovered. Should the road be constructed, a careful revision of the ground, under a more minute instrumental measurement, will be necessary, previous to a final location. This will undoubtedly result in improvements at particular points, either in straightening and shortening the line, or diminishing the expense; but it is not believed that it will be found advisable, to make any very important deviations from the general course of the routes, as surveyed, except perhaps in the instance to which allusion has already been made, of a more direct course between Ogdensburgh and Potsdam, or perhaps to carry the line still farther to the north between Norfolk, and the summit.

In the estimate of cost of constructing a railway as presented in the annexed reports upon the two divisions, a single track only is contemplated. This course has been adopted under the belief that it would not be expedient to invest in the outset more capital than is necessary to construct a single track. The capacity of a single track railway for the conveyance of freight and passengers, when provided with suitable turns-out and operated by locomotive steam power, is very great. This results in a great measure from the degree of perfection which has been attained in the construction and operation of the locomotive engine, by which its powers for traction and speed are so well understood and regulated that its times of arrival and departure and passing particular points can be determined with great precision.

The road-bed is assumed in the estimates to be 13 feet in width in embankment, with ample additional space in the excavations for drainage. The lateral slopes are supposed to have a base of $1\frac{1}{2}$ to 1 perpendicular. The various mechanical structures, such as culverts and bridges, are supposed to be built in a substantial manner; the culverts to be constructed entirely of masonry, as also the abutments and a portion of the piers of the bridges, thereby avoiding, as much as possible, the use of any perishable material in the construction of the road-bed.

Materials, suitable for the several structures, are found in abundance, and of a superior quality, on all parts of the line.

The total estimated cost of grading, manonry, bridges and fencing upon the whole line, is as follows:

For the eastern division, as per Mr. Whipple's estimate, adding thereto $5,000 for fencing, - - - -	$384,830 79
For the western division on the line through Canton and Potsdam, as per Mr. Lee's estime, . - - -	354,496 00
	$739,326 79
Add for superintendence and contengencies 10 per cent	73,932 68
Making a total for the whole line of - - - -	$813,259 47
For the Western division on the line through Colombia and Norfolk, - - - - - - - - - -	$274,099 00
Which added to the cost of the Eastern Division, as above, gives, - - - - - - - - - - - -	$658,929 79
Add for surperintendence and contingencies 10 per cent,	65,892 98
Total for the whole line, - - - - -	$724,822 77

The distance on the first line is 122.8 miles, giving an average per miles of $6,622.63. Upon the second line the distance is 119 miles, giving an average per mile of $6.090 95.

The total cost, therefore, of constructing a single track rail-way upon the two lines, exclusive of lands, which it is reasonable to suppose will be an item of inconsiderable importance, is as follows:

First line, through Potsdam, &c.

Clearing, grubbing, grading, ditching, culverts, bridges, and fencing. - - - - - - - - - -	$813,259 47
Superstructure, $5,000 per mile, 122.8 miles. - - -	614,000 00
	$1,427,259 47
Add for turns-out 10 per cent, - - - - - - -	142,725 95
Total, - - - - -	$1,569,985 42
Giving an average per mile $12,786.	

Second line, through Norfolk, &c.

Clearing, grubbing, grading, &c. as above, - - -	$724,822 77
Surperstructure $5,000 per mile, 119 miles, - - -	595,000 00
	$1,319,822 77
Add for turns-out 10 per cent, - - - - - -	131,982 28
Total, - - - - - - - -	$1,451,805 05
Giving an average per mile of $12,200	

The superstructure in the above estimate is supposed to be formed of such timber as can be obtained in the vicinity of the route, suitable for the purpose.

The rail plate for the portions of the line west of the summit, embracing a distance of 86 miles, is supposed to be $2\frac{1}{2}$ inches in width by $\frac{5}{8}$ths of an inch in thickness, equal to about 30 tons to the mile. For that portion on which the steeper grades occur, between the summit and the lake, the thickness of the plate is one inch, or about 40 tons to the mile. Should an entire iron rail be adopted in the construction of the road, with timber foundation, the cost will be increased about $3,500 per mile.

The preceding estimate does not, of course, embrace any of those items which appertain more particularly to the transportation account such as warehouses, fixtures at the depots, engines and carriages.

As it regards the straightness of the route upon the lines surveyed, it is deemed to be equal, if not superior, to most of the lines of railway which have been constructed and are in operation in the northern section of the Union.

Upon the Western Division, one-fourth only of the line is curved of that fourth, one-half has a radius of curvature not less than 5,000 feet, the minimum radius being 1,000 feet, and confined to a few hundred feet of the distance. Upon the Eastern Division the minimum radius is the same, and the curves are generally favorable as to the length of their radii, although the proportion of straight line is less than upon the western division. There are, upon the whole line, with two or three exceptions, no curves which will require, from consideration of safety any very material reduction in the speed.

The inclination of the grade lines upon the routes surveyed, are such as to permit the advantageous use of locomotive steam power at all seasons of the year. The maximum grade of forty-five feet per mile is considerably below what it is upon many other roads, designed as general thoroughfares for trade and travel, and the greatest acclivities occur upon the eastern side of the summit, a position the most favorable for the preponderance in the trade, which it is supposed will be greatest in an easterly direction.

The average descent of 33 feet per mile for the whole distance of 35 miles, from the summit to the lake, considering the near approach of the several portions of the line to an uniform descent, is quite sufficient to enable a strain of a carriages to descend by the force of gravity, requiring but little aid from the engine. The inclination of the line is not, however, so great as to prevent a complete control over the speed, by the means which are usually at command for that purpose; neither is it so great as to render unsafe the attainment of a speed in descending, as great nearly as would be desirable on the more level portions of the road west of the summit.

Of the two southern routes, the Saranac and the Au Sable, mentioned in the general view of the country between the St. Lawrence river and Lake Champlain, neither would approach the lake south of Port Kent, which is 15 miles south of Plattsburgh, and is the present principal point of concentration upon the lake, of the iron and lumber business of the Au Sable valley.

The time and means at command, did not allow of making a regular instrumental survey of either route; measurements were however made, sufficient to determine some of their leading features.

From the Lake to Cady's mills, upon the Saranac river, a distance of eleven miles, the average ascent is about 60 feet per mile; the maximum being probably about 70 or 75 feet per mile.

By pursuing a more circuitous course, so as to increase the distance, the acclivity upon this portion may be somewhat diminished.

From Cady's mills to the Forks, the ascent will average about 50 feet per mile for 10 miles; the maximum being probably not less than 60 feet per mile.

From the Forks three routes may be pursued, one passing up the south, another the north branch of the Saranac, and the third, pursuing a middle course, occupying the valley of Alder brook, which lies nearly parallel to that of the south branch, and discharges into the north branch, a short distance above the Forks.

The two latter routes, from the very cursory examination which it was possible to make, appeared to present the most favorable ground. These routes all unite north of the Upper Saranac lake, from whence the course is very direct to Ogdensburgh, descending for some distance along the valleys of the St. Regis and Racket rivers, and uniting with the survey of the north route at Potsdam, or Canton, or some intermediate point. Between the forks of the Saranac and Ogdensburgh, no very serious obstacles of steep grade, or of irregularity in the surface, will be encountered.

The highest ground is found near the Upper Saranac lake, presenting a summit about 1,550 feet above the Lake Champlain, or 360 feet higher than the summit upon the northern or Chateaugay route.

The Au Sable route presents features which, in respect to acclivity of grades, appear more favorable than the Saranac.

Measurements were made sufficient to determine that a line may be located on this route, from the lake to the summit, with no grade exceeding sixty feet per mile; and that the extent of grade having this acclivity is confined to about four or five miles, near the upper part of the valley. The remainder of the line averages about 40 feet per mile.

This route necessarily passes through the upper portion of the Saranac valley, and hence two summits are presented in the profile. The first, in passing from the valley of the north or west branch of the Au Sable to the Saranac valley; the second lies farther west, between the waters of the Saranac and St. Regis or Racket rivers, from which place westward, the line occupies nearly the same ground with the main Saranac route, already described.

The first summit, which is situated west of the White-Face mountain, is elevated 1,646 feet above Lake Champlain; the elevation of the second, as above stated, is about 1,550 feet. In passing from the first, to the second summit, the line descends at the average rate of 30 feet per mile, for 6 or 7 miles, to its intersection with the Saranac river, the maximum being about 50 or 55 feet; from whence it ascends over undulating ground 100 feet, to the second summit, at moderate grades, not exceeding probably 30 feet per mile, This opinion is formed from a very imperfect view of the ground, but is believed to be near the truth.

The maximum descent from this summit westward will not probably exceed 50 feet per mile. The average for the portion between the summit, and Potsdam which has the greatest declivity will be about 35 to 40 feet per mile. No measurements were made upon this portion of the line, but as the elevation of the summit above Potsdam is known, it is possible to form a tolerably correct opinion of the general shape of the ground, and the grades which it may be necessary to adopt.

The passage from the Au Sable to the Saranac valley may be effected by pursuing a route east of the White-Face mountain, along either of the valleys of the East and West Black brooks, tributaries of the north or west branch of the Au Sable river, and entering the Saranac valley either at Union falls or near Permit rapids ten miles above, and thence by the Cold Brook valley to the junction with the other routes near the head of the Upper Saranac lake.

The summit upon the line leading to Permit rapids is about 80 feet lower than the one west of White-Face; and upon the Union falls line the difference will, it is supposed, be somewhat greater. Whether, however, either of these routes will be found superior when distance, and expense and acclivity of grades is considered, to the one first named, passing west of White-Face mountain, can only be satisfactorily determined by a careful survey on each.

The distance by the Au Sable route from Ogdensburgh to Lake Champlain, as has already been stated from the best judgment that can be formed without actual survey, will probably vary much from the distance by the Chauteaugay route.

The time occupied in passing from one extreme of the route to the other, will probably a little exceed the time upon the northern route. The difference in this respect under a diminution as supposed above 25 per cent in the load, will not however be great.

The face of the country is apparently not as regular upon this, as upon the northern route; and hence, it is supposed that a greater expense will be incurred in the formation of the road. This difference in the cost of construction may be partially diminished by the cheaper rate at which timber of a suitable quality for the superstructure or rail-track and for other purposes can be obtained upon the south route.

There is an important feature in the topography of the country through which the south route passes, which deserves to be noticed. It is the comparative small difference in level of the lakes and streams, which are found upon the table land, described in the first part of this report.

The Saranac river from Union falls to the Upper Saranac lake, a distance by the river of about 40 miles, presents, with the exception of five carrying places, equal in the aggregate to less than three miles, a bateaux navigation for the whole distance.

The Racket river, from Racket lake to the mouth of Stony creek, in the township of Hollyswood, presents also a navigation equally perfect, the distance being about 70 miles.

The Upper Saranac and Long lakes are very nearly upon the same level, and the former is about 40 feet higher than the Racket river, which flows within four miles of its southern extremity, the summit between being only 30 feet above the lake. The present carrying place from the lake to Stony pond, which is nearly upon a level with the river, is only three-fourths of a mile. An excavation of 150 rods in extent with an average depth of 20 feet, is sufficient to turn the waters of the lake into the Racket river.

Between the Racket waters south of Long lake, and those of Mill river, a tributary of Moose river, which empties into the Black river above, and near to the High falls in Turin, there exists a low summit, with a short portage of about 1¾ miles in extent. This ground was not visited by me, but from information derived from a creditable source, it appears that the descent from the summit to the Black river is very gradual, there being in the streams mentioned occasional rapids, but no falls. The total distance from Long lake to the head of the feeder to the Black river canal, is about 25 or 30 miles, and the descent about 450 feet.

AMERICAN

RAILROAD JOURNAL,

AND

MECHANICS' MAGAZINE.

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For the American Railroad Journal, and Mechanics' Magazine.

On width of track. By W. R. Casey, civil engineer.

Whatever may have been the reasons which led to the adoption of the present width of track on the Liverpool and Manchester Railway, it will be readily admitted, that no change can *now* be judicious unless it offer advantages not possessed by, or obviate difficulties inseparable from the usual guage of 4 ft. 8 1-2 in. between the rails. The deviations from this width as yet made in the United States, few as they are in number and insignificant in amount, leave us absolutely without any facts by which to show the propriety, far less the necessity, of an increased width of track, in a manner entitled to the confidence of an intelligent Board of Directors. All we can do, then, is to examine the grounds on which the only deviations worthy of notice have been recommended and wholly or in part carried into execution.

