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THE TRUE AMERICAN SYSTEM—NO. I.

We are not about to enter upon any political or economical discussion of the principles of free trade, tariffs, or revenue laws, and to disabuse our readers of any such impression we shall state somewhat at length, the object of the present series of papers for which we have chosen the above title, with what propriety will be seen as we proceed.

It is well known that among the natural products of our extensive territory—the animal, vegetable, and mineral kingdoms, furnish many which are wholly or in part peculiar to our own country, and that a large portion of them are well calculated to replace foreign products of similar nature, and in some instances to supersede the latter. Still further it is, or ought to be well known, that there are many articles imported from various countries which not only can easily be raised in the United States, but actually abound in some places and are extirpated or removed with much difficulty. To call the attention of our readers, and all others under whose notice these papers may come, to the vast and untrodden field of inquiry and experiment thus opened to us, is our present object.

We shall in the first number confine ourselves to some preparatory remarks of a general nature, in reference to the importance and necessity of the discussion—and also as to the fitness and propriety of introducing such a subject into this journal.

It will be seen from the early history of our country, that Franklin and other distinguished philofophers who were in correspondence with European *savans*, although devoted to natural science in one or more of its branches, paid but little attention to the spontaneous productions of the land—although there are at this early period several remarkable exceptions. A very sufficient reason for this neglect is to be found in the unexplored state of the country and the occupation of a large portion of its territory by savage tribes.

The war of the revolution, in itself calculated to draw the minds of men generally from such matters, had however an indirect effect in attracting attention to our indigenous products, which is worthy of notice. Being deprived of many articles of luxury or comfort of foreign production, our active and ingenious forefathers set their wits to work in order to obtain as far as possible substitutes for the luxuries as well as the comforts. That substitutes were found we have sufficient evidence in such names as wild indigo—wild allspice—wild ginger—New Jersey—Oswego—Japan and other teas. Many of these names from their local character have entirely disappeared. Upon the restoration of peace it seems that most of these American products went out of use and were replaced by importations from abroad. It is not pretended that all of the substitutes thus used were of sufficient value to continue in use, but that many were there can be no doubt.

Notwithstanding the observations thus enforced by necessity several circumstances have conspired to divert attention from our indigenous productions. One of the most singular of these, and one which is least thought of, is the result of an old prejudice, that a *new country* is inferior in its natural productions to an *old country*. Absurd as this proposition must appear upon the least reflection, it has not only been defended in various works, but to this day has an indirect effect, now happily rapidly disappearing, in the general preference for foreign articles.

Another of these circumstances is the disappearance and extinction of the Indian tribes formerly inhabiting the Eastern portion of the United States, from whom much valuable information might have been obtained respecting many articles used in food, medicine and domestic manufacture. We are thus left to rediscover by analogy and experiment, the experience of centuries which has perished with this rude but remarkably sagacious race.

Many of the early efforts made to bring to market articles of indigenous product, have failed from the rude and imperfect mode of preparation, which is not occasioned by the high price of labor in this country as is commonly supposed, but from inexperience and want of information respecting the best processes in use elsewhere. This difficulty is likely to be much diminished, if not entirely removed by the increased attention to scientific subjects which so generally prevails throughout the country.

The first fruits of this scientific inquiry which have as yet been gathered are the geological—or more properly speaking—economical surveys of every State in the Union. We conceive the effect of these upon the country at large to be absolutely incalculable. The survey of this State in particular has been conducted upon a magnificent scale, and the very practical nature of the results already obtained, sufficiently justifies the comparatively trifling expense. We have heard it stated that the gentlemen engaged in it are determined to present the information accumulated in their respective departments, in no mean or imperfect form—but to carry out the intentions of the design in a manner calculated to do credit to themselves and to the State.

Considering the fact that these various surveys have been or are soon to be completed, we have thought no time more fitting than the present for bringing this subject to notice, being convinced that the public attention being awakened to the magnitude and usefulness of the knowledge thus accumulated, will be easily directed to the proper mode of carrying it into operation.

One single prudential reason for the multiplication of staples of similar character to those already in use, is alone sufficient to create a vivid interest in this subject. When from failure of crops or other untoward causes, either local or general, any great staple is either diminished in quantity, deteriorated in quality, or falls in price, the effects are felt throughout the Union, and the commercial fluctuations which result are highly detrimental to the national prosperity. For instance, the quantity, quality, and price of the cotton crop, has a yearly effect upon the whole business of the country. Now if, instead of this staple, we had four, five or six of similar nature, and equal value, as we shall presently show that we really may, the diversity of soil, climate and circumstances suited to these various substances, can hardly have such an influence as simultaneously to elevate or depress the price of all of them. The consequence would be a more uniform and healthy current of business, highly favorable to commercial prosperity and the general welfare.

[Translated for the American Railroad Journal.]

OBSERVATIONS UPON THE COMPARATIVE ADVANTAGES AND INCONVENIENCES OF THE EMPLOYMENT OF IRON WIRE, OR BAR IRON, IN THE CONSTRUCTION OF SUSPENSION BRIDGES OF GREAT SPAN.—*By M. Le Blanc,* Chief Engineer of Bridges and Roads.

Cables of iron wire, and chains composed of bars of wrought iron, may be compared with reference to their economy and their durability.

As regards economy, the question scarcely deserves discussion, and it is easy to prove *a priori* that, in all possible cases, iron wire has the advantage over wrought iron.

In fact, the Council of the *Ponts et Chaussees* has adopted the principle that cables of iron wire should be submitted to a tension of 12 kilogrammes (26½ lbs. nearly) per square millimetre (·0016 sqare inches) of section, but for bar iron, it was decided that this maximum of tension shall not exceed 8 kilogrammes, (17² lbs, nearly).

This principle is founded upon the comparative resistances, of iron wire, No. 18, ordinarily employed in the construction of cables, and of iron bars 3 to 6 centrimetres (1·2 to 2·4 inches) in diameter.

The natural consequence of this principle is, that the section of a chain should be greater by one half than that of a cable, for the same tension, this involves a proportional increase of its weight, In cables of iron wire no joints are used, or at most, but a single one, as in the bridge of Argentat, and this joint made up of two small eyes, weighs but little—on the contrary, they are numerous in chains, and where the system is rather complicated, as I shall prove it should be in bridges of great span, each one of these joints weighs at least 140 kilogrammes, (309 lbs. nearly). On the supposition that the suspension rods are 1·2 metre apart, (47¼ inches,) as there is a joint for each rod, there will be 233 kilogrammes (92·600 lbs. nearly) for a bridge of 180 metres span. This additional weight, together with that of the bars themselves, which, as we have just seen is one half greater than that of the cables, produces an excess of tension which must again be resisted, whence there arises a new increase of section, and consequently of weight in the chains, In applying these principles to individual cases, it is found that the weight of the unit of length of a system of chains exceeds double that of a system of cables.* Now, as the price of iron wire is once and a half that of bar iron, it is plain that the use of iron wire is more economical than that of wrought iron.

I have proved that the total tension is much greater when chains are used, it follows that greater strength must be given to the moorings and to the intermediate piers when the bridges have several openings or bays—a new cause of increase of expense.†

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* In the comparative proposals which I presented for the bridge of Roche Bernard, I showed that these weights are in the proportion of 11 to 25; in order to replace 11 kilogrammes of iron wire which at 1 f. 50c. cost 16 francs 50 cen., we must employ 25 kilogrammes of wrought iron with 25 francs

† In bridges of several bays the cables or chains should be fixed to the intermediate piers in order to avoid the great changes of form which result from unequal loads upon the

It appears to us to have been thus thoroughly proved that in regard to economy, the cables of iron wire are superior to chains of wrought iron.

Let us now compare the two systems in relation to their durability.

The principal objections which have been made to the employment of iron wires are the following:

1st. They offer greater chances for rapid oxidation.

2nd. The imperfection of the present process for manufacturing the cables does not allow us to give an equal tension to all the wires, so that when the cables are raised to their places, the wires which are under most tension have to support many pounds in excess—while those under least tension do not draw at all.

3rd. Cables form a system less rigid than chains of wrought iron do, so that the horizontal oscillations of the roadway are more considerable in the former than in the latter case.

I believe that I have not withheld any of the objections urged against the employment of iron wire, nor weakened those I have presented. I shall now examine them in order.

First objection.—They offer a much greater chance for oxidation.

It is certain that if we expose to alternations of dryness and humidity a bar of iron and a certain number of isolated wires, the sum total of their individual sections being equal to that of the bar, the surface attacked will be far greater in the wires, and in them the oxidation will be most rapid.

In confining ourselves to this general *fact*, without reference to any of the means employed by art for retarding this oxidation, it will be well to examine if even this inconvenience of the more rapid destruction of the cables, is not more than counterbalanced by the advantages which they present.

It is very evident that if the cables remain only forty years without being renewed while the chains may last for sixty or one hundred years, we must calculate what will be the amount at the end of forty years of the sum saved by the use of iron wire instead of bar iron.

To render this more plain, I will give an example. I suppose that a given suspension bridge requires 200,000 kilogrammes of iron, (which was nearly the quantity for the bridge of Roche Bernard).

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two bays, if the chains and cables can slide freely over the top of the piers. Because these piers have to resist only the difference of the tractions produced by different additional loads upon the two bays, it would appear at first sight a matter of indifference whether the permanent loads which are in equilibrio, are greater or less, nevertheless it is plain that the less these permanent loads are, the better the piers are in condition to resist the maximum load of one bay, the other being destroyed—it is then not unimportant that we diminish the permanent load as much as possible.

The expense of the system of suspensions, -	300,000 francs.
According to note (1) to replace the iron wire there must be used 454,545 kilogrammes of wrought iron, which would cost - -	454,545
Saving in favor of iron wire,	154,545 francs.

Now this sum put at interest, will amount at the end of twenty-three years, to 475,506 francs, and supposing that the cables must be entirely renewed at this time, there will still remain a surplus of 175.596 francs, which will be more than sufficient to produce at the end of another twenty-three years, a new capital equal to the cost of the system of suspension.

In the case which we have considered, cables of iron wire lasting but twenty-three years will then be preferable to chains of indefinite duration.

The supposition that isolated wires will last twenty-three years without the necessity of being renewed is not without foundation—and we shall produce a fact which strongly tends to confirm it.

M. Mongolfier, jr., having learned that a grating of iron wire from the church of St. Martin's at Paris was about being taken down, after having remained forty years without any repair, had the curiosity to prove these wires, after having carefully ascertained their number, and he was convinced that they had lost but one-fifth of their entire strength.‡

This loss of strength is not sufficient to require a complete renewal of the system of cables.

But the most determined opponents of the use of iron wire confess that cables do not afford such facilities for oxidation as detached wires. The greasy substance which covers them affords a powerful preventive to rust—their union preserves them in the interior more or less, from moist air, the ligatures are a stil lfurther obstacle to its introduction, and finally the carefull superintendence which should be given, are all reasonable motives for hoping that the effects of oxidation may be diminished in a remarkable manner.

It may be objected that experience has not fully confirmed the opinion, however probable it may be, that cables are less susceptible the attacks of oxidation than iron wires. I confess that no one fact can as yet, incontestably, prove the justice of this opinion, but there are several which we can produce, capable of giving much strength to it.

The bridge of Tournon has been in existence eleven years, but no

‡ The increase of oxidation is not as rapid as would be supposed from the first observations made—for the first layer of rust which covers the surface of a bar of iron instead of favoring this oxidation proves a coating, which is an obstacle to it.

very considerable trace of oxidation has manifested itself, at least to my observation, upon the surface of the cables, and if there existed any in the interior it would not have failed to show itself by a brownish stain upon the outside of the paint which covers them.

A bridge of iron wire was built at Brest in 1526, the cables exposed to the salt air which attacks iron with so much energy should have undergone a remarkable deterioration in the space of three years. M. Trotte de la Roche, Chief Engineer, who, on account of the plans adopted for the port, was obliged to dismount it, took the pains at the invitation of M. Inspector General Lamblardie, to prepare a *process verbal* of the state in which he found the cables.

It appears from the *process verbal,* 1st. That the continuous ligature which covered the cables, was slightly attacked, but that by the first scratch of the file, the oxidized portion was removed. 2nd. That the exterior wires of the cables showed slight traces of oxidation, but that the slightest scratch of the file caused them to disappear. (M. Trotte de la Roche supposes that the oxide was only deposited upon the wires of the cables, and that it came from the ligatures. 3rd. That the interior wires were perfectly untouched.

Eight years is a short space of time, but if we consider that the effects of oxidation probably continue to decrease, we may conclude that they are not so very rapid, and that the fears entertained upon this point are greatly exaggerated.

An observation has been made which is worthy of remark—it is that in chains the surface of the bars, which is attacked by oxidation, proves the portion of them offering the most resistance, while in a cable the interior portions have the same strength with the others.

(Concluded in next number.)

NEW INVENTION—SUBSTITUTE FOR HAIR MATRESSES.

A friend has placed upon our table a very handsome article intended as a substitute for hair in beds. Its appearance is that of a very neat curl of some substance rather smaller than fine cord, the touch and smell are at once calculated to command favor and give it the superiority over hair. In fact it is a preparation from bass and other kinds of wood, and is the product of a machine invented by Mr. Baker of Utica—late Canal Commissioner.

We understand that the article is in great demand and that Mr. Baker manufactures large quantities of it at Utica. We hope that a supply will be sent this way or that Mr. Baker will operate with his machine somewhere in or near New York. The present oppressive weather is sufficient to drive the most obstinate adherent to feather beds, from off such a mass of semi-decaying animal matter—even if he is salamander enough to stand the heat, his olfactories could hardly endure the close and disagreeable order. In fact feathers are neither wholesome nor economical, either for summer or winter—hair matresses are costly although very comfortable—but Mr. Baker's substitute has the advantage over all, for it is not only clearly durable and wholesome, but it is *cheap*, and can be afforded at one-fourth the cost of a hair matress.

The following description of a new form of *cast iron* rail, will have considerable interest, as being almost entirely new. The usual objections to rails of this material are obviated by the peculiar form, which seems to confer a certain degree of elasticity, sufficient to prevent fracture.

The great advantage, however, is, that while we are obliged to import rolled iron at high prices, cast iron can be produced in almost every section of the country at a very cheap rate.

In our next number we shall give a cut representing the rail, which could not be finished in time for the present number.

DESCRIPTION OF SPAULDING AND ISHERWOOD'S PATENT CAST IRON RAIL AND SUPERSTRUCTURE.

This rail is intended to be used for the rail and superstructure of railroads, without the auxilliary of wood.

The rail is composed of cast iron, cast whole, with an upper and lower arch, and appropriate flanges. The arches to be united by posts with braces disposed lozengerwise between.

The arches are terminated in an abutting piece at the ends, and the feet tied together by wrought iron rods. The bars are also connected transversly by wrought iron ties. The top of the rail is a horizontal bar with a flange cast under the centre of the bar, and supported by posts above the upper arch, and by braces disposed lozengerwise between them, as shown in the above plan to support the bar and load, and secure the branches of the upper arch. The rails are cast with a tongue and groove joint at the extremities, and fitted at the end into a cast iron chair, which is placed upon the foundations. The foundation may consist of wood or iron piles, stone, brick or wood blocks, or such other materials as may be most convenient.

The general arrangement of the parts is shown in the above drawing. The length of the bars is ten feet, but the length and sizes may both be altered to suit the locality. A piece of this cast iron road is now in operation on the Ithaca and Owego railroad, near the village of Owego. It is daily run over by an eleven ton locomotive with heavy loads of lumber, plaster, merchandize, etc., and in every respect gives entire satisfaction. The weight of each bar is 259 pounds, and with white oak piles placed ten feet apart longitudinally, can be built for $11,000 per mile inclusive of grading!

Any communication on the subject can be addressed to Ira Spaulding, C. E., Owego, Tioga county, N. Y.

The following prospectus has been sent us with a catalogue of the very excellent and cheap publications of the geographical establishment of Bruxelles. It will be seen that the plan is a novel one—as by it subscribers may secure a complete atlas or the sheets for a globe, 24 feet in diameter.

THE UNIVERSAL ATLAS OF GEOGRAPHY—PHYSICAL, POLITICAL, STATISTICAL AND MINERALOGICAL—*Constructed by Ph. Vander Maelen*, according to the best Charts, Astronomical Observations, and Voyages and Travels.

The science of geography which presents at once the greatest interest and amusements to every class of society, is become at present one of the most essential branches of public instruction. The excellent works which have appeared for a century, the close relations, the voyages, the discoveries, the multiplied and new connections, resulting from the great revolutions which, with the progress of time, necessarily ameliorate the condition of nations, and establish upon new basis their systems of policy and their commercial interest, render the study of geography of the utmost importance to mankind. In order to facilitate that science, it is absolutely necessary to procure charts and maps, without the assistance of which, the attention and the memory are overloaded and uselessly exhausted.

From the ambitious conqueror who would grasp the world to the sagacious diplomatist who breathes only peace; from the severe historian and the indefatigable traveller to the skilful physician and the investigating naturalist; from the simple pilot to the hardy sailor who, throughout the immensity of the ocean, searches for undiscovered countries, geographical science is more or less an indispensable requisite for all. Even the man of the world, whose life is consecrated to pleasure, can hardly have so little self-love as to remain entirely uninformed in conversation, which in the present day embraces all kind of science.

The American revolutions, the independence of the Antilles, the war of India, the extraordinary efforts of the Greeks against the oppressors of that ancient land of genius, of courage and of the fine arts, all the recollections of that classical region, of that fertile and beautiful country, at present the theatre of a deadly struggle between liberty and despotism, can never be matter of indifference: no one can disdain the geographical knowledge of places where events of so great an interest and of such importance are occurring. Such a result cannot be expected from a generation or from an age so prolific in learned, laborious and intrepid men who advance with gigantic strides towards the improvement of every culty and every human institution.

Without the assistance of correct charts, the study of the best geographical treatises would be useless. There are an infinite number of atlasses, of charts both general and particular. Different atlasses have appeared in different countries more or less complete. Most of these works have been successful, and they deserve it in many respects: but that which we now publish shall be the most complete work in this department which has hitherto appeared.

No expense has been spared to accomplish this object: our commercial relations have afforded us the greatest facilities for obtaining from the different parts of the world the best charts, voyages, treatises of geography, mineralogy, geology, etc.; the most valuable and correct works and of the greatest authority have been collected for this purpose.

Several years of continued exertion and of strict investigation have been employed, and considerable expenditure incurred; in fact, all means have been employed to give our Atlas the highest degree of perfection. The greatest care will be applied to render the physical, political, statistical and mineralogical notices as precise and exact as possible: it shall be our utmost effort to leave no part of our task unaccomplished, to justify completely the expectation of our subscribers. Such is the object we have proposed, not from the mere motive of interest, but rather from the more liberal sentiment of public utility. The desire of attaching our name to a great and useful enterprise has stimulated us in the midst of numerous obstacles which, we hope, have been surmounted by our zeal, perseverance and industry. Our most grateful recompense will be in the success we may obtain, and particularly in the suffrages of our compatriots, who are competent judges, holding a first rank amongst the nations of Europe by their industry, manufactures and commercial and territorial wealth.

Most of the crowned heads of Europe have given to this undertaking their patronage: we flatter ourselves that the English nation, so ready to encourage all works which tend to promote and adorn the age, will not refuse a portion of that favor which has so powerfully contributed in every time to the extension of geographical discovery.

By giving the conical projection to this work we are desirous to procure to our subscribers, by the re-union of different charts, one globe of 23 feet 10 inches 6 lines of France, or 7 metres 775 mill. of diameter; and by that means, all the maps will be on the same scale.

The atlas is divided into six parts: namely, Europe, Asia, Africa, the two Americas, and Austral Asia: each, part has an index chart which serves as a table.

Each map bears the designation of the country which it represents, and on each side of that title will be specified the divisions and the number of the maps.

To avoid too great a number of charts, various groups of islands shall be given upon one sheet.

Such of our subscribers as desire to form a globe by the union of our maps, are requested to intimate their intention, and all the necessary sheets to cover the surface of a globe of the above diameter shall be delivered to them.

The work, which consists of forty livraisons, is completed, and we venture to flatter ourselves to have justified by the correct execution the engagement which we have formed, and the favorable reception of our subscribers.

Those who desire to possess our atlas are requested to signify the number of livraisons which they desire to receive monthly, which should not however be less than two.

The following is the criticism upon Mr. Ellet's "Laws of Trade," referred to in our last number. The article had been overlooked, but as a correspondent has noticed it we insert it.

On the theory of tolls upon canals and railroads.—Sir—As I am aware that Mr. Ellet's remarks on Canal and Railway Tolls, extracted in your Journal for September, have attracted some attention, and have been received as sound and judicious principles by some persons, who are in a position which enables them to carry out these principles into practical operation, I beg to offer a few observations, with the view of pointing out what I conceive to be erroneous in Mr. Ellet's statement.

Mr. Ellet's object is, so to regulate the charge of toll upon a canal or railway, as that every part of the country through which the line passes, near or remote, may derive from the improved mode of conveyance the same advantage, an equal share of trade. And he contends that this cannot be effected by the system of tolls that generally prevails, namely, a fixed mileage, or a certain rate per ton per mile; and he therefore recommends the adoption of the directly opposite method, viz., that the lowest charge should be levied on the trade that is brought from the greatest distance, and increasing gradually as we approach nearer to the mart or place of consumption, that the heaviest toll should be charged on that which comes the shortest distance. And Mr. Ellet then proceeds to show that this plan would produce the largest trade, (that is, would command the largest extent of country,) and the greatest amount of revenue.

Now all Mr. Ellet's argument depends upon one little assumption which he quietly introduces, without remark or explanation, quite unconscious that it contains the grossest fallacy. The market price of any commodity at the place of consumption may be said to be fixed, (for our present purpose,) and, in order to obtain a sale for this commodity brought by the canal or railway, the cost of production and the expense of conveyance must not exceed the fixed market price. Mr. Ellet takes for granted that *the cost of production* is fixed also, and on this rests the whole theory of tolls "Let us also assume that the cost of producing this article (lumber) is 6 dollars per ton," and the market price being fixed (10 dollars,) he consequently assumes that the extreme cost of carriage which the article can bear, so as to be sold in the market, is fixed too, that it must not exceed 4 dollars in the instance given. But he assumes also, and it follows in like manner from the preceeding assumption, that *the cost of production is fixed*, that the article can always bear this fixed charge of 4 dollars, that whether the commodity be brought from near or far, whether it is carried 100 or 400 miles, it can always bear the full charge of 4 dollars for carriage, and cannot, in any afford more. And on this assumption Mr. Ellet builds his theory,—that as the cost of carriage consists of two parts, the actual expense of conveyance, including the maintenance of the canal or railway, called *the freight*, and the profit of the canal proprietors, called *toll* ; and as the freight must necessarily be directly proportional to the distance, the toll (their sum being fixed) should be inversely proportioned thereto.

Even were this principle correct in theory, it would in practice be exceedingly unjust, and therefore injurious. For nothing can be more unreasonable than that the trade which passes along the canal but 50 miles, should pay three times as much toll as that which comes 150 miles, thus paying actually *nine times* its due proportion. Let it be observed also that Mr. Ellet's system is one that can be fully carried out only on such a canal or railway, as has to sustain no competition with common roads. On the latter the charges of conveyance will always be directly proportioned to the distance, and being lowest for the nearest parts, will of course successfully compete with the canal or railway, whose toll is *here* the highest. The maximum charge for conveyance being 4 dollars, and supposing with Mr. Ellet that land carriage is five-fold more expensive than the 'improvement,' it will according to the scale given by him, be cheaper than the canal for the first 40 miles, (one-tenth of its whole length,) and from so much of the country, therefore the canal will derive no trade. With us the proportion of the cost of land and canal carriage is much nearer, perhaps greater than two to one; and the portion of country commanded by the superior cheapness of land carriage under Mr. Ellet's system of tolls, will be proportionately larger. Wherever there is the competition of another conveyance, on which the charges are made according to the distance, the inverse system of toll will be impracticable.

Leaving, therefore, for the present, the practical objections to Mr. Ellet's proposed system, I turn again to that which forms the basis of his whole theory, and which I conceive to be a most fallacious assumption. I am indeed surprised that any one writing upon such a subject, who ought to have some acquaintance with the principles of Political Economy, should hazard, or should carelessly make, an assumption so opposed to the mere elements of that science, as well as to ordinary experience. So far from *the cost of production* of any article being a fixed sum, throughout an extensive district of country, it is dependant upon, and varies exceedingly with, a great many circumstances. Every one knows that there is difference of prices in many markets throughout the kingdom, and the price *at the place of production* is, *generally*, the actual cost of production, added to the usual profits. For reasons which will be noticed hereafter, the cost of production, and consequently, prices differ less in an improved country like England, than in one possessed of fewer artificial advantages, such as America or Ireland. But the fact is notorious to every one, that differences do exist in the expenses of production, at different places, of commodities of the same quality, and equal value at the place of consumption.

The cost of production is made chiefly of rent, the wages of labor, and the profits of producer, (and, in manufactures, of the price of the raw material.) *Rent* is well known to vary exceedingly in different parts of the country, even for lands of the same kind, and equal fertility. *Wages* differ too, not only between the manufacturing and agricultutal districts, but also between different districts engaged in the same occupations. Profits differ likewise, but being nearly in a fixed proportion to the total cost, they need not be considered separately. As, then, the component parts of the cost of production thus vary throughout the country, their sum, the total cost cannot be said to be fixed. Yet Mr. Ellet seems to have forgotten these facts, palpable as they are to every man's observation

There are, however, certain articles whose value is very small, and the cost of production of which consists merely of the wages of the labor employed upon it; and this labor being of the coarsest kind, its wages vary but little. Of such commodities the expense of production cannot differ much, and may be said to be fixed. Such are stone, lime, and, in a wooded country like America, timber, and perhaps coal, ores, &c. It is to such products Mr. Ellet chiefly applies his theory, but he does not confine it to them. He intimates that some other principles come into operation with reference to the more valuable articles of trade. But as I have not seen his observations on that part of the subject, and as it appears to me that his principle, if correct, must be equally applicable to every branch of trade, and as I know that it has been so interpreted and applied by some of his readers, I have discussed the subject generally, endeavoring to refute the theory in its application to either division of canal trade. In certain cases, then, it would appear that Mr. Ellet's assumption is correct, that the cost of production is fixed (or nearly so). But it so happens, that in these instances, our author's system of tolls would be altogether impracticable. The commodities are of such little value as to be scarce worth removing, unless at a very small cost; they cannot, in general, be brought from a distance, the necessary charge for freight, even if there be no toll, acting as a prohibition; and to have any trade, even from the nearest places, you must levy only the lowest rate of toll. Thus on the Irish Grand Canal the toll on stone is 6*d*. per ton, and on manure 4*d*. per ton for any distance,—because at higher rates they would scarcely be carried at all. And here, it is evident, there is no room for graduation according to Mr. Ellet's plan.

But resuming the consideration of the cost of production, where it is not fixed, let us examine into the causes of the differences that exist; why rent is high in one district, and low in another, and why wages vary so much as they are found to do in different parts of the country. Of course they all depend upon the economical principle of the relation of supply and demand. But in the same country, all parts of which are subject to the same laws and conditions of trade, and all contribute to the supply of the same great market, this relation between the supply and demand, that is the different values of rent and wages in the various parts of this district, depends mostly upon their respective distances from the place of consumption, and the facilities of conveyance thither. Near a large town, rent and wages, and consequently the cost of production, are high, because there the great demand can be most easily supplied, and with very little expense for carriage. Farther off, as the cost of conveying the products to the markets increase with the distance, both rent and wages are lower. And if a canal or railroad be made into the country, as it cheapens the cost of conveyance and thereby facilitates its supplying the market, it raises rent and wages or the cost of local production. Thus the true state of the case is very different from Mr. Ellet's theory. The cost of production is not fixed; it is found to depend on the charges for conveyance, varying inversely with them (not in the same ratio,) that is, with the distance Of course I speak here of the natural charge for conveyance, which consists of *freight* only and is always proportionate to the distance. Such is the cost of carriage upon common roads, and as these are generally the first modes of conveyance, and the most universal, it is by the principles and circumstances that relate to them the cost of production is generally governed. In England the facilities for transport are so great, and so equally diffused throughout every part of the country, that the difference in the cost of production in different places is small, as I before mentioned. But in countries where the improved methods of conveyance are few, the difference of price, or the cost of production, at places at unequal distances from the market, or not having the same facilities, is often very striking. In Ireland, the price of potatoes, for instnace, is frequently found to differ to an astonishing degree, in various parts more or less remote from the large towns; and the only cause appears to be the expense of carriage, which being in proportion to the distance, increases or diminishes the cost of production and the facility of removal.

If then, the cost of production is found to vary, and inversely with the distance, the difference between it and the market price is not fixed, but varies directly with the distance; and the total sum which the commodity will bear as the cost of conveyance to the market is a varying quantity, increasing with the distance. The freight, one of its parts, is proportioned to the distance, and the other portion, the toll, should also, in general, be regulated by the same proportion. There are, of course, many circumstances which modify this law, at least in practice; but looking at the abstract question, I think that the theory of tolls, which the principles of economy and the laws that govern the relations of value and price indicate, is the simple, natural, and just system of charging according to the distance, in proportion to the benefit conferred, or to "the value given."

This is not only the true theory, but it is also the only system that is practicable, wherever there is competition of common roads; it is easy to show that, in all cases, it would be the most profitable system also,—the most productive of revenue to the proprietors of the canal or railway; and at the same time the most impartial, and the most equally advantageous to every part of the country. Each district has its own advantages, in which it is superior to the others, and, under a natural system, its facilities for production and transport are proportioned duly to its means; while the retrograde principle must have the effect of encouraging the remoter districts, and depressing the nearer,--by destroying the natural and equable balance, which prevails in the social commonwealth.

I cannot trespass on your space, Sir, by entering on the proofs that the natural system is also the most productive; neither could I do so without introducing diagrams, which would be found to differ very much indeed from those of Mr. Ellet. I shall add, that I hold the true and most effectual mode of gaining for a canal or railroad the largest amount of trade and revenue to be MODERATE TOLLS, charged fairly according to the distance. I am convinced that the charges upon most canals and railways are much too high; that considerably lower rates would greatly increase their prosperity, and add vastly to the resources and commercial facilities of the country. Wherever the experiment of reduction has been tried, it has proved successful, in augmenting the trade and its profits; and I have no doubt that soon the proprietors of many public works will be compelled, for their own sakes, to resort to such measures; and it is, therefore, of much importance that the principles of "the theory of tolls" should be clearly understood; and conceiving that those advocated by Mr. Ellet are fallacious, unjust, and injurious, I have endeavored to refute them,—and regret that the task has been so feebly and hastily performed.

C. E. B.

ATLANTIC AND PACIFIC COMMUNICATION.—Not doubting that many of our readers will be interested by the perusal of the following private letter to a gentleman high in office, from the person through whose instrumentality steam navigation has recently been begun in the Pacific, we cheerfully give it room, and trust that its suggestions in regard to the importance to the United States especially, of a communication between the Atlantic and Pacific oceans across the Isthmus of Panama will be marked and weighed by our statesmen and citizens. We may add that this letter shows the wakefulness and untiring industry with which all practicable means are exerted to extend the political and commercial interests of England. Our readers no doubt remember that this Pacific Steamboat Company is under the patronage of the British Government. Does it not behoove us to open our eyes to what is taking place in so many quarters of the Globe?—*National Intelligencer.*

TALCAHUANO, MARCH 20, 1841.

MY DEAR SIR: As you did me the honor to ask me to write to you, I avail myself of the present moment to do so; and as you have always manifested so much interest in my plans, I will relate to you some account of my success since my arrival in the Pacific.

The first steamers, the "Peru" and "Chili," of 700 tons and nearly 200 horse power, reached this port after a voyage of 55 days at sea from London, passing through the straits of Magellan, only occupying thirty hours from sea to sea, affording thus another proof of the victorious power of steam. Although encountering at times severe weather, not the slightest accident occurred to either ship or machinery. The combination of steaming and sailing was beautifully demonstrated, and the speed of the ships under canvass alone, with merely a section of the paddle floats taken off was fully equal to the fastest ships.

Our steam operations commenced here under the most brilliant auspices. Nothing could exceed the interest manifested by the inhabitans. I first commenced on a line of coast of fourteen hundred and fifty miles, embracing no less than eleven ports of importance, including Lima and Valparaiso. Such are the facilities afforded by the mildness of the sea, the boldness of the coast, the ease in which the ports are entered, that we accompished the voyage in its full extent within two or three hours, and to the minor and nearer ports in less period. Perhaps no part of the world whose shores are bounded by any sea offers such decided advantages for "steam" as this, and certainly no part of the world requires it more: voyages which were usually of twenty to thirty days are accomplished by the steamers in forty hours and voyages of fifteen days are reduced to twenty-four hours.

As proper measures were not taken to secure a supply of coal from England, I have been obliged to stop until such supplies were forthcoming. Encouraged with the hope of meeting coal in the south of Chili, adapted to steam purposes, I explored the country as far as Chiloe, where I found coal, but that which offered most advantages was in the bay of Talcahuano; no mines had hitherto been worked, but several cargoes had been taken superficially; here I commenced my labors. Without practical knowledge or the aid of science, I have opened no less than seven mines—have found the material necessary for our purposes, and am now engaged taking out about fourteen tons per day, at an expense of two dollars per ton placed on board the steamer; its quality is in the proportion of sixteen tons to thirteen tons of English coal. I am now in hopes of finding another and lower stratum, and with this view I am sinking two shafts which give strong indications of better coal. If I succeed, I feel confident that I shall find coal fully equal to New Castle, if we draw a comparison between the first and second stratum, and that the quantity will be sufficientto supply all the steamers which may be required on this coast for any period. This discovery of steam coal will, perhaps, be considered one of the most important events in the history of this country. It is rather a singular coincidence that the coal discovered both on the eastern and western sides of the Isthmus of Panama is of precisely the same character as the coal of Talcahuano. I have sent to the Isthmus for some tons of this coal, and hope yet to derive our supplies from that source, so far as may be required for that portion of our steaming.

The line of steam communication I propose to extend immediately as far as Guayaquil, and for the present the intercourse from thence will be by means of sailing packets once in twenty days.

The western line of packets will, I hope, be soon commenced to Australasia. I feel the greatest anxiety to see this intercourse established. For America I consider it as one of the most important points; it will make her the stepping stone between Europe and the Eastern Archipelago. The Australian Colonies of England will assume a position novel and of infinite value to their progress in civilization; the Anglo-Saxon race will occupy nearly all the vast inhabitable space embraced in their widely extended branches, and the tide of intercourse will thus reach the shores of Japan and China, and be placed in the same position as it regards our western shores of the Pacific as Europe occupies as it regards our Atlantic States.

I consider the establishment of steam navigation in the Pacific as the poineer of these great events; the barrier that divides the two seas or oceans will soon disappear. I have occular evidence that the junction can be effected with infinitely less difficulty than is imagined. I passed over the Isthmus on my return to this country without overcoming a height of forty feet, and a distance of twenty-eight miles. This is but a barrier of straw when compared to the vast results which will be produced. I sincerely hope that one of the first acts of the Government will be to investigate this, to us more than to any other nation in the world, all-important matter. Our statesmen cannot but look forward to the period when our western frontier will reach the Pacific, and when the population of the U. States reaches that coast, of what infinite value will a water communication through the Isthmus of Panama be to us. It may perhaps be thought too speculative to indulge in such views, but when I reflect that twenty years only, the time which I have resided on this coast, has witnessed one of the most important political and commercial revolutions which have ever taken place, I cannot but view the period of these great changes to which I have referred, as much nearer than we imagine.

I have again written a long letter, perhaps a repetition in some measure of my last, which I must beg you to pardon, and allow me to subscribe.

Your most obedient servant.

Papyrography.—This is a new invention for reproducing drawings, manuscripts, and all kinds of designs to an unlimited extent, and by means much cheaper than at present known. This process, which is called by M. de Manne, the inventor, *Papyrography*, is very fully noticed in a late number of the *Moniteur*, from which we abridge the following particulars. The mode by which M. de Manne produces designs, &c., on paper, is thus described. After having, by means of his prepared metallic ink, traced the drawing on common writing paper, he contrives, by an operation which he at present keeps secret, to make the lines rise from the paper in relief, and become extremely hard and durable. He fixes this matrix on a plate of metal, on which he then places the paper that is to receive the impression. Over the paper he places a piece of silk, and passes it under the roller of a copper-plate press; when the characters and lines on the manuscripts or drawing are reproduced, stamped in on the paper. These designs thus fixed on the plates are hard enough to allow of a greater number of impressions being taken without injury to them. The part of the invention, which consists in obtaining plates of metal cast from the matrix afforded by the drawing on the paper, is considered by the committee of the Society of Arts of Mulhausen, who were appointed to examine it, as of still greater importance than any other. By this engraving on paper, say the committee, may be obtained impressions fully equal to what can be had from wood engravings; by this means, therefore, works which require illustrations may be printed with great cheapness. In engravings on wood, the design and the subsequent cutting are necessary, but by the papyrographic method, the design is the only expense; and it will produce without end as many engraved plates and impressions as may be required, at a cost one half of that of the ordinary process; and with a precision equal to that of the original drawing. As M. de Manne conducted his experiments at Rouen, where there was no skilful metal founders, he labored under great disadvantage in his attempts to bring his invention to perfection, but the specimens he sent to the committee were sufficient to convince them that his plan was capable of answering all that he stated. Some of the specimens sent to the committee presented the designs, and the printed copies from them in relief to the height of from two to three millimetres, obtained solely from the matrix traced on paper. The committee propose to extend the invention to the printing of woven fabrics and paper. M. de Manne sent some plates prepared for this object, but owing to the disadvantages under which he labored, the plates were not so perfectly cast as they ought to have been, to produce the desired effect. The defect, however, he ascribes entirely to the unskiflul manner in which the Rouen founders took the cast of his matrices; for not venturing to trust them with the paper moulds, he took casts of them in plaster; from which the metal plates were afterwards cast. It is to this circumstance that M. de Manne attributes the failure of his experiment, as it was difficult to take the cast in plaster from the paper so as to preserve the sharpness of the outline. He says he is certain of the success of his process as applied to the printing of papers and calicoes, but want of means with him, as with many other inventors, prevents him from taking out patents, or from carrying the ivention into operation. The committee report that it seems to them highly probable that if the inventor was placed in more favourable circumstances, he would arrive at remarkable and very useful results. In conclusion they recommend the society to grant him a silver medal, though the invention is not of a nature within their usual subjects for prizes.—*Inventors Advocate.*

James Prinsep, whose brilliant career of research and discovery has been closed by a premature death in the flower of his age, was Principal Assay Master, first of the mint at Benares, and secondly of that of Calcutta, where he succeeded Prof. Wilson in 1833; he was a young man of great energy of character, of the most indefatigable industry, and of very extraordinary accomplishments; he was an excellent assayist and analytical chemist, and well acquainted with almost every department of physical science; a draughtsman, an engraver, an architect, and an engineer; a good oriental scholar, and one of the most profound and learned oriental medallists of his age. In 1828, he communicated to the Royal Society a paper "On the Measurement of High Temperatures," in which he described among other ingenious contrivances for ascertaining the order, though not the degree, of high temperatures, an air thermometer applicable for this purpose, and determined by means of it, probably much more accurately than heretofore, the temperature at which silver enters into fusion. His activity whilst resident at Benares has more the air of romance than reality. He designed and built a mint, and other edifices; he repaired the minarets of the great mosque of Aurengzebe, which threatened destruction to the neighboring houses; he drained the city, and made a statistical survey of it, and illustrated by his own beautiful drawings and lithographs, the most remarkable objects which the city and its neighborhood contains; he made a series of experimental researches on the depression of the wet-bulb hygrometer; he determined, from his own experiments, the values of the principal coins of the East, and formed tables of Indian metrology and numismatics, and of the chronology of the Indian systems, and of the genealogies of Indian dynasties, which possess the highest authority and value. When transferred to Calcutta, he became the projector and editor of the "Journal of the Asiatic Society of Bengal," a very voluminous publication, to which he contributed more than one hundred articles on a vast variety of subjects, but more particularly on Indian coins and Indian palæography. He first succeeded in deciphering the legends which appear on the reverses of the Greek Bactrian coins, on the ancient coins of Surat, and on those of the Hindoo princes of Lahore and their Mahomedan successors, and formed alphabets of them, by which they can now be readily perused. He traced the varieties of the Devanagari alphabet of Sanscrit on the temples and columns of Upper India to a date anterior to the third century before Christ, and was enabled to read on the rocks of Cuttock and Gujaret the names of Antiochus and Ptolemy, and the record of the intercourse of an Indian monarch with the neighbouring princes of Persia and Egypt, he ascertained that, at the period of Alexander's conquests, India was under the sway of Boudhist sovereigns and Boudhist institutions, and that the earliest monarchs of India are not associated with a Brahminical creed or dynasty. These discoveries, which throw a perfectly new and unexpected light upon Indian history and chronology, and which furnish, in fact, a satisfactory outline of the history of India, from the invasion of Alexander to that of Mohammed Ghori, a period of fifteen centuries are only second in interest and importance, and we may add likewise in difficulty, to those of Champollion with respect to the succession of dynasties in ancient Egypt. These severe and incessant labors, in the enervating climate of India, though borne for many years with little apparent inconvenience or effect, finally undermined his constitution; and he was at last compelled to relinquish all his occupations, and to seek for the restoration of his health in rest and a change of scene. He arrived in England on the 9th of January last; but the powers both of his body and mind seem to have been altogether worn out and exhausted; and after lingering for a few months, he died on the 22d of April last, in the 41st year of his age. The cause of literature and archæology in the East could not have sustained a severer loss.

Lieut. Hunter's invention. The Germ.—We notice with great gatification the arrival at the navy yard in this city, of the experimental steam-vessel of lieut. Hunter in thirty two hours from Norfolk. The Germ, as she is most appropriately named, is propelled by lieut. Hunter's submerged propellers, of which our readers have before seen some notice taken in our columns.

We cannot too highly estimate the value of such an invention as this and of that of Ericsson, recently tested on the ship Neptune on her passage outward to Havana and homewards. Should they prove successful as we have for some time past believed they would, their value to the nation as a means of extinguishing effectually the whole steam armament of the ordinary construction of any nation which may attack us, will be beyond computation.

Too much credit cannot be given to the Secretary of the navy for the prompt manner in which he has sought to iecure to the country the benefits of these inventions, by sending an experienced naval constrctor (Mr. Rhodes) to New York immediately after the return there of the Neptune, that he might possess himself of the facts relative to the operations of Ericson's propellers during her trip, and by the means adopted to bring into the public service the invention of lieut. Hunter.

The Germ performed the trip from Gosport yard to Washington in 32 hours, a distance of two hundred and forty miles, or thereabouts—and making at times nine miles per hour.

This is but a *germ*, it is believed, of what she can do. The invention, it is beleived, will also prove invaluable to the inland commerce of the country, as no greater *wake* or *swell* is produced by the action of this propeller than by the motion of an ordinary boat, propelled by sails or otherwise, at the same speed.

The Germ is believed to be the smallest steam vesesl eversent to sea, being of but 9 feet beam at the water line, and of 50 feet in length, drawing but 2 feet water, and possessing 6 horse power. Her propellers are 5 feet in diameter, superficies of each paddle one half a square foot.

In passing through Hampton Roads agaist a heavy head sea and in the face of a strong N. E. blow, her ingine performed the usual number of revolutions, and worked as steadily as in smooth water, giving conclusive proof of the safety and fit adaptation of these propellers for sea navigation.

The well established fact, that the speed of a vessel is accelerated by an increased diameter of the paddle wheels, leaves no doubt that a vessel on lieut. Hunter's plan may be propelled as rapidly as one of equal size by the propellers now in common use.

This little steamer is indeed a "*germ*" of great promise. It was presented to the notice of the Hon. Secretary of the navy soon after he assumed the duties of office in March last, and by his characteristic discrimination, and promptness of action, he has, within the short period of three mohths, at trifling expense to the country, constructed and put in operation this vessel, and thereby practically tested this important invention.—*Madisonian.*

The Russian Musket.—A meeting of several military and scientific gentlemen took place at Chalk Farm, for the purpose of testing the comparative merits of the detonating musket, now about to be generally introduced into the British service, and that invented by the Baron Heurteloupe for the use of the Russian army. Though the day was wet and boisterous in the extreme, 160 rounds of ball catridge were fired from the Baron's gun in an inconceivable short space of time, without a single failure or hang-fire; and, indeed from the formation of the peice itself, which has the lock placed under the barrel immediately before the trigger, and which is futher by a most ingenious contrivance, completely secured from the action of the weather, the priming being contained in a continuous thin flat metal tube, impervious to moisture, and enclosed in the stock of the gun itself, rain or wet can have no effect on the action of a musket so constructed. It is however the composition contained in this tube, and the simple manner in which it is acted uqon, that gives the invention its great superiority over all other fire arms now used. The tube in question, which is about eight inches long and about $\frac{1}{8}$ of an inch wide, cotains detonating powder sufficient for these, primings, and is in the first place inserted in the body of stock, under the barrel.

A very simple mechanism causes the extremity of this tube to advance over a flat topped nipple and the cock which strikes it is so constructed as to cut from the tube that portion which lies over the nipple, and the hammer acting upon it almost simultaneously produces the discharge. Leaving out of the question the chemical merits of a composition which will admit of a part being cut off and exploded, without igniting the remainder of the contents of the tube, the mechanical merits of the gun as a military engine are extraordinary; it combines within itself all the *desiderata* of cheapness, strength, simplicity, certainty of fire in all weathers, and capacity for rapid execution, which are required in a soldier's weapon, and is as great an improvement over the common copper cap lock as that is over the old flint and steel principle. Many old officers have doubt that in a military point of view it is subject to many grave objections on the score of inconvenienc, to the soldier using it in wet weather, or with cold hands, from its liability to fall off and split when exploded, to the injury of the man standing next from its great insecurity from dampness, its chemical affinity for moisture. and its liability to be injured by hygrometric changes, not to mention its difficulty of management in the clumsy and awkward hands of a soldier acting in haste, under the excitement of fire. The whole of these drawbacks are said to be avoided in the Baron's invention, which, in the opinion of the military men present at the experiment, was by far the best adaptation of the detonating principle to the common musket that has yet been seen. We are informed that the gun in question has lately been submitted to the inspection of the Master General of the ordinance, with a view to its adoption in the British army. The recent experiments convince us that the Baron's invention can be applied to all fire arms, and it is without exception the greatest improvement yet accomplished.

Steam Pile Driver.—Messrs Pond, Higham & Co. the enterprising proprietors of the "Vulcan Iron Works" in this city have just completed a machine for driving piles which is to be sent out to Liverpool, England, from whence it was ordered by a company who have taken large contracts on the great Russian Railroad. This machine, which we saw in operation on Tuesday last, is worked by steam, and with half a dozen hands to manage it, is capable of performing the labor of two hundred men and twenty of the old fashioned pile drivers. We have not room to enter into a minute description of the manner in which it is constructed, and must therefore be content with saying, that it carries its own locomotive, sets up the piles drives them, and cuts them off at a proper grode, with a circular saw, thus preparing the road to recieve the rails as it progresses onward. It is a "yankee notion" which reflects great credit on the ingenuity and skill of the inventors and manufacturers, by whom it has been christened "*Brother Jonathan.*" It is most perfect in its action, and without doubt, will entirely supersede the pile drivers heretofore used in constructing railroads and docks in Europe, as it has already to a considerable extent in this country. —*Oneida Whig.*

The Frigate Essex.—The article on our Navy, in the Southern Review, detailing the enormous expenses of building and *repairing* our goverment ships, in these days, and the interminable lenth of time employed in their construction, reminded us of the buildmg of the ship Essex, in this city, in 1798—'99. This frigate was built, as our readers are aware, by a subscription of our citizens, and loaned to the goverment. The Salem

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Gazette, of October 1, 1799, says:—Such was the patriotic zeal with which our citizens were impressed, that in the short space of *six months* they contracted for the materials and equipment of a frigate of 22 guns, and had her completed yesterday for lauching. The chief part of her timber was standing six months, ago and yesterday she moved into her destined element."

We have no means of determining the exact cost of the Essex, and should be obliged, for information on that subject from any quarter. The whole amount of subscriptions, on the original lists, is $74,400.

Mr. Enos Briggs was the architect of the Essex. The sails were made by Messrs. Buffum & Howard, from duck which was manufactured here expressly for the purpose, by Mr. Daniel Rust. The cordage was manufactured by the late Capt. Jonathan Haraden, a distinguished private naval commander in the war of the Revolution.—*Salem Gaz.*

Accidents on Railways.—It it ascertained from, a late British puplication that the "the danger of loss of life, on average railroad trips, is about 1 to 4,000,000,"

In a report of the Utica and Schenectady railroad, company to the Legisislature, it is stated that for the four years and five months the company have been in existence, they have carried over their road 389,547 through passengers and 334,522 way passengers—(724,089 passengers, ending 31st Dec. 1840). It is not known that a single life has been lost during this period by the railroad, on this important throughfare.

The Great Western railroad in England, during the last 2 or 3 months, has run 29,200,000 miles, and carried 1,520,000 passengers, without any accident, fatal or otherwise, to a passenger from its opening. The Franklin Institute, after mentioning four other roads, states "Thus are added to our former hints from these five railways, only one of which is a large passenger line, 3,365,000 passengers carried on four only of the line, (29,575,000 miles,) without one fatal accident, and only 2 slight bruises fairly attributable to the railways; for we repudiate all accidents which the drunken or head strong ways of men violating order and rules, bring upon themselves. The account therefore, will stand thus:—about 256,000,000 of miles were run, and 14,000,000 of person carried, with only two fatal accidents upon the railway system.

Fossil Remains in Lenoir County, N. C.—Extract of a letter to the editors from John Limber, dated Strabane. Lenoir county, N, C., June 10th, 1839. This location was discovered by Mr. Richard Rouse, the owner of the land, when digging a dike to drain a bog. The location is near the snmmit level between the Neuse and North East rivers It is on a branch of the Neuse, three miles from it and at least one hundred feet above it, and about sixty miles west of Pamlico sound.

The upper stratum of earth is about three feet in depth, and is the common soil of the region, viz. a fine white sand and vegetable matter. The next stratum is of about the same depth, and is composed almost entirely of *shells*, of a great variety of species; and a still greater variety of sizes. These are cast together in every manner, lying in every position, and shells in shells. Next is a stratum of yellowish clay only a few inches in depth, and containing bones of enormous size. Below this is a stratum of black clay impenetrable by water; depth unknown. This also contains a few bones and in a more perfect state.

On the first of June I visited this location in company with Mr. Rouse, and in two hours we found bones enough for a load to transport home in our arms. Among them was a piece of a rib-bone about two feet in length, which measures three and a half inches in width, and about two and a half in thickness. We also found a tooth of a triangular shape, which is four inches across the base, and about five in length. Mr. Rouse informed me that he had found a part of a tooth, which must have belonged to one four times as large as the one I found: and that he had found a *vertebra* eight inches in diameter. Those bones are found in all the strata, but the largest are the lowest. Of the quantity of shells it may not be amiss to say, that there are millions of bushels, and they are beginning to be used for manure.

REPORT OF THE DIRECTORS OF THE BOSTON AND WORCESTER RAILROAD CORPORATION TO THE STOCKHOLDERS, June 7, 1841.

The directors have the satisfaction of stating, that the operations of the railroad, for the last year, have been carried on as successfully, and its prospects at the present time are as favorable, as at any period since its establishment. The passenger and freight trains, with a few exceptions, have run with a regularity which leaves little to be desired, and all the reasonable expectations of the public are believed to have been fully answered. In the amount of travelling and freight transportation, there has been a moderate increase, in comparison with that of preceding years, and the prospect of a further increase has been at no time more favorable. The condition of the road, of the depot buildings, except those in Boston, and of the motive power, is better than it has been at any former period.

Several important improvements, however, remain to be accomplished, and extensive preparations have been made for effecting them. The prospect of the early completion of the Western railroad, and the anticipated increase of business, on the accomplishment of that event, as well as the want of further room for the business of our own road, have led the directors to adopt measures for a large increase of the depot accommodations in the south cove, (in pursuance of a design which has been before announced,) both in the passenger and freight departments, and also for a further extension of the second track. By the union of the Western and Norwich railroad trains, with those running only to Worcester, the length of trains is frequently greater than can be accommodated in the present passenger building. For this reason, the plan has been adopted, and is now in progress of execution, of making a considerable enlargement of this building. Extensive buildings have also been erected, in the course of the last season for the storage of the increased number of passenger cars.

In the last annual report, it was stated that a negotiation which had been opened with the south cove corporation, for the purchase of land on the east side of Lincoln st., to enable us to remove the railroad track from a great part of Lincoln st., and to establish the depot buildings on the easterly side of that street, had failed. Since that time, by various negotiations with individuals who had become purchasers of the lands of the cove, several purchases have been made by the directors, which have enabled them to attain substantially, though in a different mode, the objects which they had contemplated in those negotiations. The passenger building is retained on the westerly side of Lincoln st., but the track is removed from a great part of the street, by being continued for some distance on the west side of it, and several lots of land have been purchased on the easterly side of the street, for the erection of an extensive warehouse for the reception of merchandize and the storage of freight cars. This building will be in the immediate vicinity of the buildings already erected for receiving trains of cars, and also with the engine house, machine shop, and wharf.

Further wharf room has also been procured for the landing of wood, and further space for the erection of wood sheds. These arrangements involve a heavy expenditure in the purchase of land, and the erection of buildings, but the directors deem it important to provide amply at the present time, while the lands could be purchased at reasonable rates, all the accommodation likely to be required for many years to come, and to leave no room for just complaint of the insufficiency of the accommodation. The building proposed to be erected for the reception of merchandize, will be four hundred and fifty feet in length, and one hundred and twenty in breadth, and adapted to the reception of merchandize and trains of freight cars. On the land east of Utica st., it is proposed to erect wood sheds sufficient to receive all the fuel which it will be deemed expedient to keep on hand, for such period as is necessary to give it a proper seasoning for use.

The experience of the advantage derived from that portion of the second track which is already laid, and the anticipation of a greater necessity for it when the line of railroad shall be extended to Albany, have induced the directors to take measures for extending that track during the present summer, a further distance of twelve miles, reaching from Needham to Natick and from Hopkinton to Westborough. Care has been taken to take advantage, as far as possible, of the experience which has been acquired on the various railroads already in operation, to adopt a form of rail and chairs, as well as a method of laying the rails, which will give the greatest practicable degree of smoothness, firmness and durability to the track. Considerable progress has been already made in the preparation for laying this track, and a part of the iron, which proves to be of excellent quality, has arrived from Liverpool.

These additional works will render necessary a further increase of the capital stock of the corporation. In conformity with the vote of the stockholders passed at their last meeting, the directors applied to the legislature at the last session, for an act authorising the creation of a further capital stock, which act they now lay before the stockholders for their acceptance. They recommend to the stockholders the creation of three thousand additional shares, which they compute will be sufficient to meet the expenditures proposed to be made the present season. The additional act thus obtained, besides authorizing an increase of capital, also authorizes the directors to take any land which may be necessary for widening the track, not exceeding five rods in width, in the same manner as they were authorized to do on the original laying out of the road. This authority may prove useful, in admitting of the widening of the road in certain places, where a wider space for the deposite of snow is found desirable.

It becomes our duty in recounting the principal transactions upon the railroad of the current year, to allude to a disaster, which occurred a few days subsequent to the making of the last annual report, of a more serious nature than any which had occurred since the opening of the road, and the only one which has happened during that period, now seven years, by which any passenger has sustained any personal injury. We allude to the accidental and unexpected meeting, on the 17th of June last, of two trains of cars conveying passengers upon the same track, and the consequent violent collision, by which both engines and several cars were much shattered, and fifteen or twenty passengers were injured, several of them seriously. Fortunately, no lives were lost, and the directors have endeavored to make such satisfactory compensation, as the nature of the case admitted of, to the parties injured. An adjustment has been made, by mutual agreement, with all the parties who have claimed any compensation for injuries sustained, except two, which are yet unsettled. The accident happened in consequence of an attempt, on the occasion of an extraordinary assembling of the population of the State at Worcester, to comply with the expectations of the public, and to afford a much greater degree of accommodation, than the ordinary means of the establishment were adapted to furnish. The demand for seats on that day was more than tenfold the number demanded on ordinary days, and under circumstances which would have occasioned serious disappointment to the applicants, if the demand had not been supplied. To meet this demand, required the organization of a new system of movements for the day, and the employment of agents, many of whom had not become familiar by practice, with the specific duties assigned to them. The system of arrangements made by the superintendent was judicious, sufficiently simple, and apparently safe and easy of execution. It so happened, however, that, in consequence of the overloading and consequent retardation of one of the trains proceeding to Worcester, it was not able to reach the Grafton station at the appointed time, and therefore according to instructions, should have waited at the next preceding station. A returning train arrived at Grafton at the appointed time, and not finding the upward train, it should have waited for a specified period, and then have proceeded with caution. Both the responsible conductors, from a misjudgment of their instructions, and under the impression that the other was to stop, proceeded at the usual speed, and thus produced the unfortunate collision, which, if either, or both had waited for the specified period, and then proceeded with caution, could not have occurred.

The error did not appear to be the result of rashness on the part of either but of want of judgment or due reflection for the moment, arising from the novelty of their situation, the exeitements of the occasion, and the rapidity with which their respective duties followed one another. Although these circumstances afforded great palliation for the error of the agents, in the judgment of the superintendent, in which the directors concurred, they did not excuse it, and they were both discharged from the service of the corporation. The directors were not able to perceive any defect in the system of arrangements, which it would have been practicable to avoid, unless by declining to afford that degree of accommodation which was expected from them by the public. This, of course, they would have declined, had they forseen any serious danger in the arrangements which were made, arrangements which were, in fact, as easy of execution as those of every day's service, with the exception of the want of practice, and familiarity with the routine of duty, on the part of the agents.

This accident, besides the immediate injury resulting from the collision, and the interruption of the two trains, disturbed the system of movements of the other trains for the rest of the day, and although those trains brought back to Boston several thousand passengers on that day and evening, a large number were disappointed. It also subjected the corporation to considerable pecuniary loss, in the sums which have been paid in damages to the parties injured, and in the injury to the engines and cars. Besides the wreck of the two engines which came in collision with each other, a third was disabled on the same day.

The present locomotive force of the corporation consists of thirteen engines. Four of these, built in England, and purchased before the railroad was opened to Worcester, after six or seven years' service, are nearly worn out, and they are besides of too light a construction to be adapted to our presetn use, in consequence of the increased weight of the trains since the opening of the Western and Norwich railroads, and the adoption of the heavy, long cars. These engines have, therefore, been but little relied upon for the last two years, for the ordinary passenger and freight service, but they are yet of value for occasional use, and for service on the gravel trains, which are employed in repairs of the road. There are besides, nine efficient engines, one of which, the Yankee, is seven years old, and the others have been in service for different periods, from one to five years.

These engines were all purchased previous to the last annual meeting, and were described in the report of the first of June last, with the exception of one, which was purchased in consequence of the accident of June 17th, and was placed on the road in July.

In reference to this subject, it may be expected that the directors should take some notice of the report of a committee of the stockholders, appointed at the last annual meeting, which was presented at an adjourned meeting, and was referred to the consideration of this board. In that report, the committee undertook to assign the causes why the dividends of this company have not yet exceeded six per cent., a rate which, the say, appeared to them altogether too low, compared with the reasonable expectations of the stockholders, and the eligible position of the road, and which accordingly they imputed to mismanagement on the part of the directors. In prosecution of that undertaking, they went into a long detail of statements and arguments, to show the nature and extent of that mismanagement. They remark, "they have ascertained two causes which, in their opinion, account for the deficiency of dividends, viz. the great expense which, in the present state of the locomotive and depot departments, is incurred in transportation, and the important fact, that the route does not command the business of the country within the natural influence of the road and its branches." They go on to represent the locomotive establishment as entirely inefficient, the engines are described by them as of antiquated patterns, deficient in power, and decrepid for want of repairs, although, as they state, $35,000 had been expended in repairs since the 1st of January, 1838. They say that "the Worcester road is quite behind the age with respect to the power and capacity of its engines." Such was their impression of the inefficiency of the engines, that they make the following recommendation: "Your committee are persuaded, that at least six new engines are required immediately, and would recommend their immediate purchase, as most essential to the success of the road, and would also recommend that no attempts be made to repair most of the engines now in the infirmary, and that for the future, no new engines with crank axles, or mounted on four wheels only, be placed upon the road, and that two of the new engines should be freight engines of superior power."

In regard to these representations, the directors owe it to themselves and to the stockholders to say, that they are entirely disproved by the actual condition and the effectual and regular service of all the engines which have been in the employ of the corporation. The course pursued in the selection of engines, in reference to size and general construction, in the method of management, and the mode of making repairs, is similar to that adopted on the Providence and Lowell roads. In the arrangement of a machine shop, and other facilities for repairs, our establishment is believed not to be inferior to theirs, or those of other roads in the country. The committee themselves speak highly of the ability and intelligence of our machinist, under whose immediate direction all the repairs are made. It might be presumed, therefore, that there would be no very material difference in the cost of repairs of engines, in the different establishments, in proportion to the distance run by their respective engines, except such as might be called for by casualties to which all are liable. On reference to the annual returns made to the legislature by the other companies above named, it will be found that although there is a good deal of variance in the repairs of different years, arising, probably, from casualties, the cost of repairs for engines and cars on the Worcester road, whether the comparison be made of the last year's return, or of the aggregate of all the returns for four successive years, does not exceed that on either of the other roads. The distance run annually on the Worcester road, is much greater than on either of the other two. In the year 1840, the distance run by locomotives with the passenger and freight trains alone, was 152,725 miles. The cost of repairs of engines, including that occasioned by extraordinary casualties was $10,815, and for engines and cars, $16,667. The distance run during this year on the Providence, and also on the Lowell road, was less by a quarter part, than on the Worcester road; and the cost of repairs of engines and cars on the former was $16,755, and on the Lowell, $14.455. These comparisons are not made for the purpose of claiming any superior skill or economy over those skilfully and judiciously conducted establishments, but simply for the purpose of rebutting the charge that we are behind the age in our system of management, and of showing that there is no extravagant or unusual expenditure in the repairs of our engines. A further comparison with the experience of other railroads in this country, and in England, if it were necessary to pursue the inquiry, would afford further proof to the same effect.

The degree of efficiency of several engines is easily tested by reference to the records of their daily performance. From these records a table has been prepared, and is annexed to this report, which shows the actual performance of the eight engines, which were employed in the passenger and freight service, during the twelve months ending on the 1st instant, and exhibiting also the cost of repairs upon each during the year, with the dates at which each engine was placed upon the road. The statement of repairs embraces in addition to those expenses which are charged specially to the several engines, an apportionment of the general expenses of the machine shop, which go into the aggregate cost of repairs, so as to exhibit as nearly as is practicable, not only the relative, but the entire cost of repairs of each of the engines.

It will be seen by reference to this statement, that the engine which has performed the most duty is the Meteor, built by the Locks and Canals Co., at Lowell, in 1839. She has run in the course of the year, 29,721 miles with a cost for repairs of $617. The performance in the preceding six months was somewhat greater. This whole distance was run at an average, and nearly uniform speed, of more than 20 miles an hour on the passenger trains, and some part of the time on the steamboat train. She is of the same pattern and size as the oldest engines which we have in use.

(To be continued.)

THE EASTERN MAILS,—ONCE MORE.

So much censure has been cast upon the Directors of the Rochester and Auburn railroad company, by some of the papers in this city, as well as in those at Batavia and Buffalo, because the Company would not convey the mails, when the Post Office Department had refused, or at least neglected to give them a contract for so doing—that we consider it due in justice to the parties, to give the following statement of H. B. Gibson, Esq., the President of the Company, to our readers. We copy it from the Ontario Repository of Wednesday. The Rochester paper alluded to by Mr, G, is the Evening Post—which has since, it is proper to add, withdrawn its charges against the company.

"CANANDAIGUA, July 6, 1841.

"SIR,—My attention has been called this morning to two newspaper articles—one in a Rochester, and the other in a Buffalo print—concerning the conduct of the Auburn and Rochester railroad company in respect to the transportation of the mails. In reference to these articles I have only to say that, so far as they reflect upon the company they are unjust, and I presume they would not have found a place in those journals had care been first taken to ascertain *facts*.

I am requested to furnish a statement of the facts in connection with this business, and comply with this request as fully as the short time before your paper goes to press will allow.

In the month of March last, the Auburn and Rochester railroad was so far advanced as to authorize the anticipation, that, by a vigorous prosecution of the work, it would be completed from Rochester to the Cayuga lake—certainly to Seneca Falls—in the early part of the present month, and to Auburn during the coming fall.

In view of this the company, in the latter part of March, despatched Mr. Higham, the Engineer of the road, to Washington, clothed with full authority to propose and contract on behalf of the company for transporting the United States mails between Auburn and Rochester for the next four years.

On reaching Washington, and stating his objects, Mr. Higham was informed by the head of the post office Department that he was not then in a situation to receive proposals from this company, and was requested to suspend making them, until the objections to making them at that time were removed, of which the company would be duly advised. The agent, therefore, left Washington, without closing a contract.

No communication was received by the company from the post office Department between this time and the 23d day of June. On that day the Executive Committee of the Board of Directors—having incidentally heard that the objection to receive proposals from this company was removed—instructed me to make a proposition to the Post Master general to carry the United States mail between Auburn and Rochester twice a day for eight months and once a day for four months in each year, for four years, at $14,000 per annum, being about $175 per mile (it being understood that that was the rate per mile paid for transporting the mails on the railroads between Utica and Auburn) the company to receive and deliver the mails at all the numerous post offices now established, or which might be established on tho route during the four years.

On the following day, the 24th of June, I addressed the Post Master General, transmitting this proposition. On the 26th—same month, I received a letter dated from the contract office of the department 22d June, and signed by S. R. Hobbie, stating that the Post Master General had come to the couclusion to offer $150 per mile for the daily and twice daily conveyance of the mails from *Canandaigua* to Rochester.

Immediately on receipt of Mr. Hobbie's letter, I answered it by referring him to the proposition of the company to transport the mails from *Auburn* to Rochester, transmitted to the Post Master general on the 24th of June. To this letter I received the following answer:

POST OFFICE DEPARTMENT, CONTRACT OFFICE,
June 30, 1841.

Sir,—Your letter of the 26th inst. is received, your previous communications to the Post Master General being already on file.

"The amount offered in my letter of the 22d inst., is, I am instructed by the Post Master General to say, the highest compensation he can give upon route 1119. Route 1061, Auburn to Canandaigua, has been let to contract by J. M. Sherwood, Esq., at something short of $150 a mile per annum for the whole term.

Very respectfully your obed't serv't.
S. R. HOBBIE,
First Assistant P. M. G.

Henry B. Gibson, Esq.,
President of Auburn and Rochester railroad company, Route No. 1119 *is from Canandaigua to Rochester.*

The foregoing statement presents all the correspondence and negotiations between the Department and the company on the subject of transporting the mails. That the company is not now transporting them from Auburn to Canandaigua, is not owing to the demand of any extortionate or unreasonable price. No such demand has been made by the company. No response has ever been received from the department to the proposition to carry the mail from *Auburn* to Rochester, except by the information contained in Mr. Hobbie's letter, that the ronte from Auburn to Canandaigua was let to Mr. Sherwood for four years. The company has not been advised by the department whether the price proposed for carrying twice a day through the whole route, was acceptable or not. The difficulty, therefore, has not arisen out of any disagreement about price, but from the fact that the Canandaigua and Auburn route has been let to another.

The department has, it is true, made a distinct proposition to the company to transport the mails from *Canandaigua* to Rochester. But it must be obvious to every body that the company cannot make such a contract, and perform it, without such a detention of the travelling public as they would not, and ought not to submit to. The railroad is now in operution from Seneca Falls to Canandaigua, and will be finished through to Auburn in a few months. The mails will be brought from Albany to Auburn by railroad; on their arrival the Auburn and Rochester cars will receive the passengers and bring them in a few hours to Canandaigua, whilst a post coach will take the mails and bring them along the same route. Several hours detention would be necessary at Canandaigua for the coaches to arrive with the mails, so that the company could take them on to Rochester. Neither the interest of the public or the company will admit of such delay.

The company has done every thing in its power to agree with the department upon terms for carrying the mails *through the whole line of its road,* and if these efforts to accommodate the public and promote its own interests have been unsuccessful, it is not the fault of the company.

As to the charge of illiberality so unjustly brought against the company, it may be better appreciated when the fact is known that they have transported the mails between Rochester and Canandaigua during the most of the time their road has been in operation, without asking or receiving any compensation whatever.

It is not my purpose to censure any one in connection with this business; the object of this communication being purely defensive and as called for by my official relation to the company.

HENRY B. GIBSON.

President of the Auburn and Rochester Railroad Company.

RAILROAD BETWEEN ROCHESTER AND LOCKPORT.

SIR:—I take the liberty, through your columns, to ask the public attention to a recent act of the legislature, authorising the Lockport and Niagara railroad Falls railroad company to extend their railroad from its eastern termination in Lockport to the city of Rochester, or to the village of Batavia, as the company may hereafter determine. The importance of this communication over one of the routes designated in the act, becomes sufficiently evident on even a slight examination of the subject. The proposed extension, on either route, will supply the last link in a continuous chain of railroads from Albany to Buffalo via. Niagara Falls, and from Lewiston, at which point the main current of Canada travel crosses the Niagara river, and which is destined to become the main line of communication with the immense region lying north of lake Erie and west of lake Huron.

Each of the proposed routes from Lockport, east, has its peculiar advantages. From Lockport to Batavia the ground is very passable, and will not exceed 30 miles, being about half the distance of the contemplated route to Rochester. A connection may thus be formed between the Lockport and Niagara Falls railroad and the Tonawanda railroad at its western termination in Batavia. If the citizens of Batavia, and the Tonnawanda railroad company who are now urging the extension of their route on a direct line from Batavia to Buffalo, will abandon that project, and unite with the Lockport and Niagara Falls railroad company in connecting those roads, by an extension from Batavia to Lockport, making this the main avenue of travel from Albany to Buffalo, there can be little doubt that the interests of both companies and the public convenience might be greatly promoted by such an union. It may indeed be objected that the route is more circuitous and the distance to Buffalo will be thereby increased about thirty miles. But this increased distance when measured with railroad speed, becomes a trifling matter, hardly worthy of serious consideration. To compensate the travelling public for the loss of an extra hour or two, they may gain a passing view of the falls of Niagara, and may enjoy a route of unequal beauty and interest. The advantages of a connection with Lockport, a town now containing a population of 6,000, rapidly increasing, are too obvious to be overlooked. Whether these considerations will lead to concert of action and unity of purpose between the two companies remains to be seen.

From Lockport to Rochester, two routes are presented, containing many attractive features with great and substantial advantages. One of these, is the route along the beautiful and celebrated ridge road, which has been admirably graded by the hand of nature. It is mainly a gravelly formation, of all others the best adapted to railroads.

Another and a shorter route may be found along the Erie canal, which is a water level (known as the Genesee level,) from Lockport to Rochester. It is doubted if a more favorable line of equal length can be found on the globe. The cost of grading over so level a surface will be trifling as compared with other railroads. The length of the road by this route may be less than sixty miles; and it secures a communication with Brockport, Holly, Albion, Knowlville, Medina, Middleport, and the numerous smaller villages with which the line of the canal is studded. Many citizens of those villages take a deep interest in the project, and offer to aid in its accomplishment. By this route a direct connection may be formed with the Auburn and Rochester railroad at Rochester, and a communication may be opened which cannot fail to become a favorite and crowded thoroughfare.

I intend on another occasion to pursue this subject, and to consider its importance in connection with the western and Canadian travel, and the probable income to be derived from the work as an investment of capital. The hundreds of passengers now passing daily on canal boats would alone be sufficient to furnish ample revnue for a railroad.

Measures have been taken by the Lockport and Niagara Falls railroad company, for the survey of each of the routes above referred to. Mr. Julius W. Adams, an able, experienced, and highly accomplished engineer, recently engaged on the Western railroad, has been engaged for this service and has already commenced the necessary explorations. He will proceed to complete the survey as speedily as practicable, when he will report upon the several routes and their comparative advantages in respect to facility and cheapness of construction.—*Lockport Democrat.*

The New Jersey Railroad, has declared a dividend of 3 per cent., payable on the 26th inst. As a proof of the revival of business intercourse in the community, and as a testimony, though not conclusive, in favor of the policy of reduced prices, in an active commercial society, we annex the following statistics, furnished us from the books of the company. The statement, it will be perceived, embraces the first six months of the years 1839, '40, and '41: and affords a comparative view of the travelling of the railroad, during those periods. We cannot forbear noticing with satisfaction the growing intercourse between our own towns and villages, which previous to the facilities now enjoyed, was almost as restricted and infrequent, as with foreigners. It is also satisfactory to observe that the State receives from $8,000 to $10,000, in transit duties.—*Newark Daily Advertiser.*

STATEMENT of passengers carried on the New Jersey railroad for the first six months of the years 1839, 1840 and 1841.

1839—*January 1st to July 1st.*

Between New York and Newark, - - - -	72,675
" " Elizabethtown, - -	4,581
" " Rahway, - - - -	7,320
" " New Brunswick, - -	14,769
Between Newark and Elizabethtown, - -	2,582
" " Rahway, - - -	2,149
" " New Brunswick, - -	1,947
Way passengers to and from places between Elizabethtown and New Brunswick, - - - - -	3,192
Total passengers, - - - -	192,215

1840—*January 1st to July 1st.*

Between New York and Newark, - - - -	77,457
" " Elizabethtown, - -	6,733
" " Rahway, - - -	8,973
" " New Brunswick, - -	14,091
Between Newark and Elizabethtown, - -	4,475
" " Rahway, - - -	1,682
" " New Brunswick, - -	1,870
Way passengers to and from places between Elizabethtown and New Brunswick. - - - - -	2,723
Total passengers, - - - -	118,004

1841—*January 1st to July 1st.*

Between New York and Newark, - - -	123,966
" " Elizabethtown, - -	11,674
" " Rahway, - - -	9,750
" " New Brunswick, - -	15,144
Between Newark and Elizabethtown, - -	6,093
" " Rahway, - - -	2,156
" " New Brunswick, - -	2,452
Way passengers to and from places between Elizabethtown and New Brunswick, - - - - -	3,846
Total passengers, - - - -	175.081

The number of passengers carried in the Philadelphia lines, for which a transit duty of 8 cents each, is paid to the State of New Jersey:

1839—January 1st to July 1st, - -	35,320
1840—January 1st to July 1st, - -	36,477
1841—January 1st to July 1st, - -	44,299

THE CENTRAL RAILROAD.—We learn that the company has contracted with an enterprizing and responsible citizen of Macon, for laying the superstructure on this road, from the Oconee to the Ocmulgee river, and furnishing all materials except iron, and that the contractor will soon enter on the performance of the work. The amount of this contract is about $80,000.

It will be recollected that the grading of the whole road to Macon, was let, in December last, and we have the gratification to state, that all the contractors for grading are pushing on their work with spirit.

The whole road, therefore, is under contract, on terms entirely within the compass of the company, and nothing now remains to secure the completion of the road but the purchase of about 3,000 tons of track iron, which will cost the sum of $150,000. We believe, that the company will find no difficulty in obtaining a loan for this small amount, during the ensuing season of business; but even if times continue hard, we do not doubt that there are citizens of that section of Georgia, immediately interested in this great enterprise, who will subscribe the required sum.

We express with pride, the firm belief, that by the first day of January, 1843—the road will be in operation its whole extent, a distanee of 190¼ miles. It was commenced in October, 1836, under a charter which allowed for its completion a period of eight years. The next crop will be transported from a point near Sandersville, distant 135 miles from this city.—*Savannah Georgian.*

Durable Railways.—This important desideratum in the construction of railroads, has at length been attained, so that not merely an "iron ribbed" road, but the entire superstructure of that material may now be considered as practicable. This improvement combines economy, durability, and beauty, and is the invention of Mr. J. Spaulding and Mr. Isherwood, practical engineers on the New York and Erie railroad. Two arches, of two feet each, of this invention, is now in use on the Ithaca and Oswego railroad, half a mile west of this village, over which the regular trains pass every day. It has also been subjected to severe tests, and a single arch sustained a pressure of more than twenty tons. We understand that a branch road from Factoryville, in this county, to the Pennsylvania line, four miles in length, is forthwith to be constructed on this plan, and the castings are now being made. This invention is of the greatest importance. It will produce an entire revolution in the construction of railroads, as it can be built cheaper than the common mode, and its durability is beyond computation. It will open a new market for the immense beds of ore with which our country abounds, and obviate the necessity, now unavoidable, of depending upon England for rails. All who have examined the piece in operation, are struck with its simplicity, beauty, and strength—its advantages are incalculable.—*Owego paper.*

Steam Bridge.—The St. Louis Argus describes the following: "A striking use of the steam engine has been adopted at Portsmouth, Missouri. It is a floating bridge, seventy feet long, and sixty feet wide, impelled by two engines of twenty horse power, and making the passage (2,200 feet) at the speed of about 350 feet a minute. The bridge draws, with all its machinery, but two feet. This capital invention will naturally supersede the awkward contrivances of bridges of boats on the great Europern rivers, and will not improbably obviate the formidable expense of building bridges, and must greatly facilitate communication in colonies and new settlements in every part of the world."

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AND

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OBSERVATIONS UPON THE COMPARATIVE ADVANTAGES AND INCONVENIENCES OF THE EMPLOYMENT OF IRON WIRE, OR BAR IRON, IN THE CONSTRUCTION OF SUSPENSION BRIDGES OF GREAT SPAN.—*By M. Le Blanc*, Chief Engineer of Bridges and Roads.

Second objection.—The imperfection of the present process for manufacturing the cables does not allow of an equal tension in all of the wires, so that when the cable is raised to its place the wires under most tension are overstrained by many pounds, while those under the least tension do not draw at all.

This last objection is a serious one, and cannot be absolutely done away with, that is to say, it is impossible to prove that this defect does not deserve the most serious attention; but we can employ, in defence of iron wire, negative arguments, or in other words we can prove that it is not possible to resolve the problem of equal tension in a more perfect manner by the system of chains than by that of cables of iron wire.

We must in the first place distinguish carefully between bridges of large or small span; in the latter, where the tension requires only a section of the chains equal to that of 4 to 8 bars of about 0·05 metres to 0·06 m. in diameter, (4) (dimensions beyond which the quality of the iron becomes considerably deteriorated,) we can establish on each side of the bridge two or four separate chains in one or two layers, each chain being made of a single bar only; in these two cases the problem of equal tension is perfectly resolved, and although in the second each suspension rod bears upon two

(4). I reason on the supposition of the use of round iron, of which I need not prove the superiority over square iron, that is hammered again after being re-heated to a cherry red.

chains which cannot have exactly the same curvature, the holding plate of the rods will always bearm upon the two chains which will then support equally their share of the whole weight of the bridge.

By establishing three or even four layers, we can form an excellent system of sixteen chains, each made of a single bar, but these sixteen chains present only a total section of less than 44,000 millimetres corresponding to a tension of 352,000 kilogrammes, that is to say, to bridges of medium span, but if we pass to bridges of such a span that the tension increases to more than a million of kilogrammes, it will be necessary that the chains should be composed of forty-eight or even sixty-four bars—that is, 24 or even 32 bars on each side.

Let us consider the last hypothesis, which applies to the case of the bridge of Roche Bernard.

It is impossible to employ the simple system of suspension rods resting upon a couple of chains, of single bars, and arranged in layers, for we would then have 16 of these layers, one above the other, which, beside the inconvenience presented by a considerable height, would allow of the attachment of suspension rods only at every sixteen intervals upon the same chain.

Here then it is necessary to employ a more complicated system, namely to form the chains of several bars fastened together by a single bolt—in this case I would reduce the number of chains to eight, and form them of eight bars, fastened by one bolt(5).

We can double the number of chains and so reduce to 4 the bars in each, by making each rod rest by means of plates upon two chains at once, but if the two chains forming the couple are not in the same plane, the upper plate of the rods will bear only upon one of the chains—for it must remain parallel to the plane of the four bars—and one half of the system will support nothing: this disposition is too faulty to be adopted—this is my opinion in the hypothesis of eight bars to each chain and fastened by one bolt.

Whatever may be the manner of forming the eye at the end of the bar, either by welding it to the end itself, or by bending over a portion of the bar, it appears to me very difficult to prevent differences in length of at least a millimetre between the bars.

Now if there is this difference between bars, 5 metres in length, the shortest must lengthen a millimetre, or ·0002 of their length before the others draw.

But we know that a tension of two kilogrammes per square millimetre of section produces upon a bar an elongation of ·0002 of its length.

(5). I suppose it would not be desirable to employ more than four layers—this number is already considerable and troublesome in the passage over the towers and in the moorings.

The bars then of which we are now speaking, are strained to the amount of 4 kilogrammes (per sq. millimetre) before those beside them suffer any tension; what will this amount to if the differences in length are more than one millimetre?

We see then that the problem of equal tension is as difficult of resolution for a complicated system of chains as for iron cables, for supposing that in the two systems, the excess of tension, either of one wire over another, or of one bar over another, is the same, this excess will be a much smaller fraction of the absolute strength of wire than of bar iron; moreover, the manufacture of cables afford a greater hope of perfection than that of chains(6).

We see now that the second objection has no more weight than the first, to decide us in favor of wrought iron chains.

On the other hand, there are objections against the employment of bar iron more difficult to remove, and which will give additional strength to the reasons which have induced me to yield the preference to iron cables.

These objections are as follows:

1st. The greater part of chain bridges which have fallen have given way at the bolts which unite the links. Now it is extremely difficult to calculate the strength which should be given to them, as we do not perfectly understand the manner in which they resist the strain; if we compare them to bars placed upon fixed bearing points, and charged with a weight in the middle, and the resistance of which is derived from a formula $P=M\frac{ab^3}{2c}$, we find the dimensions very small, too small indeed, according to many expriments.

If we suppose them to resist as if drawn in the direction of their length, (and many constructors admit this hypothesis,) we arrive at large sections, which greatly increase the weight of the joint; besides this we have no certain information as to the quality of the iron which they need, it should not be so soft as that of the chains, because no curvature is required, but still it should not be brittle; to avoid mistakes prejudicial to the durability of the work, it is wise to make them rather too strong than too weak, but as I have just said, an increase of weight is the consequence of this precaution.

2nd. The making of the eye requires great attention; it has been observed that when the bolt is too little, during the proof, a rent takes place from the outside to the inside of the head of the eye;

(6). To make the bars as equal as possible, we can indeed, after having bent and welded the ends, drill through all of them which make up a link of the chain, when cold; but it is evident in this case, that to prevent the drilling from diminishing the strength of the eye, we must either give greater size to the bar in this part or flatten it, involving a heating which injures the quality of the iron.

when the bolt is too large the rent opens from the inside toward the outside. Now, as it is almost impossible that the work of man should be perfeet, in order to avoid the inconvenience above mentioned, several constructors have proposed to swell out the head of the eye in order to give it greater strength, but to do this we must re-disturb the particles of the iron by hammering after having heated it, an operation which I have already designated as faulty.

3rd. During the oscillatory motions, which take place in all suspension bridges, the irons rub forcibly against each other at all the joints, and this tends to wear them in those parts which have the greatest strain. This inconvenience does not exist in wire cables.

4th. In the moorings we are compelled to use curved irons, which have of course been re-heated and are most often squared, this new heating, and the difficulty of proving them, obliges us to give a greater size, which involves another increase of expense(7).

5th. In very cold weather iron becomes brittle; wire enveloped in grease and not in immediate contact with the air, must be less brittle than naked bars of iron.

6th. Cables in bridges of great span, can be much more easily raised to their places than chains. In the proposal for the bridge of Roche Bernard, I have calculated that the weight of a cable would be 7,968 kilogrammes, while each chain would weigh 31,496; a work equally difficult it may be said, has been executed at the Menai bridge, but if this proves that it is not impossible, it does not prove that it is not very difficult.

M. Vicat has asserted that wires before breaking, suffer a considerable elongation, which announces the rupture beforehand, and thus gives time to make the necessary repairs, while chains break instantaneously.

This advantage of iron wire has been disputed in the case of wires united in bundles by ligatures, and the interstices of which are filled by grease; M. Frinot thinks that these bundles form a brittle system; he doubtless would like to say, as brittle as bar iron. In support of his opinion he has cited the *herse*, a sort of skein of hempen thread, which has most strength when its elements are free, and looses part of it as soon as the loose threads are bound together, and approximated to the condition of ropes; if this assertion is confirmed by experiments, and I have prepared some for this

(7). There are, for instance, some red shear (hot short) irons which loose nothing by being wrought at a white heat, but which are injured in quality when wrought at a less elevated temperature. But the workmen cannot confine themselves to fulfill these conditions exactly, whence it happens in irons, which have even been proved, that the re-forged portions become bad, and consequently that only the final proof can give evidence of this imperfection, but as we have just said, it is very difficult to prove curved bars.

purpose, cables will in this point of view, be neither worse nor better than bar iron(8).

Third objection.—Cables form a less rigid system than bars of wrought iron, so that the horizontal vibrations of the roadway are much greater in the former than in the latter.

For equal curves and weights this is true, but when we have once given the preference, even in point of durability, to wire over bar iron, (and I confess I have done so,) will we not gain more by increasing the rigidity by means of the greater weight of heavier timbers for the roadway, and by diminishing the curvature of the cables, or the tension which they should bear per square millimetre of section—than by substituting chains for cables?

These latter likewise admit of an arrangement which cannot be adopted for chains. I refer to the cradle form, and in this case the outside cables being in a plane, inclined from the vertical, have a tendency to draw the whole roadway towards them, and as this takes place on both sides, it follows that the roadway is kept in its position better than it would be by means of stays.

I offer these reflections to the readers of the *Annales,* as the result of perfect conviction, in my own mind, after deliberate consideration, and I can indulge the hope that this conviction will be shared by at least a small number of my associates. I shall examine in a subsequent article the advantages and inconveniences of a diminution of curvature, and the defects in the proof which chains and cables undergo either before or after being placed.

We beg leave to call the attention of our readers to the announcement on our cover, of the publication of a work entitled "*Sketch of a Railway, judiciously constructed between desirable points.*"

This volume contains the largest body of Railway statistics ever collected in the same space, and possesses this advantage, it is expressly calculated for the wants of our own country, while the whole railway experience, both foreign and domestic, is brought to bear upon the present state of public improvement.

This work has been prepared by one of the most zealous friends

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(8). M. Lauraut recently attended to the work of the bridge of Roche Bernard, has given me some details in regard to the *herse* which can explain the objection of M. Frimot. The *herse* is made by laying the threads in a circle, and if they are perfectly parallel and evenly stretched, the inside ones are shorter than those outside; if ligatures are applied, and the *herse* is drawn out as it must be to lift or pull loads, we see that the threads of the bundle which from being circular are now straight or even bent in opposite directions—the outside threads then must be thrust up together, while the inner ones, if they do not stretch, must break; without the ligatures there would be a compensation between this lengthening and shortening, so that they actually injure the strength of the bundle, but it is the change of form and not the ligature which is the cause of the evil, and the *herse* bound, or not bound, would have the same strength, if it retained its primitive form, as is case with cables of wire.

of internal improvement in the United States, who has with unweared diligence and scrupulous accuracy, collected and prepared whatever could be found upon the subject.

The peculiar position of affairs at the present day is bearing with increasing effect upon the subject of railroads as a means of national convenience and private investment. A real service is therefore rendered to the community by the writer of this volume, to whose correctness and knowledge of the subject we most cheerfully give our testimony.

As a manual of information, this "Sketch" should be in the hands of all interested in public works.

We give the following abstract of the notes which will convey to the mind of the reader a very fair idea of the extent and variety of the matter treated of, and at the same time place at once before him the result of some of the more important calculations.

ABSTRACT OF POINTS, ILLUSTRATED BY THE NOTES.

As the notes in fact contain the real matter explanatory of the railway in itself, and as it compares with the canal and navigable river, a ready reference to each particular point explained by them, will be most likely to attract by not wearying the attention of the reader on this dry but important subject. The following abstract is to effect that object, and being enabled to get at once to any one point of particular interest, his curiosity may be further aroused and quickened into a gradual examination of them all. He will then be able to judge what little foothold of truth, the present condition and future prospects of the railway, can yet have in the public mind, and how much it needs investigation. Our present attempt is not offered as anything more than an Index by which that desirable object will be assisted and promoted, and it will have answered its purpose, if it but lead others to an abler and fuller exposition of the subject.

In impugning any of our statements, care only must be had, not to be misled by single instances of opposite results, and to be sure that the things compared are alike, as our positions are founded on the working of a *modern road with modern equipment*, to which those of older date have but little or no analogy. The variance in working different roads may be recalled to the reader by the two extreme cases before cited by us.

Georgia R. R. 105 ms., did its business in 1840 for 60 cts. pr m. run.
Bos. and Wor. 45 ms., " 1339 for \$2 "

And why this difference? Because the first is of the most economical length, the price and quality of fuel south, puts the motive power at half cost nearly, and slave labor is also cheaper. Thus will every road vary, one way or the other, and 75 cents per mile run, may be taken as a fair average, to cover all expenses, save interest on capital. No road will be found to fall more under that average than the Philadelphia and Pottsville.

1. Oliver Evans in 1789, and Col. John Stevens in 1812, were among the first to direct their attention to railways in the United States.
2. The performances of several locomotives, given to show their power on a level, to be equal for 11 ton engine to a gross load of 500 and a nett load of 300 tons. Also a calculation of expense, running a locomotive between Philadelphia and Pottsville with her train of 50 cars, or for 100 miles, which can be made to apply to any road.
3. The power of a locomotive of 10 tons, equal to 230 tons gross or 152 tons nett load over a grade of 19 feet per mile.
4. The expense of greasing car wheels about 1½ cents per ton for 188 miles, a mere fraction at any rate.
5. The general expenses, as estimated for the Philadelphia and Pottsville railway for motive power and freighting, as originally made, shown to have been full high by the experience on the road itself.
6. Showing that if the charge for carriage of a passenger is $3, and that for a ton of coal $2, yet that the latter is the more profitable business, there being 20 tons of coal to carry at the saving speed of 10 miles per hour, for one passenger at the *expensive* speed of 20 miles per hour. Reasons why coal has never yet been carried over a certain limit of distance, and on the folly in consequence, of restricting the practicability of carrying it to that limit.
7. List of sundry improvements in different States, showing a wasteful and unnecessary expenditure. On the necessity that canals are under to carry at rates below the cost of transportation on them, and on the false impression thus created of their being cheaper carriers than railways.
8. The leading railways, such as the Camden and Amboy, Philadelphia and Baltimore, and Columbia, exhibited in the light in which they would appear if divested of the extráneous causes which now diminish their success.
9. The just weight of iron rail yet undetermined, the adequate mean seeming to lay between 50 and 60 lbs. per yard. The greater power of the locomotive on an edge rail, and the saving thereby in general wear and tear, as compared with a flat rail.

10. The travel on the Philadelphia and Pottsville railway likely to be considerable, if the policy of making a *focus* of it by low fares be adopted. Pottsville should be to New York for *fuel* what Albany is to her for *bread*, and she is equally interested with Philadelphia in a cheap and quick avenue to that point.
11. The fitness of the railway as now constructed to carry *freight* advantageously, proved by experience in this country and in England.
12. The advantage which *long lines* of railway afford in economy of management and general profitableness as compared with short ones.
13. The proportion of expenses to the gross receipts given from several roads. The views of the monied circles in England as to the security of railways for investment as given in the Banker's Circular. Table of the business loads carried over certain grades, with the approximate cost of transportation on each per ton for 100 miles.
14. That canals as carriers are cheaper, or are less expensive to maintain than railways of the present day, shown to be untenable, and that the reverse is true. A statement of fares by steam power contrasted with those by ordinary means, to show that the former are cheapest and prefered at much higher rates.
15. The connection to be formed with the New York improvements at Elmira will bring the far western and northern travel through the valley of the Schuylkill as the nearest route to the sea board, and the importance of this union alluded to by the Governor of Pennsylvania in his message of this year.
16. The great capacity of the railway for business in freight and travel, shown by the Stockton and Darlington, being principally a coal railway. A suggestion as to the most economical mode of transporting large amounts of tonnage, by distributing it as near as practicable through the different months of the year. On the advantages of low rates of fare and freight in England and on the continent.
17. The prospect of a great extension of the iron trade in the Pennsylvania coal regions, of which the vent must ultimately be the valley of the Schuylkill. The cost of manufacture, etc., at Pottsville.
18. The rapid strides in arts and mechanic sciences, all over the world, warn us not to fall *behind the times*, but to follow up the experience of the day, always eliciting something useful. Exemplified by the notions entertained of railways, especially in the State of New York in 1835, and what they are at the present day.

19. The question of grades as now viewed in England, much changed of late by the improvements in motive power, 40 to 60 feet to the mile being no longer considered any great obstacle in attaining the requisite speed.

20. Showing the termination at Richmond, above Philadelphia, of the Pottsville railway, to be the best site for a National Foundry.

21. A list of expenditures on a canal, to show the numerous occasions thereof. Large annual appropriations required for the canals of Pennsylvania, with some reflections thereon.

22. The first impression as to the comparative expensiveness of the railway shown to be an erroneous one. The sills and bridges for instance are set down as costly to renew, but this is not found to be so when examined, and so on throughout all the other items of expenditure in the comparison with those on a canal as per sample given in note No. 21. The wooden portion of the railway likely to become cheaper hereafter, by the substitution of coal as a fuel.

23. The wastage on the coal during its long passage down the Schuylkill canal apparently irremediable, and only to be cured by its *quick* transit over the railway.

24. The freighters or boat owners on the Schuylkill canal, having no concern therein, will find and of course follow their own interest in transferring themselves to the Delaware for the export trade, for which they would be principally wanted.

25. Showing the constantly onward progress of the railway, that they have about doubled their business in five years. A statement of the great success of the Utica and Schenectada railway given, being a model for judicious and economical management.

26. The duty of government is to foster and encourage railways, as we find is the case in England and on the Continent, and that they are least of all objects for taxation. The sooner we can bring this improvement to be held in equal estimation among us, the better, and this can be done only by first understanding and then patronising such railways as the Philadelphia and Pottsville, and other standard works.

27. The current high prices of coal during the cold months, and the suffering thereby, to be only remedied by a railway to the Delaware, when instead of fluctuating from 7 to 8, it will be steady at 5 to $6 per ton. Some statistics respecting bituminous coals, foreign and domestic given.

28. On the rapid extension of the railway system in the last ten years, and on their relative costs here and in England.

29. On the importance of the Schuylkill region maintaining its ascendency in the coal trade, secured to it by the cheaper rates of transportation by railway and canal, from that region, as per details given in regard to the mere cost of delivering white ash coal in New York. The valley of the Schuylkill, is likely the soonest to require both these means to discharge its trade.

30. Facts in regard to the New York and Albany railroad, showing its ability to compete in travel with the Hudson river, far more curious than the Philadelphia and Pottsville railway pretending to vie with the Schuylkill canal. Comparison of cost per mile of running a steamboat and a railway train, being less by the latter.

31. The collateral advantages of the railway, more particularly appreciated in Massachusetts. Estimated to save three-fourths of the cost of transporting persons and merchandize in that State.

32. Facts in regard to the New York and Erie railroad, illustrates the advantages of long lines, with other statistics in regard to the relative costs of transportation to the lakes by canal and railway, the latter being able to carry *under the cost of freight alone* by canal.

33. The safety of railway travelling now fully established and of which there is daily proof.

34. Showing the hostile interest opposed to the Philadelphia and Pottsville railway, the consequence only of those rivalries which beget all improvements—and noting two of the latest, as affecting the economy of railways.

35. Statement of the Columbia railway: an attempt to unravel its management, and that if this could be got right it would be profitable. It is now working under better auspices.

36. New Jersey railway, showing its large *way travel*, and its success in competing with the steamboats to New Brunswick, the latter charging 12½ cents and the railway 75 cents. A misfortune that it is not a continuous line to Philadelphia, where it could so easily deliver the traveller in 4 hours.

37. The Ericsson Propeller. Its probable use on canals and rivers.

38. Reasons for the General Government, through the Post Office, assisting the carrying out main railways, as part of the system of aid proposed to be given to ocean steamers. On their moral influence, etc., etc.

39. Hasty and unfair judgments passed on railways, without discrimination of the bad from the good. A new era coming in railways, when their security and usefulness will be better appreciated by the capitalist.

40. On the freshets of the Lehigh and Schuylkill rivers, and the

complete security of the Philadelphia and Pottsville railway against the latter.

41. On the want of a unity of connection on the line between New York and Philadelphia, and on the advantages of making *one efficient line* between the two cities with suitable terminations. The specimens of the good and bad abound on this line, and if properly studied, are sufficient to enable the student in railways and canals to acquire a perfect knowledge of the subject.

42. A comparison of the cost of several roads, as illustrating the comparatively moderate cost of the Philadelphia and Pottsville railway. On the progressive character of the railway as compared with the stationary one of the canal. The advisableness of aiding poor inventive talent by government, or at least that it should not be subject to any expense for patenting its products.

43. Further evidence of the onward progress of railways—and also a more extended notice of the Great Western Railway from Boston to Albany. See map attached to note No. 30, showing line of and connections with this road; also the position of the canals which have been superseded by railways referred to in note No. 14.

44. Statement of the produce which reached tide water through the New York canals in 1840, and the States from whence it came, in part. A condensed view of the expenses of all the New York canals for 1840, and a sketch of the resources of the State of Pennsylvania.

[For the American Railroad Journal and Mechanics' Magazine.]

Sir—In Moseley's Illustrations of Mechanics, edited by Prof. Renwick for the School District Library, I find the following note on the Fribourg Suspension bridge.

"The bridge of Fribourg is said, however of late, to have become unsafe. If this be the case, it is probably owing, not to a want of tenacity in its materiel to resist the *ordinary* strain upon it, but to the impulses of *vibratory* motion to which, from its lightness, it is liable in high winds, or from the rapid motion of vehicles."

This note appears to belong to the author of the work. As no authority is given, and in the statement itself a doubt of the fact seems to be implied, it will not be proper to reason on the premises.

Can any of your contributors or readers give any information on the subject? As far as I can recollect no mention of the unsafeness of this work is to be found in any of the foreign journals.

Should any one communicate the desired information it would greatly oblige the writer. X.

[For the American Railroad Journal and Mechanics' Magazine.]

The public have lately been indebted to you for putting forth a work entitled "Sketch of a Railway, etc.," which, at least in my case, has relieved my mind of much erroneous impression, replacing it by quite a favorable view of that species of improvement.

Your Journal of 1st February last, in an article on the three great Railway lines to the Upper Lakes from the city of New York, had led me into the agreeable delusion, that our emporium, in proximity to them, had the decided advantage over all her sister cities. But all this has been dispelled by note No. 15 of this Sketch, which shows that Philadelphia is nearest the *fountain head* of the immense traffic and travel of the said upper Lake region by some 180 miles —thus

Cleveland to New York by lake Erie to Dunkirk, and thence by railway to New York, - - -	654 miles.
Cleveland to Philadelphia by railway, (Mr. Schlatter's middle route,) - - - - - - - - -	478 "
	176 miles

nearer to Phiadelphia, besides being a continuous railway, with lower grades than the Erie and New York railroad, which will also be tapped at Corning or Elmira, diverting a portion of the northern lake travel towards Philadelphia as nearest the seaboard from those points, and this line passing through Pittsburg, brings her also nearest to the valley of the Ohio and Mississippi. After the many disasters in crossing the lake from Buffalo, who would add to his fare by that route, the expense of a *life preserver*, when, supposing the above middle route completed, he could go direct with *perfect safety* in *half the time* and at *half the expense* from Philadelphia, which as the cheapest point for fuel, would then seem only to want one or two smart ocean steamers to give her the complete preponderance in all but foreign commerce.

The discovery of this "middle route" is well for Mr. Biddle, as it more than confirms his assertion made at the Williamsport Convention in 1838, of Philad. being nearest to the trade of Upper Lakes, (Erie, St. Clair, Huron and Michigan,) and nothing but the temporary hampered state of the finances of Pennsylvania, can retard her moving at once to secure such a prize. It is a curious fact that this State, which, up to 1830, was behind New York in her ratio of increase in population, is shown by the census of 1840 to have outstripped her, the per centage for New York being 26½ and that of Pennsylvania 28, for the last 10 years. What an acceleration to her progress would the connection by railway with Cleveland be!!

If we can ever be made to move, in New York, to connect our city with Albany by railway, we may hold on to the entire northern and Ontario lake trade, with Oswego as the outlet, distant 315 miles from New York—otherwise Boston will do much in sharing it with us, which we could but ill-afford with this prospect of losing the best portion of that of the Upper Lakes.

All we now need to complete our misfortunes, is to persist in the enlargement of the Erie canal, while we ourselves, as well as our neighbors, are constructing railways which will supersede it—but in the hope that wiser counsels will prevail in our next Legislature,

I am your very obd't serv't,

New York, August, 1841. Y. X.

For the American Railroad Journal and Mechanics' Magazine.

WEEKLY RAILWAY RECEIPTS AND PRICES OF STOCK

of the four principle railways in England, received by the last steamer, from 24th to 31st July, calculated at $5 per £1 Stg.

Name of Corporation.	Receipts per week.	Paid in per share.	Present price.	Dividends.
Grand Junction,	$50,225	$500	$1,000	13 pr. ct.
Great Western,*	70,980	325	420	1½ "
London and Birmingham,	95,845	450	800	8 "
Liverpool and Manchester,	32,000	500	1,005	10 "

It would thus appear that the march of railways is onward. The day is not distant, when railways in this country, on main lines, "*judiciously constructed between desirable points,*" will be sought after, by our capitalists with more avidity than they subscribed to safety fund bank stock, during the years 1835. '36, and '37, and we predict that this class of investment, will be considered as secure as productive real estate, and will have the preference over investments in bank stock generally in the United States.

It is true, that in this city, our capitalists in their first investments on *short* lines, costing two, three, and even four prices, from injudicious managements, are timid in touching railway stock, while the capitalists of Massachusetts have invested near twenty millions of dollars, in this better improvement of the age with 7 pr. ct. profit.

We have long viewed with surprize the appathy of our citizens, in the prosecution of a railway on the most *direct route* to Albany and Troy. It would appear, they are content with every charlatan,

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* Just completed, carried 42,397 passengers the last week in July.

who will propose to build "*a temporary cheap road*" for them, even where it will advance rival interests.

How long will this continue? Can there be a question that a line of railway extending from this island to Troy, with 400,000 inhabitants in this city and its vicinity, connectiug as it will with upwards of 500 miles of railways in manufacturing New England, with a continuous line from Albany to Buffalo, and branches to Whitehall and Oswego, to connect with Upper and Lower Canada, can fail to pay a handsome dividend to its stockholders? We would further ask, can there be a railway constructed in the United States, [where freight and passengers are combined.] that will pay as well as a good *solid railway* from New York to Troy, on which 30 miles per hour should be accomplished, with certainty and regularity? With this speed, or 25 miles per hour, the *business*, and a large portion of the pleasure *travel*, will seek the railway, in preference to the river. All the valuable merchandize, at a speed of 10 miles per hour, will be placed on the railway, for certainty and regularity of supplies to customers, at all seasons, and to keep up with the onward march of improvement.

We reiterate the sentiment expressed on a former occasion:—"*railways are destined to change the entire course of business and transportation.*" The city of New York must not fold her arms under the belief, that she is secure, and that with the North river and Erie canal, she can maintain her commercial superiority over her neighbors. J. E. B.

Important Decision of the Vice Chancellor of the first Circuit of the State of New York in relation to fences and cattle yards upon railways.

Before the Vice Chancellor:
In the matter of the Long Island Railroad Company
and
Alexander McConochie.

This matter coming before me on the annexed report of appraisers, and Alexander McConochie, the land owner, being dissatisfied with the allowance of one hundred dollars for his damages "without reference to fence," I appointed the 30th day of July, 1841, for the parties to appear before me at the court room of the court of chancery in the City Hall of the city of New York, then and there to produce their witnesses and proofs touching the use of "Cattle Guards," so called upon railroads, and the sufficiency and safety of such guards or barriers, instead of side fences along the line of the railroad so as to dispense with the necessity of making such side fences; and if side fences are indispensable, then touching the cost of making and maintaining the same where the railroad in question passes through the land of the said Alexander McConochie, and by such evidence to enable me to determine the question concerning fences, and to modify the assessment of the appraisers by allowing to the said Alexander McConochie an additional compensation, or not as should appear to be just—at which time and place the parties appeared before me—the Long Island Railroad Company by George B. Fisk, their President, and Alexander McConochie by Mr. McVean, his counsel, and on the part of the company, James J. Shipman, John Leach and John Sutphen, were sworn and examined as witnesses; and on the part of Mr. McConochie, Smith A. Parks, Luther Loper, Jarvis P. Whitsen and Lorenzo Walters, were sworn and examined as witnesses; and the substance of the testimony as taken down in writing by me is containod in the schedule annexed.

