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Title: Facts and Figures Concerning the Hoosac Tunnel

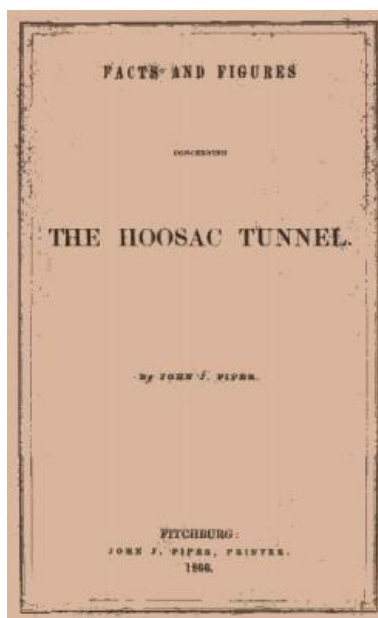
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*** START OF THE PROJECT GUTENBERG EBOOK FACTS AND FIGURES CONCERNING THE HOOSAC TUNNEL ***



FACTS AND FIGURES

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CONCERNING

THE HOOSAC TUNNEL.

By JOHN J. PIPER.

FITCHBURG:

THE HOOSAC TUNNEL.

In his inaugural address to the Legislature, Governor Bullock says, "There can be no doubt that new facilities and new avenues for transportation between the West and the East are now absolutely needed. Our lines of prosperity and growth are the parallels of latitude which connect us with the young, rich empire of men, and stock, and produce lying around the lakes and still beyond. The people of Massachusetts, compact, manufacturing and commercial, must have more thoroughfares through which the currents of trade and life may pass to and fro, unobstructed and ceaseless, between the Atlantic and the national granaries, or decay will at no distant period touch alike her wharves and her workshops. Let us avert the day in which our Commonwealth shall become chiefly a school-house for the West, and a homestead over which time shall have drawn silently and too soon the marks of dilapidation. Any policy which is not broad enough to secure to us a New England, having a proper share in the benefits of this new opening era of the West, be assured, will not receive the approval of the next generation."

This important recommendation is what the public had reason to expect from a man so keenly alive to the interests and welfare of the Commonwealth as Governor Bullock, whose close observation and discernment had long since discovered the danger, and disposed him to take a deep interest in any adequate enterprise by means of which it could be averted. The reasons which have induced His Excellency's convictions on this subject, and caused the apprehensions he has expressed, are very clearly set forth in the following articles from the Buffalo Commercial Advertiser of November 25th and 28th, 1865:--

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"To-day, the Western States are far more bountifully provided with avenues of transportation than the extreme East. This is peculiarly anomalous and inexplicable when we consider the boasted enterprise, wealth and shrewdness of New England, and the dependence which always exists upon the part of a manufacturing district toward that section which furnishes it with a market, and from which it obtains its breadstuff. It is fortunate for New England that it does not lie in the line of transit between the West and its market, or it would have drawn about its head a storm of indignation which it could not have resisted. The State of New York has contributed an hundred fold what New England has towards providing the required facilities of traffic, for the great West. Our Yankee friends have done much toward facilitating intercommunication among themselves, but very little toward direct communication with the West.

It is not a little strange that, with all the ambitious effort of Boston to become a mercantile emporium, rivaling New York, and with its vast manufacturing interest, it should have but a single direct avenue of traffic with the West. Yet such is the fact. The Western Railroad between Albany and Boston is the sole route now in existence except those circuitous lines via New York City or through Canada. Our down-east friends, usually so keen and enterprising, seem to have exhausted their energies in the construction of that road twenty-five years ago, and the consequence is that today the business interests of all New England are suffering for lack of the timely investment of a few millions.

Strange as it may seem, it is nevertheless true that Boston is now virtually cut off from its trade communication with the West for want of facilities of transportation. For weeks past the Grand Trunk Railroad has ceased to take Boston freight, by reason of its being blocked up with other through and way freights at Sarnia. The swollen tide of freight via the New York Central has exceeded the capacity of the Western Road between Albany and Boston, and the consequence has been felt in an increased charge by the New York Central of twenty cents a barrel above New York City rates, and, finally, that road has been obliged to refuse Boston freight altogether, simply by reason of the accumulation and delay occasioned by the inability of the Western Road to forward it to its destination. In like manner, Boston freight going forward by canal is hindered and accumulated at Albany. A similar state of things exists in regard to most of the westward bound Boston freight, as Boston jobbers are finding out to their cost. Merchants at the West, who purchase in Boston, are six and eight weeks in getting their heavy goods.

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We are informed upon reliable authority that flour can be sent from Chicago to New York, by lake and rail for \$1.90 per barrel, while very limited quantities only can be sent to Boston at \$2.25, and that by the "Red Line" \$3 a barrel is demanded.

New England depends upon the West for its bread, and also for its market for its imports and manufactures. If the state of things to which we refer, continues much longer, it will be compelled to go to New York both for its bread and its customers.

The West complains of New York, because, forsooth, it is tardy in enlarging its canals to meet the anticipated necessities of its future growth, and Boston has had the assurance to join in the thoughtless and unfounded clamor. Yet the great State of Massachusetts has supinely stood still for twenty-five years without making an effort to overcome the barrier between it and the great West. During that time the Western road has grown rich, and paid large dividends from a business which has been greater than it could transact, and to-day there exists an almost total blockade of Boston freight at Albany.

Surely, this does not reflect favorably on New England shrewdness and enterprise, neither does it tally with New England interest. Besides, it is detrimental to the business interests of the West. As the case now stands the fault rests with Massachusetts alone, in not providing railroad accommodations east of the Hudson river. It is also non-sense to assert, as some will, that the capacity of the Erie canal is inadequate. During the past season it has not been taxed to half its capacity, and yet it has found the Western Road unable to dispose of what Boston

freight was offered.

Western merchants and shippers ought to know where the fault lies, and to the end that they may be informed we have penned this article. Their true remedy is to buy in New York, and to ship their produce to that city, until Massachusetts shall provide adequate facilities of transportation.

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Boston is the natural eastern terminus of the great northern line of transportation, and we should have been glad to have seen her citizens and those of the great state of Massachusetts realize the fact. Their supineness, however, has lost to them for the present, if not forever, the great commercial prize which nature intended for them. It remains to be seen whether they will realize their position, and make an effort to retrieve their "penny wise and pound foolish policy."

"In a recent article we took occasion to point out the importance to the country at large of the construction of adequate facilities for the accommodation of the traffic exchanges between the different sections; and to call the attention of our readers to the remarkable fact that while the whole country, and particularly the West, had undergone a wonderful development requiring for its accommodation a corresponding increase of commercial facilities, that New England had stood still for a quarter of a century. The fact that a great State like Massachusetts, with a great emporium like Boston, should have but a single line of direct communication with the West, and that it should supinely stand still and refuse to add to it, notwithstanding the yearly demonstrations of its growing inadequacy, seemed so strange as to justify remark. The other fact that the transit of freight to and from Boston should be almost stopped by the inability of that single railroad to handle it--thereby increasing rates and compelling purchasers as well as sellers to go to New York--also seemed to be inconsistent with our traditional ideas of eastern shrewdness. Our remarks have received additional force by the fact, subsequently learned by us, that there are at the present time between four and five hundred car-loads of Boston-bound freight lying at Albany and Greenbush awaiting cars for its movement to its destination, while there exists no stoppage whatever of New York freight, thus demonstrating clearly the inadequacy of the Western road to answer the demands made upon it.

Since that article was penned, information has reached us to the effect that our Massachusetts neighbors have at last waked up to the importance of the subject, and are about to enter vigorously upon the work of providing another avenue of trade between Boston and the West, by what is known as the Greenfield route which embraces the long talked of Hoosac Tunnel. This great enterprise has enlisted the energies of the engineers and railroad men of Massachusetts for more than thirty years, with constantly varying prospects of success, and at last seems in a fair way of being accomplished.

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The high range of hills which runs along the whole western line of Massachusetts, for a long time baffled the efforts of railroad engineers; and the rival claims of competing routes distracted the popular mind, and delayed the construction of either. The most eminent engineers preferred the Northern, or Greenfield route involving the Hoosac Tunnel as being the most direct and feasible. In the struggle which followed, the Southern route was successful, and the Western road was built and opened in 1842. The other route was also constructed after a time, upon either side of the proposed tunnel, but for lack of the completion of that great work, has never been anything but an avenue for local travel and traffic.

The whole length of the proposed tunnel is 25,574 feet, and the estimated cost of construction is about three and a quarter millions. When we consider the vital interest which the citizens of Massachusetts have in the completion of this work, and the enormous interests to be served by it, the sum required seems absolutely trivial, and the withholding of it really parsimonious as well as foolish. We are pleased to learn that the State is at last about to lend a helping hand to this great enterprise, which will guaranty its speedy completion. This is an indication of wisdom upon the part of our neighbors, albeit it comes somewhat tardily.

Almost all the other States that lie between the great West and the Ocean have pursued a very different policy from that of New England, and with very favorable results. New York, which was the pioneer in the matter of internal improvements, not only built her great Canals, at a cost of over \$62,000,000, but also aided largely in the construction of her great through lines of railroads. It contributed to the Erie road \$3,000,000, which is now seen to have been a good investment despite the fact that it was entirely lost to the State. The same policy was pursued by Pennsylvania and Maryland, with equally happy results.