These are the Russian Railway, with a track 6 feet wide, constructed by the chev. de Gerstner, and the Great Western Railway, with a track 7 feet wide, by Mr. Brunel. Unfortunately no reports of the working of the former have been received in this country, though M. de Gerstner, when here, was decidedly opposed to any increase beyond 6 feet, and, on the other hand, Mr. Brunel's confidence in the ultimate and triumph antsuccess of his 7 ft. track remains to this day unshaken.

Mr. Brunel had two objects in view in adopting the seven feet guage :—the attainment of an average speed of from 35 to 40 miles per hour, and a reduction of the friction of the axles by increasing the diameter of the wheels of the cars—indeed an increased diameter of wheel may be said to be the aim of this very important change, for, by this means, is obtained the increase in speed as well as the diminution in friction.

There are probably few roads in England on which an average speed of 25 miles per hour, and still fewer in the United States, on which an average of 20 miles per hour is regularly maintained. The rate of travelling on some of the most important thoroughfares in the Union, such as the Utica and Schenectady Railroad, scarcely reaches 15 miles per hour, though their engines could easily maintain a rate of at least 20 miles per hour, and the engines on good roads such as the Providence, Stonington and the numerous substantial roads leading from Boston could, without difficulty, perform 25 miles per hour, or more if required. The speed cannot therefore be said to be limited to its present rate by the narrow guage, but must be attributed to other causes very well known, some of which are pointed out by Mr. Wood; such as the trifling load, and the immense consumption, of fuel at great velocities. The repairs of road, engines and carriages, offer however, still greater objections, for they increase in a much greater ratio than the speed, and in fact limit the velocity, on cheap roads, to 15, and on the best roads in the Union, to 20 miles per hour.

The maximum grade on the Great Western Railroad is 4 feet per mile, on which inclination, the friction of the axles will as Mr. Brunel says, form 80 per ct. of the resistance, and by increasing the diameter of the wheels from 3 to 4 feet, the friction of the axles will be reduced from 80 to 60 per ct. or inversely as the diameter. (Mr. Brunel appears to have overlooked Mr. Hawkshow's error in stating, that an increase of diameter in the wheel with a corresponding increase in the axle would not diminish the friction—in other words, that the friction is as the area of rubbing surface instead of as the weight.)

There are few, if any roads of importance in the Union, where the inclinations are not at least equal to the angle of repose, and even in this extremely favorable case, an increase in diameter of wheel from 3 to 4 feet would only reduce the friction 20 per ct., supposing the road to be straight, but with inclinations of from 30 to 40 ft. per mile and curves of 1000 or 2000 feet radius, the advantages of large wheels would be imperceptible in practice—the disadvantages obvious.

Increased steadiness was one of the collateral advantages confidently anticipated from the wide track. Mr. Wood's experiments cannot be considered as indicating any superiority in this respect, but Mr. Brunel states positively, that the notoriously worst part of the road gave the most favorable results in the diagrams, and it is indeed very easy to believe that this apparatus for measuring the irregularities of a machine much simpler than itself, and far better understood, would not give any results on which much reliance would be placed by practical men. If the steadiness actually increased with the width, the improvement from an increase of nearly one half should be immediately and plainly perceptible to all, but if it can only be ascertained by a sensitive apparatus contrived for the purpose, this "collateral advantage" disappears in practice. It is remarkable that Mr. Brunel no where states, that the motion on his road is decidedly easier, more agreeable or more uniform than on the narrow track.

The want of room for the most efficient arrangement of the working parts of the engine was, some years since, of itself considered sufficiently important to warrant an increase in width of track. Now, however, little or no difficulty is experienced in the construction of the largest engines, and the most experienced builders in England, as well as the United States, consider any increase beyond a very few inches absolutely injurious with the present construction of engines.

The propriety and practicability of maintaining an average velocity of 40 miles per hour and the great benefits to be derived from 4 feet gradients are so strongly urged by Mr. Brunel, that, with every respect for his talents, it is difficult to believe he has any practical acquaintance with the repairs and renewals of engines and cars, adjustment of rails, average size of trains and numerous other practical details, experience in which, in this country, goes far to demonstrate that his views cannot be carried out, here at least, requiring as they do, in the first place, an immense outlay to obtain 4 feet gradients and curves of several miles radius, and secondly, an amount of repairs and renewals vastly beyond what is already found so burdensome with only half the proposed velocity, and with less than one fourth of the probable cost.

In justice to Mr. Brunel it should be borne in mind, that he does not consider the wide guage advantageous for roads materially differing from his in curves and grades, and his entire course of reasoning would lead to the conclusion, that the ordinary width of track was too great for roads with grades of 30 feet per mile and curves of 2000 radius. He also refers to the Irish Commissioners, who, with certain curves and inclinations, established 6 feet and 2 inches as the most advantageous width, and feels sure that, with a line as favorable as the Great Western, the same principles would have induced them to recommend a guage of seven feet. The idea that for every series of grades and curves a different width of track should be adopted may be very true in the abstract, and may afford infinite amusement to Dr. Lardner, Irish Commissioners, cis as well as transatlantic "et id genus omne," but it has no attractions for those whose deliberate opinions instead of being confined to paper, are carried out in practice, and in the success of which, they, as well as the stockholders have a vital interest and the community a stake of some importance. Thus if we admit, that 7 feet is the proper width for the Great Western Railway with grades of four feet per mile, and that 4 ft. 8 1-2 in. is the proper guage for the London and Birmingham Railway with grades 4 times as great, or 16 feet per mile, some of the most important roads in this country would be reduced to a width of little more than 3 feet! It is worthy of remark that instead of pointing out the manner in which the present guage acts injuriously, and stating some tolerable approximation to the extent of increase by which these difficulties would be surmounted—(an investigation requiring much labor and skill), it is assumed as self-evident, that a wider track must work better than one of the ordinary dimensions though, for anything deduced from the experience of the United States, the most advantageous width is as likely to be found below, as above 4 ft. 8 1-2 inches.

A velocity of 40 miles per hour is not to be thought of, on the railways of of the United States, the diminution in friction by increasing the diameter of the wheels will only be felt on a level where it is not of the slightest consequence, there appears to be at least no gain in steadiness and "gentlemen's carriages" can be carried over the wheels as well as between them.

The success of the new system cannot be considered certain even with the incomparable grades of the Great Western Railway, and it is not easy to say what will justify its introduction on roads with grades of from 18 to 30 and even 40 ft. per mile and curves of 1000 to 1500 feet radius, unless we rely entirely on improvements to be hereafter made in the construction of roads and machinery or anticipate the eventual adoption of a superstructure far more substantial than any now existing; in short a railway of greater capacity than the London and Birmingham, the present business of which may be considered fully equal to what can ever be expected on any railroad in any part of the Union.

But, without reference to any thing which has been said or done in England, how stands the case in the United States? The present width is sufficient for any engines required in practice, and indeed for much heavier ones than any road in this country is able to bear, the wagons are large enough for greater loads than the wheels and springs ought to be loaded with, and the velocity is limited to its present rate by conditions on which an increased width of track can have at least no beneficial influence. A wider guage must be attended with increased cost of construction, and if the present superstructure and weight of engines be retained, the same load will be carried at a slight increase of cost on account of the additional capital invested in the width of road, cars and engines, supposing the cost of repairs and renewals to remain the same as with the present dimensions—a supposition only too favorable to the increased guage. A greater width of track, with correspoding additional strength in the superstructure and cars, and power in the engines, would undoubtedly enable us to carry at a lower rate than with the present roads, engines etc.,---if the business could not be properly accommodated by a road of the ordinary dimensions. Before therefore determining on any *material* deviations from the present guage [which no one supposes to be precisely the very best possible] it should be ascertained that an amount of business might reasonably be expected, which could not be *advantageously* done on a road of the ordinary width.

This subject has been before the Engineering world in this country for at least five years, during which time many of the best roads have been executed and the very best ones projected and planned. Yet Messrs. McNeill, Whistler & Robinson have retained the 4 feet 8 1-2 in. guage on all their works, some of which are not yet completed, though they have had in numerous if not in every instance "carte blanche," and were indeed bound by every consideration to have adopted a wider track if it would in their opinion have conduced to the efficiency of the road or the interests of the stockholders. In England, the London and Birmingham Railway, the most stupendous work of Internal Improvement on record, has a track of the ordinary width though leading from the heart of the kingdom to the commercial metropolis of the world, and built by one of the first engineers of the age, who could have introduced any alteration he might have deemed judicious.

The practice of all the best engineers of England and the United States, and the fact, that the present dimensions have worked admirably well, must be considered almost conclusive evidence, that there are no *engineering* considerations, which urge the adoption of a wider guage. Still another width of track *may* be attended with peculiar advantages, and the success and almost universal adoption of the ordinary guage should not deter us from the cool and impartial examination of a greater width, though it should certainly act as a warning from useless innovations and uncalled for changes.

Since the above was in type, the writer has had the pleasure of reading the admirable report of Messrs Knight and Latrobe, on the "Principal Railways of the Western and Middle States,' and notwithstanding their observations and remarks are confined principally to the proper dimensions of the various parts of the superstructure, repairs of engines, and the general economy of railroads, there is not an expression in the remotest degree alluding to the width of track, though the subjects discussed are precisely those on which an increased gauge is to exert so beneficial an influence, whilst the high standing of the authors forbids the idea of their neglecting any consideration so important as the width of track, if they considered any change desirable or if they had even anything useful or interesting to offer on the subject.

The following view of the cost of transportation on the Utica and Schenectady Railroad with its present "motive power," was made the last winter by a practical engineer well know to us, and is worthy of consideration.

Rough estimate of cost of transporting freight on the Utica and Schenectady railroad, founded on "Statement of 1838."

Albany, March, 1839.

CAPITAL.

Cost of present Road, Engines and Buildings, deducting only costs of Mohawk turnpike and coaches	$1,653,903
1000 wagons *a* $345,097 including platforms, scales, etc.	346,097
Amount of Capital	$2,000,000

Annual Expenses.

Present expenses as per statement,	$115,000
Repairs and renewals of 1000 wagons *a* $50	50,000
" " buildings and shops	8,000
Add 50 per ct. on fuel	6,000
" for oil and tallow	2,000
" for renewal of engines (exclusive of repairs)	10,000
	189,000
Say amount of annual expenses	$200,000

Now \$200,000 divided by $\overline{200,000 \text{ tons} \times 78 \text{ miles}}$ = one cent and three mills per ton per mile and 200,000 tons *a* 2½ cents per ton per mile × 78 miles = \$1,95 say \$2, per ton = \$400,000

Deduct annual expenses	200,000
Nett receipts equal to 10 per cent on capital	\$200,000

N. B. Taking the average rate of 3⅔ cts. per ton per mile on the Philadelphia and Columbia Railroad and we have an income of \$572,000 26 per ct. on the capital. This is received by the State and does not include the cost of cars, loading and unloading which is done by the forwarders and for which they charge nearly or quite as much as the State. The cost of transportation cannot be less than 5 cts. per ton per mile, twice as much as will pay 10 per ct. in the hands of individuals, but the "free and enlightened" citizens of Pennsylvania will yield to no "monopolies." !!

Railroad Convention.—At a meeting of citizens of the city of New York held at the Repository of the American Institute, on 29th July, inst.

Charles Henry Hall, of the city of New York, was called to the chair, and Philip Schuyler and Wm. Paxton Hallett, Esquires, appointed Secretaries.

The President having stated the object of the meeting, and the assemblage having been addressed by Messrs. Clarkson, Crolius, Schuyler, Hallett, Blunt, and other gentlemen, the following resolutions were unanimously adopted, viz:—

Resolved, That in compliance with a call from the counties of Renselaer, Columbia, Dutchess, Putnam, and Westchester, the city of New York cordially responds thereto, touching the importance of the immediate construction of the New York and Albany Railroad, and of the expediency of asking the aid of the State in assisting onward the great work, as well to protect the interest of our own State as to counteract the efforts making by the State of Massachusetts, in opening a line of communication from Boston to the Hudson river, having for its end the division of the products of the West from our emporium of trade.

C. H. Hall, Chairman.

Philip Schuyler,
W. P. Hallett, } Secretaries.