From the testimony of Shipman, Leach and Sutphen, and from an inspection of the model exhibited, I am perfectly convinced that "guards" properly constructed across a railroad, are effectual barriers to the passage of horses, cattle, sheep and swine, along the track, or within the lines of the road: and when connected, as the guards must be, with the *exterior* fences of a farm, or with the *interior* division fences of fields crossing the road, or any partition fence between owners of adjoining lands intersected by the railroad, they will as effectually prevent the ingress and egress of cattle or other domestic animals, as the best of farm fence will do. It is true that animals will not thereby be prevented from passing over the road, from one side to the other, nor along the road between any two of the guards, and where this may happen in any enclosed field, it can only so happen with the cattle or other animals of the owner of the field which he may turn or suffer to run therein. By laying a railroad through an enclosed field, may not deprive the owner of the opportunity or advantage of using the land on both sides in common as one field at the same time, either for tillage or pasturage—all that he may require, will be the privilege of crossing the railroad from one part of the field to the other, (and this privilege to Mr. McConochie the Railroad company avow themselves ready and willing to give). If the railroad should cross the field in a deep cut, or upon any considerable embankment, then indeed, the land owner may be put to great inconvenience, and perhaps be entirely prevented from crossing for ordinary farming purposes. But it does not appear that this will be the case with Mr. McConochie; and for whatever inconvenience he may be subjected to in this respect, or from the manner in which his land may be cut up, and his fields disfigured by the making and running of the road, as well as for the real value of the land taken, I must suppose the award of one hundred dollars is intended as full compensation. This sum is not objected to on the ground of its insufficiency to cover the value of the strip of land, and all such consequential damage, if any such there be. It is only insisted that Mr. McConochie is entitled in addition, to have fences erected along side of the railroad where it runs through his land, at the expense of the Company.

I am of opinion that such fences are not essential to the ordinary use of the farm in any branch of husbandry, and for these purposes that the construction of "cattle guards," wherever the exterior and interior fences of the farm intersect the road, will afford all the protection which may be necessary against the egress and ingress of cattle, etc., to and from the highways, the adjoining fields or other contiguous lands, and therefore Mr. McConochie is not entitled upon any such view of the case, to have fences (other than the cattle guards) erected in whole or in part at the expense of the Company.

I am also well satisfied by the testimony of the witnesses who speak from what they have seen and experienced on this and other railroads a number of years, that it is not necessary a railroad should be fenced at the sides to insure the safety of persons and property in transit on the road against accidents from cattle, etc. Indeed it is very clearly to be perceived that there is less danger of running over them, when they do get upon the road where there is no side fence to prevent their going off, than where there is such an obstruction.

The law of self-preservation, creating fear or the dread of danger, and a disposition to avoid it, operates upon the animal instinct, and impels them naturally to diverge from the course of the road, and if a fence is in their way, it serves, in the language of one of the witnesses, as a foil to turn them back upon the road, and it is only in such parts of the road as are fenced, that accidents of the kind happen.

But notwithstanding these facts, it is urged as a matter of *legal right* in the land owner, to have his lands adjoining to a railroad running through them, separated therefrom by a good and sufficient fence, to be constructed at the expense of the company in the first instance, and afterwards to be deemed a partition fence, as between owners of adjoining lands. This is the point I have now to consider.

In the case of the Rensselaer and Saratoga railroad company, (4, Paige's rep. 553,) the Chancellor speaks of an owner of land through which a turnpike or a common highway is run, being obliged from *necessity*, to make the fence along such roads to enclose his lands, (unless he is willing to leave his land open as a common,) the turnpike company or the public having no interest to keep up such fences for the sake of the roads, because the running at large of cattle upon them cannot materially interfere with the travel and ordinary use thereof, and in such cases the land owner being compelled to make fences, which, but for the laying out of the turnpike or highway, he would not be obliged to make, is entitled to full compensation for the expense to which he is thus subjected. And the counsel in argument before me insist that the evidence which proves there is more safety from cattle on a railroad when it is unfenced at the sides than when it is, only shows that the railroad company then has no interest to keep up such enclosures, and places such road upon the same footing as a turnpike or highway, and subjects the company at once to the liability in such cases pointed out by the Chancellor.

I cannot agree with the counsel in this supposed analogy, or in the application of that principle.

A railroad is not, like a common highway or turnpike intended for general travel and the passage of all sorts of cattle; it can only be used as a particular mode of conveyance for passengers and goods; it admits of *barriers* placed wherever needed, to obstruct the passage at those points of every thing except the moving power and its train; and when it runs through the land of an individual, it does not lay open and expose the land and growing crops to injury as from a common travelled road.

The Chancellor further observes, that the manner in which a railroad is to be used renders it *necessary* that the company should *secure* their road against the encroachments of cattle, etc., from the adjacent lands, to *ensure the safety* of the persons and property of those who may pass upon the road, and he considers that the obvious means of doing this is by fences. It has already been shown from the evidence before me, that this *security* can be attained better without longitudinel fences than with, unless indeed fences should be so strongly and durably built as to be completely *cattle proof*. What are deemed "*good* and sufficient" fences among farmers, for all ordinary purposes, it is very evident do not always prevent cattle from getting on the road. How often are fences broken or thrown down by cattle, which officers of the town, called *fence viewers*, adjudge to be good and sufficient, so as to justify the distraining of the cattle *damage feasant* for the trespass? Such cases do occur, and they show that a *good and sufficient* fence in the law, is not always capable of restraining cattle.

A railroad company could not be required to put up or pay for any other than an ordinary farm fence, and such, it is shown, do not afford the degree of security required. They had better then be dispensed with, and the road be left to that sort of security which consists in cattle having free and unobstructed egress from the road when alarmed, as they are sure to be by the approach of the engine.

Then if the Long Island railroad company have no *interest* in supporting fences for the *protection* and *security* of their road, upon what principle can Mr. McConochie call upon them to contribute to the making of such fences?

It is only upon the ground of *mutuality* of *benefit* that the equitable claim of contribution is founded, and it is upon that principle, the Chancellor held in the case as it stood before him, that the Rensselaer and Saratoga railroad company being as deeply interested as the land owner in having partition fences, was bound to make one half, etc. But when that mutuality of benefit does not exist, or either party chooses to forego it, and to dispense with an enclosure of his lands, no just claim of that sort can arise.

By this proceeding to take a strip of land for the use of the Long Island railroad, the company become vested with the title as owners and proprietors of the soil, and between them and Mr. McConochie, it becomes a case of ownership of adjoining lands. At common law no man is bound or can be compelled to enclose his land—he may in the freedom of his will leave his lands open and unenclosed by any fence, and at the same time use them for tillage, pasturage, or in any other way that he best can; being responsible for any injury his beasts wandering from his land may occasion to others, and entitled to an action for any voluntary trespass which may be committed upon him. (1, Cowen's Treatise 381). And the statute law of this State in relation to "Division and other fences," (1 R. S. 353, sec. 30,) expressly recognizes the right of an owner of lands adjoining to anothers, to let his lands lie open; and so long as he chooses to do so, no obligation rests upon him to contribute to the division fence which his neighbor may think proper to erect between them.

It is only when he encloses, so as to take to himself some benefit of the fence along the division line as a part of the enclosure, that he can be called upon to pay for one half of it: and why does not this law apply to cases, like the present? I am at a loss for any good reason why it does not. The Chancellor considered that this 30th section of the statute did not apply in terms to *railroads*, because he says, the lands of the railroad company are not in fact enclosed at those points where the road is crossed by the public highway. It is very evident this was said with reference to the liability imposed by the statute to contribute where lands are enclosed, but it has no reference to the exception at the close of the section recoguizing the privilege of leaving lands open and unenclosed.

This case I think is taken out of the operation of the decision made by the Chancellor, so often referred to, by reason of the facts which are in evidence before me, in relation to the utility of "cattle guards," and the *security* of the railroad without fences, which experience has verified since the Chancellor's decision was made, and it follows, that so long as the railroad company choose to leave the road unfenced at the sides, they cannot be called upon to do any thing towards fencing it by the adjoining owner. But should the company hereafter find it necessary for their own interest or convenience to have the road enclosed, they will then bring themselves under the statute and be compelled to make or pay for the making of one half thereof. And should there be any town law, or regulation adopted, (if any such there can be,) under the authority of the statute conferring powers upon the inhabitants assembled in general town meeting, requiring partition fences to be made at all events between the railroad and the lands of adjoining owners, then the company will be bound to conform to such regulation, provided it be lawfully binding upon them.

I must allow the report and assessment of the appraisers to stand without any modification or amendment, except in the order confirming it to enjoin it as a duty upon the Long Island railroad company to construct at their own expense proper and sufficient cattle guards across and upon the road, wherever it intersects the exterior boundary lines of Mr. McConochie's land, and the interior division fences thereof, upon the plan of the model exhibited, and that the company continually hereafter keep up and "support those guards or barriers in a substantial and durable manner; and that the company moreover grant to him and his assigns, the privilege or easement of crossing the railroad at such and so many places as he may designate on his land, for the convenience of farming thereon, and that the company prepare and make those crossing places at their own expense. (Signed) WM. T. MCCOUN, V. C.

August 7th, 1841.

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August 7th, 1841.

[To the Editor of the American Railroad Journal.]

The great interest which is attached to every thing entering into the construction of railroads, has induced the undersigned to give publicity through the medium of your valuable Journal to an invention whose importance, by many competent judges, has been deemed to be great. This invention is a cast iron rail of novel form, cast entire in lengths of 10 feet, and which, if brought into general use, will effect a great revolution in the construction of railroads. But before proceeding to a minute description of the plan, your attention is solicited to its general features, with their attendant advantages.

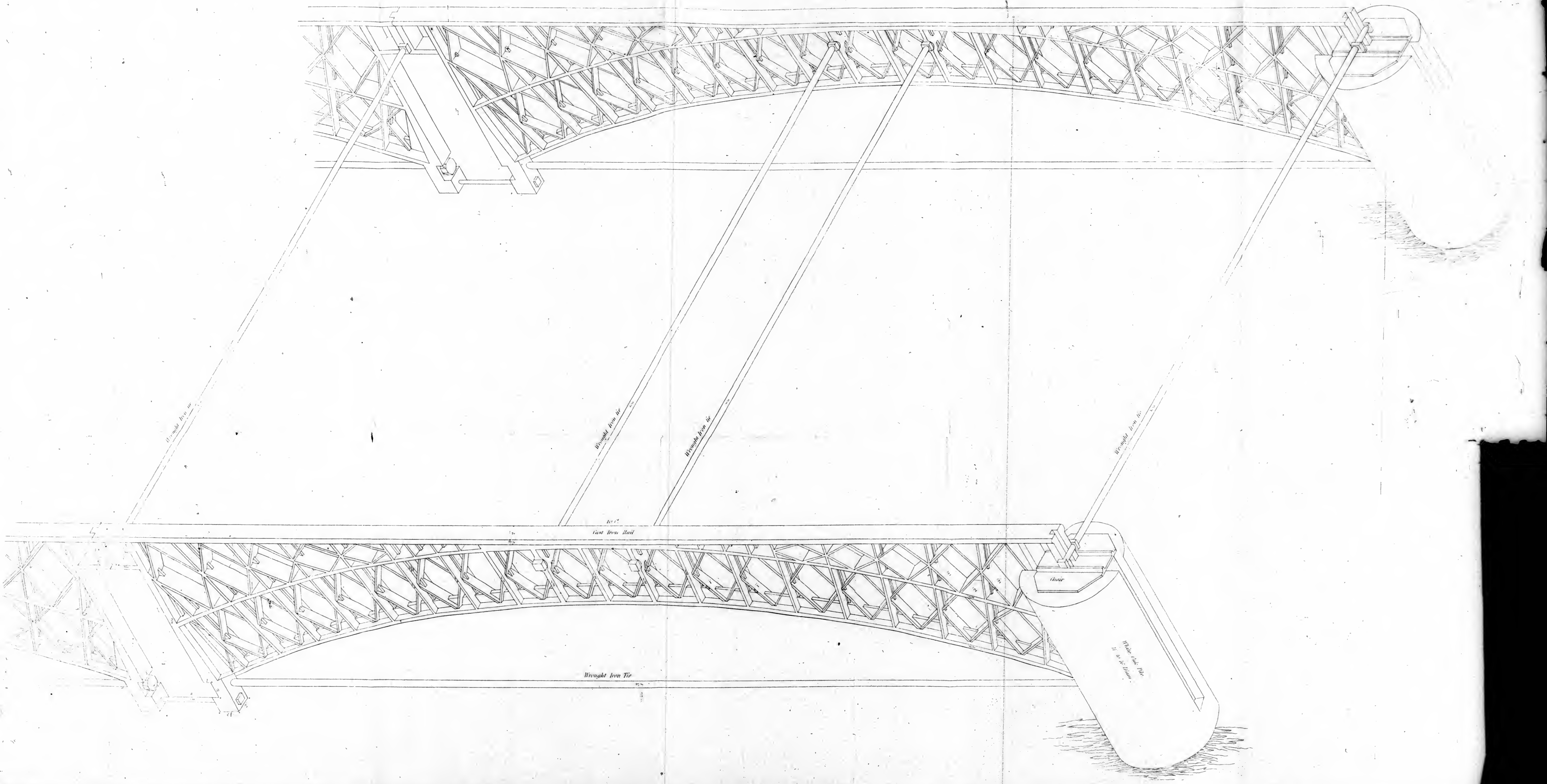
The foundations are intended to be of oak piles from 11 to 17 inches diameter, (stone blocks with cast iron standards fixed upon them to support the rail at a proper elevation, would be as effective on graded roads,) driven at distances of 10 feet from centre to centre, longitudinally, by steam pile drivers, similar to those now in use on the Susquehanna division of the New York and Erie railroad; the hammer weighing 1200 lbs., and falling through a space of 28 feet, forces the points of the piles to a depth of about 5 feet below the surface of the soil, thus protecting them from the action of frost, and the superstructure from that destructive disarrangement, always consequent upon the breaking up of winter in our northern latitudes.

Another cause of disorder is avoided; that of the liability of the mud sills to settle unevenly as has been observed to be the case on all roads of the old construction.

Great economy will at once be perceived in the adoption of this plan, for by a skilful adaptation of the grade line to the surface of the ground, the top of the rail being elevated $1\frac{1}{2}$ or 2 feet above it, a great outlay otherwise required for excavation, embankment, and ditching, will be saved.

In cases where marshes are to be crossed, the piles when they are driven to the surface, are succeeded by others dowelled upon their heads, until a sufficiently firm foundation is obtained. The superior advantages of this method are by no means speculative, for it has been used on the Utica and Syracuse railroad to the entire satisfaction of that company. The Susquehanna division of the New York and Erie railroad, for a distance of 109 miles, is being constructed on a similar foundation, as well as many other portions of that magnificent work.

With regard to the durability of the piles, observation has made known the fact, that sticks of oak of the before mentioned diameter, exposed to the action of the weather, will remain sufficiently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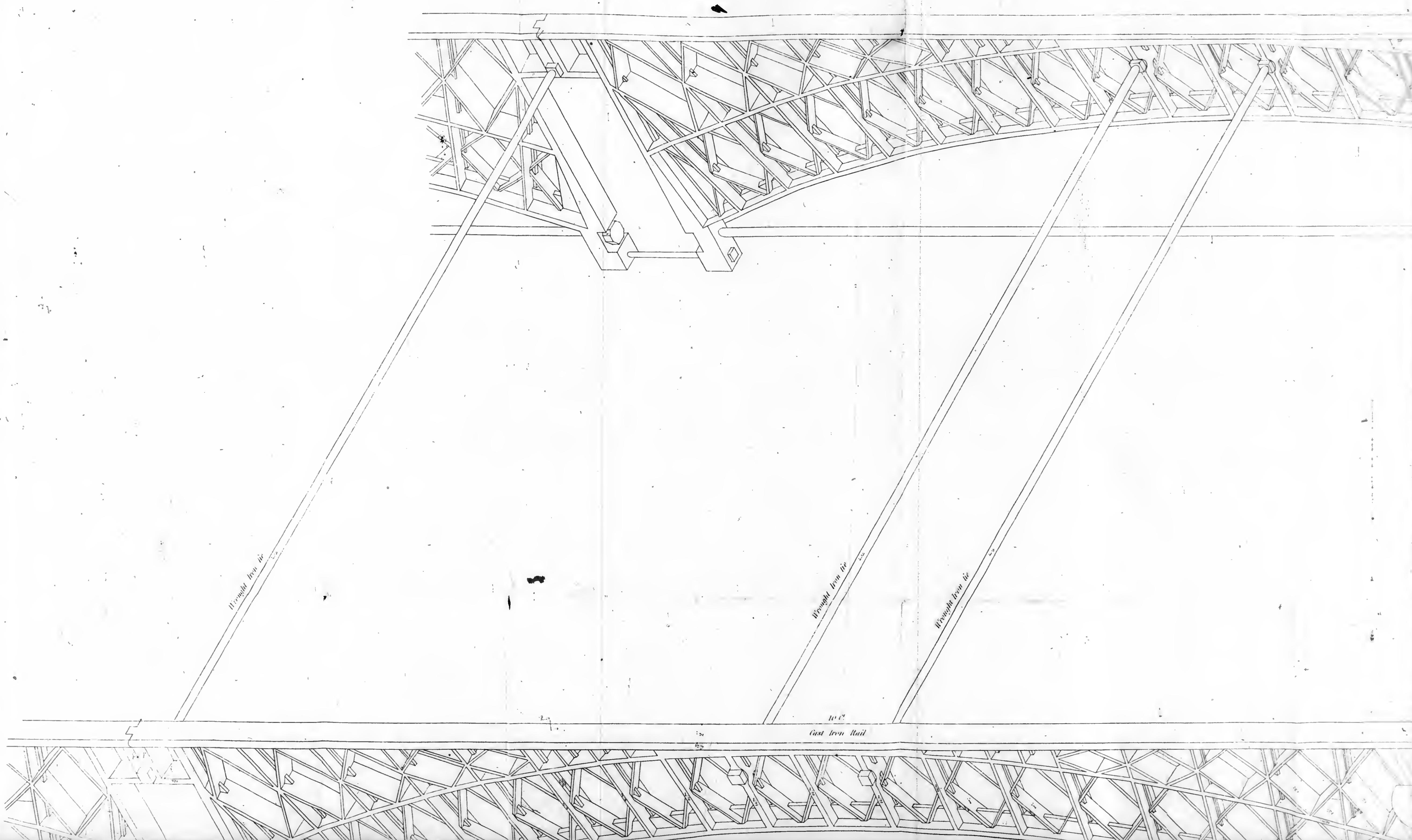
Cast Iron Rail
Chair
White Oak Pile
Wrought Iron Tie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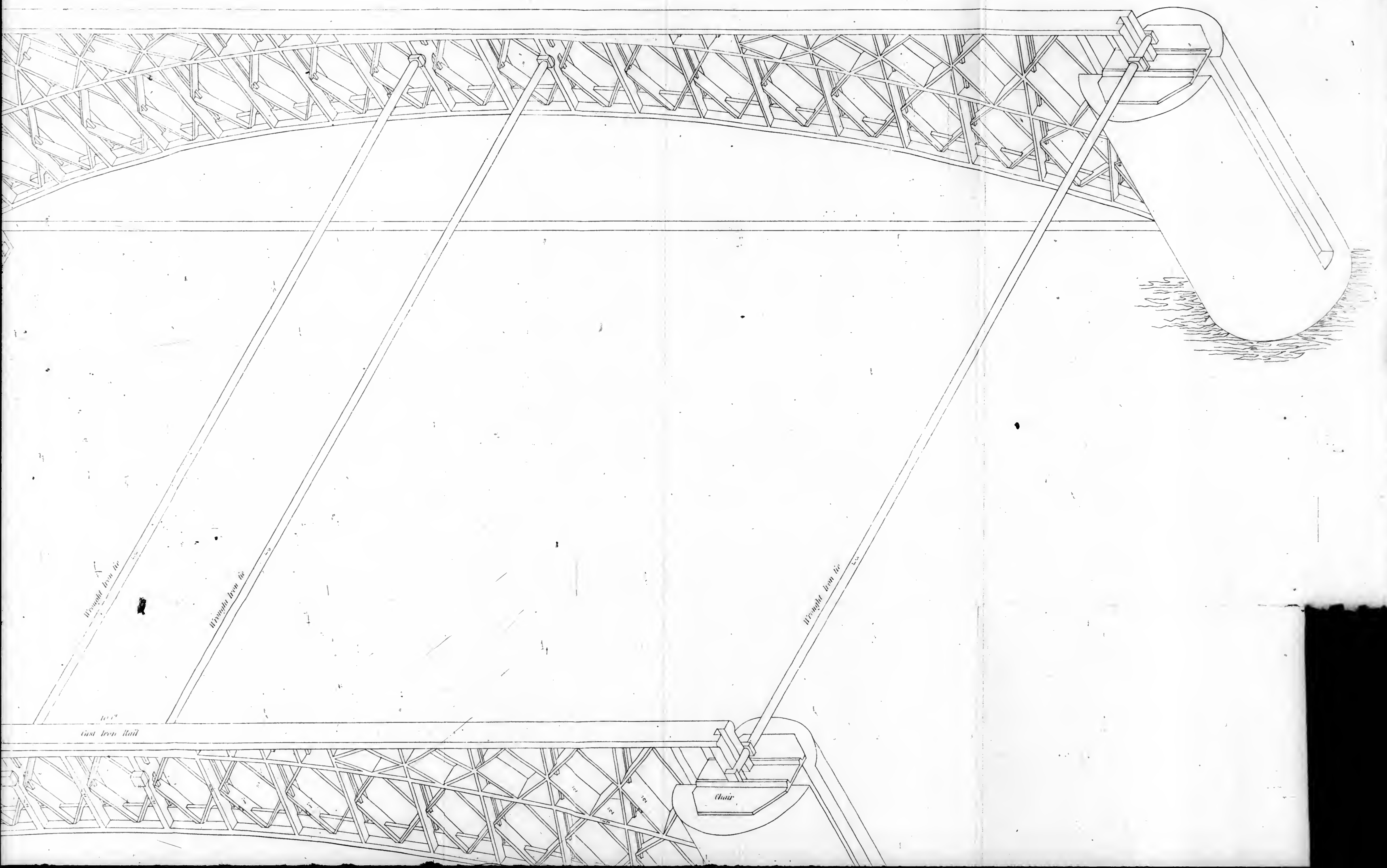
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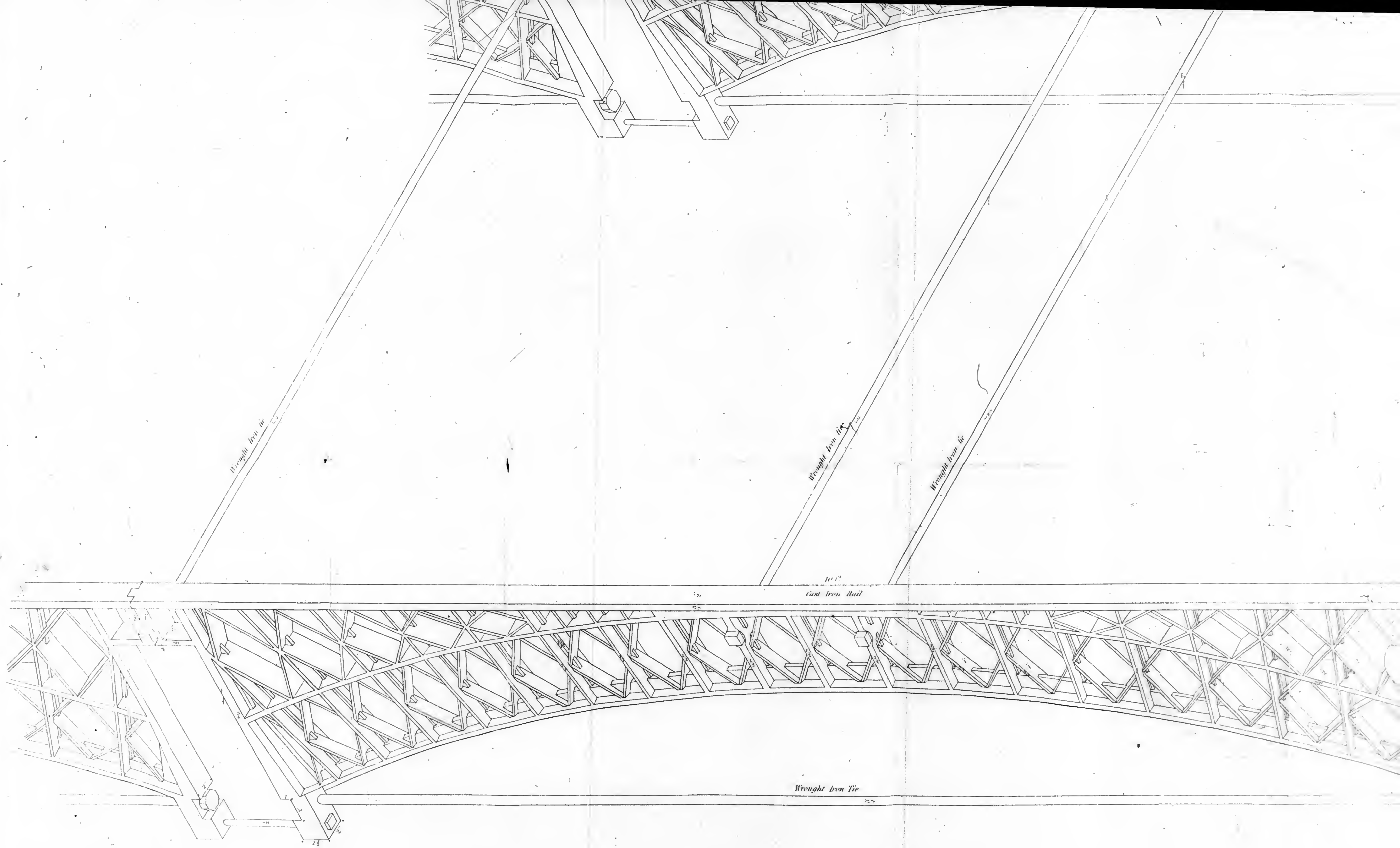

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Cast Iron Rail
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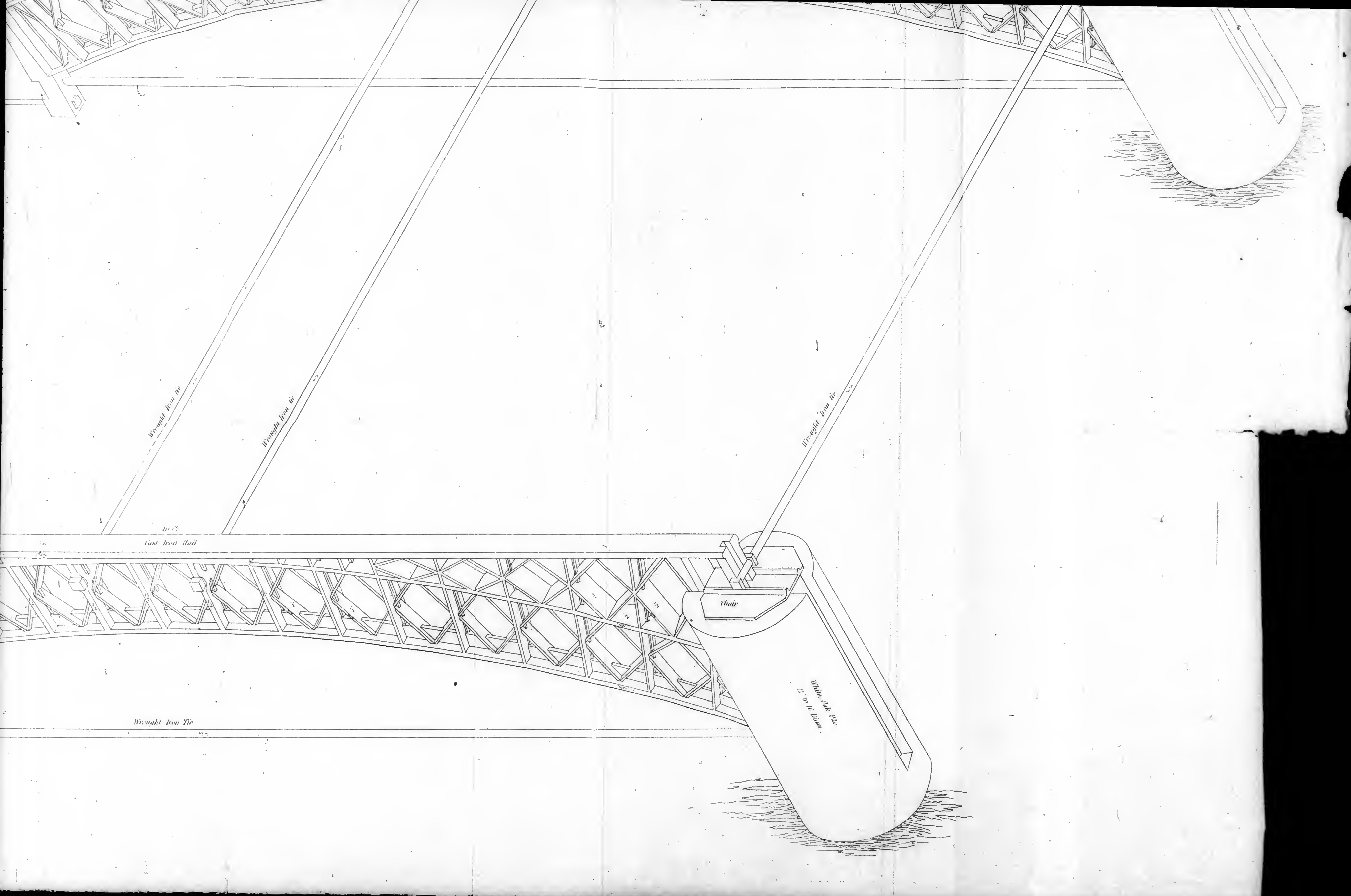
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Cast Iron Rail
Chair
White Oak Pile
11' to 16' Diam.
Wrought Iron Tie

sound for use during a period of 10 years, and if kyanized on the plan recommended by Dr. Earle, and now used for preserving the bridge timber on the New York and Erie railroad, there is no doubt but what they will remain in a serviceable condition for an additional 40 years.

If greater durability be required, the piles may be sawed off below the surface of the soil, and cast iron heads dowelled upon them, thus securing their usefulness for centuries.

In crossing broad, sluggish streams, and also those of inconsiderable width, this superstructure of 10 feet spans, may be continued uninterruptedly, and much expense as well as time saved in the construction of bridges and culverts, which are rendered absolutely necessary by the use of any of the present plans of railroad superstructure. No inhabitant of our northern latitudes will overlook the advantages to be derived by the elevated position of the rail, as it completely secures the track from the inconvenience of snow.

In conclusion it may be remarked, that cast iron bars of the flat or common form, have been extensively used in England, in the construction of railways, and that their abandonment was caused by no inferiority of the metal, when contrasted with that of wrought iron for that purpose; but solely on the score of economy. In America, however, this cause operates differently, deciding for the employment of cast iron, which is moreover the only metal that can be used in the manufacture of this rail.

Further, it may be remarked, that all deductions and rules drawn from observations made on the flat or rectangular sectioned bar of cast iron, are totally inapplicable to this invention, differing as they do in their principles and governing laws, as completely as the arch and lintel, when compared, for spanning space.

It is almost superfluous to call your attention to the durability of this superstructure, executed without any wooden auxiliary, it will ever be free from the vexatious repairs, and consequent heavy expense, always attendant upon wooden constructions.

DESCRIPTION OF SPAULDING AND ISHERWOOD'S PLAN OF SUPERSTRUCTURE WITH CAST IRON RAIL.

The rail is to be of cast iron; 10 feet in length, 9 inches in depth at centre, and 1 foot 9 inches in depth at the extremities, with a general width of 2 inches. To be laid on a pile foundation.

The rail to be composed of an upper and lower arch, with appropriate flanges; the said arches to be connected by posts, with braces inserted lozengewise between them. The top of rail to be a horizontal bar, supported at intervals by the posts produced above the upper arch, and by braces inserted lozengewise beneath it. The ends of the arches to terminate in a proper abutting piece, and their feet to be tied together with a wrought iron rod.

The rail to be cast in one piece with a tongue and groove joint at the extremities:—a cast iron chair to be placed on the heads of piles to support the joints of rails as shown in the accompanying plan.

The upper and lower arches to be parallel, 2 inches in breadth by $\frac{1}{2}$ inch in depth, a flange $1\frac{1}{2}$ inches deep by $\frac{1}{2}$ inch broad at centre of rail, and $\frac{1}{2}$ inch deep by $\frac{1}{4}$ inch broad at extremities of rail, to be placed beneath the upper arch. Also, a flange $1\frac{1}{2}$ inches deep by $\frac{1}{2}$ inch broad at the centre of rail, and 1 inch deep by $\frac{1}{2}$ inch broad at the extremities of rail, to be placed upon the lower arch.

The posts connecting the upper and lower arches, and also filling the spandrels formed by the upper arch and bar at the top of rail, to be placed in lines of radii to the curve of the arches, at distance of 6 inches from centre to centre, on intrades of upper arch, and with the exception of the five centre posts are of the following description and size: 2 inches broad by $\frac{1}{4}$ inch thick, with a flange $\frac{1}{4}$ inch by $\frac{1}{4}$ inch, placed on both sides at the centre of the post. The five centre posts are 2 inches broad by $\frac{1}{2}$ inch thick with similar flanges to the first mentioned posts; two of the centre posts are pierced by holes to receive the cross ties extending transversely between the rails.

The lozenge braces inserted in the spandrels are 2 inches broad by $\frac{1}{4}$ inch thick, those between the arches are 1 inch broad by $\frac{1}{4}$ inch thick.

The wrought iron ties, tying the feet of the arches together, are $\frac{3}{4}$ inch diameter. The wrought iron transverse ties are of the same diameter.

The horizontal bar forming the top of the rail is $\frac{3}{4}$ inch thick by $2\frac{1}{4}$ inches broad, with a descending flange of 1 inch in depth by $\frac{1}{2}$ inch thick.

The piles to be grooved to receive the ends of rails, as shown in the *flange*. A screw bolt $\frac{1}{2}$ inch diameter passes through the piles and connects the abutting pieces of adjacent rails.

These rails weigh 260 lbs. each. A number of them have been in use on the Ithaca and Owego railroad for the last three months, where twice daily they have been passed over by a locomotive engine weighing 11 tons, with heavy trains of freight, to the entire satisfaction of the superintendents and engineers of that railroad.

I. Spaulding,
B. F. Isherwood.

REPORT OF THE DIRECTORS OF THE BOSTON AND WORCESTER RAILROAD CORPORATION TO THE STOCKHOLDERS, June 7, 1841.

(Concluded.

Next to the Meteor in efficiency, we rank the Lion, which was built in England, and has been upon the road from February, 1836. This was one of the engines which was disabled on the 17th of June, by a concussion of such violence that no engine could be expected to resist it, and by which an engine of ordinary strength would have been demolished. She was put in the repair shop, and after a period of four months, came out restored to a condition apparently as good as before the accident. This engine is, with the exception of the Yankee, the oldest of the antiquated and decrepid machines which the corporation has in the passenger and freight service, yet she has run, in the course of eight months in the last twelve, 20,316 miles, with a cost of only $205 for repairs, exclusive of $1612 for her refit after the collision. In the course of four years previous to this accident, she had run with freight, and passenger trains, a distance of 76,250 miles.

The engines which class next in the amount of service performed, are the Mars and Vulcan, built by Mr. Norris, of Philadelphia. The Mars has been on the road twelve months, and has travelled 25,558 miles. The Vulcan, was placed on the road near the end of July, and in ten months has travelled 21,017 miles. The repairs of the Mars have amounted to $758, and of the Vulcan, to $533. They have generally travelled with freight trains. These two engines are of greater weight, have larger cylinders, consume more fuel, and are of greater power, than any others on the road, but they have small driving wheels, and the cylinders being placed outside of the wheels, at a distance from the centre of gravitation, they do not work so regularly when in swift motion, and are not so well adapted for rapid travelling, as the Meteor, Lion, Tartar, or Elephant, but in other respects they are well constructed, they are capable of throwing greater weight on their driving wheels, and are well adapted for freight engines, which do not require a rapid motion. These engines, it will be recollected, are of the pattern and fabric specially recommended by the committee, for their greater effiiency, and their liability to less cost for repairs. In the amount of repairs incurred by the several engines during the last year, with the exception of those which have been rendered necessary, by accidental concussions, entirely independent of the character of the engines, it will be perceived that there has been very little difference between those built by Mr. Norris and the older engines, though it might have been expected that there should be a decided difference in favor of the newest engines, especially if the old ones had been in a state of inefficient repair at the commencement of the year, as represented in the report of the committee.

Two other extremely efficient engines are the Tartar and Elephant, both built by Mr. Baldwin, of Philadelphia, one in April, 1837, and the other in August, 1839. The Tartar has travelled 22,818 miles in the last twelve months, and has cost for repairs

$800, and the Elephant in ten months has travelled 20,553 miles, with a cost for repairs of $420. The Tartar has been chiefly employed on the steamboat train, which duty she has performed with remarkable regularity, and rarely exceeding two hours in traversing the 45 miles from Boston to Worcester, with the heaviest trains. The William Penn, built by Mr. Baldwin in 1836, and the Lowell, built at Lowell in the same year, have both been in the repair shop during the greater part of the year, in consequence of the damages received on the 17th of June, but they are now both refitted, at an expense, the former of $2,315, and the latter of $1,296.

The Yankee, which the committee recommended specially should be discarded, is the oldest engine on the road, having been in use seven years. She was built in Boston, at the Mill-dam Foundry, and was the first locomotive built in New England. Notwithstanding the length of time she has been in service, she has travelled during the last twelve months, 13,926 miles, with a cost for repairs of $631.

The committee in their report, in alluding to the disabling of the three engines on the 17th of June, remark as follows: "By this disastrous day, the effective engines of the company are again reduced in number, while two of the survivors require heavy repairs, and another, the Yankee, should be at once discarded, and if a Norris engine of the second class had not opportunely arrived from Philadelphia, and proved competent to perform the duty of two freight engines, the business of the road would have been interrupted." The opportune arrival of this engine is spoken of as if it were entirely accidental, yet it was purchased by order of the directors in May, and was mentioned in the annual report of 1st of June. Its very purpose was, that it might supply the place of engines becoming unfit for regular service, and be a source of reliance in case of disaster to the engines in daily use. Although the directors did not anticipate the disabling of three of their best engines in one day, they were aware that some supernumerary force was expedient. Fortunately, the provision made by their foresight was fully adequate to the emergency.

The directors did not deem it expedient to comply with the recommendation of the committee to purchase six new engines, two to be of the larger class. They had, however, before the report was made, ordered one of the same class as the last before purchased, and this addition has rendered the locomotive force, thus far, fully adequate to all emergencies. Six of Norris's engines of the class recommended, would have cost, in conformity with the recommendation, a sum of near $40,000 beyond what, in the opinion of the directors, the wants of the corporation required; and much more than was warranted by any prospect of saving in repairs.

For the purpose, however, of being amply prepared for the contingency of an increase of freight, to arise from the further opening of the Western railroad, as well as the contingency of the accidental disabling of the engines now in use, the directors resolved, some months since, to add one more engine to their locomotive force, and a contract has been accordingly made for an engine of larger class than either of those now in use, to be built at Lowell. It is anticipated that this engine will be received in a few weeks.

Some remarks were made in the last annual report, on the comparative advantages of a larger class of engines than those now in general use for the conveyance of freight. It is not necessary to repeat the observations there made. These engines are found to be of adequate power to convey the ordinary passenger trains at a regular speed of more than twenty miles an hour, and to convey such loads of freight as ordinarily offer, provided the trains are run as often as is required to satisfy the expectations of customers. There is a great convenience in having a portion of the engines, at least, adapted to the demands of both branches of the service. To adopt engines of a large class, like the eight-wheeled engines recommended by the committee, would subject us to the disadvantages of running often but partially loaded, and consequently involving a greater expense of fuel and repairs, of adopting a system which would afford the public less accommodation from frequent trains, and of having the road occupied in the conveyance of freight by engines entirely unsuitable to be substituted in place of the passenger engines, in case of an accidental failure. For these reasons, your directors are in no haste to discard the use of the present engines, even from the freight trains, so long as they continue to be adequate to the passenger service. Should experience indicate hereafter, that a different class of engines would be better adapted to the economical despatch of the business of the road, this change may be made gradually, as new engines shall be demanded, and by adopting in place of those which wear out, such others as experience may recommend as most likely to be useful.

In connection with the inefficiency of the locomotive department, the committee complain of the insufficiency of the freight depot accommodations. As a remedy for these inconveniences has been long under consideration, and as measures for an effectual remedy already described, are now in progress of execution, it is not necessary to dwell further on this topic. It may here be proper to remark, that the committee labored under a singular misapprehension in regard to the cost of loading and unloading goods. After speaking of the embarrassments to the convenient loading and unloading of goods, from the insufficiency of the accommodations, they remark, that "on the Lowell road, the entire expense of lading and unlading is about 23 cents per ton, while on the Worcester road, it varies from 64 to 75 cents per ton." It does not appear upon what authority the committee made this statement. The whole expenditure in the freight department in 1840, for labor, salaries of masters of transportation, and clerks in Boston and Worcester, and the other depots, as well as for losses and miscellaneous charges, amounted to $14,602. This whole cost, not half of which is for loading and unloading, averaged upon 31,739 tons, the quantity transported, amounts to 46 cents a ton. By a similar computation, it will be found that the expenses of 1838, for the same branch of service, amounted to 43 cents a ton, and that in no year has the cost of loading and unloading alone been more than a third part of the rate stated by the committee, nor more than they state to be the cost on the Lowell road.

The committee proceed to argue in their report, at great length, that the second and principal cause of the deficiency of the revenue of the railroad is, that it "commands but a small portion of the business of the interior, in consequence of too high rates of freight." They go so far to maintain, "that it does not command one fifth part of the freight to which it is legitimately entitled," and the remedy which they propose, for this supposed desperate state of things, is to reduce the rates of freight about one half, and to prices considerably less than the actual cost of transportation.

The directors have not, of course, deemed it expedient to adopt the recommendation, and the reasons for it will be so easily understood, that they do not conceive it to be necessary to go into any lengthened argument in reply to that of the committee. They have satisfactory evidence that the railroad, instead of commanding only "one fifth part of the freight to which it is legitimately entitled," commands, in fact, much the greater part not only of the transportation upon the line of the road, but of all which can be advantageously brought upon it. If it were otherwise, to throw away the amount of net income now derived from freight, for the mere purpose of swelling the amount of business, which would be without profit, would be a most unwise policy. The present amount of freight exceeds 30,000 tons annually, and the profit derived from it affords an important part of the income of the road, and constitutes too important an interest to be sacrificed by any doubtful experiments.

The ground on which the committee justify the proposal to reduce the freight, to rates less than the present cost of transportation is, that that cost may be greatly reduced by the adoption of the improved engines which they recommend, and from the great increase of quantity which they predict would result from the proposed reduction. They go into a computation to prove the practicability of the reduction of cost. Their demonstration is more ingenious than satisfactory. The principal improvement in their plan of transportation, is to adopt, in place of the present engines, a single eight-wheeled engine, which shall be of sufficient power to transport all the freight by one daily trip, instead of two trips, which are required at present. For the service of this large engine, they allow only the same rate of cost for fuel, oil, repairs, etc., as would be required for an engine of the smallest class. Their computation is made also on the supposition that the engine will carry its full load of 133½ tons at every upward trip. But by far the most important saving which, by their method of computation, results from the adoption of a large engine is, that by means of a single freight trip a day, while there are four daily passenger trips, they would apportion *one fifth* only of the cost of road repairs and general expenses among the freight charges, and the other four fifths to the passenger department; whereas, if there are two daily freight trips, *two sixths* of the road repairs are apportioned to freight, and the other four sixths to passengers. As it is evident that what would be saved in this way to the freight department, would be added to the expenses of the passenger department, it would afford a very unsatisfactory reason for an abatement in the charge of freight.

Although the directors have entertained no idea of a wholesale change like that proposed by the committee, they have uniformly regarded the proper and judicious adjustment of rates of freight, as an important and delicate question, and they have given to it a careful attention. In all investigations for determining the probability of increase of revenue by means of a reduction of the rates of freight, they have endeavored to inform themselves of the sources from which the increase was to be expected, the nature and amount of the increase, and the effect which the proposed change of rate would be likely to have on the aggregate of receipts. If the results of their inquiries should satisfy them of a reasonable prospect of an increase of net income, by any proposed change, or that such change would not diminish instead of increasing the profits of the corporation, they would not hesitate to make it: but until they can obtain that evidence, or an assurance of a greater revenue than at present, from some other source, they conceive that they would be violating their duty to the stockholders, by making any reduction of the present rates.

The income of the road for the year ending on the 31st of December last, as stated in the last annual report to the legislature, amounted to $267,547 41, and the expenditures to $140,441. The receipts of the last five months, from passengers and freight, have amounted to $107,464 47, which is about $14,000 more than the income from the same sources, of the corresponding months of last year. The directors have ordered that in future the accounts preparatory to the declaration of dividends, shall be made up to the end of May and November, in each year. In conformity with this regulation, the first account for the present year has been made, embracing but five months, and a dividend of profits for these five months have been declared, of three per cent. on the capital stock, payable on the first Monday of July next.

Boston, June 7, 1841. NATHAN HALE, President.

Statement of the number of miles run by each of the Engines on the Passenger and Freight Trains, from June 1st, 1840, *to May 31st,* 1841, *with the date when each Engine was placed on the Road, and amount of repairs in each six months.*

Engine.	Built at	Put on the Road.	Miles run.	Repairs from July to Dec.	Repairs fm Jan. to May 31, & June 1840.	Repairs in 12 mos.
Yankee,	Boston,	June, 1834,	13,926	427,01	204,34	631,35
Lion,	Liverpool,	Feb. 1836,	20,316½ *	1612,11	204,75	8816,86
Wm. Penn.	Philadelphia,	March, 1836,	4,056†	680,95	1634,89	2315,84
Elephant,	do.	April, 1837,	20,553‡	330,90	89,91	420,81
Tartar,	do.	Aug. 1839,	22,818	174,37	605,60	799,97
Meteor,	Lowell,	Dec 1839,	29,721	415,63	201,38	617,01
Mars,	Philadelphia,	June, 1840,	25,558	373,47	384,61	758,08
Vulcan,	do.	July, 1840,	21,017‡	305,90	227,82	533,72
		Total.	157,965½			

The above statement of repairs embraces, in addition to the sums charged to each engine, an apportionment of the general expenses of the machine shop, for coal, tools, etc., so as to give, as nearly as is practicable, the whole cost of repairs on each.

*Eight months only on the road. †Seven months on the road. ‡Ten months on the road.

Cost of repairs of Engines and Cars, and miles travelled by Locomotives on the Boston and Worcester railroad, each year, from 1835 *to* 1840.

Years.	Repairs of Engines & Tenders.	Repairs of Freight Cars.	Repairs of Passenger Cars.	Total Repairs.	Miles run.
1835	$ 8,252	$1,157	$1,034	$10,443	82,049
1836	10,597	2,316	3,620	16,533	104,280
1837	11,441	5,016	3,600	20,057	115,564
1838	11,961	2,578	1,133	15,672	108,320
1839	16,222	4,342	5,634*	26,198	122,306
1840	10,816	1,422	4,429*	16,667	160,325

*Including a general refit of passenger cars.

Cost of Repairs of Engines, Tenders, and Passenger and Freight Cars, on the Providence, Lowell, and Worcester Railroads, for each of the last four years, according to the annual returns to the Legislature.

Years.	Boston and Lowell.	Boston and Providence.	Boston and Worcester.
1837	$16,633	$29,794	$20,053
1838	10,945	19,953	15,672
1839	16,384	19,466	26,198
1840	14,454	16,755	16,667

The Boston and Lowell road is 26 miles in length, the Boston and Providence 41, and the Boston and Worcester, 45.

Post Office Department and Railroads.—The editor of the Providence Journal, noticing the attempt to authorize the Postmaster General to establish mail lines along the great routes under certain circumstances, says:

"We think the mail might be carried from Washington to Providence, half the way by horses, at as little expense as is now incurred, and with infinitely greater convenience to the public. The Philadelphia and Baltimore railroad company, particularly, needs an overhauling. That company receives the highest compensation allowed by law, and transports the mails at such hours as suits its own convenience."

We regret that so liberal a gentleman as our brother of the Journal, should have thus done injustice to a company which serves the public.

The idea that the mail could be conveyed from Baltimore to Philadelphia by horses, in any thing like the time now occupied, is preposterous. It has been tried often enough, and resulted in complete failure. Besides, four horses cannot carry, on the turnpikes and roads, the heavy mails, at any thing like the speed usual with mail coaches.

But the company "need an overhauling." Why? The company is not a servant of the government; it was not aided by the government; it owes not its charter to the National government;

and, moreover, it has been most shamefully used by the servants of the government at different times. How then is it to be "overhauled?"

But the company received the "highest price allowed by law." Well, what of that? The law does not allow enough. If the government want more work done in less time, let it pay for it, not pass a mean screwing law, and condemn an independent company for not expending its means, and ruining its stock, to meet that law.

But the company, it seems, takes its own time, etc. The eastern mail arrives in Philadelphia about midnight, and is immediately conveyed forward to Baltimore by this company, at an hour most certainly inconvenient to itself, and most unpropitious to the reception of passengers. The same line starts a conveyance at 7 A. M., and at 3½ P. M., for Baltimore—choices of time, one would think. But perhaps, some other hours are also required. Very well; only let the government pay, and the company will start a line for each city every hour in the day. If the government will not *pay*, by what right can it look for a command of the road? This mean spirit, this attempt at tyranny, was set on foot by the late Postmaster General. It was promptly met by the company; and so, we trust, will every other attempt to use the strong arm of government against individual or corporate rights. The mail comes from Baltimore to Philadelphia quite rapidly enough. If, however, it does not come often enough, let the government pay for another conveyance. The postage collected from letters and papers on this route is immense, and the government can afford to pay for what they get. If the department, with a view of buying votes for the last election, erected and maintained profitless, nay, costly routes in the extremities, do not let it take the Baltimore, or any other company, to make up that deficiency.—*Phil. paper.*

Eeinent Success of Long Lines of Railroads.—London, 3d July, 1841. Longest lines of railroads, which are completed in England:

	Price of the Stock.	Length of Line.	Cost.
Grand Junction,	£202 for £100 paid	97¼ miles	£1,906 000
Great Western,	92 for 65 paid	118½ "	5,288 000
London and Birmingh'm,	159 for 90 paid	112½ "	5,724 000
Lon. and Southwestern,	55 for 38⅞ "	77 "	2,284 000

Receipts of said railroads for one week in July, 1841 :—

Grand Junction, - -	1 week, ending July 10,	£9,041
Great Western, - -	1 " " " 11,	12,826
London and Birmingham, -	1 " " " 10,	17,435
London and Southwestern,	1 " " " 12,	6,307

N. B. The Great Western is just completed. Its last 13 miles were opened 30th June, 1841.

Remarks by the Evening Gazette :—

The London and Southwestern railway and the Great Western, have been completed only a short time, and bid fair to give at least 10 per cent. per annum dividends.

The dividends of the Grand Junction railway are 13 per cent. per annum. Those of the Londen and Birmingham are 8 per cent. per annum; and in each of these roads the income is increasing, and a good reserve is kept, beyond the dividends.

Each road derives a great advantage from having loans at 5 per cent., which enables them to make a higher dividend on the stock than they could if the whole cost of the road was *capital.*

This is indeed wonderful success, when we consider the great cost of these roads, which, (reduced to dollars, at $4 80 per pound sterling,) is as follows:

Grand Junction, - - - - -	$97\frac{1}{4}$ miles,	$9,148,000
Great Western, - - - - -	$118\frac{1}{2}$ "	25,332,000
London and Birmingham, - - -	$112\frac{1}{2}$ "	27,475,000
London and Southwestern, - -	77 "	10,790,000

In carrying on a long line of railroad there is a great saving in the fuel, in the expense of loading and unloading goods, and in the general expenses. And while these expenses are less than in proportion to the length of the road, the tributary sources right and left of the road, and at each end of it, increase as the square of the distance, as may be seen by a moment's reflection, or by drawing a diagram on paper. Thus, (other things being equal,) *a railroad of 200 miles will have four times as many tributary sources as a railroad of 100 miles.*

Long lines of Railroad.—If a railroad 220 miles long attracted to itself tributary sources from a strip of country (right and left of it, and at each end of it,) of *precisely the same width,* as would a railroad 100 miles long,—the consequence would be, (other things being equal,) that the *tributary sources of income* of a railroad, 220 miles long, *would be double* those of a railroad 100 miles long.

But it is evident that, as you increase the length of the railroad, *you also increase its power of attraction,* and extend this power of attraction over a greater width:—say, for instance, a passenger living 30 miles, at right angles from the railroad, and desiring to go 100 miles from home on the railroad, may yet find it best to go the direct route of 100 miles on the common road, instead of the 130 miles (composed of 30 miles of common road and 100 miles of railroad.) But if the same man, living 30 miles at right angles from the railroad, desires to go 200 miles on the railroad, he will, at once, decide that it is better for him to travel 230 miles, (viz. 30 miles of common road and 200 miles on the railroad,) than to go 200 miles, by the old road direct.

Following up this course of reasoning, we readily arrive at the conclusion, *that the strip of country, attracted by a railroad,* 200 *miles long, is twice as wide* as the strip of country attracted by a railroad 100 miles long. This strip of country, attracted to the railroad, being thus *twice as wide,* as well as *twice as long,* it follows mathematically, (other things being equal,) that *the tributary sources of income* to the railroad of 200 miles, will be *four times as great* as those to the railroad of 100 miles.

It need not be suggested that the demonstration above given applies to freight precisely as well as it does to passengers.

Hence the pre-eminent success and *good dividends* of the *long lines of railroads* completed in England, notwithstanding their enormous cost.—*Boston Atlas.*

The Western Railroad.—Some of the papers speak of the depot building of the Western railroad on the South Cove. The Western railroad begins at Worcester and extends to the western line of the State, and including the Albany and West Stockbridge railroad, which it is building under a lease from the stockholders, it will extend to the Hudson river in Albany, with a depot in that city. But it comes no nearer Boston than Worcester, and of course has no depot in this city. The Boston and Worcester railroad, which forms the eastern portion of the line of communication from Boston to the west, furnishes the necessary depot buildings in this city. This company has lately enlarged its passenger depot building, which is now 290 feet in length, and 51 and 60 feet in breadth. There are besides the adjoining spacious buildings for housing of passenger cars. The company are now building, in addition to the former accommodations for the freight business, a freight house, 465 feet in length and 120 feet in breadth, covering the entire square between Lincoln, Utica, Eliot and Harvard streets, to consist of platforms on the two sides, level with the floor of the cars, and of four railway tracks in the immediate space. They have completed the laying of twelve miles of the second track of the railroad, and will complete the laying of eight miles more before winter.—*Daily Adv.*

Statistics of Railroads.—The following from the Boston Transcript should admonish the stockholders of the Harlem railroad company, to make one concern with the New York and Albany railroad. *Short roads*, with their extra expenses of management, etc., will generally preclude dividends, while *long roads*, between desirable points, are sure of success. Certain it is, from the course pursued by both companies, our capitalists will not take up either, in the desired manner, whilst Boston "is heading us off" in our western trade at Albany.

The New York and Albany railroad, we understand, have the power to construct a railroad, on this island, to the business part of the East River, "with the consent of the corporation." If the bona fide stockholders of the Harlem railroad should not come into an equitable arrangement, we trust our Common Council, capitalists and landholders, will take the matter in hand, so that a good *permanent railroad* may be commenced at the north, the south, and in the centre, without further delay. We understand the country are still ready to do their part, although they begin to think they have been trifled with by conflicting interests. Manhattan.

Steam Engine.—We saw yesterday in the store of Dr. Sutton, in Third street above Branch, an application of steam which seems so very direct and simple, as to be worthy the regard of the curious in such matters. A very small boiler sent four streams of steam, the aggregate of which was less than one-eighth of an inch in thickness, into the nave of a wheel, whence it passed by the felloes out at the periphery, giving rapid motion to the wheel, which, by bands, is communicated to machinery. We do not know that the main principle is entirely new: certainly, however, the whole is remarkable for simplicity and effect.—*Macon Telegraph.*

Utica and Schenectada Railroad.—The Schenectada Reflector says—"This road commenced operations with the month of August, 1836, from which time up to the 1st of August, 1841, making a period of five years. Within that time the company's locomotive engines have made about 1,870 trips across the road annually, or in other words, have run on an average, about 150,000 miles a year, and within the period of five years, 750,000 miles. Within the same period they have carried 434,893 passengers over the whole length of their road, and 376,695 between intermediate points; making, in the aggregate, 811,589 passengers who have been transported on that road within five years. Within this five years, during which 811,589 passengers have been conveyed on that road, no accident, (with but one exception, in 1836, when two passengers were slightly hurt,) has ever occurred, by which any passenger was injured; and no serious injury, with but one exception, has ever occurred to any of the men employed on the engines or train. Within the same period of five years, during which the locomotive engines have made, on an average, 1,870 trips annually, they have never failed to make any one trip, have never but once been six hours behind their time, and, with four or five exceptions, have never been three hours behind their time, although snows have covered the track three feet deep, and floods have carried off, and fire burnt up bridges. There is no line of public conveyance on the face of the globe, not even excepting the Hudson river steamboats, that can show a greater degree of regularity, puntuality and safety, in the transportation of so great a number of passengers, than the Utica and Schenectada railroad, and certainly no railroad that can at all compete with it. This most complete and gratifying success is owing to the care, attention, and skill of Wm. C. Young, superintendent and engineer, and of David Mathews, superintendent of the motive power on that road."

Railroad speed.—An instance of the amazing rapidity with which communication can now be effected, through the medium of railroads, was afforded recently in England. A special train was despatched from Birmingham to London, on election business, at 12 P. M., (calling in its course at seven intermediate stations, and suffering delay altogether of fourteen minutes,) and arrived at Easton station at eleven minutes past three A. M., thus performing the distance of 112½ miles, exclusive of stoppages, in two hours and fifty-seven minutes!

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HERRON'S PATENT TRELLIS RAILWAY STRUCTURE.

We are indebted to Mr. Herron for his pamphlet, containing full and well illustrated descriptions of the various modifications of his patent.

Without the voluminous drawings, it would be impossible to give the descriptions from the pamphlet before us, as continual reference is made to the cuts. It will be easy, however, to give our readers, who may not have seen the work, a very fair idea of its merits, by omitting all the details.

Mr. Herron, in the modifications specified, has adopted various expedients, which the experience of engineers has designated as the most suitable means of obtaining a good road. These he has in various ways combined with his patent "Trellis Railway Structure." This trellis, or lattice, precisely resembles that used in the ordinary Town's bridge—placed horizontally upon the ground—and extending beyond the track on both sides, with the rails placed over the lines of intersections. The rails are supported continuously by a stout string piece, and the whole structure is fastened together by suitable pins.

The advantages claimed for this track, are as follows:—First, the great extent of bearing surface. It will be evident that a road, constructed upon this principle, will contain, not only the same bearing surface as an ordinary track, but as much more as is due to the excess of surface of the diagonal timbers over the ordinary transom sills or cross ties.

2d. This extent of surface is not only great, but is distributed in the most advantageous manner, not only between the rails, but on either side, and thus distributing the effect of any irregularity of support over a large surface and diminishing the consequent weakness.

3d. The two lines of rails in the same track are intimately connected, and in fact constitute one whole piece of work. According to one of the plans proposed, each rail is supported by five in-intersections of these oblique sills; by another plan, the number of intersections is increased to seven. It must be obvious that the sills, proceeding in both directions from a single rail, are made to unite with three rails on the opposite side, and these again distribute their stress upon other sills in like manner, so that a system of support is obtained by these interlacing timbers, highly complicated in its division, yet simple in construction.

4th. Great simplicity in the structure and facility of repair is claimed as another advantage of this track. The lattice timbers are not notched or morticed upon each other, but are connected by timber pins, driven in pairs, so as to form an angle in the form of the letter V, and thus drawing in opposite directions. Screw bolts are also proposed in some cases, which are so placed as to fasten together the rail, string piece and lattice in one firm bond. By the removal of these, and by driving through the pins or inserting a saw and severing them, any one piece of this apparently complicated construction may be easily withdrawn and replaced.

5th. The author considers as indispensable feature in a good road, the continuous support to the rail, and has very properly incorporated it into all his proposed modifications. The propriety of the continuous bearing is now so generally recognised by engineers, that it would be unnecessary to discuss its merits. The joint of the string piece is judiciously placed beneath the middle of the rail.

6th. In accordance with another well established rule, the rail is permanently fastened to the structure only at the middle, while both ends are free to contract and expand under the influence of temperature, without endangering the solidity of the work. This fastening is made by the bolt before mentioned, or rather by two of them, and from the peculiar nature of the scarfing of the string piece, each of these bolts unites the rail, both of the string pieces and the lattice beneath.

7th. The track thus united, has, with the requisite strength and firmness in all its parts, that due degree of elasticity so proper to the ease of motion, which saves the wear and tear of machinery, and increases the comfort of the traveller.

It need hardly be said that the whole of this structure is to be packed with ordinary sand ballasting to the bottom of the rail, and a uniform path is thus afforded for the use of horses whenever that may be necessary, while no part of the timber is so exposed as to produce serious consequences if the cars should get off the track.

We believe we have fairly set forth the peculiar advantages possessed by the "Trellis structure" in this enumeration, and if we have alluded to devices not original with Mr. Herron, it is not for the purpose of detracting from his merit, as we do not conceive that originality, obtained in defiance of all experience, is deserving of any thing short of contempt, while on the other hand, by ingenious and original applications of well known principles, the credit of the inventor is greatly increased.

There are, however, beside the structure proper, several contrivances introduced in the plans before us, which deserve a passing notice, although they cannot be fairly represented without many cuts.

One of them is the patent wrought iron chain. This chain is made by cutting a plate of wrought iron with two cuts on either side, down to the base of the rail, over which the two outer ears thus formed are turned so as fairly to embrace the rail, while the central ear on each side, is perforated to receive the fastening. This chain needs no bolt, key, or other fastening, for the rail which is retained in its place by the elastiscity of the iron, which yet allows of a longitudinal movement, from the change of temperature. There are some objections to the use of this chair, which, however, are met by the inventor, and some of them claimed as advantages. The cast iron rail proposed by Mr. H., we cannot regard in so favorable a light as his other contrivances, although the joint which he proposes, is ingenious and useful. One objection to this rail is, is the shortness of the lengths, and although this facilitates the handling of the rail, and permits its being cast vertically, yet we do not consider these as a counterbalance to the disadvantages. It is true, that the ingenious joint proposed by the inventor, is calculated to prevent any serious jolt in passing over it, yet the weight of the passing train being distributed over so short a distance by each rail, cannot fail to injure the structure, while the strength imparted by a long bar of wrought iron is entirely lost. It must be remembered, however, that this forms no part of Mr. Herron's "Trellis Railway Structure," which is adapted to the best form of rails in use—he has merely proposed it, among other modifications, in which various forms of his other patents are introduced. The economy, however, of the cast iron rail, cannot be doubted.

The account of some of the processes for preserving timber, appended to the pamphlet before us, is so highly interesting, that we shall transcribe it for the benefit of our readers. We are for ourselves, however, by no means satisfied of the superiority of Kyanizing. It certainly is not economical, as it costs from three to four times as much per cubic foot, as the preservative process of Dr. Earle's, which we believe to be quite as effectual, and better adapted to penetrate large timber.

[Communicated.]

REPORT OF THE GRAND JUNCTION RAILWAY, 97 miles, 30th June, 1841.

The whole capital of the road and equipment is stated at £2,282,549, or at $5 per £, $11,412,700.

Receipts and disbursments for each half year since the opening of the road:—

	Receipts.	Disbursements.	Nett receipts.	Half yearly dividend.
Dec. 31, 1837,	£119,513	£62,078	£57,435	5 per cent.
June 30, 1838,	125,634	72,930	52,704	5 "
Dec. 31, 1838,	178,974	104,541	73,433	6 "
June 30, 1839,	190,511	104,667	85,844	6 "
Dec. 31, 1839,	229,593	118,140	111,453	7 "
June 30, 1840,	210,226	104,908	105,318	7 "
Dec. 31, 1840,	237,037	110,642	126,395	6½ "
June 30, 1841,	212,645	104,935	107,710	5½ "

The proprietors will not fail to bear in mind, that they are on the present occasion, for the first time making a dividend on the total expenditure of the company, and that, out of the receipts of the first, which is always the least productive of the two half years, and that first half moreover during an extraordinary stagnation of trade, not anticipated when they came to the resolution of capitalizing the entire debt of the company.

The revenue of the coaching department was kept down during a portion of the half year just ended, by an unnatural, and therefore temporary competition for Lancashire and London passengers on the part of another company, while the merchandize department is greater than under any previous half year.

The statement of the expenses will be found equally satisfactory, as they amount altogether to $40\frac{1}{4}$ per cent. on the receipts, though the proportion of goods to passengers, producing those receipts, is much greater than at any previous time.

It is gratifying to the directors to be able to say, that though the increase caused by the meeting of the Agricultural Society at Liverpool was 50 per cent. on the usual receipts, not a single accident occurred, nor, excepting some little delay from the unusually heavy trains, did any thing happen to cause inconvenience to the public; a circumstance which shows the immense advantages and facilities which railways are capable of affording in emergencies. The directors have not failed to acknowledge and reward the exertions of the different servants of the company, to which these successful results may, in a great measure, be ascribed.

Upon the state of the line of the works which the directors have personally inspected in the last few days, no remark is called for, all being in perfect order.

The directors trust they may feel gratified, on some future day, in bringing the project of a railway connection with Scotland by the Grand Junction, more distinctly before its proprietors for their support; at present their object is only to convey their own very strong opinion, that the Scotch traffic should be secured in a western route.

After speaking of the excellent condition of the railway and its stock, and of his confidence in it as an investment, the chairman said he would call the attention of the next board to two points deserving of mature consideration. The first was the passenger fares. He had observed that on railways where low fares were charged, the passenger traffic was astonishingly greater than where they were high, or even moderate. He would instance the Dublin and Kingston, where the rate was one penny (two cents) per mile for each passenger. He did not think this would apply well for long distances, for little or no difference would be made with respect to those who were regular passengers, and who had to travel. There was no inducement therefore to alter their fares throughout, unless their neighbors west and south would do the same. They ought, however, he thought, to reduce their short fares to a price which would have the effect of inducing the public oftener to use the convenience; the plan of charging the same rate of mileage on long and short passages, he was convinced was, under existing circumstances, wrong.

The other subject was the propriety of making dividends more than twice in each year, which he would strongly recommend. With the exception of goods, railway traffic was a ready money business. They might, without making up any entire statement of accounts, divide £2 10s. or £3 in the interims between the half yearly dividends, etc.—that is, make quarterly dividends.

For the American Railroad Journal and Mechanics' Magazine.

Among the subjects of most interest to the public treated of in the "Sketch of a Railway," recently published at your office, is that of the coal trade, showing that the only available mode heretofore of conducting it, has rendered necessary the demand of prices which have borne hard on consumers, and been most particularly oppressive on the poorer classes of them when they are least able to afford it.

It does seem an anomaly that the home product, which is only 200 miles off, should bear as high or a higher price than the foreign sorts which have to come to us a distance of 3000 miles. The faith in the cheapness of canals is yet too generally and too strongly implanted in our community, to bring them under the suspicion of being in any way the cause of it—nor will this faith be much shaken until by the means of a railway, coal is actually to be bought much under our present high prices.

As a useful record to look back upon at some future day, it may be well to give the present price of Anthracite coal delivered from the boat, which may now be stated at $7½ per ton. Let us then see and record also the items which fill up the margin, between the first cost and that price which would seem to imply large profits somewhere.

Cost at the head of navigation, white ash, per ton, -		$2 00
Freight down the Schuylkill, 108 miles, - -	$1 70	
Toll to the canal, " - - -	90	
Wastage, handling and shipping on the Schuylkill,	67	
Freight round to New York, - - - - -	1 40—	4 67
Cost shipped on the Schuylkill, - -		$6 67

At $2 to the miner at the head of navigation, the profit is but moderate, and the dealers in New York at a cost of $6 67, is certainly not overpaid at $7½ afloat. Those then that make the most profit under this system, are the canal and freighters—the former have maintained a steady charge at the above rate, and have divided 18 per cent. per annum—the latter fluctuate with the demand for coal, and generally absorb all the advantages in a rise of price, neither the miner nor the dealer ever benefitting much thereby.

If, therefore, reform is in any thing wanting, it is in the coal trade, both as regards a reduction of the price and a regularity in the supply, by which our own immediate comforts and the general prosperity of the city would be so favorably affected. An average reduction of $2 per ton on the prices heretofore paid on coal would be a saving to consumers generally, directly and indirectly, not readily estimated, to effect which but one resource exists, and that is by the railway.

But how small the proportion of persons, who yet believe in its efficiency—and remain to be agreeably disappointed, as they certainly will be, when the test shall be applied by the railway, which has been made the subject of the "Sketch." Meanwhile, however, the Cimerean darkness in which the many are thus found in regard to the immense powers of this improvement, as constructed and managed at this day, is attempted to be made still darker, by statements of the following cast, which appeared about the beginning of June last, on this very subject, in the Philadelphia United States Gazette, by a writer who began by claiming some *little practical* knowledge of canals and railways, and concluded his long essay, as well he might, with the reservation of not pretending to *extraordinary accuracy.* Thus, as to the *groundwork* of his calculations. The expense per annum of running a "*Locomotive and train of* 60 *cars*" on this railway is made by him to be - - - - - - - $24.550

While the actual fact, as proved by results on a dozen roads *inferior to this*, is that it cannot be made to exceed $10,000, or at most - - - 12,000

The repairs to road, maintenance, superintendance, etc., he charges at $186,700 per annum, being at the rate per mile per annum, - - - 2,000

While the actual fact, as can be proved by results on other roads, and competent to *renew the whole superstructure*, is a sum not exceeding per mile per annum, 1,250

But besides this he charges a sum of $80,000 per annum, to cover the wear of the rail per annum, putting the whole cost of the line of 94 miles at $2,000,000!! Now at 80 tons of iron rail per mile for 94 miles it would make 7,500 tons, which at $55 per ton, (the present price delivered in New York being only $45 per ton,) would amount to only $414,000 for the whole line, requiring *at his own rate of wear* of 4 per cent. per annum, only $16,500 per annum, and that without giving any credit for the *old iron*, worth at least one half of the new, an item of set-off, altogether overlooked by this *practical* man. And just as he lays it on to the railway so does he take it off of the canal—the extraordinary repairs to the canal he charges at only $10,000 per annum, on the principle that "water does not wear like the rails of the road," (see freshets of 1839 and 1841,) and he makes the coal boats on the canal deliver each in the season of eight months 1320 tons of coal, when any of the boatmen would tell him they rarely average over 900 tons.

It needs but to point to these more prominent absurdities of this writer—an elaborate exposition of them cannot be required—and we refer to them as specimens of the crudities by which the public allow themselves to be mystified, merely because they are endorsed as *unanswerable* by those whose interests debar them from knowing any better, and whose sanction by the accident of position, has some influence with those who are unwilling to do their own thinking.

The question with the public at large, is not as to the profitableness of this railway as an investment—what concerns them is, that it is competent to carry coal, as so fully established in the "Sketch," and at prices which will effect the desired reform. These prices have recently been announced by advertisement to be $1½ per ton for the winter, $1 75 for the spring, $2 per ton for the summer, delivered on the Delaware at Philadelphia.

By this route, therefore, the cost of placing coal afloat in New York will be about as follows, say for the white ash sort :—

Cost of mining, say white ash, - - per ton,	$1 00
Mine rent, - - - - - -	30
Toll on lateral road, - - - - -	15
Freight and toll to the Delaware, - - -	2 00
Shipping charges, - - - - -	10
Freight to New York through Delaware and Raritan canal,	80
	$4 35

Making a difference of $2 32 per ton less than the cost at the present moment of placing coal afloat in New York, as shown above, from the Schuylkill region. The principal advantage, therefore, of this railway is, that it will regulate the prices in future by the canal, so that hereafter, *between the two*, the public will be served at steady and moderate rates.

We say "*between the two*," for the reason that we estimate the consumption of 1842, '43, the season when these avenues will be in full competition, at 800 to 1,000,000 of tons of Anthracite, and that with only one track, and the want of other conveniences, which time alone can bring, we do not believe in the competency of the railway *at first* to deliver conveniently over 500,000 tons per annum; and further, that it is much the interest of the railway, and indeed of the whole Schuylkill region, that the remaining 500,000 tons *should be made to pass* the canal, which by the *right co-operation* could be readily effected.

The basis for accomplishing this must be a conformity in the cost of placing the white ash coal afloat in New York by canal and railway, taking $4, 35 per ton as made above by the latter for a standard, against which other regions furnishing the same quality of coal, could not long continue to compete. The component parts of that standard as suited to the canal could be adjusted as follows, although they may be here put so low as only to allow the several interests to live :

Cost of coal at the mine, white ash, - - -	$1 00
Mine rent, - - - - - - -	30
Freight and toll over lateral roads, - - -	25
Freight down the Schuylkill, 108 miles, - -	1 00
Toll to the canal, - - - - -	40
Shipping, charges, etc., and supposing waste on canal saved,	40
Freight to New York from the Schuylkill, - -	1 00
	$4 35

It must be kept in mind, that *were it necessary*, the railway can carry profitably to itself under $2 per ton, as it has advertised for the winter, when the canal is closed, and that its adherence to that price is only required, as part of a compact, to place the dealer by canal on an equality with the railway, supposing the rates just assumed for the canal to be tenable as a living average.

Details of this character are, however, only to be fairly adjusted by actual experience; but while so many interests call for an arrangement by which these two avenues may be made to co-operate for the general good of the whole, and both to prosper, we yet hope to see one concocted from this rough draft which may have a mutual and durable basis. The preponderance in advantages for trade which the railway, by its general facility of personal intercourse alone, will diffuse throughout this region, must be seen and felt before they can be justly appreciated. Let us now see how the canal will stand at a toll of 40 cents per ton, allowing that the other parts of our plan will hold together.

By tolls, 500,000 tons coal, 40 cents per ton, - - -	$200,000
Water rents, - - - - - - - -	16,000
Tolls as now through the Union canal, etc., -	95,000
	$311,000
Interest on loans, 2,200,000, $5 50 per cent., - -	121,000
Repairs and maintenance per annum, - - -	100,000
	221,000
Dividend on capital, 1,700,000, 5 per cent., - -	90,000
	$311,000

This would make the canal a 5 per cent. per annum stock for the present, and if the railway should at the same time divide 10 per cent. or more, considering its additional resources in travel and the mail, etc., it should be rejoiced at, rather than give rise to any envious feeling.

While on the subject of the coal trade, we would only further advert to the readiness with which comparatively *distant* coal regions *talk* of furnishing large supplies of this article, without first finding a consumption for it. Thus the Cumberland mines—Wyoming Valley—Dauphin company, etc.—each have their item of 500,000 tons, ready to send forth when their avenues are clear—forgetting that the Schuylkill region with her *two avenues* of railway and canal, can always flood the markets and *undersell* them for years to come, even when the consumption shall have reached two millions of tons, the present capacity of the canal being near a million of tons, and that of the railway, with two tracks, illimitable.

It should be remarked, however, that the veins of the *red ash coal* (indispensable for domestic use) are comparatively limited in the Pottsville region, and may ere long become expensive to mine. It would then be desirable to make the large bodies of it in the Swatara or Pine Grove district more available than they now are—the smallness of the Union canal, and the low state of water in it generally, not allowing this coal to be got to market on terms to compete with that from Pottsville. When, therefore, the branch road, contemplated from Reading to Harrisburg, through the Lebanon valley, is opened, the plan should be to connect with it—which will open that district to the Susquehanna at Harrisburg on the one hand, and the Delaware at Philadelphia on the other, but particularly the latter, as the most readily and cheaply reached, for supplying the *great points of consumption* on the eastern seaboard.

If the co-operation we have herein adverted to, between these two parallel avenues in the Schuylkill valley, is as practicable as it certainly is desirable to all interests, immediate and adjacent, the sooner it is so publicly understood the better—and it would, in that case, be well for the parties interested, to proclaim that the rule of conduct they intend mutually to pursue, is that of

To Live and let Live.

New York, September, 1841.

[For the American Railroad Journal and Mechanics' Magazine.]

LAWS OF TRADE.

A writer in a late number of the Railroad Journal requested the Editors to republish an article which appeared in the London "Civil Engineer and Architects' Journal," in reply to a pamphlet by Mr. Ellet, Civil Engineer, on Railway and Canal tolls. The Editors complied, and this singular specimen of trans-Atlantic argument was copied into the last number of their Journal.

It is proposed to examine this essay, and to show that the English author has neither understood Mr. Ellet's system, nor appreciated its object.

First, then—"Mr. Ellet's object," says this writer, "is so to regulate the charge of toll upon a canal or railway, as that every part of the country through which the line passes, near or remote, may derive from the improved mode of conveyance an equal share of trade."

Now this is all fancy. Mr Ellet has no where written any such thing. The idea is in itself preposterous; and the very pamphlet under discussion shows, both by diagrams directly, and by fair inference from its language, that it is impossible to produce such a result, if it were desirable to do so. The trade furnished at every point of the line is assumed by Mr. Ellet to be unequal; and he proposes, as one of the objects of pursuit, to find a method of taxing this unequal trade, so that the greatest revenue may be produced, and that the charge may bear equally upon the property which is subject to taxation; and he contends that these conditions are entirely compatible with each other.

After this definition of Mr. Ellet's object, we have the following comment on his argument—the accuracy of which matches well enough with the precision of the previous assertion. "Now all Mr. Ellet's argument depends upon one little assumption, which he quietly introduces, without remark or explanation, quite unconscious that it contains the grossest fallacy. Mr Ellet takes for granted, that the cost of production is fixed, and on this rests his whole theory of tolls."

With this precious representation of his author, the writer then spins several pages of argument to prove that the cost of production is *not* fixed: that it varies in different countries, and under different circumstances, and shows with remarkable perspicuity, that it is a function of the value of land; that it is affected by rents and wages, and countless influences which, as a political economist, (the correspondent of the English Journal appears to be quite *au fait* in political economy,) have not escaped his penetration.

But, unfortunately, all this variety of learning is wasted—for Mr. Ellet has introduced no such assumption, and his theory depends on no such basis. Our critic in his zeal has mistaken an example for a principle.

Mr. Ellet asserts in many passages that, for a certain class of articles, the cost of production is to be deducted from the market value of the commodity, and that the residue is the greatest sum which the article will bear to be taxed for conveyance; but in no place is it intimated that the cost of production is constant. The cost of production, of this particular class of commodities—be it great or little, constant or variable, and let it depend on what consideration it may—he insists, is to be deducted from the market value, to obtain the limit of the charges which the commodity will bear. But this cost of production may be fixed or changeable, without in the least affecting the correctness of the theory in question. It is true that Mr. Ellet has introduced an example in a pamphlet which he calls "A Popular Exposition," etc., in which it is assumed, for the purpose of comparison, and to exhibit an application of his method in a single instance, that the cost of production is constant. In this case it was essential to his object, to assume something; and the assumption made is a fair and probable one, and the results exhibited are such as we find of constant occurrence on the extensive lines of improvement in this country. But still that example was a particular one, and only rendered general by the excited imagination of our critic.

To pass from this misrepresentation to something original, let us take up the third and last position of this commentator.

After admitting that there *are* some heavy articles of small value of which the expense of production may be said to be fixed, such as "timber," (the very commodity, let it be observed, which is used in Mr. Ellet's example,) "stone," "lime," "coal," "ores," etc., (the very articles named in his pamphlet)—it is added—"It is to such products Mr. Ellet chiefly applies his theory, but he does not confine it to them. He intimates that some other principles come into operation with reference to the more valuable articles of trade. But as I have not seen his observations on that part of his subject, and as it appears so me that his principle, if correct, *must be equally applicable to every branch of trade*, and as I know that it has been so interpreted and applied by many of his readers," etc., —he makes a lumping matter of it, and refutes the theory in the aggregate.

Now, can it be true—the question is put to the common sense of every reader—can it be true, as is asserted by this writer, that precisely the same principles govern the direction, and the charges that ought to be levied for the heavy trade which is confined to the mere borders of a single canal,—which possesses not sufficient value to be sought by a neighboring or distant competitor—as those which control the charges on commodities which are objects of competition for watchful rivals?

Can the writer be competent to the discussion of this subject, or of *any subject* which taxes thought, who asserts that the charge for toll levied on an article for which there is but one market and no competitor, must be regulated by the same considerations as apply to merchandize brought from the Ohio, and for which the rival works of Pennsylvania, Virginia and New York, and the navigation of the Mississippi, are all striving?

Does the introduction of a competitor introduce no new consideration? Are the same charges levied under a monopoly as under brisk competition?

This writer thinks so, or professes to think so, (for we cannot admit that he has ever reflected at all on any part of his subject)—and because Mr. Ellet discriminates between these two cases he condemns his arguments in a sweeping clause, and in the next line confesses that he has never seen them.

He, it seems, prefers to regulate the tolls as his fathers did before him, in the "natural" way; and we are perfectly satisfied to leave the matter to nature's management in England, if it be her province to take the charge of this business in that country; but in New York and Pennsylvania, where no natural law is recognized, the whole subject comes under the jurisdiction of canal commissioners, and we sincerely wish that they may be governed by principles which are applicable to the condition of this country; and be guided in their action on this subject by the true LAWS OF TRADE.

P.

To the Editors of the American Railroad Journal and Mechanics' Magazine:

GENTLEMEN—A writer in the last number of your Journal quotes the practice on the Irish Grand canal, as authority for deprecating the principles of assessing toll which are advocated by Mr. Ellet in his "Essay on the Laws of Trade." After reading that book attentively, I am not disposed to think that the wages of any line, in Ireland or elsewhere, are sufficient authority for repudiating its principles. And I am very far from thinking that the example quoted by this reviewer, goes, in the slightest degree, to impair confidence in them.

According to this article it would seem that in Ireland, stone and manure are of so little value, that the managers of the Grand canal can charge but 4d. and 6d. for their transportation; which they do charge without reference to distance. "And here," your correspondent pleads, "it is evident there is no room for graduation according to Mr. Ellet's plan."

And if so, I would ask, is there not evidently less room to graduate according to the plan which he defends? If these articles will only leave a maximum charge of 10 cents per ton, they will surely better bear the reduction proposed by Mr. Ellet than the increase contended for by Mr. "C. E. B."

The fact is, the managers of the Irish Grand canal have discovered that it is more profitable not to increase their charges proportionally to the distance on certain articles, than to increase according to the usual practice—and have thus made one decided step towards the tariff which Mr. Ellet recommends for such articles. They take an intermediate position between the proper and the common tariff. They recognise that it is impolitic to increase with the distance in certain cases, and they accordingly stand still—a little more reflection may convince them that it would be still better to retrograde. I approve of the course of these managers in making one step towards what I believe to be the true system; and I hope that they may soon see the propriety of another move in the same direction. The experience of these parties as it is exhibited in their practice, is decidedly in support of the views which Mr. Ellet has advanced.

There is one other remark of this reviewer, which it may be well to notice. It is this—"There are, however, certain articles of which the expense of production cannot differ much, and may be said to be fixed. Such as stone, lime, timber, and perhaps coal, ores, etc."

"In certain cases, then, it would appear that Mr. Ellet's assumption is correct, that the cost of production is fixed or nearly so. But it so happens that in these instances, our author's system of tolls would be altogether impracticable. The commodities are of such little value as to be scarce worth removing, unless at a very small cost, etc."

All this may be true in Great-Britain, but I should be sorry to find the directors of the improvements of this country guided by conclusions drawn from such premises. Why, gentlemen, I have now before me the annual report of the commissioners of the canal fund for 1839, where I find set down no less than *six hundred and sixty-*

five thousand two hundred and eighty tons, for the quantity of "timber" shipped on the New York canals for that year; and the round sum of *four millions one hundred and eighty-seven thousand dollars* for its value; and *two hundred and fifty thousand dollars for the toll which it paid into the treasury.* I find also, in the same document, a record of more than *two hundred and twenty thousand tons of stone, lime and clay,* of which the value is estimated at nearly *one million of dollars.* And these are articles which our reviewer deems of such little value as to be scarce worth removing! Now I take issue on this ground—Mr. Ellet's pamphlet relates only to such articles—and in relation to such, this writer admits its correctness; but depreciates its value by depreciating the value of the products to which it is applicable. This, I think, exhibits great unfairness, or a ridiculous ignorance of his subject. RIQUET.

[From Herron's Description of a Patent Trellis Railway Structure.]

ON THE PRESERVATION OF RAILWAY TIMBER FROM DECAY.

The rapid decay of railway timber in our climate, exposed as it is to the sun, rain, air, damp earth and vegetation, has caused much solicitude to be felt on the subject of its preservation; but as yet little has been done in a regular systematic manner, by means of the *certain* process, so fully established in Europe, of mineralising it by means of corrosive sublimate; or, as it is there commonly called "Kyanising," after the name of him who by his address and perseverance succeeded in bringing the neglected process into general use. Wherever experiments have been made on the railways in the northern, southern, or middle States, they are officially reported to have fully confirmed the accounts we have from Europe of the astonishing preservative powers of the Bichloride of Mercury, one of the chemical combinations of common salt and mercury, well known, under the name of corrosive sublimate, as a deadly poison which arrests both animal and vegetable life, forming with their substances a new chemical combination that strongly resists all future change at natural temperatures.

On other railways, desultory efforts have been made at some considerable expense, but strange as it may seem, with the recorded experience of nearly a century against it, and without a single fact in its favor that I am aware of, *lime* has been the substance chiefly employed; lime—the powerful alkaline solvent of both vegetable and animal substances, the active fertilizer of the soil, which rapidly decomposes the dead vegetable while it quickens the growth of the living, not unlike in its action to the gastric juice in the stomachs of animals, and entering itself as a component part of the reproduced vegetables,—employed with the view of stopping decomposition and reproduction, under circumstances and in a proportion most likely to produce both results, according to our observation of natural laws.

There have been hot and cold solutions of lime used, also solutions mixed with salt, and even quick lime.

Feeling desirous that some cheap and effectual process might be discovered, I have endeavored to ascertain on what grounds the use of lime had been recommended, but have been unable to trace it to anything better than a vague popular notion in its favor. Every fact that has come to my knowledge has been decidedly against its use, which accords with inductive reasoning from cause to effect.*

Not so with some of the metallic salts, and another substance found in nature, creosote, which chemistry has separated from its combinations. To the latter, which is known to exist in the peat, is attributed the perfect preservation of the timber so frequently dug from the bogs of Ireland and other countries, bearing evidences of having lain there for ages. And it is now well known that creosote was the substance employed by the ancient Egyptians, more than two thousand years ago, to preserve the bodies of their dead, which, with the wooden cases containing them, have remained perfectly sound, as we see, to the present day.

The modern process for preserving timber, which has obtained such extensive use under the name of "Kyanising," it is conceded, was first proposed for the purpose by the celebrated chemist, Sir Humphrey Davy.

In a treatise on the preservation of timber, published by William Chapman, in 1817, he states that Sir H. Davy had recommended the use of corrosive sublimate, and from his own experiments he gave it a decided preference over every other salt: stating that a less quantity than an ounce to the gallon of water would not answer the purpose. This is equal to one pound of sublimate to 16 gallons of water, and the solution now in general use is 1 pound to 15 gallons.

Chapman also experimented with the sulphates of copper and iron; and Tredgold says recommended boiling the timber in a solution of the sulphate of iron, (green copperas.)†

We have also Dr. Ure's authority, that Sir H. Davy had, several years anterior to 1821, used and recommended to the Admiralty and Navy Board the use of corrosive sublimate; but either from doubts of its efficacy, or more probably from a vague apprehension which

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* Dr. Birkbeck states, that "about the year 1779, Mr. Jackson proposed a very complicated lixivium, in which vegetable bodies were to be immersed to protect them against decay. With total disregard of all chemical principles, he composed a lixivium of the *Muriate of Soda.* [common salt] *Epsom Salts, Lime, Potash, Salt water,* etc. He had an opportunity of trying it on the wood of several frigates and other vessels in the navy; but the result was that those vessels built with wood prepared according to his method were less durable than those which had been ordinarily constructed.

"Shortly afterwards a person named Lewis, attempted to accomplish the preservation of timber from decay by means of lime. The Amethyst frigate was assigned for his experiment; but decay was found to attack the vessel more rapidly than in ordinary cases.

"All are aware, [says Dr. B.] that when the dead among human beings are to be rapidly dissolved or disorganized, *quick lime* is thrown into the pit in which they are deposited, not for the purpose of protecting them from decay, but for the very reverse. Yet this is the substance which, upon various occasions, and perhaps more extensively than any other, has had its preservative powers boasted of by different writers."

† Chapman's work will be found in the Library of Congress, and probably in many other places, as it was on sale in Baltimore about 10 years ago. Tredgold's Carpentry was first published in 1820 or '21, and a second edition in '28; pages 199 and 200 of the latter, treats of the above, and on the use of corrosive sublimate, as recommended by Davy. He also reasons on the use of lime, tar, and other substances in his clear analytical style.

seems to have been entertained, that it might prove deleterious to those using the process, or that the prepared timber would exhale a dangerous atmosphere, its use remained circumscribed.

These groundless fears, as they have proved to be, had the effect of retarding its use, except among anatomists, to whom it was a well known preservative of the most delicate organic tissues and parts, even those most liable to putresence, such as the brain; which this metallic solution hardens in a remarkable manner, and saves from natural decay.*

Although the process was known and had been published in several respectable works, which were widely circulated, ten years or more had elapsed without much, if any considerable use had been made of it for the purpose of preserving timber; and, in fact, it seems to have been in a great measure forgotten, or more probably was deemed unworthy of trial by those who controlled the means of testing its utility, when in 1828, Mr. John H. Kyan proposed to the Admiralty to prepare timber in such a way as should resist dry rot or other decay. He was directed to prepare a 12 inch cube of English oak, which he accordingly did, leaving the sap wood on the four corners. This block was deposited in the fungus pit at Woolwich Dock-yard, where it remained three years, and on re-opening the pit, in July, 1831, it was found to be perfectly sound. This astonished all those who had witnessed the previous action of the pit, as it seems no preparation hitherto tried had been able to preserve timber for a similar period; and, so confident were the officers in charge, of the destructive powers of the pit, that they deemed it unnecessary to place an unprepared specimen of the same timber with it; particularly, as Sir T. B. Martin states, there were other specimens placed in the pit prepared in various ways with which it could be compared. All these pieces were destroyed by decay, and some of them, that appeared to have been coated with lime, were covered with fungi, one of them having a mushroom as large as a hat-crown growing out of it. The man who had charge of the pit produced a register of the experiments that had been made, in corroboration of his statement that he had never before seen timber taken out of the pit sound.

A piece of prepared Canada oak, with an unprepared duplicate, were now placed in the pit, and similar pieces put in the lining of a dock at Woolwich infected with dry rot; but the cube of English oak remained in a loft of the dock-yard for 15 months, when it was returned to the pit. In February, 1833, an inspection was made

* "A solution of corrosive sublimate has been long employed for the preservation of soft anatomical preparations. By this means the corpse of Colonel Moreland was embalmed, in order to be brought from the seat of war to Paris. His features remained unaltered, only his skin was brown, and his body was so hard as to sound like a piece of wood when struck with a hammer.

"In the valuable work upon the dry rot, published by Mr. Knowles, secretary of the committee of Inspectors of the Navy, in 1821, corrosive sublimate is enumerated among the chemical substances which had been prescribed for preventing the dry rot in timber; and it is well known that Sir H. Davy had, several years before that date, used and recommended to the Admiralty and Navy Board corrosive sublimate as an anti-dry-rot application. It has since been extensively employed by a joint-stock company for the same purpose under the title of Kyan's patent."—*Dr. Ure's Dictionary of Arts, Manufactures, and Mines. Article Mercury, Bichloride of, page* 811.

in presence of Mr. Faraday, Mr. Lockhart, and Mr. Farrell, an architect from Dublin, who took specimens; the unprepared pieces showed signs of decay, while the prepared were in the best possible state.

The pit was again opened on the "19th July, 1833, in the presence of Commodore Warren, Mr. Jephson, Mr. Benson, and several other gentlemen. The cube came out of the pit perfectly sound, it was sawn through the middle and split, and proved to be in a perfectly sound state; a certificate was affixed to the block by all the gentlemen present."

The Fungus Pit at Woolwich, had been in use since 1815; and the block of oak in question, it was proved, "had been five years surrounded by decaying matter—by the decaying property of the pit—by the heat generated by that decay—and by the quantity of carbonic acid which always existed in the pit, and escaped in great quantities whenever the doors were opened."

It seems, according to the report of Sir R. Stepping, Surveyor of the Navy, who reported the block sound, that up to the date of his report, (Dec. 20th, 1831,) Mr. Kyan had not explained the means he had made use of to preserve the wood. On the 31st of March, '32, he patented the process; the veil of mystery was withdrawn, and it was then seen that the effects which created such astonishment were produced by the neglected process of Davy.

Mr. Kyan's own statement is that he first applied corrosive sublimate to timber in 1825, and in March, 1828, he brought the subject to the consideration of the Admiralty.

The success attending the process in the hands of individuals, together with the uniformly favorable results which continued to be obtained, in the systematic experiments carried on by the engineer officers at the Royal Arsenal, Woolwich, had drawn public attention to the subject, and tanks for the saturation of timber, etc., were erected in many places.

In April, 1835, the Admiralty appointed a Board of Commissioners to inquire into Mr. Kyan's process for preserving timber; their report, together with the minutes of evidence, were printed by order of the House of Commons, 9th July, '35; from which, and other authentic sources, I select a few passages on the preservation of timber in similar situations to that in railways, which may be interesting to those who have not seen the more full accounts of the result of the experiments.

Sir Robert Smirke was one of the first architects to use the process; he had a couple of posts put up under a dropping eave, and both were exposed to the same actions. After a certain time one decayed; the other still stands. In 1825, he put some English oak paling to a house on Stanmore Hill, which was completely gone in four or five years: he replaced it in the autumn of '32 with *prepared* unseasoned yellow pine, which remains quite sound; some yellow pine paling put up the year before, *unprepared*, began to fail in a year, and is now quite gone.

He thinks it will not supersede the usual time for seasoning timber for *joiner's* work, but timber of large scantlings may be used the sooner for it. Timber, in his opinion, is not reduced in strength by the process; but cannot say to what extent the mercury penetrates the timber: he thinks, however, that it does penetrate, and stated that of the *tanked* wood he had used at Stanmore, in many instances a large piece of the prepared wood of a foot or more had been cut off from the ends: in other instances it had been morticed quite through, and in some instances a piece had been cut out longitudinally. In each case the interior wood, to the depth of at least three inches from the surface, had been exposed.

Sir Robert Smirke, when examined before the *Committee on Timber Duties*, stated:—"I have applied Kyan's process to yellow Canadian pine, about three years ago, and exposed that wood to the severest tests I could apply, and it remains uninjured, when any other, oak or Baltic wood, would certainly have decayed if exposed to the same trial and not prepared in the same manner.

"I took pieces cut from the same log of yellow pine, from poplar, and from Scotch fir; these I placed first in a cess-pool, into which the waters of the common sewers discharged themselves: they remained there six months; removed from thence and placed in a hot-bed of compost, under a garden frame, they remained there a second a six months: they were afterwards put into a flower-border, placed half out of the ground, and I gave my gardener directions to water them whenever he watered the flowers; they remained there a similar period of six months. I put them afterwards into a cellar where there was some dampness, and the air completely excluded; they remained there a fourth period of six months, and were afterwards put into a very wet cellar. Those pieces of wood which underwent Kyan's process, are in the same state as when I first had them; and all the others, to which the process had not been applied, are more or less rotten, and the poplar is wholly destroyed."

"As another example of the effects of the process, I may mention that about two years ago, in the basement story, of some chambers in the Temple, the wood flooring and wood lining of the walls were entirely decayed, from the dampness of the ground and walls, and to repair it under such circumstances was useless. As I found it extremely difficult to prevent the dampness, I recommended lining the walls and floor with this prepared wood, which was done; and about six weeks ago I took down part of it to examine whether any of the wood was injured, but it was found in as good a state as when first put up.

"This preparation of Mr. Kyan's resists all rot—'I CANNOT ROT IT,' added Sir Robert Smirke."

The following report of Mr. S. Beazley, architect, will show the effectual manner in which the prepared posts and palings of the Regent's Park, London, have been preserved by corrosive sublimate:—

"At the commencement of the year 1836, I surveyed and accurately examined the posts and palings in the Regent's Park, for the purpose of ascertaining the comparative states of those timbers which had been prepared by Kyan's patent, and those which had not been submitted to the process of solution. In my report of that period I stated that indications of decay were already perceptible in most of the unprepared timbers, both at the bottom of the posts, and in those arris edges and ends of the paling which were placed in or had come at all in contact with the earth; while those timbers which were marked as having passed through the solution were quite free from any such symptoms. I now beg leave to state that I have this day, (March 24, 1838,) after a lapse of two years and a quarter from my previous survey, again accurately examined several of the same posts and paling, digging away the earth from the foundations for that purpose; and find that the symptoms of decay, mentioned in my preceding report as having commenced in the unprepared timber, have so considerably increased as to have rendered the bottom of the posts completely rotten to a depth of from one to two inches, and that in several instances fungi have been the consequences of the decay; while I find the prepared timbers which are in the earth sound and in the same state, with the exception of mere discoloration upon the surface, probably arising from the damp state of the earth at the time of its removal. As a farther proof of the difference existing between the unprepared and the prepared timber, we could cut with the greatest ease large pieces from the former with the spade, without using any force, while it required great exertion to chip off very small pieces from the latter."

In the 1st vol. of the Professional Papers, published by the British Royal Engineers, a very interesting account is given of the experiments made at the Royal Arsenal, Woolwich, on the effect of Kyan's process in preserving various specimens of seasoned and freshly cut green timber, cordage and canvass from rotting. I select the following from page 144.

"2d. Of the pieces of wood partly driven into the ground under the eaves of a building, and exposed to the united action of sun, rain, and damp earth, we all agreed, that all the five pieces of oak, ash, elm, Memel fir, and American fir, 'prepared' with the patent, are quite sound; whilst of the duplicate pieces 'unprepared,' the elm and ash were rotten, and the progress of decay had commenced in three others, the oak being the least affected.

The woods used in the foregoing trials had, previously to being put down, been seasoned two years.

"We then proceeded to examine what you, at Mr. Terry's request, had placed under the same test as the last described woods; it appeared to be the most severe trial, viz:—

"A piece of oak, five feet long, three inches diameter.

"A piece of ash, two feet five inches and a half long, six inches and three-quarters diameter.

"A piece of elm, five feet one inch long, three inches and one-eighth diameter.

"All of which came here quite in a green state, and with the bark and some leaves on them, and after being split down the middle and marked, half of each specimen of wood was returned to be saturated with the patent, and when sent back again the whole were put down 31st March, 1835.

"They were taken up a few days ago to dry, and we find at the end of the year and a half, that the '*prepared*' pieces, even to the preservation of the *bark* and *sap*, are perfectly sound, and the 'unprepared' quite *rotten*."

I should state that the foregoing inspection and report are dated 28th September, 1836; and that the seasoned specimens had then been down *three years*.

The process has been found equally efficacious in the preservation of ship timber, even where it is exposed to the constant saturation and wash of the bilge-water, and external wash of the sea. It has the remarkable and highly beneficial effect of keeping the ship and bilge-water free from the usual prutrescent effluvia so offensive in new ships and probably injurious to the health of those on board.

The first ship built wholly of mineralised timber was the "Samuel Enderby," of 420 tons, built at Cowes, in the Isle of Wight, of seasoned oak, with the exception of some of her upper deck beams, which were felled for the purpose and saturated green, having sap on the corners, which was found to be as hard and sound as the other wood on her return from the South Seas.

This ship was launched in August, 1834, and sailed the following October for the South Sea Fisheries, from which she returned to England in March, 1837.

During her absence she was a great part of the time sailing under the line. The crew, 32 in number, continued unusually healthy; and the ship did not require caulking to the usual extent. The masts, yards, cordage and canvass were also mineralised; but the cordage and canvass of this ship did not realize the expectations that were entertained of it: the captain supposes the solution was too strong, as it seems to have succeeded in several other cases. The proofs of the efficacy of the process as regards timber have been so multiplied as to place it beyond a doubt; and my intended limits, which I have already far exceeded, compel me to pass over much that is interesting in the Reports of Lloyd's Surveyors of Shipping, and from other sources. I must confine myself to a few more brief extracts; the first is from captain Lisle's Report:

"*Timbers.*—As regards the timbers, the ship is perfectly sound in every respect, and shows no symptoms or indications of decay in any part throughout the whole ship; and it is my belief that the timber and plank have shrunk less than any new ship I have witnessed. Being at Cowes, inspecting the ship from the time her keel was laid until she was launched, and the greater part of her deck-beams being made from green timber just felled and afterwards submitted to the process, they are now perfectly sound, and firm as if cut from the most seasoned timber. These facts I consider to be strong evidence in favor of the process; and I am so satisfied myself of its good effect on timber, that I should recommend new ships to be built of timber prepared when quite green, and to let it be quite dry before placing it in the ship."

The owners of the ship, state,—"We feel so well satisfied of the beneficial effects of the preparation on the timber, that in any cases where we may have occasion either to build or repair our ships, we shall continue to use it, and in like manner for masts; in which particular we think that we have derived considerable benefit from its application."

On the return of this ship a bottle of the bilge-water was sent to Professor Faraday, who states that he found it turbid and saline, but quite sweet in smell, and though carefully examined for mercury could find none in it.

"The ship 'John Palmer' left London, December 13, 1833, on a South Sea whale voyage, and returned on 22nd of April, 1837, being absent three years and four months. Previous to her sailing underwent thorough repair: great part of the timber, masts, bowsprits, sails and cordage were saturated with Kyan's patent. The timber, from what I had observed during the voyage, and at the present time, is in the highest state of preservation We have been most of our time exposed to a tropical sun, and the planks in the sides have not shrunk in the least. The masts are in a high state of preservation, etc."

"I am of opinion that the patent has done everything for the canvass that was expected; it has prevented mildew and rot, though not wear and tear."

The above extracts are taken from Capt. Laurence's statement. It should be remarked that the whole of the ship's ceiling and sleeping berths of the men consisted of this timber. See the reports of Lloyd's Surveyors and other documents relating to her.

The process is stated to have the very important effect of shrinking timber as much in a few hours as a seasoning of years would have done; and of subsequently preventing its warping when exposed to the sun and rain; and, what will be found still more beneficial on railways, of preventing the splitting of the timber, which causes great destruction at present.

Dr. Birkbeck, who was one of the commissioners appointed by the Admiralty to inquire into Kyan's patent, in a lecture delivered before the Society of Arts, Adelphi, exhibited a piece of green larch, such as was to be used for sleepers in the Southampton railway. "When it was put into the solution it had cracked in various radial directions—some of the openings being large enough to admit a penny piece. The wood was now rendered perfectly solid, and a slight alteration in the level showed where the fissures had been."

The *rationale* of the process is as follows:—It has been ascertained that the disorganization, or decay of timber, commences with the putrefactive fermentation of the albuminous and gummy fluids, which soon extends to the starch and saccharine matter, lodged with the former in greater or less quantities in the sap vessels and pores of the timber; and as the alburnum, or sap-wood, contains a much larger proportion of these matters, it is the first part to decay. When once decomposition has commenced, the most solid part of the heart timber—the woody fibre, or lignin—offers but little resistance to the universal decomposition which rapidly follows when aided by moisture and a slight increase of temperature, of from 70° to 80°. This will not create surprise when it is understood that the lignin itself,—the most solid and insoluble part of wood,—is composed of 50 parts water and 50 of carbon; or, what amounts to the same thing, of oxygen and hydrogen in the same proportions which form water; and that the other component parts contain a still larger proportion of water, so that there is no deficiency of the materials of fermentation in any part of the wood.

Corrosive sublimate in addition to its anti-putrescent qualities, has the property of forming with albumen a compound which is insoluble in water, consisting of calomel and albumen.

When wood is steeped in a solution of corrosive sublimate, this insoluble compound of mercury and albumen forms in the pores and vessels of the wood, retaining with it a considerable portion of free sublimate, which Professor Faraday found to equal to three-fourths of the amount; but that it required the most thorough disintegration of the wood to remove it; and that it was his opinion, it would gradually continue, by a play of affinities, to penetrate the wood while it continued in a moist state: he, therefore, regarded the excess of the sublimate, in the parts near the surface of timber, as a most important condition.

Penetration.—Professor Farady stated before the commissioners, "That he had lately examined a plank cut from the middle of a balk of timber 20 inches square, to see how far the corrosive sublimate had gone in. It was easily found at one inch beneath the surface; and by a very careful examination, at four inches beneath the surface: and the process was to digest part of the wood at the spot in very diluted nitric acid, to evaporate the solution considerably, and then examine it by the voltaic battery; mercury appeared at the negative pole. He could not assure himself of its presence in the middle of the block by any means whatever. This was a piece of pine wood sent him by Mr. Brunell."

The test usually employed is the hydro-sulphuret of ammonia, which turns the prepared wood black.

Dr. Birkbeck states, "The analysis of the result performed by Fourcroy, and subsequent by Berzelius and others, is, that the *bichloride* of mercury has been converted in a *protocholride.* In that form it combined with the albumen, which being no longer soluble, descends in a visible form with the protochloride. In the change the bichloride loses one proportion of its chlorine. Bichloride of mercury consists of 200 parts, or one proportion of mercury, and 72, or two proportions of chlorine. One proportional is separated in this process, leaving the protochloride 200 parts of mercury and 36 of chlorine; that is, one proportional of mercury and one of chlorine; and the albumen, being separated along with the protochloride or calomel, descends."

M. Lassaigne, as quoted by Dr. Dickson in his lecture on the preservation of timber, delivered before the Royal Institute of British Architects, the 26th March, 1838, "calculates the composition of the albuminous precipitate to be 6.67 corrosive sublimate, and 93.33 albumen, or 1 atom of sublimate and 10 atoms of albumen."