We congratulate our New England neighbors, and, especially, the citizens of Boston, upon the improved prospect of the completion of the Hoosac Tunnel, and the opening of another great route to the West, through, instead of over the mountains which lie between them and us. We trust that the obstructions which have existed, and still exist, in the channels of commercial intercourse between New England and the West will speedily be removed, never again to be manifested in freight blockades or threatened diversions of trade."

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The statements contained in these two articles are substantially true; and they are not only interesting, but important, as throwing much light upon a subject which will, doubtless, occupy much of the attention and time of the Legislature: for the Western Railroad managers have already opened their annual attack upon the Hoosac Tunnel, through their well known agents and tools, Bird, Harris and Seaver, who shamelessly advocate the entire abandonment by the State of an enterprise to the completion of which her word, and bond, and honor are irrevocably pledged.

The Western Railroad Company was organized in January, 1836, and its road was completed in 1847, having received aid from the State, during the period of its construction, to the amount of five millions of dollars. The terms upon which State aid was granted were very liberal, as they should have been; for the opening of this line of road had become as much a necessity to the development of the commercial and industrial interests of Massachusetts and the wants of her whole population, as the establishment of schools and churches had ever been to her moral or educational welfare. The involvement of the State in so great an enterprise was strenuously resisted by timid and narrow minded legislators; but the representations of those sagacious and

far seeing men who had devoted themselves to the work, prevailed, and Massachusetts was, thus early in the history of railroads, committed to a policy which has, within a few years, not only trebled her productions and wealth, but made her the first and foremost of all her sister States which are honored for enterprise, prudence and wisdom. Many of the short sighted legislators, who voted against granting State aid to the Western Railroad Company are now living, but we doubt if one can be found who is not ashamed of his action.

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The increase of business over the Western road since the first year of its operation, would seem incredible, were it not so thoroughly established by the figures of its early and later annual reports. Yet, with a double track nearly to Albany, and every means which ingenuity can devise, or money procure, at their command, its managers are unable to meet the demand upon it its capacity is nearly exhausted and was, long ago, so great is the pressure against our western border, from the overflowing granaries of the West. From a feeble association, begging for assistance at the doors of the State House, the Western Railroad Company has become a powerful corporation. Its certificates of stock, which, about the time the road went into operation, were a drug in the market at \$40, now command \$130 to \$150. Yet it is a fact that on the first day of last November, five hundred car loads of freight were delayed at Albany, and could not be transported over the Western road in less time than ten days. And the inability of this road to meet our public needs, and the demands made upon it, from the West, is no new thing; it has been so, for years, though four competing lines have opened since 1850, which, together, transport about the same amount of through freight as the Western road. The bridge over the Hudson at Albany, the completion of the double track, and better management might afford a temporary and partial relief. But if these improvements had been already effected, they would not have prevented the freight blockade at Albany last fall.

Should our friend of the Salem Gazette, or any of the editors who quote Mr. F. W. Bird, and write short paragraphs, more flippantly than intelligently, about the Hoosac Tunnel, chance to be at the freight yard of the Fitchburg Railroad in Charlestown, on the arrival of a train of New York Central Railroad cars, laden with flour, grain, or other products of the West, he would doubtless be as much puzzled to know how they got there, as he would be, if, standing at the heading of the tunnel, he should endeavor to reconcile his situation (half a mile from daylight) with the calculations, statements and predictions of Mr. Bird and other opponents of the Tunnel enterprise. If our friend were set down at the freight depot of the Worcester and Nashua Railroad, in Worcester, he would again be surprised to witness the arrival of freight-laden cars, bearing the same mark as those he saw at Charlestown. Upon inquiry of the freight agents he would learn that freight for Boston and Worcester, is transported from Schenectady, over the Washington and Saratoga road, and from Troy, over the Troy and Boston and Western Vermont, to Rutland, Vt., and thence, by the Rutland and Cheshire roads to Fitchburg, and from there to Boston and Worcester over other roads. By glancing at a map the intelligent reader will at once observe what a circuitous and lengthened line of communication between the New York Central road and the cities of Boston and Worcester is furnished by the connecting roads above named. The distance from Schenectady to Boston via Rutland is 247 miles, while it is but 217 by way of the Western road. The distance from the same point to Worcester by the Rutland route is 222 miles, and by the Western road only 172. Yet because the Western road has not capacity to do the business, the produce dealers of Eastern and Central Massachusetts are compelled to resort to this roundabout way of transportation as one of their means of relief. But this is not the only channel, nor the most indirect, which the irrepressible stream of Western trade with the East has created, as it approaches its natural outlet, Boston; as the Mississippi, scorning the narrow embouchure which satisfied its youthful flow, now pours its resistless torrents, through numerous passes to the Gulf. Besides that already described, there are three other lines competing with the Western road in the transportation of Western freight to Boston. These are the Grand Trunk, the Ogdensburg, and the Providence and Erie. Few persons know that cotton from St. Louis, for supplying the mills of Lowell and Lawrence, is unladen in Boston from vessels which received their cargoes at Portland, but such is the fact, the cotton having been transported over the Great Western and Grand Trunk roads.

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But these four long, and indirect lines, with their single track, are in the frame situation as the Western road; their capacity is exhausted, so far as through freight is concerned, this part of the business of all the four hardly exceeding that of the Western road.

To prove the utter incapacity of these five lines of communication between us and the West, to supply our wants, and meet the demands made upon them, we need only state the fact that in November and December last, many of the produce dealers and grocers in Worcester, were unable to supply their customers, on account of the detention of freight at Albany, Detroit and Ogdensburg. We may add, by way of illustration, that the immense loss of property occasioned by the burning of a large freight depot at Detroit, and by which so many New England consignees severely suffered, was one of the incidental consequences of the incapacity of these lines of New England railroads to do the work required of them. We shall have occasion to consider further the capacity of the Western Railroad, but the facts already given are sufficient to show the necessity of opening another through and direct route from the Hudson to Boston.

The next question to be considered, if, indeed, there can be any question about it, is how shall the new route be located? We have shown that another is necessary in order to accommodate through business, to meet the demands of the West, and to promote the prosperity of the entire State. But this is not by any means the whole argument. Central and Southern Massachusetts are covered with a net work of railroads, from Cape Cod Bay to the New York border, yet Northern Massachusetts, from Fitchburg westward, has but a single road, and that terminating at

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Greenfield, nearly forty miles from North Adams, where the broken line of communication is again taken up. Hence it is, that, while villages have become large towns, and towns populous cities, all over the rest of the State, this section has remained comparatively undeveloped; and the whole tier of towns lying along the line of the Vermont and Massachusetts, though steadily growing, through the energy and enterprise of their skillful artisans and mechanics, and the facilities afforded them by the last named road, have yet suffered and languished for want of the material so abundant in this undeveloped region between Greenfield and the mountain barrier beyond.

The water power of the Deerfield river is immense, its fall along the line of the Troy and Greenfield road being nearly six hundred feet; and this magnificent force is now idle, except at Shelburne Falls, though the finest privileges are scattered along the whole course of the river. Messrs. Lamson & Goodnow, who employ four hundred men at Shelburne Falls, in manufacturing cutlery, state that the Deerfield and North rivers, at that place, afford a one-thousand-horse power. Along the course of Miller's river, between Athol and Deerfield are also many excellent privileges unimproved. At Montague are Turner's Falls, on the Connecticut, with a power sufficient to operate the mills of Lowell, Lawrence and Manchester. All these splendid privileges only await the opening of the Tunnel route. Many of them would be at once improved were the road completed to the mouth of the tunnel. Messrs. Lamson and Goodnow state that they shall double their present force of four hundred men, as soon as it is open to Shelburne Falls.

Some fifteen or twenty miles from the Eastern end of the tunnel lie extensive forests of spruce and pine, through which a highway has already been surveyed, and which will be built to the tunnel, as soon as the road is completed to that point. The whole surrounding region abounds in lumber of almost every description, which would become very valuable when the road is built, to say nothing of the extensive formations of stone, soapstone and serpentine which are found there. Though the Deerfield meadows afford some of the finest farms in New England, the tillage land will not compare in extent with that along the Western road; but in every other respect the resources and latent wealth of the Tunnel route are infinitely superior to those of the Western line.

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Six years ago, and twenty-three years after the Western road was opened, the population lying west of Springfield within ten miles of the Western road on a distance of forty-four miles, was 42,050; while that west of Greenfield, within ten miles of the Tunnel line on the same distance, without any railroad at all was 32,146. According to the average rate of increase, the population along the Tunnel line, would be more than doubled in twenty-three years. Were the mountain barrier pierced, and communication opened with the West, and the magnificent water power of the Deerfield made available, who doubts that this population would be increased fourfold in that space of time: or that more than one town would spring up between Greenfield and the Hoosac, in a few years, which would rival North Adams in growth and prosperity; or that in far less time than it has taken Lowell to acquire her present importance, a larger city than Lowell would stand on the banks of the Connecticut at Turner's Falls?

With the requisite railroad facilities supplied, it is certain that the growth of a region so abounding in the most essential reliance of mechanical industry, as Northwestern Massachusetts, cannot be measured by the snail's pace which marks the progress of an agricultural district. The farmer's interests are indeed equally promoted with those of other industrial classes, by the opening of railroads, but these do not increase the number of farms or farmers within our borders, nor stimulate the growth of agricultural towns. It is mainly by her manufactures and commerce that Massachusetts has become so prosperous and wealthy. It is because the commercial and industrial interests of the whole State require it, that another route to the West has become a necessity; and it is because such immense resources yet remain to be developed, and such a gigantic power to be employed, in Northern Massachusetts that the new route must pierce the Hoosac Mountain, if it is possible and practicable.