A novelty appeared in our river last week, it being no less than a miniature steamboat, built for the purpose of testing a new boiler, invented by Mr. John Lille, an ingenious mechanic of this village. The boat is 32 feet long, by 6 wide. The cylinder is 20 inches long with 4½ inch bore, and is supplied with steam by a boiler 2 feet in diameter by 3 feet in length, which stands upright, and will hold 30 gallons of water—with a chamber for 15 gallons more. The boiler is constructed on the strongest possible plan—is of a circular form, containing alternately 4 fire, and 3 water flues. The furnace has a fine draught, and consumes one quarter of a cord of wood per day, producing steam sufficient for an engine of 4 horse power. The inventor thinks the boiler is a great improvement, and intends making application for a patent. This little craft is propelled six miles an hour in still water.—[*Owego Advertiser.*]

The following table will be found to contain a carefully prepared comparison of three important northern railroads.

We cannot too strongly recommend this mode of arranging and comparing railroad information. Figures cannot be ambiguous and they are the fairest representatives of facts. We are much obliged to our friend J. E. Bloomfield, Esq., for this table, and we solicit from him, and from others, a continuation of the series.

Annual Report of Railroad Companies Completed in the State of Massachusetts, and in use, for 1887, '38.

—ALSO—

"Statement relative to the Utica and Schenectady Railroad, January 1, 1839, for the year 1838."

Name.		Expended in cost of road.	Repairs of Cars and Engines	Repairs of Road.	Fuel.	Oil and Tallow.	Salaries & wages, Incident'l Expenses	Total Expenses	Income from Passengers.	Income from freight.	Total.	Cost of Road per mile.	Average Repairs of Cars 2 years.	Average Repairs of Road 2 years.	Length of Road.
Boston and Lowell, . .	1837	1.575.663	16.633	14.056	11.177	3216	33.424	78.508	117.643	63.137	180.770	60.802	554	550	25¾
Boston and Lowell, . .	1838	1.575.663	10.945	15.734			48.917	75.597	109.083	82.697	191.780	7 pr ct			
Boston and Providence,	1837	1.682.900	29.794	11.707			114.737	156.238	193.469	57.413	250.882	43.460	606	334	41
Boston and Providence,	1838	1.782.000	19.953	16.856			83.234	120.044	196.974	68.140	265.114	8 pr ct			
Boston and Worcester,	1837	1.000.000	20.053	9.185			65.524	94.762	123.331	86.716	210.047	38.636	406	384	44½
Boston and Worcester,	1838	1.700.000	15 672	12.521	12.854	1985	42.534	85.572	112.032	100.292	212.324	7¼ pr ct			
Utica and Schenectady,	1838	1.738.260	16.101	24.121	22.001	3100	54.605	119.950	312.808	18.376	330.695	22.285	206	309	78

Note.—The rails of the Boston and Providence road, are 55 lbs. per yard. The Boston and Lowell, the first track, is 35 lbs.—the second 55 lbs. Boston and Worcester, and Utica and Schenectady 38 lbs. each, per yard. The first track of the Boston and Worcester road, was of the fish belly form, the present is the same as that of the Boston and Providence.

The Legislature of this State have refused the Utica and Schenectady road the privilege of carrying freight, even paying canal tolls, which may account for the difference in the expense of repairs to the road and cars.

We are pleased to hear again from our Meteorological correspondent in the West, after a long interval. The science demands an increased number of observers, and no class of men is better qualified for that purpose than the civil and military engineers of the United States. We shall again advert to this subject.

For the American Railroad Journal, and Mechanics' Magazine.

METEOROLOGICAL RECORD FOR THE MONTH OF JANUARY, 1839.

Kept on Red River, below Alexandria, La., (*Lat.* 31.10 *N.*, *Long.*, 91.59 *W.*)

1839	THERMOMETER.					
Jan.	Morn.	Noon.	Night	Wind.	Weath.	REMARKS.
1	34	58	56	calm	clear	white frost
2	53	57	56	..	cloudy	light showers and drisling all day and night
3	56	58	54	..	..	evening NW light
4	43	44	44	W	..	
5	41	44	43	..	..	
6	42	60	60	calm	clear	
7	50	70	67	SW	..	night cloudy
8	55	68	67	S	..	
9	53	72	69	..	..	evening cloudy, night clear
10	59	73	70	calm	..	
11	64	73	70	..	..	[all night
12	64	64	65	..	cloudy	drisling forenoon, light showers evening and
13	66	65	64	SW—W	..	light rain forenoon, heavy thudder showers all
14	50	52	48	W	..	[the evening
15	38	54	50	..	clear	cloudy morning, evening clear and calm
16	38	51	49	calm	cloudy	white frost, foggy morning
17	44	62	58	..	clear	white frost
18	52	54	53	W—light	cloudy	all day, rain in the night
19	47	45	42	NW	..	..
20	33	44	44	calm	clear	white frost, night cloudy
21	40	45	38	W	cloudy	morning, white frost, clear day
22	28	54	46	calm	clear	
23	34	49	44	..	cloudy	
24	44	46	46	..	..	rain, light showers all day
25	52	55	54	..	..	clear all night
26	41	60	50	SW	clear	
27	34	58	58	calm	cloudy	
28	52	65	68	S—high	..	
29	64	69	52	..	..	
30	44	44	40	.. light	..	rain all day
31	38	34	39	..	..	..
	47	56.3	53.6	....	....	mean temp. of the month 52.
Feb.						
1	31	35	35	NW light	clear	night cloudy
2	33	44	44	..	..	
3	28	55	54	..	..	cloudy night
4	44	58	46	N	..	morning, evening cloudy, rain all night
5	43	43	38	..	cloudy	rain all day, snow at night
6	33	35	37	NE	..	snow laid all day, rain and sleet at night
7	32	33	35	..	..	rain and freezing all day, roofs covered with
8	37	42	41	calm	..	snow and sleet melted and [snow & sleet
9	41	47	46	..	..	all day [gone, light showers all forenoon
10	43	48	43	..	..	morning, clear day
11	32	60	47	..	clear	all day
12	34	66	60	..	..	white frost "
13	39	67	60	..	..	" "
14	39	68	63	..	..	" "
15	45	62	60	..	..	all day
16	38	63	60	SW	..	forenoon, evening cloudy
17	46	58	48	..	..	all day
18	36	55	50	W	..	"
19	41	58	54	SW	..	" night cloudy
20	44	58	54	calm	cloudy	all day
21	48	68	62	S	..	rain all night
22	48	51	62	..	..	rain heavy all day and night
23	62	61	60	..	..	heavy rain all day, cleared off in the night
24	55	65	65	calm	clear	all day
25	52	70	64	NW	..	light thunder shower in the evening
26	50	56	54	W	..	all day
27	40	57	51	S high	..	white frost at 5 P. M., a gale and light shower
28	39	57	50	SW	..	white frost [from NW
	41	55.3	51.5	....	....	mean temp. of the month, 49.2

We commend to the attentive perusal of our readers the following sensible and well written views on the much discussed subject of Steam-boat explosions.

Mr. Redfield is well known as a practical man, and able at the the same time to call to his aid the results of science. His selection as one of the late U. S. Commission to examine into inventions for preventing explosions, is a further assurance that his abilities are generally recognized and appreciated.

LETTER TO THE SECRETARY OF THE TREASURY, ON THE HISTORY AND CAUSES OF STEAMBOAT EXPLOSIONS, AND THE MEANS OF PREVENTION, BY W. C. REDFIELD.

NEW-YORK, *December* 26, 1838.

SIR: Having recently been served with a copy of the resolution of Congress, moved by Mr. Sergeant, for obtaining information respecting the use of the steam-engine in the United States, in navigation or otherwise, and the accidents which have resulted therefrom, I am led to believe that the inquiry will be best answered by a concise statement of my own observation and practice for the last sixteen years, during which time I have been chiefly engaged in the construction or management of steam vessels.

When I first engaged in the application of steam to navigation, there were, as now, two systems of engineering practised in our steamboats. One of these, the Bolton and Watt, or low-pressure system, had been introduced by Fulton, in which the working power was mainly derived from steam of low temperature and expansive force, working upon an effective condensation; the other the high-pressure system, in which steam of high elastic force is worked against the pressure of the atmosphere. The latter system was early introduced in this country by the late Oliver Evans, who was distinguished for his mechanical talents, and who perhaps exceeded all his cotemporaries in his just apprehension and prescience of the powers and advantages of the steam-engine, as applicable to railroads and to navigation.

My first practical acquaintance with the steam-engine was under the high-pressure system; the adoption of which, in this case, grew out of circumstances not under my control. But an attentive consideration of the principles and practice of the low-pressure system, served to convince me that the claims to superiority, both for efficiency and safety, which had been mutually set up by the advocates of the two systems, could not be justly maintained.

It appeared obvious that the useful effect of highly elastic steam could be greatly increased by acting with less pressure on the surface of a larger piston, working on an effective condensation; while the tension and wearing of the different parts, and the danger of explosion common to high-pressure engines would thus be materially lessened. It appearing equally certain that the engine of Bolton and Watt could be rendered more useful and efficient by adapting it to steam of greater pressure and elasticity than was at that time employed; and that by proper modifications in the structure of the boilers, a degree of safety could also be secured which had never yet been attained. The high-pressure system, as then practised, required a tension of steam approaching, as I conceived, too near the estimated strength of the boilers in which it was generated, to be deemed safe in all circumstances;—a consideration of the highest importance in navigation. It also appeared that the use of low-pressure steam, after the English method, with weak boilers, in which any accidental increase of pressure to the amount of perhaps half an atmosphere, could hardly fail to be attended with fatal disaster, was equally unsafe; and that this practice, although universally sanctioned in England, ought not to be followed in our steam navigation.

From these considerations, it appeared to me evident that the greatest degree of safety and efficiency could only be obtained by combining, to some extent, the peculiarities of the two systems, and by adopting such forms of structure in the boilers as should afford the greatest attainable amount of surplus strength, between the maximum working pressure and the point of actual danger to the boiler. I determined, therefore, that in all cases under my control, the extra or surplus strength of the boiler should always be as great as might be fairly practicable;—a principle which, after this lapse of time, I have found sufficient reason to recommend to others for adoption.

Upon this principle of the greatest attainable strength, were also constructed the boilers of the high-pressure steamboat in which, as before mentioned, I was first led to engage. This steamboat was, for the period of four years, under my immediate observation before being dismantled, and during this time, no injury by explosion or erruption of steam, and, probably, not the least hazard thereof, was known to occur; nor do I find reason to believe that, in ordinary hands, the use of these boilers could have been rendered dangerous, either to the passengers on board or to those intrusted with their management.

In the mean time, I was engaged in the first successful attempt to establish steam navigation on the Connecticut river, between the cities of Hartford and New-York, by means of a competent steamboat of low pressure construction. In this case, my own views of safety and efficiency, as before mentioned, would have required an important modification, and addition of strength, in the boiler which was furnished for this boat. At this period, however, the influence which was exercised upon public opinion by the associates and friends of Fulton and Livingston, through the medium of the press and the intercourse between their captains and the travelling public, had extensively induced the belief that the plans adopted in the Fulton boats, and those only, were safe and proper; and a general conformity thereto was deemed to be indispensable, by those who professed to represent the public interests. In this case, therefore, the plan of construction adopted for the boilers and engine was like that of other low-pressure engines then building for the New-York waters; the boiler, which was of iron, being large, and the engine fitted with D slide valves, and adapted to a speed in the piston of 160 to 200 feet per minute, like the English marine engine now in use. It is but just to state, however, that the boiler in question, and also most of those which were used in the Fulton boats, were of greater strength than the boilers which are commonly used in England for low pressure engines. But, on the other hand, the advantages of a greater expansive power were beginning to be understood; and as confidence in the strength of these boilers increased, the practice of increasing the working pressure upon them gradually gained ground, so as ultimately to neutralize the advantage of the increased strength which had been given to them beyond that of the original English models. This steamboat (the *Oliver Ellsworth*) commenced running between New-York and Hartford in the spring of 1824, immediately after the removal of the restrictions in favor of Fulton and Livingston, by the decision of the Supreme Court of the United States; and my connection with this boat terminated in the following year. I have noticed these facts as illustrating, in some degree, the chief cause of the explosions which have since occurred in the steamboats navigating on the various routes leading from the city of New-York; and the name of this boat will hereafter appear in the catalogue of these accidents.