Dr. Dickson remarks:—"It is impossible for bichloride of mercury to come in contact with albumen without coagulating it. Bichloride of mercury is thus the established test of the presence of albumen, and so delicate is it that the addition of corrosive sublimate to any solution of albumen will indicate the $\frac{1}{2000}$ part, by causing a flaky appearance of the fluid. On the opposite hand, albumen is the established antidote to poisoning by corrosive sublimate; and, though white of egg is generally preferred, milk, or flour diffused through water, or anything containing albumen, may be employed with success."

It would seem from the foregoing that a very minute quantity of corrosive sublimate would be sufficient in ordinary cases to preserve timber from *decay alone;* but in cases where timber has to be protected against insects, or is half buried in the damp earth, as that in the structure of railways, exposed more or less to the splitting action of the sun, and to the decomposing action of vegetation, I regard the excess of the corrosive sublimate as highly important. I propose, however, that timber for the interior of buildings, much of that used in shipping, and for many other purposes, instead of being steeped for several days in the comparatively strong cold solution of corrosive sublimate, should be boiled for a few hours in a very diluted solution, to which pressure might be added in preparing large pieces.

I should not omit to add, what seems obvious to me, that, to render the process effectual, the *timber should be perfectly sound* at the time it is steeped, otherwise the nature of the albumen will be changed, and the chemical combination cannot take place between the corrosive sublimate and albumen. I am further inclined to think, that the solution will be found to penetrate the wood much more deeply, and to be otherwise more effectual, if the timber be felled in the spring about the time the sap begins to rise, and steeped as soon as possible thereafter, while the fluids are in motion; and I have no doubt but that in this case also a much weaker solution than any now in use would be found effectual.

When timber has been long cut, or is affected in the slightest degree, strong solutions should be used. On some of the English railways a much more rapid and effectual mode of causing the fluid to penetrate the timber, by means of hydraulic pressure, instead of simple saturation, has lately been introduced. It is thus described as in use on the Manchester and Birmingham railway. A cylindrical iron vessel, 30 feet long, and 7 feet in diameter, formed of wrought-iron plates $\frac{5}{8}$ of an inch in thickness, double riveted together, so as to be able to resist a pressure of 250 lbs. on the inch, is filled with the wooden sleepers, as closely packed as it is possible; the solution of corrosive sublime is then forced in by one of Bramah's hydraulic pumps, worked by 6 men to a pressure of 170 lbs. to the inch. By this means the timber is more completely saturated in 10 hours than it would have been in some months on the old system.

As to the strength of the solution, with a view to the expense as in use. The solution used at Somerset House consisted of 224 lbs. of corrosive sublimate to 1,062 gallons of water, being rather more than 1 lb. of sublimate to 5 gallons of water; which latter are the proportions stated in Mr. Kyan's patent; he has subsequently stipulated in his licenses that the solution shall not be used of less strength than 1 lb. to 15 gallons; which latter are the proportions stated to be in use at the Royal Arsenel at Woolwich,* and that the average quantity of corrosive sublimate used was 1½ lbs. to 50 cubic feet of timber. The corrosive sublimate used at the Arsenal cost 4*s.* per lb., that at Somerset House 3*s.* 7*d.*, exclusively of the patent fee. The Admiralty agreed to pay the builder of the "Linnet" packet, which was the first government vessel built of prepared timber, 30*s.* extra per 100 cubic feet, which is equal to $7 27¼; this was the cost with a solution of the strength of 1 lb. of corrosive sublimate to 5 gallons of water, and includes the patent fee, and all extra labor in handling," etc.

I have previously stated that Mr. Kyan obtained a patent in England, bearing date the 31st March, 1832; some years afterwards application for a patent was made in the United States, which was refused, I believe, on the ground chiefly of want of originality. An act of Congress was, however, obtained, dated 31st of May, 1838, authorizing the Commissioner of Patents to issue a patent to Angier March Perkins and John Howard Kyan, which was accordingly issued the 23d June, 1838. This act removes the limitation of time within which the patent should have been applied for after the date of the foreign patent, and leaves it to the judiciary to settle the question of originality of invention.

In presenting this highly important subject to the consideration of the American public, and advocating its use, I have felt it incumbent on me to state such historical facts connected with the subject as were within my knowledge, that Mr. Kyan's claims might be fairly understood.

It is thought by some persons that the increased consumption of mercury would greatly enhance its cost, and that an adequate supply could not be obtained to mineralise the timber of railways. On looking into the subject I am satisfied that after a very little time the reverse would be the case, although there are some unfavorable circumstances at present. Dr. Ure, in his new Dictionary of Arts, Manufactures, and Mines, informs us that the mercury mine of Idria in Friuli, might easily be made to yield 600 tons British per annum; but in order to uphold the price of the metal, the Austrian government has restricted the product to 150 tons.

The rich old mines of Almaden, in Spain, since 1827, have produced 110 tons per annum of mercury; and Dr. Ure says that there is nearly as much more let escape into the atmosphere and lost, to the great injury of health in the workmen and inhabitants, by the old and barbarous practice of aludels, which have experienced no improvement since the time of the Moors; his words are, "I am confident that their product might be nearly doubled, with vast economy of fuel, labor, and human life."

* See the 1st vol. of Professional Papers, published by the Royal Engineers, page 181.

Pliny has recorded two interesting facts:—1st, that the Greeks imported red cinnabar from Almaden 700 years before the Christian era;—and 2d, that Rome, in his time, annually imported 700,000 lbs. from the same mines.

The mercury, as in most other cases, is lodged in a bed of bituminous shale, which is from 14 to 16 yards in thickness, extending from the town of Chillon to Almadenejos; and contains nearly 20 per centum of mercury. Near Almaden are the celebrated mines of Las Cuebas Almadenejos, the product of which was formerly appropriated exclusively to working the gold mines; the present yield is not given.

Those of the Bavarian Rhine provinces yield from 40 to 55 tons per annum.

The Hungarian and Bohemian mines, etc., have averaged from 30 to 40 tons per annum for many years.

The present yield of the above European mines, is, therefore, about 372 tons per annum of metallic mercury; which, according to Dr. Ure, who devised an improved distillatory apparatus for some of the German mines, might by this means alone be nearly doubled.

The mines of Guaneavelica in Peru, explored in 1570, yielded to the year 1800, equal to 53,700 tons. About the beginning of the century the annual product was from 170 to 180 tons. This with the product of other South American mines was employed in working the gold mines. There are also red cinnabar mines in Yunnan China, from which mercury was at one time obtained to work the South American gold mines.

It is stated here by the dealers that the Messrs. Rothchilds have now the sole monopoly of the Spanish and Austrian mines, and that they have, in the last two or three years, advanced the price from 42 or 50 cents per pound to $1 05, its present price. Manufacturing chemists charge 20 cents per pound for converting the metal mercury into corrosive sublimate, furnishing the salt, sulphuric acid and fuel, and returning pound for pound. It may not be generally known, however, that 100 lbs. of metal mercury will make 136 lbs. of corrosive sublimate; so that instead of a charge of $20 per 100 lbs., they actually receive $57 80. Whether this charge is exhorbitant or reasonable, I cannot say.

If we suppose 200 miles of railway track be laid every year in the United States, and that, including turnouts and other timber to equal 10,000 cubic feet per mile, which will require 300 lbs. of corrosive sublimate, the increased demand for mercury will only amount to 20 tons per annum.

It is believed that there are other metallic salts which will have the effect of coagulating the albumen, and thus preserve the timber. Dr. Earle, of this city, has a patent for boiling timber in a solution of the sulphates of copper and iron, which he states, in his publications, to which I beg leave to refer the reader, will have this effect, and only cost from 1½ to 2 cents the cubic foot.

I have previously stated that to the presence of creosote was attributed the perfect preservation of the timber found in the bogs;

it is also in use, in connection with coal tar, for the preservation of timber on some of the English railways ; and the following account of some recent experiments made in France with this substance, in connection with a metallic salt, give promise of results that seem likely to prove highly beneficial to railways, as the materials employed are very cheap and may be prepared at any place in our own woods. Indeed, the pyroligneous acid may be made from the tops, limbs, and waste wood, and the charcoal will nearly pay the whole expense.

M. Boucherie's process for preserving Timber by means of the Pyrolignate of Iron.—I am indebted to Professor Frazer for the following sketch of M. Boucherie's plan for the preservation of timber, as detailed in the leading article of the Annales de Chimie, for June, 1840 ; a full translation of which article will be published in the August and succeeding numbers of the Journal of the Franklin Institute.

The chief aims of M. Bouchrie's process are :—

1st. To protect wood against wet and dry rot.

2d. To increase its hardness.

3d. To preserve and develope its flexibility and elasticity.

4th. To prevent the play which it experiences, and the resulting separation, when after being work up it is exposed to atmospheric changes.

5th. To diminish very much its inflammability and combustibility.

6th. To give to it varied and permanent colors and odors.

The first result which M. Boucherie obtained from his experiments, was the establishment of the fact, that "all the alterations to which wood is subjected arise from the soluble matters which it contains." Having then ascertained the impossibility of separating these soluble matters by mere washing—he turned his attention to such chemical re-agents as would render them insoluble and therefore inert, and found that this change could be effected by all salts which have an insoluble metallic base. Seeking then, among this class of substances for that which should combine most advantageously the strong preservative action with economy—he found these two important conditions best fulfilled by the use of the impure pyrolignate of iron, made by the action of the acid procured from the distillation of wood upon iron filings or any small pieces of that metal.

The advantages of this salt are—1st. It may be procured at a cheap rate. 2d. The oxide of iron forms stable combinations with almost all organic substances. 3d. Its acid, (acetic,) has no corrosive properties and is volatile. 4th. It contains the greatest proportion of creosote which any aqueous liquor can dissolve, and there is now no doubt but that this substance protects all organic matters powerfully against every species of decay.

But the principal difference between M. Boucherie's process, and those of other experimenters upon this subject, consists in the manner in which his preservative liquor is diffused throughout the substance of the wood. After a variety of experiments in various ways, Mr. B. was led to investigate the natural absorption of growing wood, and came to the following interesting and important result. "If a tree of great height be cut, and its foot plunged, within a reasonable time, into a saline solution, whether week or concentrated, a strong aspiration is exercised by the tree upon the liquid, which thus penetrates its tissue, and finally reaches the extreme height of the trunk and even the terminal leaves—if we are careful to furnish a sufficient supply of the liquid.

Thus in six days, in the month of September, a poplar tree, 92 feet in height and 16 inches in diameter, the foot of which was plunged about 8 inches into pyrolignate of iron, was entirely penetrated by the liquid, of which it absorbed the enormous quantity of 10 cubic feet, (about one-tenth of its cubic capacity). A variety of interesting facts and experiments follow, the most important of which is that in all woods there is a central portion which does not absorb any liquid by this means of penetration, and which will probably resist all other methods of impregnation.

In reference to other qualities, M. Boucherie finds that the hardness of wood prepared in this way is more than doubled, so that the workmen complained much of the difficulty of working it.

In regard to the elasticity of timber, M. Boucherie deduces from his experiments, that

1. The flexibility and elasticity of wood are generally proportionate to the moisture which it contains—that these qualities remain only while this moisture lasts—and that the existence of these qualities is evidence of the presence of moisture even in the driest and oldest woods.

2. That in numerous exceptions it appears to depend upon the constitution of the wood itself, and is probably frequently owing to the presence of alkaline salts in the wood.

Following up these determinations, by causing the wood to absorb a deliquescent salt, he succeeded not only in maintaining its original elasticity, but in developing a degree of pliability which it does not possess when first cut. Thus pieces of pine wood, 2 feet in length, and $\frac{1}{10}$th of an inch in thickness, could be so twisted in the direction of their length as to form a complete helix, or could be bent into three concentric circles without breaking. M. Boucherie at first used chloride of calcium, (muriate of lime,) for this purpose, but now proposes, on account of its greater cheapness, the mother waters of salt marshes, which are chiefly composed of deliquescent chlorides. Wood prepared in this way had not had its elastic properties impaired after being kept 18 months.

In regard to the shrinking and warping of wood, M. Boucherie's experiments led him to the conclusion that these effects, (or such of them as were due only to the drying of the wood,) began to show themselves only at an advanced stage of the drying, and when the wood was about to lose the last third of its moisture. Continuing his experiments he found that these effects were entirely prevented by preserving to the wood this last portion of its moisture, by causing it to absorb a deliquescent salt—as in the process for preserving the elasticity. For the purpose of testing his results he caused to be prepared tables of considerable size and slight thickness, and found that after a year, while those made of the prepared wood remained unchanged, those made of the timber in its natural state were warped in an extraordinary degree. There are many other observations of great interest both on account of their direct practical value, and from the light which they throw upon vegetable physiology. But these, in reference to the preservation of timber from rotting—the maintenance of its elasticity and the prevention of shrinking and warping, I judged would be of the most importance for your purpose.

I remain yours, etc.

JOHN F. FRAZER.

LOW FARES ON RAILROADS.—It must be evident to all whose attention has at all been directed to the subject, that low fares increase both the travel on and profit of railroads wherever they have been established. Philosophy and experience unite in teaching this truth, and they who do not carry out its principles are far from consulting their best interests. The desire for travel, keeps pace with the facilities of travel; and the great knitting together of mankind in all civil countries, by means of the modern improvements of the steamboat and railroad, is a grand proof of the position that make the means of locomotion easy, both to the body and purse, and you create a travel which will effectually reimburse and greatly outbalance the expenditures. We propose to give a summary of the various statistics on this subject, both in Europe and America; by which it will be seen beyond the shadow of a doubt, that low fares best conduce to the advantage of railroad corporations and the community at large. The railway between Liverpool and Manchester, reduced its fare one half; the next year the passengers increased 200 per cent.

The low fares on the Darlington railroad produced 560,000 tons of freight and 196,000 passengers per annum over and above the estimate of the directors. The dividends of the company were £14 per share of £100, which sold readily at £260. The mere reduction of fare on this road of one cent. per mile, created an increase of over 21,000 passengers in three months. In 1836, the fare on the Edinburg and Dalkeith railway was raised about two thirds of a penny, and resulted in a loss of over 50,000 passengers per annum, besides what should be the natural increase of travel on the road. In 1836, the number of passengers on the Garnkirk and Glasgow railway, was 145,703; in 1837, the fare was raised $33\frac{1}{3}$ per cent. and the passengers fell down to 119,460.

In 1835, the fare on the Androssin and Kilwinning railway, was for the six miles, 7d.; the number of passengers 700; in 1836, it was 6d. and the number of passengers rose to 20,000; part, however, of this increase was owing to the cars running four times instead of twice a day as formerly. From January 1st, to August 6th, 1838, at 6d. for the six miles, the passengers numbered 20,818. From January 1st, to August 6th, 1839, at 8d. for the six miles the passengers numbered but 15,525.

On the St. Germain railroad, near Paris, during the months of January, February and March, 1838, there were conveyed at the original fare, 160,542 passengers, for 172,515 francs. During the same months in 1839, at a fare reduced 25 per cent., there were carried 236,889 passengers, giving a receipt of 189,545 francs, showing that though the fares were reduced one fourth, the amount received increased one tenth.

In Belgium, the experiment of low fares has been most satisfactorily tested. In 1839, according to the official report, the fare on the roads was raised 40 per cent., the receipts immediately depreciated 11 per cent. The Belgium administration established, however, a low rate of fares, averaging from 1 to $1\frac{1}{2}$ cents per mile, and according to the testimonies of Michael Chevalier, and the Chevalier de Gerstner, the reduction of fare increased the receipts even beyond what they were before, so that they absolutely furnish an increase to the State, though the cost of a Belgium road, is double that of an American one.

In the United States we know of no road where such small fare obtains. In some, the old stage rate is kept up; in all, it is too high. What the amount of travel would be if low fares prevailed, is shown by the rush wherever opposition lines are started; as for example, from New York to Albany—from New York to New Haven and to Providence—from Boston to Portland, etc., etc. Competition cannot indeed exist on railroads, because, being expensive monopolies, but one is seldom constructed in a given route. They can therefore put the fare at what rate they will, and sustain it as long as they will; but even this cannot be done with impunity; for though those who travel by necessity may use the road, those who travel for luxury will be deterred from it, by the exhorbitance of the charge, and the road, in the end, is the loser.

Such has been the fact on the Boston and Providence route; and their high fares, caused the building of the Norwich and Worcester road, by which the travel has been divided, and the Norwich road sustained by a handsome profit. When the Worcester company raised their fare 25 per cent., it called back a part of the old line of stages—decreased the travel—produced dissatisfaction among its former friends, and the directors were compelled to recede to their former rate, and the result has been the receipt of a thousand dollars per week more than when the fares were higher.

According to the statements of the Chevalier de Gerstner, the expense of sending a train over the roads of Belgium and America average one dollar a mile, so that a road 200 miles long would cost 200 dollars per train. Taking this as the basis of our calculation, and stating the distance between this and Macon *via* railroad route, at 193 miles, it follows, that a daily train with 50 passengers, could be transported over the road, at an expense to the company of

$3 86, or two cents a mile per passenger. The fare, however, is five cents a mile, or $9 65 for the whole, giving to the company a profit of $289 50 per train. It is very evident from this, that the fare could be reduced, and that the consequent increase of travel, would increase rather than diminish the receipts, for in this locomotive age it is morally impossible to bring the facilities of travel within the reach of all, without greatly augmenting the number, which avail themselves of its advantages. That which has proved itself true in other countries, will be eminently verified in our own.

We are a moving people, made so by the unrestrained intercourse between the several States, by which we can journey through twenty-six sovereignties, and still be in a common country—circulate about in a thousand channels, and through a thousand towns, without going beyond our own laws, or the protection of our own flag; and find from the Atlantic ocean to the Rocky Mountains, from the chain of Northern Lakes to the Gulf of Mexico, the same language, the same institutions, the same free people. There is no other nation on the globe thus situated; and the spirit of improvement needs but a wise and generous direction, to lead us onward to the consummation of our most patriotic desires.

We have hitherto spoken of the increase of passengers merely; but the same laws apply to freights. The extensive examination made on this subject, by a committee of Parliament, proved to demonstration, that low rates created freights; and the strict research instituted into this matter by the French government confirms the report of the English committee, by the experience of every railroad in France and Belgium. The subject of low fares and low freights, is worthy the consideration of our railroad corporations, particularly in this State, and at this time, when it becomes an object of great importance to secure the trade and communication with the interior. It is proved by actual admeasurement, that from the eastern terminus of the Western and Atlantic railroad in De Kalb county, the route to the Atlantic through the Central railroad, to Savannah, is 19 miles shorter than by Greensboro and Augusta to Charleston. Not only so, but the local advantages of the several links composing what we may term the Savannah and De Kalb chain, are far superior to the other chain running through Augusta, Greensboro and Madison. If, as is probable, Savannah should become the depot of the Royal Mail Packets, we shall then have a continuous line of communication even to the west, with one end resting on the shores of England, and the other almost touching the father of waters, as he rolls onward through his tributary valley.

When the route shall be completed in all its details, it remains but to reduce the present high rates of fare and freight, to draw hither the merchandise and travel of the south-west, and thus effectually check the draining operation of the South Carolina road to Augusta, by which the resources of our State are made to minister to another's welfare, and build up another's strength at the expense of our own.—*Savannah Georgian.*

PARIS, *August* 28, 1841.

Authentic reports have just been issued of the results of Dr. Boucherie's processes for imbuing wood for preservation against all injury from the elements; for coloring, scenting it, etc. They are highly important with regard to cabinet ware, railways, naval architecture, and every kind of building on land. Timber is rendered superior in every respect to the metals; the period of preparation for durable use is short, comparatively; every variety of hue and fragrance may be imparted to the simple board or block. The captain of a Bordeaux vessel, recently returned from the Isle of Bourbon, states that he took out with him specimens of different woods from the collection of Dr. Boucherie, which, though kept constantly in the sea during the whole voyage out and homeward, did not suffer the least deterioration or injury. The French government, having commissioned Dr. Boucherie to operate on public timber, announces its perfect satisfaction with the experiments hitherto made.—*Correspondence of the National Intelligencer.*

THE VALLEY FURNACE.—The new Anthracite Furnace, on the Valley Furnace tract, about seven miles from our borough, was blown in on Friday, the 17th inst., under the superintendence of Mr. Ralston, with complete success, and has continued to work in the most admirable manner ever since. On the first tapping, we understand, grey iron was produced of the best quality. The furnace is 8½ feet across the boshes and has run out about an average of five tons every twenty-four hours. This quantity might be materially increased, but the proprietors, Messrs. Taylor & Co., very properly prefer producing a good iron, in the place of overworking the furnance at the expense of the quality of the article.

This is the fourteenth furnance which has been blown in under the superintendence of Mr. Ralston; and he assures us, that she was blown in with less difficulty, and works with more satisfaction, than any of the others which he has been connected with.

The ore used in this furnance is *exclusively* of this region; and those who may have doubts respecting the quantity and quality of our iron ore can easily have them removed by paying a visit to the above furnance; for we boldly affirm, there is more iron ore in Schuylkill county, and of a quality to produce the very best description of iron, than in any county in Pennsylvania.—*Pottsville Miner's Journal.*

ATTICA AND BUFFALO RAILROAD.—The Attica and Buffalo Railroad Company are proceeding vigorously in the prosecution of this work. The whole road has been placed under contract in a manner that requires each contractor to become a stockholder, receiving his pay half in stock and half in cash. Each contractor having thus an abiding interest in the road, large advances are made towards its completion. The cars will commence running on the 4th of July, 1842, those on the road between this city and Batavia being used for the whole distance to Buffalo, 72 miles.—*Rochester Democrat.*

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CREOSOTE CONSIDERED AS A PRESERVATIVE OF TIMBER.

The antiseptic properties of tar have long been known, and these, together with the comparatively trifling price of the article, have recommended it as a coarse paint for timber in exposed situations. The distillation of coal in the manufacture of illuminating gas, furnishes a large quantity of the variety called "coal tar," and this has been ascertained to possess properties of antiseptic character similar to those of wood tar.

The discoveries of Dr. Reichenbach, announced in 1830, showed that the varieties of tar were complex mixtures of various distinct principles, of which he examined and described six, viz: *capnomor*, *creosote*, *eupione*, *paraffine*, *picamar* and *pittacal*. One of these, creosote almost immediately attained great celebrity as a medicinal agent of great antiseptic power. As the limpidity of this substance renders it far more convenient to use than tar, it was soon proposed to apply it in its impure state as a preservative of timber. In confirmation of these views, a work was written, the date and title of which we have forgotten, to prove that the high state of preservation observed in the wood and bandages of the Egyptian mummies, was owing to the use of creosote. Of the correctness of this opinion, we shall speak hereafter.

That we may the better examine the propriety of the various applications of creosote, it will be necessary to consider its properties when *pure*, and then refer to the mode of preparation. The importance of this part of the inquiry, and the little information on the subject, accessible in the English language, will be our excuse for going somewhat into detail. Our chief authority is Dumas, who has collected from the papers of Reichenbach and others, nearly all that is known of this substance.

Creosote, when perfectly pure, is an oily, colorless, and transparent liquid, with a very penetrating and somewhat disagreeable odor resembling that of smoked meat. Its taste, is burning, very caustic, and at the same time sweetish. At ordinary temperatures, its specific gravity is a little greater than that of water. At 397° Farenheit, it boils and is vaporised. It is not congealed at 17° below zero.

With water, at ordinary temperatures, it forms two different combinations; one, a solution of $1\frac{1}{4}$ parts of cresotoe in 100 parts of water—the other, a solution of 10 parts of water in 100 of creosote. The aqeous solution is neutral, and although many and interesting compounds are formed both with acids and alkalies, they are not neutralized by their union with it.

Creosote, when concentrated, dissolves the oxide of copper, and is colored chocolate brown; nitric and sulphuric acids are decomposed by it, acetic acid dissolves it in all proportions.

It combines readily with lime, and is then soluble in water. Ammonia also dissolves creosote, and is an ordinary impurity separated with difficulty.

Creosote dissolves a large number of salts, including nearly all those proposed for the preservation of timber. Alcohol, the resins, and nearly all the constituents of tar, combine with it freely in all preparations. The separation of the latter constitutes the great difficulty in obtaining it perfectly pure; a condition wholly unnecessary in its economical application.

The most important property of creosote, and the one upon which its antiseptic powers are based is the coagulation of albumen. This may be illustrated by putting a drop of creosote into a dilute solution of white of egg in water, a white coagulum is immediately formed. Fresh meat immersed in an aqueous solution of creosote is in a short time preserved from all putrifaction, and in taste and smell, resembles smoked meat. This substance also coagulates the blood, the fibrous matter of which, however, is not effected.

The medical uses of creosote depend upon this property, but dangerous consequences have resulted from its indiscreet administration. Admitted into the stomach in a concentrated form, it destroys the vitality of the organ, although it preserves from putrifaction after death. The same remark applies to its improper application to the teeth, the pain is indeed removed, but the tooth is destroyed. We refer to this medical fact, as from it an argument is brought by some to prove the existence of a corrosive property. The mistake arises from confounding the destruction of the living tissue and that of the fibrous matter. The analogy with corrosive sublimate, in this respect, is perfect.

Plants watered with the aqueous solution are killed, and even the odor repels insects, hence its use in resisting the attacks of fungus or dry rot, as well as those of borers and other insects.

It is evident that the antiseptic properties of tar-water, rendered famous by the treatise of Bishop Berkley, of crude pyroligneous acid, and of smoke, depend in a great degree upon the presence of the substance under consideration. It has often been remarked that the beams of cabins, with badly constructed chimnies, or with none, are found externally covered with a sort of varnish, and imbued throughout their substance with a matter which prevents decay and the attacks of insects. This is particularly the case in those districts where peat is the only fuel; hence we may conclude that this substance might be profitably employed as a source of creosote.

Creosote is commonly obtained from crude pyroligneous acid or from wood-tar, in the former case its separation is necessary in purifying the acid, and is, therefore, attended with no loss of the products of manufacture. The most abundant supply is, however, obtained from tar, and this is the substance usually employed in preference to all others.

The processes necessary to obtain creosote chemically pure, are extremely tedious, and have been aptly compared to those of the alchemists. The tar is first distilled with rather moderate heat, and the substance which comes over, commonly called "oil of tar" contains the creosote. This is separated from the watery part of the product, is re-distilled, next digested with potash, the liquid again separated, etc., and the successive distillations, digestions, and separations, carried on with various modifications to the number of four, five or six, according to the desired purity of the article. These purifications are of course unnecessary, when the article is to be used for preserving timber, but it is well to study the properties of this substance in its purest state, in order to form a correct opinion of the various means proposed for obtaining it economically on the large scale.

Pyroligneous acid, properly speaking, is a mixture of creosote and acetic acid, which we have already seen, is its best solvent. Hence, when this impure acid is digested upon scraps of old iron, an acetate of iron is formed, which is dissolved by the creosote, and water which always accompanies the acid. There is no such thing, strictly speaking as a pyrolignate of iron, and this substance which has been proposed as a preservative for timber, is therefore an aqueous solution of creosote and acetate of iron, both substances useful in the process. As much of the difficulty of obtaining pure creosote depends upon a separation of this acid, it is probable that the process just mentioned, would prove both economical and judicious, as the formal separation is dispensed with, the acid is neutralized and serves to introduce the iron, which at least does no harm, and may do some good. The application of this mixture is easily accomplished by the ingenious process of M. Boucherie, which consist in immersing the butt of the tree immediately after felling it, into the solution, which is carried by the circulation of the sap to the extreme branches.

Several years since, a process was patented by Francis Moll for preserving timber by means of "creosote" and "eupione." The tar was distilled at a low temperature, and a product obtained called "eupione," which was set aside, the heat was then raised to a higher degree, and the product thus obtained was called "creosote." The wood to be preserved was placed in a close chamber and heated to expel moisture, the substance called by the patentee "eupione," was next introduced in the state of vapor, and when the wood was thoroughly impregnated with this, the vapor of his "creosote" was in like manner introduced. The former substance having thoroughly penetrated the timber, prepared the way for the entrance of the creosote by means of its strong affinity for the latter substance, which it drew after it through the pores of the wood. This is the explanation given by the patentee, who appears to reason from the result of experiment. It is probable that this process proved effectual, but it is very doubtful whether the substances actually used were those named. In the first place, "eupione" is hardly a product of wood tar, being obtained generally from animal tar from bones. In the next place, the difference in the boiling points of creosote and eupione is only 60°, a difference with difficulty preserved in the two distillations, particularly with large quantities of materials. It is not unlikely that the substance called paraffine, is in part the result of the first distillation, as this principle is found in tar, particularly that from the beech, and it rises in vapor at low temperatures—but paraffine has but little disposition to unite with creosote, unless in combination with naptha or some other ingredients of tar, which do in fact arise at low temperatures. Still it is evident that the process is one of some uncertainty, and we are not furnished with any means of ascertaining the uniformity of the products from different varieties of tar.

Most of the modes proposed for impregnating timber with tar, or its ingredients, agree in employing heat, and in this they are correct—but on the other hand, many of them are erroneous in introducing too much unnecessary matter, which prevents the free impregnation of the timber, and some not satisfied with this, added other ingredients, which renders the liquid still more difficult to be forced into the pores of the wood.

There is a common error, which attributes to mere resinous matter a preservative effect. One illustration of this error, is the fact that resinous wood is subject to the same decay with others, and even the richest pitch pine is said to very liable to a species of dry rot. It is true, that resinous matter, properly applied, may keep out the moisture, and thus prolong the duration of wood, but if the timber is not well seasoned, the resin only keeps the moisture confined, and accelerates the decay.

This leads us to remark that creosote is always the product of heat, and that substances which yield large quantities, under the influence of that agent, are totally inert in their ordinary state, and hence it is an error to suppose that the preservative effects of peat, are at all due to creosote. This property of peat has not been thoroughly explained, but, it would appear, that the absorption of oxigen or some other gases, or the immersion in an atmosphere of carbonic acid, were the principal causes, and the porous nature of the peat would favor this sort of action, offering an analogy to that of charcoal. If creosote were the preserving agent in peat, bodies or timber found in it would *remain* preserved after their removal; but this is not the case, for it is well known that bodies found undecayed, after the lapse of many years, have decomposed in a few days after removal from the peat.

The preparations of the Egyptians, are hardly to be considered in this connection. Too little allowance has been made for the dryness of the climate, in which even the human body is not liable to decay, after the soft parts have been removed, and a few simple antiseptics have been applied. Moreover, we have no reason to believe that any thing resembling creosote or even tar was in use among the Egyptians. A sort of bitumen or asphaltum was the only thing of the kind known to them.

It only remains for us to show the best mode of applying creosote, or some of its combinations, in a simple and economical manner

—and here experiment is undoubtedly the best guide; yet a few simple deductions from what has been said above, may serve as a direction to any experimental inquiries which may be made. A great assistance may be derived from the application of the white of egg as a test; it serves, at once, to indicate the presence, and afford an estimate of the quantity of creosote in any solution.

There are three states in which this substance may be applied. As a vapor, concentrated, and in the liquid form, or as a solution.

In the form of vapor, it is easily and effectually applied, and few operations are necessary, nor need the creosote be formally prepared. The best plan would be to heat the timber in a close chamber, and then introduce the vapor from boiling tar or "oil of tar." This process would at the same time season the timber in the most effectual manner.

The application of the substance in the concentrated form, would be attended with but little advantage, and would be far from economical. In the first place, there is the expense of preparation—in the next place, the waste caused by using an excess, which cannot be prevented—and the third place, the chance of leaving some portions of the timber unimpregnated, unless heat is applied, and then there is a risk of losing some of the substance in vapor.

The third, and it seems to us most eligible mode of application, is in the form of a solution. There are several ways of accomplishing this, and each of them may have its advantage according to the nature of the solution used. The timber may be soaked in a cold solution—it may be boiled, or be allowed to remain in the liquor, after having been boiled, until cold, ensuring a far greater degree of saturation—pressure may be applied—or, lastly, the timber may be impregnated by circulation, immediately after being cut.

The nature of the solution, itself, is a matter of some importance, and as there are various ways of obtaining it, there is a wide range within which to make a choice. The creosote may be dissolved out of tar, or still better, "oil of tar," by means of crude pyroligneous acid, by which no impurity of consequence is added, but a large quantity of creosote, which adds to the value of the solution. This solution may be digested on scraps of iron, or not, as experience may dictate.

An alkaline solution may also be obtained, by adding lime water or common potash, in solution, to the tar. The object of the alkali, being the solution of the creosote, and its separation from the other ingredients of the tar, it may be neutralized when this has been accomplished, either by some cheap acid, as in the case of lime, by the carbonic acid of the air. There are so many ways of forming these solutions, that great opportunity is afforded to a sagacious engineer, for accommodating himself to circumstances of time and place. For instance, there is hardly a railroad in the country that does not pass over or near a peat bed, large enough to afford the means of preserving all the timber of the road, at a small expense, and leaving a residuum, peat charcoal, which would pay nearly the whole expense of the process.

We have only to add another advantage of these solutions—that they can be boiled with very little loss of creosote, as its boiling point is above that of water. This is a topic upon which much might be said—but, at the same time, it is one upon which the engineer himself should take the lead in experiment, without waiting to adopt the crude inventions of unskillful or ignorant schemers.

[For the American Railroad Journal and Mechanics' Magazine.]

It is not my intention to discuss the merits of Mr. Herron's Trellis Plan of Railway, on which he seems to have bestowed a good deal of care and expense, with the very laudable desire of contributing to the improvement of this useful invention, and therefore deserves the thanks of all its friends, but merely to notice some remarks thrown out by him, in regard to the old form of railway, which, by not being rightly understood, might tend to lesson public confidence in them, which is not desirable until something really better comes to supersede them.

1st. He remarks that—*the engine being the more complex of the two, is damaged in the greater degree—hence we find that the expense of repairs in locomotive machinery, always exceeds the cost of repairs on the railway, usually* 50 *to* 100 *per cent.*

Now we are at a loss to understand how these two things can be compared, by which it is to be seen that the expense of repairs are 50 to 100 per cent. greater on one than on the other—it cannot be as relatively to their cost—and as to actual results, the fact is against the conclusion of Mr. Herron—thus, on the following roads among many as examples: Utica and Schenectady, road cost $1,900,000; repairs in 1840, $48,200; locomotive machinery cost $60,000; repairs in 1840, $9,992;—Georgia Railroad, road cost $2,300,000; repairs in 1840, $22,000; locomotive machinery cost, $90,000; repairs in 1840, $6,700. That the road and machinery re-act favorably or otherwise, on each other, as to cost of repairs, is evident enough—but such a comparison as is here made by Mr. Herron, is not readily understood.

2d. He remarks that—*Within the last* 10 *years, millions of dollars have been sent out of the country, for the purchase of railway iron, which has, for the most part, been admitted duty free, and if we may form an opinion from the rapid deterioration by crushing, exfoliation and splitting of the heavy rolled iron rails, but recently laid on some of our roads, many millions more will have to follow for repairs and renewals, etc.*

This would necessarily lead to the conclusion that this important part of the railway was very perishable, and was a constant source of trouble. That there are roads with inferior iron or inadequate strength, as compared with the motive power used on them; and thus, more particularly subject to this disastrous result, is likely enough —but that it is a general complaint, as being at all serious, cannot be allowed. On a line of road, having 4 to 5,000 tons of iron, it would not be possible, with the most vigilant inspection, to prevent imperfect bars being occasionally overlooked—but when they are thrown off the road, the iron is always valuable in the workshop—and the expense of replacement is but trifling—the general charge for the *entire renewal* of a superstruction, adjustment and management of road, only averaging about $700 to $800 per mile per annum, doing a very heavy business.

3d. He remarks that—*Now as the wear of the surface of the rails is scarcely an appreciable quantity, apart from the oxidation of the bars,* which can readily be prevented, and as the strength of the structure would save the bars from crushing and exfoliation, caused in the old mode, etc.—we may readily estimate the duration of a well made trellis track, formed of mineralized timber, at* 50 *years, etc., by which time the iron rails would not have lost more than* $\frac{1}{10}$*th of their original weight, let the trade be what it might.*

The antidote, then, to this great destruction of the rail, is simply in the adoption of Mr. Herron's Trellis Plan, by which they would be rendered nearly everlasting. On this plan, we do not offer any comment, further than to say, that in being so wide a departure from the present great aim with engineers, the diminution rather than the increase of all perishable material about a railway, it will find great difficulty in obtaining patrons—particularly as the old plan, *as now made*, with solid rail and sill, and an unsparing care and expense in its adjustment, *can be managed at an outlay of* 30 *to* 40 *per cent. on the gross receipts—which ensures a perpetuation of*

* This is now known not to extend beyond the first coating of rust, which afterwards acts as a protection to the bar.

the property, and a net profit of 6 *to* 10 *per cent on its cost.* This about describes the *present degree* of perfection at which the railway system has arrived in the United States. If any plan is likely to supersede this safe, simple, and profitable one, it is that recently put forth by Messrs. Spaulding and Isherwood, Engineers on the Erie railroad, of an entire cast iron superstructure, which seems eminently to possess the three cardinal requisites in the railway, and indeed in all machinery, of simplicity, durability, and, on the whole, of cheapness. It, at once, enables us to use our own resources on the spot, instead of remitting them abroad; and will thus allow of the construction of the railway in sections of country remote from the seaboard, to which transportation would be either too expensive or impracticable.

If Mr. Herron's plan is thus trampled over by Messrs. Isherwood and Spaulding, it is no more than the latter must look out for; the eye being required to be constantly directed over the left shoulder, to escape being run down by the throng, which is now everywhere pressing forward to conquest and to glory, in the various and open field, for bettering the condition of the human family.

X.

[To the Editor of the American Railroad Journal and Mechanics' Magazine.]

INSTITUTION OF CIVIL ENGINEERS.

Sir—The organization of the United States Civil Engineer Corps has occupied the attention of its leading members for several successive years, but so arduous has the task appeared, that, after many unsuccessful attempts, they seem to have deserted their projects satisfied with their defeat. I am one of those who believe that such an end can only be accomplished by the prompt and united efforts of its junior members, and, therefore, assume the liberty of addressing you this letter, (which is equally applicable to every assistant engineer in our country who takes an interest in the future well-being of his profession,) hoping that you will present it to the public at as early a day as convenient, through the columns of your useful journal.

A more favorable crisis than the present for such an undertaking can never be expected. A deranged currency and national pecuniary embarrassments, have necessarily checked many and delayed other improvements, until our corps has assumed the shape of a wieldy body, and become susceptible of great modification. I therefore suggest to all engineers, whose business will permit, and do so most respectfully, to meet in the city of Philadelphia, at a place hereafter specified, on the 1*st of January*, 1842, with the determination of establishing such an association as will best accord with their respective views. It would be useless, sir, to give you the details of a plan which in my opinion would answer the desired end,—this is a subject for the deliberate consideration of all who feel an interest in its success; but I will occupy your attention a few moments, by briefly stating my views as to the propriety of such a measure.

That our profession requires organization no one denies; but that it can be efficiently done, owing to the extent of territory over which its members are stationed,—the diversity of opinion existing between them on important and unimportant subjects,—the difficulty of having a general meeting,—and the various results of experiments intentionally unknown to each other, many are disposed to doubt. On account of these differences, previous attempts have proved unsuccessful. But it is not to be presumed that the same spirit of rivalry which checks the action of the older, pervades the ranks of the younger engineers; or that their judgments are so swayed by party feelings and sectional prejudices, as to preclude impartial action upon so important a subject. They are, in fact, actuated by entirely different motives. The latter seek that which the others have attained, and subject themselves to innumerable privations, bodily fatigue, and mental exhaustion, with the hope of being some day at the head of a profession which hitherto has ranked with others, but which, I fear, requires more than their energies to sustain. And impelled by such feeling, they doubtless will willingly sacrifice all minor considerations in view of the one great end, and pledge themselves to abide by such regulations as will most likely conduce to its success. Then, sir, let us begin at once; and if we can prevail upon but *one hundred* or *seventy* gentlemen, who have held responsible situations upon State or corporation works, to assemble at the time and place above specified, I feel confidant that a society can be established upon such principles as will tend, not only to benefit ourselves individually, but our profession at large. And need I stop here? Can I not say, with propriety, that every State, every corporation, and every community, is more or less interested in the success which attends the engineer's experiment. As it is, he is frequently obliged to adopt plans known only in theory, for want of a proper and direct channel of communication through which he can convey his views, and demand in return, knowledge taught by experience. I am well aware, sir, that the establishment of a society calculated to correct these and collateral evils, is not the work of a day, a month, or a year; but let the foundation be once properly laid, and the architects will receive renewed vigor from its gradual success, until they eventually behold it a permanent and beautiful structure. Look, for a moment, at England and France, and other countries of the eastern world, and see how differently our profession there stands, and ask yourself the reason why! Is it because its leaders are men of more talent, genius, and scientific knowledge? No! But because they have *system* with their wisdom. True, they have more magnificent structures to which they can direct the finger of inquiry; but the same spirit which teaches us to admire them there, would make us pronounce them ridiculously absurd at home. There, they have ample wealth, and are taught to waste thousands in decorating external surfaces, in order that they may attract the gaudy eye of the extravagant witnesses; while here, we know no dictator but economy, who teaches us that beauty is in their simplicity, and virtue in their strength.

Our civil corps has abundant material to make it rival any other in the world; and the occasional failures which it has experienced in some of its plans, may justly be attributed to a common error among the directors of companies, which is, adopting the extravagant schemes of mere scientific gentlemen and *amateur* engineers, because they are accompanied with a long and abstruse treatise upon the theory of the matter, which no one but themselves can understand, in preference to the plain, practical, and inexpensive plans of a less ostentatious individual. This is one great evil which our profession in this country has had to contend with, but an evil which, I am glad to say, is gradually correcting itself. They begin to see the virtue of the old maxim, that experience is the best schoolmaster, and apply it to their works. The course internal improvement will hereafter take will be a gradually progressive one. Our finances will forbid future extravagant projects; and works must grow in proportion to the increased wealth and capital of our country. The revenue derived from moderate taxation, increasing of course with every improvement,—and the enterprize of individual capitalists seeking safe investments for their funds, are the only safe basis upon which we can rely for future employment. True, the spirit of improvement has gone forth with an impetus that cannot be suddenly arrested, and the constant success of its accomplishments will give encouragement to further action; but our States have branched so extensively in works of every description, and so flooded the foreign market with their stock, that they will soon be obliged to adopt a course for a speedy liquidation of the debt, as prompt payment of interest has already proved insufficient to prevent great depreciation.

But, sir, to return to my subject, as I am not anxious to trouble you with questions of state policy, I know not why an assistant engineer should be retarded in his action, or allow his energies to be blunted by anticipating a want of future employment; yet if such be the case, so much the more necessity for the association in question. When we look calmly over the face of our country, we find, without much investigation, internal resources, which a proper connexion with the coast will enable us to command, and upon which we can rely as the stable basis of our future national wealth. We see mountains laden with treasures, which every successive year enhance in value; inland towns becoming seats of an almost incredible trade; and rivers, with sufficient natural fall and power to turn a hundred wheels, wasting their substance, and mingling with tide-water unimproved. Such, sir, is a true and unvarnished picture of the present condition of our country, and such views I respectfully submit for the consideration of those who may do me the honor to read them.

Yours, etc.,

G. R. R.

CONTINUOUS RAIL ROAD FROM HARRISBURG TO PITTSBURG.—*Extract of a letter from C. L. Schlatter, Esq., dated Harrisburg, Pa., September* 28, 1841.

"By an actual location of a part of the line for a continuous railroad from Harrisburg to Pittsburg, I have this season, decreased the distance ten and one quarter miles, making the distance from Philadelphia to Pittsburg, 338 miles; from Philadelphia to Cleveland, 468 miles, in round numbers; from Cleveland to New York, via Pittsburg, Harrisburg and Philadelphia, 553 miles.

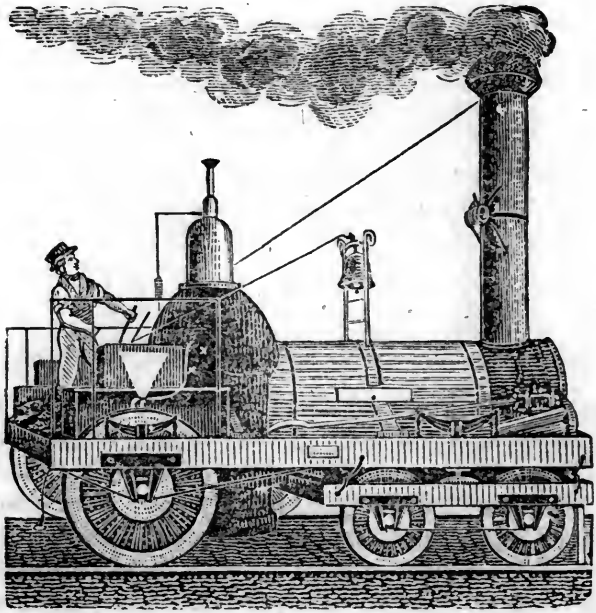
"This saving of distance was effected by carrying the line from Lewistown, on the Juniata, past Brown's Mills, (which you will find marked on the map appended to my report of 1840,) to the Stone Mountain, which is pierced by a tunnel, thence in a very direct line to the Little Juniata, three miles above Petersburg. If you look at the map, you will at once perceive the advantage of this route. It passes through a region where the Juniata iron ore abounds, and in no case do we exceed the maximum grade of 45 feet per mile."

MOTT'S PATENT FOR INCREASING ADHESION.

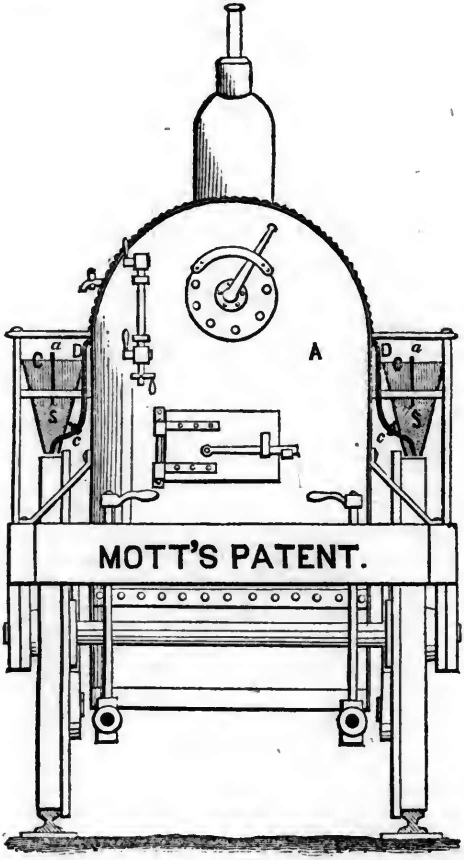
Copy of Specification.

To all whom it may concern: Be it known, that I, Jordan L. Mott, in the city of New York, in the State of New York, have invented a new and useful method or apparatus for the purpose of producing adhesion between the wheels of locomotive steam-engines and the rails of railway tracks; by which device, such engines will be enabled to overcome the slipping consequent upon oil, ice, etc., upon ascending grades without its being necessary to throw any additional weight upon the wheels for that purpose; and I do hereby declare that the following is a full and exact description thereof:—

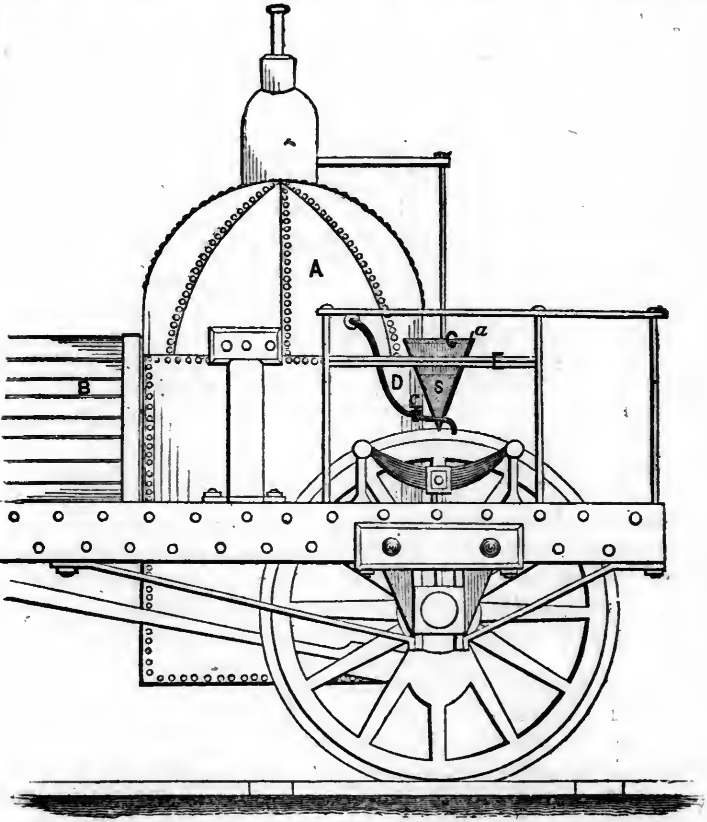
My improvement consists in the combined application of moisture and of sand or other grit to the wheels, by means of which the sand may be distributed over the surface of the tire or tread of the wheel, and will be made to adhere with sufficient force and in sufficient quantity to produce the required adhesion. In the accompanying drawings, figure 1 is a perspective representation of a locomotive



steam-engine and carriage, having two driving and four truck-wheels, to the former of which my apparatus is applied; its application, however, is not limited to locomotives of any particular construction, but is equally adapted to those with four, six, or eight driving wheels. Figure 2 is an end view, and figure 3 a side view of such part of a locomotive as is required to show the manner of applying my apparatus.



A is the steam-chamber, and *B* is the body of the boiler, which may be constructed in any of the ordinary forms; *C C* are hoppers or boxes for containing sand, the lower portions *S*, of which boxes are to be charged with this material in a dry state. These hoppers may be varied in situation, but I in general place them directly over the centres of the driving wheels; the sand is to be discharged from them through a tube or opening at their lower ends; which opening is governed by a valve or sliding shutter, by which it can be properly regulated; *a* represents the handle of such a valve or sliding shutter, which may be constructed and managed in any of the known ways of constructing and managing devices of this kind. *D D* are steam or water pipes, which are to convey the moisture from the steam chamber, boiler, or other source; these pipes are to be governed by a stop-cock, as shown at *c c*, and they discharge the water or steam into the periphery of the wheel, and



moisten it directly in advance of the aperture for the discharge of sand; if steam is used, it will be condensed upon the wheel, but it will probably be found to economise heat by using water; the quantity expended in either case, will not, however, be important in amount. Instead of using the water of steam from the boiler, water may be conducted through the pipes from a cistern or reservoir of cold water placed in any convenient situation for that purpose. Although I prefer to discharge the sand and moisture upon the wheels, it will be manifest that they may be directed with like effect on to the rails, in advance of the driving wheels, and that the combined operation of the moisture and sand, will be the same, but the apparatus will in this case have to be extended without producing a corresponding advantage. Such an arrangement is shown with a hopper at *S*, with steam or water pipes at *D*, and *a a* tubes for the discharge of sand. Having thus fully described the nature of my invention, and shown how the same may be carried into operation, what I claim as new, and desire to secure by letters patent, is the applying of sand to the peripheries of the driving wheels of locomotive engines, in combination with the application of water or steam to moisten the wheels for the purpose of causing the sand to adhere thereto, substantially in the manner set forth, and so as to enable such locomotives to ascend inclined planes or elevations on a railroad, in consequence of the friction produced by such application.

I claim also the applying of moisture and sand simultaneously to the tops of the rails in advance of the driving wheels, by means of the apparatus herein described, considering this mode of applying the moisture and sand as a mere modification of the general principles upon which the utility of my invention is dependent.

JORDAN L. MOTT.

REPORT ON THE ATTICA AND BUFFALO RAILROAD.

GENTLEMEN—In fulfilling my duty as your engineer, I have, upon the completion of the survey, and with as little delay as circumstances would admit, prepared a map and profile of the road, which, together with the following statement of the result of the survey and estimate of the cost of the road, are respectfully submitted.

As all the work requisite for the completion of the road from the summit, two miles west of Attica, to Buffalo, has been placed under contract in a manner that requires the contractors to become stockholders, and make large advances in its prosecution, it may be as well to first ask your attention to matters therewith connected.

The parties with whom these contracts have been entered into, agree to take their pay, one half in cash, and one half in stock of the road to be paid monthly, as the work proceeds. They are composed of gentlemen of intelligence, responsibility, and long experienced in the construction of railroads; they would not consequently enter into any contract involving so large an amount of their own means, until they had made a full examination of the allignments, grades, radii, of curvatures of the road, probable cost of construction, character of the country through which it is located, into the affairs of the company, and privileges granted by their charter, and fully satisfied themselves upon these and all other subjects, which can possibly have a bearing upon the value of the stock when the road is completed.

After this careful examination, proposals were received from them, and contracts entered into for the clearing, grubbing, bridging, furnishing materials, and completing the road, ready for the iron from Attica to Buffalo, including also the laying of the iron, to be furnished by the company, and excepting the grading of the 2 first miles as has been stated. These contracts require the road bed to be done by the first day of January next, and the superstructure laid and ready for the cars by the 4th day of July, 1842.

That the work has been let at low prices, and the stock valued as fully equivalent to cash, will appear sufficiently evident by referring to the contract or estimated cost of the work hereinafter submitted. The prices for excavation and embankment, ten and twelve cents, viewed in connexion with the small amount to be done, and of course the proportionably large amount of trimming, ditching and dressing, are as low as desirable; since to let work for less than it will cost, is usually attended with delays, non-fulfilment of contracts and increased expense.

The estimate of George Rich, Esq., an engineer, who last year made a survey and estimate of the route, exceeds the cost of the work at contract prices more than 15 per cent.

The grading from Attica to the summit (two miles), could not well be placed under contract till the survey of the Tonawanda road from Batavia to Attica had been made; this was necessary in order to fix upon a suitable place for connecting the two roads, and as it is now completed, the residue of your road should be placed under contract with as little delay as possible. The point supposed to be most eligible for connecting the two roads is on the table of land at the foot of the hill on the bank of a small ravine, in the rear of Mr. Seward's house, about half a mile north of the centre of the village of Attica. The distance from thence to the summit is about two miles, the ascent sixty-eight feet: this it is proposed to surmount with a grade of thirty-seven feet per mile, which is the maximum as represented on the profile.

In the chain of roads east, of which this is to form the connecting link with Buffalo, grades as steep as this frequently occur, and occasionally much steeper, but if this was not the case, it would in my opinion, still be unwise to expend a large sum to effect a reduction of a few feet at the summit, since it is a well established fact that a locomotive engine as now constructed, will, with as great speed as safety will permit, pass up such grades with double the number of passengers that it will ever be desirable to pass over the road in any one train.

The distance by the line, as located from its commencement at Attica, are 11 miles to Alden, 20 miles to Lancaster, and 9½ miles to the east line of the city of Buffalo. Maximum grade, 37 feet per mile. Minimum radius of curvature, five thousand feet.

The general direction of the line, from which there is in no instance but a slight departure, is nearly due west. From the point of commencement it follows up the north side of a small creek to the summit. The ascent of the surface of the ground to this summit is so gradual and so nearly corresponds with the angle of elevation of the plane, that the grade line has been laid at the surface of the ground at the highest point. There is, however, a cut that will average about four feet in depth, for about half a mile east of this point. After passing the summit, the line continues the same direct course along the same broad valley to Alden.

This valley is formed by the foot of the Allegany ridge on the south, and a succession of detached high ridges of ground on the opposite side, which open at every two or three miles, and admit the small streams formed by the drainage of the country, to pass off to the north.

The line surveyed by Mr. Rich, runs directly through the village of Alden, and by so doing, encountered a heavy embankment two miles east, at the county line, and another very expensive one, in crossing the valley of one of the branches of Eleven Mile creek, about half a mile west of the village.

By keeping on the south side of these valleys, and passing about 15 chains south of Alden, the greater part of both these embankments may be avoided. If there should not be a great additional expense incurred in obtaining the right of way on this line, it will be much the cheapest route; and passing near enough to accommodate the village of Alden, it should be adopted. After passing a ridge of ground about a mile further west, requiring a cut for a short distance of about ten feet, the face of the country presents a different aspect; the hills have entirely disappeared, leaving us at liberty to continue a direct course to Buffalo, or make some slight variation, if necessary, for the purpose of securing the right of way at a reasonable expense. Fortunately, this course has been unnecessary. A straight line has been located along the line of the old State road, (a short distance north of the mainroad) passing through the north part of the village of Lancaster and intersecting the Ellicott road, about six miles from Buffalo; the line then follows along this road to the city line, which is, perhaps, about half a mile from Main street, leaving the residue in connection with the depot, to be located as circumstances may hereafter render advisable.

The soil along the route is clay, sand and gravel, with no appearance of rock, quick-sand or hard-pan. There is no stream crossed by the line that will require a bridge or culvert of over twelve feet span. These facts, in connection with the small amount of excavation and embankment required in the graduation of the road-bed, and the facility of obtaining suitable timber along the line, must, in a satisfactory manner, account for the small amount estimated as the expense of constructing the road.

Superstructure.—The superstructure to be composed of mudsills, 4 by 15 inches; in length, as long as can be conveniently obtained, with ties 4 by 6, laid flatwise upon the sills five feet apart, with blocks of wood of the same size at equal distances between them, with rails 8 inches square, fastened in their proper position, with cast-iron knees at every cross-tie. By varying the form of the ties, these knees may be dispensed with, and the rails fastened in a different manner, if it should be advisable. The timber of which the superstructure is composed, to be oak, red beech and hemlock. In the first place, this form has been recommended, for the reason that in the present instance, where timber is convenient, it is not expensive, and will be much stiffer than the lighter form usually adopted. Secondly, it is better fitted for, and will leave you at liberty to adopt and place upon it either the T rail, which cannot be too strongly recommended—or a heavy rail plate laid upon an oak ribbon, one inch in thickness and spiked to the rail.

The experience of the last few years of the effect of locomotives passing with heavy trains at great speed over roads constructed with light iron, has sufficiently demonstrated the importance and economy of adopting a heavy plate or edge rail. In addition to this, it is also evident, that whatever the iron rests upon, should, if it is a timber structure, be to the last degree attainable, unyielding. To effect this, is the object of the large rail, with short bearings. It is also further necessary that the grading should be completed by the 1st of January, that the embankments may have sufficient time to settle before the rails are laid; and in addition to this, there should be in the spring, before they are laid, from eight inches to one foot of the gravel which abounds in small creeks and some of the ridges along the line, placed upon the road-bed. The expense would be about $500 per mile, but as it is not included in the contracts it does not appear in the following estimate.

Cost of one mile of road, being an average of the whole, at contract prices:—

Clearing, grubbing, grading, culverts, bridges and road-crossings, - - - - - -	$2,000
Furnishing materials and laying superstructure, -	2,200
Plate rail $\frac{3}{4}$ by $2\frac{1}{2}$ inches, spike and splicing plate,	2,000
Right of way, - - - - - -	1,000
Add for Engineering, water-stations, turn-outs, and contingencies, - - - - - -	800
Total per mile, - - - - - - -	$8,000
Miles, - - - - - - - -	30
Total, - - - - - - - -	$240,000
Total amount of excavation, (yards) - -	141,000
Total amount of embankment, (yards) - -	210,000

Should the edge rail be adopted, weighing about fifty pounds per yard, the additional expense, including the necessary chains and fastenings, would be about four thousand dollars per mile.

There will be about $30,000 required to meet the monthly payments for grading, etc., up to the first day of January. When the monthly estimates were made on the first day of this month, there were about 170 men engaged upon the work, and as this force has been considerably increased since that time, and is daily increasing, the next estimate must of course, considerably exceed those for the last month. It will be observed that the estimate of the cost of the road does not include the usual expense for cars, engines, etc.

This has not been included. since it is probable that an arrangement can be made with the Tonawanda Railroad Company, to run the road upon terms that would be advantageous to both companies. Such an arrangement would also be convenient for the travelling public, since the fare could then be paid through, and no exchange of cars would be necessary. In view of this connexion, it will perhaps be well to speak of the two roads as one, in comparing their allignment with other portions of equal length, in the same route to Boston. And in regard to this, it will be sufficient to give the distance from Rochester to Buffalo, 72 miles, and state that it is nearer than any travelled road between the two cities, and that its straightness exceeds that of any portion of the route, east, between any two points of equal distance.

The Tonawanda road has been for some time in operation as far as Batavia, a distance of about thirty-two miles; and we have the most positive assurance of that company that the remaining ten miles to Attica, will be completed as soon or sooner than your road, as will appear by the following, which is a copy of a resolution of the Board of Directors of that company, passed in August, 1840:

"*Resolved*, That the Tonawanda Railroad Company will construct that portion of their road, (now incomplete), from Batavia to Attica, as soon as they are satisfied that a railroad from Attica to Buffalo will be constructed; and that the construction of the road from Batavia to Attica shall be completed, as soon or sooner, than the road from Attica to Buffalo is completed."

Thus, you have only to complete your road, and can then say to the world, the last link in the chain is completed. There is now a continuous line of railroad from Buffalo to Boston.

This is of importance to you with regard to the decisive step you have taken in the immediate construction of your road, since you will not have to wait for other links in the chain to be supplied to enable you to offer such inducement to those seeking the most direct and eligible route from and to the west, and from your own vicinity, as will at once concentrate them upon this great thoroughfare.

The companies owning such parts of the route west of Syracuse, as has been for some time completed, have labored under great disadvantage, in consequence of being compelled for a great portion of the year to share with other routes the profits which they, upon the completion of the continuous route, will be exclusively entitled to; but notwithstanding this, their net receipts have been equal to the interest of the money expended in their construction, which has not been less than from fourteen to twenty thousand dollars per mile. This, it is true, is much less than the income from the Syracuse and Utica road, or Utica and Schenectady road, but it is believed to be equally true that it has been chiefly in consequence of what has been stated.

In 1839, the net income of Syracuse and Utica road, was fourteen per cent., and of the Utica and Schenectady road, fifteen per cent. During the same period of time, the number of through passengers upon the latter road was 95,776, and of way passengers 86,823 ; the gross revenue from way passengers was $87,-979,57, which sum is about one fourth the gross receipts of the road, and is probably not so great a proportion as the receipts from the same source on the Rochester and Auburn road will be, when compared with the receipts of that road.

This large revenue from way-travel has doubtless satisfied all that have reflected on the subject, that the route which has been established from Syracuse by Auburn, Seneca Falls, Geneva, Waterloo, Vienna, Canandaigua, Rochester, Churchville, Byron, Batavia, Alexander, Attica, Darien, Alden and Lancaster, to Buffalo, will best accommodate the public, and repay the stockholders, and is consequently the most eligible.

If there should, however, be any who yet think otherwise, or whose interest would be better subserved by the construction of a more direct line of road from Syracuse to Buffalo, passing north and nearer the canal, it is presumed the union and co-operation of the many important villages enumerated, that would be left south of such line, would always be sufficient to defeat their success.

The charter of your road and that of the Tonawanda road, are very favorable, being entirely free from any restrictions in carrying produce and merchandize. This is of much importance, as at the connection of the two roads, the Erie canal is about 25 miles north, leaving the freight of a large extent of rich country to be transported upon the railroad. The gross receipts from the freight business, upon several of our great travelled thoroughfares, are large, being upon the Boston and Worcester, Philadelphia and Columbia and Tonawanda roads, about equal to that derived from passengers.

The large amount of water power along the line of your road, would add much to its revenue in the way of freight, and would also be the cause of a great deal of way-travel upon it.

Cayuga creek runs for fifteen or twenty miles but a short distance south of the road; there are now upon this stream, in this distance about forty saw mills, several flouring mills, besides other machinery. Attica and Buffalo are several miles south of Rochester, and the line of railroad in that vicinity, and are nearly on a line with several important villages in Livingston county; there would consequently be a considerable through travel on this road, that would intersect and leave it at Attica or Alexander. There is now a stage running from those places to Genesee.

There is one more subject that should be mentioned before closing this report, since it may eventually be one of much importance, which is, that the distance from Buffalo to Attica, thence by a route up the east branch of the Tonawanda, and connecting with the New York and Erie road in the west part of Steuben county, say at or near Hornellsville, would not exceed eighty miles.

The New York and Erie road will soon be completed. What may perhaps be considered a branch of this road, is now in operation from Corning to Blosburgh. This road is doing an extensive business, principally in the transportation of coal and iron. From Elmira there is now a road, in part constructed, to Williamsport, in Pennsylvania, from which place there are several roads projected and partly constructed to Philadelphia. These roads will all soon be completed, and perhaps it will be as well for the present purpose to assume they are, in which case there would be many passengers from the section of country penetrated east of Hornellsville, that would be desirous either from business, pleasure, or curiosity, of visiting Buffalo, the Falls, or Canada. By the New York and Erie road, the distance from Hornellsville to Dunkirk is 134 miles, thence to Buffalo, by water, 40 miles, making 174 miles. By the way of Attica, as has been stated, it is 80 miles, which deducted from the distance by the other route, gives a difference in favor of this route for that portion of travel alluded to, of 94 miles. A difference in reaching Lake Erie of 54 miles, (and adding the distance 40 miles from Buffalo to Dunkirk), there still remains a difference of 14 miles in favor of this route for passengers going to and from the west. The harbor at Buffalo is not generally open as early in the spring as that of Dunkirk, but it is occasionally open several days earlier, as was the case last spring.

Having stated these facts, it will be for you to judge the bearing they may have on the value of the stock of your road, and for those most interested, to determine the future importance of this route to the city of Buffalo.

By your obedient servant,

TRACY M'CRAKEN.

Engineer Attica and Buffalo Railroad.

ATTICA, *Sept.* 14, 1841.

[From the Civil Engineer and Architect's Journal.]

ENGINEERING WORKS OF THE ANCIENTS.—THE PERSIANS.

Engineering has its archæology as well as architecture, the monuments of the Egyptians, of the Persians, of the Romans, are subjects which interest every class of readers. To some it may appear that the profession of a civil engineer is but of modern growth, it certainly may be so considered as regards its recent progress, but to the attentive observer a long chain of history is visible which records the labors of engineers, not for hundreds of years merely, but for thousands. On the engineering profession, therefore, the contemplation of the works of their predecessors is imposed as a task, if they are at all desirous that their successors should pay the same homage to themselves The works of classic authors abound with accounts of interesting works, the descriptions of some of which we mean to copy into the journal, as into a common-place book, trusting that it can never be considered useless to any man to contemplate the glories of the past. For this purpose, we shall, from time to time put down as they occur to us, extracts from the several authors, who have left materials for the subject of our inquiries.

Our present paper will principally be devoted to the works of the Persians and the Babylonians, which belong to one of the first schools of which we have authentic records. The history of this period forms the first in the annals of engineering, as now taught in this country, for the rudiments of the science laid down by the Persians, have, by successive nations, been transmitted to us. Persia being, like Egypt, a country traversed by a large river, and requiring extensive hydraulic works, naturally led to considerable proficiency in this branch, which would naturally be later of introduction among the continental Greeks, to whom it was taught by the Ionians in the Persian service. The Persian monarchs, independently of their own engineers, also became masters of the services of those of Egypt, Babylon, and Phœnicia, each of which, as we shall see, had also peculiar opportunities of study. From the Greeks, engineering passed to the Romans, and so through the middle ages down to the present time, affording an example, paralleled in few professions, of rules of practice being transmitted uninterruptedly for more than twenty-five centuries, and illustrated from the earliest period by specimens now existing.

The materials for the ensuing descriptions are principally derived from Herodotus, who had authentic sources of information as to most of the works which he described. They are, as before stated, chiefly hydraulic works, and illustrate much of the antiquities of that important department of engineering.

Canal of Mount Athos.—Cutting.—The God of the Engineers.—In the course of the war of the Persians against the Greeks, about the year 484 B. C., Herodotus* relates that, in order to avoid shipwreck on the dangerous coast of Mount Athos, Xerxes determined on cutting through the isthmus by which it is joined to the mainland, and so making a canal for the passage of his fleet. Herodotus says, that three years were spent upon this work, the Persian fleet having been ordered to the port of Eleus in the Chersonese, and all the forces on board being compelled by turns to dig, and open a passage through the mountain. In this they were assisted by the adjoining inhabitants, and the direction of the works was confided to Bubaris, the son of Megabyzus, and to Artachæus, the son of Artæus, both Persians.

Athos is described as a mountain of considerable magnitude, leaning upon the sea, and well inhabited, (now, we may observe, by monks). It terminates to the landward, in the form of a peninsula, and makes an isthmus of about twelve stades (a mile and a half) in length. The peninsula so formed consists of a plain with a mixture of little hills, from the coast of Acanthus to that of Torone. On the mountain and other parts, were the towns of Dion, Olophyxus, Acrothoon, Thysus, and Cleone, and on the isthmus stood Sana. The Persians having drawn a line before the town

* Polymnia 7.

of Sana, divided the ground among the several nations; and when the trench was considerably sunk, those who were in the bottom stages contrived to dig, and delivered the earth to men standing on ladders, who handed the same again to such as were placed in a higher station, till at last others who waited to receive the burthen at the edge of the canal, carried it away to another place. But by digging in a perpendicular manner, and making the bottom of equal breadth with the top, all the workmen, except the Phœnicians, drew a double labor upon themselves: because the earth, as it is natural, fell down continually in great quantities from the upper parts. The Phœnicians, alone, continues Herodotus, shewed that ability, on this occasion, of which they were so much masters at all times; for they opened the part which was assigned to their care, twice as large as others had done; and sloped the ground gradually till they came to the bottom, they then found the measure, equal with the rest. So much for the mode of cutting pursued two thousand three hundred years ago. We are thus enabled to ascertain the origin of the slope, and the period at which its recognized introduction into the art took place. The number of workmen employed, says our author, was so great that in a meadow adjoining they had a market furnished with great abundance of corn brought even from Asia, and there was also a temporary court of justice formed, perhaps on the piepoudre system. Herodotus is by no means disposed to approve of the necessity of the work, for he rather ascribes it to ostentation, being of opinion that it would have been much easier for Xerxes to have had his fleet carried over the land. The canal was of a sufficient breadth to carry two ships sailing in front, and at each end were deep trenches to prevent the sea from filling it up; it was completed by the time the Persian army arrived at Acanthus, in the neighborhood (about 481 B. C.)—At this time died Artachæus, one of the engineers, who appears by all accounts to have been one of the greatest men of the day, for he was in stature the tallest of all the Persians, and wanted only the breadth of four fingers to complete the full height of five regal cubits; his voice also was stronger than that of any other man. By descent, he derived his blood from the noble family of Achæmenes, and was much esteemed by Xerxes, who greatly lamented his death, and caused him to be interred with great pomp. All the army was employed in erecting a monument to his memory; and the Acanthians, admonished by an oracle, honored him as a hero with sacrifices and invocations. "Such," says Herodotus, "were the demonstration which Xerxes gave of his concern for the loss of Artachæus;" and thus did the profession obtain the patronage of a demigod from their own body, to whom if they like, they may build temples at this day. In the meanwhile we suggest to our antiquarian friends, whether the Persian engineers swore by Artachæus, and whether any devout modern would be justified in using the same ancient form.

The fleet, it seems, according to orders from Xerxes, passed through the canal of Mount Athos, and so into the bay on the other side. Our author further adds, that the people of Acanthus, in consideration of the great attention they paid in making the canal, were rewarded by the king with vests of honor.

In the Babylonian district, the people were, as in Egypt, well supplied with canals, principally for the purposes of irrigation, the water being distributed from them by manual labor, or by hydraulic engines. The largest of these canals,* continued with a south-east course from the Euphrates to that part of the Tigris where Nineveh stands, and was capable of receiving vessels of burthen. These canals and the river were navigated by a peculiar kind of skin boat or coracle, to which Herodotus devotes particular attention.

Passage of Rivers.—The Halys—the Gyndes—the Euphrates—the Danube—the Strymon.—In the course of the war of the Lydians against the Persians, Cræsus found it necessary to cross the river Halys,† when by the advice of Thales, the Milesian, it is said, that he caused the river to be divided into two branches, as if he were going to make a bridge—the diversion of streams being a resource well known to the ancient engineers both of the east and the west. He sank a deep trench, which commencing above the camp, from the river, was conducted round it in the form of a semicircle, till it again met the ancient bed. It thus became easily fordable on either side.

Cyrus in his war with the Babylonians made use of a similar expedient, with regard to the river Gyndes, but from other motives. The Gyndes is described by Herodotus (Clio), as rising in the mountains of Matiene, and passing through the country of the Darmeans, loses itself in the Tigris. Whilst Cyrus was endeavoring to pass this river, which could not be performed without boats, one of the white consecrated horses boldly entering the stream, in his attempts to cross it, was borne away by the rapidity of the current and totally lost. Cyrus, exasperated by the accident, made a vow that he would render this stream so very insignificant, that women should hereafter be able to cross it without so much as wetting their knees. He accordingly put off his designs against Babylon, and divided his forces into two parts; he then marked out with a line on each side of the river, one hundred and eighty trenches; these were dug according to his orders, and so great a number of men were employed, that he accomplished his purpose, but thus wasted the whole of that summer. It is supposed, however, that he was induced to undertake this work for the purpose of averting some omen.

On his arrival at Babylon, however, he had to carry on hydraulic works with a more important end. Finding the city strong and well provided, and that its reduction by force or famine seemed impracticable, he had to take other measures. He placed one detachment of his forces where the river first enters the city, and another where it leaves it, directing them to enter the channel and

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* Herodotus, Clio. †Herodotus—Clio.

attack the town wherever a passage could be effected. After this disposal of his men, he withdrew with the less effective of his men to a marshy part of the river, near which there was a kind of reservoir, said to have been constructed by Nitocris, Queen of Babylon, not long before. Cyrus here pierced the bank, and introduced the river into the lake, by which means the bed of the Euphrates became sufficiently shallow for the object he had in view. The Persians, in their station, watched the proper moment, and when the stream had so far drawn off as to be no higher than their thighs, they entered Babylon without difficulty.

Darius Hystaspes,* in his expedition against the Scythians, ordered a bridge to be thrown over the Ister or Danube, by the Ionians. It was placed two days passage from the sea, at that part of the river, where it begins to branch off, but of its mode of construction nothing is said, although it may be inferred that it was of boats. Darius, when he arrived at the Ister, passed the river with his army, he then commanded the Ionians to break down the bridge, and to follow him with all the men of their fleet, but by the advice of Coes, a Mytilenian officer, he allowed it to remain, leaving it under the guard of the Ionians, with orders if he did not return in sixty days to break it down. The Scythians knowing this, sent a deputation to the Ionians, to persuade them to break down the bridge, or to maintain it only for the stipulated time, to which latter proposition they assented. The delay of sixty days having, however, expired, the Ionians by the advice of Histiæus of Miletus, still maintained the bridge for the Persians, but to prevent the Scythians cutting off the retreat, broke that portion near the Scythian shore. Darius arriving in the night with his army, Histiæus with the fleet restored the bridge.

Bubaris and Artachæus, the engineers of the Mount Athos canal, were also charged during the campaign of Xerxes against the Greeks, with the construction of a bridge over the river Strymon, in Thrace. For these bridges, says the author so frequently quoted,† Xerxes provided cordage made of the bark of the biblos, and of white flax. This is all the account we have received of the bridge, except that the army afterwards passed over.

Passage of Seas.—Bosphorus—Hellespont—Gulf of Salamis.—Darius,‡ having determined on an expedition against the Scythians, gave orders to throw a bridge over the Thracian Bosphorus, or as it is now called the canal of Constantinople. This bridge was placed at Chalcedon, or as Herodotus conjectures, nearly midway between Byzantium and the temple at the entrance of the Euxine, constructed under the direction of Mandrocles, a Samian, who executed it so much to the satisfaction of Darius, that he made him many valuable presents. With the produce of these presents, Mandrocles caused a representation to be made of the Bosphorus, with the bridge thrown over it, and the king seated on a throne, reviewing his troops as they passed. This he afterwards conse-

* Herodotus—Melpomene. † Herodotus—Polymnia. ‡ Herodotus—Melpomene.

crated in the temple of Juno, with an inscription paraphrased by Beloe thus—

> Thus was the fishy Bosphorus inclos'd,
> When Samian Mandrocles his bridge impos'd:
> Who there, obedient to Darius' will,
> Approv'd his country's fame, and private skill.

This is perhaps one of the earliest instances of a votive offering, and of an artistical commemoration of an engineering work.

Xerxes, the successor of Darius, in his previously mentioned campaign against the Greeks, also had occasion to pass the same sea, but another point.* While he was preparing to go to Abydos, numbers were employed in throwing a bridge over the Hellespont, from Asia to Europe. The coast toward the sea from Abydos, between Sestos and Madytus in the Chersonese of the Hellespont, is described as rough and woody: the distance from Abydos being seven stades, or nearly a mile. The work, however, commenced at the side next Abydos. The Phœnicians used a cordage made of linen, the Egyptians the bark of the biblos. The bridge was no sooner completed than a great storm arose which destroyed the whole work, which when Xerxes heard, he ordered, as is well known, the Hellespont to be flogged, and a pair of fetters to be thrown into it. The engineers got worse off, for they were sentenced by the king to be beheaded. Our historian goes on to say, with some *naivete*, that a bridge was then constructed by a different set of engineers—which we should naturally imagine, for it is difficult to conceive how men who were beheaded, could very easily preside at works *a la Saint Denis*. The mode employed, as far as it can be made out, was to connect together ships of different kinds, some long vessels of fifty oars, others three banked gallies. These were arranged in a double row, one set transversely, but the other in the direction of the current. When these vessels were firmly connected to each other, they were secured on each side by anchors of great length; they left, however, openings in three places, sufficient to afford a passage for light vessels, which might have occasion to sail into the Euxine or from it. Having performed this, they extended cables from the shore, stretching them upon large capstans of wood, for which purpose they did not employ a number of separate cables, but united two of white flax with four of biblos. These were alike in thickness, and apparently so in goodness, but those of flax were in proportion much the more solid, weighing not less than a talent to a cubit, an expression showing that the ancients knew how to appreciate the qualities of cordage. When the pass was thus secured, they sawed out rafters of wood, making their length equal to the space required for the bridge; these they laid in order across upon the extended cables, and then bound them fast together. They next brought unwrought wood, (fascines ?) which they placed very regularly upon the rafters: over all they threw earth, and which they raised to a proper height, and finished all by a fence on each side, that the horses and other beasts of burden might not be terrified by looking down upon the sea. Two ways were thus made, one on each set of boats; on one

* Herodotus—Polymnia.

of these ways, namely, the northern, the infantry and cavalry passed, and over the southern the camp followers and the baggage. The bridge was afterwards destroyed by a storm.

At a subsequent period of the campaign Xerxes contemplating flight, for the purpose of amusing the Athenians, he made an effort to connect the island of Salamis with the continent, joining for this purpose the Phœnician transports together to serve both as a bridge and a wall.

Bridge.—Euphrates—Bricks.—Babylon,† being divided by the river Euphrates into two distinct parts, whoever wanted to go from one side to the other was obliged to pass the water in a boat. To remedy this general inconvenience, and mentioned by the historian as an expedient not usual, Nitocris, Queen of Babylon, determined upon building a bridge, from which period we may date the formation of permanent bridges as a part of engineering. Having procured a number of large stones, she changed the course of the river, directing it into a canal prepared for its reception, and so into a large marsh or reservoir. The natural bed of the river being thus made dry, the embankments on each side near the centre of the city were lined with bricks, hardened with fire. Upon this we may remark that the Babylonians used two kinds of bricks, the common brick, baked in the sun, and another brick burnt in a furnace; this latter kind was most probably used on this occasion, as the more durable. Nitocris, then, with the stones before prepared, erected a number of piers, strongly compacted with iron and lead; on these piers a platform was laid, which was removed at night to prevent communication between the different quarters of the city. The bridge being completed, the river was allowed to return to its natural bed. This work, according to Diodorus Siculus, was five furlongs in length.

Embankments.—Euphrates—Aces—Sluices.—Nitocris, just mentioned, is said to have been the author of several other remarkable works, some of which are, however, doubtful. Being fearful of the ambition of the Medes, she is said, for the purpose of preventing communication with them by the Euphrates, to have directed the course of the river above Babylon, by sinking a number of canals, and giving it a winding shape. To restrain the river on each side, she raised banks, which are described as wonderful on account of their enormous height and substance. A large lake or reservoir is also attributed to this queen, its circumference being stated at fifty miles, but it is more than probable that her works were confined to reclaiming part of a natural marsh, or to securing the banks; these she lined with stones brought thither for that purpose.

Herodotus relates, in his third book, an account of operations on the river Aces, on which doubt has been thrown, but which, whether true or false, will be equally interesting as illustrating the engineering opinions of the ancients. He says that there is in Asia a

† Herodotus—Clio.

large plain surrounded on every part by a ridge of hills, through which there are five different apertures. It formerly belonged to the Chorasmians, who inhabit those hills in common with the Hyrcanians, Parthians, Sarangensians, and Thomaneans; but after the subjection of these nations to Persia, it became the property of the great king. From these surrounding hills there issues a large river called Aces: this formerly, being conducted through the openings of the mountain, watered the several countries before mentioned. But when these regions came under the power of the Persians, the apertures were closed, and gates placed at each of them, to prevent the passage of the river, from which expression, we infer that the Persians were acquainted with the use of sluices. Thus, on the inner side, from the waters having no issue, the plain became a sea, and the neighboring nations, deprived of their accustomed resource, were reduced to extreme distress from the want of water. In winter, they, in common with other nations, had the benefit of the rains, but in summer, after sowing their millet and sesame, they required water, but in vain. Not being assisted in their distress, the inhabitants of both sexes hastened to Persia, and presenting themselves before the palace of the king, made loud complaints. In consequence of this, the monarch directed the gates to be opened towards those parts where water was most immediately wanted, ordering them again to be closed after the lands had been sufficiently refreshed; the same was done with respect to them all, beginning where moisture was wanted the most. This, however, was only granted in consideration of a large donation over and above the usual tribute.

That the Persians were well acquainted with the operation of damming, appears also by other instances. Xerxes having examined the Peneus, a river of Thessaly, inquired whether it could be conducted to the sea by any other channel, and received from his guides, who were well acquainted with the country, this reply: "As Thessaly, O King, is on every side encircled by mountains, the Peneus can have no other communication with the sea." "The Thessalians," Xerxes is said to have answered, "are a sagacious people. They have been careful to decline a contest for many reasons, and particularly as they must have discerned that their country would afford an easy conquest to an invader. All that would be necessary to deluge the whole of Thessaly, except the mountainous parts, would be to stop up the mouth of the river, and thus throw back its waters upon the country."

Hydraulic Cements and Factitious Stone.—M. Kuhlmann of Lille, a distinguished chemist, has made a discovery which promises to be of great importance in building, and for other purposes. At a late meeting of the French Academy of Sciences, the nature and results of his researches were stated. In many communications previously made by him to the Academy, he has considered the efflorescences on walls, their nature, origin, and the circumstances which caused their formation; by which the presence of salts of soda or potass is shown in the greater part of the limestones of all geological formations. He has made experiments on different cements, and they all presented decided signs of the presence of potass. It was by following up these observations that M. Kuhlmann was led to undertake a new series of researches, the remarkable results of which he communicated to the Academy. In the first place, he directed his attention to artificial hydraulic limestones, made in the dry as well as in the humid way. In both methods of operating, he succeeded in producing very economical hydraulic mortars, by adding to lime or chalk sulphate of alumine or alum. It thus constitutes an aluminate of lime. M. Kuhlmann has found that on placing chalk in contact with a solution of alkaline silicates, even when cold, a certain exchange of acids ensues between the two salts, and that a part of the chalk is transformed into silicate of lime, a proportional amount of potass passing into the state of carbonate of potass. If the chalk in powder has been thus partially transformed into silicate of lime, the paste which results from this transformation, hardens by degree, on exposure to the air, and becomes as hard, or even harder, than the best hydraulic cements; it is, in fact, an artificial stone, which, when it has been prepared in a paste sufficiently liquid, and with a sufficient quantity of silica, has the property of strongly adhering to the bodies to the surfaces of which it is applied. Thus the silicate of potass, or soda, might serve to prepare mastics analogous to cements, without its being necessary to calcine the chalk. These mortars appear to be applicable, in certain circumstances, to the restoration of public monuments, to the formation of casts, etc.

Of all the results obtained by M. Kuhlmann, the following appear to be the most interesting. When, instead of presenting the powder to the solution of alkaline silicate, it is presented in a paste of sufficient consistence, an absorption of silica also takes place, and in quantities that may be varied at pleasure. The masses of chalk increase in weight, become shining, of a rough grain, and the color is more or less yellow, according as they are ferruginous. The immersions may be either cold or hot, and a few days of exposure suffice to transform the chalk into siliceous limestone, so hard as to scratch some marbles; the hardness gradually increasing by exposure to the air. Even from three to four per cent. of absorbed silica gives a great hardness to the chalk.

The stones thus prepared are susceptible of a beautiful polish. Their hardness, which is at first superficial, penetrates by degrees to the centre, even when the mass is a thick block. On account of their hardness, and their fine and uniform grain, the chalks thus prepared appear capable of becoming of great use in works of sculpture, and in different ornaments, even of delicate workmanship; for when the *silicazation* takes place in chalk that is very dry, which is requisite to obtain the best effects, the surfaces are never altered by the weather.

M. Kuhlmann has made attempts to apply these stones for the purpose of lithography, and the first results of his experiments promise complete success.

This method of transforming soft limestones into siliceous limestones may be applied most advantageously in building. Ornaments which would be unchanged by the rain, and of great hardness, might be obtained at low prices, and in many cases, a plaster made with a solution of silicate of potass, might serve to preserve from further decay ancient monuments composed of mortar or of soft limestone. The same plaster might become of general use in countries where chalk forms almost the only building material.

The inventor has extended his process to carbonates of barytes, strontian, magnesia, lead, etc., in which the same reactions take place, and he obtained analogous results.

Plaster has also been an object of M. Kuhlmann's researches. The decomposition of plaster in silica is still more rapid and more complete than that of chalk. Plaster cast in a mould, and immersed in a solution of silicate of potass, becomes very hard, and has a very remarkable shining appearance ; but if the transformation is too rapid, this is only superficial, and after exposure to the air for some days, the surface peals off with the least touch. In order, therefore, to *silicitize* plaster, it is requisite to operate with very feeble solutions; and it is also very important to render the plaster more porous by the introduction into it of foreign matters, such as chalk, fine sand, etc. The siliceous liquid may then enter into the paste itself, to complete the silicization afterwards by immersion. M. Kulhmann, in reference to the formation of natural calcareous silicites, enters into some considerations, to show that nature appears to have had recourse to transformation analogous to those now pointed out as the means of producing factitious stone. His researches tend to prove that the silicate of lime, which accompanies chalk, has no other origin than that resulting from the filtration of the silicate of potass or soda, in a state of solution in water.—*Selected from the Moniteur Industriel.*

Benkler's New Oil-Gas Lamps.—This invention, according to Dr. Liebeg, professor at Giessen, may be considered as one of the greatest improvements in lamps since the Argand. It principally consists in feeding the flame with heated air, and directing it at a certain angle to the base of that flame, by which means it is not liable to become cooled by exposure to currents of air which do not assist the combustion. In the Argand lamps, it is not only the air requisite to supply the flame, which enters into the chimneys of glass, but almost double and even triple the quantity of atmospheric air enters also, which has an injurious effect on the combustion. These useless currents of air affect the quality of the light, for as the air becomes heated by the flame, it deprives the latter of a part of its heat, and a proportionate quantity of its illuminating power. Thus one of the most interesting problems in the theory of illumination has been to avoid this cooling, and consequently to increase the brightness of the light. This problem, Benkler has solved in the most extraordinary, the most simple, and the most beautiful manner. In Benkler's lamp, the flame is brought to a white heat. The power of its light can only be compared to the flame of phosphorus burning in oxygen, which it nearly equals in clearness and brilliancy. The apparatus of Benkler is applicable at very little expense to lamps of every description. Any kind of oil may be used, even the commonest whale oils. They produce a flame which is quite as free from smell as that of the purest oil.

THE IRON TRADE.—But few persons are aware of the tribute which the citizens of the United States pay to Great Britain annually for her iron. The annexed table will show the value of the imports of iron into this country for five years. Not more than one-eighth of the amount was furnished by Sweden and Russia.

1835,	$3,114,929
1836,	4,621,896
1837,	4,516,115
1838,	3,548,608
1839,	5,876,507

The import and value of pig iron into the United States, for the last five years, according to returns in the Treasury Department at Washington, are as follows:

		Imported.	Cost per ton.
1835,	tons	12,290	$24
1836,	"	8,516	34
1837,	"	16,160	30.
1838,	"	12,180	26 60
1840,	"	12,602	23 25

Miner's Journal.

OIL AND GREASE FOR RAILROAD CARS.—The expense of greasing the wheels of the cars, (which is thought by some to be such an item,) it has been ascertained by trial on Reading railroad, that in using lard on the wheels for eight to nine months in the year, it will not cost over $1\frac{1}{2}$ cents per ton for the whole distance between the Delaware and the coal mines and returning, or for 188 miles. Oil would cost nearly treble that sum, and has been so charged in the calculations for this road. The price of lard varies from 8 to 9 cents per lb.—*Sketch of Railways, etc.*

USE OF PRINCES.—Everybody knows, we presume, that in France the government hold a monopoly of tobacco, and derives from it a large revenue. The Paris correspondent of the National Intelligencer informs us that the Dukes of Orleans, Nemours, and Aumale, the King's sons, have taken furiously to smoking, whereby the practice is brought into fashion. Thus the consumption of the weed is greatly increased, and the revenue augmented. Princes are not altogether useless, after all.—*New York Commercial Advertiser.*

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OPENING OF THE NEW YORK AND ERIE RAILROAD.

The portion of this great undertaking which adjoins the Hudson river having been completed as far as Goshen in Orange county, the company issued invitations for a public celebration of the opening of the road on the 22d of September.

The party assembled on this occasion was very large, among those present we noticed the Governer, Comptroller, and several officers of the State, many members of both houses of the legislature, several distinguished members of Congress from various parts of the United States, the Right Rev. Bishop Onderdonk and several clergymen. The professions was represented by W. C. Redfield and S. W. Roberts, A. L. Sykes and Messrs. Miller, Seymour, Morton, Ruggles and other gentlemen attached to the road.

The fine steamboat Utica was furnished for the conveyance of the company to Piermont, the termination of the road. The passage up the river was a very agreeable one, and the spirits of the party greatly enlivened by the spontaneous salute from the bells of the boats on the river—answered by the band of music and the cannon from the bows of the boat; these merry salutes and responses were continued until the arrival at Piermont.

Piermont is the terminus of the road on the Hudson river, and at this interesting point, there were numerous evidences of the magnitude of the work. The only pass through which the route to the west can be obtained has its termination on the bank of the river at a great distance from the main channel and a pier of about three fourths of a mile in length extends from the shore to the steam boat landing. The engines employed were splendid eight wheeled locomotives made by Norris—their weight being about sixteen tons, to these were attached large eight wheel tenders and alone formed a mass of considerable length, the width being proportioned to that of the road of six feet gauge—their whole appearance far exceeding any thing of the kind that we have ever seen.

Two trains were awaiting the arrival of the company and in a few minutes they were under way filled to their utmost capacity. Our attention was immediately attracted by the evenness of the motion and freedom from all lateral action--this is no doubt to be attributed in a great measure to the width of the track, and its mode of construction—the rails weighing 56 pounds to the yard, and being placed upon a continuous bearing.

The route passes up a small stream over a ridge, and into the head of the Hackensack valley which opens beautifully to the south and affords some very fine views. From the Hackensack there is an ascent to another ridge and then the road descends to the Ramapo. At this point the scenery is truly magnificent. The narrow pass through the mountains, is in itself an object of interest and when combined with the various openings in different directions, and the singularly shaped and somewhat abrupt eminences, affords a view which alone will make a trip to this regeon a desirable one for our citizens. The valley of the Ramapo throughout its whole length, traversed by the road presents a very rich variety of scenery, the transverse valleys of various length and depth continually breaking in upon the lofty chain of hills, or rather mountains.

We were particularly interested with the immense amount of water power upon the river but little of which is as yet employed. Several extensive iron works show the mineral wealth of the vicinity, some of these have been abandoned, probably from the difficulty of transportation but we have no doubt but that this region is destined at no very distant day, to become an extensive manufacturing district of great value to our city, and furnishing a highly proftable local traffic to the road. The quantity of fuel to be obtained is almost unlimited and from all that we could learn, the ore is nearly as abundant.

At the upper end of the Ramapo valley the scene changes—the soil from being rather sterile becomes fruitful—the highlands recede, and the hills around the neighborhood of the road are more gentle in their undulations and covered with rich verdure to their summits.

Before reaching Goshen we noticed a portion of the work highly interesting to the engineer. Immediately in the line of the route is found a very extensive peat swamp; this must be crossed at a level of twenty or thirty feet above the surface, and from its extent and consistency presents difficulties as great as those of the far famed *Chat moss.* This meadow is not of so great extent along the line of the road, but is much deeper and while *Chat moss* is higher than the surrounding county, this swamp is lower and has every appearance of having been the bed of a lake. These difficulties have been met in the following manner:—Four piles are placed transversely to the road and upon them is founded a trussel work having a span of twenty feet between the piles. The piles are generally forty feet long and are driven through the peat into the solid substratum, and the level of the road is twenty to thirty feet above the surface. The whole of this upper work is open and we were unabled to judge of its action under the very heavy train passing over it. This test although a severe one was perfectly successful, and bore testimony as to the faithfulness with which the work was performed.

Immediately succeeding this peat bed, and separated from it by the dividing ridge of this region, there is another of similar character, but much less in extent. This latter is remarkable for the remains of the great mastadon found in it several years ago.

These deposits of peat, which until now, have been perfectly useless, are rendered, by the construction of the railroad, sources of great wealth to the owners, and capable of conferring incalculable benefit upon the surrounding country. As a fuel, it is excellent; as a manure, with proper management, nothing is superior;—and we understand that peat charcoal is considered the best substance that can be employed in smelting iron. The expense of preparing the charcoal or coke would very nearly be covered by the value of the tar or other volatile products which might be advantageously employed in preserving timber.

The approach to the village of Goshen is very striking, but on this occasion the effect was truly splendid. A gentle rise to the south was covered with persons who had come from all directions to witness the opening, and at the approach of the trains, the gun mounted at this point, gave notice to the neighborhood,—the church bells rang in merry peals, and the air was rent with the shouts of the assembled multitude. As the trains with moderated velocity swept along, each road and opening discovered new groups, until it seemed as if all Orange county had turned out to greet their guests. The trains of wagons extending along the roads, showed from how far most of those present had travelled; and we were informed that many had come from a great distance out of New Jersey, to join in celebrating this remarkable event.

Of the good cheer provided, and of the speeches made on the occasion, it is neither our province nor our purpose to speak. The company, after enjoying themselves for two or three hours, returned in good humor and high spirits, and finally arrived at New York about 11 o'clock P. M. Not a single accident or mishap occurred to interfere with the enjoyments of the day, and we consider this rather remarkable, as the novelty of the sight brought hundreds about the trains along the whole route, and so many crowded upon the cars, that we were in constant fear of some of them getting off as unceremoniously as they had come on.

Great credit is due to the engineers of the road for the style in which they have completed this portion of the work. The nature of the ground is rather unfavorable, and high grades are unavoidable; great care, however, appears to have been taken to avoid sharp curves, although the circumstances of the ground require frequent deflections. The many little matters, which, being under the control of the engineer, and serve to display his sagacity and ability, are sufficient evidences of the faithfulness with which the duties of this department have been performed. We were not a little pleased to find that the credit of the profession has been supported, in this case, by very young men, affording an excellent example and encouragement to those junior members who rely upon their faithful and dilligent attention to duty as the best passport to distinction.

On the completion of any great enterprize, or so much of it as is calculated to awaken public attention to its importance, it is worth while examining into the commencement of the undertaking, and careful attention to its first developements, may lead to new exertions of a similar character, and with the same successful issue. Many persons are ready to claim the honor of starting a work when it is certain that honor is to be conferred upon its originator, and it is therefore a matter of justice that the proper person should be designated.

In the case before us, we are fortunately able to identify the original proposer of a communication by railroad with the great west. In 1829 a pamphlet was published on this subject, and in 1830 a second edition was printed, a copy of which we have before us. The title is "*Sketch of the geographical route of a* GREAT RAILWAY, *by which it is proposed to connect the canals and navigable* *waters of New York, Pennsylvania, Ohio, Indiana, Illinois, Michigan, Missouri, and the adjacent States and Territories, opening thereby a free communication at all seasons of the year between the Atlantic States and the great valley of the Mississippi."* The author of this pamphlet is now well known to be our fellow citizen W. C. Redfield, and to him, if to any one, is due the credit of suggesting the New York and Erie railroad, which, as far as our State is concerned, occupies almost the identical ground proposed by Mr. Redfield for this great western railway. That our readers may be able to judge of the comprehensive views announced at a time when railroads were in their infancy, and the canal mania had hardly subsided, we take the liberty of giving the main sketch, remarking, however, that the chief portion of the pamphlet is made up of a collection of facts showing the superiority and future triumphs of railroads:

"*Sketch, etc. Atlantic and Mississippi Railway.*—The construction of a GREAT WESTERN RAILWAY, on the rout which is traced on the annexed map, is reccommended to the attentive consideration of every citizen who feels an interest in the prosperity of his country, and wishes to promote its rapid advancement in wealth and power, by the multiplication of those physical resources which constitute national greatness, and best promote individual happiness and prosperity.

"The proposed Railway has, for its object, not only the connection of the great cities on the borders of the Atlantic with the magnificent lakes and rivers of the West, by a channel, available at all seasons of the year, but also the developement of the latent wealth and resources of large and valuable tracts of country which are not now traversed by any of the great works which have been constructed, or are in progress, under the patronage of the several States. It affords happy facilities for accomplishing these great objects, in a manner that will best subserve the interests of the whole community; and by connecting the canals of New York, Pennsylvania, Ohio, Indiana, and Illinois, in one great system, will give increased value and efficiency to the plans of internal improvement, which have been adopted in these several States.

"The route commences on the Hudson river, in the vicinity of the city of New York, at a point accessible at all seasons to steam ferry-boats, and from thence proceedes through a favorable and productive country to the valley of the Delaware river, near the northwest angle of the county of Sullivan. From thence the route ascends along the Delaware to a point that affords the nearest and most favorable crossing to the valley of the Susquehanna, which it enters at or near the great bend of that river.

"Pursuing a westerly and almost level course through the fertile valleys of the Susquehanna and Tioga rivers, the route crosses the head waters of the Genessee, having in its course intersected the terminations of the Ithica and Owego Railway, and the Chenango and the Chemung canals in New York, the great Susquehanna canal in Pennsylvania, and several other points that afford important facilities for intercommunication.

"From Genessee river, our route enters the valley of the Alleghany, and proceeds along that river, which affords a navigable communication with Pittsburgh, the Pennsylvania canals, and the Ohio river. From the Alleghany, the route intersects the outlet of the Chatauque lake, by which a communication may be established with Lake Erie, and proceeds to the head waters of the French creek, in Pennsylvania, from whence it again communicates with the Alleghany and the Pennsylvania canals, on the one hand, and may be connected with the harbor of Erie on the other.

"The benefits which would result from the construction of a railway, on the route which we have thus far followed, and its capacity to multiply the elements of individual and national prosperity, can be best appreciated by those who have carefully observed the effects of such improvements; but that portion of the route which remains to be considered, offers to our view results of the highest and most invaluable character.

"From the western branch of the Alleghany, we proceed in a direction nearly parallel to the shore of Lake Erie, and entering the northern counties of Ohio, intersect the great canal of that State on the portage summit. A free and rapid communication is thus established both with the lakes and the Ohio river.

"From the Ohio canal, the route proceeds in a western direction, near the forty-first parallel of latitude, along the fertile table lands which separate the tributary streams of the Ohio from those of the great northern lakes. Having entered the State of Indiana, we pass the head waters of the Wabash, intersect the route of the canal which is to unite the Wabash river with the lakes, enter the State of Illinois, and passing near the course of the Kankakee, *arrive at the head of steam-boat navigation on the Illinois river.*

"The Illinois, which is soon to be connected by a canal with Lake Michigan, affords good depth of water for steam-boats, with a current so slight, as to be, in many places, hardly perceptible. It affords excellent navigation for two hundred and fifty miles, through a country of unbounded fertility, to the Mississippi river, which it enters near the mouth of the Missouri, and a short distance above the flourishing and important town of St. Louis.

"Having accomplished this grand object, our railway continues near the bend of the Illinois, and at a distance of little more than sixty miles, *reaches the banks of the Mississippi.*

"The proposed point of junction with that immense river, is immediately above the Rock Island rapids, from whence the navigation is at all seasons uninterrupted to the River St. Peters, and the Falls of St. Anthony. The country bordering on the Mississippi, for a great distance above the termination of the railway route, besides its immense fertility, contaius inexhaustible quantities of lead ore, and is supposed also to abound in copper.

"The whole distance from the Hudson river to the Mississippi, at the junction of Rock river, is less than one thousand miles. The route extends along one of the best parallels of temperate latitude, and in great part through the most fertile and valuable portions of our country. A railway constructed upon this route, would connect, in the most advantageous manner, the agricultural, navigating, and commercial interests of the regions bordering on the numerous rivers, canals, and lakes, with which it communicates; and would extend the production and dissemination of valuable commodities throughout the most distant portions of our common country.

"In a military, as well as commercial point of view, the results of such a railway would surpass the power of calculation. With such ample means for throwing any amount of military force and material, at any time, to almost any point of our frontier, with a rapidity resembling that of an express rider, we should have little occasion to claim the respect of our proudest foes, whether savage or civilized.

"The whole extent of the proposed railway could be constructed for a sum not exceeding that which the State of New York has expended on its justly celebrated canals; and its cost would be trifling, in comparison with its benefits, or even to the increased value, which it would give to the lands which border on the route. It would, when completed, be far more beneficial in its effects on the intervening country, and on our national prosperity, than to turn the Mississippi itself into the same course. Free from the inundations, the currents, the rapids, the ice, and the sand bars of that mighty stream, the rich products of its wide spread valley would be driven to the shores of the Atlantic, with greater speed, than if wafted by the wings of the wind; and the rapid return of commercial equivalents would spread life and prosperity over the face of the finest and fairest portion of the habitable world.

"Without inquiring whether such a work could be best accomplished by the several States through which the route extends; or by incorporations, aided by grants of money or lands from the General Government; or by appropriations from the surplus funds, which will soon be at the disposal of that Government; it is sufficient to assert, that our citizens have only to appreciate the value of the enterprize, and raise their voices in its favor, and it will be accomplished."

An examination of the more detailed description of the route through the State of New York, is, in fact, as good a location of the route as could have been made without any instrumental survey.

May we not hope that the good work thus auspiciously commenced, may extend not only to Lake Erie but to the far west, and in its completion fulfil and more than fulfil the most sanguine anticipations of its first proposer.

SNOW ON RAILROADS.

As the season is now rapidly approaching when frost and snow are to make their appearance, the prudent engineer or superintendant is examining his apparatus for the winter campaign, determined that no delay shall be caused by want of preparation. The subject is one of much importance, and not a little ingenuity is required in contriving and managing snow plows and scrapers.

We are not about to enter into an examination of the various contrivances proposed for this purpose, but to make a suggestion which we conceive may result in much good to the cause of railroads.

We propose to all those concerned in managing or directing railroads, to keep a record of the obstructions caused by snow or sleet,—of the means used for their removal,—of the length and character of the delay, if any occurs,—and of all such matters as relate to this subject.

At the end of the season, we shall be most happy to receive the result of such observations, and publish them for the mutual benefit of those who furnish the information.

We hope from the result, to obtain actual proof that *railroads are the only free and uninterrupted means of communication during the winter season*, and thus to bring one of the strongest arguments that can be adduced in favor of the system. We are persuaded that no greater stimulus need be given for the trifling care and attention which our request involves.

BALTIMORE AND OHIO RAILROAD REPORT, SEPTEMBER 30, 1841.

Length of road in use, flat bar,	92	miles
edge rail,	19	miles
	111	miles
The road from Harper's Ferry to Hancock is expected to be in operation May 1, 1842,	42	miles
From Hancock to Cumberland is expected to be in operation October 1, 1842,	54	miles
	96	miles

Total *receipts* for the year ending September 30, 1841, (being about $41,342 less than the year 1840, the falling off being principally in flour, say 138,000 barrels less than in 1840.) $391,069

Expenses for the same period.

Transportation:		
Fuel, salaries to agents, superintendants, conductors, etc.,	$107,207	
Repairs to passenger cars,	7,110	
Do. to burden cars,	17,783	
Do. to locomotives,	20,640	
		152,740
Maintenance of way:		
Repairs to road,	69,100	
Do. to depots,	5,485	
Do. to water-stations,	748	
Do. to bridges,	584	
		75,917
Management:		
Office rent, incidentals, salaries, house rent, etc.,		10,966
		239,623
Charges extraordinary:		
New passenger and burden cars,	9,766	
New water stations, engine house, and old claim for right of way,	11,850	
		21,616
		$261,239

The expenses proper on this road for this year, were 61 per cent.

on gross receipts, being a reduction on those of the preceding year. The repairs to the road have also been lessening since 1837, when they were $97,000, as compared with $69,000 in 1841 ; and as the whole line has now attained nearly a complete renovation, it is expected that the expenses of the current year will show a still further reduction. It is stated in this report that the repairs on the 19 miles of edge rail were only $180 per mile, on the 92 miles of flat rail, $724. This should be a caution to those who still persist in recommending the flat bar road, which, besides being such a moth in itself, devours everything that is connected with it, and neutralizes at least one-third of the motive power. The dividend paid on this main stem was 3½ per cent. per annum.

We turn, however, with more satisfaction to the Washington branch of this road, extending to Baltimore, 40 miles, having an edge rail, and otherwise complete in its equipment ; the cost of this branch is stated at $1,779,000.

For the year ending the 30th September, 1841, the receipts were,		$231,700

Expenses for the same period.