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That it is possible to tunnel the Hoosac Mountain cannot be doubted by any sane person who has inspected the half mile already excavated. All of the eminent engineers, whose reports upon the enterprise have been published, say it can be done; nor do any of its opponents pretend to question its practicability. But in order to estimate properly the magnitude of the work, its possible and probable cost, and the time within which it can be done, it is necessary to know what has been accomplished in this department of civil engineering. Fortunately, this needed information is contained in Mr. Charles W. Storrow's very able report on European tunnels. Mr. Storrow is a distinguished civil engineer, who made a journey to Europe in the summer of 1862, by request of the Hoosac Tunnel Commissioners, and with the approval of the Governor and Council, for the purpose of examining the most important tunnels there constructed, and, especially, the one in progress under the Alps. He describes twenty-two tunnels which he visited, besides that of Mt. Cenis. Fourteen of these are in England, seven in France, and one in Switzerland. Two of them are upwards of three miles long, and many of them between one and two miles. Some of the shafts were nearly as deep as the central shaft of the Hoosac. Some of these excavations were made without the aid of shafts, others wholly by means of shafts, without working from the ends at all.

It might be supposed that in the construction of so many subterranean ways, in such different sections of the continent, almost every conceivable geological formation must have been traversed; and so it appears from Mr. Storrow's report. Granite, quartz, oolite, limestone, shale, slate, sandstone, gravel, sand, clay and marl, were the material through which with pick and spade, drill and shovel, the patient workmen made their way. Not unfrequently, more than half the varieties of rock and earth we have named were met with in the same tunnel. Sometimes the

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work would be interrupted and temporarily abandoned in consequence of an inundation of water, sometimes enormous masses of gravel and sand would work through into a shaft or tunnel, with disastrous and, in two instances, with fatal consequences. In many instances, work was discontinued for years, for want of funds, and then afterward renewed, with eventual success. In fact, about the average amount of those ordinary and inevitable obstacles which stand in the way of all great enterprises, were encountered by the engineers and contractors, in the building of these tunnels; but time, money, and skill, never failed to remove every difficulty. But we propose to extract, and condense from Mr. Storrow's report, a few of the main facts about some of the most important of these works; as the report has, not been read, or even seen by one in a hundred.

The "Box Tunnel" between Chippenham and Bath is more than a mile and three quarters in length. Nearly one half its length passes through a kind of limestone rock, and the other through clay, the clay end being lined with masonry. Five shafts were sunk, the deepest being about three hundred feet. "During the construction of this tunnel, great difficulties were encountered from the excessive quantity of water which inundated the works, sometimes even occasioning their partial suspension, and powerful means were required to overcome the obstacles. At one time the water fairly got the mastery over the machinery used for its removal, and it was only after an additional set of pumps worked by a fifty horse power engine, that the work could be resumed." This tunnel was built in five years, and its cost was about \$1,750,000, or about \$547 a yard. [16]

The Woodhead Tunnel, on the Manchester and Lincolnshire Railway, is upwards of three miles long. It was originally built for a single track, its dimensions being 14 feet wide at the head of the rails, and 18 feet 3 in. high from the rails to the under side of the arch; which are almost exactly the dimensions of the present section of the Hoosac Tunnel. After a few years of use, the increase of business required another track and so a second tunnel of exactly the same size was built parallel with the first. It is a double tunnel with a thick dividing wall between, pierced with twenty-one arched openings. Five of the original shafts have been kept open. The deepest of these is more than six hundred feet, and the least about three hundred. The rock through which the tunnel passes consists of millstone grit, a hard material, and shale, a kind of indurated clay.

The Kilsby Tunnel is more than a mile and a quarter long, and is built in Roman or metallic cement, under a bed of quicksand, from which it took nine months to pump the water, through shafts on either side of the sand bed. During a considerable portion of that time, the water pumped out was two thousand gallons a minute. The quicksand extended over 1350 feet of the length of the tunnel.

The Watford Tunnel is a mile and one tenth long, excavated entirely from chalk and loose gravel, the treacherous nature of which rendered it a work of great difficulty, streams of gravel and sand sometimes pouring through the fissures of chalk, like water.

The Netherton Tunnel is one mile and three quarters long. For its construction 17 shafts were sunk, their total depth being 3,083 feet, the least depth of any one being 63 feet, and the greatest, 344 feet. There were 36 faces to work at, and the progress at each face was 10 1-2 feet per month. The tunnel was completed in two years.

From these brief descriptions of a few of the tunnels in England examined by Mr. Storrow, one can form a pretty correct opinion of the ordinary difficulties in tunneling which have been met and overcome by the English engineers. Mr. Storrow says that tunnels are not considered there such formidable works as they have generally been esteemed in our Northern States. They are so common that they have long ceased to attract the attention of travelers, more than eighty miles in aggregate length being already in use. Mr. Storrow estimates the average progress made in the construction of the English tunnels at about thirty feet per month on one face, and that the cost per yard varies from \$125 to \$250, for ordinary tunnels; but where peculiar difficulties were met, the cost has reached to from \$500 to \$750 per yard. [17]

The Hauenstein Tunnel in Switzerland, one mile and an eighth in length, was from four to five years in being constructed. Two shafts were sunk, one 417 feet, and the other 558 feet deep. Portions of the shafts and tunnel were lined with masonry on account of the water and sand, and varying firmness of the strata passed through, all of which caused many difficulties and delays. The progress made between the intervals of obstruction, varied from fifty-six to one hundred and nine feet per month on a face. The cost was about \$400 per running yard.

The Nerthe Tunnel in France, is nearly three miles in length. For nine hundred and fifty yards of its length it is in rock cutting, where arching was unnecessary. The remainder is lined with masonry. Twenty-four shafts were sunk, varying in depth from sixty-five to two hundred and sixty-two feet. The work was completed in three years, and cost \$412 per running yard.

The Tunnel of Rilly, on the line from Paris to Strasbourg, is a little more than two miles long. Eleven shafts were commenced, two of which were abandoned on account of the abundance of water, the others were completed. In some of the shafts the water was so troublesome that it was necessary to use for curbs cast iron cylinders, five feet in diameter, and about three feet long, bolted together. The time consumed in the construction of this tunnel was three years and four months. It passes through a chalk formation, which was, in some places, so seamy, that great precaution was necessary to prevent the falling in of large masses. The cost was \$432 per running yard. [18]

Mr. Storrow visited and examined several other French tunnels, and his reports upon them are full of interest; but the abstracts given are sufficient to show the various obstacles and difficulties encountered by the English and French engineers in the prosecution of their work, as well as the

cost, and the success which rewarded their skill and perseverance. We now come to the great tunnel under the Alps, the most remarkable and gigantic enterprise ever attempted in civil engineering. Our facts in regard to it are derived from Mr. Storrows report, (which it will be remembered was made in November, 1862,) and from a very able account in the Edinburgh Review of July, 1865.

The object of this work is to connect France and Italy, by a continuous line of railroad, by piercing the great Alpine barrier which separates Savoy from Piedmont, and thus connecting the valleys of Rochmolles and the Arc. When the scheme was first suggested it seemed like a dream of enthusiasts. The distance would be more than seven miles. No shaft could be sunk, as it was estimated that it would take forty years to reach by that means the line of the axis of the tunnel. The gallery must then be constructed by horizontal cutting from the two ends. How were the workmen to breathe? What chasms, unfathomable abysses and resistless torrents might not be encountered? Was it certain that the two sections commenced from the opposite ends would not miss and pass each other in the middle of the mountain? But as the subject was more thoroughly discussed, these doubts and fears seem gradually to have faded away, and a conviction took possession of the public mind that such a tunnel was practicable. This conviction at last assumed form and development through the genius of Messrs. Sommeiller, Grattoni and Grandis, three young Italian engineers, who have won for themselves a nobler fame than that of either of the great generals who led their armies over the Alps. It was their good fortune to have secured the confidence of one of the most enlightened statesmen of modern times, Count Cavour, the energetic minister of Victor Emanuel, who, throughout all the doubts, perplexities and embarrassments attending the first stage of a new and bold enterprise, exposed to criticisms, sometimes ignorant, sometimes malevolent, on the part of politicians and professional men, gave these engineers his "constant, earnest and sanguine support and encouragement."

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It appears that an English engineer had patented a machine for drilling by steam, by means of which the drills were darted forward against the opposing rock with great velocity and force. But steam could not be used in the tunnel, where the great desideratum is a supply of fresh air. In the meantime Messrs. Sommeiller, Grattoni and Grandis had turned their attention to the question of compressed air as a motive power, and after a long series of experiments; gave to the world as the result of their joint ingenuity, a machine which acts simply by the force of air reduced to one-sixth of its ordinary volume, by means of the pressure of water. The quick perception and practical genius of our three engineers soon enabled them to combine their machine with the perforating apparatus above named, so that the compressed air took the place of steam, and performed its work perfectly. This combination is the machine which has been in successful operation under the Alps since June, 1861, and which, greatly improved and perfected by Yankee ingenuity, is about to be applied to the Hoosac Mountain.