In 1824–'5, I was engaged in the construction of the steam vessels *Commerce* and *Swiftsure*, and the safety-barges and freighting vessels which have since been towed on the Hudson chiefly by these steamers; having acted as principal engineer and general agent of "The Steam Navigation Company," to which these vessels belonged.* Having been left free in the application of means to ends, except as measurably controlled by the opinions and habits of the contractors and artificers employed, I at once adopted the strongest form of boiler that appeared applicable to the general combinations which were then chosen. The plan of combining the advantages of the high with the low-pressure system, at an intermediate pressure of steam, was adopted for these vessels, as being best suited to the service for which they were designed. At that early stage of our improvements in the marine engine, the plan of uniting these advantages in a single working cylinder, and of making a more efficient application of them by means of an increased velocity of the piston, had not come into practice.† Double engines were therefore employed, comprising two cylinders of unequal diameters, the smaller one receiving the steam from the boilers and delivering it expansively to the larger one; the latter being worked upon an effective condensation. These vessels, with their engines, have been employed for fourteen years, with little modification, and mostly under severe duty; but no accident of an explosive or eruptive character has ever occurred, and they appear capable of rendering good service for several years yet to come. The boilers, during this period, have been twice renewed, on plans combining additional strength and convenience.

I may here state that no accident from the explosion or rupture of a steam-boiler has ever occurred in the steamboats under my particular charge; and the remark might also be extended to other steamboats, which have been furnished with boilers made under my directions. That this result has been chiefly owing to the superior care or skill of my subordinates, who have had the immediate charge of the boilers and engines, I cannot believe; for, trustworthy as were most of these men, they have partaken of the general character of their fellow men, in and out of this profession, and have, probably, no better claims to infallibility. Boilers of a structure which afford the proper degree of surplus strength may be injured as well as others, by the carelessness or neglect of those in immediate charge; but are not likely, even with bad management to destroy life by explosion.

The bearing of the considerations which have been stated should be considered as fully applicable to engines and boilers of every grade, whether for high or low pressure. Nor will the use of boilers of the greatest attainable strength, have any tendency to promote in the engineer a disposition for hazardous or untried adventures, nor to prevent him from appreciating those other substantial improvements in the art or science of engineering, as applied to steam navigation, which have been realized within the last fourteen years.

Having stated the general manner in which the steamboats and other vessels of the Steam Navigation Company have been constructed and managed, it is only necessary to add, that the sale or use of intoxicating liquors

* In this communication I use the term "engineer" in the double sense which common usage has assigned to it in this country, it being descriptive alike of him who controls and directs the specific use and combination of materials which are needful to a machine or superstructure, and of one who is employed in the ordinary charge of a steam-engine.

† For establishing the advantages of this simple combination, if I mistake not, we are mainly indebted to the practical talent of Robert L. Stevens, Esq.

has not been allowed in these vessels for the last eight years, and I believe this rule cannot be commended too strongly.

Explosions of Boilers on the New-York Steamboats.

In May, 1823, the public were astounded by the disastrous explosion on board the *Etna*, while navigating the waters of our bay, a few miles from the city. The engine and boilers of this boat had been constructed upon the plans of Evans, and in conformity with his ultra views in favor of diminuitive passages, both for the steam and supply of water: and she had recently been brought round from the Delaware, and employed between this city and the Raritan. No proper examination of the facts attending this case, such as the interests of the public and the profession required, was ever made; but, as near as could be ascertained from private statements, and the judicial testimony then published, the small pipe through which water was supplied to the boilers had become stopped, or nearly so, by incrustation; and the supply falling short, the boilers were too strongly heated upon their lower surface, and were then left to their fate, while the fire should exhaust itself. Upon this statement, however, I do not think it safe to rely, as all subsequent observation and inquiry have shown me that no statements are more to be distrusted than those which gain circulation under the terrors and excitements of these accidents. I had opportunity, however, to examine the remains of the ruptured boiler, which was of cylindrical form, without flues, about 30 inches in diameter and 20 feet in length, and had been some time in use. The iron plates of the boiler were mainly sound and good, and from the manner in which the boiler was torn, it appeared that the rending, though sudden, was also progressive; and I felt desirous to ascertain, if possible, the first point of eruption. With this object, I traced back the rent from its final termination, on the main part of the boiler, and supposing the parts again restored, successively, to their original position, followed the rent spirally around the boiler, to where it had separated from the opposite end, which had been projected from the boat, and lost in the river. At this point, I found the line of separation passing through one of the rivited joints on the under side, which had stood directly over the fire; *and this joint showed itself to have been previously separated by a crack of long standing, and of considerable extent, in the line of rivets.* This older fracture occupied the space between several contiguous rivets in one of the sheets, and, without doubt, had gradually attained the extent which was then discernable by the oxidated surface, owing to the frequent expansion and contraction of this part of the boiler, and aided, also, by the constant sagging effect of its weight, while supported only at its two extremities.—I will here remark, that boilers of small, or of moderate diameter should always be supported near their centres by lifting bolts, passing through a strong beam above the boilers, or by some other arrangement which is equivalent thereto.

The pressure under which the boilers of the Etna were worked was said to be from 100 to 150 pounds to the square inch, and it is probable that this pressure had been greatly exceeded on some previous occasions.

The explosion of this high-pressure boat, so recently introduced upon our waters, occasioned the greatest excitement; and the opportunity was seized upon to prejudice and exasperate the public mind against the owners and managers of all steamboats which were furnished with *iron boilers*—those then used in the Fulton boats being of copper; and especially was this odium directed against all those whose boats were supposed to approximate to the use of high-pressure. Several new boats were then in the process of construction, and the owners of some of these felt themselves compelled to yield to the storm of prejudice in favor of copper boilers of large and insecure construction, approximating to the old English models, with the general exception that the fire was placed within the body of the boiler and the use of the brick-work was dispensed with; and the old dogma of security in the *weakness*, instead of the strength of the boiler, now found numerous advocates. An active and intelligent gentleman, then acting as agent for one of the finest boats at that time building for our waters, on being remonstrated with for yielding his better judgment to this prejudice, and thus endangering the future security of his fellow-citizens who might become passengers, told me frankly, that his owners, as well as himself, were fully convinced of the superior strength and safety of iron boilers, and the advantages of modifying their structure; "but," said he, "we cannot resist public opinion: the people have been instructed that iron is an unsafe material for boilers, and that it is recklessly used because it is *cheapest.* It is beyond our power to disabuse them in this matter; and they threaten us, moreover, that, if we will not give them a boat with a copper boiler they will procure such a one and run it against us. We have concluded, therefore, to give them a copper boiler, the strongest of its class, and have made up our minds that they have a perfect right to be scalded by copper boilers if they insist upon it." I lament to add, that the exercise of this "right" to the use of copper, was attended, within a few years, with a fearful destruction of life, as had been foretold.

I am sorry to add, that the conductors of our public journals were mainly instrumental in enforcing upon the owners of steamboats this false standard of safety, both as relates to the use of copper and to the form of the boiler; and that to this cause must be chiefly ascribed the unhappy destruction of human life which occurred in our New-York steam-boats during the ensuing eight years. Not that all boilers were, in consequence, made of copper, for by far the greatest number brought into use were of iron, because of its known superior strength; but this untoward influence mainly controlled the structure of these boilers, which were generally confined to the strictly low pressure form, exposing greatly expanded surfaces to the action of steam, without producing adequate support. Fortunately, some of those who were then engaged in the construction and management of steamboats, posessesed more firmness than to yield to this influence, and in devising their combinations were governed only by their own knowledge and sense of the means proper to be used, in order to insure both safety and efficiency; and in steamboats so controlled, I am happy to state, such disasters have been entirely unknown.

About the same period, however, two other disasters, of a serious character, occurred in steamboats furnished with *copper boilers.* One of these accidents, on board the *Fidelity*, seriously injured, or caused the death of two or three persons.

The other case was on board the *Jersey*, one of the Fulton boats, employed on the Jersey city ferry. This explosion was second in violence only to that of the Etna; and was less destructive merely from the absence of passengers to be exposed, there being fortunately but one or two persons on board at the time of the accident.

Another fatal disaster occurred also in 1825, with a low-pressure copper boiler which had just been placed on board the steamboat *Patent*, in which the lamented Dood and several other persons, who were exposed, lost their lives. Previous to this, also, the *Paragon*, one of Mr. Fulton's boats, running on the North River, met with a similar accident which was attended with the loss of life. Again, at Elizabethtown point, fourteen miles from the city, in 1813, a low-pressure boiler on board the *Sea-Horse* had exploded, with a pressure of steam not exceeding five pounds to the square inch.*— But the bearing of all these cases was strangely overlooked, and palliatives were to be found, or uncontrolable causes discovered, by invoking the aid of dangerous and unknown gases: or, some unhappy fireman and engineer was made the scapegoat, who, by his undoubted misconduct or recklessness, had rendered dangerous and destructive, that which had previously been declared to be safe and incapable of serious mischief!

And now came the incitement of active competition on the navigable routes leading from this city, then newly thrown open to all competitors. Old steamboats were found too slow, and new ones were daily acquiring additional speed. So far as this result alone is concerned, this was as it should be; but unhappily, the greatly expanded boiler, whether of iron, or copper, being deemed stronger than was necessary for the pressure which had hitherto been used, must now bear a greater load, and gradually become worked more nearly to its full strength and capacity. In the summer of 1825, the *Constitution*, a new boat, collapsed one of the large irregular shaped flues in her iron boiler, when near Poughkeepsie, and killed or injured several persons. In this case some of the explosion theorists were content to admit that there was no want of water; but loud was the outcry which was again raised against iron boilers.

The next case in order, is the explosion on board the steamboat *Legislator*, in 1825, while lying at our wharves, ready to start on her trip to New-Brunswick. This boat was furnished with a low-pressure iron boiler, of nine and a half feet in dimeter, constructed by the late Robert McQueen, according to the then improved low-pressure pattern. The *interior* shell containing the furnace was about nine feet in lateral diameter, flattened into an ellipse at top, and supported on the outer shell at the bottom and sides by an occasional brace-bolt; the general use of the fastenings not having then received the sanction of our boiler makers. The pressure of steam on the boiler at the time of this explosion was said to be between ten and thirteen inches by the mecurial gauge.† The interior portion of the boiler was violently torn and turned inside out, with the destruction of every thing near the boiler, and of the lives of five or six persons employed on the boat; but the outer shell, which was cylindrical, remainded uninjured. On examining this boiler, I found that the rending was principally in its lower portions at the bottom of the ash-pit beneath the furnace bars. At this point the iron was not more than three-sixteenths of an inch in thickness, and had separated into thin lamellated plates, not having united properly under the roller. Thus the rupture in this case evidently originated at the lowest part of the boiler, at the weakest point, and under a head of some six feet water. But these facts were not investigated, and it was sagely assumed by manufacturers of boilers and other advocates of this stereotyped hypothesis, that this explosion could not possibly have happened had there been a competent supply of water in the boiler. On the other hand, I consider it demonstrable that a boiler of this size and construction, without a thorough system of bracing, is wholly unfit to sustain the ordinary pressure to which this boiler was exposed, and which the managers of the boat believed could be safely borne. But, instead of ascribing this disaster to its true cause, the imperfection of the favorite system of construction, the op-

* Journal of the American Institute for September, 1838, page 646.

† The mercurial tube being bent in the form of a syphon, each inch of elevation causes a difference of two inches in the actual level of the mercury, and an elvation of thirteen inches in the open end of the tube, indicates the pressure of nearly thirteen pounds to each square inch.

portunity was taken to inflame the opposition to iron boilers, and to throw the odium of disaster upon the perished firemen or engineer.

The year 1826 passed off with only one or two slight accidents of this kind among the New-York boats: one on board the *Hudson*, employed on the East River; and another on the *Franklin*, then running upon the North River. Both these boats had low-pressure iron boilers.