Transportation :		
Fuel, salaries to agents, superintendants, conductors, etc.,	$30,906	
Repairs to burden cars,	4,592	
Do. to passenger cars,	4,487	
Do. to locomotives,	7,972	
		47,957
Maintenance of way :		
Repairs to road, water stations, etc.,		24,231
Management :		
Office rent, salaries, incidentals, etc.,		6,872
		$79,060
Extraordinary charges :		
Construction of tonnage depot at Washington,	2,153	
Do. of new burden cars,	1,103	
Paid an old claim of right of way,	1,075	
Interest on Elkridge annuity,	750	
Taxes to State ⅕ of receipts for passengers,	43,407	
		48,488
		$127,548

The expenses proper on this road were equal to 34 per cent. on the gross receipts, being a reduction on those of the preceding year, and the dividend paid was 6 per cent. per annum, after deducting tax by the State of more than 2^1 per cent. on the capital. This may be truly classed among the successful specimens of the railway, although but a *short line.*

On the future prospects, as respects the completion of the main road to Cumberland, the report remarks as follows:

"It is no part of the design of this report to speculate upon the increase of the profits, which may be expected from the completion of the road to Cumberland, which may now be so soon realized. In justice, however, to the expectations with which this great enterprise has hitherto been fostered by the public authorities, in any view in which the subject may be considered, this increase should not be overlooked. The construction of the new road west of Harper's Ferry will be of the most approved and substantial kind, of easy grades and light curvatures, and adapted to the transportation of the heaviest materials, at a far less cost than must necessarily be incurred upon a less perfect structure. The extension of the work to Cumberland will offer a practicable means of transportation for the vast mineral resources of the Allegany region, at a moderate cost, and may be expected to ensure a speedy development both of the coal and iron of that portion of the country. Nor can it be doubted that the fertile valley between Harper's Ferry and Cumberland, important resources of business will be opened, while every material approach to the western waters, must afford new facilities to the trade and travel from the great valley of the Mississippi."

We say to the city of Baltimore, persevere in your great enterprise, an ample reward will flow from so doing; and it will not fail to occur to the reader how applicable are the remarks of the above extract to a kindred work now completing between Philadelphia and the Schuylkill coal region, which, of far wider influence in its effects, has yet but little of public favor to cheer it through the difficulties of the times. Both have canals to contend against; and looking to the many drawbacks which attach to the Baltimore railroad, it is truly marvellous to see it thus thriving in spite of such competition,—the rates of the canal being made without any reference to repaying cost of the work. Down the Schuylkill, however, a different state of things is found, the railway will there be complete in every respect, and will not be long in showing its pre-eminence over its rival.

A useful comparison can be made of these two roads as to the *mere cost of transportation* by either, thus:

On the Baltimore and Ohio $391,000 were earned at an expenditure of $152,700, or 39 per cent.

On the Baltimore and Washington $231,700 were earned at an expenditure of 48,000, or 21 per cent.

The flat and edge rail character of these roads explain in good part this disparity in cost of transportation. Those who would judge accurately of railways must test them first by this item, as most of them, from more or less *dead weight*, only deceive by their general results, and these two roads are not exceptions in that respect.

The public, if not already, are about turning over a new leaf in estimating the railway; and as first in importance, it will require to know how clear it starts of *unproductive cost, taxation, etc.* We recommend as the best subject for study the road above alluded to, between Philadelphia and Pottsville, which proposes to carry coal at a cost of 25 per cent. on a gross charge of $2 per ton, or at 40 to 50 cents per ton for one hundred miles; but which the majority persist in calling only *theory*, in the teeth of abundant experience, such say, as is given above, on the Baltimore and Washington railway, which transports at a cost of only 21 per cent., and is in *every respect inferior* to the road of which such a *marvel* is asserted.

The stock of this coal railway is now selling at $23 for 50 paid, (now in course of completion).

The stock of the Schuylkill navigation, now selling at $43, for 50 paid, (a fall from $180).

The stock of the Delaware and Hudson Canal Company, now selling at $106, for 100 paid, (a rise from $75).

We ask to record these quotations, without comment, for future reference.

THEORY OF THE PROCESS FOR PRESERVING TIMBER, CANVAS, AND CORDAGE, BY THE SULPHATES OF IRON AND COPPER.

In explaining the theory on which I have formed my method of treating timber for its preservation, it may be both pertinent and availing to show its agreement with the opinions of one of the latest and most approved authors who have either treated the subject professedly, or have only incidentally stated the general principles of decay, and the means by which it may be prevented. Of the latter description, is Dr. Ure, of Glasgow,—more distinguished, perhaps, for his extensive and practical usefulness in the arts and manufactures, than any other chemist of the present age.

In his late very valuable "Dictionary of the Arts," etc., Dr. Ure has presented so definite and philosophical a description of the process of vegetable decomposition—and his principles of decay, with the means suggested for preventing it, are so clearly identical with those *I had previously adopted*,*—that in quoting a few of his sentences, I gladly employ his high authority to confirm the propriety of my process and its rationale.

"In vegetables which putrefy," says the Doctor, "it is *the albumen* which first suffers decomposition. When dissolved in water (as it always is in its natural state) it very readily putrefies in a moderately warm air; but when *coagulated* it seems as little liable to putridity as fibrin itself. Hence *those means, which, by coagulation, make the albumen insoluble, or form with it a new compound which does not dissolve in water, but which resists putrefaction, are powerful antiseptics.*"

"In this way, acids," alcohol, salt, sugar, and a great variety of chemical substances, act in preserving, for domestic use, our summer fruits and vegetables, and in curing meat, hides, etc. "But, than all others," continues Dr. Ure, "the *metallic salts* operate still more effectually as antiseptics, because *they form with albumen still more intimate combinations.* Under this head, we especially class *the green and red sulphates of iron, the sulphate of copper, and corrosive sublimate.*"

On a different occasion, he says, "albumen occasions precipitates with the solutions of almost every metallic salt, and according to Dr. Bostock, a drop of saturated solution of corrosive sublimate let fall into water, containing one two-thousandths of albumen, occasions a milkiness and curdy precipitate." In other places, Dr. Ure classes *the sulphates of iron and copper*, for identity and power of effect, by the side of corrosive sublimate; and I have had occasion to show to many engineers and others that the solution of these sulphates, in the proportions in which I use them, produces with albumen the appearance here spoken of, in precisely the same manner, and in an equally strong degree, as the solution of corrosive sublimate.

The expulsion of water and of oxigen gas, or the fixation of them by other substances, is another necessary means, stated by Dr. Ure, for the prevention of putrefaction: "Even in those cases where no separation of the albumen takes place in a coagulated form, or as a solid precipitate, by the operation of a substance foreign to the juices, putrefaction cannot go on, any more than other kinds of fermentation, in bodies wholly or in a great measure deprived of their water." This, and the expulsion of the gas, so

* His dictionary was first published in 1839;—my patent was obtained a year before, in 1838.

necessary to putrefaction, "is most readily accomplished by *heat,* which, by expanding the air, evolves it in a great measure, and at the same time favors the fixation of the (remaining) oxigen in the extractive matter, so as to make it no longer availabe towards the putrefaction of the other substances."

From the above quotations, then, it appears, on the authority of Dr. Ure, that *albumen* is the first subject of decay in timber; and that, by the removal of its water of solution and the gases, and the conversion of the albumen into an incorruptible coagulum, the surest means are adopted of preventing that decay. It appears, also, that the most certain method of accomplishing this, is by the employment of corrosive sublimate, or of the *sulphates of iron and copper with heat.* Now, such are the very means I employ; and in such *proportions* as many experiments have taught me are most efficacious and advantageous.

I confidently, therefore, refer to Dr. Ure for sanction of the principles and practice *I had already adopted* in my process; and believe it to present as much certainty as belongs to any method yet known, of giving to timber the durability of which we are in search, and to all vegetable material, as canvas and cordage, of which it is as preservative as of timber.

EDWARD EARLE, *Patentee.*

PHILADELPHIA, *June,* 1841.

CIRCULAR.—*The Preservation of Timber, Canvas, and Cordage.*—The Process and Apparatus for the above purpose, having undergone repeated improvements by which they are now brought to a degree of cheapness and facility beyond which he can hardly expect to advance them; and the power of the process being fully admitted;—the Patentee offers the use of it on the following *reduced* terms. This reduction he regards as a concession, no less proper than necessary, to the pecuniary difficulties of the present period—felt by all, and by none more than those most forward in the enterprises of improvement: many of whom, although desirous to avail themselves of its benefits, have hitherto been prevented by the cost that has attended it. In yielding, therefore, to the imperative circumstances of the times, he does not affect to be uninfluenced by the bearing it may have on his own interests.

To JOINT STOCK RAILROAD COMPANIES he offers the use of his *patent-right*—be the quantity of timber on the track more or less—*at $75 per mile,* part payable, if preferred, in stock of the company.

To the other joint stock companies—and individuals—for canals, bridges, and steamboats;—for ships, canal boats, wharves, docks, mill-wheels, posts and rails, scantling, shingles—and, in short, for almost every purpose for which the duration of timber is desirable —he offers it at a cent *per cubic foot.*

The Apparatus—which, by constant efforts to improve it, he has very recently formed in such manner as to be either stationary or removable from place to place—may be had, adapted to every purpose, at 30 to 250 dollars; the last being, with suitable tanks, equal to the curing of 6 to 8000 cubic feet of timber, of the largest size and length generally employed, at a single operation, or in six to eight days; shorter and smaller pieces in 24 to 72 hours. The cost, including the *salts*, the *labor*, and *fuel*, may be estimated at $1\frac{1}{4}$ to 2 cents *per cubic foot.*

Edw. Earle, *Patentee.*

Philadephia, *June*, 1841.

TENTH ANNUAL REPORT OF THE WINCHESTER AND POTOMAC RAILROAD COMPANY, TO JULY 15, 1841.

The business done on this road for the past year is given as follows. It is a useful feeder to the Baltimore and Ohio railroad, and connects with it at Harper's Ferry, being 32 miles long.

Receipts:

Mail, etc., etc.,	$2,245	
Passengers,	16,163	
Merchandize, equal to about 19,000 tons transported, principally flour,	43,700	
		62,108
Last year's balance,		4,111
		$66,219

Disbursements.

Transportation:	
Repairs to engines, fuel, wages to attendants in trains and at depots, oil, etc.,	$22,455
Maintenance of way:	
Repairs of road, and general renewal of the same,	28,093
Interest account:	
Interest on loans,	3,946
Charges extraordinary:	
Drawback account, loss by fire and damages, removing snow, etc., etc.,	6,335
Management:	
Salaries to president, officers, etc.,	4,861
	$65,690

Being originally constructed on the cheap flat bar plan, and doing principally a freighting business, it is not surprising to find the managers of this road so soon announcing that its "superstructure had reached *a crisis* which required every active effort to renew and sustain it." From this and other causes, it had in fact become a complete Pandora's box—from which, however, it is now happily rescued, and in the current year, under its present state of renovation, as to superstructure, machinery, and management, combined with the prospect of increased business and travel, more profitable results are confidently promised by its directors.

The following remarks from this report, on the "future policy of the road,"* are very appropriately defensive of the system of railways, and we recommend it to the attention of our readers, particularly for the economical results expected from the new eight wheeled engine built Messrs. Eastwick & Harrison, Philadelphia, lately put on the road.

It would be more useful and intelligible to both stockholders and the public if the reports and disbursements on railroads generally, were classified in the manner above, giving also the number of engines employed, and the total miles run doing the year's business. As most of the reports are now made, no distinct idea can be formed from them.

COMPLIMENT TO AMERICAN MECHANICAL SKILL.

It was declared at the meeting of the committee to inquire into the condition and operation of the railway system in England, Sir Frederick Smith in the chair, that the American locomotives of Mr. Norris's build, (in use on the Birmingham and Gloucester road,) performed 50 per cent. more work than any English engine of equal weight.—[*See London Railway Times, of 22d May,* 1841.]

[From the Civil Engineer and Architect's Journal.]

ENGINEERING WORKS OF THE ANCIENTS.

Mines of the Thasians.—Siphnians.—Athenians.—Continuing our extracts from Herodotus, we find that the Thasians derived considerable wealth from their mines. From those of gold at Scaptesyla, they obtained upon an average eighty talents; Thasus itself did not produce so much; but they were, on the whole, so affluent, that being generally exempt from taxes, the whole of their annual revenue was two hundred, and in the times of the greatest abundance, three hundred talents. It may be observed that many of the Greek

* See report in another part of this number.

states derived considerable revenues from mines, which admitted of the application of slave labor on a large scale. So with some of our modern states, mining and mining monopolies are important sources of income. Of the Thasian mines, Herodotus remarks, that he had seen them, the most valuable were those discovered by the Phœnicians, who also were engaged in the Cornish tin trade, and in working the mines of Spain. The Phœnicians are stated by our author to have first made a settlement on the island under the conduct of one Thasus, and to have named the island after him. The mines so discovered, were between a place called Ænyra and Cœnyra. Opposite to Samothracia was a large mountain, which, by the search after mines, was effectually levelled, from which it is evident that the working was surface working. The Thasians also, according to the testimony of Thucydides, had some valuable mines on the coast of Thrace. If the mining of the Thasians was confined to surface-working, it could scarcely be from want of a knowledge of other modes, as we shall see by the example of the Samians, that tunnelling was carried on upon a large scale. The Siphnians were also a mining people, their soil producing both gold and silver, in such abundance, that from a tenth part of their revenues, they had a treasury or cash-box, as we should call it, in the general bank of Greece at Delphi, equal in value to the richest which that temple possessed. Their power was consequently considerable, and they were, at one time the richest of all the inhabitants of the islands, although their territory was but small, being one of the seventeen small islands opposite Attica, called the Cyclades. This isle is now called Siphanto, and although it no longer has mines of gold and silver, it still has plenty of lead, which the rains discover. The Siphnians, every year, made an equal distribution among themselves of the produce of their mines, as did the Athenians of that of the silver mines of Attica. In allusion to stream-works, Herodotus says that the Indians obtained great abundance of gold, partly by digging, and partly from the rivers. Of the Ethiopian gold our author speaks, but does not say how it was obtained. Tin is mentioned as being obtained from the Cassiterides, supposed to be the Scilly Isles, of which Herodotus says, that he has little information. The North-west of Asia is represented as abounding with gold, but how it was obtained was not known. This passage might refer to the mines of the Ural.

Works of the Samians.—Tunnel.—Aqueduct.—Mole.—Engineers.—The Samians were distinguished among the Greeks for their engineering monuments, for which very reason Herodotus says that he was particular in his account of those islanders. Of these works, remains to this day exist. Through a high mountain they are said to have cut a passage, seven stadia (about a mile) long, eight feet high, and as many wide. By the side of this was a canal or aqueduct three feet in breadth, and twenty cubits, according to our author, in depth, but in this there must be some mistake. In this, canal pipes were laid, conveying to the town the water of a copious spring, supposed to be that of Metelinous. Another work is the Mole now forming the left horn of Port Tigrani. According to Herodotus, it was two stadia or more in length, and twenty orgyiæ or cubits in height. The engineer of the tunnel was Eupalinus, the son of Naustrophus, and an inhabitant of Megara.

Trench of the Scythians.—Walls.—Bridges.—The descendants of the slave population having revolted against the Scythians, intersected the country with a deep trench, supposed to have separated the Crimea from the mainland. In the time of the Emperor Constantine, Porphyrogenitus, this was filled up, it must, however, have existed for a long period. In Scythia are also mentioned bridges and walls constructed by the Cimmerians.

Polybius.—*Carthaginian Engineering.—Bridge over the Macar.—New Carthage Canal.—God of Mining.*—From Herodotus, we come to Polybius, but it is to be regreted that the latter has rather applied himself to accounts of political intrigues, than the descriptions of the physical features of the countries on which he writes. From him, therefore, we are enabled to glean but little information, and that of a most discursive character. He gives several hints showing us the capacity of the Carthaginians for engineering, but he has not entered into those explanations which would have come with weight from him as an eye witness. The passage of the Alps, by Hannibal, is sufficient to prove the skill of the Carthaginians, but we have too vague a description of the mode of proceeding, to allow us to profit by it.

In the 1st book, chapter 6, a singular account is given of a bridge near Carthage, which was laid over the Macar, a deep and rapid river, scarcely fordable in any part. This was the only bridge on the river, and formed one of the passes to Carthage. On it, Polybius states that a town was built by the soldiers, and used as a garrison. The roads in the neighborhood of Carthage, were mostly made by great labor.

In their military operations, the Carthaginians were well accustomed to pass rivers, instances of which we have in the course of Hannibal's expedition. His passage of the Rhone, belongs rather to military tactics, but there is one point to which we think it necessary to allude, as it may be of interest to our bridge-engineers. Having formed a line of large boats across the river, he made use of them as a coffer-dam or breakwater, and under shelter of them, passed over the troops in canoes, and swam over the horses, which were guided alongside of the vessels by men stationed on board of them.

At New Carthage, (Carthagena) in Spain, one of their principal colonies, we again find traces of their engineering works, between the lake and sea they cut a narrow navigable canal, and across this there was a bridge used by carriages and beasts of burden. In the city, one of the hills was dedicated to Aletes, who is said to have obtained divine honors, from having first discovered the silver mines, which were extensively wrought by the Carthaginians in Spain.

Greek Engineering—Bridges—Phœnice—Psophis.—In Epirus, we find mention of a bridge, which seems to have been after the fashion of that at Babylon, mentioned in our first article, and to have been of a class common among the ancients. This was at Phœnice, and had piers of stone with moveable planks laid upon it. At Psophis, in Arcadia, a bridge is mentioned, over the Erymanthus, a great and rapid stream.

Causeway—Ambracus.—Ambracus, in Etolia, is descried as a fortress of considerable strength, situated in the middle of a marsh, and secured by a wall and outworks. It was only to be approached by one narrow causeway. It was besieged and taken by Philip king of Macedonia, who carried causeways through the marsh.

Size of Ports.—Speaking of Tichos, a fortress near Patræ, Polybius says that it was of no great size, being not more than a stadium and a half in circumference, so that it might have sides of eighty yards in length.

Engineers.—Among the supplies furnished by the Rhodians to the Sinopeans in their war against Mithridates, engineers are mentioned, and military engines.

Rebuilding of Rhodes.—On the destruction of Rhodes by an earthquake, large supplies were sent by the allies of that city in order to enable them to rebuild it. Among these supplies Ptolemy, king of Egypt, sent forty thousand cubits of square pieces of fir; a hundred architects, and three hundred and fifty laborers. Antigonus sent them ten thousand pieces of timber, that was proper to be cut into solid blocks from eight to sixteen cubits; five thousand planks of seven cubits; three thousand weight of iron. Seleucus, his father, sent ten thousand cubits of timber. Other parties sent in the same proportion.

Building materials seem to have been considered as of great value, for in case of the sacking of towns the timber and tiles were frequently carried off.

[From the Civil Engineer and Architect's Journal.]

PROCEEDINGS OF THE INSTITUTION OF CIVIL ENGINEERS.

"*Remarks on the comparative advantages of long and short connecting rods, and long and short stroke engines.*" *By John Seaward, M. Inst. C. E.*

The author commences the communication with a description of the engines first placed on board the steam frigate, "The Gorgon."

The engines are constructed on the principle of "direct action," that is, the power is communicated directly from the piston to the crank, without the intervention of side levers, and the other parts usually employed in the construction of marine engines; this is one leading feature. Another is, that the main shafts are placed directly over the centre of the cylinder; and as these shafts are carried by strong frames and wrought iron columns standing upon the cylinders, the force of the engines is confined between the cylinders and the frame, and thus isolated from the sides of the vessel. Other advantages accruing from this construction are, in the author's opinion, a saving of space and weight, the absence of the vibration resulting from the action of the side levers, and a more efficient application of motive power, arising from the simplicity of the construction and diminution of friction.

Two main objections have been urged against this system—1st, that the shortness of the connecting rod causes a loss of effect; and 2nd, that the shortness of the stroke is a disadvantageous application of the power of steam.

The arguments in support of these objections are combated at considerable length. With reference to the alleged loss of power by the use of the short connecting rod, it is argued, that as no arrangement of long or short rods or levers could create power; so no arrangement of similar parts could be productive of loss of power. A geometrical investigation of the force actually exerted on the crank by long and short connecting rods is then given, and the result deduced is, that by adding together the whole of the force exerted by the two kinds of connecting rods respectively, during one entire rotation, they both give the same actual amount; thus proving, that no loss arises from the use of the short connecting rod.

It is admitted, that there is some increase of friction on the journals of the connecting rod joints, but this occurs only at the extreme angles; some allowance is also to be made for the increased angular motion about the lower joints of the rod, but they are not collectively of sufficient importance to be considered as any objection in practice.

The calculations given are under the approval of Professor Airy, who thus expresses himself:—"The *greatest* force of the 'Gorgon' engines (when both cranks are below the horizontal line) is *greater* than the *greatest* force with common engines, but the *least* force is not less than the *least* force with common engines."

The whole power, in a complete revolution of the crank, is the same in both.

That a long stroke engine, under certain circumstances, may be more advantageously employed than a short one, is admitted; but considering the steam engine *per se*, it argued, that the latter possesses no advantage over the former.

In two engines of equal power, equally well constructed, the length of the stroke being respectively eight feet and four feet, the cylinder of the latter having double the area of that of the former, making the same number of revolutions per minute, and having the steam passages and valves of the same area, it is clear, that the mechanical action of the steam must be identical, because the same volume of steam will produce an equal mechanical effect, whether it be introduced into a long narrow cylinder, or into a short wide one; setting aside the effect of working expansively, which, however, is not at all affected by the shortening of the cylinder: for it is just as practicable to shut off the steam at one-half, one-third, or one-fourth of the stroke of a short cylinder as of a long one.

The most essential differences between these two engines must be in the relative amount of friction, and of radiation of heat from the cylinders and passages.

In a well made engine four-fifths of the friction is due to the packings of the piston, air-pump bucket, and stuffing boxes, and about one-fifth to the gudgeons, crank pin, and other moving parts. The friction of the piston packing is as the circumference multiplied into the space through which the piston travels, and into the depth of the packing; therefore in a cylinder 30 inches diameter, 8 feet long, the friction of the packing will be as 24, while in a cylinder of 42·4 inches in diameter, 4 feet long, it will be only as 17.

The same train of reasoning is extended to the other moving parts, and shows that if the total friction in the short stroke be 100, that of the long stroke engine will be 123.

The radiation of heat from the cylinders will be as the relative areas of surface, which is less in the short stroke than in the long.

An examination of the comparative friction of the moving parts of steam engines is entered into; rules for computing, and tabular results are given; and the author concludes by observing, that although the relative dimensions selected as examples are uncommon in England, they are not so in America, where pistons of marine engines frequently travel at the rate of three hundred to four hundred feet per minute. It is contended that the speed of the piston is immaterial, provided the engine be well proportioned to the speed; at the same time bearing in mind that a slow speed will be more favorable for the easy and pleasant working of the engine, and for durability. The paramount objects to be aimed at in the construction of marine engines are, the greatest saving of fuel, space, and weight, and the durability of the machine; and as the question is not whether the stroke should be eight feet or four feet, but relates to a diminution from the present length of seven feet to probably six feet, it is contended that the form of the "Gorgon" engines offers considerable advantages in the points treated of, independently of the positive diminution of weight and space, which formes no part of the immediate inquiry.

A drawing of the "Gorgon" engines accompanied the communication.

"*Description of a thirty-ton crane, erected on the quay of Earl Grey's dock, Dundee harbor.*" *By James Leslie, M. Inst. C. E.*

The crane is placed on a stone platform sixteen feet square, raised six feet above the level of the quay, with its centre seven feet back from the dock face; and as the sweep or radius is thirty-five feet to the perpendicular of the jib-sheave, the load is suspended twenty-eight or twenty-nine feet over the dock (as the double or single purchase sheave is used.) The height of the sheave above the level of the quay is forty feet.

Instead of the framing revolving about a fixed post, as in the usual mode of construction, the post itself is connected with the framing, and turns with it, so that the strain may be always in the direction of the greatest strength.

To avoid the extra dimensions of the castings for the post, if it had been composed entirely of cast iron, and for facility in the construction, the parts of cast and wrought iron are so combined that the "push" is thrown upon the cast-iron abutting piece which is placed in front, while the back part, consisting of wrought-iron tension bars, bears the "pull." The two rings on the post are turned on the face and edges, and being bolted together form a fair surface for the friction rollers, while the back forms a rest for the tension bars.

These back tension bars are three inches wide by two and a half inches thick, each, forming an aggregate section of forty-five inches. They were all proved in the bent form in which they are used, by making fast the ends of each bar to cross heads held apart by two logs, and suspending a load of twenty-four tons from the elbow formed by the bend in the bar; this was calculated to be equivalent to a longitudinal strain of ninety tons. There are also two side tension bars, two inches square each, firmly sunk in the cast iron block, and bolted to the top of the framing.

The post revolves within a cast-iron cylinder twenty-seven feet deep, five feet three inches in diameter, with turned and bored water tight joints. The whole is surrounded with masonry, bound together by strong iron hoops and diagonal tie bars passing through the fixed ring.

The jib is of oak two feet diameter in the middle, and twenty-one inches at the ends; the two wrought iron jib stays are each three and a half inches diameter; the chain is of $1\frac{1}{4}$ inch iron. Eight men easily lift a weight of thirty tons, and by means of the horizontal wheel work one man can turn it round.

The total weight of the castings, wrought iron bars, chain, and brasses, is about fifty-nine tons.

The crane was made and erected by Mr. Borrie, of Dundee, from the designs and under the direction of the author.

The communication is accompanied by two elaborate working drawings, on a large scale, with details of the mode of construction.

"*An account of some experiments to determine the force necessary to punch holes through plates of wrought iron and copper.*" By *Joseph Colthurst.*

These experiments were performed with a cast iron lever, 11 feet long, multiplying the strain ten times, with a screw adjustment at the head, and a counterpoise.

The sheets of iron and copper which were experimented upon were placed between two perforated steel plates, and the punch, the nipple of which was driven through by the pressure of the lever.

The average results of the several experiments (which are given in a detailed tabular form) show that

The power required to force a punch.	Inch diameter.	Through an iron plate	Inch thich.	
Do.	6·50	Do.	0·08	is 6,025 lbs.
Do.	6·50	Do.	0·17	is 11,950 lbs.
Do.	6·50	Do.	0·24	is 17,100 lbs.
		Through a copper plate.		
Do.	6·50		0·08	is 3,983 lbs.
Do.	6·50	Do.	0·17	is 7,883 lbs.

Hence it is evident, that the force necessary to punch holes of different diameters through metal of various thicknesses, is directly as the diameter of the holes and the thickness of the metal.

A simple rule for determining the force required for punching, may be thus deduced.

Taking one inch diameter, and one inch in thickness, as the units of calculation, it is shown that 150,000 is the constant number for wrought iron plates, and 96,000 for copper plates.

Multiply the constant number by the given diameter in inches, and by the thickness in inches; the product is the pressure in pounds, which will be required to punch a hole of a given diameter, through a plate of a given thickness

It was observed, that duration of pressure lessened considerably the ultimate force necessary to punch through metal, and that the use of oil on the punch reduced the pressure about eight per cent.

A drawing of the experimental lever and apparatus accompanied the communication.

"*Upon the application and use of auxiliary steam power, for the purpose of shortning the time occupied by sailing ships upon distant voyages.*" *By Samuel Seaward, M. Inst. C. E.*

But few years have elapsed since the possibility of propelling vessels by the power of steam was treated as a chimera; and although the practicability of its application for short voyages has been successfully demonstrated by the numerous vessels plying between this country and the Continent, it is but of very recent date that its employment for long sea voyages has been adopted. The weight of the powerful machinery and the fuel, and the consequent loss of space for cargo, together with many other circumstances attendant on the present construction of steam vessels, induced the author (who received the education of a seaman, and has since had extensive practice as an engineer) to believe that a more efficient mode of employing steam power for long sea voyages might be adopted.

Notwithstanding the great improvements which have taken place in the construction of steam vessels, and their machinery, it would appear that the duration of the voyage ought not to exceed twenty days, after which time a fresh supply of fuel becomes necessary; hence, steam has rarely been adopted for very long voyages. The reason of this limit to the duration of the voyage of a steam vessel, as at present equipped, is that an increase of power does not produce a corresponding increase of speed, while the weight of the machinery increases in proportion to the power employed, and in some cases exceeds it; for instance, small engines, with the water in the boilers, generally weigh about one ton per horse power, while in some large engines the ratio is nearly twenty-five cwt. per horse power.

A quadruple increase of power will not produce double the original velocity in a steam ship, although, in theory, such is assumed to be the case; for as the weight is more than doubled, the immersed sectional area becomes greater, and a still further increase of power is necessary. It has been shown by experience, that if a vessel with a given power is propelled through the water at the rate of eight miles per hour, her speed cannot be doubled, even though the power be multiplied twelve times, and the entire hold of the vessel occupied as an engine room.

The weight of fuel is also in direct proportion to the size of the engines; so that taking, for example, two vessels of two hundred and of four hundred horse power respectively—that of the higher power will have to carry nearly double the weight both of fuel and of engines, and it is still questionable whether the increase force will propel the one ship more than $1\frac{1}{2}$ miles per hour faster than the other.

The space occupied by the engines and fuel in the most valuable part of the ship, is also an important consideration: neither the "President" nor "British Queen" steamer although of two thousand tons measurement, is capable of carring more than five hundred tons of cargo when the fuel is on board.

The author then examines the question of employing too much power in a steam vessel, and refers to the "Liverpool," as an instance that such may be the fact. It appears that with the original dimensions of thirty feet ten inches beam, and engine power of four hundred and fifty horse, being a proportion of power to tonnage of about 1 to $2\frac{1}{2}$, the vessel was immersed four feet beyond the calculated water line, and a decided failure was the natural consequence; but when the breadth of beam was increased to thirty-seven feet, augmenting the capacity four hundred tons, and giving the proportion of one horse power to $3\frac{3}{4}$ tons burthen, the performance of the engine and the speed of the vessel were both materially improved.

The "Gem," Gravesend steamer, one hundred and forty-five feet long, by nineteen feet beam, had two engines of fifty horse power each; the speed was insufficient, being only twelve and a half miles through the water; but when the same engines were placed in the "Ruby," which was one hundred and fifty feet long, and nineteen feet nine inches beam, the velocity of the latter vessel was thirteen and a half miles per hour. A pair of engines, of forty-five horse power each, were then placed in the "Gem," without altering the vessel, and in consequence of the diminished weight and draught of water, her speed then nearly equalled that of the "Ruby."

The author does not condemn the application of considerable power for vessels, provided it can be employed without materially increasing the weight and the area of the immersed midship section. It appears that the length of a steam voyage, to be profitable, is at present limited to twenty days for the largest class of steamers; that we have about thirty others which can approach twelve days, while the majority cannot employ steam beyond eight days successively, without a fresh supply of fuel. It is evident, therefore, that more efficient means must be adopted for the general wants of commerce in our extended intercourse with the East and West Indies, the Pacific, Mexico, Brazil, Australia, and all the distant colonies, which now demand rapid communication with England.

The author refers to a pamphlet, published by him in 1827, entitled, "observations on the possibility of successfully employing steam power in navigating ships between this country and the East Indies by the Cape of Good Hope." He therein proposed that large square rigged ships, of fifteen hundred to eighteen hundred tons measurement, should be fully equipped and constructed, so as to sail ten or eleven miles per hour with a fair wind; that they should carry engines of small power, to assist the sails in light winds, propel them at a moderate speed during calms, work into and out of harbor, etc., and thus shorten those portions of the voyage wherein so much time was usually lost.

To all well built good sailing vessels, of four hundred tons and upwards, "auxiliary steam" is applicable. A steam engine of the necessary power can without inconvenience be placed in such vessels, either on or between decks, so as propel a ship at the rate of four to five nautical miles per hour in a calm, and for this speed a proportion of one horse power to twenty-five tons is amply sufficient. The practicability of applying this system to East Indiamen and other similar vessels is then examined at length, and it is shown that the ordinary speed of these ships under sail is, before the wind, eleven to twelve miles per hour, and in a gale thirteen to fourteen miles per hour, which is greater by two or three miles per hour than that of any ordinary steam vessel when under sail, on account of the latter being impeded by the wheels trailing in the water, and the slightness of their masts, spars, and rigging. The auxiliary steam power might, therefore, be efficiently applied, either by using it alone, or in conjunction with the sails, so as to keep up a uniform speed, by which a great saving of time could be effected in a long voyage.

The conditions of sailing and steaming voyages to India, with the influence of the trade-winds, are then examined, and the author proceeds to detail the experiments made by him, on board the "Vernon" Indiaman, which was the first sailing vessel that actually made a voyage out and home with "auxiliary steam."

The "Vernon," built in 1839, by the owner, Mr. Green, was one thousand tons burden; the sailing speed was about twelve to thirteen miles per hour in a fresh gale, and being from her frigate build well calculated for the experiment, it was determined to equip her with a condensing engine of thirty horses power, placed midships on the main deck, between the fore and main hatchways; the space occupied being twenty-four feet long by ten wide. The weight of the machiney was twenty-five tons, and it was so arranged that the motion was communicated direct from the piston cross-head by two side rods to the crank on the paddle shaft, placed immediately behind the lower end of the steam cylinder, which was horizontal. The wheels were fourteen feet diameter, projecting five feet, and were so constructed that the float boards could be raised to suit the draught of water of the ship; or they could be taken entirely away if necessary, leaving the shafts projecting only eighteen inches beyond the sides. Under ordinary circumstances they were disconnected from the engine by a simple contrivance, consisting of a moveable head, attached to the crank on the paddle shaft, by turning which, one quarter of a circle, the crank pin was liberated, and the wheels turned freely round. The "Vernon," thus equipped, having on board nine hundred tons of cargo, and sixty tons of coal, drew seventeen feet of water. In the first trial the speed of the vessel, under steam alone, was five and three-quarters nautical miles per hour, demonstrating how small a power is necessary for a moderate speed. She then started for Calcutta, and though the piston rod broke three times during the voyage, owing to a defect in one of the paddle shaft bearings, the passage was satisfactory. The details are given minutely, as are also those of the homeward voyage, which was performed from Calcutta to London in eighty-eight days, to which must be added seven days for necessary delay at the Cape, making a total of ninety-five days, which is the shortest passage on record. Great credit is given to Captain Denny for the judgment with which he used the auxiliary steam-power, and the course taken by him, by which he was enabled to overcome the difficulties incidental to a first trial of so important a system. The success of the "Vernon," induced the immediate application of engine power to the "Earl Hardwicke" Indiaman, and both these vessels are now on their voyage out to Calcutta.

This communication was accompanied by drawings of the "Vernon" and the "Earl Hardwicke," and by a chart, on which was laid down the proposed daily course of a steam ship, on a voyage to and from Calcutta, showing where sails only are necessary, then where steam alone, and also when the joint agency of steam and wind would be required. Also, the daily progress of the "Marquis of Huntly" Indiaman, of fourteen hundred tons burden, on a voyage to India and China, and home, from the author's own observation, in the year 1816.

For the purpose of demonstrating the ratio of power to velocity, a table was also given showing the velocity of ships of different tonnage, having steam power of various ratios, deduced from upwards of one hundred experiments on large steam vessels. The mode of disengaging the cranks was illustrated by models showing the gradation, from the complication of the first idea, to the beautiful simplicity of the present plan, which is now employed on board of the government war steamers.

TENTH ANNUAL REPORT OF THE PRESIDENT AND DIRECTORS OF THE WINCHESTER AND POTOMAC RAILROAD COMPANY, TO THE STOCKHOLDERS.

The stockholders were informed in the last annual report of the board, that the superstructure of our road had reached a crisis, which required active effort to renew and sustain it. The experience of the last year had convinced the board how uncertain was the supply of timber from our adjacent saw mills; and admonished them of the necessity of looking to a more sure and permanent source of supply. Arrangements were accordingly made early last fall, to import a large quantity of pine lumber from the south. A contract for upwards of sixty thousand feet was made in North Carolina, all of which, with the whole home supply has been laid; equal to an entire renewal of one-third of the whole road. A farther supply of one hundred thousand feet has been ordered, a part of which has already reached Georgetown. The whole of this last order is expected to be laid by the 1st of next January. A corresponding quantity of sills are, have been, or will be provided and laid within the same time; so that the whole superstructure of the road will be materially renewed in the course of the next year. A large quantity of iron of a heavier bar has also been purchased during the year, and laid; and the old iron as it is displaced is welded anew and straightened, so as to be placed on the track, with no material difference from what it was when first laid down. By a constant and persevering effort of this kind, with the small additional supply of new iron, it is believed that the whole superstructure of the road will be renewed in the course of the next year.

It may be added, now that the pine timber, such as we receive, will resist decay twice as long as the oak, requires not more than half the number of spikes to keep it in repair, is of a length which enables the same force to do nearly twice the amount of labor, and costs less than we have heretofore paid for oak.

The stockholders are thus advised of the exertions made during the last year, to renew the superstructure of the road, and of the means adopted by the board for its further improvement. It should be added, that the track at the curves and on the heavy embankments is being entirely renewed, the whole present superstructure being taken up, and an entire new track of sills and string-pieces 6 by 6 laid to avoid the possibility of accidents at these passes.

In this manner this track has been already renewed on the embankment between the Opequon bridges and some distance beyond them, as well as at Bulls Falls, and the same entire renewal will go on with energy and activity, until every such pass is entirely renewed.

The bridges and trussel work are regarded as perfectly safe. Two additional posts or pillars have been placed between every two trussels the whole length of the trussel work. A prudent foresight will prompt, however, as soon as possible, to cover our large bridges with roofs from the weather. The only remaining remark to be made on the superstructure of the road is, that when the present supply of timber shall have been laid, the expense of repairs will be materially diminished.

Motive power.—The last report stated that three of five engines were in good repair. On the night of the 18th of March, a fire occurred at the engine house of the company while all the engines were within the building. Two of them were soon drawn from the house with immaterial injury, while two others, the Pocahontas and the Lilly, remained within until the fire was extinguished. It resulted that the Pocahontas having her boiler filled with water was not materially injured,—the other, the Lilly, has been in the shop since that time, or if run out on experiment, has not yet done any work on the road.

In the state of things as they existed after the conflagration, the board deemed it most prudent to order an additional engine. It was obtained from the factory at Eastwick and Harrison of Philadelphia. It is constructed on the eight wheeled principle, and weighs 13 tons. It is able to do the work of three of our former engines, and is reported to the board to injure the road less than the lightest of them. It is, therefore, capable of doing the whole freight transportation of the road, though it should increase greatly over any former year.

This engine, the President, built by Messrs. Eastwick and Harrison, of Philadelphia, has been running regularly from the 24th of April last, with the exception of a few days to clean her; and has not cost the company an expense during that time of more than ten dollars.

There is no probable amount of frieght which the company is not now prepared to transport, at a greatly diminished expenditure.

Car power.—In connection with the motive power of the company, we may here refer to the car power. The company has labored under great inconvenience, and been put to great expense, from the inception of its business, by the plan of transferring all the freight at the Ferry, from and to, the cars of this company, and those of the Baltimore and Ohio railroad company. In the event of either company having an insufficiency of cars at the Ferry, the cars of either company were used as depots, to hold the freight until relieved. And this system operated with great hardship on our company; because the descending greatly exceeded the ascending trade: the business of either company was thus frequently arrested and the tide of commerce, checked and restrained, sought other channels. A negotiation was opened with the Baltimore company, to permit their cars to run through from Baltimore to Winchester, on such terms as to the two companies might seem just and proper; and such arrangement has been concluded successfully, so that no transfer of the goods from Baltimore is now made at the Ferry, and the freight which is started from that city in the morning reaches Winchester the same day, frequently before the passenger cars arrive. The same freight cars are re-loaded here for Baltimore, and of course pass through in the same manner without any transfer.

By a report of the superintendant to the president, which is on file, the actual saving to this company above our former expenditure for car power, expenses incident to the transfer, oil, etc., is more than equal to the whole amount paid to the Baltimore company for the use of their cars, or in other words, we save annually a sum equal to the whole annual expense of keeping up the car power. Some of the evils incident to the former arrangement were, the difficulty of examining all the freight as it reached the Ferry, the perplexity of comparing the freight with the manifest sent with it, the trouble of re-manifesting all the freight, the discrepancies between the manifests of the two companies, arising from the inattention or incapity of clerks, the impossibility of adjusting justly, losses which might exist or might be supposed to exist; the damages which the goods suffered from the act of transfer, the great expense to each company in keeping up the system, the exposure to depredation and the weather, which the property suffered whilst remaining at the Ferry, and above all, and more than all these evils combined, the *time* lost to the companies and the community. By the former arrangement, or rather want of arrangement, double the time was always taken, and frequently treble and quadruple of that which was necessary, to convey freight from Baltimore to Winchester; *this time was so much capital actually lost.* Upon the former plan of transfer, also, the business of the two companies was *limited* by the amount of freight that could be transferred and manifested. This evil was necessarily vital to any great improvement of our trade, and consequently of our revenue. No accident has at any time happened to any of the Baltimore cars on our road. nor has any injury occurred to any of them in our employ, since this new arrangement commenced: which was on the first day of June, nor has there been a single instance of disappointment on our part in receiving the freight train.

Revenue.—The stockholders will find in the report of the financial committee a detailed account of revenue and disbursements during the last year. It will be seen that the revenue was less by the sum of $6,993 61 than that of the last year, and that the superstructure of the road was in so dilapidated a condition, that it required an expenditure of upwards of $10,000 more than was expended for the same object during any former year. From the additional facilities given to trade and transportation, already adverted to, it may, without presumption, be anticipated, that there will be an increase of revenue during the next year, and there will be a greatly diminished expenditure at all points, except on the superstructure of the road.

Our future policy.—The day is past, when to construct a railroad was regarded as a difficult enterprise. To level mountains or to pass through them, to pass over or under rivers, to throw up embankments, which shall emulate the adjoining hills, in fine, to perfect the foundations, and rear the superstructure of a railroad, though it reach to the limits of a continent; and to move over it with the velocity of the wind, is at this day no effort for human energy. So much means, and so much labor, will necessarily produce such a result. A more serious task awaits those on whom shall devolve the multiplied, important and often conflicting interests identified, or connected with the management of such an undertaking. To discover a world requires less energy than to govern it. To raise an army, you want only men and money. To manage it, demands higher qualifications, and involves deeper responsibilities. *The enthusiasm connected with the railroad system hath passed away with its novelty, and the disappointment in its productiveness, where such exists, has arisen, not from capacity of the system to produce all the results expected, but from inexperience in its management.* The *whole economy of a railroad must necessarily, and in accordance with all other human improvements, be the work of experience; and it may be safely asserted, that no work of man has so far outstripped his conceptions in the same length of time, as the introduction of steam power upon land.* In the infancy of our undertaking, it was calculated by the accomplished and scientific engineer who made its first surveys, by the direction of the General Government, that a locomotive engine of $4\frac{1}{2}$ tons in weight, capable of drawing between 19 and 20 tons over a grade of 30 feet to the mile, would be best calculated for this road. But an engine is now in daily use on this road, of 13 tons in weight, and able to draw 100 tons over such a grade. Such an engine performing the work of three of our former engines, with less injury to the road than the lightest of them, with a corresponding diminution of expenditure in hands, fuel, oil, wear and tare, etc., is of itself an amazing change in the economy of our concerns.

But this change is but one of the results of experience, in showing the necessity of increasing the power, without increasing the expenditure; and diminishing the gravity by multiplying the points of contact with the road. Necessity is now, as she ever has been, the mother of invention, and the simple idea of distributing the weight of the engine, by multiplying the wheels, will produce results in transporting freight on railroads, which it would be rash now, either to attempt to measure or number. This engine, referred to as in daily use on our road, has never yet been loaded. Her energies have never yet been tested. Every blast from her boiler, and every scream from her whistle, is a challenge to the farmer, the miller, and the merchant to load her. At our present rates of toll, this engine alone would realise $100,000 a year after paying all the expense of running her, in fuel, hands, oil, etc., and allowing time for occasional repairs; provided she had as much as she could carry; or she would pay all the current expenses of the company, and make at least 12 per cent. upon the whole stock and debt. The question of policy is therefore now no longer, *how* we shall carry, but *what* we shall carry. In what manner shall we command the greatest amount of trade? How shall we lengthen the radius, and extend the circle of commerce?

The history of commerce bearing any analogy to ours, has perhaps, fully settled the principle, even into an axiom, that reduced rates increase revenue; because they draw trade from greater distances, and give impulse to industry and effort. Such a policy too, if successfully adopted, is in fine harmony with all our institutions, nullifying at once the idea that there is any conflict between the interest of the public and the interest of the stockholder. Into this policy the board are cautiously entering. The rates upon plaister are reduced from $1 75 to $1 per ton, and the charges of transportation on flour are put down to the lowest rates which have prevailed since the road went into operation. To be able to go on and extend the system requires the generous patronage of an enlightened public. If this road shall receive the trade which legitimately belongs to it,—if the farmer, the miller, and the merchant, resolve to sustain this policy, so important to them, then in the direct ratio in which such a course is adopted on their part, will be the ability of this company to extend this reduction of rates. The experience of the next season will test the policy or impolicy of these measures, and the future authorities of the company, by this experience alone, can determine how far they should be extended or modified or abandoned.

By order of the board:

WILLIAM L. CLARK, *President.*

THE MARGINS OF RAILWAYS.—The margins of great lines of railway that have been some years executed, are now becoming covered with grass, and much more agreeable to the eye than before; and, while lately gliding along the line to Birmingham, it occurred to us that additional interest might be given to the banks, at very little expense, by planting a collection of trees and shrubs on them. The plants might be a furlong apart; those on the sides of the deep cuttings may be shrubs; those on the sides of the embankment tall trees; and those where the ground on each side is nearly on a level with the road, middle sized trees; such as thorns, Pyrus Sorbus, etc. Half way between each tree or shrub might be a tall growing, striking, herbaceous plant, such as the hollyhock, Siberian parsnip, etc. We are not aware of any objection to this idea except the expense, which could not be very great, and if ever the ground came to be pastured by sheep, which we think must be its ultimate destination, the herbaceous plants might be given up. The trees and shrubs, when once planted, would require no expense whatever to keep them up, because the nurseryman who planted them might contract to keep them in order for three years, when they would be fully established. The herbaceous plants would require a small annual expense, but they might be omitted or given up when the ground was to be pastured.

The fine effect of herbaceous plants and trees, may be seen on the bank on the right hand side of the approach to the London terminus of the Great Western Railway. There the trees and plants are, very properly, numerous, so as to form a plantation; but along the railroads we propose the trees or shrubs to be a furlong apart, so as to form what may be callad a varied running foreground to the passing scenery.

The directors to all the railways may have paid most laudable attention to the architecture of the bridges, station-houses, and all other buildings, and have succeeded in blending utility with architectural beauty in a highly gratifying degree. It would be only consistent, therefore, to confer some ornament on the naked banks, the formation of which was not less necessary to the existence of the railway than the building of the viaducts and bridges. To any person at all fond of viewing trees and shrubs, the recurrence of a new species or variety about every minute, would be a source of perpetual interest, and would not interfere with the distant scenery. The collection on one side of the road should have no connection with the collection on the other side, in order that a person wishing to see the whole, might confine himself entirely to looking to one side in the going, and to the opposite side in returning. Many beautiful trees and shrubs might thus be brought into notice, that at present few people know any thing of. The banks of railroads in some parts of the country, when once they are completely seperated from the road by the growth of the hedge, or by some other effective fence, might be let out as garden ground, or for orchards; but, in general, too little attention has been paid to preserving the old surface soil on the new surface, for these kinds of occupation.

Gardeners' Magazine.

Performance of the "Tuscarora," a locomotive engine, built by Messrs. Rogers, Ketchum & Grosvenor, of Paterson, and the "Conhocton," a locomotive engine built by Messrs. Baldwin, Vail & Hufty, of Philadelphia.

On the 27th of July last, the "Tuscarora" engine, manufactured by Messrs. Rogers, Ketchum & Grosvenor, of Paterson, New Jersey, drew from Corning to Blossburg, a distance of 40 miles, 43 cars weighing 90 tons. The greatest resistance this train had to overcome was an ascending grade of 39 feet to the mile, $\frac{3}{4}$ of a mile in length, and in a curve of 955 feet radius, immediately after leaving an ascending grade of 30 feet to the mile, 4 miles in length. This engine returned the same day from Blossburg to Corning, with a train of 50 cars loaded with 162 tons 900 lbs. of coal. Weight of cars, 106 tons 1410 lbs., making a gross load of 269 tons 310 lbs.

The greatest resistance offered to this train was a curve of 637 feet radius on a level road. The Tuscarora has four driving wheels, and weighs 28,100 lbs. with water and fuel. The weight on the driving wheels (with water and fuel) is 18,650 lbs. The driving wheels are 4 feet in diameter, stroke 18 inches, and cylinder 12 inches; and in performing her regular trip from Corning to Blossburg and back, with the above trains, including two hours that she remained at Blossburg for her load, evaporated 3,223 gallons of water, and consumed 4,096 lbs. of coal.

On the 16th of August last, the "Conhocton" engine, manufactured by Messrs. Baldwin, Vail & Hufty, of Philadelphia, drew from Blossburg to Corning in three hours and forty-seven minutes, including stoppages, 50 cars loaded with 160 tons 400 lbs. of coal. Weight of cars 107 tons 1,280 lbs., making a gross load of 267 tons 1,680 lbs.

This engine has two driving wheels, and weighs 27,1 80 lbs. with water and fuel. The weight on driving wheels, with water and fuel, is 13,520 lbs. The driving wheels are 4 feet 6 inches in diameter, stroke 16 inches, and cylinders 12 inches, and in performing her trip of 40 miles, evaporated 1,401 gallons of water and consumed 1,736 lbs. of coal.

Both of the above engines drew their respective trains with comparative ease, and worked with a pressure of 98 lbs. to the square inch. The time that the Tuscarora was performing the above trip was not particularly noted, but was about 4 hours each way, including stoppages for water, etc.—*Corning and Blossburg Advocate.*

AMERICAN
RAILROAD JOURNAL,
AND
MECHANICS' MAGAZINE.

No. 6, Vol. VII. New Series.] SEPTEMBER 15, 1841. [Whole No. 390. Vol. XIII.

RAILWAY POLICE,—COLLISIONS.

The severe accidents which have occurred within a short time upon one of our important railroads, and all being the result of the same cause—collision, the public anxiety has been aroused, and inquiry is made as to what means are provided for the safe passage of trains. There is certainly no more important branch of railway management than that which concerns the safety of hundreds and thousands of human beings.

The laxity of discipline observed upon some railroads, has undoubtedly led to the erroneous impression that suitable checks and precautions are maintained by none ; and the ordinary language of the press upon such occasions, has done much to misdirect the public fears after every accident.

We have some recollection of having seen the rules and regulations for the mutual conduct of trains upon the Western railroad, where these accidents have most frequently occurred, but there must be either some fault in the regulations or in the mode of enforcing them. We are, for our own part, certain that such accidents are not necessarily attendant upon the railroad system, and that with proper care and precaution, most, if not all that have happened, might have been avoided.

In all rules intended to regulate railroad trains, we must bear in mind that the enginemen are generally from a class giving far greater credit to mere physical force and courage, than to coolness and skill. Hence it follows that without the proper restraints, such men are much more likely to display fool-hardiness than real courage or judgment. Yet, is it not too often the case, that life and property is risked where judgment and coolness are constantly required?

Another circumstance to be taken into consideration, is the fact that no conductor of motive power, in any shape or form, is more liable to excitement from his situation, than the engineman, unless indeed, we except the horseman. The clearness of the view, the advanced position, the more perfect control than can be found in any other mode of travel, will tend to excite the engineman to drive his fiery steed faster than he ought under any circumstances, and particularly when under uncertainty as to obstructions and delays. If it is found absolutely necessary to place the engineman of a steamboat under the control of some regularly determined officer, how much more is it necessary to do so with the driver of a locomotive.

It will, then, be found safe not to commit any more power or responsibility to this party than is absolutely necessary. In the management of burden trains the same remarks will apply, and the same necessity for a conductor exists.

The next principle in this department of railway police, is, that all regulations should be definite and specific in their application to each officer or servant of the concern. To accomplish this end, it is evident that none but printed regulations should be in force. The literal adherence to the rules, which is far more condusive to uniformity and concert of action than any implied or general regulations, can by this means be strictly enforced and readily attained. Another benefit to be derived from properly authorized and printed instructions, is the ease with which any departure from them may be noted and reported to the proper officer, either by the persons in the employ of the company or by strangers and passengers.

Nearly every accident by collision has occurred on curves of short radius, and where the view is intercepted by a bank or trees on the concave side. On a straight line nothing of the kind can happen unless in a dense fog. It is therefore essential that regulations on this point should be very precise and leave no room for mistake. On short curves the velocity of the train should always be moderated, as the wear and tare both of the machinery and the road is lessened by such precaution, and the danger of running over cattle or any obstruction wilfully placed, is much lessened. But if there is the remotest chance of meeting a train, too much care cannot be taken and the speed of the train should be reduced to the pace of a man's walk. It may be objected that this would involve a constant and regular delay in the trip. This is admitted, and moreover such delay should be added to the length of time consumed upon the road and counted upon with as much regularity as the usual stoppages—by doing this no disappointment will result, and the trifling loss of time will be more than compensated by the increased security of the passengers and the saving of expense resulting from a single accident. At such points the constant ringing of the bell or blowing of the whistle would be an additional precaution, which should in no case be neglected.

In case of thick fogs intercepting the view, the speed of the engine should in all cases be abated and the bell or whistle continually sounded.

We have not alluded to night trains as they are not frequently used on the majority of roads in our country—but when they are, the proper precautions are obvious. Suitable arrangements of colored lamps will in ordinary cases indicate the approach of a train at as great a distance as they can be detected by the eye in the day time. The sound of the bell or whistle at short and regular intervals will also be required, and in all cases, hardly excepting the brightest moonlight, the speed of a night train should be less than that of the ordinary day trains. Even where no meeting of trains is expected these precautions should not be abated, for although the *number* of persons likely to be crossing the track is less, the *risk* is far greater—while in the stillness of the night the bell or whistle can be heard at a sufficient distance to prevent any danger. We cannot reprehend in too severe terms, the practice of running at night through a populous village, without any other warning than the ordinary sounds of a train, which are almost entirely lost when any object of size intervenes. We have nevertheless seen this frequently done, and if a regularly published system of rules had been in force, the deviation in a single instance would have been reported to the proper authorities, and the abuse immediately corrected.

The consideration of this subject involves that of railway signals, but this is such a fruitful topic that we prefer leaving it for another article, in which the most perfect of all signals, the electro telegraph will be discussed.

We cannot do better in conclusion, than by giving the following rules and regulations adopted on the Baltimore and Susquehanna railroad. The excellence of these rules is proved by the safety of travel on this road, not a single case of collision having happened that we recollect. Yet the curves on this road are frequently, from the nature of the ground, very abrupt, and the view in some places extends but a few yards. From our own observation we can speak of the praiseworthy caution with which these curves are traversed.

Were we disposed to criticise that which is already so complete, we might suggest, that the rule above mentioned of sounding the bell or whistle in all doubtful cases should be introduced:—

"*Baltimore and Susquehanna Railroad Transportation Office,*
"*Baltimore,* 18

"The following regulations are prescribed, and will be required to be strictly observed. Every conductor and engineman in the employ of the company is expected to make himself familiar with them. A literal adherence to these instructions being the only security against risk of accidents, they are on no account whatever, to be violated; and no person will be retained in the employ of the company, who in any instance disregards them.

"1. Every train of passenger cars will, after starting, be under the direction of its conductor, who will prescribe the speed of the engine, the places for stopping, and length of time for remaining at the same. A burden train will be under the direction of its engineman, who shall, however, follow the instructions of his conductor, as to the receipt and delivery of freight on the road.

"2. Each conductor, both of passenger and burden trains, shall on every trip note the time of arrival at the different stations and the delay at each, and return the same at this office on his arrival. The speed of all trains on the road must be as nearly as may be, at uniform rates according to the tables given herewith.

"3. A passenger train will wait for the arrival of another passenger train, 30 minutes after the time given in the tables for their leaving the place at which passenger trains are to meet. If one of the trains does not arrive, the other after wating that length of time, will proceed slowly to meet it, going with particular caution round every curve, and at such rate only, as will allow the train to be stopped immediately, without any shock to the cars, on meeting the other.

"4. The conductor of a passenger train which has been delayed so that it has not reached the place for meeting another passenger train, at 25 minutes after the time prescribed for leaving such place, will check the speed of his engine, and proceed in the mode prescribed in the preceding regulation, expecting constantly to meet the other train on the track.

"5. The burden trains will be started in time to reach the stations where they are to meet the passenger trains, some time before the arrival of the latter. A passenger train therefore, not meeting a burden train at the appointed place, will wait but 15 minutes after the time prescribed for leaving such place. It will then proceed in the same careful manner as is directed above in the 3d regulation, prepared to meet the burden train at any moment. The engineman of the burden train which may have been delayed, will, 10 minutes after the time for the passenger train to leave the place of meeting, check his speed, and proceed very slowly in the same manner.

"6 If a passenger train has not arrived at the place for meeting or overtaking a burden train, at 45 minutes after the time for leaving the same, the engineman of the burden train will detach his engine, and leaving his train proceed until he meets the passenger train, to ascertain the cause of delay. He will proceed in the same cautious manner as is prescribed in the 3d regulation. The conductor of the passenger train delayed, will 40 minutes after the time for leaving the place for meeting or overtaking a burden train, also proceed in the same manner, expecting to meet the engine.

"7. A burden train will wait at the place where it is to meet another burden train, one hour beyond the time apointed, if the latter be so long delayed, and will then proceed. The enginemen of both burden trains will in such event proceed in the mode directed in regulations 3d and 4th with extreme caution, especially on descending grades, and keeping their trains constantly under perfect command.

"8. When any train has been detained so that another will be on the track, its conductor or engine man, unless he can by proceeding as before directed, meet such other train near to a switch, will back his train carefully to the switch last past, and wait there. When two trains meet on the track, the conductor of that which has kept its regular time shall direct which is to go back.

"9. If a passenger train does not arrive at Baltimore or York one hour after the regular time of arrival, or a burden train, 1 hour and 30 minutes after its regular time, an engine will be despatched to meet the train thus delayed. The trains so detained will accordingly proceed with great caution as before directed, expecting to meet the engine in every instance, unless written notice to the contrary has been given.

"10. The train first arriving at a station where it is to meet another, will water, and then take the proper position to allow the other to water and pass, the conductor taking care that the switches are properly fixed for the expected train. If both trains arrive near the switch about the same time, the train coming towards Baltimore will first water. A burden train however will in all cases give way to a passenger train, and follow the directions of the conductor of the latter, on all occasions.

"11. All locomotives are to hold up on approaching every water station, so that they may readily stop, should a car or train be there. If a train is for any reason stopped at any other place on the road, its conductor will send a man 300 yards, or further if necessary, along the track in the direction in which the next train is to approach, so that it may be stopped before reaching his train.

"12. If any train is not to start at the regular time, or is to meet another train at a different place than the one prescribed, a written note must be sent from the depots at Baltimore and York, or from a conductor of a train. No conductor or engineman will pay regard to any message he may receive when on the road, respecting an alteration in the time or place of meeting, unless he receives a written note as above.

"13. All conductors and engine men in the employ of the company, will take the time from this office."

The purpose of the following tables is obvious. A book containing numbers of them, both for the going and returning trip, is given to each conductor, by whom an entry is made in each column at every place, and thus the whole time consumed on the road is accounted for.

TIME TABLES *for arrival at*

PASSENGER TRAINS.

	Arrival. H.	Arrival. M.	Arrival. H.	Arrival. M.
Balt. City Depot,		M.		M.
Bolton do.		M.		M.
Cockeysville,		M.		M.
Parkton,		M.		M.
Summit,		M.		M.
Heathcote's,		M.		M.
York,		M.		M.
Wrightsville,		M.		M.
York,		M.		M.

From Baltimore to York, 184 .

Locomotive, . . .

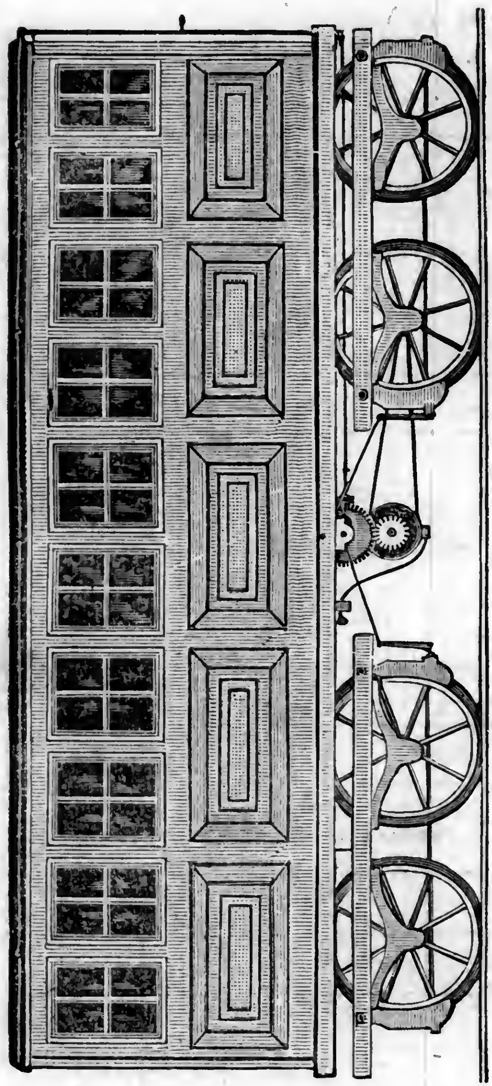
Engineman, . . .

	Arrival. H.	M.	Departure. H.	M.	Stoppage. H.	M.	Passengers. Rec'd	Dis.	Free.
City Depot,									
Bolton do.									
Relay House,									
Cockeysville,									
Moncton,									
Parkton,									
Summit,									
Heathcote's									
Clodfe's Tank,									
York,									

STOPPAGES AT OTHER PLACES.

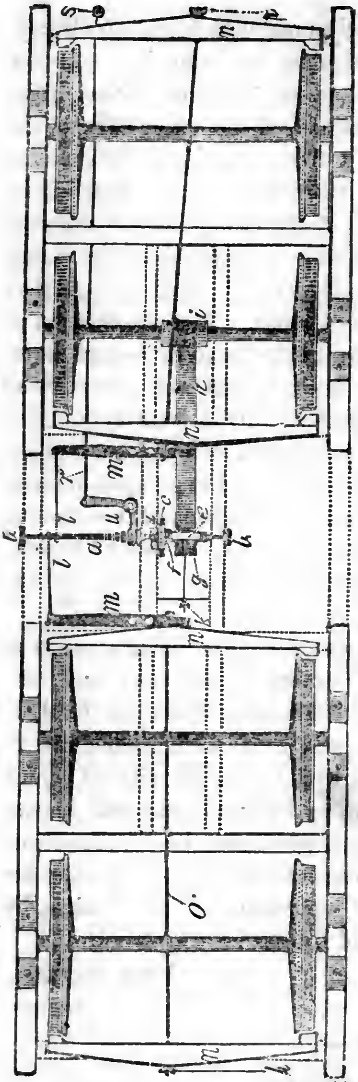
	Stoppage. H.	M.	Passengers. Rec'd.	Disch'd.

. . . *Conductor.*



SELF-ACTING SAFETY BRAKE FOR RAILROAD CARS.

Description.—*a*, Represents a shaft suspended to a body of the car by boxes *b b*. *c*, A cog wheel, which revolves on shaft *a*, when not connected by clutch *d*. *e*, A frame suspended on shaft *a*, supporting pinion *f*, pulley *g*. *h*, A belt passing over pully *g*, and the axle of the car *i*. *k*, Tempering screw, connected with frame *e*, and body of the car, to keep the bolt sufficiently tight to allow the car wheels to just turn, or to make them slide when the brakes are ap-



plied. *l l*, Chains attached to shaft *a*, and levers *m m*, which wind round the shaft *a*, when wheel *e*, is connected by clutch on shaft *a*. *m m*, Levers connected to brakes *n n n n*, by rod *o o*, on one end of which are the tempering screws *p p*, to adjust the brakes to the wheels, so that they shall bring them all to slide at the same time. *u*, A forked lever, supported by the frame of the car to move the clutch *d*, by means of the rod *r*, which is connected with the upright lever *s*, the top of which is in form of a *T*, to which is affixed lines leading to the engine, by which the wheel *e* may be clutched to the shaft *a*, (the axle of the car acting on the pulley *g*, connected to pinion *f* by belt *h*,) and cause the chains *l l* to wind on shaft *a*, and thus draw on levers *m m*, connected with the brakes *n n n n*, and cause them to stop the revolution of all the wheels.

The 1st of the above drawings is an elevation of an eight wheel passenger car, with Grigg's band and pulley-brake attached. The 2d drawing is a horizontal section, showing the band and pulley-brake.

Two lines are attached to the *T*, that may be carried to any part of the train, so that the engineer, or any person on the train, may, by means of these lines, govern the brakes and stop the train.

The advantages of this brake are described in the specification by the patentee to be, that expense is saved in the smaller number of brakemen required. The train may be checked as soon as the engineer or any one forward, descries danger; and the apparatus is more effectual and more certain for this purpose than the common hand-brake. The danger arising from the brakemen jumping off as they sometimes do, is avoided. In case of some of the cars breaking loose, as they sometimes do, the lines are so adjusted that the brake is put in gear by the very circumstance of the cars breaking loose, and thus the cars detached from the train are stopped, instead of drifting on the road as they otherwise do, to the great danger of cars thus detached, as well as of the other cars of the train;—(an instance of the security from this brake in such an emergency has actually occurred on the Boston and Providence railroad.) If the object be merely to check the speed and not stop the train, this is done by merely loosening the pulley-band by means of the tempering screw, by which its degree of tension is regulated. The brake is of comparatively small expense. The application of it does not prevent managing the brake by hand or foot as heretofore, whenever this is preferred. The principal and operation of this brake will be obvious to any person, in the least acquainted with the subject, from the above drawings and description, and the patentee deems it to be quite unnecessary to enlarge upon its utility. The want of some ready and effectual means of controlling and stopping the train, in cases of emergency, has, as is well known, been the occasion of many disasters and the great loss of lives and property.

The subscriber having been appointed by Mr. Griggs, agent to make contracts for the use of his self-acting safety brake, any communication directed to him at No. 6 Madison Place, or G. J. F. Bryant, No. 4 Court street, Boston, will meet with immediate attention. It is desirable that the first brake on each railroad should be constructed and put on by a person having a personal knowledge of the brakes now in use, that the parts may be so proportioned and fitted, that the patentee and the companies licensed, may not be subject to disappointment in the operation of the brakes, by reason of their being constructed and fitted.

Amos Bates.

Boston, *October* 23, 1841.

RAILWAYS IN ENGLAND.

A practical Treatise on Railroads and Interior Communication in general. By Nicholas Wood, C. E. 3rd. edit. Longman & Co.

The Railways of Great Britain and Ireland: a Practical Treatise. By Francis Wishaw, C. E. Simpkin & Co.

A Practical Treatise on Railways, explaining their Construction and Management. By Lieut. Lecount, R. N., of the London and Birmingham Railway. Edinburgh, Black.

Bradshaw's Map of the Railways of Great Britain, showing their Lines, Lengths, and Gradients.—A Letter to the President of the Board of Trade on Railway Transit. By F. R. Conder, C. E.—

Reports on Iron Rails. By Prof. Barlow.—*A Letter from Josiah to Prof. Barlow on Iron Rails.—Remarks on the Cheapest Distance of Railway Blocks.—The Railway Annual.—The Railway Almanac.—The Railway Pocket Book.—The Railway Magazine.—The Railway Times.*—Some dozen or more of '*Railway Guides*', etc., etc.

The Age of Iron (cast-iron or malleable?) has now at length brought with it the epoch of Vulcanian Letters. Our table trembles beneath a burden of this new and voluminous literature, of which the preceding list is only an imperfect and random selection. It is hardly to be conceived that there is a department of life or of literature not already permeated by the genius of iron, or a recluse so antiquated as not to experience a deep and soul stirring interest in the practice and theory, the statistics and the legislation, the police and the polemics, the topography, chronology, etc., of railway bars and locomotive engines. The supply of the article has done Adam Smith the justice to keep pace with the demand, and the short period of ten years has produced all the possible species of volumes calculated to meet the wants of consumers, from the substantial treatise in portly folio and folded plates down to the waistcoat bijou in satin and gold. We have railway annuals and railway perennials—the Railway 'Quarterly' and the Railway 'Magazine'—the Railway 'Chronicle' and the Railway 'Times'—the Railway 'Map,' the Railway 'Guide,'—the Railway Time, Fare, and Distance Table—and the Railway 'Hoyle,' in the shape of 'Plain Hints to Railway Speculators.' Those who relish the literature of strife, may find in the piquant polemics of railways many dishes of the highest flavor. We have, on one side, the advocates of the broad gauge. We have Stephenson backing his six-wheeled engine against time and all the world; and Bury, on the other side, betting on his four-wheelers against all the world and Stephenson to boot, for any odds. We have wood-sleepers versus stone-sleepers; continuous bearings versus detached blocks; cheap inclines versus expensive levels; inside bearings versus outside bearings; and, in fine, railways and locomotives versus all the world,—commanding and compelling all of us, old and young, male and female, learned and unlearned, willing or unwilling, to "stand and deliver" up our time, our persons, and our money, to the mercy of those ungainly compounds of most unpicturesque and ungracefully combined masses of iron—iron—iron. Not contented with the highway, they follow us to our closets, and persecute us even in our sanctum sanctorum of editorial seclusion, backed by their hosts of vociferating volumes and clamorous authors.

The three treatises at the head of this article communicate a thorough and practical digest of our knowledge of the present state and past workings of the railway system. The first may be called a Statistical, the Second a Theoretical and Mechanical, the third an Economic Treatise on Railways. Mr. Wood is a sagacious observer, and a sound and cautious reasoner; Mr. Wishsw is a discriminating statistician, and has a thorough acquaintance with his subject; Mr.

Lecount has had considerable experience in the practical working of railways, and gives his readers the full benefit of all his knowledge. The remaining works serve to illustrate the minute details of the subject.

It has, indeed, been matter of surprise and comment to some of our readers and correspondents, that we have not devoted more of our attention to the new science of railway locomotion. For our own part, we have not been inattentive to the steps by which this important art of mechanical transit has been advancing towards perfection. Neither have we undervalued the high importance of this new element of civilization, of national wealth, of national energy. But we have regarded the art as one which had not yet attained to any established system, in which could be recognised great general principles capable of scientific exposition; but rather as made up of a series of tentative experiments, a system of trial and error, of which the practical results were somewhat uncertain, and of which the short space of ten years, during which alone they have existed as channels of general intercourse, has been by no means sufficient to determine in all cases their respective value and importance.

The rapidity with which this great iron revolution is extended over space is wonderful and unparalleled, except by the strangeness and speed of transit which has itself been achieved by the iron road (*chemin de fer*) and the Vulcanian Pegasus,—that most wonderful and most perfect of all man's creations. Ten years ago a railway was all but unknown; a tram-road of iron, sufficient to guide a few coal wagons from the coal hill to the port of delivery, and to enable them to follow the track of an old horse at the rate of two or three miles an hour, was what the small number of us, who knew anything at all about a railway, understood to be meant by the phrase. It was the joint necessity and impossibility of an additional canal from Liverpool to Manchester which first compelled the merchants of that enterprising port to entertain the project of a railway on a great scale, and it is to their spirit and determination that we owe much of the advantage now obtained. In 1826, when they applied to Parliament, even their own engineers seemed to entertain very little idea of their present results. Mr. Stephenson, who has since become so eminent as a railway propagandist, held out the expectation, that on this railway locomotive engines carrying thirty of forty tons might possibly be able to travel at the rate of six miles an hour with safety and security. The author of the Railway Treatise at the head of our article, thought that the rate of twelve miles an hour would be a dangerous and useless speed. Mr. Rastrick reported, that by improvements on the engine, forty tons might be carried along a railway at the rate of six or even twelve miles an hour, but that the latter rate was decidedly unsafe! At this moment twenty-five miles is the regular slow speed, beyond which the conductors of engines are forbidden to travel, although the double of it is what has been often attained; while, instead of 30 or 40 tons, the weight of a train is 100 to 200 tons.

Ten years' experience now does all this safely and well, daily, hourly, and every where. Twenty-five hundred miles of railways, almost all of them double lines of road, traverse our little island, connecting all the principal towns and provinces with the great centre of money and of mind. Now, indeed, we may boast of an "iron-bound" rock of ocean. A chain of iron links firmly to this great head, in close and intimate union, the great members of our body politic, commercial and literary. We all think, feel and act more closely in union Provincial disadvantages and distinctions rapidly wear away; local antipathies become forgotten, and the great unit of British industry, commercial enterprise, wealth and wisdom, is becoming more firm, more energetic, more powerful, and more promising of prolonged health and permanent stability. Dissension, discord, division, dismemberment, must become less and less possible in direct proportion to the intimacy of connection and facility of communication among its component parts. More than fifty millions of capital are already devoted to the creation of new railways; and in return for this investment, something like five millions will every year be created and returned into the treasury of our capitalists, for re-investment and the extension of *its* powers and *our* privileges. Not only do these railways facilitate trade and commerce, and give increased activity to mercantile interests in general, but if we consider the expenditure of a railway consists principally in the tear and wear of machinery the produce of human labor, the great part of which is dug from the bowels of the earth and formed by human skill, we shall see that many new and important departments of commerce and trade are created and fed by this new economic and social power. This new social element is extending the range of action so fast and so far, that there will soon cease to be any section of the community, or any individual in society, sufficiently severed from its immediate interests, to be altogether beyond the sphere of its influence. Noblemen, men of property, merchants, and traders, will almost all be soon embraced in the multitudinous constituency of railway directors or holders of railway stock. While the saving of the wear and tear of human life by the wholesale means of economical transport thus provided has in many districts rendered the most laborious and the poorest portion of the community not only the class on whom the greatest benefit has been conferred, but that also which has contributed most abundantly to the success of such undertakings, as thousands now travel by this most rapid conveyance who were not before able to avail themselves of any. *The subject is, therefore, one which must, sooner or later come closely home to the interests of every member of society.*

All the great modern railways are formed of the edge rail—the rail projecting upwards above the ground, presenting an edge not more than two or three inches broad, raised some inches above the ground, on the top of which roll the wheels of all the vehicles: these wheels having, so to speak, grooves, or rather projecting edges or flanges, which prevent them from running off the rail.

In comparing together different railways, and weighing the merits of different systems, we have only to recollect that the essential requisites of all railways are—*sustaining power* in the road itself, and *self-directing power* in both the equipage it conveys and the road itself. The former the element of its economy and efficiency, the latter the condition of safety with speed.

It was long in being discovered that this rail, Stephensons famous fish-bellied rail, is essentially defective. Although it is constructed on an avowedly good principal, namely, that on which iron beams are formed to carry a weight from wall to wall, or from pillar to pillar, yet it is essentially defective in principle, for this reason, that the railway bar does not terminate at each space of three feet where it is supported: it is continuous through five such spaces, and passing over each pedestal or chair as well as up to it, is as liable to be broken across upon and over this support, by a weight resting on each side of it, as to be broken in the middle by what rests upon it; in fact the narrowest, as well as the deepest, part of the rail, becomes alternately the centre point of greatest strain. Experience proved the inability of this form of rail to sustain the enormous weights it had to carry. But although practical experience rendered it necessary to give up, to a great extent, the fish-bellied rail, that form has still its advocates, probably from the circumstance of overlooking the principal we have now adduced.

The parallel rail, consisting of a deep thin bar or web laid on edge, swelling out above into a broad flat band, about three inches in breadth, for the purpose of carrying the carriage-wheels, and bounded below by a similar, but often a smaller band, is a species of rail which is rapidly superseding the fish-bellied rail. It has the advantage of being as strong at the chair to sustain weight as a fulcrum and lever as it is in the middle, where its action is merely reversed. The comparative value of the parallel and of the fish-bellied rail has formed the subject of much controversial discussion among the different schools of engineers. The result appears to be the increasing use of the former, and the abandonment of the latter.

The following comparisons are from the experiments of Professor Barlow, and show us, that even as regards strength to oppose friction by a weight in the centre, the alleged peculiarity of the fish-bellied rail, a parallel rail may, if properly formed, bear an equal or greater weight, with less flexure:

Bellied rail, weighing	50 lb.	carried	8 tons,	and bent	0·066.
Parallel rail,	"	50 lb.	"	8 tons,	"	0·048.

These trials were made under the same circumstances, both rails weighing fifty pounds a yard, and supported at a distance of thirty-three inches. Mr. Barlow remarks,—

"It appears, from these results, that it is always possible to produce a parallel rail, of good practical proportions, which shall be as strong as a fish-bellied rail of the same weight; and this being the case, I am decidedly convinced, after hearing and weighing well every argument that has been advanced in favor of the latter form, that the parallel rail is the best."

The following are some interesting results of experiments made by Professor Barlow on this subject.

Deflections of the rail of the Dublin and Kingston Railway, by the passage of the Swiftsure engine along the rail—the rail weighing 45 lbs. a yard, with supports or bearings at 3 feet distance from each other, the bars being in lengths of 15 feet:—

Near the joint the deflection was - -	0·167 of an inch
Near the middle - - - - - - - -	0·112

Now, this deflection of from one-tenth to one-seventh of an inch in the middle of a rail, is equivalent to ascending a slope of one foot in 450, to one foot in 600, which adds from a third to a half to the resistance of the railway, or the force necessary to draw a load. Of course, this evil is one of the first magnitude, and it is now the duty of the proprietors and engineers of railways to use a rail of great strength, of a stiff form and of considerable weight.

An important fact, which is attended with practical evil, is evident in these experiments: the rail bends under the load near the joint more than anywhere else, in a proportion of nearly 4 to 3—hence, the rail should be strengthened at this point, an object easily attained by bringing the chairs nearer to one another, a precaution attended to in few of the railways we have examined.

Our readers will now be prepared for the great diversity of practice which exists in the different rails of the English railways. In perusing such a work as that of Mr. Wishaw, full of important and valuable statistics, we meet with astonishing diversity in weight of rail; but in general it is to be observed, that the more recent railways have the heavier rail, and that many have changed, although at great expense, from one to the other.

To assist our readers in this inquiry, we have compiled the following table, showing the weights of rails on different railways, and the dates at which they were in use:

		lb. per yard.		lb.
Liverpool and Manchester - -	in 1830,	35,	in 1840,	60–75.
London and Birmingham - - -	1836,	50,	1840,	75
Stockton and Darlington - - -	1832,	28,	1840,	64
Great Western - - - - - - -	1838,	44,	1840,	62
Garnkirk and Glasgow - - - -	1830,	28,	1840,	50
Ardrossan and Johnston - - -	1827,	28,	1840,	56
Ballochney - - - - - - - - -	1826,	20,	1840,	54
Eastern Counties - - - - - - -	1840,	75,		
Edinburgh and Glasgow - - -	1840,	75,		

[*English paper.*

[From the Civil Engineer and Architect's Journal.]

ENGINEERING WORKS OF THE ANCIENTS.

Persian engineering.—Canals—Tigris—inundation—irrigation.—It is in those works which treat of Persia and Egypt that we find the most information as to engineering, for the Greeks, as we have before explained, from geographical position, having no considerable rivers, were not called upon to execute those long canals and large bridges which were of vital necessity to their eastern and southern neighbors. It is therefore in Asia and Africa that we must look for the schools of engineering, of which the practice has been transmitted to us through the Greeks and Romans. When quoting from Herodotus we before mentioned the Persian canals, and we now take from Xenophon, commander of the Greek army, what he says on the subject in his work called the expedition of Cyrus, or retreat of the ten thousand; it being our purpose not to collect what has been said on each individual subject, but to abstract from each author seriatim his seperate testimony, so as to form in these essays a kind of diplomatic collection or chartulary, from which the student may derive his own materials. Of the plain of Babylon, our author says, that in it are four canals derived from the river Tigris: being each one hundred feet in breadth, and deep enough for barges ladened with corn to sail therein; they fall into the Euphrates, and are distant from one another one parasang, having bridges over them. With regard to the origin of these canals, Arrian differs from our author, as he says that the canals which ran from one to the other are derived from the Euphrates and fall into the Tigris. Strabo and Pliny confirm this, assigning as a reason for the construction of the canals, that they are cut to receive and distribute the increase of water arising from the melting of the spring snows.

Clearchus whilst in the same district on his retreat was much embarrassed by meeting with canals and ditches full of water. Clearchus suspected that as this was not the season to water the country, that the king had ordered the waters to be let out to impede the Greeks on their march.

About a day's march from Babylon the Greeks made in two days a march from Babylon, eight parasangs and passed two canals one upon a bridge, the other upon seven pontoons. Xenophon again says that these canals were derived from the Tigris, and that from them ditches were cut that ran into the country, the first broad, then narrower, which at last ended in small water courses, such as were used in Greece to water a kind of grain called panic.

To the history of these canals we shall be able to derive many contributions when we come to the works of Strabo, Pliny and Ammianus Marcellinus. The boats of the Babylonians, as described by Herodotus, were peculiarly adapted for the navigation of these canals. At present the canals are choked up.

Bridges.—Passage of rivers and canals.—Physcus.—In the course of the expedition and the retreat, the Greeks came to many broad rivers, which in general they passed by fording, or by crossing on rafts; near Babylon they were able to avail themselves of the bridges of which they mention several. On one occasion coming to the Tigris they found the river very deep, when a Rhodian proposed the following plan. "I shall want," said he, "two thousand leather bags—I see here great numbers of sheep, goats oxen, and asses; if these are flayed, and their skins blown, we may easily pass the river with them. I shall also want the girths belonging to the sumpter horses; with these I will fasten the bags to one another, and hanging stones to them, let them down into the water instead of anchors, then tie up the bags at both ends, and when they are upon the water, lay fascines upon them, and cover them with earth. Every bag will bear up two men, and the fascines and earth will prevent them from slipping." The generals considered this proposition ingenious, but were afterwards enabled to get out of their difficulties another way.

In the first book bridges are mentioned over four canals near Babylon, each a hundred feet long; in the second book we have a reference to another; and in the same book we find it stated that over the river Physcus, one hundred feet broad, a bridge was placed communicating with a large and populous city called Opis. When Clearchus came among the flooded canals, he passed them by temporary bridges made of palm trees.

Wall of Media.—In the second book we have mention of the wall of Media, which was built with burned bricks laid in bitumen: beingt wenty feet in thickness, one hundred feet in height, and as it was said twenty parasangs in length, and not far from Babylon.

Cities and forts.—Walls.—Larissa.—Mespila.—Larissa or Resen is described in the third book as a large uninhabited city near the Tigris, anciently inhabited by the Medes, the walls of which were five-and-twenty feet in breadth, one hundred in height, and two parasangs in circuit; all built with brick, except the plinth, which was of stone, and twenty feet high. One day's march from thence the Greeks came to a large uninhabited castle near a town, called Mespila, formerly inhabited also by the Medes. The plinth of the wall was built of polished stone full of shells, being fifty feet in breadth, and as many in height. Upon this stood a brick wall fifty feet also in breadth, one hundred in height, and six parasangs in circuit.

Pyramid of Larissa.—Close to the city of Larissa, says Xenophon, stands a pyramid of stone, one hundred feet square, and two hundred high, which seems to have been hollow.

Greeks.—The observation of Xenophon as to Greek engineering we extract from his history of the affairs of Greece. In his expedition of Cyrus however he alludes to the mole of the harbor of Byzantium, and to his forcing the Ionian Greeks to repair the roads through their cities preparatory to the march of his army.

Quarries of the Piræus.—The quarries of the Piræus (book 1st,) were in Xenophon's time wrought by Syracusan prisoners, who were confined there, and who made their escape by digging themselves a passage through the rock.

Capture of Mantinea.—In the course of the Peloponnesian war (book 5th,) Mantinea was captured by the Spartans under Agesipolis. Besides the usual works of digging a trench, and constructing a wall, he dammed up the river, which was a large one, running through the city. The channel being thus dammed up, the water swelled above the foundations of the houses and of the city walls. The lower brickwork (being probably of raw bricks) was soon rotted by the wet, and shrank under the upper buildings, by which means the city walls cracked, and afterwards were ready to tumble. For some time they underpropped them with timber, and made use of all their art to keep them from falling. The Mantinians ultimately consented to demolish their walls.

Bridge of Sellasia.—A bridge is mentioned in the sixth book, at Sellasia leading to Sparta, but no description is given of it.

Docks of Gytheum.—The docks of the Spartans (book 6th,) were at Gytheum.

Public Inns at Athens.—Shops, etc.—In his pamphlet on the revenue of Athens, Xenophon alludes to the public inns for the use of strangers, he also recommends the building of greater numbers of shops, warehouses and exchanges for common retailers, relying upon it as a good means of revenue.

Reparing public buildings by contract.—Xenophon also in this pamphlet slightly alludes to the custom which the Greeks had of letting out the building and repair of their temples to private undertakers, also mentioned by Athenæus and Herodotus, B. 5, C. 62.

THE INFLUENCE OF RAILROADS IN DEVELOPING THE RESOURCES OF THE STATE.

We have only begun to experience this influence in Georgia, and shall not fully realize its extent until the contemplated lines are completed, and a thorough communication is established between the sea-board and the cities of the interior. Arguments are hardly necessary to prove that the increased facilities of intercourse between the several markets of the country and the sea-ports of the same, are ever attended with the most gratifying results in every point in which it can be viewed; and yet there are two or three positions which we are anxious to set before the people, which we are sure will commend these "popular democratic establishments" (as the Chevalier de Gerstner, the celebrated Austrian engineer, calls railroads) to every reflecting and intelligent mind.

In the first place railroads bring the produce of the country and the markets of the country in close proximity. Land and crops are only valuable in proportion to the ease of access to the one, and the facility of finding a market for the other. The reduction of relative distances by railroad has been astonishing and bears directly on this question. The real distance between New-York and Philadelphia, for example, is just the same now as it was a hundred years ago,—but the relative distance is changed from seven days to seven hours. New-Orleans is just as many geographical miles from the head of boat navigation on the Ohio, as it was before the first steamboats plied upon the western waters,—but yet, for all purposes of social or commercial intercourse, the distance is reduced from two or three months, to eight or nine days, so much is space annihilated by steam.

Macon is the same number of miles from us it was before the charter was given to the railroad; and yet on the completion of that road, instead of being by the former course of transportation a week distant from Savannah, it will be but twelve hours. Such are the advantages in point of saving time and distance—such is the compacting influence of these iron links, which bind us with the interior.

The increased facilities for the transportation of merchandize with the interior, is another advantage resulting from railroads. Throughout the whole line tracked by the Central railroad, the planter was formerly compelled to wagon his produce to market. This employed a number of hands, teams, horses; involved road expenses, breakage, damage by weather, and a variety of contingencies, and after all, his crop came in slowly, and he had to send it when he *could* rather than when he *would*.

By the railroad, all these things are avoided. He can now send it to suit the market, besides saving greatly in the expenses of transportation hitherto required. His crop reaches the city in better condition, and the whole process gives him more satisfaction than by the old and dilatory method. He is in fact, instead of being removed many days journey from his factor, placed within a few hours of his counting room, and daily accessible to his counsels. But aside from theories, *experience*, true uncontroverted experience shows, that wherever new channels of communication are opened with different sections of the country, whenever opportunities and facilities, combining convenience, despatch, frugality and security, are offered to the public, they have been embraced with eagerness, and have produced changes in the condition of society, of the most marked and effective character.

The increase of the number of passengers over the old stage travelling, by the establishment of railways has been on several of the European roads as follows:—

Manchester and Liverpool - - - - - -	300	per cent.
Stockton and Darlington - - - - - -	380	" "
Newcastle and Carlisle - - - - - -	455	" "
Arbroath and Forfar - - - - - - -	900	" "
Brussels and Antwerp - - - - - -	3,000	" "

The number of passengers formerly carried by coaches over the line of travel now covered by the Darlington railway, was about four thousand a year, it is now near sixteen thousand.

The Bolton line of travel required twenty-eight coaches, carrying a weekly average of about 280 or 300 persons—the railway on the contrary, conveys a weekly average of 2,500.

The annual number of passengers over the Dundee and Newtyle line, by the old conveyances was 4,000; since the opening of the railway, 50,000 a year.

Prior to the establisment of the railroad between Newcastle and Carlisle, the public coaches carried at the rate of 343 per week; now about 1,600 a week travel by the cars.

Four hundred passengers a day was the usual amount of travel between Liverpool and Manchester, before their union by the railroad; since then, its increase has been to fifteen hundred and ninety-seven.

Between Brussels and Antwerp, the annual travel was 75,000—since the railroad opened, it has increased to the astonishing number of *one million and over*, of passengers. The increase of frieght traffic has even exceeded the increase of travel, and in some instances has created a merchandize, hitherto not supposed to exist, and has made that valuable, which previously, for want of easy access to a market, was comparatively of little account. The immense coal trade of Pennsylvania is an illustration of this; and those immense stores of mineral wealth, which, till within a few years, have been dormant in the bowels of the earth, are now being developed to the aggrandizement of the State, to the increase of her treasury, to the enriching of individual enterprise, and to the elevation in every sense, of that "Key-stone" Commonwealth.

We doubt whether a railroad can be found in the world which has not increased the value of the land, throughout the entire extent; in some instances, one, two and three hundred per cent. And numberless cases could be cited, in which the railroad has completely revolutionized the country, converted its waste places into smiling villages, and made the hitherto uncultivated districts, swell with the labors of industry, and the harvest of the husbandman.

[*Savannah Georgian.*

[From the Civil Engineer and Architect's Journal.]

PREVENTION OF EXPLOSION IN STEAM ENGINE BOILERS.

The gold Isis medal was presented by the society of arts to Mr. Robert M'Ewen, Glasgow for his double mercurial safety-valve for steam engine boilers.

There are two evils against which it is especially necessary to provide in the construction of an apparatus for preventing explosion in boilers, viz. the possibility of the steam passage being intentionally closed, for the purpose of obtaining extraordinary pressure: and the failure of the self-action of the apparatus through the accidental derangement of its parts.

Mr. M'Ewen's apparatus consists of a pair of open tubes, the ends of which are immersed in mercury contained in cups connected with the boiler by a pipe. At the junction of this pipe with its branches for the two cups, is a three-way cock, the ports of which are so proportioned to the openings of the branch pipes, that the steam can neither be opened on, nor cut off from, both cups at the same time. The mercury tubes are proportioned in length to the greatest pressure which the boiler will bear with safety; the mercury will therefore be blown out of the acting tube into the dome at the top, whenever the pressure exceeds this limit, and will fall down through the other tube into the empty cup, while the steam blows out through a pipe at the top of the dome.* When the pressure is sufficiently reduced, the cock may be turned, and the cup which was first filled becomes the acting side of the apparatus.

On the 7th of April, a committee of the society inspected the action of Mr. M'Ewen's mercurial valve, the apparatus having been attached to the boiler at the works of Messrs. Fairbairn and Murray of Mill Wall. The steam was opened on the mercury at a pressure of five pounds to the square inch, and as soon as it attained the pressure corresponding to the length of the tubes, viz. seven pounds, the mercury was blown, without any loss, into the dome and fell into the empty cup, while the steam blew out through the pipe at the top of the dome, and was condensed in a vessel placed to receive it for the purpose of experiment. On examination of the water in this vessel, not a particle of mercury was found in it. This result sufficiently proved the efficiency of the pipe, which is produced to some distance downwards within the dome, for the purpose of preventing the mercury from splashing out with the rush of steam.

As the action of this apparatus depends simply on a *physical* principle, viz. the opposition of the elastic force of steam to the static pressure of mercury, without the intervention of a *mechanical* obstruction of any kind, it cannot fail of acting, so soon as the pressure of steam exceeds the limit corresponding to the length of the tubes. The novelty of the invention is in the employment of a mercurial tube as a safe vent for the steam, these tubes having hitherto been used only as indicators of steam pressure, being long enough to allow the steam to attain a dangerous pressure without relieving it or giving any other notice of the fact than what may be observed by the eye.

[From the Civil Engineer and Architect's Journal.]

OBITUARY NOTICE OF SEVERAL DISTINGUISHED ENGINEERS, FROM THE ANNUAL REPORT OF THE INSTITUTION OF CIVIL ENGINEERS.

Francis Bramah was the second son of the late Mr. Joseph Bramah whose numerous inventions, perfection of workmanship, and genius in the mechanical arts, have rendered his name so widely and justly celebrated. The opportunities afforded to the son were ardently embraced by a mind of no ordinary powers, deeply imbued with the love of knowledge. Although his attention was in early youth more particularly directed to branches of minute mechanical construction, his acquaintance with the principal departments of professional knowledge and general science was very extensive. His attachment to the arts and to science was deep and sincere, and among many proofs of this may be particularly mentioned the valuable and essential services which he rendered to your late honorary member, Thomas Tredgold, both in his professional pursuits

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* Mr. M'Ewen intends that an alarm-whistle be placed in this opening, and also that the apparatus serve as a gauge for indicating the variation of pressure, by means of graduated float-rods in the mercury tubes.

and in the prosecution and verification of his theories and calculations. Mr. Bramah being professionally engaged at Buckingham Palace, in connection with some other engineers, difference in opinion existed and discussion arose, as to the true principle upon which the strength of cast iron beams to resist stress and flexure ought to be estimated, and with the view of verifying the principles laid down by Tredgold, he instituted a very extended series of experiments, on the deflection and strength of cast iron beams. These he presented to the Institution, and they are published in the second volume of your Transactions.

Several important works were executed under his direction, among which the iron work of the Waterloo gallery at Windsor castle, the cranks, the lock-gates, and their requisite machinery, at the St. Katharine's docks, and the massive gates at Constitution hill and Buckingham palace, may be particularly mentioned. Mr. Bramah was an early and deeply-attached member of this Institution; his constant attendance at the meetings, the information which he communicated, and his unwearied zeal as a member of the council cannot be too highly estimated, and his loss will be deeply felt and regretted within these walls. The variety of his attainments, his refined taste in the arts, his amiable character and the warmth of his affections, had secured to him the respect and esteem of a most extensive circle of friends, by whom, as indeed by all in any way connected with him, his loss will be most deeply and sincerely felt.

John Oldham, the engineer of the banks of England and Ireland, was born in Dublin, where he served an apprenticeship to the business of an engraver, which he practised for some time, but subsequently quitted to become a miniature painter, wherein he acquired some reputation. He pursued this branch of the arts for many years, but having a strong bias towards mechanical pursuits, he devoted much of his leisure time to the acquisition of that knowledge which was to prove the foundation of his future celebrity. In the year 1812 he proposed to the bank of Ireland his system of mechanical numbering and dating the notes, and on this being accepted, he became the chief engraver and engineer to that establishment. The period of twenty-two years during which he held this appointment, was marked by continually progressive steps of artistical and mechanical ingenuity. The various arrangements which he projected and carried out, attracted great attention, and conferred considerable celebrity on the establishment with which he was connected.

The late governor of the bank of England, Mr. T. A. Curtis, had his attention directed to these important improvements, and under his influence the whole system of engraving and printing, as pursued in the bank of Ireland, was introduced into the national establishment of this country, under the superintendance of its author, who continued in the service of the bank until his death.

The ingenuity of Mr Oldham was directed to other objects, especially to a system of ventilation, of which an account was given by the author during the session of 1837. Great versatility of inventive faculty, persevering industry, and social qualities of the highest order, were the prominent features in his character, and the success which attended his exertions is one of the many gratifying instances to be found in the history of this country, of talents and industry, destitute of patronage attaining to eminence in the professions to which they are devoted.

Henry Rowles, the chairman of the Rymney iron works, was educated in the office of his relative, Mr. H. Holland, the architect, on quitting which he entered into business as a builder. He was engaged, among other extensive undertakings, in building several of the East India company's warehouses, the Royal mint, the Excise office, and Drury Lane theatre. He was an active director in several docks, railway, and other companies, and finally became managing director of the Rymney iron works, in the active discharge of the duties of which office he continued until his death. The Institution owes to him the drawings of the iron works made by Mr. Richards.

John Rickman was educated at Lincoln college, Oxford, and graduated there; he subsequently devoted himself to literary pursuits, to political economy and to practical mechanics. For some years he was conductor and principal contributor to the "Agricultural and Commercial Magazine." In 1801 he removed to Dublin, as private secretary to the Right Hon. Charles Abbot, then keeper of his Majesty's privy seal in Ireland. Upon the election of Mr. Abbot to the speaker's chair in the House of Commons, Mr. Rickman continued to be his private secretary, and in 1814 he was appointed to the table of the House of Commons. He also acted as secretary to the two commissioners appointed by act of parliament in 1803, "for the making of roads and bridges in Scotland, and for the construction of the Caledonian canal," and to the commissioners "for building churches in the Highlands." The ability and energy which he displayed in the discharge and conduct of the duties of these laborious offices, for more than thirty years, in addition to his constant attendance at the House of Commons, called forth the warmest acknowledgments of public meetings held in the Scotch counties on his retirement, and various resolutions were passed expressive of the sense entertained of the unremitting exertions, and uniform and disinterested assiduity, with which he had promoted every object connected with the improvement and general prosperity of the Highlands and Isles of Scotland. The conduct of the affairs of the Highland commissioners brought Mr. Rickman into constant intercourse with their engineer, Mr. Telford; an intimate friendship was formed between them, and Mr. Rickman completed and published an account of the life and works of that eminent man, which was but partially arranged at the time of his decease.

Mr. Rickman's chief work is the census of Great Britain, in six folio volumes; he is also the author of numerous papers connected with statistics, having bestowed great pains in collecting and arranging the returns connected with education and local taxation. To this Institution he rendered very essential services, and whenever application was made to him in its behalf, was always zealous in endeavoring to promote its interests. The library was enriched by him with two copies of the life and works of Telford, and as the acting executor of Telford, he endeavored to carry out, by every means in his power, the intentions of that great benefactor of the Institution.

Mr. Rickman's acquirements in every department of knowledge were accurate and extensive; to great quickness of perception, and memory of no ordinary power, were added indefatigable industry, undeviating method, and a sound critical judgment;—qualities which caused his acquaintance to be highly valued by the most distinguished literary characters of the day, and which no less than the strict and scrupulous sense of justice and honor, which particularly showed itself in his considerate kindness towards all those with whom he was connected, will occasion his loss to be deeply regretted by a widely extended circle.

CHANGES WROUGHT BY STEAM.

Those who are able to look back fifty or even twenty years, cannot but be struck with the remarkably increased facilities of intercourse and travelling in the United States. Steam has produced a change, which the good old people of Salem would reverently attribute more to witchcraft than to the well directed agency of natural causes. It is but *eighty years* since the first stage coach was established in America. It ran between Portsmouth, N. H. and Charlestown, Mass.; was a mere two horse carriage, and would only accommodate three persons; it left Portsmouth on Monday and arrived in Boston on Wednesday evening. This was accounted quite good travelling. Now, you can go from Boston to Portsmouth, *and back again*, between sunrise and sunset. "Such was the difficulty," said one, at the centennial celebration of the settlement of Springfield, Mass., "of crossing the pathless wilderness which lay between them (the first settlers) and the coast, that a man may now go from Boston to New Orleans by way of Pittsburg, a distance of 2,500 miles, in about as many days as it took the first colonists to reach the Connecticut river." What would one of the Puritan Fathers have thought, could the spirit of improvement, assuming a mortal shape, have appeared and foretold, that in a few ages, that journey, which now costs weeks of anxious toil, would be performed in five hours of easy locomotion? It would have been to him as one that mocked. The first four horse stage coach in America, was started in 1774, and run between Boston, Salem, and Newburyport. The sound of a locomotive puffing and sputtering through the streets of Salem, would be a far more terrible sound to old Cotton Mather, than all the incantations of the condemned witches. He would indeed think as he saw it whirling, self moved, twenty miles an hour, sending forth its smoke and fire and vapor, that it was truly the embodied evil one, "going about like a roaring lion."

In the debates concerning the propriety of forming *a plan of union,* which was discussed at Albany in 1754, in a convention of delegates from the several American colonies met for that purpose, Dr. Franklin in urging that Philadelphia should be the seat of Government, gave as his most cogent reasons the following, which illustrate the condition of travelling in that day: "Phildelphia," said he, "was named as being nearer the centre of the colonies, where the commissioners would be well and cheaply accommodated. The high roads, through the whole extent, are, for the most part, very good, on which forty or fifty miles a day may very well be, and frequently are travelled. Great part of the way may likewise be gone by water. In summer time, the passages are frequently performed in a week from Charleston to Philadelphia and New York; and from Rhode Island to New York, through the sound, in two or three days; and from New York to Philadelphia, by water and land, in two days, by stage, boats and wheel carriages, that set out every other day. The journey from Charleston to Philadelphia may likewise be facilitated by boats running up Chesapeake bay three hundred miles. But if the whole journey be performed on horseback, the most distant members, viz: the two from New Hampshire and from South Carolina, may probably render themselves at Philadelphia in fifteen or twenty days; the majority may be there in much less time."

Now, the delegate from the most southern point, then represented, (Charleston, S. C.) could reach Philadelphia in about fifty hours, and the members from New Hampshire might "render themselves" in that city, in as many hours as it then took days.

It is only forty-five years since the first turnpike coporation was chartered. Who does not remember the astonishing improvement in travelling which even turnpikes introduced? It is not forty years yet, since the first canal was completed; now, more than 2000 miles have been cut in nearly every State, and have added millions of dollars to the wealth of the country. It is but fourteen years since the first railroad was finished in America; it was three miles long, and was esteemed quite a curiosity. In fact, it is but *eleven* years since they have been used to convey passengers and run with speed; now, 5000 miles of railroad are completed, employing five hundred locomotives, and a capital of nearly one hundred millions of dollars.

It is but thirty-four years, since the steamboat "North River" made her passage between New York and Albany in *thirty-three* hours. Now, about a thousand ply in American waters; and the "Swallow" or the "North America" will take you from Albany to New York in *nine* short hours. Verily, this is a locomotive age; and steam—steam is working its miracles in our midst. The mere introduction, as an agent of power, of the vapor which fumes up from the spout of the tea kettle, has produced an entire revolution in the affairs of men. The changes, however, which have taken place in the west, are even more astonishing, than those which have transpired in the Atlantic States. The following account of "things seen by a young son of the west," originally published in the Cincinnati Register, is extracted from the People's Magazine, for July 13th, 1833. "I have seen the time when the only boat that floated on the surface of the Ohio, was a canoe, propelled by poles, used by two persons, one in the bow and the other in the stern.

"I have seen the day, when the introduction of the *keel boat,* with a shingle roof, was hailed as a mighty improvement in the business of the west. I remember the day, when a Canadian barge (as the St. Louis boats were called at the head of the Ohio,) was an important event in the transactions of the year. I remember the day when a passage of *four months* from Natchez to Pittsburg, was called *a speedy trip* for the best craft on the river; and when the boatmen, a race now extinct, leaped on shore after the voyage, and exhibited an air of as much triumph as did the sailors of Columbus on their return from the New World. I remember the time, when the canoe of a white man *dared not be launched on the bosom of the Alleghany.* I remember the time, when a trader to New Orleans, was viewed as the most enterprising among even the most hardy sons of the west; on his return from his six months trip, he was hailed as a traveller who had seen the world. I remember the day when the borders of the Ohio were a wilderness, and New Orleans was '*toto orbe divisa*' literally cut off from the world. I have lived to see two splendid cities, one devoted to manufactures, the other to commerce, spring up, where, in my boyhood, nothing appeared like civilization, but the hut of the soldier or the settler.

"I have lived to see the day when a visit to New Orleans from Cincinnati, requires no more preparation than a visit to a neighboring country town; I remember when it required as much previous arrangement as a voyage to Calcutta. I have lived to see vessels of 300 tons arriving in 12 or 15 days, from New Orleans at Cincinnati; and I calculate upon seeing them arrive in 10 days. I have lived to see vessels composing an amount of tonnage of upwards of 4,000 tons arrive in one week at the harbor of Cincinnati. All these things I have seen, and yet I feel myself entitled to be called a young son of the west." With regard to the calculations of the "young son of the west," as to the arrival of vessels in 10 days from New Orleans, we can say that they have been more than realised. Steamboats have run between the cities of Cincinnati and New Orleans in seven days.

The transforming power of steam seems like the work of a master Magician.—*Georgian.*

[From the Civil Engineer and Architect's Journal.]

IMPROVEMENTS IN RAILWAYS AND THE WHEELS OF LOCOMOTIVE ENGINES AND CARRIAGES.

In the first place, the leading and trailing wheels of locomotive engines either with four or six wheels, would work better were each wheel to be keyed upon a separate shaft, so as to revolve independently. This may easily be done in the following manner: let the wheels be keyed upon their respective shafts in the usual way, with either outside or inside bearings, which ever may be the most convenient and, let the shafts have middle bearings to meet in the regulating line common to all. If the wheels and axles are made in this way, the wheels on the outside rail would revolve quicker than those on the inside, and would allow the engine to find its own bearings. This would be particularly evident in going round curves, and would be the means of preventing many accidents from engines being very liable to be thrown off the rails on those parts according to the present system. In the second place, it is proposed that each of the leading and trailing wheels shall be keyed upon a hollow shaft in the usual way; these shafts to have no external bearings, but to be bushed with brass, bored to fit the solid shaft, or spindles which will be required to work into them. The solid shafts to have a bearing at each end, and one in the middle if required. This plan will allow the outside and inside wheels to revolve independently on the curves or otherwise, and will also prevent them wearing irregularly. Should any obstacle be thrown in the way of the engine, the wheels revolving separately would prevent it from coming off the rails, as the wheels would act as a check to each other, or as a complete check or guard rail on any part of the line as hereafter explained.