Before proceeding to give some account of the Alps Tunnel, it should be stated that it is a national work, and not a commercial speculation. It was originally undertaken by Sardinia, within whose territorial limits it was then wholly included. The cession of Savoy to France brought nearly half the tunnel into French territory, and by the convention establishing the new boundary between France and Italy it was stipulated that this great national work should be continued, should remain exclusively under the control of the Italian engineers, and that France should pay into the Sardinian treasury its proportion of the cost, according to an estimate then made and considered final, and fixed at 3000 francs for each running metre, equivalent to \$550 for each running yard of its length in French territory. The work has remained, therefore, as it was, under the exclusive direction of M. Grattoni and M. Sommeiller, the engineers; and a French commission visit the work from time to time, by order of the French government, to view its condition, ascertain its progress, and vouch for the amount to be paid to Sardinia.

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It is hardly necessary to give a detailed description of the mode by which the compressed air is made to act on the perforating machines at Mount Cenis. The problem was how to get a constant equable supply of air compressed to one-sixth of its ordinary bulk. To effect this a reservoir was constructed at Bardonneche, elevated to a height of eighty-two feet above the works, which furnishes a moving force of two hundred and eight horse power, that being all which is required to operate the drills and ventilate the tunnel. The reservoir is supplied by a never failing mountain stream. From the compressing works, the air is conveyed in a pipe into the tunnel to the drilling machines; another pipe conveying water to wash out the drill holes. At the Fourneaux end of the tunnel, the reservoir is supplied with water by means of pumps.

The compressed air and water being ready for their work, an iron frame containing the perforating needles moves along the rails and confronts the rock which is to be attacked in the gallery or heading. The frame is armed with nine or ten perforating machines arranged so that the greatest number of holes can be bored in the center of the opposing mass of rock. To each of these are attached flexible tubes, one containing the compressed air which drives the drills, and the other water, which is injected into the holes as they are bored. The machine consists of two parts; the one a cylinder for propelling the drill, by means of a piston, and the other a rotary apparatus for working the valve of the striking cylinder, and turning the drill on its axis at each successive stroke. To bore eight holes of the required depth, the piston rod gives 57,600 blows. The action of each machine is independent of the other, so that if one of them is broken, or gets out of order, that of the rest is not delayed. The drills act at different angles so as to pierce the rock in all directions, and when the requisite number of holes have been drilled, the iron frame is pushed back, and the central holes are charged and exploded. The smaller surrounding holes are then charged and fired. At each blast, a strong jet of compressed air is thrown into this advanced gallery to scatter the smoke and supply air for respiration. Wagons are next pushed forward and

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filled with the fragments of broken rock, which are conveyed to the mouth of the tunnel and dumped down the side of the mountain. After each blast a fresh relay of workmen come in, and the same operation is repeated night and day.

One of the objections urged against the use of compressed air as a motive of force was, that if it were conveyed a long distance it would lose so much of its elasticity or expansive power, that it would be unavailable for any practical purpose. But this conjecture was confuted by facts. It was found that the loss of pressure at the ends of the conduit pipes where the air is applied, as compared with the pressure in the reservoir is only one sixteenth of the whole. M. Sommeiller calculates that in the center of the tunnel, a distance of three miles and three quarters from the reservoir, he will be able to apply the necessary pressure of six atmospheres. That M. Sommeiller is correct in this opinion appears to be conclusively proved by the latest accounts from Mt. Ceniz, [22] which state that the work is steadily progressing, that one half of the entire length would be excavated by the first of January 1866, and that at a distance of nearly two miles from the reservoir, the drills were operating with as much force as ever, and that there was no appreciable loss of motive power.

In the middle of the tunnel line beneath the rails, there is made at the same time with the excavation, a covered way or drain, in which are laid the pipes for gas, water, and compressed air. By this drain the waste water runs off, and it is also intended to serve as a means of escape for the workmen, in case of a fall of rock, or other accident which might block up the tunnel. Of course the tunnel must be continually supplied with fresh air along its whole length, as well as at the heading. This is easily done from the compressed air tube in the covered drain.

The whole length of the Mt. Ceniz tunnel is through rock varying in hardness, and veined throughout with quartz. In many parts it is liable to flake off, and in some places considerable masses have broken away during the construction. The full section of the tunnel is twenty-six feet and three inches wide, and twenty feet and eight inches high. The heading is carried forward about eleven and a half feet wide and nearly ten feet high. At the time of Mr. Storrow's visit the drilling machines were used only in the heading. The whole of the enlargement was done by hand labor in the ordinary way. The drills when brought up to the work drill eighty holes before any blasting is done. About ninety workmen are employed at each end. It required from five to seven hours to drill the eighty holes. Mr. Storrow visited a workshop where some machines were ready, and a large block of stone was placed in front of them for trial. The air was let on and a drill put in motion. In 6 1-2 minutes it drilled 5 1-2 inches. The engineer stated that they would make better progress than that at the rock in the tunnel. The average progress made by hand was [23] about sixty-six feet a month. That rate was about doubled by means of the machines; but since Mr. Storrow's visit these machines have been greatly improved, and the rate of progress latterly has been about two hundred feet a month.

The opening of the Mt. Ceniz Tunnel was commenced in October, 1857. Up to July, 1861, about 2142 feet had been excavated, the average progress being about sixty-six feet a month. The machines were then introduced, and at the present time, upwards of three miles have been excavated, and at the rate of progress now being made the tunnel will be completed in four years. Mr. Storrow's estimate of its cost is \$640 per running yard.

We have now placed before our readers such facts in relation to European tunnels, and more particularly in relation to that under the Alps, as will enable them to judge for themselves of the feasibility of completing the Hoosac Tunnel, and of the weight of the objections which are urged against it by the opponents of the enterprise, as well as the nature of the obstacles which have been encountered, and the means of surmounting them. We shall next present a brief history of the work, the progress made, the delays which have occurred, and the causes; and the sources, nature, and motives of the opposition which has been made to it. In the course of this history we shall have occasion to expose the gross misrepresentations and deliberate falsehoods which have, from time to time, been put in print and scattered broadcast throughout the State, for the purpose of sustaining and extending a great railroad monopoly, already too powerful, against the vital interests and actual necessities of the Commonwealth.

The first section of the Tunnel Line obtained its charter in 1842, under an act incorporating the Fitchburg Railroad Company, in spite of the strenuous opposition from Boston, Springfield, Pittsfield, and the whole power of the Western Road, which a few years before, had only obtained its charter by the aid of some twenty-five members of the House, from Northern Massachusetts, [24] who held the balance of power. Of these twenty-five gentlemen, to whom the State was thus early indebted, one was Hon. Alvah Crocker, of Fitchburg, whose name in connection with the Fitchburg, the Vermont and Massachusetts, the Troy and Greenfield roads, and with the Hoosac Tunnel, has since become "familiar as household words." The appeal of the late Judge Kinnicut, one of the pioneers of the Western line, contains this passage: "Assume if you please, that your route is better than the Southern or Western one; if you are willing to identify the Commonwealth with such an enterprise, you establish a precedent, and the Commonwealth, to be just, to be consistent with herself, must aid you in like manner. Nay, every other section. She will never be partial, as you suppose, but fair to all. She will certainly go as far as she safely can, to develop and increase her growth." Such appeals could not but prevail with fair minded men, and these twenty-five members, with a spirit of liberality and almost of self sacrifice, which should put to shame the narrow minded and selfish policy of the Western Railroad Company in regard to the Tunnel line, gave their voices and votes in favor of an enterprise, the commencement of which would otherwise have been deferred for years. The result was that by the first of January, 1843, the receipts of money by the Western Railroad Company, from the stock and scrip of the state amounted to \$5,565,610.86.

As stated above, the Fitchburg Railroad Company was authorized to build a road from Boston to Fitchburg, a distance of fifty miles, in spite of the strenuous opposition of the managers and attorneys of the Western Line. The intelligent legislator of 1866, who has passed over the Fitchburg Railroad, and observed the numerous trains of passenger and freight cars which daily follow each other over its double line of track, can but smile at the language of Mr Mills, a senator from Hampden, a little more than twenty years ago "Sir," said this zealous legislator, who, in his style and logic forcibly remind us of Mr. Bird, of Walpole, "a six horse stage coach and a few baggage wagons will draw all the freight from Fitchburg to Boston."

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It is hardly necessary to give details of the history of the Vermont and Massachusetts Road, and the struggles of its projectors against hostile legislation, and the intensified opposition of the Western line. Suffice it to say that this second section of the Tunnel Line, extending from Fitchburg to Greenfield, was commenced and finished, in spite of all opposition, without a dollar of that aid which Mr. Kinnicut said the State would have to furnish in order to be just and consistent. Its stock, which could be bought for \$9 a share, ten years ago, now commands upwards of \$40. Its gross receipts, last year, were \$390,085.79, and its net income, \$91,229.85. Its debt has been reduced from upwards of a million to one half that sum, and this year it has paid its first dividend.

The Troy and Greenfield Road was chartered in 1848, the same old elements of opposition being combined against, and fighting it at every step. The managers of the Western road clamorously declared that if this competing line were chartered, it would greatly diminish the security of the Commonwealth, for its investment in their road, and that if the State should be compelled to sell its stock after the granting of such charter, she would lose a hundred and seventy thousand dollars; while, at the same time, they affected to deride the Vermont and Massachusetts as a "pauper road," and the region it traversed as a "God-forsaken country!"