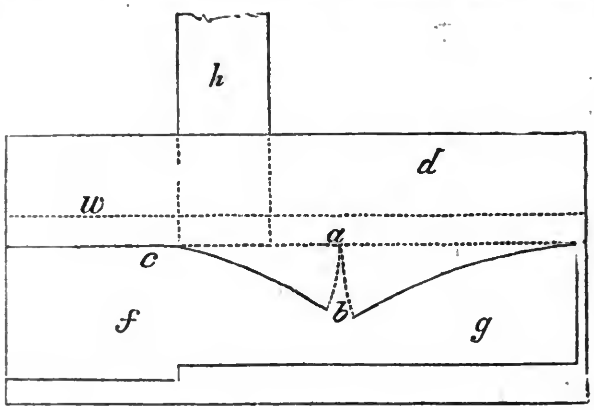
In the spring of 1827, the steamboat *Oliver Ellsworth*, on her passage from Hartford to New-York, when six or eight miles west of Saybrook light-house, in a heavy sea and head wind, burst or collapsed the main flue of her boiler, which occasioned the loss of one passenger, the engineer, and one or two firemen. This case appears to have been universally set down by theorists as owing to extreme carelessness and to want of water in the boiler.* Mr. Penfield, the worthy engineer of this boat, had acquired experience during four previous years in my employment, and I had ever found him a man of great care, prudence, and faithfulness. He had changed his employers, with my consent, on the opening of that season, in order to avail himself of a more tempting offer which was made him by the managers of the Oliver Ellsworth, on account of his known good qualities. He knew the value of the principle of surplus strength under which he had acquired experience, and was well acquainted with the condition and management of the Oliver Ellsworth. His first effort, as he then informed me, was to induce the managers of this boat to introduce braces into their boiler, in order to secure the large main flue, which was *four feet* in diameter, made of quarter-inch iron, without other support than that afforded by the connexions at its two extremities. But his views of security were deemed as savoring to much of high-pressure, and it was decided that a boiler which had occasionally sustained a pressure of 15 or 17 inches of steam by the mercurial gauge,(!) could be safely run with a pressure of 12 to 14 inches; and the too modest engineer had no remedy but submission. I had estimated a pressure of six inches as being safe for this boiler when constructed, while others of high authority in these matters then deemed it entirely safe with nine inches. On the evening of the accident, the engineer was watching both boiler and engine with great care and anxiety, being instructed to keep a full head of steam, in order to encounter with success a strong head wind and sea. He accordingly kept from twelve to thirteen inches, with a full head of water and, to prevent the latter from discharing into the cylinder by the motion of the boat, was obliged carefully to tend the throttle-valve, and was actually thus regulating the action of an *overfilled* boiler at the moment in which the explosion took place. He survived the disaster several weeks, and gave me from time to time under no apparent bias but the love of truth, a far more circumstantial account of his care and management on this occasion, than can be here introduced. But his cares and anxieties were unavailing, and he was doomed to the infamy of having been the careless or rash instrument of destroying the lives of his fellow beings, by the inconsiderate advocates of the common explosion-theory, who, in opposition to all evidence, can decide by mere intuition, the want of water in the boiler and the criminality of the engineer!

Although confident in the accuracy of Mr. Penfield's statements, I did not fail to examine closely the condition of the boiler, after the accident.—Its general construction was not unlike that of the Legislator; having an elliptical shaped interior furnace of eight and half feet in lateral diameter, and six feet in length, from which extended a circular main flue of twelve

* See certain well intentioned communications in Document 31, House of Rep. 25th Cong., 3d Session.

feet in length, and four feet in diameter; a smaller returning flue, of irregular form, leading back to a point near the furnace, where it turned upward through the top of the boiler, and was there joined to the chimney. This returning flue, on account of the irregular form, was partially sustained by means of a few brace bolts, but no securities were provided for sustaining the great flue or interior shell of the boiler. A longitudinal outline, showing a vertical section through the centre of the main flue, is here represented:

A vertical section of the Oliver Ellsworth's first boiler.



f, furnace flue; *g*, main flue; *w*, water line; *d*, steam-chamber; *h*, chimney; *a*, point of fracture; *b*, disruption. Scale, 1-8 inch to a foot, or 1-96.

On examining the parts which, in case of a deficiency of water, would have been first exposed to the action of the fire, it was found that neither the top of the furnace flue at *c*, immediately over the fire, nor the top of the main flue, on the same level, nor any other part of the flues, appeared to be in any manner affected by the heat; but, on the contrary, the iron on the upper part of the flue appeared to be, for the most part, as clean, and in as sound condition, as during the first use of the boiler, with but one exception—now to be noticed. This exception was found in the line of fracture at the point *b*, where the curved lines represent the position to which the highest point of the main flue had been depressed by the disreputive force, and by which the original fracture at *a*, had been extended around nearly half of the circumferance of the flue; the circular top of the latter, being depressed into the form of an inverted curve, extending from the fracture in opposite directions. Now, at the point *a*, (which is placed at *b*, by the disruption, as just mentioned,) the trace of a previous fracture in the line of rivets was distinctly visible for some eight or ten inches, transversely to the top of flue, which fracture, judging from its appearance, must have existed for a considerable time previous to the final disruption.

Nothing, therefore, could appear more certain than the fact of a full supply of water previous to and at the time of this accident; and the disruption was evidently caused by an amount of working pressure to which the diminished strength of the boiler, at this point, proved to be unequal, although the boiler had sometimes been worked with even a higher pressure, before the incipient fracture here noticed, had originated or become so extensive.

In the boilers of the Etna, as in other cases where the boilers have been long suspended by their two extremities, this insidious sort of fracture was induced at or near the *lower surface*, by the joint action of weight and unequal expansion; but the main flue of the Oliver Ellsworth was constantly surrounded by water, and pressed *upward* by a force equal to the whole weight of water displaced by this capacious flue, which, after deducting the weight of the flue, is equal to more than 10,000 pounds.* The fracture, in this case, therefore, was gradually induced at the *top* of the flue, which was also most exposed to heat & the unequal strain of expansion. The origin of this species of fracture may, perhaps, be referred to the process of manufacture, in which it is common to force the rivet-holes, which do not properly overlie each other, by driving a steel pin into the same; a practice which is well calculated to cause the sheets to separate in the line of rivets.

This disaster induced the owners of the Oliver Ellsworth to procure a heavy copper boiler, in compliance with the clamor against iron boilers, which on this occasion was again renewed. At a subsequent period this boat was purchased by myself and associates, and transferred to the Hudson river; care being taken to remove her large copper boiler, and to furnish her with a boiler constructed on the before mentioned principle of giving the greatest practicable amount of strength, beyond the working pressure that could conveniently be obtained. The result has been that this boat has not only run with entire safety, but is, even now, with her antiquated engine, much more serviceable and efficient than when employed upon her original route, although the steamers constructed contemporaneously with this vessel have disappeared from our waters. In truth I consider this steamboat as being at this day far more safe from fatal casuaties than most of the steamboats now on our waters. The boiler is sometimes worked with a pressure of two atmospheres above the common boiling point, while it possesses a strength which will bear a pressure of eight atmospheres, leaving a range of strength equal to more than six atmospheres between the maximum working pressure and the point of proximate hazard; and this is believed to have been accomplished without any sacrifice either of original cost or of economy in the use of fuel. If a proportionate range of surplus strength had always been given to the boilers of marine engines, it is believed that steamboat explosions would seldom, if ever, have been heard of, notwithstanding the hypotheses which are so generally and confidently relied upon as accounting for these explosions.

In April, 1830, the steamboat *Chief Justice Marshall*, employed on the Hudson, burst her boiler, while landing passengers at Newburg, by which 11 persons were killed and many others wounded. This boiler was of stout copper, and very strongly built, on the "low-pressure plan," and was more thoroughly *braced*, it is believed, than any other boiler of its date. The structure, however, was a very large one, on the general plan of the boilers in the Legislator, Oliver Ellsworth, and other boats of that day; the main flue being also circular, and five feet or more in diameter. The disruption we are informed, "was ten feet back from the front of the boiler, and was probably eight feet in length by four in width, *commencing nearly at the bottom of the flue, and extending upwards a little over one-half of its diameter.*"

We may safely infer that this explosion, commencing near the bottom of the boiler, and four to six feet below the water-line, was not occasioned by want of water. The principal engineer, who survived the accident a few hours stated to the captain, near his last moments, that there was less than sixteen inches pressure on the boiler at the time, which is probably true; and it is admitted that the steam was "blowing off" through the safety-valve during the entire stoppage till the accident occurred. That there was some unknown defect in the boiler, as was supposed by the engineer, is not improbable; but neither engineers nor captains had then learned, that such

* The length of the furnace is included in the estimate.

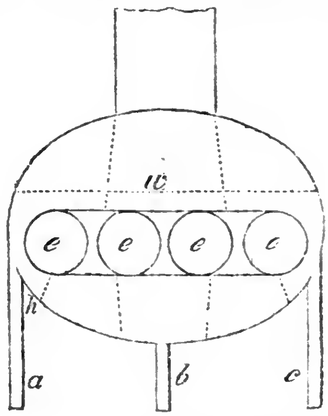
a structure, of such material, was unsuited for that pressure. The ardent advocates of copper boilers and the zealous manufacturers of public opinion, were now liberal in their denunciations of the unfortunate engineer, who, in their view by the clearest evidence, had been guilty of criminal neglect or recklessness, in allowing the water to become so wasted or reduced as to occasion this dire catastrophe. Many persons insisted that nearly all the water in boiler must have been previously exhausted. To have sought for *facts* on which to support so grave a conclusion, would have been deemed an insult to common sense; especially as persons had been brought forward, who, under their oath, had testified to the previous warning which they had heard in the shrill and piercing *whistle* with which the discharge of steam was attended previous to the explosion. But, alas for common sense! this thrilling whistle had pierced the ears of the writer, most uncomfortably, thrice in a week for several previous years, while in his office in the vicinity of the wharf occupied by this steamboat; and was known to be owing to some unfortunate peculiarity in the construction of the safety valve or its appendages! It is hardly necessary to add that the upper and most exposed surface of the flues of this boiler were found by good judges, to exhibit no traces whatever of injury by heat—a circumstance which is entirely incompatible with the supposed enormous deficiency in the supply of water.

The owners of this steamboat, having once been made the instruments or victims of a fictitious public opinion, now adopted a wiser course, and procured two strong *iron* boilers, of moderate dimensions and better suited to the pressure of sixteen or eighteen inches which their engine required; and during the remaining years of her service, this boat was run without injury to her boilers. It may be noticed that this disaster was more fatal in its results than all the explosions or disruptions of iron boilers which had then occurred on the northern and eastern routes from this city. Had this boiler been constructed of iron and secured in the same manner, is it not probable that it would have given way, even with an addition of several pounds to its maximum working pressure, had such addition been fairly practicable.

In the same year there occurred a similar disaster on board the steamboat *United States*, running between New-York and New-Haven, by which several lives were lost. The boiler of this boat was of iron, but constructed on a plan similar to those which have been mentioned. The boat was opposite Blackwell's Island at the time of the accident, with twelve and a half inches of pressure—having frequently worked with fourteen inches. This boiler, which had been recently repaired, also gave out near the bottom of the main flue, its upper portions and the roof of the furnace remaining uninjured; and yet we continually hear that nearly all of these accidents have been occasioned by the want of sufficient water in the boiler! Notwithstanding the severe lesson then recently received from the Chief Justice Marshall, and the explosion of almost every copper boiler which had been continued in use, we were again warned by the public journals against the hazard and cupidity of using iron boilers.

In 1831, the boiler of the steamboat *General Jackson* exploded on the Hudson, at Grassy point, while stopping at the wharf. This was a large, low pressure iron boiler, carrying, it is said, fourteen inches of pressure at the time of the disaster; the safety-valve being open, and the steam blowing off for some minutes previous. But the escape of steam was not, perhaps, as freely allowed as it should have been. The boiler being under deck, and breaking out through its bottom, the force of the explosion threw the boiler out of the boat and into the river, demolishing the deck and causing the vessel to sink at the wharf. The boiler was a large and unwieldly structure. It was partially braced, but without a thorough system of these fastenings, and was elliptical in its form, being, if I mistake not about eleven feet in its lateral diameter, and presenting a cross section of nearly the annexed form.

Cross section of the boiler of the Steamboat General Jackson.



Scale 1-8 inch to a foot, or 1-96.