Thirdly. The wheels to be made of either wrought or cast iron (the latter would be preferable,) and to have a flange on each side, by which plan they would not be required so strong as those now in use, because they would take the lateral concussions or side jolts more equally than the present kind.

Should the engine be thrown to one side, both wheels would take an equal share of the strain or jolt, whereas in the present system the wheels on one side take the whole strain. This properly adjusted, the conical wheels may be dispensed with, as well as the check or guide rails upon the whole line, which latter checks are a great nuisance. In the plan thus proposed the rails would be laid level or horizontally across and not at an angle as at present, and the wheels would have to be the segment of a circle upon the face, in place of being conical. Each wheel would thus act as a check rail for the other during the whole of the journey. Should the rails be out of gauge so as to cause the wheels on one side of the engine to mount upon their flanges, and throw the train off the rails, as is very often the case with the present system, the double flanges would obviate this evil and keep the engine in its proper course, until the wheels again found their places. The switches will remain without alteration, but the points may be altogether dispensed with. By this method of working, there will be a great saving in the wear and tear of the engines and rails, it will reduce the cost of keeping the engines and road in repair, and lessen the friction, as well as the quantity of fuel with all other expenses in like proportion. In constructing the permanent way, much time might be saved, as no attention will be required in laying the rails to an angle, as they would then be horizontal where the road itself is straight. Giving to the outside rails the proper rise in the curves, the angle of the two rails will incline both one way, and not reverse to each other as at present. This will afford the engine another mechanical advantage on the curves, giving gravity a much greater opportunity of acting against the momentum of the machine. The engine will also be kept in its proper course in the curves much more forcibly than is afforded by the present method of laying railroads by the present system, as the angles of the two rails are acting against each other, the outsides of both being higher than the insides, and causing a great friction upon the axles, brasses, wheels and rails; this the proposed alteration will entirely obviate. All the conical wheels now in use, through concussions and constant rolling upon the rails, squeeze out on one side. No conical wheels retain their proper form much longer than two months if daily at work; each wheel causes the flange of the opposite wheel to act with great force on the inside of the rail, and *vice versa*. The large hollow fillet that is left in the angle of the flanges of the wheels crushes down the inside angle or corner of the rails; which the proposed wheels would obviate—the weight of the vehicle would be also much better distributed over the surface of the rails. This alone is a great inducement to the introduction of double flanged wheels on loose axles, as the rails would last double the length of time.

In the fourth place, the double flanges would prevent the wleels squeezing out, as they seldom squeeze out on the side next the flange, and being all made from cast iron, there would be no spreading. The longitudinal shake or clearance that is generally given to the axles in their brasses will not be required, as the action of each being entirely in itself, and inclosed in brass, will retain the oil much longer and not require that attention which the present do. Were the engines and carriages made according to this arrangement the loss of power in the curves would not exceed from 8 to 10 per cent, above that used on a straight line, always of course depending on the radius of the curves.

In the fifth place, the whole of the engine and tender wheels should be furnished with double flanges, the latter to be of different diameters causing thus different depths from the face of the wheel to the tops of those flanges. The reason of this will be easily explained.

Railways at present are nothing but a series of complication of curves, all differing in intensity. To carry engines round those continually changing curves without trailing and great friction, would require wheels of greater and less diameters, and this difficulty I propose to surmount by means of those flanges, which will become *bona fide* for the time, the wheels of the machine.

To enable me to make use of the above arangements, I propose to have radiated plates or segments put down on each side of the main rail, at such a depth from the face of the rail, as to cause the wheels to be lifted from the rail and allow the flanges to act on those segments; the machine rolling at one time on the large flange, at another time on the small, and from thence on the face of the wheel, those alternations of course depending on the nature and radius of the curve. The length and position of those segments would be found by a calculation depending on the intensity of the curves.

Were engines, carriages, etc., provided with such wheels, and the railways with segments to suit, it would be next to impossible for the train to leave the line of road; for, even supposing the whole of the tires on one side were to come off, the train would be kept in its course by the double flanges of the wheels on the opposite side. At present if a single tire comes off, the engine is precipitated from the rails, and if without any more serious result, the train is detained till the arrival of another engine, train, or other means of locomotion. I may in addition mention that the fatal accidents arising from furious driving which is more or less practised on all lines, and is a terror to all travellers who have not the iron nerves of his Grace the Duke, would be altogether prevented; for not even the velocity of 100 miles per hour could force the engine or carriages off the line, so firmly would the wheels be bound to the rails, and so sweetly would they glide round the curves if made on the above construction.

With many apologies for intruding my ideas on your acquaintance,

I am your obedient servant,

WILLIAM ANDREWS.

Paddington, March 26, 1841.

P. S. Were the wheels and segments calculated for each other, the parting or cutting of the shafts could be dispensed with, and they might remain just as they are at present.

THE OPENING OF THE NEW-YORK AND ERIE RAILROAD.

We give the introductory remark of the *Georgian* to a notice of the opening of the New York and Erie railroad. They show how truly national the feeling in all parts of the country is, in regard to this important work.

"It sends the blood through our veins in quicker pulsations, to read of the commencement, or completion, of this or that effort, of American enterprise. *Onward!*—ONWARD! seems to be the universal watchword of our country. It resounds through the hills of New England, and meets the steam ship as it comes up from the waters; it is wafted by the winds from the nothern lakes across the rich farming districts of the middle States; the gathering streams of the great central valley bear it on its bosom; its echoes are rolled back from the base of the Rocky mountains: and the south, in all the pride of her staple products, and immense resources lifts up her voice, with the voice of the Union, to iterate and reiterate that glorious, soul-stirring word—ONWARD.

"The astonishing increase in the great schemes of improvement throughout the land, is almost incalculable. Never before has the public opinion been so thoroughly roused: never before have such noble enterprises been started: and all that is necessary to success, is to repress the wild extravagance of speculation, and confine these various operations, within the limits of prudence and judgment. The New York and Erie railroad promises to be one of the most important links between the seaboard and the west, and is a project of immense magnitude. Passing onwards from Goshen to Deposit on the Delaware river, thence across the valley of the Susquehanna, its western terminus is Dunkirk on Lake Erie, 52 miles west of Buffalo. The advantages proposed by the road, are not confined to securing a portion of the northwestern trade, but it will open a highway through regions comparatively unsettled, will develope resources hitherto unknown, and plant the workshop—the school house—the factory—and the village, like flowers of industry along its borders."

POST OFFICE DEPARTMENT AND RAILROADS.

Mr. Editor.—I would respectfully call the attention of the Post Master General to the consideration of the policy of arranging some system, by which it can be made to appear that by applying a portion of the earnings of the Department in aiding the construction of railroads on mail routes, those very railroads can be rendered *increasing contributors* to the emoluments of the Post Office Department. I believe that some arrangement or system can be planned, that will accomplish this desirable end. I would not presume to project a plan—but I would simply throw out some hints which may lead to useful investigation. I would suggest—

1st. That the department should turn its eye to railroads forming *main trunks*, or important channels, possessing also, distribution depots.

Government should not wait till these roads are finished by private enterprise, which, after struggling through pecuniary difficulties, accomplish their object at great sacrifices—but liberally step forward and lend its aid under certain conditions—that is, contract for the conveyance of the mail bags by an outright subscription to so much of the capital stock.

Let us suppose, for example, that a farmer, a merchant or manufacturer, may have occasion for the daily use of a railroad, and an opportunity is offered to him, that by subscribing so much to the stock of said railroad, and taking his *pro rata* share of its dividends he shall also have the right of free passage of his produce, merchandize or wares, would he hesitate to become a subscriber on those terms?—Why then should not the Post Office Department see its interest in the free transit of its mail bags by a similar course?

2d. *The War Department.* Here the Government is equally interested. The free transit of men and munitions of war over railroads, offers another inducement to Government to secure, by early action in aid of railroads, an almost incalculable advantage. If Government has constitutional scruples on the sepoints—if it sees that it cannot aid private enterprise in creating these facile and rapid modes of transit—it is to be hoped that it will not complain that private enterprise should demand of Government, as of individuals, a compensating charge for the use of its railroads.

The British Government aids private enterprise in the construction of packet steamers, but contracts with said steam packet owners to carry the mail bags *free*; the postage pays back the loan with ample interest; and the Government stands in improved condition, having a *steam navy* also at command, and officers and men drilled to a new and formidable service, without expense to Government; for every steam packet thus built is fitted at a few days notice to become a vessel of war: to-day a messenger of peace and price currents—to-morrow a vessel of bombs and bullets.

Precisely so could it be with our railroads; equally useful and remunerating in all the arts of peace; as formidable and advantageous in carrying within brief periods all the means of defence and attack in war. Can any one doubt that it is as well *the duty* as *the interest* of the Government to look to this matter, and take an energetic stand to aid private enterprise in carrying this country to the utmost limits of *viability*. PETER SCRIBER.

[*New York American.*

THE USE OF CAST IRON.

The multiplicity of inventions, and the rapidity with which they are improved upon, are two distinguishing features of this active age. They seem to roll over society, like wave succeeding wave; one has hardly reached the strand of demonstrated utility, before it is succeeded by another, more progressive, to be followed up by the still advancing series of improvements and discoveries. The many uses to which cast and other forms of iron, have lately been put, is an evidence of our assertion, and shows how even that, which seems not merely strange hypothesis, but positive absurdity is made to illustrate the views of practical experience. Who, had he been told fifty years ago, that ships, would be made of iron, would not have regarded the asserter as a mad man? It was a Prophet's miricle to cause iron to swim, and yet without either Prophet or miricle, by the simple application of the laws of science, ships of iron are made, to go down to the sea, to do business upon the mighty waters. It is only about eleven years, since iron was used for the construction of vessels.

The "Ironsides" was the name of the first built in England; but now many have been made, and their virtues have been tested on the Ganges, the Niger, the coast of England and France, across the Atlantic, and even on our western waters.

Almost as wild in theory as the preceeding, is the application of cast iron to buildings. It is not long since, that we read of a church called the St. George, we believe, which had been erected in Liverpool, entirely of cast iron, which exhibited great beauty of design, and skill of execution.

A still more singular use of this material, is by the King of Russia, who has had constructed for him, at Berling, an immense cast iron marque, or tent, which cost nearly 40,000 francs, to be set up in the camp at Silicia, on the occasion of an approaching grand review, for the purpose of entertaining his officers and friends. This must be a curious specimen of workmanship in iron, and the design is as curious as the execution.

Last of all comes a newspaper paragraph, announcing that there is now building in London, a cast iron light house, intended to be placed on a dangerous reef of rocks at Morant Point, in the Island of Jamaica, the height of which is to be one hundred feet, and the diameter at the base, 18¾. Where will the wonders of this wonder working age extend? We have but just left the starting post of invention. The race is all before us,—the goal is many centures ahead.—*Savannah Georgian.*

Erie Railroad.—It is gratifying to the friends of this road to observe the increase of travel and freighting upon it. We are informed that the income of the road one day last week, amounted to nearly five hundred dollars. The expense of running is estimated at $175 per day. On Tuesday last Messrs. Dill, Jennings & Co., one of the freighting establishments, sent off in the afternoon train, 323 dressed hogs, weighing 29,975 lbs., 265 tubs and firkins of butter, weighing 20,850 lbs. and ten tons of other frieght. Messrs. Cash & Co., have also had some fine freights, perhaps equally as large, but we have not ascertained the amount. Large quantities of freight are also sent from the Chester depot. A company has been formed there for the purpose of transacting a freighting business.—*Goshen Democrat.*

Wood Paving.—On Saturday, at the meeting of the Marylebone vestry, one of the proprietors of Rankin's patent wood paving, proposed to lay down 600 yards, as an experiment, in Oxford street, between South Molton and Duke streets. The gentleman produced a model to the board, and said that the only possible objection to wood—its slipperiness was obviated by their blocks, which presented a good foot holding in every direction, and the proprietors were willing to lay down a specimen on a hill where there was the most severe and continued traffic, in blocks of Norway fir or English elm, at 16s. a square yard, the same to be kept in repair for seven years at 6d. per square yard. He remarked that though the surface blocks might be worn at the expiration of that time, the base blocks would be found as good as ever; and that if, at the end of six months, the specimen was not approved, the proprietors would remove it at their own expense. After it had been moved and seconded that the proposition be complied with, Mr. Cochran took occasion to observe that, on the previous day, Mr. Stephenson, the engineer, had told him that it was a mistaken notion that wood paving became rotten and quickly worn out, as was proved by the sleepers on the Leicester and Swanston railway, which though they had been laid down nine years, were now as good as at first. The motion was carried unanimously.—*London Standard, Oct.* 4.

London and Brighton Railway.—This stupendous undertaking is at length achieved, and the whole line was opened throughout, to the public yesterday morning. The difficulties with which the company have had to contend have been great, but they have all been surmounted with comparative ease, and the great work—a work characterised by an eminent engineer as almost impracticable—does honor to the engineers and the company. Its cutting, its embankments, and its tunnels, are immense, exceeding, perhaps, any other line in the kingdom in point of magnitude in the same distance. The most magnificient and imposing object on the line is the Ouse viaduct, about 34 miles from London, which is 1434 feet long, entirely built of brick. and consisting of 37 semi-circular arches, and 30 feet span. From the surface of a small river the parapet rises about 105 feet, and the structure, when seen from the bed of the valley, has an elegant appearance.—*Railway Times.*

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EXTENSION OF THE LONG ISLAND RAILROAD.

It is probably known to most of our readers that the Long Island railroad, intended to extend from Jamaica to Greenport, near the eastern end of the island, has remained uncompleted, and hitherto with but little prospect of a completion. The road having been made as far as Hicksville, sixteen miles, the whole distance traversed (including the Brooklyn and Jamaica railroad, which is leased by the Long Island railroad company,) has been but twenty-seven miles from Brooklyn.

During the past year, vigorous efforts have been made to renew the work. Aided by a legislative grant, by the donations of land and money from the inhabitants, and by the direct expenditure of the company, the means have been obtained for building *twenty miles* of road, in addition to the portion already finished. About seven of these twenty miles have been prepared for travel, and the company desirous of showing how much had been done, and how favorable the nature of the ground continues throughout the route, a large company assembled on the 2d inst., by their invitation, to pass over the road as far as finished.

Some idea of the admirable facilities of the route may be formed from the fact, that the sixteen miles of road which have been built for several years, form a perfectly straight line, the surface being but gently undulating, and the grades light. This being the fact, we could not but express our surprise that an excavation of some eight or ten feet should have been continued for a great distance over a plain, through which the road might as well have passed on or near the surface of the ground. We learn too, that this portion of the road causes great trouble in winter by the snow sweeping over this wide expanse, uninterrupted by a fence, and filling up the road way, causing vexatious delays, and sometimes actually interrupting the travel.

There is probably no better ground for a railroad in the world. The soil, which is not deep, but very dark in color, being removed, a beautiful white gravel, resembling ordinary beach shingle, is uncovered, and through this, excavation is readily made, while a uniform material is presented both for excavation and embankment, and of the very best kind.

Hicksville, the former termination of the road, is situated in the middle of Hempstead plains, and at a short distance to the west a branch has been made to the village of Hempstead. From Hicksville, the line of the road as formerly located, pursuing the direct route through the middle of the island, passed over a transverse spur at a great cost of excavation and embankment.

At this point the work has been re-commenced and the old route abandoned The road as constructed sweeps to the south and touches only the extremity of the transverse ridge, where but a slight excavation is necessary. A slight curve returns the road toward the middle of the island, and after some gentle undulations, the plain ground again occurs with the gravel, which in this case has a tinge from the iron in the minerals of which it is composed, and which gives a greater tenacity to the earth.

The termination for the present is at Farmingdale, formerly Bethpage, but as about a mile of the track had been laid beyond this, the locomotive passed over it for the first time and an opportunity was afforded to the company of examining the actual construction of the road. The point at which the line of rail terminated, was to us one of singular interest. The plain is here entirely covered by a species of scrub oak (Quercus Bannisteri) not exceeding the height of a man and so completely covering the ground by its spreading and interlacing branches, that at a distance, the rich mass of foliage appears like a coating of dark grass upon the ground. The extent of these plains is very great, and in them large numbers of deer are shot annually. The surface is so level and favorable, that a straight line of twenty miles or more, is here obtained for the road.

Indeed we do not think that in the whole history of railroads there has been found a similar extent of country offering so perfect a surface for the construction of a road, and one so entirely free from all soft or perishable material. At the same time, we conceive that great credit is due to the engineer, Mr. Shipman, who, assisted by Mr. Shotwell, has re-located the road with the greatest economy, and uninfluenced by the more costly style of the former portion of the road, has aimed at what is most requisite, the speedy and economical construction of the road to its termination, as the interests of the concern demand the earliest possible command of the Boston travel, after which it will be an easy matter to improve those portions of the work which need further outlay. But while we characterise the work as economical, we do not wish to be understood that security or convenience has been sacrificed, on the contrary, a heavy rail has been used, 56 lbs. to the yard, and laid on an adequate foundation.

On the return of the company to Farmingdale a very substantial repast was provided, and after paying due attention to it, a number of very happy sentiments were given. The party consisted chiefly of those by whom the railroad system had received much attention, and had been properly appreciated. The Mayor and Common Council of Brooklyn, several members of the Common Council of New York, the directors and officers of the Long Island, and Brooklyn and Jamaica railroads, the president of the Harlem and the vice-president of the New York and Albany railroads, Mr. Davis of New York, Capt. Perry and others were present, and addressed the company. With the utmost good feeling on all sides, was combined the warmest devotion to the cause of railroads, particularly in reference to our great commercial focus.

Mr. Fisk, the president of the Long Island railroad company, gave a very plain and gratifying statement of the prospects of the work, of its economical management, and the successful removal of obstacles of various character. Indeed it is well known that to this gentleman is chiefly due the credit of resuscitating the work, and amid the numerous difficulties attendant upon it, of directing the financial department upon which its prosperity depended. Mr. F. highly complimented Mr. J. A. King, the former member from Queens, by whose exertions the legislative aid was obtained.

There are few routes of greater interest and more deserving the encouragement of the inhabitants in its vicinity. Long Island has long been considered as the garden of New York, but while the western portion has more properly deserved that title, the eastern and more remote parts have been so much separated by distance, that they have hardly received the attention which their importance and magnitude have deserved. By the completion of this road an opening far more expeditious, certain and economical, than any other, is afforded for the vast traffic of the island, and how much this traffic may be increased, it is almost impossible to imagine. However important this road may be as a route to Boston, we think that as a route through the island it is far more important. This is essentially a farmer's railroad, by them it should be supported and for their interests it should be directed. It is in the power of this work to build up a population and a consequent traffic that shall excel that of any other road in the United States. Although this result may be calculated on with certainty, it cannot be attained unless the proper direction is given to the enterprise. If however the vigorous efforts which have been made, are continued, and the same perseverance is shown in the conduct, that has been manifested in the prosecution of the road, the true policy will soon be ascertained and acted upon.

Since commencing the above, we have learned with pleasure, that eleven miles more have been prepared for travel and will be opened in a few days. That an equally rapid progress to the end of the road, may reward the exertions of its friends, is our heartfelt wish.

[For the American Railroad Journal and Mechanics' Magazine.]

Your correspondent X's inquiry in the Journal for the 15th July, relative to the *Wire Suspension Bridge at Frybourg*, can be answered by a satisfactory account, I owe to a friend, who examined that bridge about a year ago. Until that time that superb structure had ably sustained the heaviest loads and its well established reputation of solidity and safety. A heavier and stiffer construction of its platform would have been a desirable improvement, as likewise an efficient system of under floor stays; its vibrations however are of less magnitude than those of most of the English chain bridges.

Speaking of Suspension bridges, I take this opportunity of commenting upon an article of M. Le Blanc, on the comparative merits of chains and cables in the same number of your Journal.

Le Blanc is quoted to say, that the imperfection of the present process of manufacturing cables does not allow of an equal tension in all the wires, so that when the cable is raised to its place, the wires under most tension are overstrained by many pounds, while those under the least tension do not draw at all.

I confess, that by the methed of the French engineers it appears indeed impossible, to attain a uniform strain. Changes of temperature, which can by no means altogether be avoided, will, during the manufacture of a heavy cable, produce considerable contractions and expansions of the different wires, as they are put on in succession. A uniform tension, the most desirable object in a cable, is therefore partially defeated.

This great defect however, may be avoided by employing a process different from the French, and also less expensive.

The method I allude to, appears to me indeed, so certain and sure, that I hereby do offer to manufacture cables of the largest dimensions, for suspension bridges or inclined planes or other purposes, where heavy weights are to be supported, so perfect that the tension of the different wires, say from No. 10 to 15 must not vary *one* pound.

To give due weight to my assertion, I will add, that I have just finished a wire cable of 600 feet long for an inclined plane, where I have applied the above mentioned process with the best success.

After a patent right has been secured for my improvements in the manufacture of *wire cables*, then my interest will admit to say more about it.

John A. Roebling,
Civil Engineer.

Saxonburg, Pa., *Oct.* 27, 1841.

INSTITUTION OF CIVIL ENGINEERS.

Having read with pleasure the communication signed G. R. R., in the No. of the Journal for the 15th of August, the writer takes the liberty of making some remarks upon the subject, and of calling the attention of the members of the Profession to the letter in question.

If but a small number of engineers should enter into the views of G. R. R., and follow them up in the spirit which he shows, there is no fear that the Profession will long remain without efficient organization. The true mode of proceeding, is, carefully to avoid the errors which have caused the previous failures, and seeking only to bring about the main objects of such an association, to leave all small matters for after consideration, and with a mutual good feeling and spirit of concession, these will undoubtedly be looked upon only as subservient to the chief end.

The writer of these remarks is under the impression that the failure of the Baltimore convention was caused by the attempt to locate the association, and by the exclusive character assumed, chiefly on account of the expensive annual dues. That the attempt to locate the institution should prove a serious obstacle in the outset, is not surprising. Local prejudices were immediately called into play, and the hearty co-operation of a large part of the profession at once rendered impossible. The feeling that generally prevailed, that directly or indirectly a connection with any existing association was contemplated, rendered these prejudices still stronger, while the distance constantly to be travelled before each meeting, was an impediment that assumed a formidable character, merely from the fact, that an unequal tax was laid upon the time and money of the members.

The expensive annual dues, gave an exclusive character, by at once setting up a standard, which, instead of measuring the professional zeal or merit of members, seemed rather to contemplate the length of their purses. All the members of any one Profession are never found to be equally successful, and to imply that those only who were so, afforded the proper elements for an association would be absurd and unjust. The distinction of members and associates is also one of doubtful utility. The fact that this distinction has been made in the British Institution, probably led to the attempt to introduce it here. But it must be recollected that the spirit and manners of the two countries are essentially different, and that these affect the relative position of engineers as much as any other members of society. Let the term Civil Engineer be adopted in its broadest sense, and respectability of character, and professional merit, and intelligence, be the qualifications, and no harm will result from the operations of an institution thus organized, for it will not be likely that any will seek to associate themselves with it, unless they have common interests; and to exclude such, would be a real injury. But we have the experience of such distinctions in our own country, and it is uniformly opposed to such an organization as would be desirable in an association of civil engineers—party feelings—dissatisfaction and servility, are the necessary results; and the tendency is always to consolidation; whereas the very reverse is to be aimed at in the proposed body. It is not intended to insinuate, nor is it imagined by the writer of these remarks, that the gentlemen who drew up the constitution proposed in 1839, had any such views, but it is only meant that such results were anticipated from the system then adopted, and that this impression was so general as to cause its ultimate failure.

What we want is first—concert of action and some general plan of union, and to this every thing else must be sacrificed. Unless this grand object is carried out, any society that is formed must finally become a local club and local in all its interests and feelings.

The previous discussion of the question can do no harm, and by a free interchange of opinion much good may be done. The following hints are respectfully offered for consideration. It is thought by many, that a plan of meeting similar to that of the British association, would answer better than any other. Let some suitable place be named each year as the point of assemblage, and let the selection depend upon the wishes of the majority, guided as they would be by a desire for mutual accommodation and benefit. There can be no doubt that a body respectable as this should and would be, might make suitable arrangements that its members receive free passage on the various railroads on their route going and returning, this would at once remove the objection of expense. To this plan of meeting, there is but one objection, and this is really of no consequence—we allude to the inability of forming a deposite of books, maps, models, etc. If such a deposite was actually formed, how many members even of those resident near the location, could avail themselves of such a collection? In the case of a school of engineering, this would indeed be a matter of moment, but as the end proposed is mutual information, to this end every thing else must subserve. By such a plan too, much expense might be saved, as there could hardly be named a place of meeting in which one or more scientific associations would not be able and willing to afford suitable accommodations.

In the next place, let a new president be elected each year, the happy effects of such a provision are too obvious to need any further remark. The same rotation might also take place in all the offices, excepting perhaps such as require the attention of the same person for successive years, and as these would be offices rather of labor than honor, there would be no difficulty, except to induce any one to take them.

The yearly contribution should be moderate and only intended to pay the actual expenses including sums appropriated for investigations. The labors of the members rather than their money, should be required and every inducement and encourangement should be offered to members in bringing forward their personal experience and observation. Even the personal attendance of members would not on this plan be necessary, although very desirable.

The evil of almost all associations, is the accumulation of a vast paraphrenalia of officers, councillors, etc., ect., and a corresponding scramble for situations. Too much time is wasted in going through these endless details of elections, appointments, etc., etc., and the true business is proportionably neglected.

If a sufficient number can be assembled and the proper spirit is shown, there will be with some such arrangements as those proposed, no fear that time will be wasted or unpleasant feelings aroused, but there is a certainty that the most happy results will follow, and the association become a source of honor to the profession and of pleasure to its individual members. *C.*

RAILWAY FROM HARRISBURG TO SWATARA OR PINEGROVE COAL REGION, IN SCHUYLKILL COUNTY.

The Pennsylvania Harrisburg Intelligencer furnishes the report of a committee appointed to collect facts in reference to the advisableness of constructing the above road, and which is strongly urged by them, the ground admitting of a descending grade of 15 feet to the mile for the whole distance of 35 miles in the direction of the trade, and consequently adapted to the cheapest transportation. The very best kind of road, with a heavy rail of 50 pounds per yard is very properly recommended as the only suitable construction,—the Philadelphia and Pottsville railway being referred to as a model.

The following description is given of the region from which this railway is to derive its trade.

"Extending from the head waters of the Schuylkill more than twenty miles to the head springs of the Susquehanna; comprising seven mountains of coal broken by creeks, exposing the coal in breasts of 6, 7 and 800 feet above the water in thirty-six gaps at the mountain ends; embracing every variety of anthracite from the inflamable Welsh coal of black and gold mine gaps, to the hard white ash of the broad mountain: containing the largest body of free burning red ash coal, in Pennsylvania; and also grey and white ash coal in inexhaustible quantities, this Swatara coal region is capable of supplying any amount of coal which the market may demand.

"There is at present but little more than one mile of railroad now made in this region. All the remainder of this extensive coal field lies waste and profitless. This is on Lorberry creek, where three or four operators now mine about 30,000 tons annually. This quantity now finds its way on a badly constructed wooden railroad five or six miles long to the union canal at Pinegrove; at an expense nearly equal to that on a good iron railroad to Harrisburg. From Pinegrove it is shipped into twenty-five ton boats, and traverses the union canal 52 miles before it reaches the Susquehanna ten miles below Harrisburg. The present state of the union canal, in addition to its small capacity, is unfit for the coal trade. Every dry summer the navigation is suspended. The company is too poor to widen the canal, build reservoirs, or make repairs. It has lately made an assignment for the benefit of its loan holders, and therefore all hopes of an outlet to market by this canal seems to be at an end. But was it widened at an expense of $1,000,000, it is believed a well constructed railroad to Harrisburg, costing not more than one-third that sum, would answer a better purpose, as it shortens the distance nearly one half."

Thus it is seen from the above discription, that this Pinegrove region, is fully equal to that of Pottsville in variety of quality and inexhaustible stores of coal, and in fact may be considered preferable as being scarcely yet touched. Mining would here be cheaper and it is capable of being brought quite as near as Pottsville by railway, to the great mart for export at Philadelphia. We do not ourselves see the merits of giving at present, the outlet for this valuable region a westerly direction towards Harrisburgh, and after seeing the operation of the Philadelphia and Pottsville railway, it is more than probable a reconsideration of the subject will lead to the adoption of a continuous railway to Philadelphia. The portion to Reading from Philadelphia is already in operation 54 miles, it remains then only to invite a branch from thence towards Womelsdorf, or further on, say 20 miles, to be met by one of 20 to 25 miles from Pinegrove, making the whole line between it and Philadelphia, about 100 miles, and the connection might afterwards be completed with Harrisburg. The grades in the direction towards Philadelphia are all of a *suitable* character.

All mixed modes of transit, involving transhipments and frequent handlings should be avoided when possible, the railway and canal or river, work as little together as oil and water. Water-links are ever uncertain, and are one-third of the time positively useless, how unsuitable a clog are they therefore upon the incessant operations of a railway, and the more particularly so in this case, with a termination no where, that is at Havre de Grace, which will take a quarter of a century to grow into a coal mart, while in the other direction at Philadelphia, the consumption is already between one and two hundred thousand tons, with an export demand of at least from 4, to 500,000 tons more, which also will be continually on the increase. Harrisburg might be a point of delivery, if it could be made the head of sloop navigation for 150 ton boats, which could clear direct for eastern ports, but such a contingency is too remote, even were it practicable. The cost of mining coal in this region, and delivering it at Havre de Grace by railway and canal is thus stated.

	Per ton.		
Mining - - - -	$ .50		
Screening and loading cars -	12½		
Mine rent - - -	25		
Profit of miner - - -	50		
		$1 37½	
Transportation to Harrisburg by railway 35 miles - - -	70		
Transportation to Havre de Grace by canal 71 miles - - -	1 06½		
		$1 76½	
Waste - - - -		25	
			$3 39 per ton.

By the proposed continuous railway to Philadelphia, it could be delivered on the same terms, with the advantage of a sure market, and *without any interruption during the whole year.* Under these circumstances, it would be no wonder to see the Pinegrove region very soon rivalling that of Pottsville in the amount of its trade.

The coming season of 1842 will be one of unusual interest in the coal trade, particularly if the canals are all spared from freshets, and are enabled to open early in the spring, when the several regions will find themselves in hard conflict. The Lehigh and Lackawanna, versus the Schuylkill region with two avenues of railway and canal, which, despite their enmity, will be compelled to co-operate in maintaining the ascendency in cheapness, of their own region, while the consumer will be too glad to have the contest rage, as the party sure to profit by it.

EXTRACT FROM "A SKETCH OF A RAILWAY JUDICIOUSLY CONSTRUCTED BETWEEN DESIRABLE POINTS."

The construction of the New York and Albany railroad, 15 to 25 miles from the Hudson river, and running parallel with it, is about to be undertaken in earnest. That railways should pretend to contend against canals for freight, although that were considered presumptuous enough, was not so much wondered at; but that they should offer to compete *in any way* with the mighty Hudson, that truly great natural stream, in which the *auxiliary element* is found "without stint and without cost," is generally considered in New York as truly chimerical. Greater wonders than this, however, have been realized. Mr. Wood, for instance, the able editor of the "Practical Treaties on Railways," when it was advertised in England that a locomotive on the Liverpool and Manchester railway would be made to proceed at a rate of 15 to 18 miles per hour, interested himself to have the announcement suppressed, as being too absurd, and therefore injurious to the cause; yet Mr. Wood was, shortly after, carried himself at the rate of 40 miles per hour, and although the ground is much narrowed of late for equal progress, yet there is continued evidence of advances in one or other branches of the railway.

It is shown in note No. 11, that in the south, rivers using steam are being *deserted* for the railway. The same cause should have the same effect at the north. In one sense, for the freight from and to Albany and New York, during the season of navigation, it is not pretended that the railway would attempt to compete with the river, but in other senses *sufficient to warrant the work, it can do so effectually*, and its advocates are fully justified in urging both its importance and its *profitableness* upon the community. The following is a summary of the reasons urged by them in its favor, which it behooves every New Yorker to examine and fully to understand, as his decision, either way, must be fraught with important consequences to himself and to his posterity. (See report of the Common Council of the city of New York for 1840 on this subject.—Document No. 10.)

1. Authentic statistics show that apart from the river, on the *line* of the road, the tonnage now got to market at great expense, is at least 100,000 tons.

2. That the summer travel for eight months, in 1839, was 3,500 per day, exclusive of sloops and market boats, or equal to through passengers, *each way*, per day, between Albany and New York, 1,000.

3. That once the competition by railway was open, and the travel *divided* with the river, the number now crowded into each boat would cease, and the two conveyances would then carry about an equal number of through passengers per day each way, far more comfortably.

4. A steamboat, costing $70,000, capable of accommodating properly the above number, would cost in fuel, wages, wear and tear, insurance, etc., about $2 per mile, performing the trip, on an an average, in 10 to 11 hours.

5. The locomotive and train, costing together $20,000, capable of accommodating properly the same number, would cost in fuel, wages, oil, wear and tear, including *charge for repair of road*, 80 cents per mile, performed on an average in seven hours.

6. The following is the data upon which the above statements are made: first, as regards the expense of running a steamboat on the North river. At present wood is the fuel generally used, but anthracite coal is being introduced with apparent present economy, but it is yet doubtful if it will be found so ultimately, the heavier boats, with large fire surfaces, not being able to dispense with the blower it is said, and which is found injurious to the boilers. Nevertheless, for ferry boats, tow boats, etc., the use of coal is increasing, particularly with those on the sound.*

* This has reduced the price of wood to $4 per cord for Virginia pine, which used to sell at $5 and $5 50 per cord. The engineers of the boats to Albany say they consume about

Cost of boat \$70,000, at 7 per cent., - - -	\$4,900
Wear and tear, 12 per cent., - - - - -	8,400
Fuel, 220 trips, 40 cords per trip, 8,800 cords, at \$5 per cord, - - - - - - -	44,000
Insurance on \$70,000, at 3 per cent., (their own underwriters generally), - - - - -	2,100
Oil, tiller ropes, packing, etc.. - - - - -	2,400
Wages, 1 captain, \$1,500 ; 1 2d captain, \$600 ; 2 pilots, \$800 ; 2 engineers, \$1,000 ; 6 firemen, \$960 ; 10 deck hands, \$2,000 ; steward, \$400 ; 12 assistant stewards, \$1,440 ; barkeeper, \$400, together, - - -	9,100
Deduct interest on capital, *to put it on an equal footing with the railway,* - - - - -	4,900
Average trips per season of eight months 220, or equal to \$300 per trip of 150 miles, - - - -	\$66,000

The above then, excluding interest on capital (wood costing five to six dollars per cord, and the consumption being equal to one cord to about every four miles), brings the cost of running a steamboat on the Hudson river \$300 per 150 miles, or at - - - - - -	per mile \$2 00
On Lake Erie, upan data given by Mr. Klein, between Buffalo and Detroit, to and fro, 720 miles, (wood costing only \$1 50 or \$2 per cord, and consumption as above), excluding interest on capital, the trip round costs \$900, or - - -	per mile \$1 25
A locomotive and train, equal to the same number of passengers per trip, (on an average of fuel, so important in either case), would cost, excluding interest on capital, but including an allowance for repair of road, which the steamboat has free, to be fully covered, say \$80 per 100 miles, or - - - - - -	per mile 80 cts.*

These comparisons then show most clearly that the actual running cost without allowance for interest on capital in any case, is less by railway, but particularly in the middle States, where wood fuel is the

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one ton of anthracite to every twelve miles, or twelve tons per trip, and which is delivered at about \$6 50 to \$7 per ton. This would reduce the running cost of boat to \$1 20 per mile or a saving over wood of 80 cents per mile, unless counteracted by the quicker destruction of the boiler.

* To accomplish the years business our trains have traversed (on an edge rail) a distance of 110,540 miles. Dividing the expense, \$67,282, on this, will give the average cost of working the road 60 8-10th cents per mile run.—J. E. Thompson's report, Georgia railroad, May 10, 1841.

In 1840, on the Utica and Schenectady railroad, with a *flat bar*, the business was accomplished by the trains having traversed 145,260 miles for \$119,900, equal to about 80 cts. per mile, the repairs to the road that year exceeding the preceding by \$13,000, or equal to nine cents per mile. Of course these fluctuation will occur, and will vary on different roads. A fair average for roads over 50 miles, with an edge rail, would be about 75 cents per mile run, which would include *cost of transportation, motive power, and repairs to road and management.*

dearest, and performing more than the steamboat, it generally operates an entire saving to the traveller of the fare by the latter, of which we have the practical illustration given in No. 36, which shows that the railway is preferred at even a higher rate, where they run parallel.

It would, however, be best tested between New York and Albany, where it would be seen that *for the business travel* the railway would have the preference at even a higher fare, being enabled to return the traveller the same day after a respite of an hour or two at either end, which cannot be done by steamboats; the loss by which would be, to the business traveller, on an average, at least equal to a fare of $1 50 to $2 per trip. The railway would thus be a regulator of the steamboats, and without any jealous or rival feelings, they could arrange with profit to both, to accommodate the public with the choice of cheap conveyances, the immense travel in the season of navigation being sure to require both. Under the present system, the fare is very fluctuating, from three dollars down to one, the latter, however, only nominal, for besides the fifty cents for supper, the traveller finds also superadded, an extra charge of two dollars for a state-room, and from one dollar down to fifty cents for a berth, according as he may think fresh air indispensable to his comfort, or he has the choice of escaping these charges by exposure on deck to the night air. The dividends made by these steamboat companies are said not to be less than 25 to 30 per cent. per annum, and without a *regulator* may easily reach 60 per cent. per annum before long.

Compare this to the railway, affording a clean charge of two dollars, and a clear *undisturbed* delivery, in six or seven hours, without foregoing home fare, wholesome air, or suffering any loss of time, the latter often so invaluable.

7. In the winter the railway would of course be without opposition, and at $5 dollars per head the traveller would then be *far better* accommodated than he is now at $15 to $20 in a winter trip to and from Albany.

8. A *night train* to *sleep* two to three hundred passengers, as on the Baltimore road, would always be *full.* Starting at 9, P. M. and *awakening*, after an uninterrupted rest, in Albany at about 6, A. M., would be admirable, as compared with the steamboat, by which you now start so as to sup away from home, and are aroused at an inconvenient hour without rest and generally from a pestiferous pillow. This could, however, be occasionally resorted to by way of a change.

9. As already conceded, the tonnage on the river in the summer to and from New York and Albany may be yielded to the river, as it can there be carried from the enormous scale of towage at about *twenty-five cents* per ton, while between those points on the railway, by *the limitation* of the *load* over the grade of 30 feet, the cost of transportation is enhanced 75 or 80 cents per ton per 100 miles. But for the greater portion of its length the road is ten to twenty miles *away* from the river, and for the *way freight*, provisions, and building materials, would be without a competitor.

For a distance, also, of near one hundred miles, from a dense business point *in the direction of the trade towards the city of New York*, the grades are moderataly descending, over which the cost of freighting, not exceeding 50 to 60 cts. per ton per 100 miles, would give the road an opportunity to attract much profitable business to it, skirting as it does the States of Connecticut, Massachusetts and Vermont, which would each furnish also their fair quota of way travel.

10. The construction of the railway, to realize all we have said above, and as a matter of pride to the State and city, should be of the *first order*. This we should say could be accomplished for four millions of dollars, which would allow for an edge rail of 56 lbs. per yard, and to be graded for two tracks for the 146 miles from Harlem river to Albany and Troy.

And how might this be contributed, with such evident advantage and honor to those who would embark in it? Thus we will say:

The State, Make the road bed for 146 miles from Harlem river to Troy, contributing a loan, at 6 per cent. per annum - -		$1,500,000
Residents on line of the road, Furnish the right of way and depots, taking stock to the amount of - - -	400,000	
The city of Albany, Contribute to the road in stock, say in the proportion of one-third of the amount agreed by them to be contributed to the *Boston and Albany railroad* - -	350,000	
The city of Troy, Contribute sufficient in stock to connect that city with Greenbush, opposite to Albany - - - - -	150,000	
The city of New York, Contribute sufficient in stock for the cars, motive power, and sight for depots -	600,000	
The leading capitalists of New York, The superstructure, to be equal to the most approved and recent models in England as to solidity, etc. An opportunity is here presented for a *lucrative investment*, which would far outstrip in utility and profit that fine structure the ASTOR HOUSE, and would be the means of more widely extending the usefulness of the intended *munificent bequest* to the city of a PUBLIC LIBRARY, say -	*1,000,000	—2,500,000
		$4,000,000

* Of this sum, about $600,000 would be required for the iron rails, a contract for which at the present depressed state of the iron trade in England, could be obtained on the most

The investment could be relied upon as yielding at least 10 per cent. nett dividend, on a capital of $2,500,000, after paying the interest on the loan from the State, and every one would feel its collateral advantages in bringing to the city the nothern and western travel at all seasons of the year, as well as greatly increasing its supplies of provisions. This subject in particular is worthy of investigation by a *special committee*, to be got up by the above parties, and its attention would also be worthily directed to the whole subject treated of in this work, as a means of refuting or verifying its statements, so important, when really based in truth, to the general interests of the country. By the 1st of November next the advantages to Boston of a connection with Albany, by railway, will develope themselves, for the especial consideration of the citizens of New York.

The tender of such a contribution as that which would furnish the superstructure should be the means of securing all the rest, and it would not be inappropriate, in that event, that the road be approached by a monumental arch, on which should be inscribed the NAME OR NAMES, of he or they, who would thus have started and inspired confidence in so *useful and necessary* a work.

As the main stem to the northern railroads, the saving and convenience to the winter travel would be immense; and who, in looking ahead three years, in which time the New York and Albany railway could be put into operation, would say that it could then want profitable occupation, considering that the present enormous travel between those points will have nearly doubled, if there be any truth in the report of the owners of steamboats, officially made to Congress, which gave the average ratio of increase in that direction at 100 per cent. for each successive period of five years for fifteen years.

It is also in similar periods, or in cycles of five years, the whole population manifests its movement, which is scarcely perceptible in its progress from the ripple to the wave, but which then declares it self in the evident enhancement of all real values; and although there will come intervals of overgrowth, which will debilitate it for a period, yet the elastic energies of such a population are sure ultimately to recover it from all adverse pressure. It is now performing a reaction of this sort.

[From the Civil Engineer and Architect's Journal.]

WARMING BUILDINGS BY HOT WATER.

The subject of warming buildings by hot water having lately excited a more than ordinary degree of interest, owing to the recent disasterous fire at Manchester, we lay before our readers a report

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advantageous terms, both as to price and mode of payment. The price for June, 1841, was per ton 8*l*., lighterage 2*s*. 6*d*., commission 3*s*. 6*d*., freight 15*s*., insurance 3*s*., together 9*l*. 4*s*., at $4 80—$44 16 per ton.

It is a curious coincidence that the same apathy should pervade the communities of New York and Philadelphia, in respect to works about equally vital to each, as the New York and Albany, and Philadelphia and Pottsville railways. See Journal of Commerce of 23d June, as respects the first, which has, however, no immediate rival interests to shock like the second.

made to the Manchester Fire Assurance Company, by Mr. John Davies, M. W. S., and Mr. G. V. Ryder.

"Before we proceed to detail the experiments which we have made, we shall briefly describe the appearances observed, and the information obtained at a few of the principal places which have been visited. We shall then be enabled not only to confirm but to extend the statements in Mr. Ryder's first report.

It has been found, on inspection, that Birch chapel has, at various times since the occurrence alluded to in the former report, sustained much damage. Wood, matting and cushions have, in a variety of places contiguous to the hot water pipes, been charred to an alarming extent.

With respect to Mr. Barbour's warehouse, farther inquiry has fully corroborated the previons statements of its having been on fire, close to the pipes, at different times and in different places.

Of the Unitarian chapel, in Strangeways, the directors are already in possession of information from both Mr. Ryder and Mr. Rawsthorne, and this information seems to leave no doubt as to the injury which has resulted from the use of Mr. Perkins' hot water apparatus.

The heat in the Natural History Museum having been repeatedly stated to vary in different parts of the pipes, and to become, in some cases, the greatest at places remote from the furnace, the fact has been confirmed by our own observations, and by our subsequent experiments. As this circumstance has excited much interest, and been generally questioned, we shall presently endeavor to assign the cause.

The apparatus, which it may be proper to notice in refference to its general form and construction, consists simply of a long, endless iron tube, carried, in different directions, from a furnace to which it returns, and in which about one-sixth of the whole length is inserted and formed into a coil, so as to be sufficiently exposed to the action of the fire. The tube is at the commencement, filled or nearly filled, with water, which, by the application of the heat, soon begins to circulate, and, in that way, to impart an increase of temperature to the apartments which it traverses. The dimensions of the pipes are such, that on the average, eleven feet in length will contain one pint of water. Connected with the principal pipe are two others, which are opened by a screw, one to allow for the ultimate expansion, and both subservient to the introduction of water.

As far as lay in our power, we have made such experiments as occurred to us, repeatedly, and under every variety of circumstance.

Not having any instruments which would furnish speedy and adequate criteria for the determination of high temperatures, we have resorted to the inflammation of combustible bodies, and the fusion of others, depending on the recent and high authority of Professor Graham for the degrees which they indicated.

The ordinary method hitherto resorted to for ascertaining high temperatures in the pipes, is to file a small portion perfectly smooth, and observe the progressive changes of color which occur. We did not neglect this expedient; and we witnessed, to great advantage, the successive and beautiful tints. As the temperature increased, we were presented first with a straw color, then a deep bluish purple, and finally, with a dark silvery hue. The first is said to indicate 450°, and the blue 600°.

In the Natural History Museum we applied our tests, but were enabled to do so only to a very limited and unsatisfactory extent. Mr. Walker, the proprietor of the patent right for Manchester and the neighborhood accompanied us to the establishment of Messrs. Vernon and company, engravers, where we had the opportunity of trying the system rather better, but still imperfectly. Finally, Mr. Walker acceeded to our request to have put up, on his own premises, a suitable apparatus, which was to be submitted entirely to our control. It consisted of an iron pipe upwards of 140 feet in length, 26 of which were coiled in the furnace; 20, at least, being freely exposed to the full action of the fire.

In addition to the apparatus, as at first fitted up, we had a branch pipe and a stop cock, which enabled us, by cutting off at pleasure a great portion of the circulation, to perform our experiments on a contracted scale, and under a variety of modifications.

Mr. Walker, being from home at the time, placed his foreman entirely under our directions, so that we had the opportunity of pursuing the investigation to any extent which we might think proper. It is but justice to state, that this person rendered, very willingly and with much practical skill, all the assistance which was required.

The apparatus having, on Friday the 5th ult., been fitted up and found on trial, to be in proper condition, the experiments were commenced on the following morning, at ten o'clock, when the apparatus had arrived at a suitable state.

I. *First class of experiments, viz. those made with the whole length.*

1. The pipe from the furnace became very soon sufficiently hot to singe and destroy small feathers resting upon it.

2. Speedily afterwards, the same pipe exploded gunpowder.

3. On the highest pipe, within a foot of the expansion pipe, bismuth was readily melted, denoting a temperature exceeding 470°. The pressure at this point must have exceeded 35 atmospheres, or above 525 pounds on the square inch.

4. Feathers were singed instantly, and matches lighted, at the same place.

5. Gunpowder inflamed readily in various parts of the flow pipe, and on the expansion pipe.

6. Blocks of wood, of five different species, were charred: from the dea wood the turpentine issued profusely.

7. Other combustible materials were also severally much charred.

II. *Class of experiments, with the shorter circulation. By this change a greater pressure was immediately observable, as the expansion pipe and several of the joints emitted steam, and admitted the escape of water.*

1. Cane shavings, on the pipe above the furnace, readily inflamed.

2. Lead melted at the same place; and the temperature must, therefore, have exceeded 612°. Making a rough calculation from

the table of the French Academy, which does not extend beyond 50 atmospheres, I take 612° to represent 75 atmospheres, or about 1,125 pounds pressure on the square inch.

3. Different wood shavings inflamed on the upper pipe.
4. Cotton ignited freely at the same place.
5. Matting inflamed at the same place.
6. Cotton, hemp, and flocculent matter, collected from Mr. Schunck's fustian room, ignited on the returning vertical pipe.
7. The blocks of wood, tied to different parts of the tube, were much acted upon and charred in a very short time.

Observing the expansion pipe to be in a state of considerable agitation, and warned of an explosion, the temperature was reduced, and the experiments were, for the time, suspended.

The pipes having, before three o'clock, been refilled and screwed up, for the express purpose of an explosion, the following experiments were made in the progress of the preparation :—

1. Mungeet was readily ignited.
2. Different sorts of paper and pack thread were destroyed.
3. Bismuth fused instantly.
4. Cotton inflamed.
5. Sheep's wool became speedily charred, in 2″ or 3″ after the stop-cock closed.
6. At five o'clock the sheet lead, affixed to the upright pipe, freely melted ; steam issued violently from the bend in one of the upper horizontal pipes, and, in three minutes afterwards, the explosion occurred in the furnace pipe, at the top of the seventh coil, which presented, on subsequent examination, a lateral aperture about two inches long and about one-sixteenth of an inch broad.

In the lapse of two or three minutes after the commencement of the explosion, the furnace was entirely emptied of its contents, which were propelled, in a divergent direction, like one mass of fire, so as almost to fill the apartment. The force with which the ignited embers rebounded from the opposite wall, and other obstructions, occasioned them to scatter in profusion like a shower of fire over every part of the place. The noise was so great as to bring to the spot a multitude of people from the adjoining streets. A number of articles in the shop—as, for example, packing cloth, paper, and hemp—were subsequently found to be on fire in different parts of the premises.

These appearances and their immediate effects, seem to have been precisely similar to those which are said to have been witnessed at the explosion in the warehouse of Messrs. Craft and Stell, and would evidently have been inadequate, in the same situation, to produce all the consequences.

It may be here observed, that the experiments clearly prove, that the heat, in different parts of the pipe, is not uniform. Generally it is greatest at the highest elevation, where its superior temperature appears to be of the longest duration under ordinary incidental changes. At the commencement of the operation, however, and a short time after fresh fuel had been applied, the temperature was highest in the flow-pipe contiguous to the furnace. Another circumstance, likely to produce an inequality of heat, may be adverted to: the tubes are far from being of uniform internal diameter; the consequence of which must be, that as the same quantity of water has to pass, in the same time, through every part of the apparatus, the liquid must move with greater velocity at one place than at another, and thus, from obvious causes, develope a greater quantity of caloric. The difference is sometimes so great in the relative bores of the tubes employed, that in some which were examined, one tube had an internal diameter of 9-16ths, and another of $\frac{3}{4}$ths of an inch, that is to say, in the ratio of three to four; or, taking the relative areas or sections of the tubes, which represent the relative quantities of fluid contained in a given length, in the proportion of nine to sixteen. Thus, taking the velocity reciprocally as the section of the pipe, the velocity of the water at one part of the apparatus being represented by sixteen feet, the velocity in another part would be nine, or the rapidity of the current would be at one place nearly double that which it was at another.

It is stated, in a work recommending the hot water system, that "the application of heat fills" the ascending or flow-pipe "with minute bubbles of steam which rise rapidly to the upper part of the tube, and become there condensed into water again:" now, as condensed steam, wherever it occurs, produces seven times as much heat as the same quantity of water at the same temperature, we have, at once, a reason for the heat of the pipe being generally greater at a distance from the furnace than contiguous to it. This apparent anomaly, which has been repeatedly observed and denied, admits, therefore, of an easy explanation.

The explosion may, under different circumstances, occur from various causes.

1. As water expands in bulk about five per cent. from 40°, its point of greatest density, to 212°, the boiling point, the expansion must be very considerably more when raised to high temperatures. If, therefore, the pipes be nearly filled with water, and the expansion pipe not adequate or in proper condition, an explosion must be inevitable. Dr. Graham states, that, from freezing to boiling water, the expansion is from 22·76 to 23·76=100 to 104·4 nearly.

2. The conversion of the water into vapor, producing an expansion which is in the proportion of a pint of water changed into 216 gallons of steam, "with a mechanical force sufficient to raise a weight of 37 tons a foot high," must present a pressure upon the tubes sufficient to ensure their destruction. Dr. Graham makes a cubic inch of water to expand into 1,694 cubic inches of steam, or one pint of water to become nearly 212 gallons.

3. It has been observed, as an ordinary occurrence, by those much accustomed to the apparatus, that, in some cases, a quantity of gas is generated, and has been found to escape, in considerable quantity, when an aperture is made in the upper part of the pipes. The only gases which could be thus obtained are the elements of the water, oxygen, and hydrogen. The former would probably be taken up in the oxydation of the metal. Now the hydrogen gas, which would remain, has never been deprived of its elasticity, and never made to change its state, by any compressing force hitherto

applied. It is obvious, therefore, that inevitable danger must arise from its production. It may be worth while to remark, that air, steam, and hydrogen gas expand in the same proportion by augmentations of temperature. The law discovered at the same time, and by independent methods of experiment, arose out of the researches of Dr. Dalton and M. Gay Lussac. It may be thus expressed: Aeriform bodies expand the 1-480th part of their bulk on the addition of each degree of temperature. Thus, taking 480 cubic inches of steam or hydrogen gas at 32°, the mass becomes, at 33°, 481 cubic inches; at 34°, 482, cubic inches; and so on: or, in a general form, a bulk a raised d° of temperature becomes $a + \frac{d}{480^{\circ}}$.

4. The last source of explosion to which it is necessary to refer, arises from any casual impediment in the pipes: and it is freely admitted, that in frosty weather such an impediment is likely to occur; it has been found to result from other causes, as in the case of extraneous matter accidentally getting into the pipes, an example of which was recently presented in the establishment of Messrs. Wood and Westheads.

In a very obliging letter received, in the course of the investigation, from Sir Robert Smirke, it is stated, that, though he has "never seen the pipes heated sufficiently to ignite wood, except on one occasion," yet, "if a fire is incautiously made when there is a stoppage in the pipes from frost or other accidental cause, the pipe within the furnace may be burst or made red hot near the furnace. I have known the pipe, he adds, " so heated only in one istance, when the red heat extended to a distance of upwards of 12 feet from the furnace."

Sir Robert concludes his letter by suggesting a protective modification of the apparatus. " Therefore," he observes " to prevent the risk of fire to a building, I would never place the furnace in a room or cellar that is not fire-proof, nor would I have the pipes in any part of their circuit in *actual contact* with wood or other combustible material. Security, he continues, " is still more effectually attained by having a safety-valve upon the pipe near the furnace, by which explosion or excess of heat would be prevented."

That which has happened once, may, under the same circumstances, happen again. The exclusion from *actual contact* with combustible materials, could it be permanently ensured, would, when the red heat extended along the pipe upwards of twelve feet, afford at least, very reasonable grounds for apprehension.

On this system of warming buildings, therefore, danger must be produced from either negligence in the feeding of the furnace, or any stoppage in the pipes: the former evil may be obviated by proper precautions; but the latter, occurring unexpectedly, exists unobserved, and precaution and care must be equally unavailing."

Signed, JOHN DAVIES,
GEORGE VARDON RYDER.

March 10, 1841.

An answer to Messrs. J. Davies and G. V. Ryder's report on Perkins' System of Warming Buildings by Hot Water. By A. M. Perkins.

The excitement that has been occasioned by the destruction of Messrs. Craft and Stell's premises in Manchester, by fire, arising from the bursting of the furnace-coil of a hot water apparatus, on "Perkins' System of warming buildings by means of hot water" and the measures taken in consequence by the Manchester Assurance Company, have created an alarm as to the general safety of his plan, which the patentee feels it incumbent upon him to show is unfounded, and to prove that whenever accident has occurred, it may in every case be traced, either to the improper construction of the apparatus in the first instance, or to carelessness and mismanagement in the use of it. It appears by a report which has been extensively circulated by the Manchester Assurance Company, that a committee of the directors of that company was appointed "to inquire into the nature of the accidents which have recently occurred from the use of hot water apparatuses, and to report thereon;" in pursuance of which resolution, Mr. John Davies and Mr. George Vardon Ryder were directed "to institute a personal investigation into some of the cases referred to, and to make such experiments as might tend to satisfy their minds as to the causes of the accidents which had occurred."

In the report presented by these gentlemen to the directors, they commence by describing "the appearances observed" at some of the places which they visited. These appearances consisted of "wood, matting, and cushions, in a variety of places contiguous to the hot water pipes, having been charred to an alarming extent," and that Mr. Barbour's warehouse had "been on fire, *close to the pipes*, at different times and in different places." The Unitarian chapel in Strangeways, also showed marked "appearances," the floor being charred black, and at the Natural History Museum in Peter street, the matting on the floor had been charred, and the floor itself appears to have been scorched. The whole of these appearances were produced by one and the same cause—the overheating of the pipes; and this was doubtless occasioned by the disproportion of the furnace-grate and draught to the furnace-coil, like that erected on Mr. Walker's own premises, for the purpose of Messrs. Davies and Ryder's experiments. Mr. Rawthorne's communication respecting the Strangeways chapel affords sufficient evidence of an ill proportion and ill-constructed apparatus, the deficiency of heat, great consumption of fuel, offensive scent, and charred wood, are convincing proofs that the quantity of tubing laid down in the chapel was insufficient to afford a proper supply of warmth; and the endeavor to procure more heat by extra firing, sufficiently accounts for the great consumption of fuel, and the offensive scent given out by the pipes when thus overheated. In an apparatus justly proportioned, the water circulating in the pipes can receive but a given quantity of heat, and any fuel added beyond that point would not cause them to become overheated. It is necessary here to describe what "Perkins' system of warming" really is; for the patentee utterly disclaims the apparatus experimented upon by Messrs. Davies and Ryder as his, any further than that the pipes were closed in all parts.

Perkins' apparatus, then, consists of a continuous or endless tube, closed in all parts, a portion of which is coiled and placed within a *duly proportioned* furnace; from this coil the rest of the apparatus receives its heat by the circulation of the hot water flowing from its upper part, and which, cooling in its progress through the building, returns into the lowest part of the coil to be re-heated. The expansion of the water, when heated, is fully provided for by the expansion tube, which is of three inches diameter, and of sufficient length to afford an expansion space of from fifteen to twenty per cent; this, long practice has proved, is ample for the greatest heat which can be attained by the water, as it expands only five per cent from 40°, its point of greatest density, to 212°, the boiling point. This tube is placed at the highest part of the apparatus, and is empty when the water is cold: the furnace is provided with a damper, by which the fire may be regulated at pleasure. In a well managed apparatus, this damper is in general nearly closed after the fire has become well ignited, and the draught is so regulated that little more than a slumbering fire is kept up which at once economises fuel and prevents the possibility of the pipes being overheated. The degree to which the damper should be closed, depends entirely upon the goodness of the draught; and a very few days'—even a few hours' experience will show the person in charge of the apparatus the point at which it is desirable to keep it. To most of the apparatuses recently erected by the patentee, a self-regulating damper has been attached, acting from the expansion and contraction of the pipe; when this becomes heated beyond any given point to which the damper has been previously regulated, the elongation of the pipe by the excess of heat acting upon the handle of the damper, partially closes it; the draught is thus checked and the fire lowered; the pipe consequently cools, and in cooling, contracts; the contraction again opens the damper and the fire is revived. By this action of the self-regulating damper, any degree of heat from the pipes may be maintained within a few degrees; if the damper be so fixed as to work the apparatus at 250°, it will be found that the heat of the pipes will range between 255° and 245°, whatever quantity of fuel may be thrown upon the fire; thus again the overheating of the pipes is effectually prevented, and an equal temperature at the same time obtained.

In the arrangement and fixing of any apparatus, regard ought always to be had (as has been already stated) to the due proportions of grate surface, heating surface, conducting and radiating surface, and draught; and where these have been duly observed, accident becomes impossible, even if the damper should be left wide open. It is not deemed necessary here to state the proportions the above surfaces should bear to each other, but their necessity is sufficiently obvious; an unlimited supply of heat arising from an excess of fire or heating surface and draught, with a limited means of carrying off that heat, must cause overheating somewhere, as is proved by the high temperature of the apparatuses at Birch chapel, Mr.

Barbour's warehouse, the Strangeways chapel, and the Natural History Museum; while, on the other hand, the due observance of these proportions renders an apparatus upon this system perfectly safe. Nor can it be considered that, in claiming attention to the foregoing points in constructing an apparatus, the patentee demands too much; it is the duty of every tradesman who undertakes to erect these apparatuses to understand them; and too such an one, what has been said presents no difficulties; and surely common care and the usual degree of prudence required from every person attending upon fires may reasonably be asked for in the management of a hot water apparatus.

After this brief description of what hot-water apparatus erected upon Perkins' system ought to be, it is necessary now to examine whether the apparatus erected in Mr. Walker's premises, and experimented upon by Messrs. Davies and Ryder, is to be considered as an apparatus on Perkins' system, and what degree of weight ought to be attached to experiments conducted as they were, and upon such an apparatus. It appears from the report of those gentlemen, that it consisted of 140 feet of tubing, of which 26 feet were coiled in the furnace. With these proportions of tubing, no fault is found; but it seems from the diagram annexed to the report, that only 15 inches of expansion tube was attached to it (at least only that quantity was left unfilled with water,) which, supposing it to be of three inches diameter, the largest size used, is six inches less than the apparatus required. This in so small an apparatus, is a serious difference when worked at a very high temperature; still, however, under ordinary circumstances, the apparatus would have worked. The *damper* is not once mentioned in the report, nor does it appear that it was ever made the slightest use of during the experiments, so that the full force of the draught was admitted to the furnace at all times unchecked, even when it was loaded with fuel to repletion. This might suit the purpose of those who erected this apparatus with the express view of making it as dangerous as air, fire and water, recklessly employed, could make it; but what tradesman would introduce one so constructed into his employers premises? But more could yet be done to increase the dangerous tendency of this apparatus: and, accordingly in the absence of Mr. Walker, a stopcock was introduced, which, cutting off the greater part of the circulation, left only *forty feet of the tubing* out of the furnace, to carry off all the heat that could be communicated from *twenty-six feet within it*, with a fire out of all proportion to those surfaces, and a draught totally unchecked. With the apparatus in this state—a state in which no man in his senses ever before thought of working one, and which, it may be safely asserted, had never before occurred since the introduction of warming by hot water—preparations were made for an explosion. The process of "igniting," "destroying," "fusing," "inflaming," and "charring," various substances, went on most prosperously, and, at length, the desired explosion took place, the fire was thrown violently out of the furnace, and the ignited embers were scattered in profusion over every part of the place. Some gray calicoes spread around the furnace were alone wanting to complete the scene, and put the finishing touch to this exquisite specimen of Perkins' hot-water apparatus.

But can it be seriously intended that an apparatus thus erected, and thus worked, is to prove the *danger*, and caution the public against the use of Perkins' system of warming by means of hot water? Is the abuse of a thing to be used as an argument for discontinuing the use of it? To what invention will not such reasoning apply? Steam-engines, railways, all must vanish before it, since, if great skill and care are not employed in their construction, and much caution and prudence in their application, they become imminently dangerous.

Messrs. Craft and Stell's premises were burnt down; the fire was caused by the bursting of the furnace-coil of the hot water apparatus, which threw the ignited embers among combustible materials, and set them on fire. But was common precaution used in placing the furnace in such an apartment (the very walls of which were boards,) and in surrounding it with grey goods? Would not a vault or a cellar have been a more appropriate place? and had the furnace been so situated, would the premises have been destroyed by the explosion which took place? This explosion was caused by a stoppage in the pipes; the water in them was frozen. It appears the warehouse was closed on Saturday evening, and not opened again before Monday morning: the frost being intense during the two intervening nights. A fire lighted in the furnace on Sunday morning was an obvious means of preventing such an occurrence; and it might have been supposed would have naturally suggested itself. Weather of such extreme severity is not very frequent in England, and the short time required for such a purpose (the necessity of it being evident) could scarcely be considered a desecration of the day. And even after the pipes were frozen up, common attention on the part of the fireman would have shown him the circumstances in a few minutes after the fire was lighted; the want of any circulation in the pipes being always indicated by their great heat near the furnace and their coldness in every other part. Had the fire then been raked out and the most exposed parts of the pipes been thawed by the application of heat to them externally, the circulation might have been restored, and all would have been well. No precautions, however, of any kind appear to have been taken, and the endeavor to force a circulation in the state the pipes were then in, produced the disastrous event that ensued. It is not the object of the patentee to throw blame upon others, he only wishes to show that his apparatus may be used with perfect safety, if the same care and attention be bestowed upon it, as is required by every other mode of warning.

There are some palpable errors in the report of Messrs. Davies and Ryder in their remarks upon the inequality of the heat given out by the pipes in the Natural History Museum, and the manner in which they attempt to account for it. They observe, that the heat in those pipes had been repeatedly stated to become the greatest at places remote from the furnace, and that the fact was confirmed by their own observations and subsequent experiments; and in another part of the report they account for it by stating, that the minute bubbles of steam which rise rapidly to the upper part of the flow-pipe become there condensed into water again. From this acknowledged fact, they deduce the inference that, "as condensed steam wherever it occurs, produces about seven times as much heat as the same quantity of water at the same temperature, we have at once a reason for the heat of the pipe being generally greater at a distance from the furnace than contiguous to it." This is a manifest absurdity, for it is impossible that increase of heat can be produced by the condensation or cooling of steam. There cannot, therefore, be the slightest doubt that the statement of those gentlemen, that the heat is generally greater at points distant from the furnace than contiguous to it, is founded altogether in misconception and error. Another observation from which erroneous conclusions are drawn, is, that the temperature of the pipes is influenced by the variation of their internal diameter, this is not the case; the amount of heat conducted off, depends upon the surface exposed to the atmosphere, and not upon the internal diameter. Equal surfaces exposed to the atmosphere give off equal heat, whatever variation there may be in the velocity of the current of the water within the tubes.

The objection No. 1, relative to the possibility of an explosion from the inadequacy of the expansion tube, has been already met in the description of the apparatus in the former part of this paper; and overfilling the apparatus is impossible while the filling pipe is made the only medium of supplying it, and the screw-plug of the expansion tube is at the time of filling taken off.

In objection No 2., it is inferred that, because a pint of water may be converted into steam capable of exerting a powerful mechanical force, and present a pressure upon the tubes "sufficient to ensure their destruction," that such must inevitably be the case. Ten years experience has, however, proved the contrary; any quantity of steam which can be formed in an apparatus properly put up, the tubes are perfectly able to resist.

Objection No. 3, supposes the presence of hydrogen gas in the apparatus to be a common occurrence, instead of a very rare one; and where it has occurred, it has invariably arisen either from a faulty construction of the apparatus, or great neglect in its management. Admitting, however, that hydrogen gas has been formed within the pipes, no explosion can be produced by its expansion, as its expansive power is far less than that of water; neither can it explode within the pipes by ignition, as it requires an admixture of atmospheric air to render it explosive.

The remaining objection urged against the use of the apparatus is, the danger of explosion from stoppage in the pipes. This is a very unusual occurrence, and rarely happens except in seasons of very severe frost, when it may always be prevented by keeping a slumbering fire. The addition of three per cent. of salt to the water will also prevent it from freezing, even during such severe weather as was experienced last winter. The objection of stoppages by extraneous substances getting into the pipes, is scarcely worth notice; the last operation of the workman in erecting a new apparatus is always to scour the pipes well through by means of a forcing pump, and then to close them up. How then can any substances get into pipes thus closed in every part, except by design?

It seems that previously to putting up the apparatus at Mr. Walker's those at the Natural History Museum, and Messrs Vernon & Company's, had been tried and found "unsatisfactory;" that is to say, they could not be sufficiently overheated. The patentee can show Messrs. Davies and Ryder some hundreds of apparatuses that would prove still more "*unsatisfactory*" to them than those just named. Since the foregoing remarks were written, Mr. Perkins has received a letter from Sir Robert Smirke, in which that gentleman says, "I am sorry to know that you think the partial use of my answers to the questions sent to me from Manchester (as printed in the report there) has been in any degree prejudicial. If it has been so, I think you ought in the reply you are about to publish, to counteract that effect, especially as it was one not at all intended. They should, at least, have directed equal attention to my remark that complete security, under every contingency, might be obtained from the adoption of your safety-valves."

Comment upon this is unnecessary; it only strengthens the feeling which the perusal of Messrs. Davies and Ryder's report has very generally produced, viz. that it is very unjust, and that the absurd experiments detailed in it were conducted with any view rather than that of candid investigation.

If those who possess the means of obtaining the information would make known the causes of all the fires that have come under their cognizance within the last eight or ten years, as far as they can be ascertained, the patentee is confident that such a statement would speak more in favor of his apparatus than the most labored arguments. There are not wanting, however, many persons even in Manchester itself, who, placing more confidence in their own knowledge of the apparatus, founded on several years' experience, than in the report, have unhesitatingly expressed their determination to continue the use of it as heretofore.

The safety-valves, alluded to by Sir Robert Smirke, have been but recently applied; and effectually provide for any casualty which can arise from a stoppage in the pipes.

In conclusion, the patentee begs that the Directors of Assurance companies, and the public generally, will not hastily form their opinion of Perkins' hot-water apparatus from the very erroneous reports which have been circulated respecting it, as it is his intention to request a committee of competent gentlemen connected with Insurance offices to inspect an *apparatus properly constructed* and which he *wishes* to have subjected to any test to which such committee may think proper to submit it.

6, *Francis Street, Regent Square,*
April 10th, 1841.

EXTRACT FROM THE ANNUAL MESSAGE OF THE GOVERNOR OF NEW JERSEY.

"There are questions of some importance depending between the State and the Camden and Amboy railroad and transportation company, and also between the State and the New Jersey railroad and transportation company, which will require the attention of the legislature. They arise upon the extent of the claims of the State for transit duties, and per centage on the transportation of passengers, reserved in their respective charters. I do not call it a controversy, because it results from a difference of opinion between the officers of these companies and the officers of the State, as to the true construction of those acts, and from no disposition, as I am assured, to avoid on the part of the companies a faithful discharge of their liabilities to the State. It is proper that the subject should be adjusted, and the right ascertained. The State can have no disposition to encroach upon the companies, but her just claims against them must be insisted on, and it will be your duty, representing her interest at this time, to see them maintained and recovered. The question affects the revenue of the State, and should therefore not be passed by.

"By the act of March 1832, provision was made for securing to the Delaware and Raritan canal and the Camden and Amboy railroad and transportation companies, (which companies had by an act of the preceding year been united into one,) the exclusive right, during the continuance of their charter, of transporting passengers and merchandize by railroad between the cities of New Yord and Philadelphia. The act declares that no other railroad should be built between those cities, to compete with the companies named, without their consent, reserving only to the State the right to grant a charter for a road between New Brunswick and the Hudson, which reservation was doubtless made from the fact that an application for such a charter was then pending, and which became a law in a few days thereafter. By this act great power was confered, no less than the entire and exclusive right of way, by railroad, across that part of the State over which not only the travelling between the two great cities of New York and Philadelphia, but from all parts of our extended and rapidly growing country, must pass. The company, as a compensation for this important grant, agreed to transfer to the State one thousand shares of the capital stock of the companies, and further stipulated that the dividends on that stock, and the transit duties on the road, should amount to $30,000 annually. The dividends and transit duty do not, of late years, amount to that sum, but there is a deficit of several thousand dollars, and yet under the guarantee, the companies are bound to pay the full amount of $30,000. This stock was transferred and is still the property of the State, and the $30,000 are annually paid into the State treasury.

"Had no subsequent acts been passed, the present difficulty would not have occurred, but the legislature, by the act of March, 1837, authorized these companies to erect a railroad from Trenton to intersect the New Jersey railroad and transportation company, and reserve to the State the same transit duties as were reserved on the road from Camden to Amboy. This transit duty the companies claim the right to carry to their account, to make up the $30,000 for which they have given a guarantee to the State. The effect of this is to deprive the State of all transit duty under the act of 1837, until it shall amount to more than the deficiency under the first act required to make up the $30,000. The loss to the State by this construction will be several thousand dollars annually.

"I think this, from any view I can take of it, a perfectly plain question, and that the transit duty under the act of 1837 must be paid, independent of any provisions in the act of 1832.

"They have no connection with each other, and must stand on independent grounds. This would be the construction if there was nothing in the last act upon the subject, but the fifth section of that act decides the question by declaring, that nothing in that act shall impair the right of the State to the shares it then held in the companies, or the interest or dividends accruing thereon, and to the transit duties for the transportation of goods and passengers, but that the State shall be and remain entitled to their said rights, privileges, and emoluments, as fully as if this act had not been passed. This is the first question depending between the State and these companies.

"The remaining question with the Camden and Amboy company, is of much less consequence, yet it is right and proper that it should be adjusted and put to test. The companies insist that by the 23d section of the original "act to incorporate the Camden and Amboy railroad and transportation company," passed 4th of February, 1830, the 3d section of the act of February 4th, 1831, and the 3d section of the act of 15th of March, 1837, they are bound to pay a transit duty only upon such goods and passengers as are brought from, and destined to, places beyond the bounds of this State. I do not perceive by a recurrence to those acts, that there is any thing to limit the transit duty to the decision of the question, where the goods or passengers come from or are going to, provided they pass over the road from South Amboy to Bordentown or Camden, or from New Brunswick to Trenton.

"The questions with the New Jersey railroad and transportation company, are of a somewhat different and more doubtful character. The first refers to the time when, by the charter, they are bound to pay a tax of one quarter of one per cent. upon their capital stock. The language of the 10th section is "that from and after the completion of the said railroad, and *after the expiration of five years*, the said corporation shall pay into the treasury of this State, yearly and every year, a tax of one quarter of one per cent. upon their capital stock paid in," and after ten years the tax shall be increased to one half of one per cent. Is this tax of one quarter of one per cent. payable at the completion of the road, or in five years thereafter? It seems to me that the legislature intended to name five years for completing the road, and that the company should pay the tax at the end of that time. That no tax should be demanded while the road was in progress of building was reasonable, and it was also proper that time for its completion should be allowed, but it is not so obvious that the State should wait five years after such completion; nor do I think such is the intention of the law. The remaining question arises under the same section which provides "That in addition to the tax, if at any time thereafter any railroad should intersect or be attached to this railroad, so as to make a continued line of railroads carrying passengers across the State of New Jersey, between the States of New York and Pennsylvania, then the treasurer of the company is required to make return of the number of passengers and the number of tons of goods transported over the *whole line of the road,* and to pay to the treasurer of the State at the rate of eight cents a passenger, and twelve cents for every ton of goods so transported thereon *in manner aforesaid.*" The question is made upon the words, "the whole line of the road." The company have a depot at the city of New Brunswick, but their road extends almost two miles further towards the city of Trenton, and it is contended that for goods carried from Jersey City to New Brunswick, they are not bound to pay any transit duty, because that is not the whole line of the road. The charter of the company authorises them to construct a road from Jersey City to the city of New Brunswick, and it is understood that the chartered limit of the city of New Brunswick extends as far south as the termination of the road, but in the case of goods unloaded at New Brunswick, they claim an exemption from the demands of the State. The words of the charter justify this construction, and I cannot but think that such is the true spirit and intention of this section. In construing statutes we must look into their spirit and object. This tax was not to be imposed until a road should be built intersecting the New Jersey railroad, and then only on goods passing over the whole line. I incline therefore to believe that the company is right in this particular, and that it is not bound to pay for goods and passengers unless they go over the whole line. This exemption, it will be observed, is only claimed to passengers and merchandize that stop at New Brunswick, and can effect only a minor portion of their business: for all the charges on passengers and goods that do so pass over the whole line, which embraces the large amount of their business, the company have paid with promptness.

WESTERN AND ATLANTIC RAILROAD REPORT.

Engineer's Office, Western and Atlantic Railroad,
Marietta, Ga. *October* 18, 1841

Sir: I have the honor to submit the following report upon the progress of the Western and Atlantic railroad.

Very respectfully, your obedient servant,
James S. Williams, *Chief Engineer.*

To His Excellency
Charles J. McDonald.

ENGINEER'S OFFICE, WESTERN AND ATLANTIC RAILROAD.
MARIETTA, GA., *October* 15, 1841.

GENTLEMEN: I have the honor to report concerning the progress of the Western and Atlantic railroad during the last quarter, that the amount of work done is as follows, viz:

185,285 cubic yards grading.
5,157 perches of masonry.
66,780 feet, board measure, of weather-boarding for bridges, delivered.
4,000 feet, board measure, of bridge timber, delivered.
1,919,925 feet, board measure, of timber for superstructure, delivered.

The value of which is - - - - -	$110,933 93
The amount paid - - - - - -	92,582 10
The amount of balances retained as security -	18,351 83
The amount of reserved balances paid on the completion of contracts since the commencement of the quarter is - - - - - -	10,341 28
The total expenditures from the commencement of the work up to the present date, on account of surveys, construction and the engineer service, is -	2,181,272 06

During the quarter, contracts have beem made on favorable terms for laying the timber part of the superstructure of the road between the southeastern terminus and the Etowah river, a distance of about 50 miles. The contractors are gentlemen whose testimonials of energy and experience in the kind of work they have undertaken, promises faithful and speedy compliance with their engagements. Arrangements have been made by the purchase of materials and apparatus, and by building the necessary tanks for subjecting the timber of the track and bridges to the preservative process of Dr. Earle.

The location of the road has been extended from its present southeast terminus, about 1,200 feet in order to occupy ground suitable for the erection of depot buildings. Proposals for executing the grading of this extension have been called for by public advertisement.

The original contractor for the tunnel having failed to comply with his agreement, the contract was declared forfeited, and arrangements made for the continuation of the work by engaging a contractor to complete the excavation of the approaches, and by inviting proposals from experienced tunnel contractors for the excavation of the tunnel proper. The excavation of the approaches is progressing steadily. Several proposals have been received for the completion of the tunnel. The indications of geological formation, apparent from the present state of the excavations, lead us to expect favorable material for the safe and easy completion of the work.

I submit the following estimate of amounts required for the prosecution of the work:

To fulfil existing contracts for the grading, masonry, bridges and superstructure, not including iron rails, chairs and spikes, the amount required is	$408,764 11
For the purchase and laying of iron rails, chairs and spikes for the road south of the Etowah river	254,640 00
For the completion of the road besides the above-mentioned sums, there will be required for grading, masonry and bridges, not yet contracted for, including the tunnel through Little Blue ridge	226,400 00
For the superstructure north of the Etowah river, (about 95 miles) - - - - -	779,000 00
For the necessary depot buildings, work shops, turn tables, car houses, passenger houses, water stations, store houses and machinery in workshops -	76,000 00
For locomotive engines, passenger and freight cars	150,000 00
	$1,894,804 11
Adding 5 per cent. upon this amount for engineering, superintendance and contingences -	94,740 20
We have, as the sum required for the completion of the work, and for putting it in operation -	$1,989,544 31

Among matters which at present claim your attention, I would urge as immediately necessary, the erection of depot buildings, water stations and warehouses, and the purchase of locomotive and stationary machinery. The plan of buildings should be made suitable for the business of an extensive and active trade, the style plain and substantial. In the purchase of machinery, we should be governed not by the fancy or prejudice of those who uphold the claims of a particular model of engine to the exclusion of all others; but by the very full experience of the working of the different kinds of engines made in our country. The cost of locomotive engines is nearly equal in several of our manufactories. The difference in the service they perform is to be measured principally by the cost of repairing them. In the question of choice among the different models, too much stress is laid upon a supposed intrinsic quality or power of traction that one model may possess over another. The power of traction is the result of adhesion, and this the effect of gravity. Therefore, in choosing among the approved kinds of engines, faithfulness and accuracy of workmanship are mainly to be considered. This subject is one of great importance. A choice should be made of a particular kind of engine for our road. There should be but one kind employed, and not more than two classes of that kind: one for the heavy duty of transporting freight, the other for the rapid passenger srvice. The advantages on the score of convenience and economy in the similarity of construction of all machines on our road is obvious.

The portions of the road that have been completed are in excellent condition. The drainage upon which the character of the road surface so much depends, is in good order. No damage worthy of notice has resulted from the frequent heavy floods and freshets.

The progress of the work is as rapid as could be expected under the unfavorable circumstances of scarcity of mechanics and laborers, and the depreciated value of our currency.

I have the honor to be, very respectfully,

Your ob't servant,

JAMES S. WILLIAMS, *Chief Eng'r.*

To the BOARD OF COMMISSIONERS
of the Western and Atlantic railroad.

NEW YORK AND ERIE RAILROAD.—We are happy to be able to place before the public the following exhibit of the revenue on this important work of internal improvement. Its results exceed the most sanguine expectation, and when it is considered that the part of the road completed does not reach any important point of communication or trade, it would seem that scarce any calculation of the profits which will be derived from it when entirely finished, would be too large.—*New York Courier and Enquirer.*

" A statement exhibibiting the gradual increase of revenue upon the eastern division of the New York and Erie railroad, between New York and Goshen. from the opening of the road on the 23d September to 30th October 1841—33 working days.

Sept 23.		Average of each day.
1st week, 3 days, revenue -	$ 476 40	$158 80.
2d " 6 " " - -	1178 52	196 42.
3d " 6 " " - -	1300 32	216 72.
4th " 6 " " - -	1727 46	287 91.
5th " 6 " " - -	2274 90	379 15.
6th " 6 " " - -	2426 46	404 41.

NOTE.—The receipts upon the 28th, 29th and 30th of October, average $409 06 per diem."

LOCOMOTIVE STEAM EXCAVATING MACHINE.—There is now exhibiting in New York, at the Fair of the American Institute, a machine, the invention of a Mr. Cochran, which is said to be fully worthy of the high commendations bestowed upon it as an immense labor-saving machine. On an average one thousand cubic feet of earth may be excavated and placed in the cars in the course of a day; and the workmen have dubbed it the " Steam Paddy." "We hardly know," says a New York paper, " which most to admire, the perfect control which the engineer possesses over its diversified motions, or the vast amount of labor it performs in a given time." It operates equally well under water, and may be used in clearing out docks, digging canals, etc. Mr. Cochran has a contract in negotiation with the British Government, to dig a ship canal three and a half million cubic yards in length, for which they offer fifty cents per yard. Mr. Cochran says he is satisfied he can accomplish the work at an expense to himself of from five to ten cents per yard, which would leave a pretty fair profit as times go. He has patented his machine in England, and in most of the kingdoms of Europe, and he now proposes to get up a company to contract for all the heavy works of excavation."

AMERICAN

RAILROAD JOURNAL,

AND

MECHANICS' MAGAZINE.

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REMARKS UPON A PAPER "ON THE BUILDING MATERIALS OF THE UNITED STATES OF NORTH AMERICA.—*By* DAVID STEVENSON *C. E.; Edinburgh*."—*Read before the Society of Arts for Scotland, in session*, 1841.

Mr. Stevenson has already become known to the profession in this country by his work upon Civil Engineering. The paper upon which we design to offer some remarks, has been but recently published, and probably from the length of time elapsed, the writer's memory has failed in recording many things which actually fell under his observation and for this, due allowance must be made. As this paper however, attempts to give general information as to our building materials, and as it has been very widely circulated, we have thought it incumbent upon us to notice a few of the egregious errors which the writer has made.

In characterizing Scotland as a stone country, and England as a brick country, Mr. S. adds, that the United States may be considered as a timber country, and supports his position by our *shingle roofs*, and *corduroy roads*, which latter are considered as compared with the McAdam roads of England and Scotland, the stone paved roads of France and the "clinker" pavements of Holland in which comparison our corduroy roads of course bring up the bottom of the list.

In speaking of iron, Mr. S. says that it is "pretty abundant," and forgetting our manufactories of machinery in all its forms, dismisses the subject with the following remark.

"It may be safely said, that the manufacture of iron in the United States, and what is more closely connected with the subject of this paper, its application to engineering works, are still in their infancy, at least when we regard the great extent and perfection to which these arts have been brought in Britain; and my observations on the materials of the country will therefore be confined to those of masonry and carpentry, as these are in some degree peculiar to the country, and any remarks regarding them will of course be more interesting."

Under the head of Brick, the following general remark is made:

"Experience in our own and in many other countries, has proved that brick is well suited for house-building; but experience has also shown that it is by no means so well adapted as stone for engineering operations generally; and to some works it is with us considered wholly inapplicable. Marble and granite, of which I shall afterwards have occasion more particularly to speak, occur in the northern parts of the United States; but stone easily accessible to the quarrier, and fitted for building purposes, is very rarely to be met with, and the American engineers have therefore been obliged, as is the case in all countries, to adapt the structure of the works to the materials they possess; and in making this adaptation, they appear to have violated many of the established rules of engineering as practised in this country. The scarcity of stone, and the unsuitableness of brick for hydraulic purposes, for example, has forced them to construct most of the locks and aqueducts on the lines of their great canals, wholly of timber, with which the country abounds; and that material, ill adapted as it may seem to such a purpose and situation, where it is not only exposed to the constant tear and wear occasioned by the lockage of vessels, but also to the destructive effects of alternate immersion in water and exposure to the atmosphere, has nevertheless been found in practice to form a very good substitute for the more durable materials used for such works in Europe."

Although wood has too often been used under the circumstances alluded to, it has been not so much from want of stone as a desire to complete works hastily and economically, yet there are many cases in which substantial stone works might have been noticed, in which "the established rules of engineering" have not been "violated;" for instance, the locks on the Delaware and Raritan canal. The use of wood instead of stone blocks for railroads seems here and elsewhere to be considered as one of these violations, practice has now given the preference to wood, and stone blocks have been removed to make way for a material more perishable in the abstract, but more enduring as a component part of a railway structure.

In the notice of Granite which we insert, we are gravely told that the Sing Sing marble is a dark grey or bluish granite! of which the Astor House, "one of the few stone buildings in New York," is built.

"Granite is worked in the northern part of the country at Quincy in the State of Massachusetts, and at Sing Sing in the State of New York, and also in New Hampshire. The Quincy granite is of a fine grey color, and can be quarried in large blocks. It has been used a good deal in Boston and the neighboring country for architectural works. It has also been employed for railway blocks on some of the lines of railway in the neighborhood of Boston, and in the construction of the only two graving docks which exist in in United States, the one at Boston, and the other at Norfolk in Virginia, the latter at a distance of upwards of 500 miles from the quarries; and these, so far as I am aware, are the only engineering works of any consequence in America in which granite has been employed.

"The Sing Sing granite, which is of a dark grey or bluish color, is quarried on the banks of the Hudson, about 25 miles from the town of New York, at which place it has been pretty generally used for some time for stairs and lintels, and has lately been introduced for facing buildings. The Astor hotel, the largest in America, and perhaps in the world, which is one of the few stone buildings in New York, is built of this granite."

Have we not a "granite State" and mountains of granite, or can any one travel over but a small portion of our primitive formation without constantly noticing the immense masses with their surface already exposed and seeming to invite the hammer and the drill? But we cannot better correct these statements than by giving the following extract from Dr. Lee's Elements of Geology, etc.

"For building purposes, no country in the world possesses such an inexhaustible quantity and variety of granite rocks as New England; none more duarble in structure, or beautiful in appearance.

"Of the eastern States, Maine is pre-eminent for the abundance and excellent quality of her various granite rocks, which offer facilities for quarrying and exportation unequelled by those of any other part of the known world. Here all varieties are to be met with, porphyry and syenite, more beautiful than that of Pompey's Pillar or Cleopatra's Needle, to the close-grained, compact granite so often seen in the public buildings of New York and Boston. Situated directly upon navigable waters, it can be quarried and transported to market cheaper than perhaps any building material in the country; many of the quarries of Maine, Dr. Jackson states, can furnish unhewn blocks of any size, on board ship, for $1 12 per ton, and the expense of transportation to New York is rarely more than $2 50 per ton. As the article in any of our principal cities is worth $7 per ton, this will give a profit of $3 38 for each ton of granite. Masses suitable for columns command about 90 cents per cubic foot; so that a column similar to those of the New York Exchange costs $1,500. At Kennebunk, rough-split granite sells for $5 per ton of 14 cubic feet on the wharf. The price remains uniform up to the dimensions of 25 cubic feet, and above that measure, two cents per foot is charged for every additional foot. Stones for store fronts, hammered, sell for 75 cents per superficial foot; and where two sides of a stone are fine dressed and two rough hammered, three sides are charged, and nothing is demanded for the ends. Where three sides are fine dressed and one rough hammered, they charge for four sides and not for the ends. Numerous and very extensive quarries of granite are now worked both in Maine and Massachusetts, which are a fruitful and increasing source of wealth to the inhabitants.

"In the State of New York we find mountains of granite and gneiss, and various modifications of these rocks, especially in Dutchess, Putnam and Westchester counties. Prof. Mather states, that 'there are many places in these counties where quarries may be opened, which would afford building materials of the best quality, and which, would endure the changes of our durable climate for ages, without decay or disintegration. The naked crags and masses of rock afford irresistible evidence on this point. These rocky hills and mountains, worthless as they now seem to most persons, undoubtedly contain the best of building materials. The quarries which will be opened, will form an important branch of industry, and will enable our citizens to construct both public edifices and private dwellings of our own native materials, and which are as durable and beautiful as those now brought from Maine, Massachusetts and Connecticut, at so great an expense.'"

Marble according to Mr. S. is our principal material and to it he devotes more space than to our granite. We must protest however, against his citing Messrs. Strickland and Struthers of Philadelphia, as authorities either upon this particular item, on the subject generally, these gentlemen no doubt feeling themselves rather awkwardly placed in being made sponsors for such monstrosities. It seems that the marble quarries in the vicinity of Philadelphia, were visited, and as we have seen them ourselves, we can testify that they are primitive establishments, altogether behind the age—but by a rapid generalization, all "American marble quarries" are put into the same category. We cannot refrain from giving the passage.

"In some of the quarries which I visited, the beds of marble dipped from north to south at an inclination of 60° with the horizon, and they were worked at considerable disadvantage. In one quarry the men were working a bed of white marble, 14 feet in thickness, at a depth of 120 feet below the natural surface of the ground. The blocks, some of which weighed 12 tons, were raised to the surface by means of a rudely constructed horse-gin, there being no road to the bottom of the quarry, or rather pit, from which they are taken, by which even a man could conveniently, or safely, descend or ascend, without the use of a rope to prevent his falling headlong to the bottom. In this respect the American marble quarries reminded me of the celebrated sandstone pits of the ancient city of Caen in Normandy, which are not only remarkable as having produced the materials for the old London bridge, but as presenting a mode of working very similar to that pursued in the coal pits of this country; the blocks, being excavated at a great depth under the ground, are conveyed in subterranean passages to shafts, through which they are raised to the surface by horse power, as in the American quarries."

The passage immediately following, is the "gem" of the whole paper. Possessed with the idea that this is our sole building material, Mr. S. makes this wise conclusion.

"The price of American marble, varies according to its quality and kind. The carriage of the materials, owing to the badness of the roads, forms a very expensive item in all the public works, and is of course, regulated by the distance of transport; but the white marble costs about 4*s.* 10*d.*, and the blue about 4*s.* per cubic foot at the quarries, and although this may seem a very moderate price for marble, which in this country costs from 16*s.* to 2*l*, a cubic foot, still, when used instead of stone throughout the whole thickness of the wall of a dwelling house, or the pier of a bridge, it becomes, even at the lower price I have mentioned, a costly material."

The Stockbridge quarries were not examined, and are merely stated to furnish white and blue marbles, while those in Vermont afford black and white. As our author gives us no further information, we take the liberty of supplying this omission by another extract from Dr. Lee's Elements, etc.

"The Stockbridge marble is well known, as the City Hall of New York is built of it. It is a pure white, moderately fine grained, and very durable. The Lanesborough and Sheffield marble is very similar, and from the Sheffield quarries the marble is obtained which is now employed in the erection of the Girard College at Philadelphia. 'A visit to this quarry,' says Professor Hitchcock, 'will give one perhaps, the best idea of the value and extent of the Berkshire marbles, and, at the same time, of the power which the arts give to man over nature. To see masses more than fifty feet long, and six or eight feet thick, split out by the apparently feeble means employed. makes a strong impression on the mind, and recalls the history of the enormous blocks of stone quarried and removed by the pyramid builders of antiquity.' It may with safety be said, that no marbles in the United States exceed in elegance and durability those of Berkshire county. The value of all the marble now exported from that county cannot be less than $70,000 annually, and the beds are inexhaustible."

Making no mention of the extensive marble quarries of New York, the beautiful varieties found in Connecticut, nor of the celebrated Potomac breccia marble, after naming but four localities, we are told in conclusion, that :—

"Those enumerated are the principal quarries in the United States ; but from the circumstances of their being so much confined to particular localities, and the manner in which they are worked, it is evident that their produce cannot be applied by any means to the general wants of the country ; and consequently, excepting in the case of buildings on which a good deal of money is to be expended, it is but little employed, the cost of the material itself, and the expense of carriage, being very considerable."

We give entire what follows, because with the exception of one strange mistake, it is a redeeming paragraph. The criticism upon the want of taste displayed in the colors of the exteriors of our houses, is, with a few honorable exceptions, richly deserved, and indicates Mr. Stevenson's good taste.

"The marbles of the United States, according to the account of many intelligent Americans with whom I conversed on the subject, are not suited for sculpture or very fine ornamental works, or even, indeed, for the capitals of columns, which require superior workmanship and the marble used for the capitals of all the fine buildings throughout the country, it is imported from Carara in Italy, whence a very large quantity is annually exported to America. For similar purposes black marble is also imported into the States of

Ireland. If, however, I might form a judgment from the quality of some of the specimens which I procured, I should think that were the American quarries efficiently worked, there could be very little necessity for applying either to Italy or Ireland, for so great an annual supply. Those buildings which are constructed of the whitest description of American marble, carefully selected for the purpose, such as the Capitol and the President's house at Washington, the Bank of the United States, the Mint, and other public buildings at Philadelphia, and the monument erected to the memory of Washington at Baltimore, have certainly a most imposing and gorgeous appearance, owing to the fineness and beauty of the material. But the buildings which are constructed of the blue or unselected marble, such for example, as the State Capitol at Albany, or the Town-House at New York, have a bloated and dingy look, and the general effect produced by the marbles in these buildings is greatly inferior to that of some of the sandstones from Craigleith and other British quarries.

"The white marble retains its purity of color much longer in the United States than it would do in this country owing to the clearness of the atmosphere and the absence of smoke, the use of anthracite coal, which produces no smoke during combustion, being common in most of the towns. These circumstances may also account for the seemingly permanent vividness of the various colors, such as red, white, brown, yellow, and green, with which according to the taste of the occupiers the exteriors of the brick houses in New York, and many other towns in the United States, are generally planted."

Thus concludes the notice of our mineral materials. How the writer could have put together so much that was incorrect, is a mystery to us, unless, indeed, the lapse of time between his visit to this country and the date of the paper, as before hinted, may have rendered his memory treacherous as to facts. The consideration of the remainder of his paper we reserve for another occasion, but before we conclude, it will not be amiss to refer to several singular omissions. Mr. Stevenson does not seem to be aware of the fact that in our country are to be found the representatives of nearly every rock found in Scotland or England,—that our surface is much greater, and that consequently the same formation covers a vast extent of country, and diffuses the same mineral over a large space, and that these mineral treasures are wrought only in proportion to the wants of the community, and that the same scale which measures propinquity in the dense population of Great Britain, will not do in our country, either for men, mines or quarries.

Had the writer but recollected for a moment, he must have remembered the striking ridge on the west bank of the Hudson, called the Pallisadoes, which, for about thirty miles, presents one of the most remarkable features of our noble river. At the foot of these hills, he might have observed immense masses of debris, into which, here and there openings seemed to have been made ;—these, a few years since, were the sources of the stone for the Delaware breakwater, (Mr. Stevenson says our breakwaters are built of wood,) and yet an impression has hardly been made, and only the careful observer could detect either the marks of human labor or the immensity of the masses before him.

In the same region, and indeed in many other places, might be seen vast quantities of sand stone, which, by the way has not even been mentioned in this communication, and this is a most important material and much used.

Our vast bowlder formations is also entirely overlooked in the search for quarries; and no one can, for a moment, hesitate to say that they are, for ordinary purposes, our most valuable source of stone. Who would take the trouble to dig into the bowels of the earth for that which lays already to his hand upon the surface ? or who would hesitate between a corduroy road and a Mac Adam turnpike, particularly when the latter was cheaper ?

We have passed over miles of railroad, which, for the breadth of a double track and for two feet deep, formed an entire stone wall, and most if not all of this stone taken from the surface of the ground. A glance at any of the geological reports will show what an unlimited variety of materials is providentially furnished us at the least possible cost, and the use of which actually enhances the value of the ground.

Upon the whole then, we feel satisfied with the supply of building material in our country, and are neither disposed to envy our transatlantic brethren either of Scotland, England or France for being, as our author seems to think, richer in stone than we are.

PHILADELPHIA AND POTTSVILLE RAILROAD.

We may now announce with every certainty, that the Philadelphia and Pottsville railway will be completed to the mines before the closing of the year 1841, or in the course of the next two months. No greater blessing could possibly be conferred on that region, which may henceforth consider its supremacy in the coal trade fully secured; and they may well be proud of this railroad as embracing more of the qualities which constitute perfection in such a work, than can any where else be presented.

Towards its prosecution and final completion, it is well known that this region has not contributed a cent, which may well have been owing to circumstances above their control, but it is not likely they will allow the occasion of the opening of this road to go unsignalized by some appropriate mark in acknowledgment of its great advantages to them.

What, under the circumstances, therefore, could be more suitable than for this region to present the road with a pair of locomotives, either for travel or burden, to be called the "Pottsville" and the "Schuylkill Haven," which should run forever over the road as a memento to show that their hearts are as full of gratitude as the hills of the region are of coal.

A contribution of about 3000 tons of coal, disposed of in Philadelphia, at $5 per ton, would accomplish such a purpose, and could be so arranged as to be little onerous to the region, the principal value of such a gift being understood to consist in its being an ever living and active evidence of a mutual good feeling between the parties. A committee of the leading miners of this region would do themselves infinite credit in organizing and giving execution to the above suggestion in time for a "celebration" on the 1st of January, 1842.

NEW YORK AND ERIE RAILROAD.

New York, *November* 1st, 1841.

My dear sir: At your request I have hastily thrown together some remarks on the prospects of the New York and Erie Railroad.

The ideas contained in them are familiar to yourself and the other gentlemen who have watched over the interest of the company. They can therefore lay no claim to originality, but may still be interesting to those who, though willing to listen to truth, have not examined the arguments on which our confidence is founded.

Very respectfully your obed't serv't,

Edward Miller.

Chief Engineer N. Y. and Erie Railroad.

To the Hon. Aaron Clark.

Communication from the Chief Engineer of the New York and Erie railroad, on the revenue and prospects of the road.

In the report of the committee of ways and means to the house of assembly of New York in 1838, the future greatness of the mighty northwest was shadowed forth by a master hand.

The predictions and calculations of that able paper were sneered at by the sceptical and derided by the prejudiced. Mr. Ruggles was termed a schemer, an extravagant visionary; and yet many of his conclusions, which then seemed wildest, are already matters of history, and those still in the womb of time are steadily working out their own fulfilment.

None but those who have seen the favored region bordering upon the lakes, and attentively considered its geographical position, its immense natural resources, and the countless throng of hardy, intelligent, and enterprising yeomanry, which is rushing westward like a mighty torent, can form just conceptions of the capabilities of this inland empire. Until lately the tide of immigration was so strong, that all the produce of Indiana, Illinois and Michigan, was insufficient to feed the comers, and large quantities of provisions were sent from Ohio, Pennsylvania, and New York, in order to supply the deficiency. This unnatural course of trade, however, is now arrested, and the increasing tolls on the Erie canal during the two last years, in spite of new avenues which have been opened, and the general depression of trade every where, indicate the commencement of that commerce which, if secured exclusively to New York, must make her the greatest city in the world, and which, even if shared with Boston, Philadelphia, and Baltimore, will more than satisfy the most avaricious cravings of all.

The avenues which are now opened for this trade are crowded, and before those in progress or contemplated can possibly be completed, the business for them will be created and ready.

In the last general report of the directors of the New York and Erie railroad, the subject of the lake trade was hardly touched. The board preferred considering the road in that light in which many of its friends feared to regard it, viz: as a work depending upon the local trade of its borders.

The following statistical information is condensed from that report:—

The railroad traverses eleven counties, containing a population of 340,385; and as many more counties and parts of counties, containing 266,085 inhabitants, will be tributary to it in New York alone.

In Pennsylvania and New Jersey, an entire range of counties, estimated to contain 230,000 people, will also use the road.

The present population, therefore, waiting anxiously for the road, exceeds 836,000, and under the influence of its construction and use will exceed a million in 1845. The counties in this State through which the road passes increased in population in ten years, from 1830 to 1840, thirty per cent., while the taxed valuation of real and personal estate has nearly doubled. This increase was doubtless caused in a great measure by the confident hope of the construction of the railroad.

The whole number of persons tributary now to the Erie canal and the railroads near it, may be set down in round numbers at a million, of whom nearly or quite 300,000 would prefer the New York and Erie road, if it were finished. This million pays an average of nine dollars each for tolls, freight, and travel, annually.

If the people residing on or near the southern road pay only half as much in proportion to their number, (and there seems to be no good reason for such a reduction, since the southern counties are generally more fertile and productive than those on the canal, and are besides rich in the treasures of the mine and the forest, which are wholly wanting on the rival route,) even with this large reduction, and estimating the road to cost $12,000,000, and those using it to be but 800,000 in number, the profits, after paying all expenses, would be $2,500,000 per annum, or more than 20 per cent.

These statements are necessarily meagre. The report alluded to, to which attention is invited, elaborates the arguments above stated, and adduces many others which show conclusively that it is not necessary to assume that a single passenger or a ton of freight shall be drawn from a point west of Dunkirk, in order to prove that the stock of the New York and Erie railroad will be a most safe and profitable investment.

But the friends of this improvement claim that it is the best, shortest, and quickest route between the city of New York and the lakes, and that it must therefore be the great thoroughfare between the commercial metropolis of America and "the brotherhood of nations" which is springing into power around our inland seas.

Commencing at a point on the Hudson from which steamboats can run regularly to New York in winter as well as summer, and terminating at a harbor on lake Erie 40 miles west of Buffalo, and always open earlier in the spring and later in the fall than the latter place, the distance from New York to Dunkirk is 468 miles.

By the line of railroads running near the Erie canal, the distance from New York to Buffalo is 470 miles, and as Dunkirk must be taken as a point of comparison for the western travel, the New York and Erie road has the advantage in distance of 42 miles.

With such a road as the company are now making, the time occupied in passing over the entire route will not exceed 24 hours for the through-passenger trains, and the charge for first class passengers will not exceed twelve dollars, while the second class will be carried for half that sum.

If the New York and Albany road were completed, and substantial superstructures, with heavy iron rails, were laid throughout the whole northern route, instead of the slight and dangerous ones now employed, and if arrangements were entered into between the different companies forming the chain so as to avoid detention and changes of cars, Buffalo might be placed as near to New York as Dunkirk will be, both in point of time and distance; but still 40 miles of steamboat travelling on lake Erie would be added to the journey of those who should prefer this route to the New York and Erie railroad. As matters however are likely to stand for the next ten years, the saving in time by taking the southern route will be about 17 hours.

The northern route already shows the difficulties under which a long line labors, when made up of a number of independent corporations. Each link(although one of them extends only 16 miles) has a seperate organization in every branch; its own general superintendents, cars, engines, and workshops. There will be in the chain eight or perhaps ten companies: the works of some favorable in point of expense and character,—others very costly and difficult to manage.

To fix a tariff of prices, when a powerful rival comes into the field, which will be just to all, and yet low enough in the aggregate; to prevent local detentions, when the stockholders of each portion are chiefly inhabitants of the towns and villages, and interested in producing delays; to avoid clashing and ill feeling, such as is now witnessed between two of these corporations; to find, in short, *an animal with eight or more heads which is not a monster;* are matters involving most grave and serious difficulties.

The reduction in price which the company proposes, when joined to the rapidity and comfort of transportation, must have the effect of throwing upon the New York and Erie railroad nearly all the emigrant passengers, and at least a moiety of those paying as first class.

If we suppose that there are only enough of these, however, to make a single through-train daily, in each direction, say 250 first class and 200 second class passengers, one thousand dollars per diem will pay all the expenses of carrying them, and the receipts, even at the low rates of twelve and six dollars, will amount to $8,400 per diem, leaving a clear profit of $2,701,000 per annum; enough to pay 22 per cent. on a capital of $12,000,000 from through-passengers alone. In making these calculations, the difficulty consists, not in swelling the amounts, but in keeping them down to the level of moderation. We fully believe that all our anticipations will be more than realized by the results of experience.