In 1858, the Western end of the Tunnel Line, extending from the Western base of the Hoosac Mountain to Troy, had been completed through the enterprise of the citizens of that thriving city and those of North Adams. The Vermont and Massachusetts was finished, and only thirty-seven miles of rail were needed to complete the direct connection of Boston with the Great West. Then was the time and opportunity for the State to have continued the same liberal policy which it had adopted toward the Western road, and to have extended her helping hand to the struggling corporation, which had undertaken the noble enterprise of piercing the barrier which was interposed between them and their "promised land." But their appeals for aid were met with sneers and derision; the work was bitterly opposed at every stage of its progress; the arts of demagogues, the cunning of lawyers, the fears of the timid, the credulity of the ignorant, and every conceivable influence which the well-filled treasury of the Western road could purchase were enlisted and combined against it. But, at last, perseverance and a good cause prevailed, and in 1854, the Legislature authorized a loan of the State credit to the amount of two millions of dollars, to the Troy and Greenfield Railroad Company, "for the purpose of enabling said company to construct a tunnel and railroad under and through the Hoosac Mountain, in some place between the 'Great Bend,' in Deerfield river, and the town of Florida, at the base of the Hoosac Mountain on the East, and the base of the Western side of the mountain, near the East end of the village of North Adams, on the West." But this loan was modified and restricted by such conditions, artfully introduced by the foes of the enterprise, that the work still languished, and its friends almost despaired even of ultimate success. The enabling act of 1857, would have greatly relieved them, but it was vetoed by Gov. Gardner. At the beginning of 1860, only \$230,000 of the two millions had been advanced.

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In the Legislature of that year, the original act was modified so that the balance of the loan might be divided between the road from Greenfield and the Tunnel, for the construction of both parts of the work simultaneously. Provision was at the same time made for the appointment, annually, by the Governor, of a state engineer, to examine the work, make monthly estimates, and impose such requirements upon the company and contractors as he and the Governor and Council might deem expedient. In the summer of 1860, Colonel Ezra Lincoln of Boston, was appointed State engineer, and resigning in the following autumn, on account of illness, was succeeded by C. L. Stevenson, Esq.

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In the meantime the company had contracted with Messrs. Haupt and Cartwright to construct the road and tunnel. The first named gentleman was one of the most eminent and experienced engineers in the country. Under the administration of the State engineers, Messrs Lincoln and Stevenson, the existing location was approved, and certain prices were established, upon the basis of which contracts were made for labor and material, and rapid progress was made with the work. Upon the accession of Governor Andrew in 1851, Mr. Stevenson was summarily removed, and Mr. William S. Whitwell appointed in his place. This gentleman at once proceeded to change the entire basis of work as established by his predecessors, reduced the prices under which extensive contracts had already been made, and cut down the estimates, so as to compel an entire suspension of the work. More than a thousand laborers and mechanics were discharged. Mr. Haupt states that at the time of this suspension, "the graduation of the whole line could have been completed in a few weeks. The iron and nearly all the ties and bridge material had been delivered; but little remained to be done except finishing the bridge and laying the track."

After a warm and protracted discussion of the subject in the Legislature of 1862, an act was passed, providing that the State should take possession of the road, tunnel, and all the property of the Troy and Greenfield Company. A commission was also authorized to examine the work, ascertain the feasibility of completing it, and report to the next Legislature. The commissioners appointed under this act, by Governor Andrew, were Messrs. J. W. Brooks and Alexander Holmes,

of Massachusetts, and Mr. S. M. Felton, of Pennsylvania, two of them being eminent civil engineers, and all three gentlemen of large experience in railroad affairs. They entered upon the duties of their commission at once, and having dispatched Mr. Storrow to Europe to examine the tunnels there, proceeded to take possession of the road and property of the Company, which was surrendered to them in September of the same year.

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The elaborate and exhaustive report of the Commissioners was submitted to the Legislature in the latter part of February, 1863. The closing paragraph expresses their "opinion that the work should be undertaken by the Commonwealth, and completed as early as it can be, with due regard to economy." The result of another discussion in the Legislature was the adoption of the recommendation of the Commissioners, and the responsibility of completing the tunnel and road was assumed by the State, in April of 1863, operations having been suspended nearly three years.

Since that time, the work has been conducted by the Commissioners, under the immediate superintendence of Mr. Thomas Doane, chief engineer, in such manner and with such progress as to give very general satisfaction to the friends of the enterprise, and promise its completion within a reasonable time. A very considerable portion of the labor and expenditures, since the operations were resumed, have been applied to preparing buildings and machinery, to the construction of a dam across the Deerfield river, in order to secure power to operate the tunneling apparatus, and to an enlargement and an alteration of the grade of the Eastern end of the tunnel, which had been excavated by Haupt and Cartwright.

But before proceeding to consider the present condition and prospects of the Tunnel, it is necessary to revert to the legislation of 1862 and 1863, in order to note the tactics of its enemies, who had by no means been idle, nor had in any degree relaxed their opposition. In fact, it was through this opposition that the act of 1862 was effected, the bill being a substitute for that reported by the committee, and generally regarded as a compromise between the friends and foes of the enterprise, though the latter believed they had, at last achieved a triumph, and exultingly whispered that the great Hoosac Tunnel scheme had received its death blow. They certainly did play their game with boldness and skill. While the contractors, Messrs. Haupt & Co., had actually applied all their private means, to the extent of more than \$200,000, to carry on the work, it was asserted that they were swindling the State and pocketing its funds to the tune of \$300,000. They proclaimed that they were in favor of the Tunnel, and only desired to take the work from the hands of swindling contractors and the control of a bankrupt and irresponsible corporation, in order that it might be assumed and prosecuted by the Commonwealth; but they were secretly confident, and not without reason, that a board of commissioners would be appointed who would report against the prosecution of the work by the State. Of the three gentlemen appointed, not one had expressed an opinion in favor of the enterprise, and Mr. Brooks, the president, was known to be opposed to it. Both of the two resident members were from localities where the prevailing sentiment was against the Tunnel. But this adroitness of the opposition was baffled, and its confident hope disappointed by the integrity and fairness of Mr. Brooks and his associates. The latter had no prejudices to conquer, and Mr. Brooks had not applied himself many weeks to the duties of his commission, before he was convinced of the feasibility of the work, and satisfied that the State ought to assume and complete it. When their report was made to the Legislature in 1863, the old opposition manifested itself with more intensity than ever, and the same honest gentlemen, who, the year before, were so friendly to the enterprise, and only wanted to transfer it from the hands of rapacious contractors and a bankrupt corporation, to the fostering care of the Commonwealth, threw off their masks, resorted to their old tricks and arts, and renewed their old clamor, against the "Tunnel swindle;" yet, vainly, as the result proved.

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The name of Mr. F. W. Bird, of Walpole, has been once or twice mentioned in this article, and not improperly, since he has gained that equivocal notoriety in connection with the Hoosac Tunnel, which attaches to the enemies of all great and noble undertakings. This gentleman has informed the public, that in 1847 and 1848, when he was in the Legislature, he "voted for everything that the friends of the Tunnel asked for." This action cannot have greatly embarrassed Mr. Bird during his subsequent career, since the only thing asked for by the friends of the Tunnel, during those two years, was the charter, granted in 1848. Mr. Bird further informs the public, that "in 1862, we were overruled by the committee, but we defeated them before the Legislature. In 1863, we were defeated, and the Legislature sanctioned the resumption of the work." Mr. Bird also boasts that, while a member of the Executive Council, he "did resist the assumption by the chairman of the commission, of irresponsible control over the work, and did something to prevent the building of the road from Greenfield to the mountain."

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In 1862, Hon. W. D. Swan represented the opposition to the Tunnel in the Senate. Mr. Bird, in a communication to the Boston Journal of Nov. 3, 1862, says:--

"The Tunnel fight was organized and directed by three members of the Third House.

The Tunnel matter came before the Senate late in the session, when many important questions demanded the attention of the Senate and rendered it very difficult for them to make personal investigations.

As to Mr. Swan, he very frankly declared that the whole subject was so new to him that he must rely upon us for his materials.

His published speeches upon the Tunnel, upon which his fame as a practical legislator is based by his friends, were written substantially by one of us beforehand, and afterward revised by all of us for the press.

We furnished every fact, made every calculation, prepared every table and arranged *every point and every argument logically and rhetorically.*"

One of the arguments which Mr. Bird confesses he and his associates "arranged," is expressed in the following extract from Mr. Swan's speech:

"I am aware, sir, that it may be said: 'You are going to stop a great enterprise.' No I am not. I have no such intention. I am in favor of the Hoosac Tunnel. If Massachusetts has granted her aid for the accomplishment of any great purpose, I am for going through with it. I am for going through with the Tunnel; but I am for going through with it understandingly; and if Massachusetts is to do the work, let us know that we are to obtain something like an equivalent for our expenditure.

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We say, then, to the corporation, we will send intelligent commissioners to examine the road and tunnel, and if the report to us, or our successors, next year, is favorable to this great enterprise, we will go on with it; we will bore a hole through the mountain, we will arch it, lay the track, and give you ten years in which to redeem the property."

But it is not necessary to quote further from Mr. Bird himself; he has been well known for years as an agent of the Western Railroad Company, and the leader of the combined elements of opposition to the Tunnel. He is a man of ability, bold, and adroit in his management, but entirely unscrupulous in the choice of means to effect his objects. As a lobby member, as newspaper correspondent, as pamphleteer, as councillor, and in the numerous other characters which his Protean genius has enabled him to assume, he has, by fair means and foul, diligently adhered to his boastful promise that he "should not desist from opposition till the work is stopped;" and he has lately reiterated his purpose of keeping that pledge, "with the help of God." Those who know Mr. Bird well, entertain no doubt that he will continue to do his best to stop the work, whether with or without the Divine assistance, and that he will literally fulfill his promise, since the work will, undoubtedly, be "stopped" when it is finished.