The fire was beneath the boiler, instead of within it as in the foregoing cases; the dependant portions *a*, *b*, *c*, being what are technically called water-legs, and riveted to the main shell of the boiler, which was here perforated with large openings to allow a free circulation of water. The return flues *e*, *e*, *e*, *e*, were circular, and united at their extremities by attachments, and terminating in a square cross flue, which communicated with the chimney; and *w* shows the water line. The rending, when traced to its point of commencement, appeared to have originated at the angle *h*, where the water-legs joined to the boiler;* and whatever influence the large perfoations in the shell may have had in weakening the structure, it is certain that the riveted joints on the line of disruption showed several preliminary fractures, of considerable extent, of the same character as those already pointed out in the boilers of the Etna and the Oliver Ellsworth, and one of these was particularly obvious at the point *h*.† The other portions of the boiler appeared to have been previously in good order; and the flues, and their flat connections, though soonest exposed to any deficiency of water, were as entire and as perfect in their condition as ever. Nothing, however, could exceed the storm of indignation which was raised against the captain and the suffering engineer for their supposed criminal negligence or recklessness in this matter; and instead of ascribing the disaster to the obvious weakness of the boiler, iron boilers were as before, held to be worthy of all proscription.

We now arrive at a period when the old low-pressure boilers, and those which were constructed according to the requirements of public opinion at the epoch of the Etna's explosion, had been destroyed or laid aside. A gradual improvement had in the mean time taken place in the construction of boilers, which, although leaving much to be accomplished, had gone

* Under this point also, the planks were started from the bottom of the boat, which caused her to sink.

† When this kind of fracture occurs on the outward lapping of the sheets, it usually causes a leak and is easily discovered; but when it occurs on the *inner* lap of the boiler iron, it sometimes will remain tight for a long period. I have known this fracture to extend, in a high-pressure boiler, to *fourteen inches* before it was detected; which with the ultra pressure sometimes used on the Mississippi, would surely have caused an explosion.

far to remove the immediate danger of explosion. But with the new method of working the steam expansively, in a single engine of increased stroke, there was also introduced an extension of the steam chamber of the boiler, vertically, around the flue of the chimney; this extension being of the cylindrical form, and technically known as the *steam chimney*. In the summer of 1832, the steamboat *Ohio*, one of the largest on the Hudson, burst the interior shell of this appendage to her boiler; by which five persons lost their lives, three of whom were passengers. The boiler was under a pressure of 14 inches at the time, and was often worked with 18 inches, and sometimes with 20 inches. The disruption took place about a foot above the water line, in that part of the flue which is ordinarily subject to a high degree of heat. *This flue was three and a half feet in diameter*, unsupported by suitable brace bolts; and from the description of Mr. Ewbank, published in the Journal of the Franklin Institute, it appears that the iron had been much injured by previous heating and exposure. That such a flue should have given way under the above pressure is not at all surprising. Since that period a like accident has occurred in our harbor, in one of the Charleston steamboats, by which several lives were also lost, chiefly of her own crew.*

But we have still to notice a more serious disaster than either of the foregoing, which has attended the use of copper boilers. The disruption of the boiler of the Oliver Ellsworth, and the warfare of the press against the use of iron boilers, induced the owners of that boat to provide a copper boiler, as the only means of restoring confidence. This boiler was of unusual thickness, and secured in a manner surpassing that which had been previously practised. The new boiler was worked with a pressure of 13 to 18 inches, and when the boat subsequently came into my hands as before noticed, showed evident effects of this pressure upon its form. A faster and more modern boat, however, was soon required in her place; and a new one was constructed, called the *New-England;* and the managers, in the face of repeated warnings of the comparative weakness and insecurity of copper, felt bound again to conform to public sentiment, and accordingly furnished their new boat with copper boilers. These were of the ordinary thickness; constructed with two fire arches in each boiler, together with five return flues of circular form, and 16 inches in diameter. These boilers had they been of iron, which was then used in nearly all other boats, would probably have sustained any pressure that was likely to be required in the use of a modern expansive engine of ten feet stroke; but the strength assumed or estimated for these copper boilers by the manufacturers, unfortunately, was nearly if not quite as great as iron of the same thickness could have borne. On the 9th of October, 1832, which was soon after this boat commenced running, her boilers were both exploded, with a pressure of 28 or 30 inches, while landing passengers at Essex, on Connecticut river, and about twenty lives were lost on this occasion.

The influence of the press in favor of copper, as may have been seen, had been generally overruled by practical men; and the effect of this disaster was such as nearly to put an end to the use of copper in this part of the country. But some of the conductors of the press who had been most active in establishing the untoward influence by which the owners of this boat had been governed, were now loudest in their denunciations; and men

* On board the steamboat Wm. Gibbons, on the 21st of January, 1836; which is the last steam accident which has occurred to the boats running from New York.

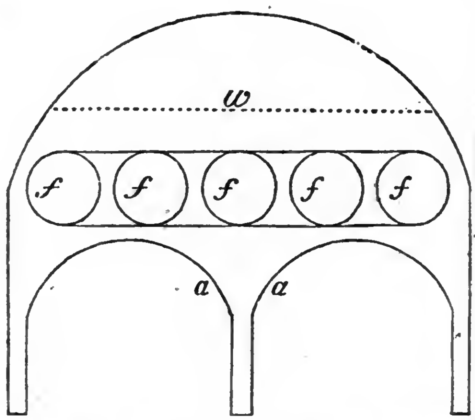
It may be here remarked, that no reliance for strength, should ever be placed upon the circular form of the boiler metal, when the pressure bears upon the *outside* of the curve; except when its diameter is less than 24 or 18 inches; and in *no case* where the metal is exposed to heat, above or near the water line, as in the "steam chimneys."

of the highest integrity and benevolence, who had perhaps exceeded all others in their well meant efforts and sacrifices in order to insure safety, were held up to public odium as being, virtually, the murderers of their fellow-citizens.

The proprietors of the New-England, subsequently to the ordinary judicial inquiries, instituted a thorough investigation of the causes which led to this fatal explosion. They procured the attendance of a board of examiners, comprised of persons from different parts of the country, deemed competent to the investigation; and every facility was afforded for the most full examination and inquiry that the case admitted. The result of this examination, as given in the report of the board, has been already published; but its importance, as connected with the history of steamboat explosions, and its bearing on the future safety of steamboats, induces me to annex a copy of the same to this communication; and ~~which is~~ herewith respectfully submitted. [See Appendix.]

I will, however, add here, for the benefit of those who may not have opportunity to examine this report in full, a summary of the facts in evidence, and of the results to which the examiners arrived.

This boat had been running but little more than a month, and was fitted with two boilers, each about 8 or 8 1-2 feet in diameter and 16 feet in length, placed on the guards behind the paddle-wheels, and outside of the hull of the boat. Their construction may be understood from the annexed figure which represents a cross section of the boiler, near where the disruption first took place.



a, a, lower flues or arches; *f, f, f, f, f,* returning flues; *w,* water line.

The shell of the boiler was torn open in the lower arches, and spread outward till its parts met in an inversed position, and was thrown some distance from the boat. The flues and steam chimney were uninjured by marks of heat or otherwise, and those of one boiler were thrown forward against the paddle wheel cover, while the other was thrown over the same into the river. The parts of the deck or guards lying beneath the boilers, including the beams, were entirely blown off. This effect, which was directly beneath the apparent origin of the fracture, when taken in connection with the direction in which the parts of the boilers were thrown, appeared to indicate that the disruption commenced in the lower flues or arches, at the places which had shown indications of straining, or leaks, on previous passages, (near the points *a a,*) and which had already received repairs. The engine remained uninjured, but the steam pipe of the boiler which first exploded, was found broken entirely off from its fellow, at the point of junction in the engine room, by the force of the explosion.* The safety-valve was attached to the main steam pipe in the engine room, near its junction from the two boilers, and was found in good order. A mercurial gauge, which was affixed at the same place had not discharged its mercury, and two similar gauges were attached near the boilers, in one of which the mercury was also found. These guages had been so charged as to sustain a maximum pressure of about 32 pounds to the square inch! The pressure at the time of the explosion was therefore *below* this point.

The copper of these boilers was rolled to the thickness of Nos. 3 and 4 of the wire gauge, or 1-4 of an inch nearly. No marks of heat or of the absence of water, could be discovered on the flues or on the flat work connected with their upper extremities, where a deficiency in the supply of water would first have exposed the metal, and where, in such case, injury or fracture could not fail to have resulted, with even a lower pressure of steam than was known to be on the boilers at the time of the explosion. In short, every appearance on those parts of the boilers which were exposed to heat, appeared to indicate that a full supply of water had been maintained. The weakest portions of the lower arches appeared inadequate to sustain a pressure of 30 pounds to the square inch. It came out in the testimony that the maximum working pressure in these boilers had commonly been from 14 to 17 pounds; that immediately previous to the explosion, it had accumulated, from stoppages of the boat, *to over 28 pounds!* And furthermore, that the engineers and firemen had been led to believe, by the manufacturers, that these boilers would sustain a pressure of even 50 pounds to the inch!—an opinion which there is no doubt was honestly entertained by the latter. (To be continued.)

It is with great pleasure that we commend to the attention of our readers the following paper on Suspension Bridges—by one of our most able and enterprising young engineers. He has the merit of having been one of the foremost in drawing the notice of the profession to this most beautiful and economical mode of structure.

A striking indifference has hitherto been shown in this the land of their origin to suspension bridges—and yet few countries present positions more favorable to this form of bridge. Rapid rivers with steep banks, and a considerable navigation are intersected by roads much travelled and needing an uninterrupted and uninterrupting mode of transit.

We have seen in the possession of A. Blanc, Esq. C. E., recently from France some most beautiful drawings of wire suspension bridges of very large span. Mr. B. informs us that a large number of these bridges are

* This fact deserves special notice; chiefly, because the explosion of the two boilers of the New-England at nearly the same moment, has been gravely brought forward as proving the disaster to have resulted from want of water! But the boilers were alike in their structure, and both subjected by the connection of their steam-pipes, to an equality of pressure; and being charged to the limit of their strength, it is not seen why both should not give way, especially under so powerful a shock, in addition to the pressure, as was necessary to separate the steam-pipes; which blow must alone have been equal to many tons. On the other hand, the boilers were supplied from separate pumps and pipes; and were a deficiency of water found in one boiler, it could have no connection with the state of water in the other. It is on such shallow grounds, that hypotheses and opinions are defended which appear to have a direct tendency to perpetuate these disasters. It was under the delusive notion of *security in a full supply of water*, that these boilers were exploded.

now in progress of construction and that their use even for Railroads is becoming quite common.

We have long been favorably impressed by the suggestion of Mr. Elliot—that a suspension bridge would be the most suitable mode of conveying the Croton Aqueduct across the Harlem river. Many objections have been adduced, but from an intimate acquaintance with the nature of the locality—from frequent consideration of the subject and from an interchange of opinion on the subject with many engineers, we do not hesitate to say that this mode of structure may be made the safest and be finished in the shortest space of time.

No objections can be advanced that cannot be readily answered, and it is very certain that the original cost of a suspension bridge will be less than that of a failure of the mode at present proposed for crossing. Leaving out all consideration of the rapidity of completion and other attendant advantages, we cannot but consider this as a most admirable opportunity for constructing a wire suspension bridge that shall be as creditabte to the taste as profitable to the purse of our city.

With our acknowledgments to Mr. Ellet for his paper, we propose the further consideration of this subject, and shall be happy to give a place to any communications on this subject.

A POPULAR NOTICE OF WIRE SUSPENSION BRIDGES. BY CHARLES ELLET, JR., CIVIL ENGINEER. [HISTORICAL NOTICE.]

1. The Suspension Bridge is not a recent invention. It is hardly to be doubted that it was used, in the simplest form, at as early periods as any other species of construction which has called into exercise the mechanical ingenuity of man. And, without adopting the fanciful idea of a modern writer, that the first efforts of the kind were in imitation of the spider, it is easy to perceive that a precarious passage might be obtained by stretching a grape vine across a ravine, and securing its extremities to the limbs of trees on the opposite banks, without an assumption of greater sagacity than might be attributed to our own species, in its most primitive condition.

2. Among the earliest and rudest attempts in this department of architecture, are those bridges described by Humboldt, Don Ulloa and other writers, by means of which the gorges in the passes of the Cordilleras in Peru, and some of the mountain torrents of India, are traversed by the natives of those countries. Suspension bridges of considerable importance, are here sustained by cables formed of twisted roots supporting a flooring of bamboo.