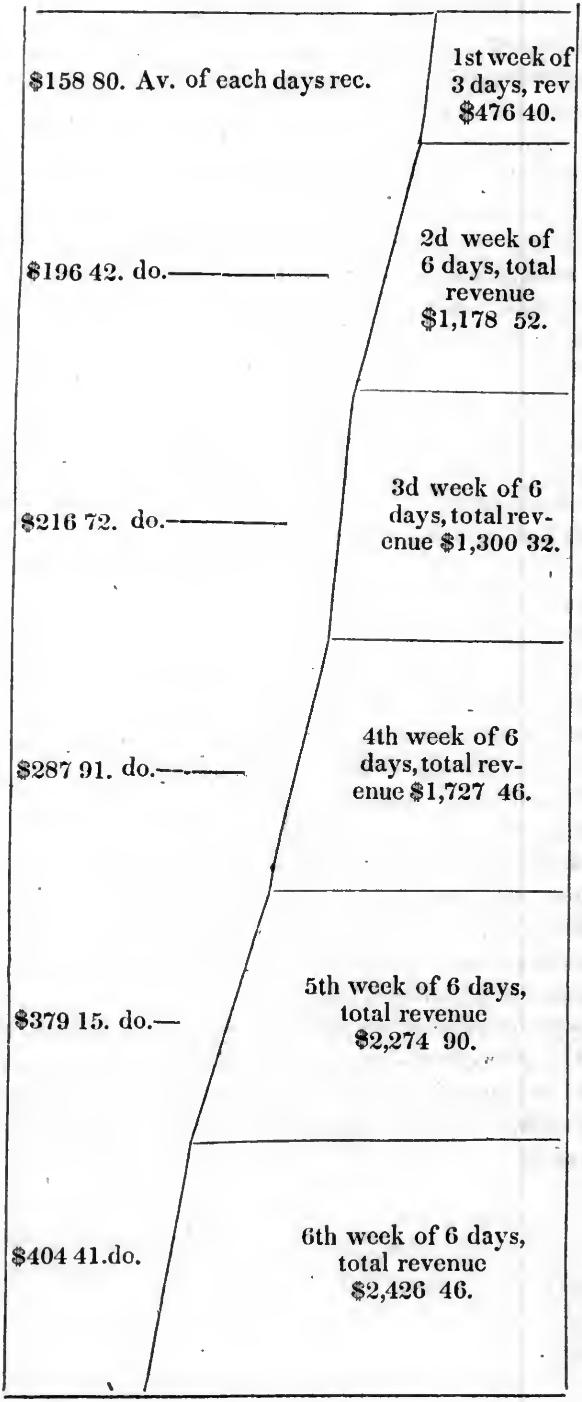
Can there be a doubt, then, of the success of this work? Will New York sit tamely down and see Boston on the east, and Baltimore and Philadelphia on the south, stretching out their iron arms to grasp the birthright of this city, and make no struggle to rescue it from their efforts?

The eastern division of the road, between Piermont and Goshen, 46 miles, was opened for general use about five weeks since. Throughout that time, the receipts have been steadily increasing, although this portion of the road runs nearly parallel to the Hudson river, and has to contend with a formidable competition from steamboat and stage lines already established. The revenue now amounts to more than $400 per diem, a sum far greater than the most sanguine friends of the road anticipated.

Before next spring, nearly 200 miles of the grading will be completed between Binghamton and lake Erie, on which distance much of the wooden portion of the superstructure, and about thirty miles of the iron rails, will be laid. On fifty miles of the distance between Binghamton and Goshen, the grading is two-thirds finished and would have been further advanced but for peculiar circumstances, beyond the company's control.

The prize worthy of the efforts of nations is within reach. Will New York voluntarily decline it, and abdicate her position in favor of more enterprizing rivals, who, trusting to her apathy, are expending millions to obtain the vantage ground which she has hitherto occupied?

A PROFILE *exhibiting the gradual increase of Revenue upon the Eastern Division of the New York and Erie Railroad, between New York and Goshen, from the opening of the road, on the 23d of September, to 30th of October,* 1841,—33 *working days.*



Sept. 23. *Oct.* 30.

HORIZONTAL SCALE $4\frac{1}{2}$ days to 1 inch—VERTICAL, $200 to an inch.

NOTE.—*The receipts upon the 28th, 29th, and 30th of October average* $409 06, *per diem.*

UTICA AND SCHENECTADA RAILROAD.

"Will some of our New York and Albany friends inform us whether the Utica and Schenectada railroad company are prohibited from carrying merchandize over their road, during the whole year; or, if they are allowed to do so while the canal is closed?"—*Philadelphia Gazette.*

It is not sufficient to answer, that they are prohibited from carrying merchandize at all seasons. We would call on our Albany friends, and particularly certain directors in this company to enlighten us, as to the mysterious policy they have pursued in circulating the idea, much to the injury of the railway system in this State, in remarks like the following, "that *their* railway was not competent to carry freight; that it was not profitable for railways to carry freight and passengers over the same road; *that they did not wish the privilege to carry freight.*" While this language was held by certain directors in Utica and Albany, there was an unseen influence exerted along the line of the railroad, to get up petitions to the legislature "to *compel* the Utica and Schenectada railroad company to carry extra baggage," as an accommodation to the public, on paying Erie canal tolls into the State treasury.

The canal interest, took alarm at this covert mode to carry merchandize, and to facilitate emigration and travel through this State. It was understood that the canal interest, which the railway directors appears to have been afraid of, defeated this bill, and added insult to the friends of railways and common sense. They amended the bill, so as to read in one section, as follows. "It may be lawful for the Utica and Schenectada railroad company, to transport *without charge*, extra baggage, or articles for passengers or who may have charge thereof, travelling in the same train of cars, on which the same are transported."

The canal influence was exerted in 1839, when numerous petitions were again presented to the legislature, "praying that the Utica and Schenectada railroad company, should be *compelled* to carry freight, as well as baggage." These petitions conceded that the State should levy black mail on private enterprise, in the shape of canal tolls, to be exacted by the State on all goods passing on this road, yet strange to record, this beneficial law was defeated.

We well recollect the speech of Mr. Noah Cook, a leading member from this city in 1839, a professed friend of internal improvements, who, like many others of that day, believed that improvements only meant, the Erie canal and its enlargement. This gentleman scouted the idea, that railways, parallel to the Erie canal should be permitted to carry freight, or extra baggage, during the period of its navigation, even with the payment of canal tolls. He told the committee of the whole, of the assembly, himself a forwarder of large and respectable standing, "that it would ruin the business of the forwarders, if the railway was to carry freight and extra baggage, that the forwarders made comparatively nothing in transporting a barrel of flour from Buffalo or Rochester, to New York, that their main profit was derived from the *up* transportation of merchandize, and particularly from passengers in their semi packet boats, that if railways were permitted to take the extra baggage of emigrants, *on any terms*, it would ruin their business and prevent the enlargement." Such arguments prevailed, although as a great boon, it was proposed and carried, in committee, that the road should have the extraordinary "privilege, of carrying freight during the time the Erie canal was closed, provided they paid into the State treasury canal tolls on all freight transported." It need not be stated to any one acquainted with railways, that it was no object to the company to accept this favor. It was about as important to them, as to carry extra baggage at an extra cost to the company, free of charge. For so short a period as the winter months, it would never pay the cost to procure the extra *motive power* and cars requisite to operate this road at a period when it would be the least effective, certainly more costly in fuel, to draw less loads, than in the summer months.

Had the friends of this road, and another important road met the repeated requests made them during the sessions of 1839, '40, and '41; to examine into "*the relative merits, with cost of transportation on canals and railways,*" we should not have taken the pen to expose the ridiculous assertion, that "*the Utica and Schenectada railroad, was too weak and fragile to sustain the weight of freight trains.*" In their hearts they knew the error of this statement, or the directors are more weak in intellect, than we are willing to suppose them to be. Certainly, they had seen trains of 100 tons of wood, carried over the road with a bearing of 3 tons on the 4 wheels, of each freight car, drawn by a locomotive engine, having the pressure of 9 tons on *two* points; *the driving, or adhering wheels,* yet strange to state, a certain director in Albany gravely argued with the uninitiated, that a load of wood, or merchandize, of three tons, divided over four points of bearing, was more injurious to the road than the locomotive, therefore, it would not answer to carry freight, and that the company did not wish to carry it, unless they were "*compelled to.*"

The days of humbug, under this order of things in this State, we trust has gone by, we hope the period has arrived, when every class of public improvement, and the mode of operating them, whether by the State, or private enterprise, aided by the State, will stand on their separate merits, and that a legislative committee, consisting of three members from the Senate and five from the Assembly, will, at an early period of the ensuing session, investigate the merits of railways, compared with canals, preparatory to a fresh departure in support of a system, or some general law to aid in the construction of railways, "between desirable points, judiciously located."

MANHATTAN.

EXTRACT FROM "A SKETCH OF A RAILWAY JUDICIOUSLY CONSTRUCTED BETWEEN DESIRABLE POINTS."

As further illustrative of the advantages of long lines of railway, and as affording some other useful views on the subject in general, we offer a summary of the report of the New York, and Erie railroad, now in progress, and which it is calculated can be maintained from the *way travel and business alone*, leaving that obtained at either termination for the *whole line* as profit, and ample after paying interest on State loan to give the stockholders a liberal dividend.

The distance from Dunkirk, on lake Erie, to *Piermont*, on the Hudson, is - - - - - - - - - 446 miles.
The distance from Piermont to New York is - - 22—468 miles being the whole distance. The track is six feet wide, with an edge rail of 56 lbs. per yard, and for nearly two hundred miles is built on piles. It is intended to finish it in 1845, at a cost of $9,000,000, of which the State, by the present arrangement, is to furnish $6,000,000, and the stockholders $3,000,000. If it can be completed for $10,000,000, it would still be a cheap road, and that sum need not be exceeded, if the contributions along its line, in right of way, labor, etc., are carried out.

Taking as some guide the business on the Erie canal, through the northern tier of counties, with a population per last census of seven hundred thousand, they seem with good reason to rely upon the way travel being ample on this railroad to support it, the southern tier of counties, through which it passes, being calculated to have a population of about one million when the road shall be finished, in 1845. To the north on the Erie canal, in 1839, the whole traffic was as follows, and which must increase annually:

162,500	tons mdz., of an average value of		$280	per ton
500,500	" manufactures, flour, etc.,	do.	125	"
764,000	" lumber, coal etc.,	do.	51	"
1,426,000	tons, total estimated value, - - -		$73,400,000	

On the above 1,426,000 tons there were paid in tolls to the canals, - - -	$1,500,000	
On the above 1,426,000 tons there were paid in freight to forwarding men, - -	4,500,000	
The travelling consequent on this business per annum, is estimated to cost - -	3,000,000	—9,000,000

The railways on the line of the Erie canal derive nearly one half of their whole receipts from the *way travel*, although the canal takes a good portion of it, and in respect to freight, they are not allowed to carry it, although offering to pay the canal tolls. The travel is here found, for short distances, to be as two to one compared with that for long distances.

Now, on the line of the Erie railroad, with an estimated population 30 per cent. greater than along the Erie canal, there would be neither competition nor restriction like the above, nor is there any reason for supposing a difference in the wants and business energies of the two populations, only that the former would be more stimulated by an improvement affording greater facilities, and which would be the certain means of drawing along its line, in preference to going to the far west, a fair share of the large daily influx of emigrants from Europe, who would there find cheapness and fertility, without letting go their hold on civilized life.

Of the tonnage on the canal about one half is of a value to seek a railway in preference, by which it would only be two to three days from the emporium of the States, instead of eight to nine days as now by canal and river.

It is intended to work this railway by sections of eighty miles each, adapting the weight of the locomotives to its varying grades, which are as high as sixty feet per mile for short distances.

The present mixed route to the lake, by river to Albany and thence by railroads, is as follows:

From New York to Albany, by the Hudson river, -	147
From Albany to Buffalo, by railroads, - - -	320
	467 miles,

or the same distance as by the entire railroad route terminating at Dunkirk. With a railway to Albany, to obviate the closing of the river in winter, New York would then be doubly armed against any undue diversion of trade from her by the connection of Boston with the same points.

Having thus adverted to the different routes to the lakes, it is next of consequence to understand what are the expenses of transportation by those at present available, and to compare them with the rates which would remunerate a railway, say either the New York Albany and Buffalo, or the New York and Erie, the latter having rather a more open port at Dunkirk than the canal or railway at Buffalo. The cost of transportation on these railways, for four hundred and sixty-eight miles, would be rather under $4 per ton, calculated at 80 cents per mile, and on a nett load of 100 tons, so that these companies could well *stipulate to carry at the rates affixed below*, on condition of their roads being carried through forthwith, by which some millions of dollars could be saved annually to the public on the best portion of the one and a half million of tons now carried over the canal and river, besides the gain in time of at least a week per trip, and operating all the year round.

STATEMENT.

ARTICLES.	Lake Erie to New York.		New York to Lake Erie.	
	From Buffalo, 150 ms. by river, 363 " by canal, — 513	From Dunkirk, by railway, 468 miles.	To Buffalo by river and canal 513 miles.	To Dunkirk by railway 468 miles.
	Freight and toll per ton of 2,200 lbs.	Freight and toll per ton of 2,200 lbs.	Freight and toll per ton of 2,200 lbs.	Freight and toll per ton of 2,200 lbs.
Flour, - -	87½ cts. pr bbl., or $9 62	67 cents per bushel or $7 87		
Grain, - -	25 cts. per bush., or $10	20 cents per bush. or $8		
Provisions, Ashes, Seed,	45 cts. pr 100 lbs., or $9 90	37 cts. pr 100 lbs. or $8 14		
Furs & skins,	$1 per 100 lbs., or $22	75 cents per 100 lbs. or $16 50		
Light goods,	- - - - - - -	- - - -	$1 30 per 100 lbs. or $28 60	60 cts. pr 100 lbs. or $13 20
Heavy goods,	- - - - - - -	- - - -	95 cts. per 100 lbs. or $20 90	55 cts. pr 100 lbs. or $12

The above rates on light and heavy goods are those of 1840. In the present season of 1841, in consequence of the competition through the Oswego canal, Lake Ontario and Welland canal to Lake Erie, they have been forced to carry at 70 cents for light, and 60 cents for heavy goods per 100 lbs. on the Erie canal; but these rates are *admitted to be ruinous*, which therefore settles the question of the railway being the cheapest, as at those rates it would be well paid. Thus the canals should be bound to carry at, or in view of the loss of time by them and other losses sustained by the public in foregoing the railway, *under* the rates at which the latter would stipulate to do the business, as the only real test of their being cheaper carriers—otherwise to the favoritism now shown to them in the State of New York, will be added the vilest monopoly.

By the present mixed Pennsylvania route from Pittsburg to Philadelphia, 348 miles, the charges for 1841 are stated to be:

Flour, $1 25 per bbl., $13 75 per ton of 2,200 lbs. - - -	By the *Middle route* of railway $9 00 pr ton would pay.
Cotton, 56¼ cts. per 100 lbs. $12 37 per ton of 2,200 lbs. - -	do. do. $10 00 do.
Provisions, 62½ cents per 100 lbs. $13 75 per ton of 2,200 lbs. -	do. do. $8 00 do.
Tobacco, 62½ cents per 100 lbs., $13 75 per ton of 2,200 lbs. -	do. do. $8 00 do.

From Philadelphia to Pittsburg the rates for 1841, are about 18 to $25 per ton on heavy goods; on fine goods, 28 to $30 per ton.

The charge for light freight at $28½ per ton, in 1840, per Erie canal, is called and passes for cheap, but at $14 per ton by a railway, it would pay better and be *cheaper*, and thus only by presenting a later and improved standard, can the public escape being mystified, and be enabled to see, that canal transportation is only cheap, as compared with that by the horse-wagon or the ox-team.

It should not be overlooked that the Erie railroad passes through Olean, at the head of the Alleghany river, which will in time connect it with Pittsburg and the Ohio valley; the intention being to improve that river for a steamboat navigation.

What then is the *mere cost* of freight by river and canal, and by railway only, to the lake, without toll or profit in either case?

By river.—150 miles, freight and towage per ton by *canal boat* of 50 tons, (only about 25cts. pr. ton by the large *tow barges* of 3,500 bbls.) - - - - - - -		62 cents.
By canal.—363 miles, at one cent per ton per mile, average time of trip to and from Albany and Buffalo 16 days, and longer while the enlargement goes on -	$3 63—4 25	
Railway.—468 miles by railway, in 50 hours to Dunkirk, would cost, at 80 cents per mile and load of 100 tons nett, - -		$3 72

But put them at the same cost of freight, (although the canal boat must be further liable to a toll at least adequate to maintain the canal,) and the railway would have the advantage of a week in time of delivery, and an earlier navigation at Dunkirk, which on many articles would be equal to the whole charge by canal.

The toll is a charge distinct from the freight, and appertaining exclusively to the canal and railway, necessary first to cover repairs and maintenance; and secondly, interest on cost and a fair profit, to accomplish which, the charge should vary with, and be regulated by, the amount of tonnage passing over the improvement, as illustrated by the two following *extreme*, but real cases among canals:

Erie and Champlain Canal—			
Cost $8,500,000 440 miles, interest 7 per cent., - - - -	$595,000		
Repairs and maintenance, for 1840,	364,000—	959,000	
Passes 1,400,000 tons, on which, to repay the above, an average toll is required for the whole distance of per ton. - - - -			cts. 68½
Tide Water Canal on the Susquehanna—			
Cost $2,800,000, 42 miles, interest,	$168,000		
Repairs and maintenance, -	42,000—	210,000	
Passed 70,000 tons in 1840, on which to repay the above, an average toll is required the whole distance of per ton, - - - - -			$3

Any charge exceeding these rates which are mere *toll* independently of *freight*, would be profit over and above the interest on the capital and current expenses. The Tide Water canal received $35,000 in 1840, and therefore the average toll for the whole distance was 50 cts. per ton. On minerals it is restricted to one half cent per ton per mile, or twenty-one cents for forty-two miles, and is not allowed to regulate the charge on the standard of repaying interest on repairs, costs, etc., even if competition permitted, and thus, as adverted to in note No. 7, have canals been *made to pass for cheap*, greatly to the disadvantage and just progress of railways, by being obliged to consider in most cases, their first cost as sunk.

IT COMES TO THIS, THEN, THAT THE RAILWAY IN MOST CASES, CAN CARRY MERCHANDIZE AT OR UNDER THE COST OF FREIGHT ON A CANAL, AND IS (WITH PERHAPS THE EXCEPTION OF THE HUDSON RIVER) AS CHEAP ON ALL OPEN RIVER AND BAY NAVIGATION USING STEAM, AND THAT THEREFORE, ANY CHARGE FOR TOLL BY CANAL, WOULD BE ONLY AN ADDITIONAL BOUNTY IN FAVOR OF THE TRADE SEEKING THE RAILWAY, WHICH BESIDES, NEVER SUSPENDS ITS OPERATIONS, AND HAS A GREATER DESPATCH AND CERTAINTY OF ARRIVAL, THAN EITHER OF THE OTHERS.

The objection to the apparent disparity in the amount of capital required for the railway more than for the steamboat, is met by the former doing more for passengers, combining the carriage of freight with them, working four to five months longer in the year, being a less perishable property, and requiring no insurance like the steamboat, which together bring the two, on the score of capital, at least on a par.

Looking upon the New York and Albany, and New York and Erie railroads as adding to the useful and beneficial links in the great chain of the Union, a mixed physical and moral bond to it, they have had our hearty advocacy, and in framing these notes, in respect to them, we have endeavored to make them unanswerable commentaries on the superior cheapness and more general utility of the system itself, to which in due time the most sceptical will yield. The subject, indeed, is worthy of the special investigation we have before alluded to, and as the country generally is now making its observations for a fresh departure, it would be well not to start unprovided with correct views on the important item of internal improvements, which will be found almost indispensable, among the other means necessary to preserve it in a true and steady course for the future.

EXTRACT FROM THE MESSAGE OF THE GOVERNOR OF GEORGIA.

I lay before the legislature the report of the chief engineer of the Western and Atlantic railroad for the third quarter of the present year,* in which are stated the amount expended upon that work thus far, and the estimated cost of its completion. The sum expended is two millions one hundred and eighty-one thousand two hundred and seventy-two dollars and six cents, on account of which

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* For this report, see R. R. Journal for October 1st.

a public debt has been incured, amounting, according to the best information at my command, to between thirteen and fourteen hundred thousand dollars. From the report of the President of the Board of Commissioners, a copy of which is laid before you, it will be seen that arrangements have been made for the completion of fifty-two miles of this road, beginning at the southeastern terminus, which will carry it two miles west of the Etowah river. It should be put into operation to that point, as soon as the connection of either of the branch roads with it will justify the belief that it may be profitably employed. The tunnel through Little Blue Ridge has been abandoned by the original contractor. This should be relet, that it may be in readiness to receive the superstructure when that point shall be reached. In the further prosecution of this work I would recommend the use of the strictest economy. The work should now be prosecuted gradually, and in such manner that the profits of that part which may be expected to be carried soon into operation may be applied to the construction. The corps of engineers should be reduced to the number that, when constantly and actively employed, shall be adequate to the superintendence of the entire work.

The Commissioners have resolved to subject the timber to be used on the road to the action of preservative salts, to prevent the expense arising from its decay. It may perhaps be prudent to lay down the ballance of the road in the hardy and durable timbers of the country through which it passes, until the efficiency of the preservative material be tested by the application already determined upon and we have evidence of our own experience of its economy.

The high moral obligations that the State is under to those enterprising companies which have been induced to incur heavy expenses, relying on the public faith; the immense facilities the road will afford the inhabitants of the north-western section of the State for the transportation of the abundant products of their fertile lands to a profitable market; the advantages of commerce it will open to the adjacent States, inviting their wealth to our borders, and offering them the most convenient and rapid communication with the Atlantic; the revenue it will bring to the State treasury, reimbursing the State for the entire cost of its construction, besides affording the means of either relieving the people from taxation, or executing any other public enterprise that may contribute to the general prosperity; its incalculable benefits in time of war, in the easy and speedy transportation of men and provisions to the point at which the assults of the enemy may be expected, all combine to recommend it to the fostering care of the representatives of the people. No local strifes, no sectional jealousies, no unjust prejudices, no partisan considerations should be permitted to stand in the way of the progress of a work which promises for Georgia, what the Erie canal has accomplished for New York.

While, however, I propose a steady perseverance in the execution of this noble enterprise, I would earnestly recommend its farther prosecution to be based upon permanent legislative provisions and regulations which shall not add to the burdens of the people, Contributions should never be demanded from the people, unless equivalent benefits are secured to them, and this cannot be the case when public exactions exceed the probabilities of individual advantages. If the profits of this road, as it is gradually extended, are brought into the work and applied to the payment of the interest and gradual reduction of the principal of the debt contracted for its construction, it may be completed without resort to additional taxation.

NEW YORK THIRTY THREE YEARS AGO,—VIZ.—1808.

This year was one of the most remarkable in the history of the world, for the advancement of one branch of the sciences and the arts. Robert Fulton, whose name is now immortal, made his great and successful experiment in the art of propelling and constructing steamboats. On the return of Fulton from France he, with the aid of Chancellor Livingston, commenced his first steamboat; in 1807 she was launched, and in 1808 she was completed. In August of this year the public were on tip-toe to witness the first steamboat that ever floated. This boat was called the Clermont, after the country seat of the Livingston family. She started on the 17th August from the foot of Courtlandt street, N. R., in the presence of thousands who looked upon it as a visionary and foolish scheme. The success of this voyage is thus described in a letter of the great inventor himself.

Letter from Robert Fulton to the American Citizen:—

New York, August 20, 1808.

Sir:—I arrived this afternoon at 4 o'clock, in the steamboat from Albany. As the success of my experiment gives me great hopes that such boats may be rendered of much importance to my country, to prevent erroneous opinions and give some satisfaction to the friends of useful improvements, you will have the goodness to publish the following statement of facts:

I left New York on Monday, at 1 o'clock, and arrived at Clermont, the seat of Chancellor Livingston, at 1 o'clock on Tuesday—time, 24 hours—distance 110 miles. On Wednesday I departed from the Chancellor's at 9 in the morning, and arrived at Albany at 5 in the afternoon—distance 40 miles—time 8 hours. The sum of this is 150 miles in 32 hours, equal near 5 miles an hour.

On Thursday, at 9 o'clock in the morning, I left Albany, and arrived at the Chancellor's at 5 in the evening. I started from thence at 7 and arrived at New York on Friday at 4 in the afternoon—time 39 hours—space run through, 150 miles—equal to 5 miles an hour. Throughout the whole way, my going and returning, the wind was ahead, no advantage could be drawn from my sails; the whole has, therefore, been performed by the power of the steam engine.

Your obed't servant,
Robert Fulton.

Fulton, in a conversation with Judge Story, gave the following account of this experiment: "When," said he, "I was building my first boat, the Clermont, at New York, the project was viewed by the public either with indifference or with contempt as a visionary scheme. My friends were civil but they were shy. They listened with patience to my explanations, but with a settled cast of incredulity on their countenances. I felt the force of the lamentation of the poet,

> "Truth would you teach, to save a sinking land,
> All shun, none aid you, and few understand."

As I had occasion to pass daily to and from my building yard while my boat was in progress, I had often loitered, unknown, near the idle group of strangers, gathered in little circles, and heard various inquiries relative to the object of this new vehicle. The language was uniformly that of scorn, sneer or ridicule. The loud laugh rose at my expense, the dry jest, the wise calculations of losses and expenditures, the dull but endless repetitions of the Fulton Folly. Never did a single encouraging remark, a bright hope or a warm wish cross my path. Silence itself was but politeness veiling its remarks or hiding its reproaches. At length the day arrived when the experiment was to be brought into operation. *To me it was a most trying and interesting occasion.* I invited my friends to go on board and witness the first successful trip. Many did me the honor to attend as a matter of personal respect, but it was apparent that they did it with reluctance, fearing to be partners in my misfortune and not of my triumph. I was well aware that in my case then, there were many reasons to doubt my own success.

The machinery was new and ill-made, and many parts were manufactured by mechanics unacquainted with such work; and unexpected difficulties might reasonably be presumed to present themselves, from other causes. The moment arrived when the word was to be given for the vessel to move. My friends were in groups upon the deck. There was anxiety mixed with fear among them. They were silent, sad and weary. I read in their souls nothing but disaster, and almost repented my efforts. The signal was given, and the boat moved on a short distance, and then stopped and became immovable. To the silence of the preceding moment, now succeeded murmurs of discontent, and agitations, and whispers and shrugs. I could hear distinctly repeated—"*I told you it was so,—it is a foolish scheme; I wish we were well out of it.*" I elevated myself on a platform, and addressed the assembly. I stated there, I knew not what was the matter, but if they would be quiet, and indulge me for half an hour, I would either go on, or abandon the voyage, for that time. This short respite was conceded without objection. I went below and examined the machinery, and discovered that it was a slight mal-adjustment of some of the work. In a short period it was obviated. The boat was again in motion: she continued to move on; all were incredulous: none seemed willing to trust their own senses. We left the fair city of New York: we passed through the ever-changing scenery of the highlands: we descried the clustering houses of Albany: we reached its shores—and then, even then, when all seemed achieved, I was the victim of disappointment. Imagination superceded the influence of fact. It was then doubted whether it could be done again, or if done, if it could be made of any value.

Fulton obtained a patent for his inventions for navigating with steam in 1804, and another for some improvements in 1811. Fulton was a native of New Britain in Lancaster county, Pennsylvania, and born in 1765, his parents were in humble circumstances and were enabled only to give him a common education. He early exhibited a fondness for painting, and at the age of 18 he established himself in Philadelphia. At the age of 22 he went to England to advance his talent, and was received into the family of West, with whom he spent several years, and entertained a warm friendship. During his stay he became acquainted with the Duke of Bridgwater and Lord Storhope, the former famous for canals, and the latter for his love of mechanism. He soon turned his attention to the use of steam for propelling boats. In 1796 he obtained a patent for a double inclined plane. He also professed himself a civil engineer, and published a treatise on canal navigation. He soon went to France and obtained patents for his improvements. He spent the succeeding seven years in Paris in the family of Joel Borlem, during which time he made himself acquainted with the French, Italian and German languages, and acquired a knowledge of mathematics, physics, and chemistry. He turned his attention to sub-marine explosions and in the harbor of Brest, demonstrated the success of his discovery. The British ministry invited him to London where he blew up a vessel; which led them to wish to suppress rather than encourage his improvement, they therefore gave him no employment.

In 1803, he made several experiments in steam to apply his principal to boats,—Chancellor Livingston was then minister to France. Fulton, with his aid, constructed a boat on the river Seine; this was in 1803, which fully evinced the practicability of applying it to boats. He determined to enrich his country with the discovery, and immediately embarked for the United States, and in 1806 commenced the construction of the boat, the results of which we have given. In 1811 Fulton was employed by the legislature to explore the routes of the canal, and was engaged with zeal in prosecuting that object, on the breaking out of the war. In 1812 he again experimented on sub-marine explosions. In 1814 he contrived an armed ship for the defence of New York, and invented a sub-marine vessel for plunging under water. These plans were approved by the government, but before he had accomplished them he died suddenly on the 24th Feb. 1815. His person was tall slender and well formed. We have thought proper to give this full account of the first steamboat that was constructed in this country, and of the great inventor. *The advantages that have followed this discovery are too great to be calculated.*

Locomotive Performances.—Extract of a letter dated Sept. 9, 1841, from Captain William S. Moorsom, of the Royal Engineer Corps, and chief engineer of the Birmingham and Gloucester railway company, England.

"On Monday, 23d August last, the following trial was made on the Lickey inclined plane, near Bromsgrove, on the Birmingham and Gloucester railway.

"The plane is 2 miles and 3 chains in length, with a uniform rise of 1 foot 37 4-10ths, or a total rise of 285 feet.

"The engines tried were 'No. 65,' built by Mr. Bury, of Liverpool, and the 'Philadelphia,' built by Mr. Norris, of Philadelphia, their dimensions and weights being—

	**No. 65.*	*Philadelphia.*
Cylinder,	13 inches.	12½ inches.
Stroke,	18 inch.	20 inch.
Wheel,	5 feet.	4 feet.
Weight empty,	10 tons 10 cwt.	10 tons 6 cwt.
	Adhesion of 4 wheels coupled.	Adhesion of 2 wheels.

"The engine 'No 65' began the trials with 6 wagons loaded with rails and a composite carriage, and stopped at the foot of the plane. She then tried 4 wagons and the carriage, and stopped 270 yards up the plane. The following loads were then taken, first by 'No. 65,' and then by the 'Philadelphia' in the same order, one wagon being taken off each time. Each Engine started about 150 yards distant from the foot of the plane, upon an inclination of 1 in 300.

No. 65.

Load exclusive of engine and tender, say 19 tons more.

	Tons.	Cwt.	Time of ascent.	Rate per hour.
3 wagons and 1 carriage,	24	12½	840 sec'ds,	8¾ miles.
2 do. 1 do.	17	18¾	534 do.	14 do.
1 do. 1 do.	11	4¾	349 do.	21 do.
1 do.	4	10	297 do.	24¾ do.

Philadelphia.

	Tons.	Cwt.	Time of ascent.	Rate per hour.
3 wagons and 1 carriage,	24	12½	483 do.	15¼ do.
2 do. 1 do.	17	18¾	446 do.	16½ do.
1 do. 1 do.	11	4¾	421 do.	17½ do.
1 do.	4	10	347 do.	21 do.

Pressure, 65 lbs. per inch.

"The 'Philadelphia,' has been working daily up this plane since June, 1840, with 5 wagons, each loaded with 6½ tons, and with four or five persons in each. She has taken as many as 8 wagons. I estimate the extreme load she has taken up, as equal to 82 tons, (including self and tender,) of 2240 pounds each. I congratulate you on this result. We shall also offer Mr. Stephenson a like trial, and I have no fears for the result.

Very truly yours,

WILLIAM S. MOORSOM.

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* Mr Bury has not stated the weight of his engine, and I have taken the weight as stated to me by the foreman of his engine house.

NORRIS' ENGINES.—AMERICAN LOCOMOTIVES.

As additional evidence of the superiority of our machinery, must be gratifying to every true friend of improvement, we have extracted from a pamphlet recently received, several complimentary notices of Mr. Norris' engines, received from those connected with foreign railroads, who have had an opportunity of testing their capabilities.

Certificate of the Chief Engineer of the Berlin and Potsdam railroad.

The Berlin and Potsdam railroad company received from the manufactory of William Norris, of Philadelphia, two locomotive engines, the "*Prussia*" and "*America*."

Previous to the arrival of these engines, the reputation of American machines was considerably weakened, and suffered much, by the bad performances of a locomotive engine built by another manufacturer, for the Leipsic and Dresden railroad. These machines of Norris', consequently, were looked upon with doubt and suspicion; and when they were put in operation, an express condition was made that no more than 45 lbs. pressure on the square inch should be used. With the greatest anxiety at the first trial, I ascended one of the engines; and with the greatest satisfaction at the result of its performance, I descended, with surprise and joy. After two months close observation and attention, I recommend these engines, with complete conviction of their efficiency, and under all circumstances, their adaptation to every railroad for all emergencies, and conquering all difficulties. Their motion is perfectly regular, and their speed great; the consumption of fuel very trifling, and their power so remarkable, that with a train of 16 full loaded cars, and only under a pressure of 45 lbs. to the square inch, they run with the greatest facility, at the rate of 27 miles per hour. I therefore recommend these engines, without hesitation, in preference to the best of any English manufacture.

If I could by the foregoing, testimony, convince the incredulous and irresolute of doubts of the efficiency and adaptation of these engines, and create by the same their general use, which have far exceeded our expectations, I then should feel sincerely gratified.

I also recommend Mr. William Gwynn, agent for Mr. Norris, as a gentleman upon whose word and veracity, those who would charge him with any orders, the greatest confidence can be placed.

Should any railroad company desire to have any further information of particular performances of these engines, I shall, with pleasure, give it, either verbal or written.

(Signed,) LOOF.
Chief Engineer of the Berlin and
BERLIN, *October* 16, 1839. *Pottsdam railroad company.*

From the Chief Engineer of the Birmingham and Gloucester railroad.

GLOUCESTER, *January* 16, 1840.

MY DEAR SIR:—In reply to your request expressed only this morning, that I should give you my opinion of Mr. Norris' locomotive engines, I have pleasure in stating briefly—I have worked for a period altogether, of about two months, at various times, over above 1500 miles of railway, with four of Mr. Norris' engines, three of them being of class B, and one of class A.

I have worked over various grades from one in thirty to a level, and with various loads from 120 to 30 tons, (up one in thirty, our load was 39½ tons at 13 miles per hour) and at various speeds. The general result in my mind is a conviction that Mr. Norris' engines are admirable machines, and calculated particularly for full loads, (say 100 tons) at a moderate speed (say 20 miles per hour,) and for such occasion I should prefer them to any English engines with which I am at present acquainted.

I have not yet had sufficient experience to judge of their durability but I should infer from what I have seen, that in this respect also they will prove fully as durable, and as economical as any that we have in this country.

Believe me, very truly, yours,

(Signed.) WILLIAM S. MOORSOM,
Late Captain of the 52d. Lt. Infantry and Civil Engineer.

WILLIAM GWYNN, *Esq., Chief Engineer and agent of* WILLIAM NORRIS, *Esq., Philadelphia.*

Copy of a letter received from WILLIAM S. MOORSOM, *Chief Engineer of the Birmingham and Gloucester railway, England.*

WORCESTER *July* 20, 1840.

MY DEAR SIR:—I reply to your request that I should give you my opinion of Mr. Norris' locomotive engines, I again have pleasure in stating briefly.

The Birmingham and Gloucester railway company are in possession of nine of Mr. Norris' engines, and have given orders for more.

I have certified under date of 16th January, 1840, to the excellent performances of Mr. Norris' engines of class A. and B., with heavy loads and at moderate speeds. My further experience of these classes of engines fully confirms that certificate, and also enables me to state that they are now performing on the Birmingham and Gloucester railway in an admirable manner. The usual train on this railway comprises four passenger carriages and two trucks, being an ordinary gross weight of 45 tons, with such trains, these engines class B, run on level grades at a speed of thirty-four miles per hour, and sometimes they make as much as thirty-eight per hour, without any difficulty arising out of the rapid action of the piston. On grades rising 1 to 300, they take the same train at a speed of 24 to 25 miles per hour.

I have lately tried on the Lickey inclined plane, (which rises one in 37½) one of Mr. Norris' engines of class A, weighing 10 tons, with 12½ inch cylinder, 20 inch stroke and 4 feet driving wheels; I have under date 22d June, stated to you the performance of this engine, and I have only to add, that in the letter alluded to, I have underrated the work done, in consequence of my not having then ascertained the friction of the wagon used.

I now conclude that whether the rails are wet or dry, the Philadelphia will take up the plane, a gross load of

81 tons at an ultimate speed of				9 miles per hour.			
74 "	"	"	"	10 "	"	"	
53 "	"	"	"	15 "	"	"	

and in the best or dry state of the rails and weather, she will exceed the above performances, which are as I believe, nearly double as much as any engine in England has ever been authentically reported to perform.

(Signed.) William S. Moorsom.
Chief Engineer of the Birmingham and Gloucester railroad.

William Gwynn, *Esq., Engineer and agent of* William Norris.

SAFETY ROTATION RAILWAY.

We have been to a private view of this ingenious contrivance to effect a rapid power of locomotion with more safety, less expense, and with equal or greater speed than is achieved by the present system of railways. The following is a brief outline of the plan:

"The safety rotation railway is an inversion of the ordinary construction, inasmuch as wheels are made to revolve on fixed bearings, placed in two parallel lines along the road; and the carriage, without wheels, is built upon a pair of running rails, carried along upon the peripheries of the train of wheels kept in revolution by steam engines at fixed distances. The wheels may be driven by a succession of endless bands, or any other mode of actuating them one band in every case passing around two pulleys attached to every two adjacent wheels. The carriages are designed to hold forty passengers each, with luggage, the whole, including the carriage, not to exceed five tons; the running rails always to bear on eight or ten wheels, so that no wheel shall have to support more than 10 or 1200 weight. The luggage box is made to pass between the line of wheels and so reach below their centres, kept in place by a pair of guide pulleys; so that the carriages cannot get off the road, nor can they meet or overtake each other, consequently no collision, can take place. It is practicable by this system (the carriages being despatched singly) to ascend steeper acclivities than ordinary, so that the expense of tunnelling would be obviated, and of cutting and embanking considerably reduced; and railways may be made available in fifty districts, from which they are now excluded, nothing more than the bare weight of a slight carriage, its passengers, and luggage, being required to be elevated, thus saving the enormous power necessary for carrying up a heavy locomotive engine and its appendages.

"On this road the public may travel with safety, ease, and comfort, unaccompanied by the nuisance of a locomotive engine and free from annoyance by sparks, smoke, or dust.

"It is calculated that not only the cost of the construction of a safety rotation railway will not exceed two-thirds of the expenditure now actually required for one of equal dimensions of an ordinary nature, but the annual saving in the maintaining it in constant and substantial repair, will be 70 per cent. less than what is ordinarily required for the like purpose in railways now used.

"For this ingenious plan we are indebted to the scientific abilities of Mr. John Rangeley, who has obtained a patent for the invention, and who is inviting the public to take part in the formation of a railway of sufficient dimensions to prove its efficiency when carried into operation, and to test by actual experiment whether the friction in this mode of construction will be greater than in the ordinary way.

"If the plan be found to succeed, there will be no difficulty, in the opinion of other eminent engineers, in connecting the rotation railways with those now in use.—*English paper.*

[From the Railway Magazine.]

SUCCESS OF LONG LINES OF RAILROADS.

London and Birmingham and Grand Junction Railway Companies.—Table showing the amount of capital advanced by the shareholders; the present market value of the shares; and the amount of profit resulting therefrom:—

London and Birmingham Railway—112½ *miles.*

Shares.	Nominal amount of shares.	Paid up. Per share.	Paid up. Amount.	Market value, Feb. 1, 1841. Per share.	Market value, Feb. 1, 1841. Amount.
25,000	£100	£90	£2,250,000	£179	£4,475,000
25,000	25	5	125,000	30½	762,500
31,250	32	32	1,000,000	60	1,875,000
			£3,375,000		£7,112,500

Grand Junction Railway—83 *miles.*

Exclusive of the part of the Liverpool and Manchester railroad, which forms a part of the line to Liverpool:

Shares.	Nominal amount of shares.	Paid up. Per share.	Paid up. Amount.	Market value, Feb. 1, 1841. Per share.	Market value, Feb. 1, 1841. Amount.
10,918	£100	£100	£1,091,800	£214	£2,336,452
10,918	50	40	436,720	106	1,157,308
17,000	25			29	493,000
5,000	50	50	250,000	52½	262,500
			£1,778,520		£4,249,260

Recapitulation.

Market value of London and Birmingham railway shares - - - - - - -	£7,112,500
Market value of Grand Junction railway shares -	4,249,260
	£11,361,760

Money advanced by shareholders of London and Birmingham railway shares - - - -	£3,375,000	
Money advanced by shareholders of Grand Junction railway shares -	1,778,520	
		5,153,520
Profit (equal to $29,799,552) - - - -		£6,208,240

The Grand Junction railroad is a continuation of the London and Birmingham railroad, and forms with it and about half the Liverpool and Manchester, an aggregate length of 209½ miles. This is *about* the same length of line as is presented by the Worcester railroad and Western railroad, from Boston to Albany, which form an aggregate line of 200 miles. This last line is a continuation of the Erie canal, on which the tolls and freight will, this year, exceed $5,000,000.—*Boston Daily Advertiser and Patriot.*

Wooden Pavements.—A correspondent of the Charleston Courier has been advocating, with great earnestness, the adoption of wooden pavements in that city, appealing to the experience of London, of New York, and of Philadelphia, to sustain his argument. The London papers all agree in stating that the wooden blocks have proved to be an excellent pavement, and that on taking them up, after two years use, they exhibit no evidence of rotting. We hear but little from New York; but of Philadelphia, we may say that, so far as the experiment has been tried, it has not been found successful. The blocks have rotted after two years, and made a rougher surface by far than the ordinary paving stones. The experiment, then, has not been successful. The blocks in Walnut street, opposite the exchange, are of a shape quite different from those first used, but the shape of the block cannot have much effect in preserving them from rotting.

But as all consider the subject of much importance, we may perhaps inquire as to the cause of the failure. In the frst place, the lightest wood was used because it was the cheapest, viz: hemlock, with pores always open, taking in every drop of moisture that falls upon the block. In the next place, the mode of laying the blocks has not been the best.

We are not prepared to say what would be the difference in durability between hemlock and some of the harder woods—gum, for instance, or chesnut; it must, however, be very considerable, and seasoned gum might have given a different result to the experiment.

We have hitherto spoken of blocks with no other preparation than that of shaping. But a part of the pavements tried in different streets of the city was of blocks saturated with some preservative solution under the direction of Dr. Earle, and after a formula of his invention. These have now been down, we think, two years; and, if we mistake not they have thus far withstood the atmosphere above and the moisture of the earth below. We shall, at another time, make closer inquiries as to the result of the experiment of Dr. Earle's plan, and report thereupon; because we think that it is of great importance. We are satisfied that if Kyanising or injecting by Dr. Earle's mode will remove the liability of wood to rot, then the community will call for its use as a pavement. Even should the cost very much exceed that of pebble paving, the comforts to all, and the merciful operation upon the beasts, commend it to consideration and adoption.—*U. S. Gaz.*

Canal Boats.—Modern improvements in ship building have lately reached the lesser and more humble (though perhaps not the less useful water craft,) canal barges. A part of these improvements consist in increased capacity for carrying without any material increase in the draft of water; thus, for instance, we remember well when thirty tons was about the average burden of coal boats on the Schuylkill canal, where of late years 50 to 60 tons is a common load. On the Tide Water canal, the largest and finest class of boats are more generally employed, some of which may be seen at our wharves daily, and among them, we noticed yesterday the new and well equipped boat Juniatta, Captain Woods, now loading with merchandise, below Spruce street, for Lewistown, Mifflin county. This barge is capable of carrying 3,100 bushels of wheat, and then only drawing three and a half feet of water. She belongs to the line of Messrs. S. & S. Milliken, of Lewistown.—*U. S. Gazette.*

Atmospheric Vacuum Engine.—The Louisville Advertiser notices a new invention by a Mr. Lanning, of that city, which would be invaluable, if the principle could be successfully applied to the propelling of heavy machinery. It is an engine which is put into operation by atmospheric air, dispensing with boilers, water, and steam, and putting all danger of explosion out of the question. It is thus described:—

"In its construction it is exceedingly simple. Two tubes, or *chimneys*, capable of bearing a pressure of fifteen pounds to the inch, are placed perpendicularly over a stove or furnace, from which a flue leads to each. The flues have valves at each end. A fire is lighted in the furnance, the blaze of which ascends into one of the chimneys, (the other being closed by the valves.) This rarifies the air, which rushes through a pipe into a common cylinder, and moves the piston. The action of the engine shuts the first flue, in which a vacuum is created, while the heat and propelling force are changed to the other, producing the reverse motion. Thus heated, air is applied to the common engine in the same manner as steam. With a slight fire, we saw the engine put in motion, and, though but a rough model and upon a small scale, it afforded sufficient power to drive a common fanning mill, or wheat cleaner, with considerable rapidity. It will require *less fuel* than is necessary in working a steam engine, no water nor boilers. We understand that the inventor has received liberal proposals already, from men of capital, who have confidence in its complete success."

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Continued from page No. 232.

REMARKS UPON A PAPER "ON THE BUILDING MATERIALS OF THE UNITED STATES OF NORTH AMERICA.—*By* DAVID STEVENSON, *C. E., Edinburgh."—Read before the Society of Arts for Scotland, in session,* 1841.

In noticing the omissions of Mr. Stevenson in the last number of this journal, no reference was made to our hydraulic and other limes. As these are most essentially building materials, a few remarks upon them may not be improper before proceeding to notice that portion of the paper which relates to timber.

The great variety and extent of the limestone throughout the country, is too well known to need extended notice. While one portion furnishes good stone for building, including marble, and another an inferior lime highly useful as a manure—a very large quantity of good lime for mortar, is to be procured over the whole county.

It is true the Thomaston lime from its high reputation and the low cost at which it is furnished, has prevented many other excellent limestones from coming into extensive uses, but still lime *is* manufactured in very many places, and the business is continually on the increase. Hydraulic limestone is also abundant and instances of its occurrence are familiar to all who have been employed on such works as involve the employment of this material. Indeed it is not unlikely, that hydraulic limes are more abundant than pure limestones, and in course of time, they may, for many purposes, replace common lime.

The bituminous limestone, resembling that of Seysal, is known to be frequently found, and should the preparation known as "asphalte" ever come into general use, we have an abundance of the material at hand without the necessity of importing it.

In the same connection, we might also mention our fire clays which are numerous and excellent, and as an important material for the founder, the builder, and the manufacturer, are not to be overlooked in a survey of our resources.

The notice of our timber is prefaced by the following general remarks:—

"The forests, to the British eye, are perhaps the most interesting features in the United States, and to them, the Americans are indebted for the greater part of the materials of which their public works are constructed. These forests are understood to have originally extended, with little exception, from the sea coast to the confines of the extensive prairies of the western States; but the effects of cultivation can now be traced as far as the foot of the Alleghany mountains, the greater part of the land between them and the ocean having been cleared and brought into cultivation. It is much to be regretted that the early settlers, in clearing this country, were not directed by a systematic plan of operations, so as to have left some relics of the natural produce of the soil, which would have sheltered the fields and enlivened the face of the country, while at the same time they might, by cultivation, have been made to serve the more important object of promoting the growth of timber. Large tracts of country, however, which were formerly thickly covered with the finest timber, are now almost without a single shrub, every thing having fallen before the woodman's axe; and in this indiscriminate massacre there can be no doubt that many millions of noble trees have been left to rot, or what is scarcely to be less regretted, have been consumed as fire-wood. This work of general destruction is still going forward in the western States, in which cultivation is gradually extending; and the formation of some laws regulating the clearing of land, and enforcing an obligation on every settler to save a quantity of timber, which might perhaps, be made to bear a certain proportion to every acre of land which is cleared, is a subject which I should conceive to be not unworthy of the attention of the American Government, and one which is intimately connected with the future prosperity of the country. But should population and cultivation continue to increase in the same ratio, and the clearing of land be conducted in the same indiscrimnate manner as hitherto, another hundred years may see the United States a *treeless* country. The same remarks apply, in some measure, to our own provinces of Upper and Lower Canada, in many parts of which the clearing of the land has shorn the country of its foliage, and nothing now remains but blackened and weather-beaten trunks.

"The progress of population and agriculture, however, has not as yet been able entirely to change the natural appearance of the country. Many large forests and much valuable timber still remain both in Canada, and in the United States; the Alleghany mountains, as well as other large tracts of country towards the north and west, which are yet uninhabited, being still covered with dense and unexplored forests."

Mr. S. does not seem to have distinguished sufficiently between the clearing of a thickly wooded country and the indiscriminate and wanton destruction of our forest trees. While there is some reason for the complaint which he makes, yet the "destruction" is greatly overrated. Tolerably familiar with some of the oldest settled parts of the country, we have not yet seen these large tracts formerly well wooded which "are now almost without a single shrub." For instance, from within a mile or so of the city of New York, the forest may be traversed in one case twenty-five and in another, thirty or forty miles with scarcely a single interruption, except from the woods crossing the path. We have heard the bells of the city in a forest which has never been cleared, and where hundreds of trees are now standing which probably were in existence when Columbus discovered the New World. We are however, informed by Mr. S. that "many large forests and much valuable timber still remain"—a consolation that we must thankfully receive.

The remarks upon timber generally, appear to be taken from works known to most of our readers and we shall therefore pay less attention to them than the preceding portions of the paper, and only extract such passages as relate to the use and estimation of our timber in Europe.

The following calculation may be new to some of our readers, and is we believe, correct:—

"The species of forest trees indigenious to different countries is an interesting subject connected with vegetable physiology. There are said to be about thirty forest trees indigenious to Great Britain, which attain the height of thirty feet; and in France there are about the same number. But according to the best authorities, there are no less than 140 species, which attain a similar height indigenious to the United States."

Appended to the history of the Live Oak are these remarks: —

"There can be little doubt, from its great density and durability, that this is one of the finest species of oak that exists, surpassing even that for which Great Britain is so famous. Its cultivation has been tried in this country without success; but could it be imported, it would be found admirably suited for the construction of lock-gates and engineering works, for which hard and durable timber is required, and for which English or African oak is generally used."

"The White oak (*Quercus alba*) is the species of which so much is imported into this country. It is known by the name of 'American oak,' but it is a very different and much inferior wood to the live oak of the United States, which I have just described. It is also much more widely distributed, and occurs in much greater quantity, than the live oak. It is very common throughout the northern States and in Canada, from whence it is exported to this country. It attains an elevation of seventy or eighty feet, with a diameter of six or seven feet. It is known by the whiteness of its bark, from which it derives its name, and from a few of its leaves remaining on the branches in a withered state throughout the winter. The wood is of a reddish color, and in that respect is very similar to English oak. But it is generally acknowledged to be greatly inferior to it in strength and durability. It is very straight in the fibre, however, and can be got in pieces of great length and considerable scantling—properties which, for certain purposes, make it preferable to the British oak. It is much used in ship building, and also for the transverse sleepers of railways. There are many other oaks in the United States, but the two I have mentioned, are those most in use."

* * * * * * *

"The White, or Weymouth Pine (*Pinus strobus*,) is widely distributed both in the United States and in Canada, and is exported to Britain in great quantities from the latter country. It is the tallest tree of the American forest, having been known, according to Michaux, to attain the height of 180 feet. The wood has not much strength, but it is free from knots, and is easily wrought. It is very extensively employed in the erection of bridges, particularly *frame* and *lattice* bridges, a construction peculiar to the United States, and very generally adopted in that country, which I have described in detail elsewhere.* For this purpose it is well fitted, on account of

* Stephenson's sketch of the Civil Engineering of North America. London: John Weale, 1838.

its lightness and rigidity, and also because it is found to be less apt to *warp* or *cast* on exposure to the atmosphere than most other timbers of the country. It is much used for the interior fittings of houses, and for the masts and spars of vessels."

Our Yellow pine is not found in Canada and therefore does not reach England.

"The Red pine (*Pinus resinosa,*) is the only other of the pine species that is much used. It occurs in great plenty in the northern and middle States, and in Canada, from whence it is exported in great quantity to this country, and it is known to us by the name of 'American yellow pine.' * * * * * * * The wood owing to the resinous matter it contains, is heavy; and is highly esteemed for naval architecture, more especially for decks of vessels, both in this country, and in America."

Of the Locust so extensively cultivated, and of which acres upon ares are planted, Mr. S. says: —

"Its growth being chiefly confined to the United States, it is not imported into Britain. It is one of the very few trees that are planted by the Americans, and may be seen forming hedge-rows in the highly cultivated parts of Pennsylvania."

"The Red cedar (*Juniperus Virginiana,*) is another valuable wood, the growth of which is confined to the United States. In situations where the soil is favorable it grows to the height of 40 or 50 feet, with a diameter of 12 or 13 inches. This wood is of a bright red color; it is odorous, compact, fine grained, and very light, and is used as already stated in ship building, along with live oak and locust to compensate for their weight. It is considered one of the most durable woods of the United States, and being less affected by heat or moisture than almost any other, it is much employed for railway sleepers. I remember, in travelling on some of the railways, to have been most pleasantly regaled for miles together, with the aroma of the newly laid sleepers of this wood. It is now, however, becoming too scarce and valuable to be used for this purpose."

In his concluding notice, Mr. S. abandoning the authority he has safely followed for some time, gives us the result of his own observations in the following singular paragraph: —

"Such is a brief notice of some of the principal timbers of the United States, which, from their great abundance and variety, are suitable for almost every purpose connected with the arts, and thus serve in some degree to compensate for the want of stone, while at the same time they afford great advantages for the prosecution of every branch of carpentry, an art which has been brought to great perfection in that country. Many ingenious constructions have been devised to render timber applicable to all the purposes of civil architecture, and in no branch of engineering is this more strikingly exemplified than in bridge building. Excepting a few small *rubble arches* of inconsiderable span, there is *not a stone bridge* in the whole of the United States or Canada. But many wooden bridges have been constructed. Several of them, as is well known, are upwards of a mile and a quarter in length, and the celebrated Schuylkill bridge at Philadelphia, which was burnt about two years ago, but was in existence when I visited the country, consisted of a single timber arch of no less than 320 feet span. Canal locks, and aqueducts, weirs, quays, breakwaters, and all manner of engineering works have there been erected, in which wood is the material chiefly employed; so that if we characterize Scotland as a stone, and England as a brick country, we may, notwithstanding its granite and marble, safely characterize the United States as a country of timber."

Where were the famous stone viaducts on the Baltimore and Ohio railroad, and the Washington branch, when our author was in that vicinity? We cannot account for the singular statement, that there are no (dressed) stone bridges in the United States, in any other way than by supposing that the queer crotchet in Mr. Stevenson's brain, —that there was no stone in the United States—led him to imagine that every bridge must necessarily be built of timber, and that satisfied with this hypothesis, he gave himself no further trouble to examine into the matter.

We have thus examined at length, this extraordinary paper, but with other objects than the mere criticism of the ridiculous statements contained in it. We wish to draw the attention of engineers to two important facts which force themselves upon the mind of any one reading Mr. Stevenson's paper. The first of these is the remarkable ignorance which prevail in England and elswhere as to our civil engineering. Such statements could hardly have been admitted into respectable journals, had they not received credit from those who were supposed to be informed on such subjects. The second fact is, that no better information either abroad or in our own country, will be found, until our civil engineers as a profession and in a body, vindicate their practice and thus correct these errors which are so prevalent. It may be thought that the estimation in which they are held abroad, is a matter of little consequence—but it is far otherwise—if a feeling of self respect is not inducement enough to correct such erroneous estimates, let them recollect that these errors will react upon us, and that we shall, among other evils, suffer an immigration of gentlemen unable to attain any standing at home, and who will be most happy to show our civil engineers how to avoid the violation "of the established rules of engineering as practised in *their* country"—how to build stone bridges of large span, and finally to discover that, although not known before, there is an abundance of stone in the United States.

[For the American Railroad Journal and Mechanics' Magazine.]

NEW YORK AND HARLEM RAILROAD.

A report on the "past management, present condition and future prospects," of this company was issued under date 15th October, 1841, from which we extract the following particulars. The original act of incorporation was dated 25th April, 1831, and the final act of amendment was passed May 7th, 1840—by which the whole capital authorized per amended charter, consists of 59,000 shares of $50 per share, $2,950,000.

By this last act of amendment, the company are authorized to construct their road from the Harlem river, through the county of Westchester to the north line of that county, and eastwardly to the line of the State of Connecticut, and there to intersect with a line or lines from that State or from Massachusetts, etc., etc,

The amount of stock sold is as follows,

26,233 shares at $50, - - - -	1,311,650	
Deduct loss on 11, 420 shares, sold under par	301,178	
		1,010,472.
The loans are, one amount for which there are 4,700 shares at $50 hypothecated	235,000	
One amount, for which the road and appurtenances are mortgaged, - - - - -	125,000	
		360,000
		1,370,472
Add loss on 11,520 shares, - - - -		301,178
		$1,671,650
which is represented by a road from City Hall to Harlem of double track, flat bar, - - - - - - -		8 miles.
From Harlem to Fordham, single track, edge rail,		4½ miles.
		12½ miles

or in all 20½ miles of single track of road costing about $70,000 per mile, after deducting $247,660 of real and personal estate, included in the above expenditure of $1,671,650.

If the reader would more clearly understand how little has been obtained for this vast expenditure—let him cross into Jersey City, and examine the road to Brunswick of 37 miles, including 3 of turnouts, having an edge rail throughout, and an equipment nearly equal to the conduct of the whole line of traffic and travel between New York and Philadelphia—look at Bergen hill—the bottomless swamps filled up—the long bridges on this route—the whole cost of which, exclusive of right of way, does not exceed $1,600,000, and he will see how much the latter have to congratulate themselves on the economy which must have obtained in its construction.

The amount of travel over this road for the year ending September, 1840, was,

From City Hall to 25th street	- -	$605,477	fare $6\frac{1}{4}$	cents.
Do. do. Yorkville,	- -	42,832	do. $12\frac{1}{2}$	do.
Do. do. Harlem,	- -	375,272	do. $18\frac{3}{4}$	do.

These rates of fare are of course regulated by the competition of omnibusses by which the accommodation may be called equally good and some would call better. The following list of fares for travel on the English roads, will serve for a record of the rates which have hitherto obtained there, but being now thought generally too high, the controversy created thereby, has within this year caused important reductions on most of the main lines—the standard now assumed as productive of most travel being $2\frac{1}{2}$ to 3 cents per mile, which for the *despatch and accommodation* there afforded is very cheap indeed. Compare it for instance with the line between New York and Philadelphia, the most important in the United States, where the fare and *loss of time* etc., come to at least ten cents per mile, and not only checks the immediate travel, but that which a better communication would induce both north and south of those points.

Rates of fare on the railroads of Great Britain.

Road.	*Length. Miles.*	*1st. Class. Charge.* £	*s.*	*d.*	*Cts. pr. mile*	*2d. Class. Charge.* £	*s.*	*d.*	*Cts. mile.*
London and Birmingham,	$112\frac{1}{4}$		30	0	$5\frac{1}{8}$		20	0	$3\frac{7}{8}$
Midland counties,	$49\frac{1}{4}$		10	0	$4\frac{1}{2}$		8	0	$3\frac{1}{2}$
Lancaster and Preston,	21		5	0	$5\frac{3}{8}$		3	0	$3\frac{1}{8}$
Grand Junction,	$97\frac{1}{4}$	1	5	0	$5\frac{1}{4}$	1	3	0	$5\frac{1}{4}$
North Midland,	72	1	2	0	$6\frac{3}{4}$		18	0	$5\frac{1}{2}$
" " and York,	27		5	0	$4\frac{1}{8}$		3	0	$2\frac{1}{2}$

Road.	*Length. Miles.*	*1st. Class. Charge.* £ *s. d.*	*Cts. pr. mile.*	*2d Class. Charge.* £ *s. d.*	*Cts. mile.*
Great Western,	118	14 0	5	10 0	$3\frac{1}{2}$
Eastern counties,	$17\frac{1}{2}$	4 6	$5\frac{3}{4}$	3 0	$3\frac{3}{4}$
Croydon,	$10\frac{1}{2}$	2 0	4	1 6	3
London and Blackwall,	$3\frac{1}{2}$	0 6	3	0 3	$1\frac{1}{2}$
South Western,	77	1 0 0	$5\frac{1}{2}$	12 0	$3\frac{1}{2}$
Birmingham & Derby Junc.	$38\frac{1}{2}$	—	—	—	—
London and Brighton,	47	—	—	—	—
Birmingham and Gloucester,	59	11 6	$5\frac{1}{4}$	8 0	$3\frac{5}{8}$
Manchester and Birmingham,	$45\frac{1}{2}$	—	—	—	—
Liverpool and Manchester,	31	6 6	$6\frac{5}{8}$	6 0	$4\frac{1}{4}$
Manchester, B. and Bury,	10	2 6	$5\frac{1}{2}$	1 6	$3\frac{1}{2}$
Leeds and Selby,	20	4 0	$4\frac{3}{8}$	3 0	$3\frac{3}{8}$
Hull and Leeds, Junction,	$30\frac{3}{4}$	8 0	$5\frac{3}{4}$	6 6	$4\frac{5}{8}$
Sheffield and Ratheham,	$5\frac{1}{4}$	1 0	4	0 6	2
Stockton and Darlington,	40	—	4	—	3
Newcastle upon-Tyne,	$61\frac{3}{4}$	11 0	4	8 6	3
Manchester and Leeds,	50	—	—	—	—
Glasgow and Ayr,	40	6 8	$3\frac{5}{8}$	5 0	$2\frac{7}{8}$
Dundee and Arbroath,	$16\frac{3}{4}$	2 6	$3\frac{1}{2}$	2 0	$2\frac{3}{4}$

This gives an average of twenty-one railroads, as follows:—

1st Class, - - - - $4\frac{3}{4}$ cents per mile.
2d. " - - - - $3\frac{1}{2}$ " " "

It need scarcely be stated that at the above scale of travel and fare on the Harlem road, that the receipts are inadequate to meet the current expenses of road and interest on its debts, the latter being stated to fall due as follows:—

Before the 1st day of January, 1842, - - -	$182,000
In the course of the years 1842, '3, '4, '5, '6, and '7,	178,000
	$360,000

As the road now stands we do not see any other result but increased deficiency in the means of meeting its expenses, nor do any of the expedients proposed in this report, seem adequate to save it from sinking deeper and deeper into the abyss in which it is already plunged.

The expedients here referred to, are alluded to in the report as follows:

"The connection of the Harlem railroad company, with the New York and Erie railroad at Piermont, can be effected by constructing a branch of eight miles through an eligible route from the main line of the road to White Plains, and a connection with one of the eastern routes (Housatonic,) may be readily effected from this point."

Against these projects, it may be stated that the present termination of the Erie railroad, will be brought into Jersey City by being tapped at Ramapo by the Paterson railroad, which requires an extension of only 12 miles for that purpose, and the eastern connection so far as the northern travel is concerned, could be superceded by the construction of an entire line of road from the city of New York to Albany, taking the valley of the Saw Mill parallel to the Hudson river, which is maintained by some engineers to be a cheaper route for a railway than that through the valley of the Bronx, now occupied by the Harlem railroad. Besides, during the best part of the year would not the river route to and from Piermont by steamboat be preferred to a mixed one by horse, locomotive, and steamboat?

There never could have been but one legitimate termination for a railway in this direction, and that was at Albany, which however, was not considered by this company in the charter or its amendments. In leaving it where it now is, the results here exhibited, were but natural, and the parties to blame are not so much those having charge of its management, as the whole community between the city of New York and Albany, for thus suffering it to become an inevitable and as it were an *insuperable barrier*, to a connection between them, unless the strong arm of the legislature be made to aid in its removal, or a new route be taken, now that that connection will be found of imperious necessity to the metropolis of the State.

The report furnishes the following remarks:—

"While almost every other considerable city in this Union, has liberally contributed of its means or its credit to put into operation great works of internal improvements, connecting with important parts, the corporation of New York have remained inactive, resting in false security upon the advantages which nature has conferred upon its position, while ART is successfully giving to others all the facilities we enjoy. If the public guardians of the welfare of our city, continue to be insensible to the spirit of advancement, let the people agitate the question, until they are aroused to the support of our commercial pre-eminence.

[For the American Railroad Journal and Mechanics' Magazine.]

DEPRECIATION OR RESERVED FUND ON RAILWAYS,—FROM THE ENGLISH RAILWAY MAGAZINE.

This is understood in England to apply simply as a fund set apart to cover the amount of wear and tear, and actual depreciation of value in the working stock, comprising locomotives, cars, etc., etc.

The real bona fide nett income of a railway, ought to be apportioned to the shareholders, and no part be applied to the liquidation in part or in whole of its capital stock.

Then comes the question as to what is at any given time, really left to divide as actual profit—the current expenses being understood, to include the whole actual expenditure in every shape, and not merely the expenses paid, and which alone it was possible to have paid, but there should be ample security, that what appears in the accounts as nett profit really is such, and that the *future proprietors* are not left responsible for any portion of the expenditure, which has been in fact, incurred and exhausted in earning the present apparent dividend—hence the necessity for a careful periodical valuation of all the perishable stock, which at some time, will require partial or entire renewal. And therefore previously to the declaration and payment of a dividend, the actual value of working stock, etc., not with reference to its price if sold, but simply to its relative efficiency and precise comparative degree of wear and tear, should be ascertained to be, either the same as it originally was, or jointly with a reserved fund or per centage for future expenditure, capable of being made so. The object should be to avoid heaping an unusually larger expenditure on particular periods for wear and tear, going on gradually during a whole series of years. This course is one which every well conducted railway company must and will ultimately adopt.

A little further experience will show the per centage which the valuation will require to be set aside for this purpose, and which will vary on different lines, according with the degree of excellence in the original construction of the stock, and in the *efficiency of the servants and establishments* of each company.

In addition to all the actual disbursements, there is always, going on an imperceptible depreciation *of stock*, which must be provided for in some way or other. In the Liverpool and Manchester company, they have no depreciation fund,—when a new engine is wanted, it is charged in the current expenditure. The Grand Junction adopt the principle of a valuation annually, but this being too much a matter of guess work, on the London and Birmingham road, they prefer the principle of forming a depreciation fund, and setting aside over and above the ordinary charges for repairs, a certain per centage annually, out of the receipts, to keep up the value of the stock, and which they had fixed at 5 per cent on the value of the carriage stock, 5 cents per mile run by the engine, to provide for its superannuation.

This is an important subject, and has not been very particularly attended to in this country by any of our incorporated companies, whether railways, canals, banks, etc.

In this country, the working stock is found to be amply provided for, or perpetuated by an annual expenditure of, say, on the locomotives of $800, to $1,000 each; on the cars, of 10 to 15 per cent on the cost, modified of course by the quality of each particular road.

In the sketch of a railway, the proportions for a just appropriation for renewal of superstructure and adjustment of road bed is there given as applicable to the particular case of the Philadelphia and Pottsville railway as follows:—

The Rails:				
Estimated to last 30 years—8,500 tons per 100 miles, cost originally, say $60, (price of 1837 and '38) - - -	$510,000			
Deduct $20 for old iron, - - -	170,000			
	$340,000			
Or per mile, per annum, - - -		113		
Sills or Crossties:				
Estimated to last 10 years, 170,000 per 100 miles, at 50 cents, - - - - -	$85,000			
Or per mile per annum, - - -		85		
Bridges:				
Estimated to last 25 years, costing $450,000 for whole line, or per mile per annum,		180		
		——	378	
Road-Bed:				
Levelling and to keep it true, estimated to require 2 men at every 2 mile station at $27 per month each, making $32,500 per annum for 100 miles, and supposing them, as they should be, *constantly* on the road, per mile per annum, -			325	
			——	703
Management:				
Office rent, salaries, water stations, incidentals, etc., say per mile per annum,				350
				$1,053

We consider the above as a very full allowance, and indeed overcharged in the main item, of iron, which might be more fairly stated as follows:—

We know of a road which has recently been supplied with iron for £7 per ton, for an edge rail, which cost landed here say, $39 for 8,500 tons, would be	331,500	
The flat bar sells higher than the edge rail in the shops, but the latter would always command, say, $25 on 8,000 tons	200,000	
	$131,500	
An appropriation, per mile per annum, of		$45

There is no doubt also of the sills or crossties being had at 30 to 35 cents each, in place of 50 cents, and a less amount would also do for the bridges than is charged above. It is well to bring up these matters to the notice of the public, as on no other subject are they more at fault than in the expense for renewal of railways, which require to be judged separately—take for instance the Long Island railway, which has not a bridge in its whole length of 95 miles. What a saving is here both in original outlay, and in subsequent adjustment and renewal; and then nature has provided it with a gravel bed throughout, in which it may be said to become embalmed and to last for ever!

[For the American Railroad Journal and Mechanics' Magazine.]

OPENING OF THE MANCHESTER AND LEEDS RAILWAY,—LENGTH FIFTY MILES.

On the probable results and expense of working this railway, the chairman remarked, "that although it was scarcely his business to enter much into the future, still he thought it his duty to put the proprietors into possession as far as he could, of all those circumstances which tend to show the ultimate prospects and future increase of the concern. He had looked over with some care the result of the traffic on the London and Birmingham, and Grand Junction, and from these he inferred, it would be likely to reach in 1843, about £6,000 per week."

"The next important subject, was the expense of working the line—taking every pains to ascertain the probable amount, including maintenance of way, the depreciation of stock, and in fact every charge that could come in, he found that with a receipt of £5 to 6,000 per week, their expenditures would not exceed £100, 000, per year, *equal to about 33 per cent on the gross receipts.* If they succeeded in keeping it to that amount, they would work their line at a more moderate cost than any other of the large line."

The very superior character of roads in England, give them every advantage in their economical management, at the same time that they afford the best accommodation and despatch. It is perhaps only in the eastern States, that we can as yet, compare with them in these particulars. In most of the later enterprises of railway, the comparison will hold as regards a solidity of road and structure, and our machinery being superior to that of England, we ought hereafter, to make a more favorable show in the comparison.

It has often occurred to us how wide the field will be on the New York and Erie railroad, 468 miles in length, for the display of rivalry in the cheap and efficient management on the 5 or 6 sections into which it will be divided. With this road, and a few others, of similar calibre, in full blast, we may then claim to compare with England in all the points of excellence connected with the railway. This is the right sort of battle ground on which to fight her.

[From the Journal of the Franklin Institute.]

ON CAST IRON RAILS FOR RAILWAYS. *By* ELLWOOD MORRIS, *Civil Engineer.*

We are informed in Wood's Treatise upon railroads, that in the early part of the seventeenth century, railroads were first used in England, and they were then formed of wood; *the wooden rails* were employed for about 110 years, when in 1767, *cast iron rails* were first introduced, and thereafter continued for a period of near fifty years, to be used instead of any other material; but in the year 1815 *malleable iron edge rails* were devised, and after Mr. Birkenshaw, in 1820, had obtained his patent for an improvement in the form of such rails, and applied the rolling mill to their manufacture, they were very extensively adopted, and subsequent to that period of time have been almost exclusively used; indeed, since the modern improvements in the means of intercommunication by railways have enabled locomotive steam engines to travel at velocities of thirty miles and more, per hour, the use of *cast iron rails* has been, for the present, laid aside, if not wholly abandoned, on public railways.

The chief reasons which seem to have induced engineers, both here and abroad, so much to prefer *malleable* before *cast iron rails*, as to exclude the latter from use, appear to have been, originally, a belief that,

1. Malleable iron rails were cheaper than those of cast iron.
2. Malleable iron rails being made in longer lengths caused fewer joints.
3. Malleable iron rails were less liable to fracture from concussion.

4. Malleable iron rails were thought to be somewhat more durable.

Although these reasons are very plausible, they have nevertheless been found not to be valid in practice to the full extent that was anticipated by those who fostered them, and with regard to them it may be observed,

I. With respect to the comparative economy of cast and malleable iron rails, it is certain that the latter, in this country at least, are not cheaper than the former, and if made of American rolled iron instead of imported, they would be much more costly.

II. Convenience of handling seems to have fixed the length of wrought iron rails at about fifteen feet, and of this dimension there is but little difficulty either in moulding or casting rails; but it is very questionable whether sufficient practical advantages do not attend cast iron rails of six or ten feet length, to induce a preference to be given to them over others of greater lineal extent.

III. It is unquestionably true that *malleable iron rails* are far stronger than *cast iron* ones of the same dimensions, when exposed to *a direct impulsive force;* indeed, we find it stated in Tredgold's essay on the strength of metals, "that a velocity, (direct,) of 17 six-tenths feet per second, or twelve miles per hour, would break a beam of (cast iron;) or a beam would break by falling from a height of five feet!"

Now if any such force was actually brought to bear upon the rails of railways in practice, it would, of course, be improper to employ those of cast iron, but happily this is rarely, if ever the case, for although Tredgold's statement may be true, when a weight *falls directly* upon a cast iron beam; no such result would ensue from *oblique impact*, with the same momentum that would be generated in the supposed case; and as the concussions produced upon a railway by a train at speed are of the latter character, it becomes necessary to inquire what vertical stress, or pressure, imposed by the wheels, results from their *oblique impact* when in rapid motion upon the rails?

A little reflection will satisfy any one that the impact upon the rail of a carriage wheel running at high speed, is a very different affair from the concussion produced by a weight falling freely; for instance, if an engine with a velocity of thirty miles an hour passes over a rail which, at the joint, is one-tenth of an inch higher than its neighbor, the wheel would advance in the air without touching the rail for the space of *one foot;* for, by gravity, "a body requires one-forty-fourth of a second to fall one-tenth of an inch, and in that space of time a wheel running at the rate of thirty miles an hour would move horizontally forward *one foot;*" in such a case, then, the wheel may be regarded as having traversed in the air an inclined plane, of which the base would be 120 times the altitude, and consequently if the force of impact be resolved by the parallelogram of forces, into two others, one perpendicular to the rail, and the other parallel to it, the former will be not quite the one hundred and twentieth part of the whole impulsive force, instead of being equal to it, as would have been the case if the stroke were direct, or if the engine had fallen freely by the action of gravity alone through the vertical space of one-tenth of an inch, and the percussive force upon the rail, produced by a free fall through even that small height, would far surpass that which would be created by the one hundred and twentieth part of the oblique momentum of the wheel at the pace of thirty miles an hour.

This reasoning leads us to the conclusion that in such cases the greater the velocity of the engine the less will be the vertical pressure of the wheel upon the rail, and this, to a certain extent, is undoubtedly true, for the horizontal component of the force of impact will be greater than the perpendicular one, just as the velocity is greater.

Upon the same principle it is, that a musket ball shot parallel along a horizontal plane, so as to barely touch it tangentially, will not press upon the plane at all within the limits of its level or point blank range.

Whether these views agree or not, with those commonly entertained concerning fast trains on railways, they are, nevertheless, legitimate deductions from the established doctrine of forces, and serve to account for the small effect produced by the ordinary inequalities of a railroad, as shown in the results displayed by the following direct experiments touching this matter, which were made by Professor Barlow, and recorded in his work on the "strength of materials," English edition, 1837; these experiments are conclusive in their character, and establish, beyond question, the fact, *that the vertical stress imposed upon a railway by the transit of locomotive engines at velocities varying from twenty-two to thirty-two miles an hour, is but little, if any, in excess of that produced by a quiescent load of the same weight!*

These experiments by Professor Barlow, were made with an ingenious and accurate instrument, to determine the deflection of rails under trains running at high speed, and as the deflection of materials under a strain, is as the insistent weight, the vertical pressure upon the rails is by this means accurately indicated.

Experiments.

	Deflection in inches of the rail in the middle length.
1. Speedwell engine and train at twenty miles an hour, weight upon the driving wheels nearly six tons, or three tons on each wheel - - - - =	.0425
	.0400
	.0400
2. Ditto same speed - - - - =	.0320
	.0400
	.0420
3. Ditto very slow - - - - =	.0240
	.0250
	.0320
	9).3175

Mean deflection in these experiments, inclusive of the yielding of the stone block supports - - } = .0353

Now, by trials made with direct pressure, upon the same railway bars which were travelled over by the trains in the above experiments, and then taken up and forwarded to Woolwich, for the purpose of examination, Professor Barlow states that the mean deflection, under a load of three tons weight at rest, was = .0314

While the mean deflection, under trains in motion, at velocities as high as twenty miles per hour, as stated above, amounted to - - - - - - = .0353

Difference - - - - - - - = .0039

which when we consider that a portion of this difference is due to the depression of the blocks, indicates "a close agreement, which shows, that when every thing is well fixed and secure, the deflexion, and consequently the strain is nearly the same, whether the load be *in motion or at rest;* and that each rail is only pressed with half the weight on one pair of wheels."

The rail tried in the preceding experiments, was that of the Grand Junction railway, weighing sixty-two pounds per yard, and laid with three feet nine inches bearing; in those following, Professor Barlow employed the same pattern of rail, but laid with bearings five feet asunder.

Experiments.

	Deflection in inches of the rail in the middle length.
1. Swiftsure engine, velocity twenty-two miles an hour, three tons weight on each driving wheel - - =	.093 .077 .080
2. Ditto same speed - - - - - =	.082 .070 .077
3. Speedwell engine, velocity thirty miles an hour =	.112 .091
4. Ditto, velocity thirty-two miles an hour =	.122 .115
5. Fury train, velocity twenty-three miles an hour =	.083 .085
	12)1.087

Mean of these experiments, inclusive of the yielding of the stone block supports - - - - } = .090

In experiments made at Woolwich, with vertical weights at rest, upon the same rails, the mean deflection produced at five feet bearing by a quiescent load of three tons, was - - - - - - = .079

And the mean deflection found above, with three tons on a wheel in motion, at rates from twenty-two to thirty-two miles an hour - - - - - - = .090

Difference, part of which is owing to the depression of the blocks, = .011

Upon the whole series of these experiments, Professor Barlow observes that "nothing can be expected much more satisfactory, as it is thus proved, *independently of any opinion*, that while the blocks and fixings are secure, the strain from a passing load is but little in excess of that from a quiescent load."

The above quotations, demonstrating as they do distinctly, that the vertical stress of trains at speed, surpasses so little the effect of quiescent loads of the same weight, (*that it is only necessary to proportion the rails of railroads to resist quiescent, and not concussive forces,*) change the whole face of the question between *cast and wrought iron rails;* they strike away all the objections heretofore urged against the brittleness of cast iron, for it does not admit of doubt, that a beam of that material, of suitable proportions, is quite as competent to carry a quiescent load as is one of malleable iron; again, a cast iron rail will yield sufficiently to impact, and return to its proper level the moment it is relieved of the weight of a train, for it is well known that its elasticity and power of restoration, after deflection, is within certain limits so perfect, that owing to its regularity in that respect it was even proposed by Tredgold to use beams of cast iron as weighing machines, measuring the weights imposed by the deflections produced!

In view of the conclusive argumeuts of Professor Barlow upon the relative effect of passing and quiescent loads upon railways, we may limit our researches to ascertaining simply the dimensions of a cast iron rail, *which shall have the same surplus strength to resist a quiescent load equal to the maximum weight upon one wheel, as is found in practice to be necessary in a malleable iron rail;* to aid us in this matter we shall again recur to the valuable work from which we have already quoted so much, and upon pages 428 and 430 these statements will be found; that when the road is in good order "the rail is only deflected at the greatest velocity, a little more than is due to a quiescent load, equal to half the weight on two wheels; but that in consequence of imperfections a strain is occasionally thrown on the rail which produces a deflection about double that which belongs to the load in question." And as a consequence of this, results the "experimental fact that with engines of twelve tons weight, (and three tons on a wheel,) running at velocities not exceeding thirty-two or thirty-five miles per hour, *it is not necessary*, even as railways have been hitherto constructed, to provide for a strain of more than seven tons, which is allowing a surplus strength of sixteen per cent, beyond the double of the mean strain," and this was experimentally found to be a strength amply sufficient to resist the lurching of locomotive engines running at high speed. Tredgold, on the strength of metals, informs us that compared with *cast iron as unity*, the strength of *malleable iron* is 1 $\frac{12}{100}$ times, and its stiffness 1 $\frac{3}{10}$ times.

Now as the stiffness of rails is a matter of such importance as to be almost the controlling desideratum upon railroads, having in fact, induced the preference given to parallel over fish-bellied rails, it would perhaps, be proper so to proportion cast iron rails that they may be *as stiff* as those of malleable iron of suitable strength; hence in the case of a railway destined to carry at a high speed locomotive engines of twelve tons weight, and running three tons upon a wheel, as assumed by Professor Barlow, if *a wrought iron rail* possessing an elastic strength of seven tons* is sufficient, *a cast iron one* to have the same stiffness should be proportioned to resist a vertical weight of nine tons, for supposing the stiffness to be as the weights imposed, and the comparative flexibility of the two materials, we have 1 : 1.3 : : 7 : 9.1, which would give an excess of strength to the cast iron rail in the ratio of 1 $\frac{3}{10}$ to 1 $\frac{12}{100}$.

Therefore it will be perfectly safe to assume, as the proper size for *cast iron rails*, sufficient dimensions to give them such a transverse section, as with the fixed length of bearing, will furnish a strength equal to *three times the maximum weight designed to be imposed upon any wheel*, and this is precisely the same conclusion as is arrived at by Mr. Wood, in his valuable treatise on railways, third edition, page 130.

The proportions proper for the section of a cast iron rail may be readily ascertained, either by the formula of Tredgold, which give an excess of strength, and the accuracy of which, up to the limit of perfect elasticity, has lately received ample confimation;† or the section may be more conveniently determined by the accurate rules given by Professor Barlow, for malleable iron rails, as quoted in the third edition of Wood on railroads, allowing for the difference between the two materials in the ratio of 1 to 1 $\frac{3}{10}$.

If notwithstanding all that has above been said concerning the capacity of cast iron rails to endure successfully the strains which really exist in railway practice, fears should still be entertained of their sudden fracture under trains at speed, all such fears may be completely nullified, by casting in the centre of the head, or top table of the rail, a rod of malleable iron of about a half an inch in diameter, as has already been done with success in cast iron wheels,‡

* The necessity of proportioning rails to resist strains so mnch greater than is really produced upon a way in accurate adjustment, arises chiefly froman unequal settlement taking place in the two lines of rails, producing that lurching of carriages which sometimes doubles the weight upon a wheel; now, if in all cuttings, and upon all well consolidated embankments, both lines of rails were laid upon *a continuous bed of concrete*, of sufficient depth and width, it would be impossibie for the rails to settle irregularly, and if they subsided at all, it would be so equally as to preserve still the proper relation to each other.

† See experiments on the strength of cast iron, by Francis Bramah, Civil Engineer, in the second volume, Trans. Inst. Civ. Eng.

‡ At the works of the New Castle, (Del.) Manufacturing Company, and also at other places, by this operation the strength of wheels is very materilly augmented.

to prevent an immediate separation of the fragments in case of sudden breakage; and in addition to subserving its purpose effectually the wrought iron rod would improve the chill of the head of the cast iron rail to an adamantine hardness.

These observations apply especially to rails supported at intervals only, as is now the usual practice; but if the plan of *continuous bearings** should be generally adopted in railways, the propriety of which has been strongly urged by English engineers, (see an able paper by J. Reynolds, Esq., Civil Engineer, recorded in the second volume Trans. Inst. Civ. Eng.,) as a perfect remedy for acknowledged defects, and which method has been used with success by Mr. Brunel upon the Great Western Railway; *all objections against cast iron rails must wholly vanish;* and with regard to railways of continuous bearing, if the preservative processes now applied to timber should fully answer their intended purpose, without too much expense, as now seems highly probably, it cannot be questioned, that if laid upon Herron's patent trellis plan, or in some other mode, which, with continuous bearing, furnishes also the requisite solidity of foundation, and strength of lateral tie, such roads will possess unquestionable advantages over those laid with isolated supports.

There is another very important fact developed by the judicious experiments of Professor Barlow, which demands the attention of engineers in all subsequent railways, (particularly if they are not of continuous bearing,) whether laid with cast, or malleable iron; and that is, that if rails are supported by isolated bearings at *uniform* distances asunder, *they deflect unequally between the supports, when traversed by the trains;* the joint lengths are the most flexible, and consequently, in order that the railway may be equally stiff in every part, the rails must either be made of greater size in the joint bearings, or else the supports at the joint ends must be brought nearer together, in the same proportion as the deflection of the joint length beneath a passing train is greater.

Professor Barlow found by experiments made with his accurate deflectometer, that the heavy rails of the Grand Junction railway, laid with uniform bearings, deflected under trains running at velocities as high as thirty-two miles an hour, .121 in the joint lengths, when in the middle lengths the deflection was only .090 of an inch.

Consequently, if the rails are of such length as to span *more than two spaces*, and if one of the middle bearings, or spaces, be assumed $= x$, then the joint bearing, if the rail has every where the same traneverse section, must be made $= \sqrt[3]{\frac{.090}{.121}x^3}$, or $\sqrt[3]{\frac{3}{4}x^3}$, because the deflection is as the cube of the bearing length; thus if the strength of a rail be calculated for bearings of three feet, and that distance be assumed for the central lengths between the supports,

* The tendency of the extensive practice which has now been had on railways is certainly establishing gradually in the minds of engineers a conviction of the superiority of roads of continuous bearing laid with the U, or bridge rail, over those of any other construction.

the joint lengths to make the rail equally stiff throughout must be

$$\sqrt[3]{27 \times \frac{.090}{121}} = 2\tfrac{7}{10} \text{ feet.*}$$

The principle that the deflections of rails of the same section are *as the cubes of their bearing lengths*, obtains, as a matter of course, in the case of trains at speed; thus in the experiments heretofore cited, the deflection of the Grand Junction rails, with three and three quarter feet bearing, was found by the deflectometer to be 0.353; consequently the same rails, at five feet bearing, under trains of the same weight ought to have deflected $\frac{.0353 \times (5)^3}{(3\frac{3}{4})^3} = .084$, the actual deflection found by experiment was .090, a sufficiently near coincidence.

[To be continued.]

[From the Civil Engineer and Architect's Journal.]

ENGINEERING WORKS OF THE ANCIENTS.

In our last we gave an account from Xenophon of the Athenian silver mines, which, by some inadvertence, was detached from this series of papers, and now we proceed to give what Diodorus Siculus says as to the gold mines of Ethiopia (book 3.)

Egyptian or Ethiopian gold mines.—In the confines of Egypt and the neighboring countries of Arabia and Ethiopia there is a place full of rich gold mines, out of which with much cost and pains of many laborers, gold is dug. The soil here naturally is black, but in the body of the earth, run many white veins, shining with white marble, (query quartz,) and glistening with all sorts of other bright metals, out of which ,laborious miners, those appointed overseers cause the gold to be dug up by the labor of a vast multitude of people. For the kings of Egypt condemn to these mines notorious crimnals, captives taken in war, persons sometimes falsely accused, or such against whom the king is incensed; and that not only they themselves, but sometimes all their kindred, and relations with them, are sent to work here, both to punish them, and by their labor to advance the profit and gain of the king. There are infinite numbers upon these accounts thrust down into these mines, all bound in fetters, where they work continually, without being permitted any rest day or night, and so strictly guarded, that there is no possibility or way left to make an escape. For they set over them barbarians, soldiers of various and strange languages, so that it is not possible to corrupt any of the guard, by discoursing one with another, or by gaining opportunities of familiar converse.

The earth which is hardest and full of gold, they soften by putting fire under it, and then work it out with their hands; the rocks thus softened, and made more pliant and yielding, several thousands

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*The system of spacing the bearings unequally has been observed by those able Civil Engineers, Messrs. Knight and Latrobe, in planning the new track recently laid upon the Baltimore and Ohio railroad.

of profligate wretches break it in pieces with hammers and pickaxes. There is one workman who is the overseer of the whole work, who marks out the stone, and shows the laborers the way and manner how he would have it done. Those that are the strongest among them that are appointed to this slavery, provided with sharp iron pickaxes, cleave the marble shining rock by mere force and strength, and not by slight of hand. They undermine not the rock in a direct line, but follow the bright shining vein of the mine. They carry lamps fastened to their foreheads to give them light, being otherwise in perfect darkness in the various windings and turnings wrought in the mine; and having their bodies appearing sometimes of one color and sometimes of another (according to the nature of the mine where they work.) They throw the lumps and pieces of the stone cut out of the rock upon the floor. And thus they are employed continually without intermission, at the very nod of the overseer or taskmaster, who lashes them severely besides. And there are little boys that attend upon the laborers in the mines, and with great labor and toil gather up the lumps and pieces hewn out of the rock as they are cast upon the ground, and carry them forth and lay them upon the bank. Those that are about thirty years of age take a piece of the rock of such a certain quantity, and pound it in a stone morter with iron pestles till it be as small as a pea, then those little stones so pounded are taken from them by the women and older men who cast them into mills that stand together near at hand there in a long row, and two or three of them being employed at one mill, they grind it so long till it be as small as fine meal, according to the patern given them. No care at all is taken of the bodies of those poor creatures, so that they have not a rag so much as to cover their nakedness, and no man that sees them can choose but must commiserate their sad and deplorable condition. For though they are sick, maimed or lamed, no rest nor intermission in the least is allowed them, neither the weakness of old age nor the infirmities of women are any plea to excuse them; but all are driven to their work with blows and cudgelling, till at length overborne with the intolerable weight of their misery, they drop down dead in the midst of their insufferable labors; so that these miserable creatures always expect worse to come than that which they at present endure, and, therefore long for death as far more desirable than life.

At length the masters of the work take stone thus ground to powder, and carry it away in order to the perfecting of it. They spread the mineral so ground upon a broad board somewhat hollow and lying shelving, and pouring water upon it, rub it and cleanse it, and so all the earthy and drossy parts being seperated from the rest by the water, it runs off the board, and the gold by reason of its weight remains behind. Then washing it several times again, they first rub it lightly with their hands, afterwards they draw up the earthy and drossy matter with slender sponges gently applied to the powdered dust, till it be clean pure gold. At last other workmen take it away by weight and measure, and they put it into earthen urns, and according to the quantity of the gold in every urn, they mix it with some lead, grains of salt, a little tin, and barley bran; then covering the pot close, and carefully daubing them with clay, they put them in a furnace where they abide five days and nights together; then after a convenient time that they have stood to cool, nothing of the other matter is to be found in the pots, but only pure refined gold, some little diminished in the weight.

And thus is gold prepared in the borders of Egypt, and perfected and completed with so many and so great toils and vexations. And therefore I cannot but conclude that nature itself teaches us, that as gold is got with labor and toil, so it is kept with difficulty, creates everywhere the greatest cares, and the use of it is mixed both with pleasure and sorrow. Yet the invention of those metals is very ancient, being found out, and made use of by the ancient kings.

Assyrian Engineering.—Keeping Diodorus Siculus as our guide, we now come to such notes as he has left of Assyrian engineering. (Book second.)

Walls of Nineveh.—Ninus (1950 B. C.) is styled the builder of Nineveh, having provided money and treasure and other things necessary for the purpose, he built a city near the river Euphrates, very famous for its walls and fortifications, of a long form; for on both sides it ran out in length above a hundred and fifty furlongs; but the two lesser angles were only ninety furlongs a piece; so that the circumference of the whole was four hundred and fourscore furlongs. And the founder was not herein deceived, for none ever built the like, either as to the largeness of its circumference, or the stateliness of its walls; for the wall was a hundred feet in heigth, and so broad that three chariots might be driven together upon it abreast. There were fifteen hundred turrets upon the walls each of them two hundred feet high.

Babylon.—Semiramis, the wife of Ninus, was the founder of Babylon. To this end having provided architects, artists, and all other necessaries for the work, she got together two millions of men out of all parts of the empire to be employed in the building of the city. It was so built that the river Euphrates ran through the middle of it, and she compassed it round with a wall of three hundred and sixty furlongs in circut, and adorned with many stately turrets; and such was the state and grandeur of the work, that the walls were of that breadth that six chariots abreast might be driven together upon them. Their height was such as exceeded all men's belief that heard of it (as Ctesias Cnidius relates.) But Clitarchus, and those who afterwards went over with Alexander into Asia, have written that the walls were in circuit three hundred and sixty-five furlongs; the queen making them of that compass, to the end that the furlongs should be as many in number as the days of the year. The walls were of brick cemented with asphalte; in height, as Ctesias says, fifty fathoms; but as some of the later writers report, but fifty cubits only, and that the breadth was but little more than what would allow two chariots to be driven afront. There were two hundred and fifty turrets in height and thickness proportionable to the largeness of the wall. It is not to be wondered at that there were so few towers upon a wall of so great circuit, seeing that in many places round the city, there were deep morasses; so that it was judged to no purpose to raise turrets in places so naturally fortified. Between the wall and the houses there was a space left round the city of two hundred feet. That the work might be the more speedily dispatched, to each of her friends was alotted a furlong, with an allowance of all expenses necessary for their several parts, and commanded all should be finished in a year's time; which being dilligently perfected to the queen's approbation, she then made a bridge over the narrowest part of the river five furlongs in length, laying the supports and pillars of the arches with great art and skill in the bottom of the water twelve feet distance from each other. That the stones might be the more firmly joined, they were bound together with hooks of iron, and the joints filled up with molten lead. And before the pillars she made defences (sterlings) with sharp pointed angles, to receive the water before it beat upon the flat sides of the pillars, which caused the course of the water to run round by degrees gently and moderately as far as to the broad sides of the pillars, so that the sharp points of the angles cut the stream, and gave a check to its violence, and the roundness of them by little and little giving way, abated the force of the current. This bridge was floored with great joists and planks of cedar, cypress and palm trees, and was thirty feet in breadth, and for art and curiosity yielded to none of the works of Semiramis. On either side of the river she raised a bank, as broad as the wall, and with great cost drew it out in length a hundred furlongs. Semiramis built likewise two palaces at each end of the bridge, upon the bank of the river, whence she might have a prospect over the whole city, and make her passage as by keys to the most convenient places in it as she had occasion. And whereas Euphrates runs through the middle of Babylon, making its course to the south, the palaces lie the one on the east, and the other on the west side of the river, both built at exceeding cost and expense. For that on the west had a high and stately wall, made of burnt brick, sixty furlongs in compass; within this was drawn another of a round form, upon which were portrayed in the bricks, before they were burned, all sorts of living creatures, as if it were to the life, laid with great art in curious colors. Our author goes on further to describe the ornaments of the places, which as less connected with our object we omit. He also describes the formation of a vaulted passage between the two palaces under the Euphrates, made by diverting the river. He says that the walls of this vault were twenty bricks in thickness, and twelve feet high, beside and above the arches; and the breadth was fifteen feet. The arches were of firm and strong brick, and plastered all over on both sides with bitumen four cubits thick. This piece of work being finished in two hundred and sixty days, the river was turned into its ancient channel again.

Semiramis's way.—In a march towards Ecbatana, Semiramis arrived at the mountain Larcheum, which being many furlongs in extent, and full of steep precipices and craggy rocks, there was no passing but by long and tedious windings and turnings. To leave therefore behind her an eternal monument of her name, and to make a short cut for her passage, she caused the rocks to be hewn down, and the valleys to be filled up with earth, and so in a short time at a vast expense laid the way open and plain, which to this day is called Semiramis's way.

Aqueduct at Ecbatana.—Besides this road, when she came to Ecbatana, which is situated in a low and even plain, she built there a stately palace, and bestowed more of her care and pains than she had done at any other place. For the city wanting water, (there being no spring near) she plentifully supplied it with good and wholesome water, brought thither with a great deal of toil and expense after this manner. There is a mountain called Orontes, twelve furlongs distant from the city, exceedingly high and steep for the space of five and twenty furlongs (query) up to the top; on the other side of this mountain there is a great lake which empties itself into the river. At the foot of this mountain she dug a canal fifteen feet in breadth and forty in depth, through which she conveyed water in great abundance into the city.

Bridge of boats.—In the expedition into India, Diodorus relates that to cross the river, she carried with her boats, and made a bridge of boats by which she crossed.

Semiramis deified.—After her death or disappearance, Semiramis was adored by the Assyrians in the form of a dove, it being believed that she was enthroned among the gods.

Memnon's Causeway.—Of this work Diodorus gives the following account. Memnon the son of Tithon, governor of Persia, was in the flower of his age, strong and courageous, and had built a palace in the citadel of Susa, which retained the name of Memnonia to the time of the Persian empire. He paved also there a common highway, which is called Memnon's way to this day; but the Ethiopians of Egypt question this, and say that Memnon was their countryman, and show several ancient palaces, which (they say) retain his name to this day, being called Memnon's palaces.

We shall now cull from the fifth book of Diodorus a number of desultory notes on different subjects, and first as to the

Iron mines of Ethalia.—This island (Elba) abounds with iron stone, which they dig and cut out of the ground to melt, in order for the making of iron; much of which metal is in this sort of stone. The workmen employed first, cut the stones in pieces, and then melt them in furnaces, built and prepared for the purpose. In these furnaces, the stones by the violent heat of the fire, are melted into several pieces in form like to great sponges, which the merchants buy by truck and exchange of other wares, and transport them to Dicearchia, and other mart towns.

Tin mines of Britain.—Now we shall speak something of the tin which is dug and gotten here. They who inhabit the British promontory of Bolerium by reason of their converse with merchants, are more civilized and courteous to strangers than the rest are. These are the people that make the tin, which with a great deal of care and labor they dig out of the ground; and that being rocky, the metal is mixed with some veins of earth, out of which they melt the metal, and then refine it. Then they beat it into four square pieces like to a die, and carry it to a British Isle near at hand, called Ictis (Wight.)*

Gold mines of Gaul—Arms.—In Gaul there are no silver mines, but much gold, with which the nature of the place supplies the inhabitants, without the labor or toil of digging in the mines. For the winding course of the river washing with its streams the foot of the mountain, carries away great pieces of golden earth; and when it is so done, they cleanse them from the gross earthy part, by washing them in water, and then melt them in a furnace; and thus get together a vast heap of gold, with which not only the women, but the men deck and adorn themselves.

As the arms used by the Gauls are calculated to show the progress made by them in the working of other metals, we copy the following descriptions. Some carry on their shields the shapes of beasts in brass, artificially wrought, as well for defence as ornament. Upon their heads they wear helmets of brass, with large pieces of work, raised upon them for ostentation sake, to be admired by the beholders; for they have either horns of the same metal joined to them, or the shape of birds and beasts carved upon them. Some of them wear iron breastplates, and hooked; but others, content with what arm nature affords them, fight naked. For swords they use a long and broad weapon called *spatha*, which they hang across their right thigh by iron or brazen chains. Some gird themselves over their coats, with belts, ornamented with gold or silver. For darts they cast those they call lances, the iron shafts of which are a cubit or more in length, and almost two hands in breadth.

Celtiberian mode of preparing iron.—They carry two edged swords exactly tempered with steel, and have daggers beside of a span long, which they make use of in close fights. They make weapons and darts in an admirable manner, for they bury plates of iron so long under ground, till the rust hath consumed the greater part, and so the rest becomes more strong and firm; of this they make their swords and other warlike weapons, and with these arms thus tempered, they so cut through every thing in their way, that neither shield, helmet, nor bone can withstand them.

Silver mines of Spain.—Having related what concerns the Iberians, we conceive it not impertinent to say something of their silver mines; for almost all this country is full of such mines, whence is dug very good and pure silver; from which those who deal in that metal gain exceeding great profit. The Pyrenean mountains are the highest and greatest of all others, and being full of woods, and thick of trees, it is reported that in ancient times this mountanous

* Valso Spain.

tract was set on fire by some shepherds, and continuing burning for many days together, (whence the mountains were called Pyrenean or firey,) the parched superficies of the earth sweated abundance of silver, and the ore being melted, the metal flowed down in streams of pure silver, like a river; the use whereof being unknown to the inhabitants, the Phenician merchants bought it for trifles given for it in exchange, and by transporting it into Greece, Asia and all other countries, greatly enriched themselves; and such was their covetousness, that when they had fully laden their ships, and had much more silver to bring abroad, they cut off the lead from their anchors, and made use of silver instead of the other. The Phenicians for a long time using this trade, and so growing more and more wealthy, sent many colonies into Sicily and the neighboring islands, and at length into Africa and Sardinia; but a long time after the Iberians coming to understand the nature of the metal, sank many large mines, whence they dug an infinite quantity of pure silver, (as never was the like almost in any other place of the world,) whereby they gained exceeding great wealth and revenues. The manner of working in these mines, and ordering the metal among the Iberians is thus; there being extraordinary rich mines in this country of gold, as well as of silver and brass, the laborers in the brass take a fourth part of the pure brass dug up, to their own use, and the common laborers in silver have a Euboick talent for their labor in three days time; for the whole soil is full of solid and shining ore, so that both the nature of the ground, and the industry of the workmen is admirable. At the first every common person might dig for this metal, and in regard that the silver ore was easily got, ordinary men grew very rich; but after Iberia came into the hands of the Romans, the mines were managed by a throng of Italians, whose covetousness loaded them with abundance of riches, for they bought a great number of slaves, and delivered them to the task masters and overseers of the mines. These slaves open the mouths of the mine in many places, where digging deep into the ground, are found massy clods of earth, full of gold and silver; and in sinking both in length and depth, they carry on their works in undermining the earth many furlongs distance, the workmen every way here and there making galleries under ground, and bringing up all the massy pieces of ore, (whence the profit and gain is to be had,) even out of the lowest bowels of the earth. There is a great difference between these mines and those in Attica; for besides the labor, they that search there are at great cost and charge; and besides are often frustrated of their hopes, and sometimes lose what they had found, so that they seem to be unfortunate to a proverb. But those in Iberia who deal in mines, according to their expectations, are greatly enriched by their labors; for they succeed at the very first sinking, and afterwards by reason of the extraordinary richness of the soil, they find more and more resplendent veins of ore, full of gold and silver; for the whole soil round about is interlaced on every hand with these metals. Sometimes at a great depth they meet with rivers under ground, but by art give a check to the violence of their current; for by cutting of trenches under ground, they divert the stream; and being sure to gain what they aim at, when they have begun, they never leave till they have finished it; and to admiration they pump out these floods of water with those instruments called Egyptian pumps, invented by Archimedes the Syracusan, when he was in Egypt. By these with constant pumping by turns they throw up the water to the mouth of the pit, and by this means drain the mine dry, and make the place fit for their work. For this engine is so ingeniously contrived, that a vast quantity of water is strangely with little labor cast out, and the whole flux is thrown up from the very bottom to the surface of the earth. The ingenuity of the artist is justly to be admired, not only in these pumps, but in many other far greater things, for which he is famous all the world over, of which we shall distinctly give an exact enumeration, when we come to the time wherein he lived. Now though these slaves that continue as so many prisoners in these mines, incredibly enrich their masters by their labor, yet toiling night and day in these golden prisons, many of them by being over wrought, die under ground; for they have no rest or intermission from their labors; but the taskmasters by stripes force them to intolerable hardships, so that at length they die most miserably. Some that through the strength of their bodies, and vigor of their spirits are able to endure it, continue a long time in those miseries, whose calamities are such, that death to them is far more eligible than life. Since these mines afforded such wonderful riches, it may be greatly admired that none appear to have been sunk of later times; but in answer thereunto the covetousness of the Carthaginians, when they were masters of Spain, opened all.

In many places of Spain there is also found tin; but not upon the surface of the ground as some historians report, but they dig it up and melt it down as they do gold and silver. Above Lusitania there is much of this tin metal that is in the islands lying in the ocean over against Iberia, which are therefore called Cassiterides; and much of it is likewise transported out of Britain into Gaul, the opposite continent.

COST OF STEAM SHIPS.

The construction of the noble steam frigate *Kamschatka*, at New York, by contract, for the Russian Government, has been made the occasion in a New York paper of some comparisons between her cost and that of the two steam frigates (the *Missouri* and *Mississippi*) building at the New York and Philadelphia navy yards by our Government, unfavorable to the latter; it being alleged that these cost $900,000 each, while the Kamschatka, of three hundred tons burden more than either of them, cost but $450,000. This allegation has been met by the North American of Philadelphia, with sundry refutory statements which, in justice to the Navy Commissioners, we think it proper to transfer to our columns—divesting them of every thing beyond the naked facts presented.—*Nat. Intelligencer.*

"The public have been amused ever since the launching of the Kamschatka frigate, with boastings of her qualities, performances, and cheapness of construction. And in extoling this vessel, pains have been taken to hold her in contrast with our Government steam frigates now being constructed, and to prejudice the public mind against these vessels and the administration under which they are building.

"We are not conversant with the acts of the Navy Board in former years, but whatever may have been the errors in times past, the noble specimens of naval architecture which have been constructed under their supervision and orders, and presented to the American public in the two steam frigates *Missouri* and *Mississippi*, ought to entitle them to entire confidence. Of the machinery and performance of these vessels we will not speak, because it has not yet been brought to the test of trial, and we do not feel disposed to take a hand at 'the game of brag.' When completed, these ships will tell their own story, but as specimens of naval architecture they are before the world, and stand, by the verdict of public opinion, unsurpassed, even by the vaunted Kamschatka, whose beautiful proportions have been so justly admired. But to the article in question :—

"It is charged that the 'navy ships will cost upwards of $900,000 each.' That 'the Kamschatka is three hundred tons larger,' with 'two decks instead of one,' and is 'superior in workmanship and engines,' and 'will be delivered in Cronstadt for $450,000 or less,' 'including Schuyler's profit of $30,000,' all which we will show to be the reverse of the truth, so far as regards the American vessels, from information derived from the most authentic sources. We have also information on which we place firm reliance, that the cost of the Russian is enormously underrated, and that she will not be delivered at Cronstadt short of $600,000.

"All three of these vessels are two deckers, (and as such we have rated the tonnage) except in the engine rooms, where they all have single decks.

"The Missouri and Mississippi measure on the upper deck, from the front of the stem to aft stern post, ranged up, 224 feet long.

"Breadth of beam, 40 feet.

"Depth of hold, 23 feet 6 inches.

"Tonnage measured as two deckers, 1,684 20·95 tons.

"The Kamschatka measures as above, 219 feet.

"Breadth of beam at the paddle wheel shaft, 35 feet 10 inches.

"Depth of hold, 24 feet 6 inches.

"Tonnage by the same rule, 1,385 89·95 tons.