One other gentleman has been associated with Mr. Bird, as a leader of the opposition to the Tunnel enterprise, who, perhaps, deserves a passing notice in this article, Mr. D. L. Harris, President of the Connecticut River Railroad. He has less ability than Mr. Bird, but much more practical knowledge of railroad engineering and management. It has apparently been a part of the duty assigned him, to furnish Mr. Bird with the texts for his pamphlets and newspaper articles, and to supply such information, from time to time, as that gentleman's inexperience and ignorance required. He has also emulated the example of his associate by contributing to the anti-tunnel literature of the newspapers. While a member of the House, a few years since, he had the bad taste, in the course of discussion, to quote from one of his own anonymous articles. Upon being accused of being the author of his quotation, he roundly denied the charge, but was convicted by the production of his own manuscript. His seat was vacant during the remainder of that session. Whether this desertion of his post was occasioned by a conviction in the minds of anti-tunnel men and the Western Railroad managers that the exposure had impaired the influence of their agent, or whether he was impelled to retire by the stings of that remorse which a certain class of men experience only when they have been detected in a falsehood, the writer of this paper is unable to determine.

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The Boston Advertiser of October 5, 1865, contains an article over Mr. Bird's signature, which was soon after published in the form of a pamphlet, and profusely distributed throughout the State, having for a title, "The Hoosac Tunnel: its Condition and Prospects." It appears, that a few weeks previous, Mr. Bird and Mr. Harris visited the Tunnel locality, and this pamphlet purports to be the result of Mr. Bird's "observations." It has been extensively read, and has, doubtless, inspired the minds of many timid and ignorant persons, with honest doubts of the practicability or expediency of ever completing the Tunnel. It is considered "smart" by those who mistake denunciation and abuse for wit, and baseless assumption for truth. To those who are familiar with the history of the Tunnel, and who understand its present condition, it is more remarkable for misrepresentation and disingenuousness, than even any previous effort of its author.

He introduces his subject by stating that the commissioners, "since they commenced operations, have had unlimited and irresponsible power, and that, for all failures and blunders, they, and they alone, are responsible;" yet, within a month from the penning of this assertion, Mr. Bird boasted that he did something, while a member of the Council, to prevent the building of the road from Greenfield to the mountain.

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The obstacles encountered at the West end of the Tunnel, which had been foreseen and understood from the beginning, by the friends of the enterprise, appear to have first engaged the observation of our inspector, and are represented as a startling and recent discovery. The well known effect of water upon the soft material in this locality is described as "rock demoralized" into "porridge," and this "porridge" is represented as a difficulty of such serious nature that "the managers are at their wits' ends."

Mr. James Laurie, an eminent civil engineer, employed by the commissioners to make a survey, in his able report in January of 1863, says "the portions of the Hoosac Tunnel embraced between the Western entrance and the present shaft, a distance of 3008 feet, will, from all indications, be the most troublesome and expensive. The material consists of gravel, clay, sand, detached beds of quartzose sandstone, some of which is partly decomposed, and limestone. The whole formation is full of springs. *However bad the material may prove*, this part, under proper management, can be completed long before the rest of the Tunnel." Mr. Bird says, "Common men, and some uncommon men, too, look upon these difficulties as insuperable." Those who can, for a moment, weigh the opinion of the accomplished and experienced engineer, Mr. Laurie, with that of Mr. F. W. Bird, of Walpole, may relieve their doubts by referring to Mr. Storrow's report on the European tunnels, in a very large proportion of which the most formidable kind of "porridge" was encountered and subdued.

Mr. Bird observed the Western shaft. The work at the Western face of this shaft was suspended

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on account of imminent danger of "porridge" and our observer's most important criticism here, is that they were, at the time of his visit, advancing on the Eastern face of the shaft, at the rate of only "thirteen feet weekly," that is fifty-two feet per month. Mr. Storrow says the average progress in the European tunnels was about thirty feet per month.

The Central shaft was visited, and Mr. Bird does not appear to have observed anything which demanded an expression of his disapproval. The work was progressing at the rate of twenty-two feet a month, and the pumps gave a gallon and a half of water per minute. In constructing the Kilsey Tunnel, in England, Mr. Storrow says that during a considerable portion of nine months, the water pumped out was two thousand gallons a minute.

Mr. Bird's report of progress at the East end was certainly very encouraging the heading having been advanced successfully during the two months preceding his visit, at the rate of sixty-five feet per month, and the work was being pushed with vigor and activity.

The dam across the Deerfield next claimed the observation of the inspector, who appears to have regarded it with much surprise, both on account of its cost and because it was thrown across a fitful mountain torrent, so feeble at the time of Mr. Bird's visit, that it was only allowed to run by night, for the reason, as he "guessed," that "if it was allowed to run by day, under the hot sun, it would all evaporate before it reached Shelburne Falls!" This *guess* is associated in the same paragraph with an assertion that "there was not then in the river, and had not been for some weeks, and has not been since, (unless they have had heavy rains,) water enough to give under a thirty feet head, twenty, or even a ten-horse power for twenty-four hours a day." It is as well established a fact that the Deerfield river was never known to be so low as at one time during last year, as it is that wells all over the State were dry last autumn, which were never dry before. Yet, at the time of Mr. Bird's visit, when the river was lowest, Mr. Doane, the chief engineer, states that the water was running at the rate of "thirty-four cubic feet per second. On a head of thirty feet this gives, theoretically, one hundred and sixteen, and, practically, eighty-seven horse power." The intelligent reader will not be at much loss to decide whether he will rely upon the guesses, observations and loose assertions of Mr. Bird, or the record and word of the careful and skillful engineer. Mr. Bird says, "it is discreditable that the precise quantity of water has not, so far as we know, been ascertained by actual measurement." Such measurement had been made, and Mr. Bird might have known it if he had taken pains to inquire of Mr. Doane or Mr. Hill.

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The testimony of Messrs. Lamson & Goodnow, of Shelburne Falls, as to the power and reliability of the Deerfield river, is that "this is the first season we have been at all troubled on account of the scarcity of water, but not as Mr. Bird stated it. We have not been compelled to stop our mills except one half day, and we employ four hundred men on cutlery."

The same gentlemen (Messrs. Lamson & Goodnow) state that the Deerfield and North rivers furnish water enough, at Shelburne Falls, for one thousand horse power. The North river is a small stream, and deducting its contribution together with that of the brooks which find their way into the Deerfield between Shelburne Falls and the mountain, at the high estimate of two hundred horse power, and there remains to the Deerfield alone a force of eight hundred horse power, which is the estimate made by the commissioners. The measurements made by Mr. Doane and his assistants confirm their accuracy. Yet Mr. Bird who boasts of "an intimate acquaintance of over thirty years with water power," asserts that for such a privilege, "ten thousand dollars would be an extravagant price!" Would he sell even the puddle which works his paper mill at Walpole, and which, we presume, has afforded all his knowledge of water power, for half that amount?

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The writer of this article has not enjoyed "an intimate acquaintance of over thirty years with water power" but he has resided exactly the same length of time as Gov. Gardner said he had been a temperance man, in the manufacturing town of Fitchburg, and during that time has learned something about its *thirty-four* water privileges and *five hundred and eighty-two feet head* of water which they command, on the little Nashua and its tributaries. His knowledge of this water power enables him to exhibit the gross absurdity of Mr. Bird's efforts to dry up the Deerfield. One of these tributaries, which is less than eight miles long, affords a privilege with a head of twenty-one feet, of from seventy-five to one hundred horse power. The reader can form his own conclusions, by comparing this brook with that "fitful mountain torrent," the Deerfield river, which has its sources in the town of Stratton, Vt., flows southward to the foot of the Hoosac Mountain, then turning eastward, finds its way into the Connecticut, near Greenfield, traversing in its course, a distance of more than sixty miles. The length of the "fitful torrent" above the Hoosac dam, is about forty miles, and in that part of its course it is swelled by the contributions of numerous tributaries, several of which are respectively from twelve to eighteen miles long. A shrewd Yankee, who is not a civil engineer, and has not even had the experience of running a small paper mill, might "guess" that such a stream would furnish, with a head of thirty feet, as much as an eight hundred horse power.

But it is not eight hundred horse power, nor four hundred that is required to operate the drilling machinery and ventilate the tunnel; for two hundred and eight horse power is all that has ever been used or needed at Mt. Cenis. This leaves a pretty wide margin for drouths, evaporation, and other contingencies.

In his observations upon the power required, Mr. Bird becomes severe and sarcastic. He assails the opinion of the commissioners that "the loss of power by carrying the compressed air through five miles of pipe will be quite insignificant," and after asserting that there are no data by which to test the correctness of this opinion, and claiming "some experience in such matters," prefers that such an "experiment". should be tried with somebody's money besides his own. It is

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gratifying to learn from Mr. Bird, himself, that he has had experience in the matter of compressed air as a motive power, and that a "cussed furriner," as he elegantly phrases it is not to be allowed to bear off the palm of this great discovery uncontested. Doubtless M. Sommeiller will yield to the superior science and sagacity of Mr. Bird; but our countryman should lose no time in informing his fellow citizens of his investigations, experiments and success in arriving at the conclusion that compressed air cannot "be carried through five miles of pipe without a very serious loss of power through friction, leakage, &c." But, unfortunately for this view of the case, there are data establishing the fact that compressed air has been conveyed through more than two miles of pipe at Mt. Cenis, and then operated the drills without any appreciable loss of power. If there is no loss in two miles, how can there be in five? It is no longer an experiment, but an established scientific fact.