These structures are frail, and the footing which they offer is unsteady, of course. But great as may seem the contrast between these rude attempts of an unlettered people, and the more recent efforts of European engineers in the same department, it is not greater than would be observed in every other branch of practical science. The passage from the earliest Egyptian lintel, to the arches of Rennie, in England, and Perronet, in France; from the hut of the savage to the dome of St. Peter's or the Pantheon, might probably call for equal admiration.

3. There is nothing remarkable in the extent of the improvement in the partuiclar branch of architecture under consideration; although it may be regarded as a matter of surprise, that the application of the principle should have been so long confined to remote and uncivilized countries. The circumstance is probably attributable to the fact that it is not much more

than a century since the laws of the curve formed by the links of flexible chain, suspended by its extremities, has been known to mathematicians; and it is still more recently that the science necessary for such investigations began to be familiar to persons engaged in practical pursuits.

It is consequent, only within the last 40 years that the subject has at all commanded the attention of practical men. Some successful attempts, on a moderate scale, were made in the United States about the year 1800; but having been executed on a very economical plan, and before the subject was properly exposed by the investigations of modern engineers, these specimens offerd no inducements for the extension of the system, and it has since fallen into neglect, if not disrepute.

4. The example exhibited by these early efforts in our own country, were not, however, altogether lost. It is even probable that to their seccess is due the design of the famous bridge across the Straight of Menai, between Wales and the Island of Anglesea. The width of the straight, at the point where this structure was to be erected, was 1000 feet; the depth of the water at high tide 48 feet; and an indispensible condition, to be satisfied by the plan, required that the edifice should offer no obstruction to the ships navigating the channel.

Stone arches were out of the question, both because the depth of the water rendered the construction of piers almost impracticable, and no span could be attempted wide enough to permit the safe passage of a ship beneath the arches. The same objections would apply, though with less force, to a wooden superstructure; and though a cast iron arch was suggested, and was practicable, the consideration of the cost of such a work led to its rejection.

To obviate these difficulties, Telford, one of the most illustrious of modern engineers, proposed a suspension bridge—or revived such a proposition previously submitted by another—and was charged by a committee with the preparation of suitable plan.

This is the first important suspension bridge that was construced in Europe; and it is still justly regarded as one of the noblest specimens of art in existence. The distance between its points of support is 580 feet; the flooring is sustained at an elevation of 128 feet above low tide, and ships pass beneath it under full sail.

5. The success of this experiment was the signal for the prompt extension of the application of the principle of its construction; and its adoption for many sites, both in England and on the Continet, where the difficulties, or anticipated expense, had previously prevented any attempt at the erection of bridges.

The Minister of Public Works in France, appointed a distinguished engineer, M. Navier, with instructions to proceed to England, and examine the most approved works of the kind in that kingdom, and report in detail on their cost and construction, the principles of their equilibrium, the ad-advantages that would result from their introduction into France.

The memoir submitted to the Academy of Sciences of Paris, on the subject, by this officer, forms one of the most beautiful applications of science to objects of practical utility, with which the profession of the engineer is enriched. The work received the approbation of the Academy, of which its author was elected a member, and a board of engineers added the sanction of their approval in recommending the subject to the attention of government.

6. About this period, 1823, M. Seguin, a practical mechanic of Lyons, constructed, at his own cost, a suspension bridge across the Rhone, at Tournon, of a material which had not yet been used in any structure of consequnce. In this bridge a series of cables, manufactured of iron wire, was substituted

for the wrought iron chains which had been previously employed for the support of the road way. And in the memoir which followed soon after, the same individual described very minutely his mode of constructing these bridges, and sustained the merit of his plans by many cogent and irresistible arguments.

The experiment, though a rude one, was regarded as successful, and was immediately repeated, in a superior style, at many points on the same river, and subsequently in many other places in France, and in other parts of Europe. The system spread with extraordinary rapidity, and there is now no mode of construction in such general use, and few bridges of any other description erected on the continent.

They are to be found spanning all the principal rivers of France and England, substituting the ferries at difficult points, and affording access to important places which had, before the improvement of this art, been precluded from the benefit of a bridge.

PARTICULAR ADVANTAGES OF WIRE CABLES.

7. The bridges which it is the object of these remarks to recommend, are sustained by wire cables, stretched between appropriate supports of masonry. The cables are formed of an assemblage of strands of wire, about the diameter of a common writing quill (No. 10, in commerce) which are laid parallel to each other, in the process of their manufacture, and afterward collected in a solid mass, and bound together by ligatures of the same material. The number of strands in each cable depends on the strength which it is intended to be made capable of exerting. In a bridge of 400 feet opening, between the points of suspension, and 25 feet wide in the clear, there would be needed 5 cables on each side, each of which would be composed of not less than 500 strands of wire. Or, there would be required for such a bridge, 10 cables, about 3 inches in diameter, each of which would resemble, when in place, a solid bar of iron, about 750 feet long; the whole number possessing an absolute force of 2500 tons.

A coat of varnish applied to every wire previously to the formation of the cable, offers an adequate protection against oxidation.

8. There are many reasons adduced for the preference given to wire cables, over the chains of bar iron, which they have nearly superseded. It is not possible to obtain iron free from flaws, though all reasonable precaution be observed in its manufacture; and it is not always practicable to detect the flaws by the test to which each bar is subjected prior to its employment in the structure. There is no practicable means, either, of preventing injury to the material, from the sudden and extreme variations of temperature incident to a high northern latitude.

These difficulties, though not sufficient to offer any very serious objection to the employment of the metal in this state, are, nevertheless, considerations of sufficient weight to be avoided when possible.

Wire cables are not liable to these objections.

9. But the great superiority of this material consists in the remrakable increase of tenacity which is imparted to iron by the process of wire drawing. The structure of iron, in bars, is somewhat chrystaline. By converting it into wire, the granular particles of which it is composed, are elongated, and the structure becomes fibrous. The consequence of this change appears to be an extraordinary increase of strength and toughness. The experiments of M. Seguin authorize us in valuing this increase, for the wire employed in the construction of bridges, at nearly 100 per cent.

OF THE APPLICATION OF THE SYSTEM.

10. It is far from the design of the writer, to recommend the exclusive use of this sort of bridges in place of any of those in common practice. The evidence of merit in bridge or civil architecture, is not to be found in a rigid adherence to any particular mode of construction. That plan is best which best subserves the intention of the builder; which best satisfies the essential conditions to be fulfilled.

If the object be to erect a bridge where a very extensive communication is likely to be maintained for all time, and great inconvenience would result from the interruption of the passage, even at the most remote periods; where the consideration of cost is secondary to that of perfect solidity, and the necessity of preserving the navigation is not an essential condition, the expense of constructing stone arches may, with propriety, be encountered.

Such a site corresponds with the position of the London and Waterloo bridges on the Thames; the Pont d'Neuilly on the Seine; the bridge of Bordeaux on the Garonne, and various other remarkable works in different parts of Europe.

If, on the contrary, the intercourse were inconsiderable, the price of timber low, and the expense of erecting piers not likely to be great—conditions which apply to many points on the Delaware, Schuylkill, Susquehanna, and other rivers of the United States, above their confluence with tide—any of the approved varieties of American wooden bridges, might be advantageously adopted.

But there are cases where neither stone arches nor wooden superstructures can be judiciously employed—and some method more permanent than the one, more durable than the other, and cheaper under the circumstances, than either, is indispensable to the accomplishment of the design.

11. The peculiar advantage of the suspension bridge, is due to the power which it furnishes of bridging rivers of great breadth, without the necessity of intermediate supports. *If the breadth of the stream be not over the third of a mile, and the object is sufficient to justify the cost, a bridge may be constructed without the need of a pier in the channel.* Where it is expedient, therefore to avoid obstructing the water-way, or impairing the navigation; where it is essential to elevate the flooring far above the surface of the river, or where the expense of permanent foundations for the piers will be great, this system will be found to present remarkable advantages.

12. To give some examples, in point, we will suppose that it were intended, as has sometimes been suggested, to construct a bridge across the Mississippi, somewhere near its confluence with the Missouri. In this situation a resort to the most approved kind of wooden bridge would be found to be both exceedingly expensive, and extremely hazardous. The breadth of the river being some 6000 feet, there would probably be needed about 35 piers for its support. The river being subject to frequent freshets of great height and power, and being navigated, at those times, by steamboats of the largest class, the level of the flooring should be elevated more than 100 feet above the surface of the river, in its ordinary state, to permit the passage of the boats beneath it.

Even at this elevation, the navigation of the river would be somewhat impaired by such a bridge; and the cost of raising so many piers to so great a height would not only be enormous, but the piers when built, would present an obstruction to the channel, which would endanger the foundations and jeopardise the adjacent shores. And still, after encountering these difficulties, and submitting to the inconveniences which would result from the most successful consummation of the enterprise, the superstructure would at all times, be liable to be consumed by fire, readily communicated by a spark from a steamboat.

To erect a suspension bridge at the same point, would require but 5 or 6 piers. The bridge so constructed would offer no appreciable obstruction to the river, or impediment to the navigation. The danger arising from freshets would be entirely obviated, and the edifice being chiefly of stone and iron, would be perfectly secure against destruction from fire. The first cost of the bridge would be less than that of a wooden one; its durability—apart from the risk of accidents—would be immeasurably greater; and, as a beautiful and commanding ornament, its appearance would be unrivalled by any structure in the country, and, perhaps in the world

13. The same considerations obtain in discussing the project of a bridge over the Ohio, in any part of its course. The freshets in this stream, also, rise to such a height, that to admit the passage of steamboats beneath the structure, the flooring ought to be elevated nearly 100 feet above the level of the summer surface of the river. The construction of piers would consequently involve a heavy expense, would be equally exposed to the violence of the river, and offer the same impediments to the navigation, as would result from a similar work over the Mississippi. There are many parts of the Ohio. where a suspension bridge could be conveniently constructed without the aid of a single pier in the water, and but few places where more than one pier would be really advisable.

14. The same observations apply to the Niagara river, below the Falls, where the gorge could be readily spanned by a beautiful edifice, which would involve but an inconsiderable expense, and stand firm for ages.

15. It has frequently been proposed, of late years, to construct an additional bridge across the Schuylkill at Philadelphia. The citizens of Philadelphia have had some experience of wooden bridges, in the use of the three that have been erected, at different periods, across this stream.

The style of these bridges is different. That at Market Street, is supported on well executed and permanent piers of masonry. That at Fairmount, spanned the river at a single sweep; and that at Gray's Ferry is supported on piers, though with foundations less secure than those of the "permanent bridge." One has recently been destroyed by fire, and both the others are liable to the same accident.

The foundations of Market Street bridge, are too excellent to admit the suspicion that they will be endangered by any violence ever likely to be exerted by the floods of the river. Those of the bridge at Gray's Ferry were obtained by a less expensive process; but having resisted serious freshets since their erection, it is probable that they may not yield to those which will hereafter occur.

It is of much consequence in the establishment of a bridge across a river, which, like the Schuylkill, is subject to discharge great quantities of ice, when swollen by freshets, to leave the channel clear, and the course of the current unobstructed. The erections of piers is directly adverse to this condition. They interrupt the progress of the largest masses of ice; which form a barrier to the water, and by increasing the height of the freshets above the piers, and accellerating the current between them, endanger the safety of the edifice, and, at the same time, frequently submerge property of value along the shores.

16. A suspension bridge across the Schuylkill, would leave the channel unobstructed, as at present. It would be secure again destruction by fire, or by flood. It would be much less expensive than a wooden bridge, constructed on permanent piers, and not more expensive than the lowest class

of those bridges that could, with any show of propriety, be admitted. It would be not less firm than one of timber, and scarcely less durable than one of stone. As a contribution to the architecture of the city, and an ornament to the Schuylkill, it would be unsurpassed.

17. The lightness, grace and beauty of these structures, when tastefully designed and judiciously applied, can be only adequately appreciated when witnessed in place. No drawing or description can properly represent their appearance.

And the edifice never parts with its beauty. The form it assumes, when first thrown over the stream, is the result of natural laws, which are always in action, and will preserve its position and figure for ever. It may, at times, undergo a slight inflection—imperceptible to the eye—when heavily and unequally loaded, but immediately recovers its position on the removal of the charge.

18. There have been many bridges constructed in Europe on this principle, which are familiar to instructed engineers of all countries. Some of these, on the Rhone, are very beautiful, and some are regarded as among the most remarkable of the victories of modern art.