"The Kamschatka is sponson built. That is to say, she widens above the water line fore and aft the water wheels, in order to give her a more roomy deck. The breadth here given is the body of the vessel as she sits upon the water. But the act of Congress, which was not intended for a craft of this build, requires the measurement of breadth to be at the widest point above the wales, and consequently the register gives a fallacious tonnage of 1,787 40·95; the breadth across the sponsons being 41 feet 10 inches; the real breadth at the water line being 3 feet 2 inches narrower than the navy ships. The cost of the Missouri and Mississippi has been ascertained with as much accuracy as their state of forwardness will admit, within a short period. Including their armament, the expense of these vessels, fitted complete, will not vary five per cent. from one million of dollars, or FIVE HUNDRED THOUSAND dollars each. But we have some deductions to make. The frame of the Kamschatka is the frame of a 1,400 ton ship, while the frames of the American vessels are of 1,700 tons. The frame of the Russian is white oak, worth forty cents a foot, and will rot in ten years. The frames of the Americans are Florida live oak, of larger dimensions, costing one dollar and seventy-five cents a cubic foot, and will last for ages. The Kamschatka is fastened with wooden trenails. The Americans are fastened throughout with copper, without a trenail in them. Let us put this to figures:—

21,000 cubic feet of live oak timber in the American frames, at $1 75 - - -	$36,750	
16,000 cubic feet of white oak in the Russian, at 40 cents - - - - - -	6,400	
Difference - - - - - -		30,350
100,000 lbs. copper fastening in Americans, at 25 cents per lb. - - - -	25,000	
20,000 lbs. copper fastening in Russian, at 25 cents per lb. - - - - - -	5,000	
Difference - - - - - -		20,000
These two items of materials give - - in excess for the American ships, expended to make the ships more lasting and stable, and to save future repairs.		$50,350
We have given the cost of the American, each		$500,000
To bring them on an equality with the Russian in point of quality, we must deduct - -		50,350
Showing the cost to be - - - - - or about the same as the pretented cost of that vessel.		$449,650

"These are but two items of excess, for it must be borne in mind that every dimension about the Russian was less than the American in the proportion of fourteen to seventeen.

"But we have another test of comparative cost, which cannot be controverted.

"We will assume for the moment that the materials of the two vessels were of similar cost. The displacement of a ship in tons of water is the weight of the ship in tons, and the comparative cost of two ships should be nearly as their weights. The Russian's displacement, with all machinery on board, was, or ought to have been, 2,100 tons. The displacement of the American's with all on board, will be 2,700 tons, consequently the costs respectively should be as 21 is to 27.

"Now the American costs $500,000. Therefore, the Russian, by this proportion, ought to have cost $390,000; and if we take the proportionate tonnage, she ought to have cost about $400,000; which brings the two modes of estimating very close.

"We think we have clearly shown that the much abused Navy Board have built two ships, superior in every respect to the Russian frigate, at a *saving* of sixty thousand dollars over the cost of the Kamsckatka."

PENNSYLVANIA AND NEW YORK IMPOVENENTS.

The great advantages possessed by the New York canals over our own State improvements, both in their superior management and the comparative lowness of the tolls, has long been a cause of reproach to our own State, and of regret to her citizens. Those having charge of our canals have flattered themselves that on account of the shortness of our route, the avoiding of the danger of the lakes, and the earlier and the later periods of the season in which they were navigable, would obviate the objections of high tolls and frequent detentions on account of breaks. But they were mistaken. While the business on the New York canals has almost doubled this season, our canal men and commission merchants are complaining for want of business.

A gentleman, who is a warm friend to our improvements, informed us a few days since, that he had lately conversed with an intelligent merchant of Beaver, who informed him that he had made the following experiment, in order to ascertain which route possessed the greatest advantage for shipping goods to the west. He purchased a lot of groceries in New York, and ordered a part to be sent by way of the New York canal, the lakes, and the Ohio and Crosscut canals, and part by the Pennsylvania improvements. The result was as follows. The merchandize by way of the New York route, delivered in Bridgewater, (near Beaver,) cost $1,15 per 100 lbs., freight paid in currency, while on the Pennsylvania route, it cost $1,50 in par money; and *three days longer on the way* than by the New York route.

The same gentleman also informed us that a barrel of flour could be shipped from Massillon, on the Ohio canal, to New York, for 93 cents per bbl., while on the Pennsylvania canal the toll alone is $1,25.

How can it be expected that our canals should prosper with such drawbacks as these to their prosperity? The wonder is that there is so much business done on them as is still doing, and this fact shows that our improvements possess great natural advantages over the New York route, and that with low tolls and good management would do the best business.

A few days ago we published an account of an investigation into the comparative profits of railroads conducted with high and low tolls, the results of which were decidedly in favor of *low rates of toll*. We have no doubt the same will hold good in reference to canals. Official reports of the business done on the New York canals this season exhibit an immense increase of profits from tolls over any former year, and it is expected will amount to the enormous sum of nearly *two millions of dollars.* These canals are conducted on the *low toll* system. We have as yet seen no exhibit of the amount of toll received from our State improvements, for this season, but from the falling off of business, the amount will probably be less than last year, and will doubtless be less than *one half* the amount received on the New York improvements. Our canals are conducted on the *high toll* system.

We present these facts to call public attention to the matter, and especially to direct the attention of Mr. Butler, the new canal commissioner, to the subject. Every citizen of Pennsylvania is concerned in this matter. We have spent millions of dollars to construct these improvements, and have involved ourselves in an enormous debt which must be paid, and yet after all, through improper management, our works do not produce money enough to pay for keeping them in repair. This is a humbling and lamentable state of affairs, and calls for a proper and efficient remedy to be applied. Mr. Butler is said, by his friends, to be intelligent and patriotic—devoted to the interests of Pittsburgh and the State, and we shall therefore soon expect to hear a good account of his management of our affairs.—*Pittsburgh Gazette.*

The western railroad.—The directors of the Western and Boston and Worcester railroads, in anticipation of the speedy opening of the Albany and West Stockbridge railroad from Greenbush to the point where it unites with the Hudson and Berkshire railroad, by which a continuous railroad line will be extended from Boston to Albany, have established the rates of fare and freight for the ensuing winter. The passenger fare from Boston to Albany is established at $5,50; from Boston to Pittsfield, $4⅛; and second class fares, half those prices.

The charges for freight will be for the first class, embracing the more valuable description of goods, $10 per ton of 2000 lbs; for the second class, embracing groceries, and many agricultural products, $8; the third class, embracing the least valuable products, $6,50; and flour, 50 cents per barrel. The fares for places in the interior are of course at higher rates, according to distance.

Railroad fares.—A committee was appointed some time since, by the Government of England, to make inquiries in different parts of Europe, concerning the comparative advantage of high and low fares on railroads. The result of these inquiries, with all the details, containing the answers to upwards of eleven thousand questions, put by the committee, has been published by the British Parliament, and has uniformly presented in every case the conclusion that a low rate of freight creates great quantities of goods to be carried, and thereby becomes the most profitable; that great masses of passengers are created by the low fare; and that a rise of fare has invariably diminished the nett income, and a reduction of fare has invariably increased it.—*Philadelphia American Sentinel.*

The Scotch capitalists who have a high reputation for shrewdness in their money investments, have been of late among the principal purchasers of Great Western, South Western, and Brighton railway stocks.—*London Railway Times.*

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MANAGEMENT AND DIRECTION OF RAILROADS.

While every attention and care has been bestowed upon the construction and improvement of railroads and their machinery, but little has been done towards improving and perfecting the system of management of these works, after their completion. That this neglect is unwise in the extreme, is very evident, for the best constructed and most substantial work can be so managed as to become, in a few years, a mere ruin, and as unprofitable to its owners as if it had never possessed any advantages. That this error has been in a great degree a cause of the unsuccessful operation of many works for which a far different fate had been reasonably anticipated, cannot be denied.

The management of a completed work resolves itself into two departments,—the engineering and financial. The former of these is the most important, as upon it alone, will depend the prosperous condition of the work;—the latter should be managed simply with a view to the proper collection and disbursement of the moneys received.

Our object at present is to make a few remarks upon that portion of the management of public works which belong more properly to the engineering department, and we are the more anxious to do so, as this is a point which, in our opinion, has been sadly overlooked by the direction of railroad companies. No one would think of committing the equipment and sailing of a ship to the supercargo, although the captain is frequently entrusted with the sale and purchase of cargoes, and the reason of this is obvious, for while the science of navigation requires the experience of years, the mercantile knowledge necessary in the purchase and sale of goods, under general directions from owners, is very simple and easily acquired. But in the management of railroads, a very different system prevails,—the supercargo sails the ship, attends to the repairs, and has unlimited control over things of which he has no knowledge, and is not likely to acquire any, unless at the expense of the owners,—or in other words, the management and repair of the road and machinery, are too often placed in the hands of those as ignorant of engineering as a supercargo is of seamanship. It cannot be expected that when a rather complicated system of machinery has been put in operation at great cost, not only of money but of the labor of professional men, that the whole can at once be handed over to persons of entirely different habits and attainments, for their exclusive control, unless at great hazard.

Although many companies have undoubtedly been so fortunate as to secure the services of non-professional persons, highly capable of carrying on the mechanical department, it is yet to be considered whether the influence of a respectable engineer is not calculated to operate to better advantage for the interest of the company, than the mere opinion of an individual generally under the control of one or two directors. We need no better evidence upon this head than the comparative success of those roads which are under the superintendance of engineers, and those upon which no such arrangement prevails.

The great objection to the employment of resident engineers as general superintendants of railroads, is the expense. Retrenchment and reform are the great words of the day; but that they always mean what they profess to mean, we are by no means willing to admit. It is considered a great master stroke in financiering, particularly on the coming in of a new board, to show how much of the current expense of the road has been, or rather is intended to be, cut off. Great eclat attends this curtailment, while but few think of looking into the accounts to see whether what has so suddenly been taken off at one end, has not been as suddenly put on at the other. There are few items of expense more insidious than wear and tear of machinery, and it is quite possible that with the same amount of receipts, a reasonable profit may remain in one case, or be eaten up in another. Moreover, the condition of a railroad track has an important influence upon the machinery, and a false economy upon the one, may be imperceptibly bringing ruin upon the other—the yearly expenses are shown to be small, and stockholders are annually gratified by a fair detail of monies saved, and by good dividends—but in a short time the whole road and every thing belonging to it are racked to pieces.

Proprietors should recollect that it is the interest of those in power to retain their influence, and they themselves are too apt to look at the present value of the stock—but while this is well enough for dealers in stocks, it is proper that those who look for permanent investments should keep an eye to the preservation of suitable checks upon a speculative spirit. The tendency of the times is so much towards the abuse of power in the hands of corporations or rather of a few individuals in these bodies, that great care should be taken to avoid even the appearance of evil, and no better means can be taken to advance the character of railroads as an investment, (and good roads are already favorites,) than by establishing a check upon the financial direction, which may prove to stockholders that all is fair and above board, and that the condition of their property is not yearly depreciated to swell the amount of their *apparent* profits. To prevent this, proprietors of railway stock in particular, should not be so direlict of their true interests, as not to follow the example of England, in having annual *competent* investigations into their condition and management.

But it is by no means necessary, that the intention to deceive should exist, to produce the same results. Self deception may prove as fatal as downright fraud, why then trust to those who are most likely to be misled because they are not even supposed to possess the proper information? It is but a poor comfort when money has been lost to say, that it has happened rather from the ignorance than the dishonesty of those to whom it has been entrusted.

But the expense of employing engineers in such situations has been greatly overrated. When railroads were first introduced, the demand for civil engineers was far greater than the supply, but at present, very many competent and experienced men can be found who would be the means of saving more than the most liberal salary would cost. Moreover, the expense of superintendance alone would hardly be increased by such an arrangement, for the substitution of one responsible and intelligent head for several offices, would in itself, in some cases, at least be the means of saving expense.

This subject is one upon which much more might be said, and to which we hope again to return. The character which the profession will attain when properly united and organized, will have great influence upon the whole railroad system, and to such an organization do we look with the earnest hope that among many other important topics, the present will receive their attention, and much assistance to the cause be derived from the information thus accumulated.

[For the American Railroad Journal and Mechanics' Magazine.]

COLLATERAL ADVANTAGES OF RAILWAYS.

The "Sketch of a Railway," etc., on this important subject furnishes the following note, No. 31 :—

"It is not to be expected that the collateral advantages of improvements of any sort are to have much influence in promoting their contruction, the majority only recognizing that which touches them *directly*. But they are of no small importance, and should be better understood than they generally are. It is among our eastern friends that they are most fully appreciated, and their testimony on such points, as close calculators is always valuable. Thus they say :—

"'That it cannot be doubted that a railway, by economy of time saves three-quarters of the labor and expense of transporting burdens and persons. At a low estimate for Massachusetts this expense is calculated at 16,000,000 of dollars, of which 12,000,000 per annum could be saved. Every month's delay is, therefore, a shameful waste of 1,000,000 of dollars.'"

So reasoned these far seeing people, who have now the practical demonstration, that such is the effect of the railway ; but it is not elsewhere so generally recognized, even among the more intelligent. If indeed it were practicable to withdraw the railway, its advantages would then be brought immediately home to the people, and who would quickly find their condition without it, to resemble most nearly that of "fish out of water."

A case of this kind occurred not long since on the coast of Chili. The steamboats which had been established along that coast, through and under the agency of our enterprising countryman, Mr. Wheelright, and which had made neighbors of those, between whom scarcely any intercourse had ever existed, were suddenly suspended by the exhaustion of their stock of fuel, for which they had relied on supplies in coal from England. The effect was, as if the world had ceased its revolutions, and the impatience along the whole coast under this suspension is easier imagined than described. Such a calamity it is now said will be averted for the future, by the discovery of mines of a suitable quality of coal on that coast.

Projects of public improvements, however, by private enterprise, having their origin mainly if not entirely in the great spring of selfish views, it is not reasonable to expect for them any sympathy from the public, where it results, as it too often does, that the projectors have lost their money and misspent their time; but an enlightened selfishness should incline the public to deal more kindly with all such efforts, by which *they* rarely escape being benefitted, however, otherwise abortive; and this will be so, as light can be made to reach into the darker corners of the community.

But where the relative advantages of an improvement to the projectors and the public will shortly show themselves in the strongest relief, is in the case of the Philadelphia and Pottsville railway; and it is also a fitting opportunity to remark that this railway has been the least understood or appreciated in its day, considering that by casting off the dependence solely on canals for a supply of fuel, it at once relieves the communty of an onerous tax of some millions of dollars annually, from which it could *never otherwise* have escaped, and which must have swelled yearly in amount. The account may be thus made up:—

Its projectors,		
On a cost of \$5,000,000 for 100 miles of road, from the mines to tide water on the Delaware river at Philadelphia, after paying interest on two millions of loans, expect to make on the remaining \$3,000,000, as the capital, say 13⅓ per cent. - - - -		400,000
The public,		
On the other hand, will be benefitted after the following manner:—The consumption of anthracite coal is now ascertained to be about 900,000 tons per annum, the average price hitherto may be stated at \$7 per ton, which, on the opening of this railway will be reduced to \$5, being a *direct saving* of \$2 per ton, or in all say - - -	1,800,000	
To which may be added, an equal *indirect saving* by the reduction of the price of wood and other fuels, and generally in the cost of the innumerable wants of		
Amount carried forward	\$1,800,000	\$4,00,000

Amount brought forward,	$1,800,000	$4,00,000
the community, now produced by steam power, together with the infinity of new applications of that power in consequence of the reduced price of fuel; all of which may be stated to be equal to a similar saving of - -	1,800,000	
		3,600,000
Total gain to the community by this railway on the single item of coal at the present amount of consumption -		$4,000,000

This is no fancy picture, but which may be fearlessly presented to the intelligent as not overcharged. Such are the benificent effects of the railway, arising in the perfect control at all times, which is had over its immense powers; while it is otherwise with water improvements, which in all northern latitudes are fettered in ice at one time, at others are dried up, and anon are overwhelmed by a torrent.

[For the American Railroad Journal and Mechanics' Magazine.]

EXPORTATION OF SPECIE.

"We are noticing from time to time the exportations of specie from the United States to foreign countries. During the last six weeks, as stated in yesterday's paper, the aggregate amount shipped from New York to Europe exceeded two millions of dollars.

"A wholesome trade implies the exchange of commodities. The productions of industry in one country are bartered for the productions of industry in another. We cannot afford to pay specie in large quantities and constantly for foreign productions, because specie has other services to perform beside those of trade. If a surplus of specie accumulates, more than is wanted for the uses of currency, it then becomes a mere commodity, like tobacco or tea; being disengaged from those other relations which in ordinary circumstances it hold to the circulating medium. But in this country we have no surplus; there is a scarcity: our currency is prostrated for want of a specie basis. Policy—common sense—inevitable necessity—demands a change in our regulations of trade, We cannot continue to admit the productions of foreign countries that will not take our staple productions in return. England and France refuse almost every American commodity except cotton. They would refuse that if they could, and they hope in time to be able to do so.

"We have been laboring for a National bank; and beyond all question the interests of the country require such an institution. But unless a stop is put to the foreign drain of specie, we do not see how a National bank is to re-establish our downfallen currency. A National bank will be subject, like other institutions, to the unfavorable influences which have paralyzed our circulation; it can do no more than any other bank to keep specie in the country when the force of circumstances drives it out; it can substitute no other means to supply the foreign demand; it can bring into existence no new production to be available in paying our European debt. With a substantial tariff, a National bank may do all that is expected of it;—without a tariff, its ability for good to the country must necessarily, we think, be much restricted."—*Baltimore American.*

The above remarks on the exportation of specie express sound views and in terms easily comprehended—it is a subject which yet puzzles many wise heads, and the oftener it can be presented in a clear light the better.

Two thirds of our commerce is with England and France, and much the largest portion with the former, where the tendency is always from the redundancy of population and capital, to over production, the natural consequence of which, is, to force upon her customers more than they are generally able to pay for in commodities agreeable to her, and specie is then required to make up the balance. Either she must take more of our agricultural products, or by a tariff we must be enabled to buy less from her, by producing the difference at home.

Free trade, as understood by these two nations, is truly hit off in the following words, mark too, that *after ourselves,* they are allowed to be the most enlightened in the world: "*England and France refuse almost every American commodity except cotton, they would refuse that, if they could, and they hope in time to be able to do so.*"

No one disputes the beauty of free trade as an abstraction, and which can never prevail until RECIPROCITY comes into fashion—but from which man, whether in his individual relations, or as congregated into nations, is now as distant in practice as he ever was; or is he not perhaps a little farther off? Any hope then of free trade alias reciprocity, becoming general is utterly forlorn, and for the present the attempt to introduce it would be to contend against "policy—common sense—and inevitable necessity."

Without this tariff, a National bank as here remarked, would do but little good—but that vexed question may now, however, be considered as put at rest—as it now seems very generally conceded that the element all essential to its profitable working, *full confidence in those who must conduct it,* cannot be reposed—certainly the history of banking of late years fully justifies this mistrust, and few will again be found entrusting the management of their earnings *to any but those* who may be *equally* with themselves interested in their safe employment.

Disappointed thus in a bank, through so lamentable a cause, as the infirmity of human nature, we are not without a resource or a substitute in the railway, its quick transit and facility of communication making it a most effectual leveller of exchanges, and what other evils it might not cure, could be borne with in comparison with the troubled sea, which a National bank seems ever destined to keep up, while the banks of the States, always jealous of encroachment, cannot be controlled. A subscription therefore, of seven or ten millions of dollars by Government towards aiding and stimulating private enterprize to make *main post lines* of railway, would do far more general good than if subscribed to any bank, and would be quite as constitutional an application of the people's money, in the single effect of facilitating commerce between the States, beyond all other means, and as a *circulating medium* answers fully to the term.

Our country is still destined to be the direction in which a large portion of the annual accumulation of foreign capital will seek investment, and the more so, were our vast home resources better shielded by a fixed judicious tariff. Does any thing more than the uncertainty of our legislation in this respect tend to keep capitalists aloof? Fortunately however, since the opening of a constant avenue to Philadelphia from the coal and iron beds in Pennsylvania, it will be soon discovered that they can be made to give up their treasures without much extraneous aid, and the ability once demonstrated of being able to place constantly in market, at a profit, say, pig iron at 20 to $22, and anthracite coal at 4 to $4½ per ton, foreign competition would quickly cease, and Philadelphia would rise up to be the eastern, as Pittsburg is now justly called the western, Birmingham of America.

The value of imported iron is rather over seven millions of dollars per annum, which could nearly all be supplied at home, if we would attract capital around our mountains by offering it the security of a permanent tariff. It would be the part of true wisdom that we sought for thorough and entire independence in this great staple at least, which is constantly being applied to new and important uses. When the avenues to market at Philadelphia are perfected, what a field will be opened for good investments at Sunbury, situated at the junction of the north and west branches of the Susquehanna, a region teeming with mineral treasures. The cost of materials at that point for making a ton of iron are thus given:

2½ tons of iron ore, including mining, mine rent, and transportation at $1,50 per annum	$3,25	
1 ton of limestone at - - - - -	65	
3½ tons of coal at $1,75 including steam power,	6,62½	
		$10,52½

These estimates are not merely theoretical or speculative, but are taken from actual results in daily operation, and there can be little doubt that this would be one of the points from which pig iron could be furnished in the Philadelphia market, at 20 to $22 per ton and to yield a fair profit.

That our readers may have before them the particular articles of import, with the valuation attached, which it would be as well if possible, to produce ourselves, we copy the following list from the New York Tribune, a paper zealously devoted to the encouragement of home labor and reciprocal commerce. We hope to see the "home league" made a rallying point throughout the Union, and which our richer and heavier capitaled rivals abroad, will understand as not approving the system, but as only retaliating, and as the most effective means of forcing them into free trade *in reality*, that is accompanied by reciprocity, which we always have been and will continue to be ready for on those terms. This is precisely one of the *exceptions* to the general rule, that *two wrongs* cannot make *a right.*

Statement of the principal articles of foreign manufacture imported into the United States, for the year ending Sept. 30, 1840.

Articles.	Amount of imports.
Woolen manufactures - - - - - - -	$6,345,345
Cotton do. - - - - - - - -	6,504,484
Silk do. - - - - - - - -	10,982,191
Lace - - - - - - - - -	468,425
Carpeting - - - - - - - -	338,501
Hats and bonnets - - - - - - -	438,000
Boots and shoes - - - - - - -	71,533
Leather - - - - - - - -	473,091
Cabinet ware - - - - - - - -	86,275
Soap - - - - - - - - -	13,859
Manufactures of iron and steel - - - - -	7,324,482
" Flax and hemp - - - -	5,966,944
" Copper, brass, tin, pewter and lead	362,423
Amount carried forward	$39,555,459

Amount brought forward	$39'555,453
Earthen and stone wares	2,010,231
Plated, gilt and japanned do.	166,072
Saddlery	201,000
Worsted stuff goods	2,387,338
Watches and parts	420,959
Glass manufactures	563,429
Cotton bagging	310,211
Oil cloths	33,648
Paper hangings	76,521
Paper	76,124
Books	210,764
Hair cloth	59,555
Brushes	38,762
Jewelry	201,590
Saltpetre	24,171
Cigars	869,434
White and red lead	41,043
Sugar of lead	11,385
Cordage and twine	244,911
Corks	56,186
Total	$47,378,888
Exports of the above articles	3,809,526
Consumption in the United States	$43,569,362

Most of the manufactures in the above list of imports, it will be observed, come in direct competition with articles made by our own manufacturers and mechanics. More than two thirds of the above imports might doubtless be advantageously manufactured in this country if we had adequate protecting duties. About two thirds of all our imports into the United States consist of luxuries, and manufactured articles which should be made here. Thus many millions are thrown away annually, keeping us always in debt to foreign countries.

[From the Journal of the Franklin Institute.]

Continued from page 277.

ON CAST IRON RAILS FOR RAILWAYS. *By* ELLWOOD MORRIS, *Civil Engineer.*

IV. On the subject of the comparative durability of wrought and cast iron rails, the experiments are not entirely decisive, but they certainly appear to incline in favor of those of malleable iron;* al-

* See Wood on Railroads, third edition, page 138 and 729.

though it must be remarked that the exfoliation and separation into laminæ, which, owing to the mode of manufacture, it was originally anticipated, would occur to wrought iron rails, when travelled by locomotives at high speed, and the existence of which was formerly most pointedly denied, *does actually take place*, as may be witnessed upon most of our railroads which have been long subjected to the action of heavy trains and high velocities; upon such we may perceive not only exfoliations on the rails, but also that in some instances the sides of the heads have been forced into laminæ, and almost, or actually crushed off; it cannot be doubted that all such disruptions of the material facilitate oxidation and wear, and, therefore, if due weight is given to this cause of deterioration, which was not formerly taken into the account of decay of wrought iron railways, there seems to be reason for the belief, that under the action of a weighty traffic, cast iron rails may reasonably be expected to endure quite as long, if not longer, than those of malleable iron, especially if the former have their heads, or top tables, properly *chill cast*, which ought certainly to be done; it must also be recollected that if from wear, breakage, or any other cause, it becomes necessary to substitute new rails, the old cast iron ones would be worth at the foundries, almost the price of pig metal.

General Remarks.

The introduction of the hot blast, by enabling the ores of iron to be smelted direct with raw bituminous coal, and the recent application of anthracite to the same purpose, rendered successful by the same means, has, in consequence of the diminished cost of cast iron in the coal basins, drawn the attention of enterprizing practical men in this country, to the propriety of employing cast iron rails, instead of those made either of wood plated with wrought iron, or wholly of the latter material.

At the Lonaconing works in Alleghany county, Maryland, cast iron train rails, with an upright ledge, of the usual form, are wholly used for the service of the coal and iron mines.

The writer is indebted to J. H. Alexander, Esq., Civil Engineer, and Topographical Engineer of the State of Maryland, for the following information respecting the rails cast and used at those works.

1. The Lonaconing rails are of the common tram pattern, of three and a half inches base, and two and three quarter inches height; they are a little heavier at the joints than in the middle; the length of each rail is three and three quarters feet, the weight, forty-five pounds, or thirty-six pounds per yard lineal; for the curves, which are usually of ten feet radius within the mines, separate patterns are used in casting the rails.

2. Some of the rails were cast direct from the ore, and had the furnace continued in blast all would have been.

3. The hot blast was used in casting the greater part of the rails from the cupola, and altogether with those from the blast furnace.

4. There was no difficulty attending either moulding or casting the rails.

5. Intermediate between the ends which rested on a cross tie

there was placed out of doors a block of wood, but within the mines, slate was packed under the rails instead.

6. One hundred and ten tons of rails of the above pattern were laid.

7. These rails are valued at the furnace at $ 40 per ton by the quantity.

8. The cars run upon these rails carried one ton, or one-quarter of a ton on each wheel, besides the weight of the car.

Mr. Alexander further observes, that from their experience at Lonaconing, he has "no doubt of the useful application of cast iron to larger works, and accordingly the plan of the railroad designed to connect the Lonaconing mines with the Potomac river, rests, in part, upon the adoption of that material."

Since iron has been made in Schuylkill county, in this State, by using anthracite as the fuel for reducing the ore, cast iron rails have been substituted in several coal railways instead of the plate rail upon wood; and wherever they have been used they appear to have fulfilled every expectation formed of their utility, and have been universally approved.

The writer is indebted to Samuel B. Fisher, Esq., of Pottsville, Surveyor, for the following information respecting the cast iron rails employed in that portion of the anthracite region of Pennsylvania.

1. The lengths of rails most used are six feet; but some of twelve and fifteen feet are about to be cast, and any required length short of twenty feet can be made.

2. Some of the rails have been run at the blast furnaces direct from the ore, while others were cast by the cupola.

3. The rails are generally laid on cross ties, three feet apart, from centre to centre.

4. Some rails have been cast by Eckert & Guilford, at Pinegrove, with charcoal fuel, of the weight of eighty-four pounds per lineal yard from a pattern furnished by B. Aycrigg, Esq., Civil Engineer, the section being that of the U, or bridge rail, *cast solid;* the rails now cast at Pottsville are similar to the T pattern.

5. If care is taken in moulding and removing the castings no warping occurs.

6. The rails used under ground for mines, weigh from twenty-seven to thirty-two pounds per yard, while others, for outside use, weigh, from fifty-three to sixty pounds per yard running.

7. Cast iron rails are found quite smooth enough for use.

8. The cast iron rails cost from $40 to $45 per ton at the blast furnace, and $56 per ton when cast at the cupola from re-melted iron.

9. On the heavier rails, cars, weighing, with their loads, from four to four and a half tons, are drawn by horses at the rate of about four miles an hour.

10. Few, if any, instances have occurred of a rail breaking from regular use.

Mr. Fisher further states, that the rails cast at the foundries are preferred before those run at the blast furnaces.

On this branch of the subject, notwithstanding its importance in an economical point of view, there are no decisive experiments known to the writer, but this much we can declare, that it is by no means a settled point that castings made from re-melted iron are better than those which are run at the blast furnaces direct from the ore; at least, the idea of such superiority seems *to rest wholly upon opinion, and not upon experiment;* in the recent discussion which took place in New York, regarding the conduit pipes and other castings necessary for the supply of water to that city, it was stoutly maintained by the friends of the cupolas that castings from re-melted iron were the toughest and best, and this was as stoutly controverted by the advocates of castings run at the blast furnaces direct from the ore.

In the midst of the dispute, Frederick Graff, Esq., superintendent of the Water Works of Philadeldhia, was appealed to, whose long experience in this matter entitles his opinion to the utmost respect, and he stated that the conduit pipes, and all the other castings, now, and for many years, used in the distribution of water through the city of Philadelphia, under a head as high as 100 feet, were made at the blast furnaces direct from the ore; Mr. Graff further declared, that after having, in 1821, repeatedly proved and examined pipes cast in both ways, he had not been able, "with his experience, from that time to this, to determine why a pipe cast from the ore was not as good as one cast from re-melted iron, nor had he been able to determine why other castings cannot be made as perfect and durable from the ore as in any other manner."

On the other hand, the experiments detailed in Wood on railways, third edition, page 127, show clearly enough, that a mixture of different kinds of cast iron forms a stronger, though also a heavier rail, than any one kind of iron cast separately; and this mixture can evidently be had only by re-melting iron through the agency of a cupola furnace.

But let this be as it may, there is no doubt that rails of sufficient strength can be most economically cast direct from the ore, and they would be cheaper than those produced at the foundries, even if it should be found necessary slightly to enlarge their dimensions.

The writer has been informed by Erskine Hazard, Esq., one of the managers, and Josiah White, Esq., the president, that the Lehigh coal and navigation company having adopted a heavy T rail of malleable iron, for their railroad from Whitehaven, upon the Lehigh, to Wilkesbarre, upon the Susquehanna, a distance of twenty miles; contracted for it in England, at £10 10*s.* per ton; but one ship-load having been lost at sea, they resolved to supply its place with rails cast from anthracite iron, at the furnace now in operation upon Crane's principle, on the Lehigh canal, about fifty-five miles below Whitehaven, the eastern terminus of the railroad; and with these they purpose laying about four miles of the road next to Wilkesbarre, on which horses are to be used.

The malleable iron T rail of the road referred to, weighs forty-eight pounds per lineal yard, and is near five inches deep, three quarters of an inch thick in the stem, and two inches wide on the head; the cast iron rail designed to supply its place upon four miles of the road, is of a similar section, but made six inches deep, a little larger every way, and weighs seventy-five pounds to the yard; it is cast in six feet lengths, direct from the ore, by anthracite worked with the hot blast.

The strength of this rail was tested at the furnace, with six feet bearing, and it required *more than* five tons weight to fracture it; consequently, at three feet bearing, its strength (with the same section being inversely as the distance between the supports,) is ten tons, but we have already shown, in a former part of this paper, that, according to Professor Barlow's experiments, and the relative properties of cast and malleable iron, an available strength of nine tons in a cast iron rail is ample to sustain the progress of trains carrying three tons on a wheel, and running at thirty miles an hour; consequently, if the rail of the Lehigh and Susquehanna road is laid with three feet bearings, as is now contemplated, it will be equal to all the present exigencies of trade, and might be safely travelled by twelve ton locomotives at a very high speed; this rail covering *but two bearing spaces* between the joints, ought to have its supports spaced equally, which is, in fact, designed.

The writer has recently observed upon the Columbia railroad, a short distance laid with cast iron rails, apparently for trial; these are in section nearly parallelograms, about two inches thick by five inches deep; they are wedged in cross ties, about three feet apart, and appear to answer perfectly.

In a former part of this paper, we showed that a cast iron rail, of strength sufficient to resist, without permanent injury, a strain of nine tons, was equivalent in stiffness to a wrought iron rail of seven tons strength, and this ratio we took as the guide of comparison between rails of these materials; hence assuming that the weights of rails suitable for the same railway should be as these numbers, then if a wrought iron rail of seventy pounds per lineal yard is competent to carry any given trade, a cast iron one, proportioned for the same traffic, should weigh ninety pounds per yard, for 7 : 9 : : 70 : 90.

The cost of the *imported wrought iron rails* of the Lehigh and Susquehanna railroad, when delivered on the road, will be about $65 per ton, while those of *cast iron*, for the same road, will scarcely exceed $45; therefore, if the latter was strictly proportioned in strength to the former, the ratio of economy at the above rates would be,

70 tons at $65 - - - - - -	= $4,550
90 tons at $45 - - - - - -	= $4,050
Difference, -	= $500

which, with these particular prices, would make the cast iron rails cheaper than those of English rolled iron, in the ratio of nine to eight; and if compared with American wrought iron rails, the relative economy would be still more conspicuous; the price of foreign railway iron delivered in America, fluctuates very much, but it is believed that it would very seldom be so low as to make the rolled rails cheaper than those of cast iron of equal strength, even if the former should continue to be admitted into our ports free of duty. We do not wish to be understood as asserting, in this paper, that cast iron rails are intrinsically superior to those of malleable iron; all that has been proposed is to show that the former material is equally sufficient and suitable for the formation of railways, while it is generally *more economical;* but there is one practical advantage which is inherent to cast iron, and ought not to be overlooked, it is, *that it expands and contracts less than wrought iron by alterations of temperature.* Tredgold's essay on cast iron, informs us that while malleable iron expands $\frac{1}{143000}$ of its length by each degree of heat, cast iron elongates but $\frac{1}{162000}$ by an elevation of temperature to the same extent, consequently their ratio of comparative dilatation is nearly as seven to eight.

That cast iron is thus refractory under heat, is of some practical importance, for if the rails be cast in lengths of ten feet, the lineal elongation produced by an alteration of 100° in the temperature, would be only $\frac{1}{1620}$, or about $\frac{1}{14}$ of an inch, so that if rails of from six to ten feet lengths are used, and the laying is carried on at medium temperatures of the weather, they may then be placed almost, or quite in contact end to end, the unavoidable imperfections of the joints allowing sufficient play; and as the joints will therefore be so much closer than can be admitted with malleable iron rails, less objection will be made, even if their number should be greater.

James Herron, Esq., Civil Engineer, in a memoir descriptive of his patent Trellis rallway, of continuous bearing,* which he has recently laid before the public, makes at page 35, the following judicious remarks, touching the subject we have under discussion, and which we take the liberty of quoting:—

"That cast iron rails can be furnished from our own mines at a much cheaper rate in the United States, than foreign rolled iron rails, seems probable from the improved modes of smelting iron with anthracite coal. That they will fully answer the purpose, when constructed and laid as I have described, there are but few engineers of practical experience in mechanics, and who are familiar with the extensive use made of cast iron edge rails throughout England and Wales, on their mineral railways, will deny. Should there be some, however, who are disposed to advance adverse views, it matters not from what motives, let me ask them why is it that the chilled cast iron wheels of our railroad cars should have so completely superseded the imported wrought-tried wheels, if it be not their *greater durability and cheapness* that recommended them?

"Within the last two years, some millions of dollars have been sent out of the country for the purchase of railway iron, which has been, for the most part, admitted duty free, and if we may

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* A very ingenious railway of continuous bearing, has been devised by B. H. Latrobe, Esq., Civil Engineer, (see the March No. of this Journal, 1841,) consisting of a Z rail attached laterally to a continuous string piece; this peculiar arrangement is strikingly deserving of trial upon a working scale, and *on a bed of concrete.*

form an opinion from the rapid deterioration by crushing, exfoliation, and splitting of the heavy rolled iron rails but recently laid *on some of our roads*, many millions more must continue to follow them, to furnish a supply for the renewals and repairs, so that it will form an insatiable drain on the currency of the country.

"A material that enters so largely into, and forms so costly a part of, our great public works, should not, therefore, be imported from a foreign country, if we can by any possible device render our native materials available. That the large sums of money which would thus be retained in the country would greatly benefit the mining, manufacturing, and farming interests, and, in fact, all others, even the works themselves, by an increase of business, must be evident to all."

Reflecting, then, upon the following facts, that for a long series of years cast iron rails were successfully used in England for public railways, that they are now used a great deal in the mineral districts, that they were originally superseded, in consequence, chiefly, of the superior enconomy of malleable iron rails, that so far as they have been used in this country they have fully answered every expectation, that the peculiar character of the strains upon a railway is such as cast iron is well calculated to withstand, that they can be well and cheaply made in this country, instead of sending our money abroad for foreign iron, that the transportation of iron rails from the sea-board to many of the interior railways, is very expensive, and finally, that they are as cheap, or cheaper, than wrought iron rails of equal strength*—can there be any reason why cast iron rails should not be universally adopted in the United States? On the contrary, are we not urged to their exclusive use by every consideration of economy, as well as of patriotism in supporting home, instead of foreign manufactures? And do not the arguments in favor of *cast iron rails*, appeal with peculiar force to all those States, which, like Pennsylvania, possess within their bosoms inexhaustible supplies, both of the ores of iron and the means of fusing them into metel?

PHILADELPHIA, *September* 1, 1841.

LOUISVILLE, CINCINNATI AND CHARLESTON RAILROAD COMPANY.

At an anniversary meeting of the stockholders of this company, held yesterday, at the hall of the South Western railroad bank, the following report was submitted, and ordered to be published, for the information of the stockholders:

The special committee to whom was referred a resolution of the company, adopted at the meeting in February last, "That in the opinion of the meeting, it is expedient and necessary to promote

* The Congress of the United States, at their late session, have passed a law providing that from and after the 3d of March, 1843, all foreign railroad iron imported into this country, shall be subject to "a duty of twenty per cent. ad valorem," and that no iron shall, hereafter, be allowed to enter free, except what may be required for railroads, or inclined planes, *now under construction*. This act would seem to settle the question of economy decidedly in favor of the use of cast iron rails, on all future railroads constructed by the American people.

economy in the expenditures of this company; and for the efficient management of its business, the affairs of the two companies, the L. C. & C. R. R. company, and the S. C. & C. R. R. company, be consolidated under one board of directors, and one set of officers, and that a committee be appointed to report the manner of carrying the same into effect at the next meeting of the stockholders"—

Report.

That in considering the mode in which the concert in the direction and management of the two companies may be effected, as contemplated by the resolution, they find that by the original charter of the C. & C. R. R. Co. twenty-four directors were provided, three as the local representatives of each of the States of Ohio, Kentucky, Tennessee, North Carolina, and South Carolina, and nine, as the general representatives of the whole stock. In consequence of Ohio not acceding to the terms of the charter, by an amendment granted by act of assembly in 1836, the number was reduced to twenty-one; and by the same act it was provided that unless Kentucky accepted the amendment granted by that act, the company should exist in the State of Tennessee, North Carolina and South Carolina, with twelve general and three local directors for each of the last mentioned States. By a further amendment, granted by act of assembly in 1840, it was provided that the stockholders in the States of Tennessee and North Carolina might release their shares to the company and receive back the amount of their subscriptions. By this amendment it was contemplated that the charter of the company should be limited to the State of South Carolina. The interest of the Kentucky stockholders was withdrawn from the company at a very early period of its existence. The stockholders in Tennessee and North Carolina, there seems to be little doubt, will all release their shares to the company under the permission granted by the act of 1840. It is, therefore, very doubtful whether there be any local interest in the last mentioned States to be represented, or any stockholder who may be qualified, by the possession of fifty shares, to serve as a director. If no local directors be elected for these States, the number will be reduced to fifteen. By the omission to elect local directors for those States the relinquishment of the charter in them may be inferred. It is believed to be the impression of the stockolders of this company, that the charter has been by the act of 1840, confined to this State, at least the committee believe it is the opinion of the stockholders, that it is the policy and interest of the company, that the charter should be so limited. Under these circumstances it is recommended by the committee, that fifteen directors, the number required under the charter and its amendments, be elected from the stockholders in South Carolina, from which number a president is to be elected, constituting a president and fourteen directors for the government of the company. By the charter of the S. C. & C. R. R. Co., the direction consists of a president and twelve directors—except that the election of the president of the S. C. & C. R. R. Co, is by the stockholders, from among themselves, and of the C. & C. R. R. Co. by the directors from their own number: the provision of the two charters in all particulars affecting the purpose of the present inquiry are, in most respects, precisely similar. The term of service of the directors is in both companies for one year and until an election. Their general powers, with respect to contracts, meetings of the board and company, manner of authenticating contracts, supplying vacancies in the board between the periods of election, are the same, and the seal of votes by the stockholders is the same.

In the year 1839, this company purchased all the stock of the S. C. & C. R. R. Co., with the exception of a few shares, so as to posses the entire control of the affairs of that company. By the charter of neither company is it prohibted for the president, directors and officers to serve in the same capacity in any other company. The same individuals therefore may be elected to those stations in both companies.

The manner in which this shall be done, may admit of difference of opinion. The committee, however, recommend that the president of the company be authorized and instructed by a resolution, in all elections of president and directors of the S. C. & C. R. R. Co. to represent the shares held by this company, and to vote for the twelve individuals as directors of that company, who at the election for this company, had received the largest number of votes for the office of directors, and to vote for the same individual to be president of that company who might hold that office in this company. The immediate agency of this company, cannot be extended beyond the election of president and directors. But the expression of the will of this company, respecting the election of subordinate officers and other particulars, designed to effect a concert in the management of the affairs of the two companies, it may be assumed, will be respected by the president and directors of that company, and recognized by them as obligatory. In order to complete the arrangement proposed, it will be necessary to declare that the offices of treasurer and bookkeeper, subsisting in this company and the offices of treasurer and secretary in the S. C. & C. R. R. Co. be abolished at the expiration of the terms of office of the present incumbents. If this company approves the recommendatior of the committee, to postpone carrying into effect the system proposed until the completion of the road to Columbia, these officers may be retained with the understanding that their employment is indefinite. Otherwise, immediately on the expiration of the period of their offices, those proposed by the committee in substitution of them may be elected. For a permanent establishment the committee have concluded that after the completion of the branch of the road to Columbia, one president with a salary of three thousand dollars, one auditor, with a salary of two thousand dollars, and one secretary, with a salary of twelve hundred dollars, will be sufficient for the bureau service of both companies. The compensation of the two latter offices may be thought excessive, but from the nature and responsibility of the duties required of the auditor, the committee deemed it important to make such an allowance as would invite competition and secure the continued services of any one who might be found qualified for the office. The salary of the assistant clerk has been fixed at a higher rate than otherwise it would have been, from the consideration that he must occasionally discharge the duties of the auditor, and should be a person of like experience, character, and permanent employment. In addition to this motive, the secretary is charged with the duty of receiving and forwarding merchandize on the road. This arrangement recently made, has not yet given to that office any larger share of business, but it is expected as soon as it becomes generally known, to devolve on him an active and responsible charge, and that the increase of the business of the road by the employment of an officer to receive and forward goods without charge, will greatly outweigh the consideration of his salary.

After a careful inquiry, the committee have been induced to recommend that the union of the direction and officers of the two roads be deferred until the meeting of the company in November, 1842—not that they would affirm such union at the present time, to be impracticable, but that they believe a judicious economy would retain the present organization, until the branch to Columbia is completed. The existence of two presidents is a superfluity, rather in name and appearance than in reality. Their duties are very different, and in both departments very important. One is engaged in superintending the affairs of a road in active operation, and the other in constructing a branch of the road through a very difficult country. It is believed that neither could be without serious prejudice to the interest of the company, greatly exceeding in amount the salary, divide his time between the duties of both. The officers in the service of the S. C. R. R. Co. the committee are assured, could not undertake also the duties discharged by the officers of this company. Besides, that the former are fully engaged in the proper dutuies of their offices; the business of the latter requires for its proper discharge the experience of the present officers. Until the accounts with contractors on the branch be closed, the scrip issues be discontinued, the stock list of the railroad company and bank be completed, and the regular call for instalments be discontinued, it is thought most advisable to retain the officers of this company also. The committee derive support for this recommendation from the belief that at the time of the adoption of the resolution referred to them, it was supposed the branch to Columbia would by this time have been nearly if not quite completed. It seems that that event has from unavoidable difficulties been retarded, and may not be expected before July next.

The result of the report in what relates to retrenchment of expenses, may be stated thus:

By immediate reduction in the salaries of the president,	$1,000
In the salary of superintendant of transportation by discontinuing the office, - - - - -	2,000
In the rent of offices, - - - - - -	500
Amount carried forward	$3,500

Amount brought forward,	$3,500
By reduction after the union of the two companies, in the salary of the president, - - - -	2,000
By discontinuance of offices and reduction of salaries,	3,300
	$8,800
To which may be added reduction in bank salaries,	5,800
	$14,600
And the salaries of the principal and assistant Engineers, - - - - -	6,000
	$20,600

Making an agregate retrenchment of expenditures of $20,600, to be effected in the course of a year.

In the engineering department for the construction of the road to Columbia, there appeared to the committee, no room for further reduction. In the expenditures for the various employments connected with the transportation of freight and passengers, and keeping the road and engines in repair, the committee have not been able to make any reduction. The amount seems large but the employments are so much out of the experience and knowledge of the committee, that they cannot undertake to say it is too large. But the committee are convinced from the zeal and determined spirit of economy actuating the presidents of both roads, that every retrenchment, compatible with the interest of the companies, will be effected as time and circumstances may permit.

For the convenient consideration of the measures recommended in the report, they propose the following resolutions:

1. *Resolved,* That fifteen directors be elected to serve for the ensuing year.

2. *Resolved,* That at all meetings of the S. C. & C. R. R. Co., the president of this company do represent the stock held by this company in that corporation, and that in elections for president and directors of that company, he be instructed to vote for the individual who may be president of this company to be president of that; and for the directors of that company to vote for the twelve individuals who have received the greatest number of votes as directors of this company.

3. *Resolved,* That the president of this company do vote to postpone the election of president and directors of that company until the meeting of this company in November, 1842.

4. *Resolved,* That the offices of superintendant of transportation, and of treasurer and bookkeeper of this company be abolished after the expiration of the terms of office of the incumbents; and thereafter that the services of the last two mentioned officers, if necessary, be retained indefinitely.

5. *Resolved,* That the president and directors of the S. C. & C. R. R. Co. be requested to abolish in like manner, the offices of sec-

retary and treasurer in that company, and that the services of those officers, if necessary, be retained indefinitely.

6. *Resolved,* That until the meeting of this company in November, 1842, the salary of the president be $2,500 per annum; and that the directors of the S. C. & R. R. Co. be requested to fix the salary of the president of that company at the same sum.

7. *Resolved,* That the stated and special meetings of the two companies should be held on the same day and in the same place.

8. *Resolved,* That from and after the meeting of this company in November, 1842, the business of both companies be transacted by one set of officers; and that it consist of one president for both companies, with a salary of three thousand dollars; an auditor and a secretary, the first with a salary of two thousand dollars, and the latter with a salary of twelve hundred dollars, who, in addition to their duties as officers of this company, shall discharge all such duties as may be required from them by the S. C. & C. R. R. Co.

9. *Resolved,* That the offices of the two companies be removed as soon as practicable to the building occupied by the S. W. R. R. bank.

10. *Resolved,* That after the completion of the road to Columbia, one superintendant of the road and two assistants only to be employed, the salary of the principal to be $2,000, and of the assistants not more than $1,200 each.

ANDREW WALLACE, *Chairman.*

THE NEW BRIDGE AT FAIRMOUNT.

We visited Fairmount a few days since, and took some pains to inform ourselves of the peculiarities of the new bridge, now in course of construction across the Schuylkill.

The position which this structure occupies in the neighborhood of the most favored haunts of our city, renders its erection a matter of more than ordinary interest, and it is with satisfaction we find that it has been progressing very vigorously, though quietly, since its commencement.

This bridge is to be supported by 10 cables of iron wire, which are to be stretched across the river from one abutment to the other, and well secured on the eastern shore in the solid rock, and on the western side, in massive walls which rest on the rock. Each of these cables is formed of nearly 300 strands of iron wire about the eighth of an inch in diameter, which are assembled and bound together by ligatures of smaller wire, so as to form ropes or cables from 2 to 3 inches in diameter.

The separate strands of wire are covered with a varnish which is intended to protect them from oxydation, and the use of which is said to be justified by experience. These cables are to be upheld by four columns of granite placed near the edges of the abutments; two of which are now nearly completed, and exhibit we think, a specimen of substantial and excellent workmanship. They are formed of very large blocks of granite, which are obtained chiefly from the quarries at Hallowell, in Maine. These blocks are dressed with much care, and so placed in the columns as to form pillars of great strength, and quite ornamental. The columns are 30 feet in height, and 8½ feet square at the base. They stand on abutments of massive masonry, which have been built up from the surface of the river within the last three or four months. The wire cables are to pass over the tops of these columns and then descend towards the middle of the bridge to the level of the flooring—forming in their course symmetrical curves which we presume will present a very graceful appearance.

The flooring or carriage way, is suspended from the cables by 170 wire cords, similar in their construction to the cables themselves, but of much smaller dimensions. The suspenders are attached to the cables by a very simple cast iron saddle, and are secured to the joists of the flooring by wrought iron bolts. The cables are 647 feet long; and the span of the arch from centre to centre of the supporting columns, is 357 feet. The width of the bridge is 26 feet in the clear space between the parapets—10 feet of which space is appropriated to the carriage way, and four feet on each side is reserved for the footways.

The fastenings by which the ends of the cables are secured are somewhat curious. Those on the western side of the river are now completed. This work consisted in excavation of the soil down to the rock; which here constitutes the bed of the Schuylkill, and founding upon it very large and heavy walls of masonry into which were anchored 120 large bars of iron. These bars are completely imbedded in the masonry and terminate in archways which are intended to receive the cables and protect them from contact with the earth where they penetrate the soil. Indeed every necessary precaution appears to have been observed to secure the cables against the corrosive influences of the atmosphere and the earth.

On the whole, from our idea of the character of this work we should judge it is destined to be an exceedingly graceful and imposing structure, and peculiarly adapted to the picturesque scenery in which it is situated.

The work is progressing with great rapidity and will be finished by March next, if not delayed by the difficulty of obtaining the heavy granite blocks necessary for the remaining columns.

We regretted to learn that two of the vessels laden with the blocks intended to be used in the bridge were lost in a recent gale, and that the deficiency has yet to be supplied from Maine.

The bridge is constructed at the expense of the county, and under the superintendence of Mr. Ellet, the Engineer, who furnished the plan. We wish him success in his enterprize; though we should judge from the magnitude of the edifice, and the costliness of the materials employed, that the contract price (fifty thousand dollars) will hardly remunerate him for his exertions. The former bridge on the same site cost about one hundred and twenty thousand dollars, though the masonry was of the coarsest description, and the superstructure of wood. We can, therefore, hardly suppose that such an edifice as is now in progress, composed of massive blocks of granite, finely cut and beautifully fashioned, and which is supported by cables of an indestructible material, can be erected on the same ground for less than one half the cost of its predecessor. At any rate if Mr. Ellet succeeds in accomplishing the work at his estimate, we speak for this sort of bridge, a degree of popularity which may eventually remunerate him for the hardness of his present bargain. —*U. S. Gaz.*

[From the Civil Engineer and Architect's Journal.]

ON THE THEORY OF BARS.

"Lorsque l'homme s'ecarte de la vraie cause d'un objet quelconque, il doit se considerer dans les tenebres, et il est force de chercher des arguments absurdes, dans lesquels il se perd, ce qui fait que les sciences deviennent ridicules dans l'opinion du vulgaire."—*Cuvier on marine deposits.*

Sir—Pursuant to the notice I gave in the last number of your valuable Journal, I take leave to send you for insertion the following observations on a "New Theory of Bars, etc., by Mr. Brooks."

The importance of the subject to this great naval and nautical nation, and to the maritime commerce of the world, should admonish us to pursue the investigation of this matter with the most cautious and serious consideration, for as it is well observed in the quotation at the head of Mr. Brooks' treatise, "our errors in this matter are of more importance than in mere objects of taste, luxury, or pleasure, because they will ever result in injury, or in the loss of some previous advantage," Let us also bear in mind Cuvier's reproof quoted above.

It does not appear requisite that I should refer to the many theories quoted by Mr. B., the controversy so prevalent at present, and in past times, in the scientific world on the subject of bars, demonstrates that it has not received that attention and examination which can lead to a right conclusion as to their cause, and what are the most eligible means to obviate the many evils incident to their existence; but I do presume that my subsequent remarks, based on facts and practical observations, will prove, that if the desideratum has not previously been developed, Mr. B. has not reflected any new light on a subject hitherto by many supposed to be enveloped in darkness.

It appears apposite to notice that Major Rennel, quoted by Mr. B., p. 1 and 2, states, "that mud and sand suspended in the waters," (*i. e.* the egress waters) "during their motion are deposited when that motion ceases, or rather they are gradually deposited as the current slackens, according to the gravity of the substance suspended;" and the late Mr. Telford gave a similar exposition. I did not expect in this age of the world, any one would reject such an evident and irrefutable fact, a principle ever in operation during the discharge of the egress tides, or currents; but Mr. B. p. 4, says, "I venture to submit, that it is insufficient," (*i. e.* the Major's thesis) "to account for the formation of bars, because the operation described (the deposit,) as producing the latter (the bar,) takes place in all rivers, in a greater or lesser degree, and in those which although their waters are abundantly loaded with sand or mud, are nevertheless free from bar." Mr. B. therefore disputes the accuracy of the Major's deduction, because it is the result of a partial, and not of a general law; why, Mr. B. has endeavored to rest his entire case on local and partial data, and neglected to observe general principles.

That all rivers, harbors, bays, estuaries, etc., where the waters pass with a velocity sufficient to hold matter in suspension, have *beds* of sand, etc., is quite correct; but where the receding waters do not return or run out into the ocean with a force adequate to disturb the deposit that occured during the quiescent state of the waters, as described by Major Rennel, there certainly *no bar or exterior accumulation* can take place; for matter does not move without an impetus. Mr. B. then *de facto*, leaves the Major's thesis (with which I agree,) where he found it, based on the solid and immovable foundation of truth.

It is quite obvious that the Major has adopted the thesis that I have, viz.

1st. That wherever rivers. sluicing, or back waters disembogue into the ocean, either under a natural or artificial impetus, and run with sufficient velocity to hold matter in suspension, and cause a conflicting action with the waters into which they pass, there a bar is formed.

2nd. That wherever there is an absence of egress waters, currents, tides or sluicing power, and where no conflicting action ensues, there no bar exists.

3rd. That to these rules there are no exceptions throughout the world, for wherever nature is placed under similar circumstances, she is immutable in her results.

"Here then we fix the universal cause,
God acts by general, not by partial laws."

These primordial, universal, and indisputable facts are deduced from an extensive field of observation of many years, and on various harbors, rivers, etc., during which time I have visited the Baltic, Gulf of Finland and Bothnia, Russia, Prussia, Denmark, Sweden, Norway, Jutland. Friesland, Holland, Belgium, France, Spain, Portugal, the Mediterranean, Africa's shores, and many harbors of the united kingdom,—but all this devotion has been dealt with by Mr. Brooks in a most summary way, and to refute my theory he has used the following words, page 5, chap, 6, viz.:—"That the casual direction of the lower reach, or the position of the mouth of the river cannot truly be assigned as the cause of the existence of a bar, is easily proved by observation on rivers subject to great variations at the enterance, the bar being always found to exist independent of the direction of the discharge into the sea, this fact at once refutes the third and fourth theories."—In this extract there seems to be two distinct facts, *i. e.* the casual direction of the lower reach, and the independence of a bar, in the direction of the discharged waters, that is, he means that the deposit or bar does not occur in the direction or course of the egress waters. With respect to Mr. B.'s assertion of the independence of the bar, of the egress waters, I have much to say, if he be correct, he has indeed "at once refuted my theory," and would prove it to be a mere visionary and hypothetical deduction; but I will proceed to show the converse, and that he has committed, as in other parts of his book, an egregious error. If the reader will turn to the author's theory, subsequently here inserted, where he uses the *wedge* to aid his illustration, and where the battle with the elements occurs at the first quarter flood, he will find it stated, "that in the conflict, the sand or other materials, which it was (*i. e.* the effluent waters,) capable of holding in suspension previously to its encountering the conflicting action of the flood tide, yields it to the latter, and when this takes place the *bar is formed*;" now observe, Mr B. tells us that the material which drops and forms the bar, is brought down into the ocean by the egress or effluent waters, that as it advances onwards, (in its own direction of course,) it encounter the flood tide, and where it meets that tide, there the bar is formed; so that Mr B. himself destroys the premises which he had the boldness to adopt for the annihilation of my thesis. The positive and irresistible fact, is, that all bars are formed in the direction of the effluent waters, the latter are the impetus to the matter held in suspension, and that matter must fall in the direction of the impelling power, as a shot from a gun, the ball from the foot, or the deposit from the stream of the milldam.

Passing on towards Mr. B's. theory, I notice in chap. 2, page 19, "pier harbors, which though free from bar in their natural state, are well known to become encumbered by them, on the introduction of the scouring power," here I suspect he cast his eye southward on Lowestoft piers. Scouring power no doubt (this is my principle,) causes a bar, no matter whatever way or manner it is conducted to the sea, naturally or artificially, whether there be piers or no piers.

The commencement of chapter 11 is a mere repetition of my second proposition, "that whenever a river or harbor approximates to the condition of a simple inlet for the reception of the tide, it would have no bar." I endeavored some time ago, in conversation with Mr. B., to illustrate this truism by a reference to various harbors where the water did not pass into the sea, with a sufficient velocity to disturb the bed, there no exterior deposit could take place; no matter whether such a harbor be naturally or artificially constructed. Norway, Scotland, Ireland, Scilly Islands, Minorca, and Malta harbors, are of the first kind; Ramsgate, Margate, Scarboro', Cronstadt, Elsinore, etc, the latter.

In page 13, Mr. B. in noticing the geological features of the Yorkshire coast, says, "that a residence of some years on its shores, and a close observation enables him to state, that those seas that break on the outward platform, (the outer flat) are much heavier than those which break nearer the shore." I bear testimony to the accuracy of this fact, taught me in my boyish days by the boatmen, sailors and fishermen, that on all flat shores, or in different elevated platforms (if they must be so designated,) the sea loses its force, where it is first intercepted by the shore, and as it advances and rolls up the inclined plane; so the concave dimension diminishes, till at last it finishes in a mere ripple, or tiny billow.

I have now arrived at our author's theory, and it is *multum in parvo.* "During the period of the first quarter flood, the current, in lieu of being able to take its natural upward course, as in rivers where *no bar exists,* is opposed, or effectually checked, by the effluent back-waters; the declination of the stream in the lowest division of the river presenting a head which ensures a strong downward current, long after the tide would have been able to maintain an upward course, provided the backwater had a free discharge; at this period the flood tide, by reason of its greater specific gravity, occupies the lower stratum of the tide way, and like a wedge endeavors to force its course up the channel, which it is unable to effect, but merely elevates the lighter effluent water, the lower strata of which, being checked by the opposition of the tidal waters, yields to the latter, the sand or other materials which it was capable of holding in suspension, previously to its encountering the conflicting action of the flood tide; where this takes place the bar is formed."

Having shown that Mr. B. has attempted to refute my thesis by the aid of a fallacious assertion, I now proceed to prove that he has based his own on a sandy foundation. He commences this part of his work by stating that the current, in the first quarter flood, is not able to take its natural course upwards, as in rivers, where no bar exists—that is, where a bar does exist it is not able—and that this inability is occasioned by the conflicting action of the waters (and which conflicting action only exists where a bar is already formed,) and where this takes place (the conflicting action,) there the bar is formed. So that, in order to sustain his "novel theory" on the cause of bars, he first must have a bar, to produce the cause of a bar, and thus the effect produces the cause, and with this mode of reasoning illogical as it is, he has attempted "at once," and with one fell swoop *nolens volens,* to throw me overboard and in his general sweep, all who have attempted by principle and practice, ancient and modern, a development of the cause of bars. Mr. Brooks requires a back-water falling out of a sloping river, and that water to be opposed by a first quarter flood, and a bar, itself to produce a bar; he appears not to be aware that in various parts of the world bars have accumulated where there is an entire absence of his causes, and not only at places "which approximate to the condition of a simple inlet," but where the only existing cause, amongst those which he assigns for a bar, is the egress or scouring waters; examples of which we have in the Baltic, the Black, and other seas.

In my examination before a committee of the House of Commons in 1826-1827, on the proposed Lowestoft harbor, I then stated "that so soon as the scouring water should be applied as then proposed, a bar would accumulate where no deposit or bar previously existed, and if the sluicing were continued, the harbor would be so blocked up that small vessels only could enter at high tide." He need only refer, to prove the accuracy of his prescience, to the present state of the bar at that harbor, and the fact that about £150,000 have been expended thereon, the entire of which has been recently offered for sale by the loan commissioners for £17,000, it being completely lost as a harbor of refuge for which it was intended.

It is an incontrovertible fact, that the greater quantity of egress, or sluicing waters, and the more rapid their course, the greater is the exterior deposit. The Mississippi and other large rivers demonstrate this fact—the entrance to that queen of rivers is most difficult in the spring of the year, when the melting of the snow on the mountains increases the quantity and rapidity of the egress waters, so as to carry with them, trees, earth, and other matter, all of which are deposited on the extensive bar, at its outlet, and it does not again decrease until after a long continuous dry season, when the quantity of egress water is reduced.

Mr. B. follows his "new theory" by stating, "that he might easily extend his illustrations," and adds that the "direct tendency of the whole period of the ebb, when unobstructed by the tidal currents, must be to reduce the bar." This is really hypothetical.—That the ebb or outgoing waters have a direct tendency, and are the real cause of all exterior deposits or bars, etc., I have asserted for the last 20 years, the accuracy of which I will now attempt to prove. At the Neva, gulf of Finland, the Narva, Dantzic, the Danube, the Nile, and many other places, the current, without intermission (there being no *flood tide*,) is perpetually running out at the rate of six, seven or eight knots per hour, and yet the old entrances to those rivers have been blocked up by impassable bars, and either new passages have been cut into the ocean, or the egress waters have forced a passage out in a new direction ; here we have an absence of quarter flood, sloping, and of the difference in the gravity of the two waters, no salt water being in the vicinity of the disemboguing site of the above rivers.

I must now take leave to make an observation on Mr. B's. proposition to take away the shoals or deposits in the Thames, at Woolwich by scouring, and not by dredging, the result of such an operation (if it were accomplished) would be, that the matter moved could only be impelled onward, while the impetus was retained, but so soon as that ceased, a re-deposit would occur, which would occupy the same extent of the bed of the river, which it had previously done—he seems not to be informed of the effect produced on Barking Shelf, removed by dredging, although an immense accumulation of sand and shingle, the base of which appeared at low water, but I will not further interfere with the interior part of his subject, that is all plain sailing, no insurmountable difficulty occurs in attempts to improve inland navigation, there we have no impinging billow, or any material effect produced by the winds or tides.

Before I conclude, allow me to give some farther proofs of the accuracy of my two first propositions—New Zealand, "the entrance to the bay at Wangarver is 11 miles broad, perfectly safe, and without a bar; the bay is studed with rocks, (so are the harbors I have previously referred to as being free from bar.) The water is deep close to the shore. The bays of Plenby and Port Nicholson are similarly formed and are free of bar, although no back waters. The harbor of Hokianga with an extensive interior river, where the waters run out at every ebb tide, there a bar exists. In the West Indies, at St. Lucia and the Havana, both splendid harbors, but have neither rivers, backwaters, nor bars.

I remain, sir, your obedient servant,

Henry Barrett.

FLINT AND OCMULGEE RAILROAD.

We copy from the "Southwestern Georgian," published at Albany, Baker county, the following remarks on this railroad:

"General Brisbane, with commendable energy, and a perseverance which would daunt most persons, is pressing forward this all important work; about two-thirds of the whole distance, (we learn from a gentleman from that quarter) is already graded. It is an unfortunate circumstance that the planters in that section of country are not aware of the vast improvement which will result to their property, from the completion of this road. They have generally commenced planting there with small means, and have been so far removed from railroads, that they have had no chance of testing their advantages.

"This road pierces the very garden of Georgia, whose rich products will come to our own doors. We wish it might receive some aid from Savannah, as we consider it next in importance to the Savannah and Macon railroad. Charleston promised to help them out, if the planters would stipulate that the crop should be laid down in that city. Such an arrangement would be too expensive, and those concerned are for other reasons strongly opposed to such a plan.

"From an advertisement in our paper, it will be seen that at a recent meeting held by the directors of the company, at this place, it was ascertained, 'that an accession of the small sum of $30,000 to its present means, payable one half on the first day of January, next, and the other half on the first day of January, 1843, will enable the company to complete the work, within the ensuing year for the transportation of freight and passengers.' Savannah, if she knows her true interest, will come forward and subscribe for these three hundred shares. It will open to her the richest part of the State, the trade of which, in less than five years, will be of more value than any other. However much the people of this section may wish to give a city of their own State the preference, if they are compelled to obtain assistance to carry on this work from the city of another State, to that city the trade will eventually be carried. Savannah certainly will not permit this; she knows her interest too well to suffer a work which will bring the best trade of the State to her door, to be defeated for the want of the pitiful sum of $30,000."

We give our most cordial assent to the views of this writer, as to the bearing of that road on the interests of Savannah. Any one has but to take the map of Georgia, and look at the counties through which it runs, to see what a large territory it will bring into proximity with us; and a very little inquiry on the subject will convince the most incredulous that you have but to give those counties easy access to a market, to develope their agricultural resources, and thus increase their wealth, population and influence. We are not for urging reckless investments, but we think that the merchants of Savannah have a deep interest in this scheme, and that by showing the counties in the southwest our willingness to assist in this enterprise, and our appreciation of its value, it would create a strong reacting feeling in our behalf, and might exercise no inconsiderable influence in bringing it to ultimate success. The true interests of Georgia are bound up in the carrying out of these improvements; for nothing can more surely call forth the resources of the State; nothing can more effectually create and sustain trade; nothing can more happily draw out the energies of the people; nothing can more certainly add to their wealth; nothing can more speedily break down all the sectional prejudices of the various counties, and unite us all as one people, striving for one common good, than the advancement and completion of the works of internal improvement, begun and projected in Georgia. This is not theory, but strict, experimental truth, which the history of every railroad country and corporation will confirm, and which cannot be too often or too forcibly presented to our readers, particularly to those (if any there can be) who are dubious of the benefits and advantages of railroads. —*Savannah Georgian.*

INTERNAL IMPROVEMENT IN GEORGIA.

In the extent and magnitude of her schemes for internal improvement, Georgia stands first, south of Pennsylvania.

There are now commenced no less then five railroads, viz.: the Central railroad from Savannah to Macon, the Georgia railroad, the Monroe railroad, the Western and Atlantic railroad, the Flint and Ocmulgee railroad.

These traverse the most productive agricultural districts of the State, and communicate with the Atlantic by two channels, viz.: Charleston via Hamburg railroad, and Savannah. We have long since urged upon our citizens the importance of making one of our own ports the outlet of the State, and having spoken of the attempts strenuously made by the Carolinians, to control the railway trade and operations of the up-country. Intent upon their own interest, striving to make Charleston the emporium of the Atlantic South, her merchants knowing the resources which the upper part of our State presents, are striving to turn to their own markets, the trade which should flow only to our own. This is a serious subject; and this, we think, a critical period. It is no time to slumber in indifference when our neighbors are stretching every sinew, or to relax our efforts when they are ever augmenting theirs. Our own railroad is steadily progressing towards its terminus. The report of the Western and Atlantic road, shows that operations are kept up there, and that section after section, is gradually put under contract, graded and made available. One half of the Flint and Ocmulgee road is already graded, and the rest under, contract; and the other roads are completed, or progressing to their several destinations.

With these facilities growing up around us, with the resources of the State daily augmenting, with every element of State wealth and greatness, the important question comes up, how shall the system be controlled?—how shall all these resources be made available to the interest of the State and its citizens, and make Georgia what she should be, the key-stone of the south? To sell the State road, would be suicidal; to withhold further appropriation, would depreciate its stock and destroy its usefulness. No, there is, we think, but one way, and that is FORWARD. Carry out by every laudable means the great schemes already begun; throw the country open to the influence of railroads, and though the State may be temporarily embarrassed, yet she would soon receive more than compensating returns, and in the increased value of her lands, her produce, her stock, her mines, would be repaid a hundred fold both in wealth and honor. Unless some vigorous system is adopted, all these resources will but turn to the benefit of another State, and our rich and productive interior, instead of finding its natural outlet in the ports of Savannah, Darien, and St. Marys, will be drawn away to swell the profits of other merchants, and the revenues of another State. New York is already beginning to feel the effects of her supineness, in silently allowing the Bostonians to tap the great railroad line of the west at Hudson, and thus divert to its city, the produce which had else found its way to the former. They are indeed endeavoring to remedy the evil by the Erie and New York railroad, but it will be no easy thing, even admitting that it can be done, to dispossess Massachusetts of her strong hold upon the western trade. Happy would it be for our State, if her leading men would unite on these measures of internal improvement; if, for a time, they could free themselves from the curse of party prejudice, and legislate with enlightened and liberal minds for the good of the State; forgetting all sectional interest, all local divisions, all dissonance of political feeling, in the one aim of raising our State to the position which her size, her resources and her wealth entitle her. While we are wrangling, others are working; and while our energies are wasted in angry debate, others are expending theirs in efforts which are impairing our strength, to nourish their own. The splitting up of these simple measures, on which union is all essential to prosperity, into party measures, may be our ruin.

Let enlightened legislation rescue our State from so disastrous a result.—*Savannah Georgian.*

THE STEAM FRIGATE CLYDE,—TRIAL TRIP.

In our last we briefly noticed the trial trip of the steam frigate Clyde, and promised to give a more particular account of this splendid vessel in the present number. She is the first of the fleet of fourteen vessels, recently contracted for by the British Government, for the double purpose of carrying, during peace, the mails to our West India colonies, and in time of war to act in the capacity of armed vessels of the largest size and power. The first trial of the Clyde was looked forward to with an intense and extended interest, every one feeling that the prospects of the Royal mail steam packet company, who have made the contract with Government, were dependent in a great measure upon its success; and because it was expected to demonstrate whether the construction of these ships had been able to combine, with the great capacity and strength required in war frigates, the requisite speed, power, and accommodation absolutely indispensable to the performance of their duties as packets conveying the mail, and carrying passengers on a longer voyage than any yet accomplished by our trans-atlantic steamships. We, therefore, feel much pleasure in being able to assure our readers that the trial was, in every sense of the word, highly satisfactory.

Before alluding farther to this matter, we may mention that the Clyde is by far the largest and most powerful steamer in her Majesty's service. Her engines are nominally of 480 horses' power, but they are capable of working up to a much higher effect. The nominal tonnage of the ship by the old law is 1350 tons, but her real capacity is about 1800 tons. She is constructed with the strength and proportions required for carrying Paixhan's guns of the largest class about ten inches in diameter, which are now coming into use for firing shells and hollow shot to the greatest distance. The whole frame and beams of the Clyde are of the best British oak, bound and fastened in every direction, so as to combine all the means that are known for giving the greatest strength to so large a structure.

She has one complete system of diagonal oak trussing between her timbers—a complete internal ceiling caulked and fastened like the outer skin—and a third system of oak and iron trussing upon the ceiling itself. The result of all this strength is such, that the shape of the vessel, now that she is afloat with all her machinery, and a considerable quantity of coals, stores, and fresh water, has not altered one inch since she rested on the blocks in the building yard of its able artificer the late Mr. Robert Duncan.

The Clyde and her sister ships, the Tweed, the Tay, and the Teviot, are all of the same dimensions—all built on the river Clyde—have all engines of precisely the same size and power—are constructed on the plans and under the direction of Mr. Scott Russel, of Messrs. Caird, & Co. of this town, who are the contractors for furnishing the four frigates complete and ready for sea; and it is worthy of remark, as showing the capabilities of our establishments of the kind, and how little we have to fear in the event of sudden war, that although not more than fifteen months have elapsed since the order was given, three out of these four vessels have already received all their machinery, and will within a few weeks be ready for sea. Thus one single establishment in thist own has completed engines of the agregate power of 1920 horses, in the short space above referred to. At this rate it is plain that the river Clyde alone, could, in a year, furnish a fleet of twelve such frigates, and one per month for any longer period.—*Greenock (Scottish) Advertiser.*

Electro Magnetique Locomotive.—The following annunciation of a vast improvement by a new modification of mechanical power must, we should think, attract very generally the public attention:

"A letter has been received from Leipzig, dated 23d July, stating that Mr. Lewis Gabriel Stochrer, a mechanician of that city, has just finished an Electro Magnetique locomotive, the greatest part of which is constructed after Mr. Wagner's plan, and which has been purchased by the Germanic Diet. This locomotive is of seven horse power, and will draw three cars full of passengers. It costs about $1,000, instead of $7,500, the cost of a common steam locomotive; the supply for it amounts to not more than 60 cents per day.

"The experiments which have been made with Mr. Stochrer's locomotive on the railroad between Leipzig and Dresden left nothing to be desired."—*Translated for the National Intelligencer from the Echo du Monde, savant No.* 653, *Paris*, 4*th Aug*. 1841.

Powers of Locomotive Steam.—A steam coach running at a moderate rate, which is about 21 miles per hour, would run over a distance of 500 miles per day of 24 hours, and at that speed would reach British India from London in about 8½ days—or Pekin in China in 11 days—or from Gibralter to the Cape of Good Hope in 10 days—or from Quebec to Cape Horn in 17 days—or once round the globe in 51 days—or 7 times round the globe in one year—or a distance equal from the earth to the moon in about 16 months, or from the earth to the sun in 500 years.—*Greenock paper.*

Railway Traffic.—One week's receipts from the principal lines of railway in Great Britain, according to our last week's returns amounted to £97,670 on a captial of £37,000,000. Deducting one half for expenses, which is full as much as they average, there remains a balance for dividend of about 7 per cent, proving at once that railway speculations have not been so unproductive as some would represent; for although there has been a loss (or rather no profit) on some lines, it is more than made up from others. The country at large, therefore, has been rather a gainer in regard to investment of capital, to say nothing of the immense benefits conferred on the whole community in making and keeping those undertakings in repair, as well as in the cheaper, speedier, and safer mode of travelling to which they have given birth.—*Railway Times.*

Locomotives for Common Roads.—A gentleman residing at Southwell, Dr. Calvert, has constructed a machine, which he purposes to call "the *Alternate*," because he rides or walks in turn according to the ascending or descending inclination of the road he travels. By merely rising from his seat, and throwing part of the weight of the body upon the hands placed upon a guiding bar, he *walks* with less fatigue than he could do without the machine, especially where the ascent is not very steep. On descending he sits down and *rides* at his ease with considerable speed. The propelling action (the most powerful that can be exerted, and one of the most lasting,) is that of rowing.—*Nottingham Journal.*

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AND

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[For the American Railroad Journal and Mechanics' Magazine.]

LONG ISLAND RAILROAD.

" *This is essentially a farmers railroad ; by them it should be supported, and for their interest it should be directed,"*—Ed. Railroad Journal.

It would be no uninstructive occupation to the citizens of our goodly city of New York to look into the past history and present condition of the approaches to it by railway, now about receiving its deserts from the public, in the acknowledgement, that over all other modes of improvement, it is the *most conducive* to prosperity.

In casting the eye around then, we have in the fragments that remain, evidence that the attempt was at least made at an early day, to render our city, by this speedy process, accessible at all seasons, to and from the four cardinal points.

Let it be, as in truth it was, more owing to the misfortunes pecuniary and moral, of the times—and of necessity, that three of these attempts were abandoned and left for so long a time to their fate, and it is now to be viewed as matter of congratulation, that we have at all and in any how been again enabled to resume work upon them, which we receive as the earnest of more enlightened views in regard to this improvement, and of the intention to prosecute them with vigor to completion.

These avenues may be thus reviewed:

To the South.—Completed for some years, but in a very bungled manner, the immediate 87 miles not being run over in less than 7 hours, in the average, while it ought to be done in 4½ and 5 hours, the nominal fare for that distance being 4¾ cents per mile, while by this loss of time, the real cost is at least 10 cents—this is the more important, as this line forms the *clasp* to the chain connecting nearly our whole Atlantic coast.

To the North.—Has been completed as far as Fordham, 12 miles from New York, and is now being continued to White Plains in the county of Westchester, and is to go ultimately to Somers on the confines of that county, by the company styled, the New York and Harlem railroad company. From Somers it is to be continued to Albany and Troy, a great focal point, by a separate company, some time since organized, but which has been unable to operate, owing to the peculiar position in which it is placed as to connecting on fair terms with the Harlem company.

To the West.—Has been completed as far as Goshen in the county of Orange 68 miles from New York, and has been for some months in successful operation; the remaining 400 miles terminating at Dunkirk on lake Erie, is in rapid progress—a large portion has been already graded in different sections and 3½ millions of dollars on the whole expended. It is calculated to finish the entire line in about three years.

To the East.—Has been completed from Brooklyn to Hicksville on Long Island 27 miles, and is now being continued 20 miles further, terminating in the neighborhood of Smithtown, Islip, and Patchogue, leaving 48 miles to take it to its terminus at Greenport, 95 miles from Brooklyn ferry.

The perusal of a report of the 1st February, 1841, from the directors of the Long Island railroad company to its stockholders, induced us to a personal visit along the line of the road and of their renewed operations, and called up the above lines in review before us, as well as led us into a fuller consideration of this eastern approach, the important points about which, we find really worth being brought to the notice of our readers.

And first, as to the actual financial condition of this concern:

The amount expended on the Brooklyn and Jamaica railroad, 11 miles, - - - - -	$370,000	
The amount expended on the Long Island railroad to Hicksville 16 miles. - - - - -	773,000	
Amount carried forward		1,143,000

Amount brought forward -	$1,143,000	
The amount required to complete the road to Greenport 68 miles, it is found by *actual contract* will not exceed $6,000 per mile,	408,000	
		1,551,000
Locomotives, freight and passenger cars and ferry boats, -		149,000
Cost of the whole line equipped equal to about $18,000 per mile,		$1,700,000

Thus it is seen, that if the road is carried through to Greenport, that even after throwing in the heavy cost of the first short sections, a most moderate average cost per mile, is still obtained for the whole line, owing to the very cheap rate at which the last and long section can now be contracted for. It is therefore of the highest consequence to the holders of the first large issue of scrip, now nearly worthless, ($3½ per share,) of understanding well the facts in this case, which ought to satisfy them, that the opportunity is before them, by united action, to bring the whole up to par, and under the influence of such temptation, we trust the opportunity will not be lost, by at once making this road the great eastern outlet to our city, as it naturally is, by the greater facilities it offers, and which require only to be *properly applied.*

And secondly.—The road being thus completed, it is well to look first, at the certain *fixed sum* which it must earn to pay the interest on the outlay, and the expenses of repair and management. This may be stated as follows:

Interest on $1,700,000 capital at 7 per cent		$119,000	
Repairs and renewal of rail, an appropriation per annum, of - - - -	6,000		
Repairs and renewal of wooden structures, an appropriation per annum, of, -	5,000		
Adjustment and charges extraordinary, for ferries, etc., an appropriation per annum, of, - - - - - -	10,000		
Management, salaries, etc., etc. -	9,000		
		30,000	
			$149,000

and which it *must earn at any rate.* It remains therefore to show what are its resources for so doing.

And thirdly, as to those resources.—The business and travel on this line are fortunately no longer conjectural, but are matters of record. It is, however, unusually beset by competition, there being no less than seven other avenues to reach the same point, one of which only, is of any real moment to this line, and that is by the steamboats running parallel to it on the sound. If we assume, therefore, that the boats could not afford to run to Stonington at less than $2 per head, that rate could be safely taken as ensuring a majority of travel to the railway, performing the distance in half the time and with less risk, but in order to make assurance doubly sure, it may be most prudent for an estimate to put the fare at $\$1\frac{3}{4}$ per head for delivering the *passenger and his luggage* at the depot at Stonington or at $\$1\frac{1}{2}$ deliverable at Greenport, giving him the advantage of the competition of the Norwich line to Boston against that from Stonington. In this manner will the lowest possible fares be secured throughout, which in no case here, can be matter of option, but must be that of the cheapest rate with the best *accommodation and most despatch.* To give full effect to this line it is scarcely necessary to say, that its arrangements must assimilate to that opposite to it and leading south from Jersey City. The passenger being booked and his luggage crated on this side of the water, leaving him only to care for his safe transfer from one conveyance to the other, and but to look after his umbrella clear through to Boston.

From data furnished by the lines which have for some years been in operation in this direction it may be assumed that the through travel to Boston is not now short of 105,000 annually, of these we will say that three quarters or 75,000 pass over the Long Island railroad at $\$1\frac{3}{4}$ landed at the depot at Stonington, $131,250

The way travel for the whole line is more difficult to come at, for 27 miles it now averages per annum, almost $40,000, say that it will double itself as a moderate calculation, -	80,000	
	$211,250	
Cost of transportation, say 25 per cent as per experience on other and less favorable roads	51,250	
		$160,000
Freight through to Stonington, and express packages, etc. - - - - -	35,000	
Way freight being now $20,000 for 27 miles, may be put at double for the whole line -	40,000	
Amount carried forward	$75,000	$160,000

Amount brought forward	$75,000	$160,000
Cost of transportation, say 30 per cent, agreeable to experience on other and less favorable roads - - - - - - - - -	23,000	
		52,000
Mail carried, say 120 miles from *New York to Stonington* - - - - - - -		25,000
		$237,000
Deduct repairs and management as above, being a full allowance - - - - - -	30,000	
Interest on $370,000 at 7 per cent, as stipulated to be allowed to the Brooklyn and Jamaica railroad - - - - - - - -	26,000	
		56,000
		$181,000

being equal to $13\frac{60}{100}$ per cent on a capital of $1,330,000.

This exhibit, therefore, based as it is, on ascertained results, makes it entirely certain that 8 per cent at least, will be yielded on the full value of this stock, and if we allow for the reduced fare and better accommodation here contemplated, it must be admitted that the scale of business above assumed for it will be at least maintained, if it be not exceeded by the actual result.

It remains only for us to add a word as regards the character of this road—it comes fully into the category of those "judiciously constructed between desirable points"—it has indeed, three important features peculiar to itself, one, that of being in *nearly a perfectly straight line,* another, that of not being *disfigured by a single bridge,* and another, that of *laying on a gravel bed throughout its whole line,* in which it will be more likely to petrify than to rot. These advantages united to a solid structure generally, the rail being 57 lbs, per yard, with very light grades, will ensure the transportation being done over it whether light or heavy, at the cheapest cost, and will keep down its general expenses at the veriest minimum rate.

We are advocates of personal inspection, and we say, therefore, go ride over this road and draw your own conclusions. You will there find in Mr. Shipman, the engineer of this road, not only the willingness but the ability, to give you every necessary information.

[For the American Railroad Journal and Mechanics' Magazine.]

STEAMBOAT NAVIGATION.

" *The advantages that have followed this discovery are too great to be calculated.*"

Such are the concluding words of a notice of the first essay between New York and Albany, made by *Robert Fulton* in 1808, with the Clermont steamboat, the particulars of which are given in the October number of this Journal.

Every body must have heard of the " Fulton claim," of which we may here give a summary. It is not altogether one which can be made out *exactly* in dollars and cents, but requires in estimating it that expansion of the mind and swell of the soul which accompany the contemplation of the *glory* of one's country, and which lies so emphatically in her GREAT MEN.

1st. In 1814, the only steamboat in New Orleans, about the time of the attack on it by the British, was the Vesuvius, she belonged to Mr. Fulton, but was appropriated by the Government to their own uses, and the opportunity of immense profits during that period of alarm was taken from him.

2d. For his time given in various experiments during the war, in submarine defensive operations against the British fleet on the coast. It is well known that the terror of Fulton's name, who had given the English admiralty a specimen of his torpedo, and which they would have bribed him to suppress, kept the British vessels out of our waters, and when they chanced to catch a prisoner off the coast, the first inquiry always was, " *Where is Fulton ?*"

3d. For his time and services in building the Government steam frigate Fulton, in that day of inexperience, a most arduous duty, compared to a later period, when the Greek Government paid our mechanics most liberally for their skill in ordinary ship building, and very recently when the Spanish and Russian Governments have paid our mechanics the compliment of employing them in building steam frigates at a very handsome remuneration.

4th. In the use of his patent, by which the whole nation has been advanced in the last twenty-five years in numbers, wealth and innumerable comforts, which, without his discovery, it would have taken them centuries to have reached.

It was some time before this claim could be embodied in any shape proper for the consideration of Congress, until it was taken up by Mr. Whittlesey, so long the stern and indefatigable chairman of the Committee of Claims, and by his disinterested exertions was such data placed before Mr. Dickerson, then Secretary of the Navy, and to whom Congress had referred it for appraisement, as enabled him to report to be due to Mr. Fulton's heirs a balance of $100,000 arising in the four items above enumerated.

To show the *noble feeling* of one branch of Congress on its first reference to them, we give the report of the debate which ensued on the bill being brought before them, and which then passed by a majority of thirty-six. It did not reach the Senate until the *last hour* of the following session of 1841, when by the absence of its friends it was lost by a majority of four, but the *reconsideration* of the vote was subsequently asked for by the Honorable John Davis, Senator from Massachusetts.

In renewing it now, the claimants will have the *additional ground* of the extensive use to which the Government are about applying this invention in naval defence, and as its very terrors are enough to keep off foreign aggression,—the consequent saving to the nation in outlay of preparation, and the escape from the destruction which would follow attack, makes the item awarded in this case to the heirs of this great benefactor of his country and the world, but *a fraction* in the comparison.

" Mr. Owens, of Georgia, called for the reading of the report of the Secretary of the Navy on the case, which was read accordingly.

" An animated debate now arose, which occupied the House during the remainder of its sitting.

" The bill was opposed by Messrs. Owens, McKay, Craig and Russell, and advocated by Messrs. Wise, Whittlesey, Hoffman, Legare and Biddle; when

" Mr. Duncan, after expressing a desire for further information relative to the case, moved to postpone the further consideration of the bill to the first Friday in March next; but the motion was negatived without a count.

" Mr. Petriken moved an adjournment; this motion was promptly negatived.

" Mr. Russell moved to amend the bill by striking out 'one hundred' before 'thousand dollars,' (referring to the sum to be paid to Fulton's heirs,) and inserting 'twenty-five,' but subsequently modified the motion so as to leave the sum in blank.

" On this motion he demanded the yeas and nays, which being taken resulted as follows: yeas 80, nays 111.

" So the motion to *strike out* was rejected.

" Mr. Haynes then moved to strike out 'one hundred' and insert 'fifty.'

" Mr. Wise demanded the previous question.

"The House sustained the call: ayes 91, noes 72.

"The previous question was then put and carried; and the main question, on ordering the bill to its third reading, was decided by yeas and nays in the affirmative.

"So the bill was ordered to be engrossed for its third reading; it was then (after an unsuccessful motion for a call of the House) read a third time, passed, and sent to the Senate for concurrence.

"[The debate on this bill was highly interesting. The opposition to it was placed mainly on the ground that in making up Mr. Fulton's account with the Government, the Secretary of the Navy had made by far too large an allowance for his personal services, and also for the use, by the Government, of his steamboat Vesuvius, during the attack on New Orleans, where she was impressed for the conveyance of troops, and was run aground while thus employed, and remained useless for three months of that busy period. The opposition of Mr. Russell was determined and persevering, and accompanied, occasionally, by remarks not highly complimentary to the merits of the illustrious dead.

"The defence of the bill was warm, resolute, and at times very eloquent. The merits of Fulton,—the debt of gratitude due him from the whole American people, and the national reproach arising from the destitute situation of his orphan children, were dwelt upon with great effect, especially by Mr. Hoffman and Mr. Legare; *while Mr. Whittlesey advocated the claim in the most spirited manner, as matter of right, on the documentary evidence submitted to the Committee of Claims.*]"

JOBBING ON RAILWAYS.

We extract the following from the English Railway Magazine, as furnishing a useful hint in all future railway or canal schemes, or any public improvement whatever:

"*Jobbing of directors.*—Our readers will remember that some time ago we hinted that jobbing was going on in some companies, that in fact there were directors, who, unmindful of their duty to their constituents did not keep their hands quite clean of the contracts.

"There are, probably, some who believe that the dealing in, or supplying of articles for the railway, is not improper conduct, provided it be done in the honest and straight forward way of business, and without taking advantage of their situation to exclude others, to get larger prices or larger profits by furnishing inferior articles.

They think the sole object of the act preventing directors from taking contracts was confined to this, and that it was not intended to exclude fair and honest trading transactions. We have no doubt such in effect was the object of the legislature, but knowing from the experience of six thousand years, that all the sons of Eve partook of that primitive lady's weakness in resisting temptation, and her propensity to taste of forbidden fruit, the Parliament has wisely commanded that all temptation, and even the possibility of it, be removed from railway directors, in order that their virtue may not be assailed.

"Hence all acts of Parliament contain the following clause:

"'Provided, nevertheless, and be it enacted, That if any director secretary, clerk, treasurer, or other officer, or servant of the said company, shall, either directly or indirectly, be concerned in any contract with the said company, etc., etc., every such director shall thenceforth be disqualified from voting or acting at any succeeding meeting of directors, and his office shall thereupon immediately become vacant, and every such clerk, secretary, or servant of the said company shall, thereupon, be immediately discharged from the service or employ of said company,'" etc., etc.

It is no excuse, although some palliation, that in these matters of tergiversation they are nearly as bad abroad as we are here at home. It is now time to be a little more restrictive than it has, however, been our custom, and no company of any moment, which has run its career in the last ten years, but should have a thorough overhauling as to its past doings, present condition, and future prospects. It has been most fully shown, of late, that corporate immaculacy is scarce indeed.

[From the Railway Magazine.]

PRESENT STATE OF THE QUESTION OF LOW FARES.

The subject of fares is one, which, with the extension of railways for traffic, must necessarily attract much attention, and it is evident that it now attracts a great deal. Like all other questions, it has two sides and two parties, one, which we may call the passive party, that which holds that the higher the fares the greater the profit, and the other, which is an active party, which advocates low fares as the only genuine source of healthy traffic and steady profit. For this latter cause we have long labored, both in the former series of the *Magazine*, and in the present, and we believe that we may claim the merit of having been the first and most persevering advocates of this great principle. To us, therefore, to contemplate the present state and prospects of the parties contending for low fares, must be most agreeable, and we know no period more fitting than this, when the yearly meetings of most of the companies have been held. It will be found from this investigation, that the principle of low fares is no longer dependent upon the pen or upon theory, advocated only in the closet by a few, but that it is daily making way, and coming into practical operation among a large number of the railway companies. It is evident that the sticklers for high prices are alarmed, and although Mr. Chaplin and its other partisans, may thunder forth from the chair diatribes against writers and theorists, he and they will find that the rapid progress of the other system already prognosticates the ultimate result. The following, among other companies, have now declared themselves in favor of low fares:

The Manchester and Leeds.
The Glasgow and Ayr.
The Glasgow and Greenock.
The Croydon.
The Blackwall.
The Dundee and Arbroath.
The Arbroath and Forfar.
The Dublin and Kingstown.
The Chester and Birkenhead.
The Hull and Selby.
The Stockton and Darlington.

The following have affirmed the principle of third class carriages at low fares:

The Great North of England.
The Greenwich.
The Newcastle and North Shields.
The Eastern Counties.
The Birmingham and Gloucester.

We shall now proceed to give some of the testimonies to low fares, furnished by this years proceedings from the present volume of the *Magazine*. The Newcastle and North Shields directors state (p. 98,) that "they had advanced the second class fares, and given increased accommodation, at the same time they added a third class of open carriages at a lower price." The Grand Junction (p. 121) announce "a further reduction in the rates for the carriage for goods has been made since the last general meeting; the result of which, has been an increase in the quantity, as well as in the money receipt from this source. The directors have been guided by a conviction that the undertaking would be promoted by the increase of traffic created by such inducements." The Greenwich directors (p. 139,) confess that they have been obliged to introduce third class carriages, "rather in deference to the wishes of many of the shareholders, and to the practice of other railways, than from convictions of their own." At that meeting they seemed rather disposed to throw them up, but in July they say, (p. 600,) "some experience has been afforded by the use of these lower priced carriages for the last twelve months, by which it would appear to be imperative, from the existing competition, that they should be continued." They further recommend the abolition of 2nd class fares, and reduction of 1st class fares. The directors of the eastern counties (p. 187,) say, "that they have been for some time in negociatiin with the Thames Haven company, and the Harwich and Colchester branch, to decrease the toll." At the North Midland meeting, (p. 195,) the chairman stated that the board were prepared to entertain the question of a reduction in the Manchester and Leeds toll, as a matter only of revenue, but as matter of principle, there were some doubts. By the Manchester and Leeds directors, who honorably lead the way in maintaining the great principle, it is avowed (p. 237,) that the company have adopted this "principle of carrying a larger number at low fares in preference to a smaller number at high fares." In March, the Croydon directors announced (p. 239,) that "they adhered to the opinion expressed in their late report, that increased facilities and reduction of fares are the means most likely to lead to a remunerating revenue." Again, in September, they say, (p. 775,) that "they are firmly convinced that lower fares would so greatly increase the number of passengers as to add to the income of both companies, (the Greenwich and Croydon.") The Dublin and Kingstown directors (p. 299,) express their satisfaction with the result of the late reduction in the second class fares, and in the rates of subscription, and with the plan of family tickets. They also intimate an intention of giving greater facilities. Notwithstanding an increase of a quarter of a million of passengers, or twenty per cent., the expences of the locomotive and carriage departments, were £772 less on the year. The Chester and Birkenhead board report, (p. 339,) that the charges had been reduced, and the traffic has since steadily and progressively increased. The directors of the Hull and Selby, state (p. 688,) that they have consented to grant monthly tickets to parties residing on the line of railway, allowing them to pass as often as they think proper, on the payment of one fare daily. The Glasgow and Greenock board announce (p. 581,) that their fares are unusually low, and that the result already confirms the soundness of their views. The Glasgow and Ayr directors advocate (p. 788,) a reduction in the fares of the joint lines. The report of the Blackwall directors states (p. 715) that, "although the present fares are unquestionably low, (perhaps lower than any other railway in England,) the directors would deprecate any increase, until the present rates have had a fair trial, with the advantages of the extension line." The Great North of England directors state (p. 799,) that "third class carriages have been attached to some of the trains, and the scale of fares fixed so as to enable all classes, according to their means, to avail themselves of the railway." The Ulster directors announce (p. 802,) that "they are anxious to settle rates of fare on as moderate a scale as possible."

Another proof of the interest taken in the debates which have taken place at several of the meetings :—At the Manchester and Leeds (p. 239) a long and interesting debate took place on fares, and even in that liberal company a motion was brought forward to give some additional accommodation to passengers. At the Dublin and Kingstown meeting (p. 300,) eminent for its maintenance of low fares, a motion for increased accommodation was similarly brought forward and dropped. At the Greenwich meeting (p. 602,) some able remarks on the reduction of fares were made by the late resident director, Mr. George Walter, and a long debate ensued. At the Grand Junction meeting, a sound and sensible speech was made by the retiring chairman, Mr. Moss, (p. 698,) on the subject of low fares. At the Sheffield and Manchester meeting (p. 735,) Mr. Jackson advocated accommodation for third class passengers. It was at the North Midland meeting, however, that the grand debate of the year took place, on the speech of Mr. Vickers (p. 742,) and although the motion was lost, the opposition was evidently of a very moderate character. A proprietor of the Glasgow and Ayr meeting (p. 790,) expressed an opinion in favor of high fares, but the sense of the meeting was against him, and the meeting subsequently passed a resolution declaratory of their desire for a reduction of the fares on the joint line. At the South Western meeting (p. 754,) Mr. Chaplin delivered a masterly speech in defence of high fares which may be considered as the counterblast of that expiring cause against the opinions of Mr. Vickers. Discussions or questions were also raised at the meetings of the Great Western, Birmingham and Derby, and Blackwall companies. Thus the question of fares has come before the meetings of eleven companies.

We have now to sum up the names of the advocates who have this year declared themselves on either side. We therefore find among the advocates of low fares, Mr. Moss, late chairman of the Grand Junction (p.698,) Mr. Houldsworth, chairman of the Manchester and Leeds (pp. 237, 499,) Mr. Routh, chairman of the Blackwall, Mr. M'Call, chairman of the Glasgow and Ayr, Mr. W. A. Wilkinson, chairman of the Croydon, Mr. George Walter, late resident director of the Greenwich (pp. 446, 585, 602,) Capt. Lawes, superintendent of the Manchester and Leeds, (p. 239,) Mr. Bass, manager of the Glasgow and Greenock (p. 791,) Mr. Entwisle and Mr. Gill, directors of the Manchester and Leeds, Mr. Vickers, etc. Those who have stood forth in defence of high fares have been Mr. Chaplin, deputy chairman of the South Western (p. 754,) Mr. J. P. Maubert (p. 776,) Mr. Levi, the turnpike contractor, (p. 776,) and Mr. Henry Wheeler, director of the Greenwich (p. 604,) who cuts so ludicrous a figure in our pages !!!!!

One of the results of the agitation which is not the least curious, and another proof of the progress of low fares, is the recent formation of a third party, which adopts modified views, and which may be regarded as a weakening of the high fare party. This party may be considered to have declared itself at the North Midland meeting, (p. 742.) It was then put forward that high fares are to be preferred, but that low fares may be adopted as expediency may dictate. Among the adherents to this expediency party we may reckon Mr. Glyn, chairman of the London and Birmingham, and North Midland, (p. 742,) Mr. Hudson, chairman of the York and North Midland, (p. 743,) Capt. Porter, R. N. (p. 743,) Mr. M. A. Goldsmid, director of the Brighton and Greenwich (p. 602,) and Mr Robert Stephenson. Mr. George Stephenson expressed an opinion at the Birmingham and Derby meeting (p. 783,) against high tolls on mineral traffic, but we do not rightly understand whether he objected to high rates on mineral traffic on *canals only*.

[From the Civil Engineer and Architect's Journal.]

HISTORICAL SKETCH ON THE USE OF BRONZE IN WORKS OF ART. *By* CESAR DALY, *Architect*.

Some years ago, many, otherwise remarkable for their learning, would ask in what degree modern civilization differed from that of ancient Greece or Rome; and even in the present day, there are some who will ask the same question, even in England, in the heart of London, or of Manchester, or of Birmingham, with a thick cloud of coal smoke from a hundred factories rolling in volumes over their heads. To these, a feature so extraordinary, unknown to the ancients, tells no tale, though it is one which marks most strongly the character of modern times, superior in its power over physical nature, and the great development it has given to the efforts of mechanical invention. So generally, indeed, is the industrial character of modern times unnoticed, that we have scarcely any accounts of the various branches of manufactures, or of the subject generally, although this practical history is one which has the greatest interest in relation to the human race. This history in all its ramifications, whether as to the tools employed or the materials upon which they are exercised, would open a wide field of research, capable of ample gratification, notwithstanding the manner in which the records are dispersed. Among the metals and their alloys known at an early period, none has been devoted to such important uses as bronze, to which we shall devote the present essay.

Had the art of metallurgy been better known in distant periods, and the use of iron and steel more prevalent at a former epoch, or even had copper been more extensively used, we should have remained ignorant of much of the material history of antiquity, for both of the former metals disappear under the influence of rust, and copper is also a sufferer from the action of damp. Thus, while in the Portici Museum the bronze articles are well preserved, those of copper have been more or less affected, and those of iron are scarcely recognizable.

Copper was known in the earliest times, and is mentioned by Moses; but the difficulty of working it with the hammer, and the high degree of heat requisite to melt it, greatly limited its use. It was fortunately not long before the properties of a mixture of copper and tin were discovered, a mixture with greater tenacity and resistance than copper alone, fusible at a lower temperature, and denser than the mean of its components. By this mixture was obtained a metal which readily flowed into every part of the mould, so as to take a correct impress of the pattern, while it was hard enough to wear well, was not brittle, and so far from being injured by oxidation, which only affected it slightly, it was preserved by it from the action of the atmosphere, taking the beautiful color which is so much admired. The providential discovery of these properties doubtless gave a great impulse to the infant civilization of the early stages of society, affording at the same time a greater facility for manufacture united with great durability. Thus it came to be employed for arms and edge tools by all the nations of antiquity, whether Indians, Chinese, Egyptians and Hebrews, Greeks, Etruscans, Romans or Celts. In connection with them, indeed, it might be well said that for many long ages bronze was the iron of the ancients. The fine arts were not long in making use of it, and we find it ministering to the decoration of many of the most ancient monuments of Egypt. In Scripture we find that the Philistines, after the capture of Sampson, loaded him with chains of brass, and Josephus relates that Solomon employed Hiram of Tyre to make two columns of bronze richly decorated, eighteen cubits high, twelve cubits in circumference, and four inches in thickness, or four times as thick as that on the Column of July. The columns were placed at the entrance of the porch of the Temple at Jerusalem. From these works, we may judge that working in copper and brass was already of old date at this distant period.

We are quite in the dark as to the processes of melting and forms of the furnaces used by the ancients; but we can readily judge, from the interest, in these days of the progress of science, still attached to the castings of bronze on a large scale, of the difficulties to which workmen must have been subjected in the rude state of chemistry and metallurgy. In Greece the use of bronze was very common; the Chalciæcos, at Lacedemon, was a temple of bronze, dedicated to Minerva, and executed about 750 years before the Christian era by the celebrated Gitiadas, poet, sculptor, and architect. Every part of this building, from the top to the bases of the columns, was entirely covered with plates of bronze decorated with mythological sculptures. Pausanias (B. 10, ch. 5,) relates that when the temple of Apollo at Delphi was rebuilt for the third time, it was constructed of copper, which is not surprising, adds he, as Acrisius had a bronze room made for his daughter, and as there is still to be seen at Sparta, the temple of Minerva Chalciæces. He goes on further to say, "at Rome, the place in which justice is administered excites surprise by its grandeur and magnificence; but what is most admired is a bronze ceiling, which extends from one side to the other. The same author, who attributes to Theodosius and Racos of Samos, the discovery of founding statues in bronze, informs us that it was about the year 600 before our era, that this art was first practised. This, like all the other arts, made great progress in the time of Pericles, but did not reach its full height until the age of Alexander, when each of the principal cities of Greece possessed several thousand figures of bronze, among which were some enormous colossi. This is what Pliny says in his 24th book, sec. 18, "There are numberless instance of boldness in this art, for we see that enormous colossal masses have been executed as large as towers. Such is the Apollo of the Capitol, brought from Apollonia, a city of Pontus, by M. Lucullus; this is thirty cubits high, and cost fifty talents. Such is the Jupiter of the Campus

Martius, consecrated by the Emperor Claudius, and called Pompeian, because it is near Pompey's Theatre; such is that of Tarentum, executed by Lysippus, and which is forty cubits in height. What is most remarkable as to this figure is, that it is so well balanced that it may be moved by the hand, although it could not be upset by a whirlwind. The most admired of these colossi was that of the Sun at Rhodes, made by Chares of Lindus, a pupil of Lysippus. This figure was seventy cubits high, was overturned 56 years after its completion by an earthquake; but cast down as it is, it still excites admiration. Very few men can put their arms round the thumb, the fingers are bigger than most statues, and the hollows in the broken limbs are like the yawning mouths of caves; inside are seen stones of large size, which were used to settle it on its base. It is said to have been finished in twelve years, and to have cost three hundred talents, a sum produced by the warlike engines of King Demetrius, when he raised the siege of Rhodes. In the city are a hundred other smaller colossi, each of which would be worthy of bestowing distinction on the town in which it might be placed; besides these are five colossi of gods by Bryaxis. Italy has also produced colossi, for we see in the library of the temple of Augustus, the Tuscan Apollo, which is fifty feet high from the toe, and in which it is difficult to tell which to admire most, the bronze or the beauty of the workmanship. Spurius Carvilius had a Jupiter made for the Capitol out of the helmets, cuirasses and greaves of the conquered Samnites. The size of this statue is such that it may be seen from the place in which is the Latial Jupiter. But in our times, Zenodorus has surpassed all the figures of this kind in height, in the Mercury which he made for a city of the Gauls in Auvergne. This was ten years in execution, and cost four hundred thousand sisterces."

It is probable that these colossi were formed of a number of pieces secured with nails, like so much brazier's work, for it is thus that the ancients made their metal statues before they had acquired the art of founding. At Lillebonne in Normandy, a few years ago, in the course of the excavations for uncovering the Roman theatre, a bronze Mercury was found made in this manner. In reading the travels of Pausanias in Greece, we cannot but feel surprised at the immense number of bronze works in sculpture which he meets with at every step, particularly when we recollect that this country has been in the possession of the Romans for three centuries, and that they had already, on several occasions, carried away thousands of bronze figures. Of 33 colossi described by the tourist, 30 were of bronze, the three others of wood; he also describes 32 equestrian statues of bronze and 24 chariots, at least of natural size, sometimes with two, and oftener with four horses, and holding one or two figures. Some were accompanied by runners or grouped with men on foot who led them; in fine, he mentions more than 40 animals of considerable size, also of bronze. And yet Pausanias only visited a part of Greece. It was of bronze that the Athenians, after the death of Pisistratus, formed the first quadriga, in memory of their fellow countrymen who died while fighting for their native land.

Of bronze also is constructed, in our days, the Monument of July. Bronze is, in truth, the symbol of strength, and it is interesting to observe how the same metal has been chosen, at two periods so remote, to consecrate the remembrance of facts having so much resemblance.