The size of the present excavation next engages the attention of our observer, and he calls the commissioners to account because they have not followed their own recommendation to excavate the Tunnel to its full dimensions as the work proceeds. Since their recommendation was made in the winter of 1863, the commissioners have had much experience, and the price of labor has doubled. Only a small number of men can work on a heading, but when a heading has been advanced a large number of workmen can follow rapidly in enlarging the excavation, and will soon overtake those engaged on the heading. At Mt. Cenis, the pneumatic drills are only used on the heading, and the enlargement is done by numerous laborers with hand drills. It is apparent that the commissioners have been actuated solely by motives of economy in prosecuting the heading alone, at the present high rates of labor. The work of enlargement is comparatively easy and rapid, and might well await a decline in the cost of labor, though it must be admitted that the importance of completing this noble work, ought to outweigh the consideration of any possible cost.

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On the subject of pneumatic drills, Mr. Bird is emphatic. He says, "no intelligent man puts the slightest confidence in the successful working of any borer, or drill, in the rock of the Hoosac Mountain, unless operated by hand. In a strictly homogeneous rock, machine drills might work, but in a rock like the Hoosac, where the drills, working generally in a comparatively soft material, are liable at any moment to strike veins of quartz, and where a part of the hole will be in the slate and the rest in quartz, no machine drill has yet been found to stand." This reckless and false assertion is made in utter defiance of Mr. Storrow's report and all other authorities upon the Alps Tunnel, which has now been excavated nearly four miles with machine drills on the heading. Mr. Storrow says that masonry is used because the rock "*is not* homogeneous in character. I stood at the front of the machines, watching them for three quarters of an hour. One drill was driving directly into hard quartz, advancing very slowly, and making the sparks fly at every stroke. Others working in softer spots, were cutting rapidly."

Mr. Bird has much to learn about pneumatic drills, and, without going beyond the borders of Massachusetts, he can see a drill operate by compressed air, so indifferent as to the character of the rock it works upon, that it will penetrate the hardest granite and the composite rock of the Hoosac with the same facility, and at a rate which would astonish even M. Sommeiller.

The figures upon which Bird bases a "calculation" as to the time of completing the Tunnel, are as far from being correct as his general statements are from the truth. One example is enough to illustrate, and by this the reader may fairly judge what the "calculation" is worth. He says the total length of the Tunnel is 24,586 feet, when the fact is that it is 25,586 feet. This is no mistake of the printer, for the figures repeatedly occur in the pamphlet, and always the same; and it is with this gross blunder that the "calculation" sets out. The truth is that any careful reader of this article, is a Better judge of the whole subject than Mr. Bird, because he will have reliable dates, facts and figures, by the aid of which he can make a calculation for himself, or form an opinion as to the time within which the work can be done, which will be quite as likely to be correct as any, "I undertake to say," of the oracular Bird.

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On the 1st of December, 1865, the penetration at the East end was 2904 feet; at the East heading of Western shaft, 414 feet; West heading of same shaft, 280 feet; at West end heading, 756 in the whole, 4354 feet. The central shaft had been sunk two hundred and twenty feet. The average progress on this shaft during the months of August, September, October and November was 18 3/4 feet per month. Assuming this for the average in December, January and February the shaft was 275 feet deep, on the 1st of March, the whole depth to grade being 1037 feet. The average progress on the East face of Western shaft was sixty-three feet per month. Allowing that average for December, January and February, and the penetration on this face is now more than 600 feet. The average on East end was forty-four feet. Add this average for the last three months, and the penetration at this end is now 3036 feet, and the total penetration 4675 feet, with 575 feet of shaft sunk.

Mr. Laurie states in his report that in the ten tunnels which he names, in this country and Europe, the average progress made on each face from a shaft was thirty-eight feet, and on the end faces fifty-four feet per month. Let the intelligent man who forms opinions and conclusions for himself, compare the statistics which have been given in the course of this writing in relation to tunneling in Europe and in this country, and then, taking into consideration the inadequate means which have, until recently, been applied to the Hoosac enterprise, and surveying the progress which has been made whenever the work was prosecuted with vigor, let him judge how soon, and at what cost, the Tunnel may be completed, even without the aid of machine drills.

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The concluding pages of the pamphlet contain a general charge against the commissioners, or rather Mr. Brooks, the chairman, of mismanagement. The only "illustrations" of this charge are, first, that Mr. Brooks declined to sell the 3,000 tons of railroad iron which had been purchased,

and distributed along the graded track from Greenfield to the mountain, and "other saleable property;" second, that he has "disregarding the advice of others, whose judgment was entitled to weight, put his own constructions upon the acts of the Legislature relating to the powers and duties of the commissioners, in opposition to the construction and in defiance of the orders of the Executive Council;" third, he has seriously contemplated "the amazing folly of building the railroad from Greenfield to the mountain!"

It is gratifying to know from more reliable authority than the intimation of Mr. Bird, that Mr. Brooks did justify the opinion which is generally entertained, of his good sense and judgment, by contemplating that "amazing folly," and the only evidence of serious mismanagement on his part, which Mr. Bird can produce, is that he did not, at once execute his purpose, lay the rails and put the road in operation from Greenfield to the mountain. The additional facilities which the completion of this road would have afforded for expediting the work, and reducing its cost, are too obvious to be enumerated. The extent and value of the resources and material of the region through which the road passes, and the importance of their speedy development, have already been shown. The distance from Greenfield to the mountain is about thirty miles, by a very uneven and hilly road; and yet, in 1861, the amount of freight transported over it, was 12,350 tons, and the freight and livery receipts were nearly \$50,000. With a good railroad in operation, in the place of a rugged highway, and the summer travel which it would induce, there can be no doubt whatever, that the local business alone would afford receipts very far beyond the estimates, upon which it is presumed the offer of the Fitchburg and Vermont and Massachusetts companies to take a lease of the road was based, that is, \$21,500 a year more than running expenses.

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Whether Mr. Brooks is responsible for the delay in putting the road under contract, and for the waste and damage which have resulted from a neglect of three years, or whether Mr. Bird did succeed, while a member of the Council, in procuring an absolute injunction, the public cannot now well determine, for, as the reader has already observed, Bird declares that Mr. Brooks had absolute power, that the whole responsibility rests with him, and yet boasts that he "did something" towards preventing the completion of the road.

Since the foregoing pages were written, Mr Bird has published and distributed another pamphlet, the remarkable audacity of which challenges our attention. If one half of the assertions it contains were true, if one half of its calculations and estimates could be demonstrated, the Hoosac Tunnel ought to be abandoned at once, as the greatest folly of the nineteenth century, and its ruins sacredly preserved as a monument to coming generations of a monstrous popular delusion: and if the epithets swindlers, tricksters, liars, plunderers, thieves, ingrates, rascals, traitors and fools which Mr. F. W. Bird, of Walpole, so freely and indiscriminately applies to everybody who has advocated or favored the building of this Tunnel, were deserved; then a very large proportion of several legislatures, a majority of several executive councils, and many distinguished citizens and state officers, including the late governor and attorney general, ought to be lodged for the remainder of their days either in the state prison, or the asylums for idiots.

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This last publication of Bird's is mainly a repetition, "with embellishments," of his previous pamphlet, with the addition of a preface purporting to be the history of tunnel legislation to the beginning of the present year, a string of calculations and conjectures as to the capacity of the Western Railroad to transport (provided it were properly managed, and the double track completed) all the Western freight and travel for all future time, and several pages of coarse denunciation of Mr. Brooks, chairman of the Tunnel Commissioners, and the manner in which he has managed the trust committed to him. The subdivisions of these subjects are:--

1st. Tunnel Legislation. 2d. Abuse of Mr. Brooks. 3d. Power Drills. 4th. The Deerfield Dam. 5th. "Porridge." 6th. The Western compared with the Tunnel line. 7th. The Possible Capacity of the Western Road. 8th. The Cost and Time required to Complete the Tunnel.

It is not our purpose to expose *all* the misrepresentations and perversion of facts to which Mr. Bird has resorted in the treatment of his subject; but only enough of them to show what disreputable means the foes of the Tunnel are capable of using in order to deceive the community. Late results in the progress of work at the mountain, and in the perfection of machinery, will enable us to illustrate the utter absurdity of several of the most important of Mr. Bird's calculations, or rather speculations, and enable the reader to judge what reliance can be placed upon any of them.

In a review of the history of tunnel legislation, as given in this pamphlet, passing by the frequent charges of "packed committees," "deceived legislatures," and "tricks of legislative legerdemain," we come to an account of the Act of April, 1862, by which it appears that the bill passed was not materially different from that prepared by Mr. Bird, and offered by Mr. Swan. It was entitled, "An Act for the More Speedy Completion of the Hoosac Tunnel," yet the anti-tunnel league considered its passage "a substantial defeat of the scheme," because they believed that Governor Andrew "was opposed to the Tunnel," and would appoint commissioners whose opinions were in harmony with his own. And the virtuous and honest member of the "Third House," through whose adroit management, a bill bearing a title so inconsistent with its purpose, was framed, affects a pious horror of legislative trickery!