The bridge over Menai, is a grand and imposing edifice. That at Freiburg, in Switzerland, is a still more commanding structure, though much less generally known. The former, at the time of its completion, was one of the most elevated bridges in the world, and exceeded, by many feet, the span of the broadest arch that had ever before been thrown. The bridge at Freiburg, is hung still higher above the stream that flows under it, and exceeds, in the space between its abutments, by more than one hundred yards, the span of that of Menai.

The distance between the points of suspension of the Freiburg bridge is 880 feet, and the elevation of its flooring is 167 feet above the bed of the river.

Richmond, April 15, 1839.

American Locomotives in England.—Notwithstanding the views of certain English Journals as to the folly of using American Locomotives we are pleased to find from the following, that they have performed the allotted task with the greatest ease.

American Locomotive Engines.—It will be recollected that a contract had been entered into between the Birmingham and Gloucester Railway Company, and Mr. Norris, of Philadelphia. U. S. for the supply of Locomotives for the Gloucester Railway. The contract was conditionally made on the first engine manufactured by Mr. Norris, performing certain work agreed upon. As much interest has been felt in this country with reference to the contract, and as some doubts were entertained as to the correctness of the representations made respecting these engines, we have pleasure in giving the following partlculars as to the engine sent over to this country by Mr. Norris, and the work it has actually performed on the Grand Junction Railway, in conformity with the agreement to which we have alluded. "The England" weighs about eight tons, without water or fuel; she is built much lower and smaller than the engines commonly in use here, and has six wheels, the driving pair being four feet in diameter. The cylinders are ten and a half inches in diameter, and are enclosed in proper cases to prevent radiation—stroke eihteen inches. The machinery is of the simplest construction, and consists of a much smaller number of parts than we have been accustomed to see. The cylinders are placed on the outside of the framework, which allows the advantage of a straight axle; and the general appearance of the engine more nearly resembles that of the old "Rocket" engine than any which we are acquainted with. The engine is got up in a most superior style, and is finished, even to the most minutest particular, in a very beautiful and workmanlike manner; every part having been executed with perfect accuracy, by means of self-acting machinery. As a proof, indeed, of the mathematical correctness of the work, we may mention that the steam-tight joints are formed simply by the bringing into contact of metallic surfaces; the workmanship of which is so true, as entirely to supersede the necessity of packing of any kind. The boiler is similar to those used in engines manufactured in this country, but it contains only seventy-eight tubes; instead of from 100 to 140, the number commonly used in those on our railways; and the consumption of fuel compared with the work performed, is we understand, very small. The task undertaken to be performed by "England" was to run from Birmingham and Warrington, fourteen journeys each way, carrying 100 tons in the gross, and performing the distance eighty miles, at the rate of twenty miles per hour, which the engine has accomplished considerably within the specified time of four hours; the average time having been 2 hours 50 minutes, or the actual running time, without stoppages, from 3 hours 9 minutes to 3 hours 19 minutes. On one occasion it is stated that the engine brought into Birmingham the enormous load of 126 tons, drawing it up the inclined planes without any assistance; and on no occasion has it failed to perform the required duty, nor has even the least derangement of any part of the machinery taken place. It should also be mentioned, that the various parts were never put together until its arrival in this country, when they were first fitted at Liverpool, the day previous to making a trip; nor has a tool been applied to the engine since they were first set up. We understand the conditional order to Mr. Norris for ten engines, of similar capability has been confirmed.---[London Morning Journal.]

Cerography.----Under this name we notice a new mode of engraving, the invention of Sydney E. Morse Esq. Editor of the New York Observer.

The specimen which we have seen is a portion of a map of Connecticut which has the appearance of a well executed wood engraving but of a size much larger than is generally attainable in that art.

The following notice from the New York Observer gives a comparison with other methods. We cannot but remark that Cerography appears to promise the readiest and neatest execution for Tographical maps, of all the various methods in use.

Cerography.---To enable our readers to understand the value of the new mode of engraving, which we call Cerography, we will first state briefly some of the prominent advantages and disadvantages of the three modes of engraving now in use, viz: *Lithography*, or *stone* engraving; *Copper-plate*, or *metal* engraving; and *Xylography*, or *wood* engraving.

The great advantage of *Lithography* is the ease with which the engraving is executed. With a pen or crayon, and an ink properly prepared, a drawing is made upon the stone almost as rapidly as it could be done with a pen and ink, or pencil, on paper, and when the drawing is finished, the plate is ready for the press.

The disadvantages of Lithography are, 1. Lines are not clear and distinct. They have a muddy and ragged appearance, which is offensive, especially when the eye dwells upon the print. 2 The engraving is not durable under the press; it frequently requires renewal after only one or two thousand impressions have been taken. 3. The printing is expensive. From plates of the best dimensions, for printing a large amount of surface in a given time, (say, plates of two feet by 18 inches) it is not usual we understand, to print more than 1000 square feet of paper in a day of ten hours.

The great advantage of *Copper plate* or *metal* engraving, is, that lines can be made perfectly clear and distinct, and of the utmost fineness and delicacy.

The disadvantages of copper-plate engraving are, 1. The engraving, as compared with Lithography, is expensive. To engrave a map on copper will usually cost at least three or four times as much as to draw it upon stone; and to engrave it on steel, probably six or eight times as much. 2. Copperplate is not durable under the press. It will usually require to be retouched, at half the expense of the original engraving, after 10,000 copies have been taken; and although three or four times 10,000 may be struck on steel, the greater cost of the engraving on steel will still give Lithography the advantage of metal in cheapness. 3. The printing from copper plate is expensive. It is even more expensive than printing from stone. From plates of the best dimensions, [say, plates of one foot by 18 inches,] it is not usual to print more than 400 copies, [equal to 600 square feet] in a ten-hour day.

The great advantage of *Wood engraving* is the cheapness of the printing, and the convenience of using the blocks in the same form with type. If one side of this paper, [3 feet by 2, equal to 6 square feet,] they could be printed easily under a single Napier press, at the rate of 1000 an hour, making 10,000 copies, or 60,000 square feet, in a ten-hour day. This is sixty times as fast as lithographic printing, and a hundred times as fast as copper-plate printing! With a double Napier, these rates could be doubled. Such a rate of printing, of course, would never be attempted where beautiful work was the object; but even with a medium sheet, and under the hand press, 6000 square feet of very handsomely printed wood-cut prints may be obtained in ten hours. This is ten times as many as are usually got from copper, and six times as many as from stone.

The disadvantages of wood-cuts are, 1. The imperfection of the engraving. This is especially applicable where there is much lettering and cross lining in black, as in maps. The most accomplished wood-engraver in this country informs us that the map of Connecticut, which we published a few weeks since, cannot be equalled on wood, the difficulties of such work, from the very nature of wood-engraving, are so great. 2. The engraving on wood, except from a limited class of subjects, is very expensive. The map of Connecticut to which we have referred, could be beautifully engraved on copper for less than a fourth part of the expense which would be incurred in cutting it out in a rough way on wood.

The advantages of *Cerography* are, 1. The engraving of many subjects can be executed with a rapidity approaching very near to that of drawing upon stone; and the whole expense of a plate prepared for the press will ordinarily be less than that of a plate in copper or wood. 2. The plate is durable under the press. A million good copies may be struck from it; and as it can be stereotyped, the number of plates may be multiplied indefinitely at a trifling expense, and each plate will give a million copies. 3. Lines of all engravings, except, perhaps, the very finest class, can be made with nearly or quite the same perfection as in copper or steel, and with less labor. 4. We know of no limit to the size of cerographic plates. We suppose they may be made as large as the largest bed of the Napier press. 5. The printing is executed with the common printing-press, and of course as rapidly as wood-cut, or letter-press printing; that is, at the rate of 6000 square feet in ten hours, for beautiful work under the hand-press, or 60,000 under the single Napier.

With this statement. our readers can judge, as well as ourselves, of the effects which Cerography, in the hands of accomplished artists, will probably produce on the other arts of engraving.

We suppose that, with an improvement of which it is evidently susceptible, it will also have an important effect on the art of printing, especially on printing in the characters of the Chinese, Hindoo, and other oriental languages. Even in its present state, it will no doubt be used as a substitute for type setting in some cases; but of this we will say more hereafter.

CEDAR QUARRIES.—On asking a friend from Oswego, the other day, who used this term, what it meant, he informed us that much of the cedar which comes from Lake Ontario is absolutely dug out of the soil. On some of the islands in that lake, which furnish great quantities of that valuable timber, there has not been growing a single tree for many years.—Generation has apparently succeeded generation of this timber, and fallen, and been successively covered with earth, and is now dug out for railroads, fence posts, etc. and in a perfectly sound state.

The above is from the Cultivator. Persons who have been on the island have stated to us similar facts. We believe, however, the quarries are getting exhausted of their most valuable mineral--the red cedar, or that it is so deeply imbedded, that the labor of excavation is not sufficiently rewarded. During this season nearly all the cedar importations have been of the white species. We have heard it stated that on some of the islands--the Ducks and Pidgeons for instance, at the northeastern termination of the lake--there are subterranean passages pervading their whole area. That the roof, or exterior surface, seems to be composed of agglomerated earth matted and held together by roots of trees which rest upon it and have covered it with a thick growth of timber. The vaulted passages or dens below are filled with cedar logs lying in every variety of position, and which were no doubt formerly, like the rafters of a house, gave support to the superincumbent mass. From the accounts we have had, there are more wonderful labyrinths constructed by nature on Lake Ontario, than that of old upon the banks of Lake Mœris.--[*Oswego Palladium.*]

☞ We have to make an apology for a succession of errors in these three numbers. They are all incorrectly *numbered* and *dated*, and the last one incorrectly folioed. There are *two* parts marked *No.* 9,--from which the subsequent numbers are all wrong. We were, at this period, about to change our printer, in order to have the work done as formerly, under our own roof--we do not, however, believe that the errors were intentional, but arose from *gross carelessness.* It will be perceived that there are *two parts* marked *number nine*, and the folios of the last number are a repetition of the folios of the *preceding number.* It is believed, however, that no *serious* accident will occur from these errors, unless they should perchance, throw the Locomotive off the track. Yet it is mortifying to have them occur so frequently; we anticipate from our present arrangement, more punctuality, and errors less frequent.

☞ In consequence of my long absence during the past winter and spring, the publication of numbers *ten, eleven, and twelve*, of this volume, has been vexatiously delayed. These three numbers are now presented in *one cover*, and complete the volume. D. K. MINOR.

NEW ARRANGEMENT.—I have disposed of my interest in the Railroad Journal, to *Mr. Egbert Hedge*, who, being a practical printer, will attend personally to the mechanical department, and see that it is hereafter issued punctually at the proper time.

It is with great reluctance that, after having established, and continued it for more than seven years, I relinquish my interest in the Journal. It was projected and commenced more with a hope of promoting the cause of Internal Improvement in this country, than with the anticipation of much profit from its publication ; I shall not therefore express an opinion as to its influences, whether for good or for evil upon the great cause to which it has been mainly devoted---yet I may without hesitation say that the anticipation of *not much profit* has been, to the *fullest extent* realized. I do not, however, regret having devoted so much time to it; nor shall I, even when my *pecuniary* interest in it has ceased, forget it entirely; but shall hereafter devote as much time to its concerns as other avocations necessary for the support of my family, will permit; and I do not give up the hope, that I may, with returning prosperity, yet acquire an interest in it again ; that will however, depend much upon the success which shall attend the collection of accounts, now due.

To the real patrons and friends of the Journal, who have contributed to its continuance for so long a period, by *punctual payment*, as well as by valuable contributions to its columns---and also to the Corps Editorial, from whom it has received so much kindness, I desire to express my grateful acknowledgements, and I will avail myself of this opportunity to solicit for my late associate, Mr. Schaeffer, and my successor Mr. Hedge, a continuance of their patronage and kind offices, as they will, I am sure, richly merit them. D. K. MINOR.

It will be seen by the above notice that I have purchased of D. K. Minor his interest in this periodical---the RAILROAD JOURNAL, and MECHANICS' MAGAZINE. I shall devote my personal attention to the mechanical department, and shall endeavor to have the numbers hereafter issued punctually at the proper period, in a manner satisfactory to its readers.

I am prepared to do with promptness, Job Printing of all kinds, especially Railroad Reports, Circulars, and all matters pertaining to Internal Improvement. EGBERT HEDGE.