The Romans, as we have seen from extracts before given, made frequent use of bronze, and like the Greeks, employed in the form of candelabræ, lamps, furniture, triclinia, altars, tripods, tools, fastenings, letters for monumental inscriptions, window fastenings, etc. The doors were sometimes plated with bronze, secured with nails of the same metal; such as those of the Pantheon. Pliny (B. 34, § 7,) says that the ancients were accustomed to make the threshold and gates of the temples of bronze. Ancient gates entirely formed of bronze are still to be seen in the church of St. Cosmo and St. Damian in the Forum at Rome, formerly the temple of Romulus and Remus, and this luxury was not exclusively confined to temples, for 380 years before our era, the ornaments were of bronze on the doors of the house of Camillus. By means of cramps, large masses of bronze ornaments and carvings were fastened on monuments by way of decoration. On bronze tablets were engraved laws, treaties of peace, and public acts intended to be made known to posterity. Three thousand of these tablets were destroyed in the fire of the Capitol, in the time of Vespasian. Capitals were also made of bronze, which were secured on cores of stone. Pliny relates that "C. Octavius, who conquered Perseus in a naval action, erected, in honor of his triumph, a double portico, which was called Corinthian because the capitals of the columns were of bronze; this portico was near the Flaminian Circus; the capitals of the Pantheon, placed there by Agrippa, are of the same metal." The Romans further applied bronze in the execution of works on a large scale; the framing of the Pantheon was constructed of bronze, and, according to Serlio, who had examined it in its place, the different pieces were hollow; they were put together in the same way as woodwork. The caissons of the vault of this monument were also of bronze, and the circle which frames the opening by which the rotunda is lighted, still remains. In the baths of Caracalla the ceiling of the immense hall known as the Cella Solearis was formed of a net-work of bronze; a fact of which M. Blouet did not seem to be aware when he published his restoration of that monument. The ancients also constructed roofing of bronze, for at Rome, 212 years before the Christian era, the temple of Vesta, at Rome, was covered with tiles of bronze, and so, at a later period, was the Pantheon. As to bronze statues, there was at Rome a number truly prodigious, brought from all the great cities of Etruria, Greece, Sicily, and Asia Minor. Scaurus having erected a temporary theatre at Rome, towards the end of the republic, decorated it with three thousand of these statues.

The art of the founder naturally underwent all the vicissitudes of the other arts; in the time of Nero, the decadence had already commenced, it not being possible to cast the colossal statue of that emperor, modelled by Zenodorus, and which was to have been 110 feet high, although a century afterwards the beautiful equestrian statue of Marcus Aurelius was cast. Falconnet, in comparing these two facts, endeavors to make out a case for an attack on Pliny; but it seems to us that the circumstances may be reconciled by supposing that casting in bronze had been momentarily neglected before the time of Zenodorus, and that they had been more successfully cultivated in the time of Marcus Aurelius, for a similar circumstance happened in our own days. The brothers Keller, under Louis XIV., carried the art of casting in bronze to a high degree of perfection; but under Louis XV., the founders were not so good; and in the early part of the empire, great difficulties were met with in executing works of this kind, while now the art of casting in bronze has made greater progress than ever. Besides, it may be said that whenever a process is not carried on scientifically, while the reason of the different phenomena has not been discovered, and the artist consequently is reduced to take the bare results of experience for his guide, the neglect of the art for some time is enough to cause the facts to be forgotten, and the guides are consequently lost. This, however, cannot happen when the theory of an art is firmly based on scientific principles, and the reason of the phenomena is consequently understood; drawing our conclusions, from which we may say that the art of casting in bronze will henceforward never be lost, even should it be neglected for centuries; a few trials would be enough to bring it back to the point at which it had been left.

In the Middle Ages.

During the Lower Empire, nothing remarkable was executed, except some bronze gates, and the process of casting seems to have been quite lost at Constantinople. The gates of the Basilica of St. Paul, at Rome, were cast in the 11th century by Staurachios Tychitos of the Isle of Chios. In the 11th century were cast those of the basilica of St. Zeno, at Verona, on which are represented passages of the Old Testament and the miracles of the Saint. The bronze gates of St. Mark, at Venice, were also brought from Constantinople in the 13th century.

Germany possesses some bronze gates of the 11th century, such as those of Mentz and Augsburg. In 1330, Andrea Ugolino executed two panels for gates in bronze, from the designs of Giotto, for the Baptistry of Florence. Ghiberti finished his chef d'œuvre in 1424. In the 15th and 16th centuries several gates of bronze were cast at Venice, Padua, Bologna, Florence, Pisa, Loretto, etc.; but these works were not sufficient to prevent the art of casting in bronze from falling into complete oblivion, and during almost the whole of the middle ages this art was wholly limited to casting bells.

In Modern Times.

At the Revival appeared several bronze works of art, in which Italian artists, and particularly those of the famous school of Florence, in the beginning of the 16th century, distinguished themselves most, and contributed most efficaciously in diffusing a taste for it in different European countries. The sculptor Torrigiani passed several years in England, where Henry VIII. gave him several commissions for bronze works. Primaticcio also executed, at Fontainbleau, several bronze statues from antique models which he had brought from Rome. At this time there were several French artists who were employed in brass founding; but their modes of proceeding seem to have been very imperfect, for Benvenuto Cellino relates in his memoirs that during his stay in France, he wished to cast a bronze statue of Jupiter about six feet high, which had been ordered of him by Francis I., "but never having been engaged in this kind of work," said he, "I consulted some of the old masters of Paris, and explained to them how we managed in Italy. They replied that their manner was different, and that if I would leave it to them, they were sure to make my model in bronze such as it was in clay. I made my bargain with them; I promised them the price they asked, and even something over. I put my hand to work, but I could see well enough that they were not trying the right way. I wanted also to try myself upon a head of Julius Cæsar, larger than life, made after the model of a small head designed from a beautiful antique which I had brought from Rome. I added to it a head of the same size which I moddled from that of a beautiful girl in my service, and whom I called Fontainbleau, from the name of His Majesty's favorite palace. When I saw my furnaces finished, and our models baked, I said to my master founders, I fear that the Jupiter will not come out well, because you have not left draught enough for the air; but they replied that, if they did not succeed, they would give me my money back again, and that I should find less chance of success in the Italian method. This took place before some gentlemen whom the king often sent to see how I was getting on. Before casting the melted metal for the Jupiter, the founders wanted also to place my two heads to cast them at the same time, feeling persuaded that their mode would not succeed, and that it would be a pity to lose such fine works; but the king, who learnt it, sent to them to tell them that they must think of learning from their master, and not of teaching him. Then, smiling, they put their Jupiter in the pit, and I also arranged my two heads at the sides, and when the metal was ready, we left a free passage for it. Our moulds were quite filled, and we were all happy, I, with having succeeded in my way, and they in theirs. They asked me for something to drink, and I gave them plenty of refreshments; they then asked me to pay the sum I had promised them. You smile, said I to them, then, but I very much fear that you will cry soon; for I saw that more metal ran into the Jupiter than was wanted, and that is the reason that I shall not pay you until it is all right. These poor men felt that I was in the right, and went away without saying anything. They returned the next day very quietly to empty their pit, and began with the two heads, which were perfect; they then came to the Jupiter, which caused them to cry out, as I thought, for joy, and which made me run, but I found their faces like those of the soldiers who watched the tomb of Christ. You see, said I, what has happened to you from not believing me; you would have reaped more profit and I more honor. Learn, then, to work, and not to laugh at what is said to you. They acknowledged their error, but they regretted their time and expenses, on account of their families, whom they had to keep, and for which they should be obliged to run into debt. Never mind that, said I, I will pay you as soon as the treasurer pays me; for I pitied them, because they had worked with a good heart." Further on, telling the story about his statue of Perseus, which was also cast in bronze, he says, "The model of the Medusa, made of clay, and well secured with iron, had already passed through the fire; I had already covered it with wax, and the bronze only was wanting. I had my furnace built directly; I took such good care, and the figure came out so clean, that my friends thought it was all done, like the French and German founders, who never finish their bronzes after they come out of the fire, being doubtless ignorant of the practice of the ancients, and many of the moderns, who finish off with a hammar and chisel." This remark of Benvenuto would lead us into the belief that the French and German bronzes contained a good deal of tin; for when the bronze contains a good deal of copper, its fusion requires a very high temperature, which vitrifies part of the sand of the mould, which, becoming attached to the figure in cooling, requires to be removed; on the other hand, a larger proportion of tin making the metal more fusible, this result was less to be feared. Benvenuto, not contented with having executed so many admirable works, left also a treatise on casting in bronze, which was long the best manual on the subject.

SEVENTH REPORT OF THE ENGINEER OF THE CENTRAL RAILROAD.

Engineer Department, Central Railroad,
Savannah, *November 1st*, 1841.

Sir: A year has elapsed since the date of my last report of the operations of this department, and the progress of the work committed to its management. The expectations which were at that time entertained, that the grading of the whole of the road not previously let, would soon be put under contract, were soon afterwards realized; a large number of proposals were received from very respectable men, which rendered it easy to make a selection of good contractors; the work was speedily commenced under very favorable prospects both to the contractors and the company; and although nearly the whole year has been marked by a constant succession of heavy rains, with much sickness on some parts of the line among the laborers, I have the pleasure to state that the grading of nearly half the distance at that time remaining to be done has been accomplished.

The bridging over the swamp of the Oconee river, from the above causes, is not so near completion as I hoped it would be by this time, about 4,000 feet in length of bridge work has been completed in a very satisfactory manner; a large portion of the stone has been placed on the spot for the piers and abutments of the main bridge over the river, and contracts have been made for the supply of materials for the rapid progress of the work during the present season.

The heavy freshets of the past year have induced me to increase the opening for the passage of the river water, and it is now intended to extend the bridge work to about 11,000 feet, leaving less than a mile of embankment in the swamp.

The citizens of Macon have, by a vote in town meeting, expressed their opposition to our crossing the Ocmulgee river with the road, and in acquiescence in this expression of their will, a site has been selected, and the land purchased, for a terminating depot on the east side. Although I always have been, and still am persuaded that the interests of all parties would be best promoted by terminating the road on the west side of the river, I do not apprehend that any serious disadvantages to the company, will arise from the present arrangement, and as a large sum will be saved by avoiding the construction of a bridge, the result is the less to be regretted.

The road is now completed, a distance of 137 miles, and the grading done 170 miles, leaving a little more than 20 miles of grading to be done, containing short of 1,000,000 cubic yards of excavation and embankment. The total length of the road being 190 miles and 2822 feet.

A contract has been made on favorable terms for laying the superstructure from the Oconee to Macon, including the furnishing of all materials excepting iron. The iron already on hand and ordered, is sufficient to extend the track 174 miles, leaving 16 miles yet to be provided for.

The following table exhibits the proportion of curved and straight line throughout the whole road, with the different radii of the curves. Number of curves 109. Number of straight lines 110.

Length of radius.	No. of curves.	Aggregate distance.
2,000 feet	25	44,017 feet
2,100 "	4	9,802 "
2,300 "	2	3,943 "
2,500 "	5	8,138 "
3,000 "	13	20,788 "
3,500 "	6	13,781 "
4,000 "	12	25,683 "
4,500 "	2	4,980 "
5,900 "	15	45,729 "
7,000 "	2	3,656 "
8,000 "	5	15,312 "
10,000 "	8	28,100 "
15,000 "	5	21,916 "
16,000 "	1	7,139 "
20,000 "	1	8,374 "
30,900 "	2	6,920 "
150,000 "	1	26,500 "
	109	294,778 feet

Total length of curved line	55 miles and		4,378 feet
" " straight line	134 "	"	3,724 "
Total distance,	189		2,822 feet

The maximum inclination of grade is 30 feet per mile. The grades of the road may be classed as follows:

	Miles.	Feet.
Level	26	1,750
Inclinations not over 5 feet per mile,	44	4,880
" from 5 to 10 feet per mile,	30	4,600
" " 10 to 15 " " "	17	4,240
" " 15 to 20 " " "	13	3,160
" " 20 to 25 " " "	9	3,880
" " 25 to 30 " " "	47	1,432
Total	190	2,822

The trains are now in regular daily operation to the Sandersville depot (Franklin) 135 miles from Savannah where ample accommodation are provided for the comfort of passengers, and storage of freight.

In our motive power department we have eight locomotive engines, all in good repair—6 passenger cars—4 baggage cars—50 eight-wheel transportation cars—10 platform cars, besides a large number of repair cars.

Our enterprize has within the past year been visited by one of those disasters which often cloud the prospects, and retard the progress and prosperity of public works of this character. The unprecedented rains which fell in March last, brought down such a deluge in our water courses, as to threaten for the time to overwhelm us in ruin—several miles of our road lying along the vallies of the Ogeechee and Williamson's swamp, were overflowed; and to the portion of the embankments which had been most recently made, great damage was done—many of the small bridges and culverts were swept away or injured, and a considerable portion of the superstructure removed from its place.

Measures were immediately taken to place as large a force on the work of repairing these damages, as could be worked to any advantage; and it was then confidently hoped that all the damages would be repaired, and such alterations and improvements made in the construction of the most exposed parts of the road, as to make it secure, therefore, by the first of August. Our expectations would have been realized if the season had not been most unfavorable to the prosecution of the work; a constant succession of freshets in small streams traversed by our road, retarded our operations, and the almost universal prevalence of fever among the men, rendered them unfit for duty, and made it almost impossible to employ others to supply their places; these causes have prolonged the period of the completion of the work to the present time, and have also increased its cost. The total amount of the repairs including such alterations and improvements as have been made in many parts of the construction, is about $56,000.

The question will doubtless suggest itself to every one feeling any interest in the success of enterprise. "Is there the probability of of the frequent occurrence of these disastrous visitations?" In reply to this question, I will remark that the grades of the road where projected and established upon the assumption that the great freshet of 1796 commonly called the "Yazoo freshet," was the extreme of high water, and that if we provided against a similar flood, we shall be secure. No freshet for a period of 44 years has reached the same height in the rivers with which we come in contact; but the flood of March last, was in the Oconee (at the point where we cross) the Ogeechee, and in Williamson's swamp creek, an average of at least *nine feet* higher than the "Yazoo." The measures we have taken for future security have, been the substituting of trestle work founded on piles for embankment at the points where the latter was washed away; raising the grades in several instances, and planting the embankments with "Bermuda grass." The works in the Oconee swamp did not receive the least injury from the freshet, and I feel the most entire confidence that that part of the road when finished, will be perfectly secure.

I do not pretend. that, should we have another flood equal to the one of the last of March, we should escape without injury; but I feel assured that the damage, even in that case, would be small, compared with the last; and I think we have nothing to fear, except from such extraordinary freshets. Scarcely a public work in the country has escaped during the past year, and many have suffered much more severely than ours. I have thus extended my remarks on this subject, for the reason that I am aware that it is a point on which the friends of our enterprize feel much solicitude.

Every day's experience gives additional assurance that the success of the undertaking, so far as regards its profitableness to the stockholders, and usefulness to the public, is concerned, is placed beyond a doubt. On the opening of the business season this fall, the merchandize on its way from the northern cities to the various points of its destination in the interior flowed in immense quantities to our depot, which for a considerable time was kept full to the roof, for the reason that wagons could not be obtained in sufficient numbers to transport it from the head of the road. The cotton crop is rather late this season, but large quantities are daily carried to the head and other points of our road, and from present indications, the business of the season will exhibit a cheering prospect to the stockholders. The receipts of the road for freight and passengers for the last twelve months, ending October 31st, amount to $106,145,81, although the business was almost entirely suspended by the effects of the March freshet, for more than half the year.

There has, during the past year, been a great deal of discussion upon the subject of the rates of freight and passage on the road. It has been contended that a reduction of them would have the effect of increasing the amount of business sufficiently to yield a greater revenue to the road—the fact that this has been the effect of reduction on the English roads, and some of those of the eastern States, is assumed as conclusive evidence of the applicability of the principle to ours, without for a moment considering the difference of circumstances. In relation to passengers, we have the benefit of an experiment recently made on a neighboring road, which shows conclusively the error of the advocates of lower fares in this section of the country. The president of the South Carolina railroad, in his last report, says, that the receipts of the company have been lessened $25,000 by making the experiment of reducing fares.

In regard to charges on merchandize, the fact of our having had, during the business season, more freight than could be regularly transported away from the head of the road, and that we should have had still more if a sufficient number of wagons could have been obtained, proves that no advantage would have been derived from a reduction of the rates of up-freight. The freight on cotton is less in proportion to weight and bulk than other goods, and less than one half the ordinary wagon rates. It is not contended that we have as yet arrived at the precise point in the arrangement of our tariff of freights, that no amendment or improvement can ever be made, but, while we are yet far from the completion of the road, and while there are so many circumstances bearing on the question, which will be entirely changed when we reach our final terminus, it is believed by those who have the control of the matter, that the interest of the company would not be promoted by a reduction, and this conclusion is the result of much study of the subject.

The probable period of the completion of the road is a subject of frequent inquiry, and could readily be answered if the company had in hand a sum of money sufficient to cover the cost of the remainder of the work and materials; but, as nearly all the contracts now in progress, provide that payment shall be made in the bonds of the company, the contractors cannot be pushed with the same spirit, as if they were receiving ready money for their work.

Application will be made to the legislature for the extension of the time allowed for completion; not from any apprehension (so far as present prospects indicate) that the road will not be finished within the time prescribed by the charter, but to provide against unforseen contingencies.

The experience of the last year confirms my previous opinion, that the business of *freighting* is to be relied on mainly to support the road, and will constitute by far the greatest proportion of its earnings; although our passengers must of course increase greatly whenever we cross the Oconee river.

I am sir, very respectfully,
Your obedient servant,
L. O. Reynolds, *Chief Engineer.*

W. W. Gordon Esq., *President.*

[From the Railway Magazine.]

MANUFACTURE OF IRON FOR RAILWAYS.

A considerable portion of the evil arises from the fact, that, with some very few exceptions, neither the directors, nor the engineers of railways, are practically acquainted with the manufacture of iron, and are therefore not aware of the immense difference which exists in the quality. The price of railway axles (in their rough state) varies from £12 per ton to £25 per ton. The price of wrought iron wheels is just double the price of cast iron; in chairs, the price varies as much as forty shillings per ton; and in rails, there is a difference of from thirty to forty shillings per ton between different manufactures; and this too in an article where from the enormous quantity used, the cost of production is calculated by the manufacturer with the greatest nicety. Now whence arises all this difference? Entirely in the quality of the articles themselves, and not in the amount of profit which different manufacturers consider themselves entitled to, nor in the difference in the expense of carriage from different parts of the country. For, by a strange anomaly, the lowest priced articles come from those quarters from whence the carriage is generally the most expensive.

One great evil attendant on the employment of iron of inferior quality, arises from the circumstance, that iron exposed to great and sudden changes of temperature, and to a constant percussive action, is liable to a slow and gradual change, arising from a re-arrangement of the particles among each other. Although this may appear too theoretical for some, it is still capable of proof by direct experiments in particular and extreme cases. The two great distinguishing features of wrought iron are known by the names of "cold short iron," and "red short iron," the former being the toughest when hot, and the latter when cold. The cause of this great difference is still involved in mystery. It has been attributed to a minute quantity of arsenic in the former description of iron, which is not present in the latter. But this may well admit of considerable doubt, for by heating red short iron a few times, and suddenly quenching it with water, or by a longer continued process of heating without this sudden cooling process—as for instance in the case of wrought iron furnace bars—the most fibrous and toughest red short iron, becomes converted into the most brittle cold short iron, the fibrous appearance being exchanged for that peculiar crystallized arrangement of the particles, which so distinctly marks the cold short quality. By what process this crystallization takes place is wholly unknown: but many similar facts in natural philosophy would lead us to suppose, that the effects of sudden changes of temperature, under peculiar circumstances merely cause the particles of matter to approach or recede from each other, to that particular distance which allows of a new arrangement of the atoms among each other. The instantanious formation of ice, when water is cooled several degrees below the freezing point and a sudden vibration is communicated to it by a blow given to the vessel containing it, is a familiar instance of this kind of effect, arising from a new polar arrangement among the particles when, by change of temperature or some other cause, they are brought within a particular distance of each other. As regards this crystallization of wrought iron, there are many facts which seem to lead to the conclusion, that iron continually exposed to minute vibrations, slowly changes to that state of crystallization which can be more rapidly affected by the agency of high degrees of temperature; and if this be the case, we have in constant operation, in many instances, a process which is continually tending to weaken the cohesive strength of iron, and which will more readily take place in iron which partakes in any degree of the cold short character. This, I think, will scarcely be doubted, if we may at all draw any analogy with the process of the congelation of water already alluded to. When water has been cooled several degrees below the freezing point, a sudden blow given to the vessel will generally, but not always, cause its instant congelation. But if the smallest possible particle of ice be put into the water, the crystallization of the whole mass will *always* be instantaneous. We may imagine, therefore, if any similarity exists between the two cases, that iron possessing *a tendency* to the cold short quality will, when subject to the constant state of vibration to which it is exposed on railways, more rapidly deteriorate than red short iron, and become more crystalline in its texture, and therefore possess less cohesive strength.

But whatever may be the tendency to deterioration, there is far too little attention paid to procuring, in the first instance, iron which has been manufactured by processes likely to secure an approved quality. I need scarcely say, to those acquainted with the subject, that railway axles cannot be made of faggotted iron (which I consider indispensable for this purpose) for the low price at which they are charged by some manufactures, and therefore inferior materials are always substituted. I shall, however, pass over this, and confine my remaining observations to the manufacture of railway bars and chairs.

The iron masters have for many years been trying to avoid the process of refining the metal which is used for remanufacturing at the forge. As far as mechanical structure, and even chemical examination goes, the process of refining appears merely to reduce the better qualities of pig iron to the same state as the common "white iron" produced by the furnace. But experience proves that the one cannot be substituted for the other without a very great deterioration of quality in the manufactured bars. Many years of continued experiment have fully proved this, and it matters not, that no rational explanation can be given why the one will not answer the purpose of the other. All parties are agreed that "refining" is necessary to produce really good iron, and that no addition to the subsequent operation of "puddling" can compensate for neglecting it. But the saving of expense is considerable by this mode; and hence the Staffordshire iron masters are now very generally adopting the plan of omitting the refining process in the manufacture of rails, to enable them to compete with the Welsh manufacturers, who it is supposed, can make iron cheaper than their English competitors. The processes which all pig iron ought to undergo, in order to convert it into bars, are, refining, puddling, shingling, rolling, piling, balling, and re-rolling. This makes common, or No. 2 bars, which, when cut up and again heated, are rolled into rails. Now nothing *less* than this process ought ever to be employed for rails, and several manufacturers increase these processes in different ways, some by an additional hammering, and others by an additional heating and rolling, before rolling the iron into rails. But some also there are, who considerably *reduce* these processes in the following manner:—They leave out *both* the fining and the shingling, substituting for the former a trifling addition to the time the metal remains in the puddling furnace, and for the latter, or shingling process, they give the blooms a "nobling," as it is technically called, which puts the iron into a little better shape for the rolls, but adds nothing to its quality, as when the shingling hammer is used. Some manufacturers still further reduce these operations, by using a portion of No. 1 bars, which have only passed once through the rolls. Now the result of all this is, that the finished rails, instead of being of a tough fibrous texture, are only one remove from cast iron in quality. The bars, if broken, will present a chrystaline appearance; and in strength they bear no comparison to iron which has been properly manufactured. This I consider to be a most serious matter. Thousands, nay, tens of thousands of tons of rails have been made, and are now making in this way, and the directors and the engineers are alike ignorant both of the practice and of the very serious results to which it may lead.

There are, however, other causes which deteriorate the quality of iron, not less than deficient processes of manufacture. The minerals of some districts are naturally so weak, that no art or care in the manufacture can render the iron made from them sufficiently strong for any description of railway work. I am unwilling to enter into particular descriptions, which might appear invidious, or which might seem the result of personal interest. Neither of these sentiments, however, influence me, as I have no interest whatever in the question, nor any motive beyond that of making known a matter of what I consider of great public importance.

But if the question of the strength of the minerals, from which the iron has been made, is a matter of importance in the case of rails, where, according to the general plan at present in use, the rails are made so exceeding strong, for the purpose of resisting deflection, that they may be considered comparatively free from the liability to actual fracture, it becomes of double importance in the case of railway chairs, which are constantly liable to fracture from the very nature of the materials of which they are made, as well as their form and the position they occupy. The very general introduction of the hot blast has tended much to deteriorate the strength of pig iron. I consider cold blast iron ought alone to be used in the manufacture of railway chairs; and not only so, but that the strongest description of cold blast pig iron, ought to be allowed to enter into their composition. Instead of this being generally the case, the greatest rubbish, provided only that it possesses the general characteristics of iron, is frequently used for this purpose. The very worst description of old iron, so bad as to be unfit for any other purpose, is purchased expressly for mixing with other iron to make railway chairs; and the only wonder is, not that such chairs should frequently break, but that they should ever stand the required strain. Others there are who mix the pig iron with the commonest description of hot blast iron; and others—and they too among the largest manufacturers, cast the chairs direct from the furnace, instead of making them from pig iron of the second fusion. Now all these practises, while they tend to reduce the cost of the chairs, are, I contend, dangerous in the extreme; and no saving which can be effected by these means ought for a moment to be put in comparison of the danger which must result from the use of inferior iron either in the rails or chairs.

[From the Troy Whig.]

CATARACT OF TAQUENDAMA, IN SOUTH AMERICA, COMPARED WITH THE WALLED BANKS OF THE AU SABLE RIVER, THREE MILES FROM PORT KENT, ON LAKE CHAMPLAIN.

SARATOGA SPRINGS, *August* 29, 1840.

These two objects, the most singular and wonderful display of Almighty power in this world, just begin to be known to the North American public, although the former has for ages been considered and visited by the South Americans as the greatest natural curiosity in that country. Having noticed in a late Troy paper a short but interesting description of the Walled Banks of the Au Sable, inviting further disclosure and a more minute description; and having lately made an excursion to that place, with the celebrated Colonel Duane's description and map of the Cataract of Taquendama in hand, I was astonished to find so close a resemblance in their general features; but finding myself inadequate to afford a just description of either, I will avail myself of the classic pen of the Colonel, in his visit to the cataract with Colonel Todd, who made up a party of pleasure, mostly of Americans, at the city of Bogota, in Colombia, for the excursion. He says:

"No painter can convey any adequate idea of this extraordinary work of nature. None of the descriptions I had read of this cataract conveyed to my perceptions any thing like what it is. I placed myself on my breast to contemplate this wonderful display of Almighty power, with my head only over the side, while Lieutenant Bache stood on the verge, with folded arms, surveying the abyss below with perfect composure. The mind is beguiled in the intensity of admiration and awful sublimity of the spectacle, which in every aspect presents new beauties and astonishments.

"Imagine a lane, if I may so call it, three-fourths of a mile long, with perpenticular and parallel walls, about fifty feet apart and one hundred and seventy-nine feet high, as uniformly fair on their faces as the best masonry at the Capitol, which will always induce the astonished spectator to ask if these walls be not the work of art, constructed with the chisel, the trowel, the level, and plumb line! The elevation of the side walls—their parallel length of three-fourths of a mile—could be but imperfectly expressed by the pencil on canvass. The reader must therefore, from the data, figure to himself some conception of this extraordinary work of the Great Architect of the Universe."

In reference to the Walled Banks of the Au Sable, it is impossible that a more correct view can be given than by Colonel Duane's description of the Cataract of Taquendama—the length, the relative distance of the walls, the *workmanship*, all compare with such wonderful precision, with the exception that the cataract receives the entire river at its summit, whereas the Au Sable enters the Walled Banks at its base.

No person can contemplate either of these wonders but with solemnity and awe, in a profound belief that both are the works of the Divine Architect of the Universe, and works which will in process of time be visited by millions upon millions, through all ages, to the end of time, with sublime admiration. All who have visited both the Falls of Niagara and the Walled Banks do not hesitate to say that the latter is by far the most interesting as a natural curiosity—the Falls having originated from natural causes, from a combination of vast inland oceans seeking the Atlantic.

A Visiter.

Walled Banks of the Au Sable.

This wonderful display of Almighty power at creation, is situated about three miles from Port Kent, on Lake Champlain, and is one of the most interesting natural curiosities on the globe, with the exception of the celebrated Cataract of Taquendama, in South America, both of which nearly correspond in their general features. As no just idea can be formed by any, of either, short of a personal examination, I dare not attempt it, but leave that to the pen of a poet and to the pencil of a painter. As the curiosity of the public is strongly excited and greatly increased within a few weeks, in consequence of the passage of the Port Kent and Ogdensburg railroad, crossing, near the celebrated high bridge, nearly two hundred feet above the river, our readers and the travelling public are notified that a trip is easily made from here to the Walled Banks by the way of Whitehall, where you can embark daily, at ten o'clock, on board an elegant steamboat, and arrived at Port Kent in the evening.

The ensuing morning you cross the Au Sable river, at the village of Birmingham, three miles from Port Kent: the bridge passes over rocks piled on rocks, the river dashing in the midst, descending one hundred feet at their base, proceeding about half a mile in a direct course to the entrance of the walled banks, which runs in two parallel lines from 40 to 60 feet apart, nearly in a direct line for a mile in distance, and about 150 feet deep. What will forever astonish the eyes of every beholder is, these perpendicular banks in their whole extent were constructed by the Great Architect of the Universe, to all appearance, as if by the hands of masons, with hewn stones in uniform lines, the seams neatly pointed. About half a mile beyond Birmingham, on the Keeseville road, you pass at the edge of Watson's falls, a perpendicular pitch of 60 feet of the entire river, thence to Keeseville, one and a half miles, you again find the river precipitated to its destiny in the midst of the rocks and iron manufacturies. We hope soon to see a good description for public information.

[From the Mining Journal.]

ON THE MANUFACTURE OF IRON.

The principal difference between the metal contained in iron ores of various species consists in the metal, when in the shape of good cast iron, being either red short or cold short—that is, more brittle when red hot than when cold, or more brittle when cold than when hot: for the forge purposes, the red short is the best. The cold short quality is generally believed to be occasioned by a very minute quantity of phosphorus contained in the iron. By ascertaining this fact respecting ores, if necessary, the difficulty may be greatly obviated by mixing it with ores of the opposite quality, whereby, with proper management, the produce may be neutral. When the metal is intended for forge purposes, and required very tough, it should be ascertained whether the ore contains any manganese, and in what proportion, as nothing tends to render apparently very good iron more brittle than the presence to any amount of this metal. If it exceeds 1 or 1½ per cent., ore perfectly free should be mingled with it in various proportions—somewhere about half and half; nothing is better than either one of the hematites. The quantity of fuel and the quantity of flux required, in proportion to the ore, depends on the character of the ores; all argillaceous ores, which generally contain a little sulphur, should be calcined before they are thrown into the furnace; the general shape of these calciners is that of a lime kiln. A fire having been made at the bottom, the ironstone and small coal is thrown on in alternate strata, and the whole kindled; it is drawn out as it is thought to be calcined, faster or slower. This process greatly assists the smelting, inasmuch as a great quantity of earthy matter is got rid of, which could not be separated by hand; and also the metal in the ore, if an oxyde, is raised to a greater point of oxydation, and reduces more speedily in the furnace. The hematites, being in the state of the highest oxygenation, require not calcining, and if they are used alone, must be fluxed variously, as some contain argillaceous earth, others calcareous, and other silicious. Also, to obtain the best metal from them, charcoal should be used instead of coke, there being much less earthy matter in it; the earth of the coke is very apt to get into the iron, which renders it impure.

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The pig-iron is first melted in the back fire, which generally occupies about three quarters of an hour; the man keeps working it about with a bar till it is all melted; and if when he stirs about the bar and withdraws it, the metal on the point sparkles and scintilates, it is ready; the metal should never be let out till this is the case; if the next fire is not ready, the blast should be slackened, so as not to burn the iron, but still to keep it up to the proper pitch. The metal generally requires a little slag more than it produces by itself, and some thinner, as its own is thick and turgid. The cinder from the lower fire is the best, as it is, when liquid, much thinner, and allows the metal to sink after being well worked. In working iron rather inferior in this fire—say, poor bright and low mottled—it may be a great deal improved by throwing in a shovel of broken limestone to each charge. This engages with the earthy impurities, and clears the iron a great deal, though it by no means makes it equal to that produced from better cast iron. During the operation some of the slag is tapped out by the hole under the fire plate, when it has accumulated to too great a quantity, which is apt to impede the blast.

When the lower fire is ready for receiving the metal, it is tapped from the back, and runs into the bed of the lower one, where it is received on a bed of charcoal dust, and, as it runs, the workman, with a bar, stirs it up; the fire is kept full of charcoal, or of coke, when making coke iron, in which case they generally use some of the small broken charcoal on the floor of the yard. This operation is conducted by the workman continually stirring up the iron, and raising it up to the stream of air—the oxygen of which soon deprives some of the iron of its carbon, which coagulates; and this process of decarbonization proceeds till all the iron is collected into one mass or ball; the small balls, which form at first, are continually raised to the top of the fuel, and then allowed to sink, with its combustion passing slowly before the blast, which generally blows holes through it, and completely frees it from carbon; the operation is considered finished when all the iron is coagulated into one ball and the cinder lies underneath it, which is taped out as it requires. The charge in a back fire is generally about 3 or 3½ cwt.; this, of course loses much in the two fires according to the nature and quality of the iron. The charge, when working on coke iron, is taken out in one lump to be hammered, but working charcoal, one lump is drawn about three quarters time, and the rest follow it, as small pieces are better refined in the fire and better hammered, than large ones. The only requisite in hammering is to do it regularly, so that all the stamp may be of the same texture, and also to hammer it thin enough. Coke should never be more than 1½ inch thick, and charcoal not more than one inch. When of these sizes, they heat much more regularly at the hollow fire than when thicker, as in that case, the outside surfaces are apt to burn before the mass is hot enough to weld well. After being hammered, the stamp is thrown into a large box of water, where a continual stream is running through; this assists the stamp in throwing off the scales of oxyded iron formed during the hammering, and what little cinder may still adhere to it. The appearance of a stamp, which has been well worked and properly hammered, is that of large open crystals; if this is intermixed with parts cutting much finer, either towards the edges or in the middle, it is a sure sign of its not having been sufficiently worked, or what the men term "raw," part of it having escaped the action of the blast, and therefore, still containing a proportion of carbon and earthy matter. If the men are careless in working it, the stamp sometimes throws a quantity of dirt in the middle or towards the edges; this must be thrown back by the stamp cutter, as one piece will spoil a whole bar. The stamps are now taken to the hollow fires to be wrought into bars; they are piled on the end of staffs, in three layers; the middle layer here always consists of black plate shearings, bundled, which tends to keep the lump open and more accessible to the heat uniformly: where these cannot be obtained, the best thing is the cuttings off the ends of other bars; it also permits the cinder that may be attached to the surface to run or be blown out from between. The lump should never, when cut off after working, and rolled into a bar, weigh more than 100 lbs. as the men cannot possibly work a heavier piece well. The staff is then entered into the fire, and the heat continued, till it is throughout in a welding state; it should, then be drawn under the hammer, to weld it firmly; it should, before the heat is off, be hammered on on every side, to make it perfectly solid, but the first three or four blows should come on the flat, which renders the middle solid, and and drives out any cinder that may be between. As it is impossible to improve the body of a lump after the first or welding heat, great attention should be bestowed on it, that the iron is not burnt in the first place, and that it is not drawn out before it is quite ready in the next. To make the best bars, the iron should not be heated more than twice if possible, as every heating partly undoes what the preceding hammering has done; and the second, if required, the third, heat should be as low as possible, for the proper drawing of the bar. The lump should first be drawn into a piece about three inches thick, and 3 or 3½ feet long, then cut in the middle, and the end piece turned upside down, back on the staff piece; this reverses the fibres, and tends to strengthen the iron; and also brings all the waster piece to end. This operation, of course, requires a good welding heat in the second process, but the hammering should be completed in that, the bar drawn to the proper length, and cut off hot enough for rolls to receive it an once; if it must be heated again for passing it through the rolls, it must also be hammered: sometimes men, if not watched, pass it through without—the almost sure consequence of which is, the bar is spoiled. This process of cutting the lump and doubling it is not always practiced, but where the best and toughest iron is wanted, it should be done. The hamslow, or cinder, driven off with the hammering, is generally preserved for the furnace: when the hearth is at all foul, the addition of a little hamslow will generally work it off, as, being already an oxyde of iron, it works much hotter than raw mine. The bars are then sent up to the black plate mill, where they are cut into lengths, according to the sized plates wanted. The pieces are then piled on one another, (about 12 or 14) and placed in the furnace, which is a large reverberatory, having a small fireplace in proportion to the square of the furnace itself. Four or six of these piles are heated at once—the door and the top of the chimney being closed, so that all the heat being retained, the plates get a uniform heating. The rolling of these pieces, which vary according to the plates wanted, from ⅜ to ⅝ by 5 inches wide, is called breaking down. They are passed through the rolls a certain number of times, so that they come to nearly the same length, about two feet or so long. These first plates are then thrown, as they are rolled, into the same furnace again, on one side upon one another, corresponding to the first pile; and, after all are in, the door is again closed, and they reheated. In breaking down, the pieces should be entered rather corner ways, as if the whole broadside is entered at once, the jar is likely, if not certain, to break the rolls. The first plates are then again rolled, which brings them about $4\frac{1}{2}$ to 5 feet long; they are thrown over to the doubler, who doubles them up and flattens down the bend with a hammer; they are then thrown to the furnace man, and again heated and rolled. This process is continued according to the plates wanted—sometimes doubled twice, sometimes three times, and four times, which last makes it sixteen thicknesses. The plates, during the last rolling, are measured by a guage which the workman has for the length; he makes them as near to this length as possible, so that two or three, as they are wanted, may come out lengthways. They are then passed on to the shearers, who mark and cut them to the proper size; girls then divide them, and they are sent to the scaling furnace.

Western Trade.—The western trade of New York is about to assume a new channel. The railroad from Boston to Albany, direct, will be completed the entire distance in three weeks. Soon after that time, the navigation of the Hudson will become uncertain, and the boats will in part suspend their trips between the two cities. Heretofore a perfect embargo has been laid upon all business of a heavy nature, after the river closed. Thousands of barrels of flour and other articles of western produce have annually remained in the storehouses of Albany, from inability to reach the Atlantic market. This will no longer be the case. The moment navigation ceases, or before that time, the long trains of cars, led on through lofty mountains and over deep ravines, will be making their daily trips between Albany and Boston. In spite of wind or tide, sunshine or tempest, this daily communication will be kept up, and the produce of the vast west will find a ready and at all seasons an accessible market. This "iron river" will not be affected by droughts or floods, or the exigences of the seasons. It connects at Albany with a continuous railroad to Buffalo, thus uniting the "village of Boston" with the most fertile and extended portion of the western world. Boston, during the winter, will carry on an exclusive trade with that portion of the west with which New York has heretofore enjoyed the exclusive traffic. Her merchants will supply their wants, and in return she will except the products of western fertility as compensation. When trade once is diverted from old into new and successful channels, it is no easy matter to regain it. Between New York and Boston there will now be a rivalry for trade, which the "commercial emporium," with her strength and dimensions, has been accustomed to speak of vauntingly, as of no account—mere child's play. It will now require all her resources to be active, and her energies to be put forth with more than ordinary zeal, not merely to gain new business, but to retain her *accustomed trade.* —*Philadelphia North American.*

AMERICAN
RAILROAD JOURNAL,
AND
MECHANICS' MAGAZINE.

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UNGUENTS FOR RAILROAD MACHINERY.

The vast consumption of oil upon railroads has turned the attention of engineers to various compounds as substitutes, some of which have been recommended for their superior anti-attraction power, and nearly all, for their cheapness. The due consideration of this subject, is therefore, a matter of great importance whether we regard the saving of the machinery or the more direct economy of using a less costly substance than oil. To persons unacquanted with railroads, the latter may appear trifling, but it is well known to those accustomed to the details of expense of various roads, that the item of oil is no inconsiderable portion of the yearly cost of management. We remember a statement made upon good authority that $1,000 was saved in six months upon one of the eastern railroads, by substituting tallow for oil.

Various experiments upon friction and unguents have led to certain results, which have been so fully confirmed that they may now be taken as data in any discussion of the subject. These results are as follows:

The friction without unguents is nearly invariable, for the same metals for any surface and velocity, being directly as the pressure.

The friction with unguents varies with the insistent weights, and with the nature of the unguents.

Each unguent therefore, appears to have a specific action independant of the nature of the rubbing surfaces.

The lighter the weights, the purer and more fluid should be the substance interposed, and vice versa.

Without entering into numerical detail, which we propose to give at another time, we shall merely give the general results, which have been obtained for particular substances. Oil, from its fluidity, has been found to answer admirably for light weights, and possessing the power of preventing oxidation, has added to its reputation as an unguent. But on increasing the weights, friction is found to increase rapidly, and with a weight of 10 cwt., and over, to be some times greater than with a weight of $\frac{1}{2}$ cwt. With hogslard, a smaller increase of friction is observed, but yet sufficient to discourage its use as an unguent.

With substances of great tenacity the results are far different—some of these compared with oil increase the friction with small weights and greatly diminished it with great weights. In all cases with such. substances, the friction decreased with the pressure. A composition formed of black lead and hogslard, although producing varying results, was found to decrease the friction from $\frac{1}{4}$ to $\frac{1}{85}$ of the insistent weight. Tallow gave nearly the same results, with a more uniform action. Soft soap was found to be next in order, but the rate of decrease of friction, with the increase of weight, so rapid as to promise, at weights of half a ton or more to prove superior to tallow. A mixture of soft soap and black lead was next in order to soft soap alone. Black lead alone, at pressures of half a ton is about equal to oil.

Numerous receipts have been given for compounds of various natures to be used for railroad wheels, and most of them have been made with reference to the above named principles. The advantage of the harder compounds over oil, is that, while the latter feeds in the usual oil cups at all times, and therefore, consumes almost as rapidly in a stationary car as in one in use, the former are only reduced to the fluid state, by the heat of the wheels when in motion, and when quiescent, no loss is sustained during an indefinite period. The cost of these compounds being trifling, and the waste by spilling, etc., almost nothing, it is surprising that they have not entirely superceded oil, for the axles of wheels at least.

When black lead is used, great care must be taken to procure it in a state of purity and to reduce it to an impalpable powder, and this is easily accomplished by a process given below. Inattention to this precaution has sometimes caused mischief, and thrown discredit upon all mixtures containing black lead. For the same reasons it is desirable to keep all dust out of vessels containing the oil or other grease to be used.

It is quite likely that many new combinations may be made quite as good as any in use, and as experiments have not been made to test the relative value, much yet remains to be known, but this much is certain that some pastey or semi-fluid oil, or soap, either alone or combined with black lead, should in all cases be preferred to oil. The solid palm oil appears to be one of the most suitable substances for these mixtures.

The following remarks from Lecount, are very good, and we give them without abridgement, as containing the best process for purifying plumbago for anti-friction compounds:

"Grease tubs will be required, with lids to them, and wooden knives to fill the boxes of the carriages with the grease. One man should be specially stationed to do this, and nobody else allowed to touch it: and he should be charged to keep the grease free from dust. The carriages suffer very much from this; the rapid motion and the friction consequent on dust getting into the grease, bringing on rapid wear both of the axles and the boxes.

"The grease which is put in at the grease box, over the axels of the carriage, after having performed its duty, gradually falls out at the lower part of the box; and through the action of the wind, often falls on the inner part of the tire of the wheel. This should be carefully cleared away occasionally, and the boxes filled every journey; although instances have been known, of well made boxes and axles not requiring a fresh supply of grease, till the carriage had travelled 800 miles.

"The best kind of grease for railway carriages, is an object of no small importance, from the great loss incurred in the wear and tear of carriage axles. The two following compositions have been very strongly recommended for railway works; but we have had no opportunity of speaking of them from our own personal knowledge. The one is composed of Dantzig soap, boiled for half an hour in as much palm oil as it will dissolve, and a small quantity of water; and when the oil, soap and water have combined, one quarter of the weight, of fine black lead powder should be added. The second composition is merely hogslard and fine black lead powder; but both in this and the preceding, the whole art consists in having the very best black lead, in the purest state in which it can be procured. This is best done by first pounding the black lead and then washing it: pouring off the water, when all but the finest particles have settled to the bottom; and setting this water by till it deposits these particles, which alone are to be used. The first settlings may be again pounded when dry, and submitted to the same process as before. This has been found the only effectual method. Mr. Booth's patent grease is much used and highly spoken of. It is tolerably hard when cold, and melts with a moderate degree of heat, which is a desideratum; it is composed of common soda half a pound, and water 1 gallon; to which 3 lbs. of clean tallow, and 6 lbs. of palm oil are added, or instead of these, 10 lbs. of palm oil, or 8 lbs. of tallow. The mixture is then heated to 200° or 210° Fahrenheit, and well stirred till it cools down to 66° or 70° Fahrenheit, when it is ready for use. Soft unguents, such as oil or hogslard, only do for light weights; with heavy ones, a thicker composition must be used."

[For the American Railroad Journal and Mechanics' Magazine.]

COST OF RAILROAD TRANSPORTATION.

We are very well pleased to see the Harrisburg Intelligencer endeavoring to enlighten the public in regard to transportation on a railway, as well as in regard to the comparative cost by steam and horse power. As they truly say, it depends upon *the amount of tonnage*, whether most economy will be found in the use of the one or the other, and as it may be as well expressed, whether it is a coffee or a grist mill that is required to be turned. A tonnage of or exceeding 20,000 tons, we should incline to believe, would generally be most cheaply moved by steam power, and under that limit by horse power. The subject for a comparison selected by the Intelligencer are not sufficiently analogous to draw from them any certain conclusion. The ancient railroad of 1830, and the modern one of 1840, have but few features in common. It is like comparing a jacknife and a razor, of which, all that can be said of them in common is, that they are both knives. As our estimates in these instances differ somewhat from the Intelligencer, we will append them, the subject being one, which cannot be kept alive and agitated without imparting some information.

The Danville and Pottsville railway.—This is but a half finished road, and is of the ancient order of flat bar, etc. The first cost of of road and machinery must now go for nothing—the present limited business on it being done at little over mere cost only, for local accommodation. It transports 15 to 20,000 tons of coal per season to Sunbury 20 miles, equal to, say, 80 tons per day—the expense on which would be as follows;

1 locomotive in daily use for 250 days at $13 per day, including only actual repairs, - - -	$3,250	
40 cars daily on the road, repairs, attendance, and oil, 25 cents per car per day, is $10 per day for 250 days, - - - - - - - -	2,500	
		5,750

Repairs to road are said to be about $3,000 per season, which may well be, when those on the Minehill, in 1840, doing a business of near 180,000 tons were only $3,200, using horse power for 16 miles. The cost by steam power is here then only, $5,750, while doing the same business by horse power, is made to amount to $6,325 by the Intelligencer. This company could not afford to transport at a loss, and with the addition of travel and back freight no doubt have a small surplus at the end of the season. An effort should now be made to renew and connect it with Pottsville, and by that means with Philadelphia, particularly as the State of Pennsylvania is guarantee for the interest on a portion of its cost.

The Roush creek and Harrisburg railroad, 35 miles.—This is a projected road, to be built solidly, and on which it is assumed 150,000 tons *per season*, or 600 tons per day, will be transported. The expense of which will be as follows:

1 locomotive in daily use for 250 days at $16 per day, to include depreciation, - - - - - -	4,000
87 cars daily on the road, repairs, depreciation, oil and attendance, 50 cents per car per day, or $44 per day, for 250 days, - - - - - - - - -	11,000
	$15,000

or equal to 10 cents per ton, instead of 14 cents, as made by the Intelligencer, who makes his charges as if the road were operating the whole year, when by terminating at Harrisburg, it must go to sleep with the canals for four months—may it have a worthier termination at Philadelphia.

The above about accords with our estimate for the Minehill road at Schuylkill haven, by which it is seen the 260,000 tons carried over it in 1841, could have been transported by steam power at not over a fippenny-bit per mile, in place of 15 to 20 cents, which it must have cost by horse power, and yet we are told that the leading directors of that road, which has been lately relaid with a heavy rail, are scarcely yet persuaded of this fact. The 10 miles of this road accessible to locomotives, will now of course be used in continuation of the main stem from Philadelphia; otherwise its business will be transferred to Pottsville.

The following comparison of these powers, by steam and horse is from the Intelligencer, and is faithfully drawn:

" Horse power is better adapted to narrow limits, narrow means, and harrow minds—steam power annihilates time and space, and under the direction of mind and science, accomplishes great objects by great means. Horse power is the puny wheelbarrow, the cheapest and best vehicle to transport a single bushel from the canal to the Susquehanna—steam power is the conestoga wagon, capable of transporting the burden of one hundred wheelbarrows the whole length of the commonwealth at less than one tenth of the expense. Horse power, is a pigmy, killing mosquitoes with his finger—steam power is Hercules, with his club, destroying the Lærnean serpent. Horse power is the simple bodkin in the hands of a child, to pry the meat of the walnut from its shell—steam power is the lever of Archimedes, to move the world."

[For the American Railroad Journal and Mechanics' Magazine.]

TRADE OF THE GREAT WEST.

A leading forwarding merchant, Mr. James O'Connor, of Philadelphia, explains the causes of the falling off of this trade on the Pennsylvania improvements in the season of 1841 particularly, and for its seeking the more circuitous one by those of New York. A remedy is also suggested by him worthy of the attention of those concerned.

It appears that, for the *spring trade*, destined to the Ohio and Mississippi, Pennsylvania is without a rival,—the route to Pittsburg being the cheapest and shortest,—there being no difficulty of getting from that point by the river prior to the 1st of July. After that date, the Ohio is generally navigable for keel boats only, which answer but for the down freight; the charge for carrying it to Louisville being \$25 per ton, and to Cincinnati \$22 50 per ton of 2000 lbs., performing the trip in 20 to 25 days, the charge by them for insurance is also *very high.*

Owing to these difficulties traders have preferred, *after July*, to forward through the New York works,—making their purchases mainly in that city, or when made in Philadelpnia, the seller there has been obliged to pay the freight to New York, and the amount paid in that way the present season, he estimates at \$20,000, and and at least \$100,000 of tolls lost to the Pennsylvania works.

Thus do the Pennsylvania works lose considerably by this diversion; and besides, attention is now particularly called by Mr. O'Conner to a *new competitor*, the Boston and Albany railway, just coming into the field, and which aim to throw both the old horses, "New York" and "Philadelphia" off the track. This it takes the most effectual means of doing by using "the better improvement of the age," and putting its charges *at half the price* hitherto charged on other routes for the same distance,—thus :—On dry goods and other merchandise, per

Albany and Boston railway,	204 ms.	the charge is	\$6 to \$10	per 2000 lbs.	new order of railway.
Camden and Amboy	87	do.	\$10 and \$15	do.	old order of railway.
Philadelphia and Baltimore	92	do.	\$10 and \$12	do.	
Philadelphia and Columbia	82	do.	\$8	do.	
Philad. and Chambersburg	156	do.	\$15	do.	

New York and Philadelphia will therefore be compelled to counteract this competition;—the first by the completion of the Erie railroad, and the latter by making her *middle route* of railway to Cleveland as soon as possible.

The remedy proposed by Mr. O'Connor to the interruption which now exists at Pittsburg, after the 1st of July, by the lowness of the water in the Ohio, is to dispense with the keelboats, which draw too much water, and to substitute in their stead "*scow modelled sheet iron steamboats,*" capable of carrying 40 to 50 tons of freight, and to draw only 13 inches,—say, 180 feet long by 12 feet beam—which could make the trip to Louisville and Cincinnati in 4 to 5 days, at $8 per ton, in place of the keel boats, which, when they can start, take 20 to 25 days, and charge $22 to $25 per ton. Twenty to thirty scow iron steamboats, to cost about $5000 each, he estimates as enough to continue the summer and fall trade, and while the river is too low for the navigation of the larger boats.

The keelboats, as stated, not answering for the trade up the river or towards Pittsburg from Louisville, etc., it is directed into the Ohio canal at Portsmouth and thence to Cleveland or Lake Erie finds its way through the New York and Erie canal, and the transporters on the Pennsylvania works thus find this interruption from the low water at Pittsburg to cut both ways, and is as injurious as if a break in the canal had suspended navigation from four to five months in the season.

In the spring, goods are generally carried from Philadelphia to Pittsburg in six to eight days—by steam scows in five days to Louisville, or in all, 13 days, at an average charge of $40 per ton through from Philadelphia, would ensure for this route, says Mr. O'Connor, a preference at all seasons from western merchants.

The tolls on the New York canals have this year increased some $258,000, reaching a sum of nearly $2,033,000, in which may be partly accounted for by the facts above given. There is ample trade now on this line to maintain these canals, particularly the Erie or main stem, which is fortunate, if we look to the day which will certainly come, when the railways on its line are left unrestricted, and the Erie railway is completed to Dunkirk. The actual tonnage from beyond Buffalo, and that going through from New York on the Erie canal, is of an amount which could be *easily and better* accommodated by the Erie railway alone, to say nothing of the assistance from those on its line, and hence to advocate the enlargement with only half its capacity even now filled, is the rankest folly. Nor should the competition from other States in drawing off a portion of that which now helps to swell the toll on this canal, be overlooked by our legislators when they come to consider this matter of enlargement.

[For the American Railroad Journal and Mechanic's Magazine.]

RED ASH COAL.

Fuel and iron may be termed the keys to the arts as well as to all the substantial comforts in social life. As the advocates of whatever, therefore, throws any light upon this subject, we willingly publish the following account from the Harrisburg Intelligencer, giving some further particulars of the district in which the red ash coal more particularly abounds. The demand is as specific for this quality, as it appears the Pinegrove region is specifically that, where it is only to be reached in bodies under circumstances which will render it the cheapest to mine, and it is therefore, with the neccessary facilities for placing it in market, even now a most legitimate object for investment and speculation, however abundant may be every other sort of coal. Now that the public mind has been so unsettled as to all other kinds of investments, capital may seek these mountains, and it may, therefore, not be long before this region is furnished with the requisite avenues to render it available. As every body now asks for "Peach Orchard" so will they then inquire equally for "Pinegrove" coal.

This quality of coal is sure to maintain a preference for domestic use, particularly where fine furniture is used, the ashes being heavier do not rise in the room when the fire is stirred—it more easily ignites, burns more freely, and will burn when only a small quantity is used; and besides the red ash coal does not injure the skin or chap the hands of those who make the fires, nor take the varnish from furniture like the white ashes. The great majority of all the red ash coal in the State, (Pennsylvania) lies in the deposites in the Swatara or Pinegrove region. There are five mountains of it running for more than 20 miles parallel through it, broken to their bases, by the Swatara and its branches, exposing the coal to veiw, in several places, like a ledge of rocks. There are also two mountains of white and grey ash coal on the north side of the basin. The veins of the red ash here vary from 3 to 20 feet in thickness, rising in tracts above the natural level in many instances more than 800 feet. In the Pottsville region the largest veins are only 5 to 7 feet thick and every good vein is worked out above the water level, and a drain of half a million of tons a year will soon take all the available red ash coal above 600 feet below the water level south of Minehill. It may therefore be anticipated that the whole Union will soon look to the Pinegrove region for its supply of red ash coal.

The distance for a railroad, over the most suitable grades on either side, would therefore be, from the grand centre, on Roush creek, to Harrisburg, 35 miles, to Reading 45 miles, and the locomotives will be able to run up to the very mines with full trains. The distance to Philadelphia would be 100 miles, *or as near to it as the great supply of the Delaware company, on the Norwegian above Pottsville, or on the west branch of the Schuylkill above Minersville.*

We may add that the demand for red ash coal being specific, the Pinegrove region, as the great repository of it, cannot fail to have enterprise and speculation very soon directed towards it.

In presenting the following opinion of the Hon. Mr. Beardsley, we feel a pleasure which is undoubtedly felt by every true friend of the cause—that, notwithstanding any doubts entertained upon the subject, the integrity and vitality of the New York and Albany railroad company is unimpaired, and that a fair prospect now exists for the completion of this most important "link" in our chain of railroads. We are also informed that contracts have been made with responsible and competent men for the graduation of the entire road from this island to the city of Troy.

We cannot omit this opportunity of complimenting those zealous friends of the work who have so perseveringly and faithfully continued to promote the advancement of this most important road by preserving through many difficulties, the valuable charter which they possess, and by stimulating the dormant energies of our capiists to the important and profitable undertaking, which will both do credit as a work of private enterprise, and maintain the superiority of our city, in spite of the active competition of our neighbors.

The season is now approaching when our citizens are about again to experience the disadvantage of their too fond reliance upon our *natural* advantages. Nature is about to close with icy bonds our free communication with the interior, removing us for all purposes of transportation, several days journey from the outlet of all our public works, while Boston is within one day's travel by a continuous railroad to the city of Albany.

How our large holders of real estate in this city can thus quietly submit to a rivalry which is affecting them as surely and steadily as if their whole property were gradually removing into the interior, is to us matter of great surprise and regret. Let them remember, that this line of road places our city in direct communication with nearly every place of consequence in the State, and that laterally a communication is established with a large portion of our most fertile and thriving territory—that by the Hudson and Berkshire railroad, we shall have an uninterrupted line of railroad through Boston to Portland in Maine—by the northern railroad to Canada, an avenue to that country—thus bringing together to one great centre the products, we had almost said, of different climates—let them remember all this, and then *can* they hesitate as to what course they are to pursue?

But in this view of the subject, we have omitted a source of traffic, which by itself is sufficient to support the work—we refer to the business to be derived from the region through which the road passes, and which for mineral produce, for agricultural wealth and magnificent scenery, is unrivalled. To the existing traffic, is to be added, the vast amount which will follow the increased population, both from active busines men and retired citizens. Such a district will afford the greatest advantages on account of the ready access to the metropolis, and the man of wealth may enjoy the comforts of his residence during the whole year, being but a few hours removed from the gaities, the news, or the libraries of the city, even in the depth of winter.

Such are a few of the benefits to be derived from this most necessary work—necessary alike to our comfort, our pleasure, and our profit; and if there is money, or enterprise, or *common sense* in the city of New York, its completion cannot be delayed.

OPINION OF THE HONORABLE SAMUEL BEARDSLEY RELATIVE TO

The Acts of Incorporation authorizing the New York and Albany railroad company to construct a railroad from the Island of New York, through Westchester, before the expiration of May, 1844, and to extend the road from Greenbush to Troy, together with branches to eastern points.

Opinion.

By an act of the Legislature of this State, of the 17th of April, 1832, "*The New York and Albany railroad company*" was incorporated, "with power to construct a single, double or treble railroad or way, betwixt the cities of New York and Albany, commencing on the Island of New York where the Fourth Avenue terminates at the Harlem river, and passing through the counties of Westchester, Putnam, Dutchess, Columbia and Rensselaer, and ending at some point on the said Hudson river, opposite or near the city of Albany." (Laws of 1832, p. 258, § 1.)

Such is the general designation of the terminating points and the route of the road, but the company was expressly empowered "to continue and extend the same to the city of Troy;" and also "to construct a branch or branches to the eastern limits of each or any county or counties within this State, into which the said railroad may enter, where such branch or branches shall be necessary to connect said main road with any railroad already or hereafter to be constructed in either of the States of Massachusetts or Connecticut." (§ 1.) The charter of the company was to continue for fifty years.

It is expressly declared, that unless said corporation shall "within three years from the passage of this act, commence the construction of said railroad or way, and spend at least the sum of two hundred thousand dollars thereon," and "within ten years from the passage of" said act, "construct, finish and put" the same in operation, "then the right of the said corporation shall be null and void," (§ 2,) said section also particularly provides that "if a sufficient amount of the stock of the said company shall be subscribed within the county of Rensselaer, to construct and continue the railroad from the village of Greenbush to the compact part of the city of Troy, then the said company *shall* construct and continue said railroad to the said city of Troy, within four years after said amount of stock shall be subscribed therefor."

The capital stock of the company was to be three millions of dollars. (§ 3.) Books were to be opened within six months, and as soon as said stock should be subscribed, the company was authorized to organize by electing directors, but no subscription was to be allowed "unless five dollars on each share subscribed," were paid at the time of subscription. (§ 4, 5.) In addition to these, the ordinary powers to acquire title to the lands necessary for the work, construct the road, etc., were conferred on the corporation, and the directors were particularly required to make an annual report in detail, of their proceedings and expenditures, verified by the affidavit of at least two of their number, to be filed in the office of the Secretary of State. (§ 16.)

It is understood that nothing was done under this act prior to the passage of the amendatory act of 1836.

By the original act, the road was to be commenced, and at least two hundred thousand dollars expended thereon, "within three years," or the right of said corporation was to be void. (§ 2.) This had not been done, and the corporation had, of consequence lost all right to do any thing under its original charter, when the amendatory act of the 9th of May, 1836, was passed. (Laws of 1836, p. 373.)

This act is entitled "An act to amend an act, entitled 'An act to incorporate the New York and Albany railroad,' passed 17th April, 1832." It extends "the time for commencing the construction of the New York and Albany railroad, for two years from the passage of said act, (§ 1,) and declares, expressly, that "such parts of the act hereby amended as may be inconsistent with the provisions of this act, are hereby repealed." (§ 10.) Thus, in effect, continuing in force and applying to said corporation, as revived by the amendatory act, such parts of the original act as were not inconsistent with the provisions of the amendatory act.

By the "*New York and Albany railroad*," as indicated in this amendatory act, must, in my opinion, have been intended, not only the road from New York to the Hudson river at Albany, but the road continued and extended to Troy, and such branches as were authorized by the original act of 1832. All these are regarded as parts of one and the same work, which was designated as "*The New York and Albany railroad.*" If this view is not correct, it must follow that no authority has existed, at any time, to extend the road to Troy, or to make branches, except such as was conferred by the the original act, but which, I believe, has not been urged by any one. The amendatory act, it will be observed, authorized the commencement of the work, at any time within two years. It also authorized subscription books to be opened at any time within six months; and without waiting for the whole capital of three millions to be subscribed, as required by the original act, the company was authorized to organize by electing directors, etc., as soon as one million of dollars were "subscribed, and the first instalment thereon paid in." (§ 3.)

The original act, (§ 2,) required the road to be constructed, finished and put in operation, within ten years, or the right to make the same was to "be null and void," but the amendatory act declares, that "the said company are hereby authorized, after they shall have completed not less than thirty miles of said road in the county of Westchester, to commence the said road upon the Island of New York, with the consent of the corporation of the city of New York, and to construct the same in such sections as they may deem most eligible, and as fast as they may obtain means for so doing; and such portion of said railroad as may be so constructed, shall be vested in said company for and during the period allowed in the original act of incorporation." (§ 4.)

I understand this to be an unqualified authority to construct such parts or sections of the road as might be deemed most advantageous, except the part on the Island of New York, which could only be made after completing thirty miles, at least, in the county of Westchester, and with the consent of the corporation of New York. But as to the other parts or portions of said road, they might be made at any time, and as made, title thereto would become "vested in said company," and that without any regard to the time when the entire work should be completed.

The amendatory act adopts and applies to this corporation "all the privileges and provisions which are granted to, and made in favor of the corporation created by the act entitled "An act to provide for the construction of a railroad from Attica to Buffalo," passed May 3d, 1836, and declares that it "shall be" subject to all the conditions and reservations which by the act aforesaid, are imposed upon the corporation therein referred to, except as herein provided." (§ 5.)

The act thus referred to, may be found in the laws of 1836, page 319. It is in the ordinary form of railroad charters of that year, and it is not deemed necessary for the purpose now in view, to make particular reference to any of its provisions. They seem not to bear at all upon the present question.

A further amendatory act, was passed on the 12th of May, 1837. (Laws of 1837, p. 456.)

At that time, nothing had been done towards organizing the company. By this act the company was authorized to organize by electing directors, "as soon as seven hundred and fifty thousand dollars shall be subscribed, and the first instalment paid thereon." (§ 3.)

This act required the corporation to commence the work within two, and expend three hundred thousand dollars thereon within three years from its passage, and within five years after its passage "complete the said road so as to unite, at some convenient point, with the line or lines of railroad running to Greenbush and Troy, or the right of the said corporation to continue the said road" should cease. (§ 1, 3.)

By this act, several important alterations were made in the charter.

1. The corporation had time to *commence* the work until May 12, 1839.

2. The company might organize as soon as seven hundred and fifty thousand dollars were subscribed, instead of a million, as required by the act of 1836.

3. Three hundred thousand dollars were required to be expended on the road, by the 12th of May, 1840.

4. It was to be completed to a certain extent, by the 12th of

May, 1842, or the right of the company to *continue* the road, was to cease. A failure, however, to comply with these requisitions, would not necessarily, annul the corporation or forfeit all its rights, for notwithstanding some of them might be violated, such parts or sections of the road as might be completed, would remain "vested in said company for and during the period allowed in the original act of incorporation," as is provided in the fourth section of the amendatory act of 1836. This, it is plain, might be the result, although the company had lost all right to *continue* and *complete* the road.

It is said the company was duly organized under the act of 1837; on the 2d of May, 1838, the sum of seven hundred and fifty thousand dollars having been subscribed towards the capital stock, directors were chosen, and have been continued by subsequent elections, and it is assumed that annual reports, etc., have been regularly made. In these respects, there seems to be no doubt that the corporation was legally organized and conducted; and I do not see that any objection of this nature has been urged against its present existence or powers.

The next legislation on this subject, was an act of the 18th of April, 1838. (Laws of 1838, p. 299.)

This act declares that "the time for the commencement and completion of the New York and Albany railroad, is hereby extended two years." The road, was, therefore, to be *commenced* by the 12th of May, 1841, and *completed* by the 12th of May, 1844,

Another amendatory act was passed on the 16th of April, 1839. (Laws of 1839, p. 158.)

This act adopts certain provisions in another railroad act, which relate principally, to the mode of acquiring title to the land for the road, and applies them to this corporation. These need not be particularly stated. The second section, however, of this act of 1839, is highly important, and should not be overlooked. It authorizes the New York and Albany railroad company, "to locate, secure titles and construct their road, in such sections as they may deem most eligible, and as fast as they may obtain means for so doing, within the time limited by law for the construction of the said road;" and it declares that "such portions of said road as may be constructed, shall be vested in said company, for, and during the period allowed in the original act of incorporation." (§ 2.)

This, in substance, is a repetition of part of the provisions in the fourth section of the amendatory act of 1836. That section, it will be observed, prescribed certain conditions, as prerequisites to the construction of the road upon the Island of New York, although it gave, as I have supposed and suggested, an unqualified power to construct the residue of the road in parts or " sections," and vested title to the same in the company, as they might be completed. But this act of 1839, seems to have removed *all* restrictions and conditions, giving to the company absolute and unconditional power to "*construct their road in such sections as they may deem most eligible,*" and vesting title thereto " in said company for" the period limited in the original act.

These are the only legislative acts which bear upon the question of the present existence and general power of this company. There is another act* which has been supposed, more or less, to affect the extent of the rights of this corporation, but in no degree its existence or general powers. How far, if at all, the act " relating to the New York and Harlem railroad company," may have curtailed the rights and powers of " the New York and Albany railroad company," as to a part of the line in Westchester county, (and no one pretends it can have any effect—further up the Hudson,) is a point upon which others have advised, and no opinion is of asked me, I have therefore not examined that question.† But my opinion has been requested " in relation to the existence of the charter," and as I understand it also, upon the general powers of the New York and Albany company, and I must say that upon the act, before particularly referred to, I see no ground on which the existence of the charter and general powers of this company can well be drawn in question.

We have seen that the company was, by its original charter, authorized to make and construct a railroad from New York to Albany, with power to extend the same to Troy, and make lateral branches at certain places, the time originally limited, for the commencement and completion of the work expired, but was extended from time to time, so that by the last act on that subject, the road was to be *commenced* by the 12th of May, 1841, and *completed* by the 12th of May, 1844. (Act of 18th of April, 1838.)

The road was commenced, and considerable progress made in

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* "An act relating to the New York and Harlem railroad company. Passed May 7, 1840."

† Upon this point, the opinions of David B. Ogden, Charles McVean, John Anthon and Jonathan Prescott Hall, were previously given, fully sustaining all the rights and privileges of the New York and Albany railroad company, in and through the county of Westchester, and stating "that the right of the New York and Albany railroad company to construct a road commencing *on* the island of New York, *through* Westchester, is not in any manner impaired by the act of the 7th May 1840," "relative to the New York and Harlem railroad company."

the work, as I learn, prior to the 12th of May last, the time limited for its commencement. Upon what principle then, can it be doubted that the company have a right to go on and complete the road by the 12th day of May, 1844? I confess I perceive no ground for any such doubt.

1. But it is said that the act of 1837 required three hundred thousand dollars to be expanded on the road by the 12th of May, 1840, and that this was not done, and therefore the charter is at an end. It is true such an expenditure was required by that act, which also required that the work should be *commenced* by the 12th of May, 1839. But the act of the 18th of April, 1838, extended the time for the *commencement* of the work to the 12th of May, 1841, and thereby, necessarily, annihilated the obligation, imposed by the act, to *expend* three hundred thousand dollars by the 12th of May, 1840. It would be inconsistant, not to say grossly absurd, to allow until the 12th of May, 1841, for the *commencement* of the work, and still require an expenditure of three hundred thousand dollars, or any other sum a year, prior to that time. I think it very clear, therefore, that the clause requiring this expenditure of three hundred thousand dollars to be made, was wholly abrogated by the act of 1838, which has been refered to. The provisions are inconsistent and both cannot stand; the first must therefore yield to the last, upon a principle of universal law. This would seem to be in accordance with common sense, as it is a plain principle of law. Blackstone says an "old statute gives place to a new one," "where its matter is so clearly repugnant that it necessarily implies a negative." (1 Black. Com. 89.) Giving time to *commence* the work until May, 1841, *necessarily* implies that a large *expenditure* could not have been required a year previously to that time.

2. Nor is there, as it seems to me, any difficulty, as may have been supposed, growing out of the words of the act of 1832, which, after authorizing the construction of the road from the Island of New York, to "some point on the said Hudson river, opposite or near the city of Albany," proceed as follows, "with power to *continue* and *extend* the same to the city of Troy." (§ 1.)

It has been suggested, that the road can only be made from Greenbush to Troy, after the main work has been completed up to the former place; that then, and not before, the power will arise, to "*continue* and *extend* the same to the city of Troy." But this could not have been the meaning of the original act of incorporation, for that required, *peremptorily*, that the road should be constructed and continued from Greenbush to Troy, within four years after certain stock should be subscribed, (§ 2,) (a provision in my opinion, still in full force,) although the charter allowed ten years for the *completion* of the entire work. It might, therefore, become the imperative duty of the company to make the road between Greenbush and Troy, although the road had not been completed up to, or within fifty miles of Greenbush.

But the amendatory act of 1836, not only extends "the time for commencing the construction of the New York and Albany railroad," (§ 1,) (by which I understand the entire road from New York to Troy with its branches as authorized,) but declares, expressly, as to the whole line, except a part in the county of Westchester, and on the Island of New York, that the company may "construct the same in such *sections* as they may deem most eligible, and as fast as they may obtain means for so doing; and such portions of said road as may be so constructed, shall *be vested in said company* for and during the period allowed in the original act of incorporation." (§ 4.)

Similar language is used in the amendatory act of 1839, which authorizes the company "to locate, secure titles and construct, their road in such sections as they may deem most eligible," etc.

"*Their road,*" is the language used to describe the work to be done,—*that,* may be located and constructed in "*sections.*" What road is thus referred to? Certainly not the road from New York to Greenbush only, but that road continued and extended to Troy. This, at least, is my understanding of the language used. In my opinion, therefore, the corporation is still in full life, with power to construct the road, in *sections* or *otherwise,* as has been fully explained.

SAMUEL BEARDSLEY.

JOHN DELAFIELD,
GEORGE R. DAVIS,
JONAS C. HEARTT, ESQRS.
Committee of the Directors of the New York and Albany Railroad Company.

UTICA, *December* 2, 1841

PENNSYLVANIA AND OHIO CANAL.

We give place with pleasure to the following abstract, from the report on one of the most important links in the chain of the Pennsylvania improvements, as indispensible in securing her an equal portion, and would be the means of placing her indeed on higher grounds than all the other eager competitors for the western trade;

unhappily for her it is yet in an incomplete or rather dilapidated state. It should be well looked to as a likely means hereafter, of relieving the plethora which the Erie canal has been of late years suffering under, and which is made the plea for so much outcry for the measure of enlargement, in so many other respects, useless. To justify such an expenditure, an honest representative must satisfy himself:

1st. That the Erie canal has ever been filled when in good order beyond the one-half of its full capacity, estimating it at 56,000 lockages.

2d. That the railroads on the line of this canal, which in July next, will connect Albany and Buffalo, are to be for ever prohibited from *assisting* the canal to carry freight.

3d. That the Erie railroad, on which near $3,000,000 of the public money has already been spent, is to be abandoned, and its completion given up, as it would otherwise take nearly all the valuable *through trade* at either end, from the canal.

4th. Whether the section of the State through which the Erie canal and a line of railroad now passes, has not been sufficienly pampered with this consequent enormous outlay of near $25,000,000, and whether, therefore, the outlay of another dollar can be justified except on the direst necessity, and until after other portions of the State, having an equal claim, have had their just proportion of the State patronage.

There is a disposition *to log roll* in regard to these two main works, the Erie enlargement and the Erie railroad, but if the coming legislature will justify its title of *democratic*, let them kill at once all such squinting.

The sixth annual report of the directors of the Pennsylvania and Ohio canal company to the stockholders:

The whole extent of navigation created by the improvemont is substantially as follows—

Length of main canal from Beaver canal to Ohio canal and Akron - - - - - - -	84 miles.
Length of Cuyahoga feeder, made navigable - -	10 "
Length of slackwater above the dam - - -	4 "
Length of Middlebury side cut - - - - -	1 "
Making the total extent of navigation about	99

The amount of lockage on main line is 420 feet, overcome by 54 locks and 15 feet on the feeder and side cut requiring those locks. There are 2 aqueducts, 80 culverts, 75 bridges and 9 dams. One of the aqueducts, 2 dams, nearly all the locks and culverts, are of cut stone masonry laid in hydraulic cement. The company has also provided and furnished four new substantial covered boats with furniture, cooking implements, bedding, etc., for the convenience of boarding and transferring hands from one point to another along the line, and the necessary stone boats and other machinery and tools for making repairs as occasion may require.

The whole of these expenditures are charged in the foregoing account of work or contingencies and it is found in practice, that repairs are made with greater facility and much less expense than in any other mode.

The whole amount of expenditures including work, all contingent expenses, damages, superintendence, repairs and boats, up to the present period, will not exceed $1,256,000, being less than $13,000 per mile for each mile of navigation created.

The subscriptions of stock from which the foregoing collections have been made, are as follows:

In the city of Philadelphia, - - - - - -	$623,780
From the State of Pennsylvania, - - - - -	50,000
From the county of Alleghany, Penn. - - -	50,825
From Beaver and Mercer counties, do. - - -	46,360
From Trumbull county, Ohio, - - -	51,042
From Portage county, do. - - - - - -	22,470
From the State of Ohio, - - - - - -	420,000
Total amount of collections credited to stock, -	$1,264,477

Although the original design, contemplated by the charter of the company, of forming a continuous canal from the Ohio canal at Akron to the main line of the Pennsylvania canal, at or near Pittsburg, has not yet been accomplished, still the amount of business which was immediately secured, and which has been so rapidly augmenting, since this communication has been thus partially opened, demonstrates its present importance, and evinces the wisdom and utility of the original project. By subjecting this line of communication between Pittsburgh and Beaver, a distance of twenty-six miles, to all the fluctuations and interruptions of the navigation of the Ohio river, not only suspends its business during the time its waters are too low for steamboat navigation, but by rendering it uncertain and insecure, drives much of the commerce between the Atlantic cities and the west, into other channels which would otherwise flow into this. It also incurs the additional expense of transhipment, storarge, and drayage, or by compelling the freight to pass into the hands of extensive transportation companies, having the control of steamboats upon the river, creates a monopoly, against which, individual enterprise cannot successfully contend, the natural tendency of which, is to keep up the price of transportation at unreasonable rates.

Let this communication be once opened, so that boats could pass from any point on the Ohio canal to Johnstown, where they could secure a return cargo, its business would be doubled, and individual enterprise would reduce the cost of transportation in the same ratio. So well satisfied were the directors, by a comparison of the prices of transportation with those on the Ohio and New York canals, that this reduction could be sustained on the Pensylvania improvements, that inquiries were made of some of the principal merchants in Pittsburgh, from whom information was obtained that by making separate contracts with individuals owning boats upon each side of the mountains, they procured their goods to be brought from Philadelphia to Pittsburgh at about half the customary charges of the transportation companies, and that the carriers were well satisfied with the stipulated prices and anxious to secure their business. Such has been the disparity in the cost of transportation, compared with distances, that contracts have been made for the delivery of merchandize the present season from New York to Pittsburgh, by way of the New York, Ohio, and crosscut canals, a distance exceeding eight hundred miles, at one dollar and forty cents per hundred; while the customary charges by the transportation companies for the same articles from Philadelphia to Pittsburgh, less than half the distance, have been greater. This disparity in prices cannot have arisen from excess of tolls, or any expenses of transhipment to which the latter route is subjected more than the former.

On the former route, transhipments are required at Albany, Buffalo, and Cleveland, and were the whole amount of tolls remitted on the latter, the disparity although lessened, would still be apparent. These facts are presented to show the reason why the wheat, flour, and other productions of Beaver, Mercer and other counties bordering on the Pennsylvania and Ohio canal, have taken this circuitous route to market in preference to the shorter, quicker and safer one to Philadelphia or Baltimore. The same system of monopoly formerly existed on the New York and Ohio canals, and a simultaneous reduction, (by agreement of the officers having them in charge,) of twenty-five per cent. on the established rate of tolls on each, caused no reduction in the cost of transportation, until discriminating tolls were assessed, increasing with the increased charges for transportation. These measures, and the numerous individuals who have vested their small capitals in boats navigated by themselves in carrying the surplus produce of their immediate neighborhoods to market, and bringing merchandize in return, have reduced the cost of transportation on those canals to its present low standard, by which they retain the carrying trade against such fearful odds in point of distance.

The amount of tolls collected the last year was $13,250; this year, up to the forepart of November, the receipts amounted to more than $26,000, with a reasonable expectation that they would reach $30,000 before the close of navigation.

In consequence of the bad condition of the Beaver canal, though a portion of which the business of this canal must pass to reach the Ohio river, the navigation was interrupted by low water and other obstructions to such an extent, that boats having more than half or two-thirds of a load could not be passed during the month of July. On application to the Canal Commissioners of Pennsylvania to remedy this evil, although stating that they had no funds at command appropriated to this object, they promptly gave directions to the engineer and superintendent having it in charge, to make such repairs as should be necessary to sustain the navigation through the season. A compliance with these instructions necessarily required the water to be drawn off, by which the navigation was suspended most of the month of August, nor was it in a condition to pass boats fully laden until the fall rains caused a rise in the streams. These interruptions not only diminished the receipt of tolls for the time being, but by compelling the forwarding and other merchants to give different orders for the transportation of goods, seriously injured the reputation of the line, and affected its business through the season.

There can be no doubt that these causes have lessened the amount of receipts the present season at least twenty-five per cent., and there is much reason to apprehend that the imperfect and insecure condition of that work will effect still more injuriously the business of this canal the ensuing season. Very extensive repairs are required to keep up the navigation upon it for any length of time—to do this, will require the water to be drawn off, and consequently a suspension of business on the cross cut canal, until the repairs are completed.

Notwithstanding these causes have tended to lessen the business and receipts upon this canal the present year, still if its utility and productiveness can be tested by a comparison of these items with those on the Ohio canal from the first year of its operations down to a later period, we have good reason to be satisfied with its future prospects.

The Ohio canal was opened about fifty miles south of Cleveland in 1827—was extended in 1828 about one hundred miles, and in 1832 was opened the whole distance to the Ohio river, about three hundred miles.

The following statement of the amount of tolls received on that canal is taken from the Canal Commissioner's reports:—

In 1827	the amount of tolls received was - -	$1,500
1828	" " " - -	4,000
1829	" " " - -	7,000
1830	" " " - -	30,493
1832	" " " - -	79,982
1836	" " " - -	211,823
1838	" " " - -	382,135

In 1840 the Ohio canal yielded an income of about seven per cent. on its cost of construction, over and above all expenses of superintendence and repairs for the current year.

The rates of toll established on this canal are, on most articles, materially lower than those on the Ohio canal, and are not intended to exceed them in any case.

The following list of articles, taken from the collector's returns, comprises the principal items of business in which tolls have been charged during the present season up to the 1st of November:

Merchandize, including iron, glass and nails,	10,620,247	pounds.
Butter and cheese, - - -	1,516,977	"
Pot and pearl ashes, - - -	1,222,987	"
Pig iron, - - -	1,016,000	"

Iron ore, - - -	2,346,000	pounds.
Extra baggage and furniture, - - -	301,000	"
Flour, - - -	36,500	bbls
Salt, - - -	12,486	"
Fish, whiskey, beef and pork, - - -	1,610	"
Wheat, - - -	147,124	bushels,
Mineral coal, - - -	377,000	"
Number of passengers, (returns from one office only received,) - - -	1,394	
Number of miles conveyed, - - -	68,040	miles.

Most of these important items, such as merchandize, wheat, salt and coal, have increased in amount more than one hundred per cent. on the last year.

[From the American Journal of Science and Arts.]

STEAM NAVIGATION TO THE PACIFIC BY THE ISTHMUS OF PANAMA, AND ALONG THE WESTERN COAST OF SOUTH AMERICA.

Some interesting pamphlets on the subject named in the title were placed in our hands early in 1840 in Boston, by a brother of Mr. William Wheelwright, to whom mainly the world is indebted for an undertaking which may be with propriety ranked the first among the enterprises by steam. Mr. Wheelwright has labored several years at this undertaking and is now on the eve of success. From himself we have just received a communication, which, although not intended for the public eye, contains many facts in which the world is interested, and we therefore venture to annex certain portions of his letter or abstracts from it.

[To Professor Silliman.]

Talcahuano, *March* 8th, 1841.

Dear Sir: I had the honor of receiving your valued favor only a day or two since, having left the United States about the time it was written, to take up the superintendence of the Pacific Steam Navigation Company, which I had previously formed in England. Two of our steam ships, of about seven hundred tons each, the Peru and Chili, arrived in this port in fifty-five days from England. passing through the Straits of Magellan, from sea to sea, in thirty hours: sails were employed when the winds were fair, otherwise steam, and the voyage may be said to have been one of the most brilliant ever undertaken. The field for steam navigation in these seas is so ample that our first voyages came off most successfully, proving and fulfilling every statement made: unfortunately, however, the directors in England, neglecting to send a supply of coal, as previously arranged, the operations of the company have ceased for the present, and I am now engaged in this place in mining for coal, an operation never before undertaken in this country, and which, of course, presents a thousand difficulties. My first object when I arrived here, was to make a practical examination, to ascertain the strength of the coal, and see its influence upon our boilers and fire bars; for this purpose I proceeded south, with the double object of proving the coal and exploring Valdivia and the island of Chiloe. After some unsatisfactory experiments, we finally came to such an arrangement of our fire bars as to produce a result decidedly favorable; the access of expenditure over the best Welsh coal was twenty-seven per cent., which is nearly as good as Newcastle coal. The formation of clinker is great, but it is not of an adhesive character, and the fires are easily cleared; the coal seems to possess no sulpher, and there is nothing disagreeable in the smoke; the ashes are white, and the coal free from smut. The coal lies in horizontal strata, rising or falling not more than ten or eleven degrees; is about three to four feet wide, and is found, most generally, cropping out on the precipitous sides of hills: the upper stratum is generally soft; the next stratum, which is what I now send you, is found from twenty to forty feet beneath; and I am now engaged in sinking a perpendicular shaft for the purpose of finding a third stratum and still better coal. Some two or three cargoes of this coal have been shipped, and spontaneous combustion has been produced, which set fire to the vessels; it must be considered that the coal first used was never mined, and was taken merely from the surface. I have ascertained that in two instances the vessels which have been set on fire had vegetable matter on board—the first was a cargo of wheet stowed over a deep bed of coal: the next, the coal was shipped in what are called here *chequas*, made of grass. What influence they may have had in producing spontaneous combustion it is not in my power to say, and I should be much obliged if you could account to me for its spontaneous ignition. I cannot at present make any large deposit of this coal until I make some experiments, and for this object I shall load one or two small vessels with the coal, and watch it carefully, keeping it free from any vegetable matter, and from water, and giving it all the ventilation in my power, it is a great drawback upon my operations at present. On board the steamers we have iron bunkers for about ten or eleven day's fuel, and it causes me no anxiety in putting it on board. I had this arrangement of our bunkers made with a view of using this coal.

On my voyage south, I found at Valdivia and Chiloe the same strata of coal, and in a line of coast of more than four hundred miles, there does not appear to exist the slightest difference in quality. It is perhaps worthy of remark, that the coal found at Boca del Toro, on the Atlantic side of the isthmus of Panama, and near Cherokee on the Pacific side of the isthmus, is the same to all appearance as that found in this district.

I am at present mining about fifty tons a week, but hope in the course of a few days to open some more mouths, and mine in much farther than I am doing at present; my only fear is that in sinking a shaft I shall be obliged to contend with a large quantity of water. As it is a new thing, and a work in which I have no knowledge, I am obliged to adopt a common sense view of it, and work on as well as I can, until miners can be sent me from England. The cost at the pit's mouth will not exceed two dollars per ton; should I get it lower down, it will be necessary to clear it of water by a steam engine, which will render it somewhat dearer. Notwithstanding our operations are paralyzed at present, I feel persuaded that by the end of this year our line of intercourse to Panama will be completed, and our communication with North America and Europe greatly facilitated.

I have no doubt that the coal beds here will bring about sooner the steam intercourse westward from Europe to Australasia: this has been a favorite plan of mine for several years, and I hope that the arrangements which I made before I left England, patronized by Sir Edward Parry, Captain Fitzroy, Mr. Montague and others, will soon go into effect. Perhaps the greatest change ever effected will be produced by opening an intercourse westward from Europe to Asia, and making America the stepping stone between them. The isthmus of Panama is destined to become one of the most interesting spots in the world: a ship canal will be formed, and it will become the highway between the Paciffic and Atlantic oceans. I have been frequently on the isthmus, have passed often between the two seas, have examined with much attention the facilities and obstacles which it offers for the object proposed, and have satisfied myself of the perfect feasibility of establishing a communication between the two oceans. On leaving England, I was requested to report upon my journey over, and to examine the isthmus with care, as well as the river Chagres. As it may, perhaps, be acceptable, I extract from the report such parts as I conceive may prove interesting to you.

"Having prepared myself with the necessary apparatus, I commenced by sounding the Chagres bar, where I found at low tide fourteen feet of water; the river being then swollen eighteen inches, left twelve and a half feet of water, from thence upwards to the junction of the rivers Chagres and Trinidad, (which you will find in the map in my pamphlet,) where there are four and three fathoms close to bank, which vessels might use as a pier to discharge goods. A little above the junction, the water shoals to seven or eight feet—the channel below is never less than three hundred to four hundred feet, and often one thousand to twelve hundred feet; a steamer of five hundred tons, properly built, might navigate as high up as the Trinidad, with perfect safety and ease; at this point it is also perfectly healthy; from this junction the distance is twenty eight-miles to the Rio Grande, which empties into the Pacific about three quarters of a mile from the city of Panama. Vessels of any size may enter this river, as the tide rises in spring twenty-two feet; the space between the two points has but a very slight rise. I should say that it could not exceed forty feet, for, in passing over to Panama from Gorgona, I found there was not a hill to ascend, and that a good carriage road could be formed without making a single cut. While the land to the left towards Cruces was mountainous and broken, that to the right seemed to decline to an unbroken plane; hence, it appeared to me, that Lloyd's statement respecting that line was strictly true.

"My impression is, that the first object, before thinking of a canal, should be to make a good road from the junction of the rivers Trinidad and Chagres to the Rio Grande or Panama; by this means an intercourse between the steamers on the Atlantic and the steamers on the Pacific could be affected in three or four hours with perfect ease, and a cargo even transported in that time."

As it regards steam navigation in the Pacific, I feel convinced that it will gratify you to know, that the great work is going on. Even the few voyages made between Chile and Peru have shown, so palpably, its advantages, that the stopping of the steamers has produced a great sensation throughout the land; it is impossible to form an estimate of what it will do for these countries—the governments of Chile, Peru and Bolivia, have granted every protection and continue to give me every support; and I am under the firm conviction that when once perfected, its advantages will be found vastly beyond what I have described them. I am very much indebted for the insertion in the American Journal of Science of my paper on iron steamboats. I have made considerable efforts to bring forward that subject in England; I have gone into its detail and examined with all minuteness the whole subject, and I am perfectly convinced that not only all our western waters will be navigated by steam vessels built of iron, but that trans-atlantic steamers will and must be of iron. Mr. Brunel, the celebrated engineer of England, wrote me a letter of thanks for the paper, and promised to lay it before the board of directors of the Great Western company, and I have reason to believe that it was mainly instrumental in bringing about the building of the great iron steamer, which will shortly ply across the Atlantic, and show herself as vastly superior to the Great Western, as the Great Western was superior to others when she commenced trans-atlantic navigation.

[To Mr. Wheelwright.]

New Haven, *July* 20, 1841.

My dear sir: I am much gratified by your very interesting letter of March 8th, received yesterday, with two specimens of coal, for which I thank you. You rightly judge that I feel a deep interest in your project, which I consider to be one of the most interesting that has ever been undertaken. Your present mining operations are of the utmost importance, and their success must, I should suppose, be decisive of that enterprise; it must be too expensive, one would think, to bring coal from England, and it is most happy that Providence has supplied it in such immense quantities in the very regions where it is wanted, not only for navigation coastwise, along your immense ocean barrier from Panama to Patagonia, but for the supply of those points in the Pacific—Gallipagos Islands, Sandwich, Otaheite, etc., where depots will anon be established for the navigation of the Pacific, and eventually around the world. Your South American coal is a treasure of inappreciable value, and with the aid of trained English miners and engineers, I cannot doubt you will succeed. I dare say, however, that your New England "common sense," will suggest expedients that do not always occur to those who have been trained to move in a beaten track. Can you not drain your water out at a lower level, by carrying in galleries connected by shafts? You do not say which way your strata incline—if towards the declivity of the hill or mountain in whose sides the coal crops out, then your drainage will be easy. You will of course look out for vallies and gorges, and all those positions to which you can make a communication so as to have the water go off by gravity—for even a long tunnel may be a less expense in the result than a steam engine, and it is vastly more simple and easy in the management. I have made some little blow-pipe experiments upon the coal you have sent me; that from the upper layer appears more like lignite, which you know, is merely wood of trees, altered by time, pressure, and fermentation. The lower stratum is good bituminous coal, and from the abundant flame with which it burns, it must be well adapted to produce steam. It is very probable, that your next stratum below will be still better, as having undergone a more perfect assimilation, for you are aware that the true coal, (as distinguished from lignite,) is also a product of vegetable decomposition, but the plants were of a much earlier date, and in general not composed of firm woody fibre, but more soft and succulent. It would require extensive and skillful geological observations on the spot, to decide whether you have the true bituminous coal formation of Europe and of North America, or a coal of a more recent date and less perfect—for such coals there are, as that at Brora in Sutherland, Scotland. The lignite belongs to the tertiary formation, a much more recent deposit than even the newest coal; but you may have a tertiary reposing directly upon the true coal formation. If your coal beds are of the more recent formation—which is very possible, (although I would not hazard an opinion from seeing merely hand specimens,) then it will never be as good as the true coals of an earlier geological date; still, however, you must mine it at all events, as it is your only resource, (wood being I suppose out of the question;) it is certainly well worth mining, and judiciously managed, will no doubt yield you a good result.

As to the spontaneous combustion, it is propably occasioned by the fermentation of iron pyrites, (sulphuret of iron;) which, in the present case, is abundantly visible to the eye, and where invisible, may be disseminated in minute and thin flakes and points through the body of the coal. It is very prone to absorb oxygen from the air and from water, and thus to heat and inflame. Your security, as I conceive, will be to lay out your blocks of coal in the dry, warm air, so as to have them thoroughly dry before they are shipped; and if it ever rains where your mines are, the coal after being above ground should be housed. In the ship, the coal should not be in contact with wood; if your bunkers are not all of iron, those that are of wood can be lined with stout sheet iron, and the coal should be covered from the air, especially the damp air of the sea, and the spray; if protected by wooden covers they should be lined with black tin, (thin sheet iron as prepared for tinning.) I mention this because it is light, and covers ought not to be to heavy; but no combustible thing should lie in contact with the coal—certainly not wheat or grass as you mention, or any other vegetable. You will of course, reject any large visible masses of pyrites from the coal; any masses that are *visibly sprinkled* with it, you will also throw away; the English miners call the pyrites *mundie.* With these precautions, I do not believe your coal will spontaneously ignite, and should it do so, it will burn so slowly that it can be kept under till you make a port. I should remark that the small coal should never be taken on board, as being much more liable to ferment; they may be consumed in the engines on shore.

[From the Civil Engineer and Architect's Journal.]

ENGINEERING WORKS OF THE ANCIENTS.

Works of Hercules.—Besides the performance of the Egyptian Hercules already mentioned, Diodorus Siculus, Book 4th, gives an account of several works of the Greek Hercules. Not to speak of the operations attributed to him at the straits of Gibralter, there were two hydraulic works in Greece said to have been executed by him. The large champain country about Tempe being all over a stagnant lake, he cut trenches through the lower grounds, and through these trenches drained all the water out of the lake, by which means were reclaimed all the pleasant fields of Thessaly as far as the river Peneus. In Beotia he did quite the contrary, for to punish the Minyœ, it is related that he caused a river to overflow the whole country, and turn it into a standing pool. In his passage of the Alps from Gaul, an expedition in which he was the predecessor of Hannibal and Napoleon, he leveled and opened the rough and difficult ways to make way for his army and carriages. In Italy, Hercules performed some remarkable works about the Lake Avernus, for whereas the lake extended as far as the sea, Hercules is said by casting up the earth, to have stopped up its current, and to have made the way near the sea, called the Herculean way. In Sicily to express his good wishes for the inhabitants, he caused a pond or tank to be sunk near the city of the Agrineans, four furlongs in compass, which he called after his own name. In Greece, Hercules had the further merit of having diverted the river Achelous into another channel which he had dug for it. This irrigated a considerable part of the country, and was done to please the Calydonians. It gave rise to the poetical fable that Hercules fought with Achelous transformed into the shape of a bull and in the conflict cut off one of his horns and gave it to the Etolians. This they call Amalthea's horn, in which the poets feign that there grows all manner of summer fruit, as grapes, apples, and such like, not the only time, by the bye, that engineers have filled the horn of plenty.

Dedalus.—Engineering Festivals—Diodorus gives a long account of Dedalus, from which we have made the following extracts. Dedalus was an Athenian, of the family of the Erechthidæ, being the son of Hymetion, son of Eupalamus, son of Erechtheus, king of Athens. He was extraordinarily ingenious, and very studious in the art of architecture, an excellent statuary and engraver upon stone, and improved those arts with many noble inventions. Dedalus was obliged to flee to Crete for the murder of his nephew Talus who was killed by him out of envy. To Dedalus is attributed the invention of sails for ships. After leaving Crete, he staid with Cocalus and the Sicilians, in whose country Diodorus, a native, says that works of his were to be seen in that day.

While on the subject of Dedalus we must not omit what the Biographic Universelle says on the subject of festivals established in his honor. When the Plateans returned to their native city, 311 B. C. after an exile of sixty years, they instituted an annual festival called Dedalia, which every sixtieth year was celebrated with extraordinary magnificence. All the trees cut down were made into statues called Dædala. The name of Dedalia was also given to a Theban fete in honor of the reconciliation effected between Jupiter and Juno by Cithero.

Talus.—Talus is sometimes called Atalus, Calus, and Acalus; he was the nephew of Dedalus, as before mentioned, and murdered by him. Being the son of Dedalus's sister, and but a young boy, he was bred up with his uncle to learn his trade. Talus, for ingenuity, exceeded his uncle, and invented the potter's wheel; he got likewise a serpent's jawbone, and with it sawed a little piece of wood asunder, then in imitation of the tooth in the jaw, he made the like in iron, and so he found out an instrument for sawing the greatest pieces of timber. He invented likewise the turner's lathe and many other tools.

Prometheus—Cretan Hercules—Vesta—Minerva—Vulcan.—Prometheus is according to some the first who stole fire from the gods, and bestowed it upon men (Book 5th,) but the truth is, he found out the way how to strike fire out of flint or stone. The Idæ Dactyli are also said to have found out the use of fire. They discovered the nature of iron and brass to the inhabitants of the Antisapterians, near the mountain Berecynthus, and taught the manner of working it, and because they were the first discoverers of many things of great use and advantage to mankind, they were adored and worshipped as gods. One of them they say was called Hercules, a person of great renown. After them were nine Curetes who invented swords and helmets. Vesta invented the building of houses, and upon this account almost every body sets up her statue in their houses, and adores her with divine honors. Minerva was the introducer of architecture, and also according to our chronicler of the use of garments, so that architecture and tailoring according to him boast one common parent. Vulcan they say found out the working of iron, brass, silver and gold, and all other metals that require forging by fire; and the general use of fire in all other cases was found out by him.

Xerxes—Agrigentum—Pheax—Themistocles—Diversion of the Nile.—The eleventh book of Diodorus, is on Greek history, he mentions Xerxes throwing a bridge over the Hellespont, and cutting a canal through Mount Athos.

The Agrigentines in Sicily having acquired great spoil by the defeat of the Carthaginians, took the greater part of the prisoners into the public service, and employed them in cutting and hewing stone. They not only set them to build the largest of the temples, but made water courses and sewers under ground, so great and wide, that though the work itself was contemptible, yet when done and seen was worthy of admiration. The overseer and master of the work, was one Pheax, an excellent artificer, from whom these conduits were called Pheaces. The Agrigentines likewise formed a tank for fish, at great cost and expense, seven furlongs in compass, and twenty cubits deep. This by neglect of succeeding ages, filled up with mud, and at last through length of time turned wholly into dry ground; but the soil being very fat and rich, it was planted, and yielded the city a large revenue.

Themistocles has the merit of projecting and carrying into effect the construction of a haven at the Pyræus, by which the naval power of Athens was greatly increased. The account of his negociations with the assembly of the people is of much interest in an historical sense, but not immediately relating to the end we have in view, we are compelled to omit it.

In the 21st chapter is mentioned the diversion of the Nile during the war between the Persians and Egyptians.

Blocking up of the Euripus.—In his 13th book our historian describes the measures taken by the inhabitants of Eubœa on their revolt from the Athenians. This island being separated from the continent only by the narrow strait of the Euripus, they solicited the Beotians to assist them in stopping it up, in order that they might receive assistance against any attacks from the Athenians who were masters of the sea. To this the Beotians agreed, and all the cities set upon the work, and every one strove with diligence to perfect it, all the citizens, foreigners and strangers being set to work. The mole began at Chalcis in Eubœa on one side, and at Aulis in Beotia on the other, that being the narrowest part. In these straits the sea was very boisterous and rough, but after this work much more unquiet and raging, the passage being made so very straight and narrow, that only one ship could pass through. There were forts built on both sides upon the extremities of the moles, and wooden bridges made over the currents for communication.

IMPORTANT INVENTION IN MACHINERY.

It has been often said that the Steam engine now in use will in time be displaced by some invention less in bulk, cost and risk of explosion, and at the same time equally powerful for all the purposes to which the steam engine is now applied. Whether the invention of the engines described in the following extract is a first step towards the looked-for improvement, the scientific reader can judge.—*National Intelligencer.*

[From the London Times.]

Our attention has been called, by an article in one of the provincial newspapers, to a very important mechanical invention, for which a patent has recently been granted to two Scotch gentlemen, and which promises to effect a greater and more beneficial change in the working of machinery than has taken place since the brilliant discoveries of Watt. The two great drawbacks of the steam engine (besides the large space it occupies) have been the *bulk*, and the consequent *expense* of the fuel which it requires, the latter preventing its application to many purposes for which it would otherwise have been a most effective agent, and the former impeding its locomotive energy, and confining it, particularly as regards navigation, within comparative narrow limits. Any reduction in either of these respects is thereby obviously so much *clear gain*. The invention to which we allude promises to effect a prodigious saving in *both*, by diminishing the expenditure of fuel to somewhat less than *one-fifth* of what is now required for an equal degree of power. It has already, we are informed, been put to the test by the construction of an engine of about twenty horse power, which has for some time been driving all the machinery of an extensive foundry, with no larger consumption than we have just mentioned, and with every prospect of a considerably greater reduction being effected by some slight changes in the details. The motive power used is the common atmospheric air; and another great advantage of the new engine arises from a saving of space equal to what is usually occupied by the furnace and boilers of a steam engine.

If these things be so, it is impossible to calculate the results to which so important a discovery must lead. But we hasten to present our readers with the following description of the engine, which we have abridged from the newspaper already referred to:

Description.—The air-engines now working at the Dundee foundry, for which a patent was lately taken out, is the joint invention of the Rev. Dr. Stirling, of Galston, and of his brother, Mr. Stirling, engineer, Dundee.

The principle of the invention consists in alternately heating and cooling two bodies of air confined in two separate vessels, which are so arranged that by the strokes of two plungers, worked by the engine, the whole of the air contained in one of the vessels is sent to the lower end immediately over the furnace, and is consequently made quite hot, while the whole of the air contained in the other vessel is at the same time transmitted to the upper end, which is cut off from any communication with the furnace, and is therefore comparatively cold.

The expansion caused by the heat renders the air in the one vessel alternately much more elastic than that of the other; and the two ends of the working cylinder, which is fitted with a piston similar to that of a steam engine, being respectively connected with the two air vessels, a preponderating pressure is produced, by turns, on each side of the piston, which is thereby pushed to the opposite end of the cylinder; and so, by the alternate action of the plungers in the two air vessels, it continues a reciprocating motion, and is applied to turn a crank in the same way that a steam engine does.

It has been satisfactorily shown that this engine may be worked with very great economy of fuel as compared with a steam engine.

The principal means of producing the saving is this—that of the heat which is communicated to the air from the furnaces, only a very small portion is entirely thrown away when it comes again to be cooled; for, by making the air, in its way from the hot to the cold end of the air vessel, to pass through a chamber divided into a number of small apertures or passages, the great extent of surface with which it is thereby brought in contact, extracts from it in the first place, but only temporarily, the greater part of the heat, and afterwards restores it to the air on its passage back again from the cold to the hot end of the vessel. The process of cooling is finally completed by making the air pass through between a number of tubes in which there is a current of cold water, and thus far the heat cannot be made available again, but the portion which is abstracted in this way is very small.

As a sufficient expansive power could not be obtained in so small a space without great alternations of temperature from using air of the common density of the atmosphere, the air used is pretty highly compressed, and a much greater power is thereby obtained upon a given area of the piston.

A small air-pump, worked by the engine, is therefore necessary to keep up the air to the requisite density; but very little power is expended on this; all that is required of the pump, after the engine has been once charged, being to supply any loss of air that may arise from leakage, which is found to be very trifling.

The machine has been working occasionally for above six months, and it has been proved to be capable of performing advantageously the amount of work which the inventors had anticipated from their calculations and previous experiments. It has now for upwards of a month been driving all the machinery at the extensive engineering works of the Dundee foundry, which a steam engine of approved construction had hitherto been employed to do; and it has been ascertained that the expenditure of fuel is, *cœteris paribus*, less than one-fifth part of what was required for the steam-engine; but, as considerable improvements are contemplated in some of the details, it is confidently expected that a much greater saving will eventually be effected.

The whole machine, including the furnaces and heating apparatus, stands in about the same space that a steam engine of equal power would occupy without furnaces and boiler. Taking into account the saving of space, along with the vast economy of fuel, this invention must necessarily be of immense importance for all ordinary purposes requiring motive power. As an instance, it would reduce the expense of the power employed in driving machinery in Dundee alone, by at least £25,000 or £30,000 a year. But viewed in reference to the purposes of navigation, it must lead to results still more extraordinary, and will render a voyage to India round the Cape by machinery a matter perfectly easy of accomplishment.

THE EVILS OF WOOD PAVING.

The following from the London Herald of 23d October, will be read with interest by all who are engaged in preparing wooden pavements in the United States:

Mr. Editor: There is one awful drawback which accompanies wood paving, and if it be not obviated before the consequences are impressed upon the public mind, it will be likely to create so strong a prejudice against its universal adoption, that the blocks already down may have to be taken up again through legislative interference, and the use of wood *prohibited.*

Wood runs so rapidly to decay when subjected to humidity, that the best seasoned timber exposed to damp soon becomes decomposed and putrescent. The albumen contained in it, like similar matter in animal substances, is a susceptible germ of rottenness, which straits into existence the moment the combined energies of wet and warmth reach it, and then its desolating influence spreads with a rapidity that nothing can reach or control.

Wood paving is not only acted upon by these two fertile sources of decay, but its fibres soon become impregnated with pestilential *carburetted hydrogen,* which exudes through the gas pipes, saturates the surrounding earth, and being that very substance which escapes from animal and vegetable bodies when in a highly putrefactive state, it will have a tendency to assist rapidly in the decomposition of the *blocks.*

Long before half the streets of this metropolis are covered with such a pavement, the "*malaria*" that will arise from so extensive a mass of vegetable corruption will sweep off its inhabitants more numerously and with more unerring certainty than the "*plague of London,*" because every individual will be incessantly breathing the deadly venom floating in the poisoned atmosphere.

This is no imaginary theory. I have seen its deleterious and disastrous effects in those parts, where, from vegetable decomposition, human victims, thus infected, die like rotten sheep.

These lamentable results can, however, be prevented by the blocks undergoing a previous preparation in a solution of the "bichloride of mercury," which stops fermentation, renders vegetable albumen insoluble, hard, anti-putrescent, incorruptible, and therefore indestructible through the agency of decay.

Now this fact being no longer doubtful, parish boards will be neglecting a very sacred public duty if they do not in future stipulate that *all* blocks shall be so prepared, not only to preserve the general health, but from motives of economy, as it is admitted that it increases their durability fourfold.

Yours respectifully.

W. A. Kentish.

London, *October* 20, 1841.