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Whatever Mr. Bird may have to say upon any of his various topics, he never forgets to abuse Mr. Brooks; "Carthago delenda est" at any rate; and he returns to the assault at the beginning or end of almost every chapter, with renewed spitefulness. On page 21 it is represented that Mr. Laurie,

the engineer who had been designated by the governor and council to make surveys, had a personal interview with Mr. Brooks, and that the following colloquy took place:--

"I am here, Mr. Brooks, to make the surveys ordered." "What order? What surveys?" "The surveys ordered by the governor and council." "I have ordered no surveys and want none. When I need your services I will send for you. Go about your business."

Even those who have never reckoned Mr. Bird a man of strict veracity will be surprised to learn that this story is a pure fabrication, that no such conversation, and no such interview ever took place. The communications between the two gentlemen were a letter from Mr. Laurie, who was at Hartford, and a reply by telegraph from Mr. Brooks, who was in Boston. Mr. Laurie wrote, "Presuming that you wish me to make these surveys, I will come to Boston," &c. Mr. Brooks telegraphed,--"The new survey has not been acted upon by commissioners."

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On the same page of the pamphlet it is stated that Mr. Brooks, not being satisfied with Mr. Laurie's conclusions, "demanded the suppression of some portions of the report, and the modification of others." "Mr. Laurie, after making such concessions as he could honestly make, resolutely refused to yield to Mr. Brooks' imperious demands upon material points." Now' this representation is just as false as the story about the colloquy. Mr. Brooks did not make any such demands. An exposure of both these fabrications is made in a communication to the Boston Advertiser of March 10th, which contains copies of all the correspondence on these subjects, between Mr. Brooks and Mr. Laurie.

On page 23, we are requested to "look at the item of the amount of the people's money applied by Mr. Brooks to the payment of Mr. Haupt's debts," than which "there never was a more atrocious swindle." By referring to the records of the executive council for May, June and July of 1863, it will be seen that the subject of paying these claims was referred to a committee of the council, consisting of Alfred Hitchcock, F. W. Bird and Joel Hayden for special investigation. Upon the question of the meaning and intent of the Act of 1862, and its legal interpretation, the committee took counsel of Dwight Foster, Emory Washburn, and Isaac R. Redfield, lawyers who had been designated by the governor, as a commission to whom should be referred such questions upon legal points as might arise in prosecuting the work, and in accordance with the advice of these gentlemen, and their own convictions, a majority of the committee (Mr. Bird of course opposing) reported that the claims ought to be paid. A majority of the council and the governor being of the same opinion, the claims were paid. The part performed by Mr. Brooks and his associates was merely to audit and allow them. They could not draw a dollar from the state-treasury for any purpose except upon the governor's warrant. If the payment of these claims was "an atrocious swindle," then the governor, a majority of his council, and the three lawyers, as well as the commissioners, were the atrocious swindlers. It would appear that the incorruptible and virtuous Bird was the only person about the state house, at that time, who could make any pretension to honesty or fidelity.

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The motives of Mr. Bird, in these unscrupulous attempts to disparage the judgment and asperse the character of Mr. Brooks are best known to himself, but it will be remembered that when Mr. Brooks received his appointment he was thought to be opposed to the tunnel enterprise. He has proved to be one of its ablest and most resolute friends. The disappointment and grief of Mr. Bird may have been rendered more poignant by his defeat last fall as a candidate for the honor of representing his district in the Legislature, a defeat which he has publicly attributed to the opposition of Mr. Brooks.

The only noteworthy thing in this pamphlet concerning the Deerfield Dam, is an absurd attempt to misrepresent the commissioners' report of its cost. They state that it is \$125,919.74. It was finished last fall. Mr. Bird says "the dam will have cost when finished, at least \$275,000," and thereafter to the end of his chapter on that topic, assumes that sum to be the actual cost. He obtains these figures by adding to the real cost of the dam, that of all the canals; buildings and machinery which are being constructed between the dam and the tunnel. He might, with equal propriety, have added the cost of the Walpole meeting house, or that of his own paper mill. In a supplementary note we are informed that the dam across the Connecticut at Holyoke, 1017 feet long, cost about \$115,000. We may assume that Mr. Bird applies these figures to the present dam, and not to the one which gave way some years since. The cost of the first dam is not given, and the inquisitive reader might ask what that was, or whether the \$115,000 should not with more propriety be considered as an expenditure for repairs of an old dam rather than the cost of a new one. However that may be, the cost of labor and material at the time the new dam was built, or the old one repaired, was less than one half of the cost of labor and material, at any time since the Deerfield dam was commenced. It is possible that a cheaper structure might have been built, which would answer the purpose, but the commissioners and their engineers, warned perhaps, by the Holyoke disaster, may be excused for constructing a work that will not be washed away, though done at some additional cost for its security.

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If there is one thing which Mr. Bird absolutely loves it is "porridge," and he returns to this topic with great vivacity. It may be briefly stated that in December last, after the heading from the West portal had been carried forward 111 feet, progress was stopped by an inlet of water from a brook overhead and a spring below. This water operating on the rotten rock, produced what Mr. Bird calls "porridge." It was a difficulty which had been foreseen, but was never regarded by the commissioners or engineers as of a formidable character. Soon after work was suspended at this point, responsible parties came forward with an offer to construct an arch lined with solid masonry through the "porridge" to the Western shaft, a distance of about 2000 feet, for less than \$700,000; and to furnish satisfactory security for the performance of their contract. The offer was declined.

When Mr. Bird learned that work at this point was suspended, he became jubilant. He has filled ten pages of his two pamphlets with "porridge," and excited some fears on the part of his friends that the stuff has found access to the thinking part of his own person, and "muddled" it badly. But of this the reader may judge by noting on page 34 of the last pamphlet an assertion that the distance from the West portal to the shaft is all demoralized rock; and on pages 36 and 37 a calculation that it will cost \$5,430,300 in gold, to construct this section of 2000 feet! But "porridge" is unreliable, and that at the Hoosac, has given out; and so Mr. Bird's hopes and calculations, which were based upon it, fall to the ground. Work has been recently resumed, and twenty-seven feet beyond the point at which it was discontinued, solid rock was reached, in which the workmen are now drilling and blasting without molestation or fear of "porridge." The brook is passed, and in the artesian well about half way from the portal to the shaft, solid rock has been reached at 130 feet above grade. "Porridge" has served its friends a mean trick and "well might *Mr. Bird* exclaim in the language of Woolsey (slightly altered,)"

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"Had I but served the truth with half the zeal
I served my *porridge*, it would not, in my need,
Have left me naked to mine enemies."

The theoretical capacity of the Western Railroad is a fruitful subject for speculations and array of figures, but facts and demonstrated truths are what practical men wish to deal with. A comparison of the Tunnel and Western lines is of no significance, when both are urgently needed. In 1847, when the Western Road was opened to Albany, it transported from Albany to Boston 88,438 tons of freight, and last year, only 87,254 tons, 1184 tons less. Yet in 1847 it had no double track, and in 1865 it had 116 miles of double track. The greatest tonnage was 116,288, in 1864: and that same year, 588,207 tons of through Eastward freight arrived at Albany and Troy, and the total amount to those two points was 3,866,025; nearly three fourths of which was transported on the Erie canal, an institution which is entirely left out of Mr. Bird's calculations. More than six million tons of freight were brought from the West last year to the Hudson river. Of this vast amount only a little more than one sixtieth found its way to Boston over the Western Road. In 1864, 471,919 tons of freight were transported from Albany and Troy to Boston by the circuitous routes we have mentioned.

Mr. Bird makes a calculation that the capacity of the Western Road can be so increased, by finishing the double track, increasing the rolling stock and adding special auxiliary force to draw its freight trains up the steep grades, that it can bring 1,797,120 tons of freight in a year. It may be presumed that he means both local and through freight. But his "calculation" is as baseless and flimsy as any of his numerous statistical bubbles which have already been pricked. The best answer to his whole argument is contained in a memorial of the Albany Board of Trade to our legislature, with some extracts from which, our review of this topic will be closed. But a few more of Mr. Bird's misrepresentations must first be exposed. On page 56 he represents Mr. Brooks as claiming that the whole through freight from the West to Boston eight years hence, will amount to 448,101 tons. This estimate was made three years ago, and the words "eight years hence" were used at that time, and not now, as Mr. Bird represents.

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On page 50, is a list of names purporting to have been taken from the original subscription list of stockholders in the Troy and Greenfield Railroad. Mr. Otis Clapp is represented as having subscribed \$200 in "services;" and Daniel S. Richardson's name is appended, with ciphers and exclamation points. The first of these misrepresentations has been exposed by Mr. Clapp, who writes to the Boston Advertiser that he never charged the company for any service, nor was ever credited by them for services, but that he did subscribe and pay \$1151.43 for stock of the road. Mr. Richardson also writes to the Advertiser, and mildly suggests that he was never in any way connected with the Troy and Greenfield Railroad. On page 51, E. H. Derby is represented as being president of the Fitchburg Railroad a pure fabrication; and Alvah Crocker as having "large investments" in the same road, when its books show that at that time he owned but six shares of stock. The truth is, Mr. Bird has no hesitation or scruple in using other people's names in the same manner as he uses figures and statistics in his calculations.

Mr. Bird says lie never had any communication or correspondence with, and never received a dollar from, any person connected with the Western Railroad. That may be; but it is well known that Mr. D. L. Harris, president of the Connecticut River Railroad, has been for years the "fidus Achates" of Mr. Bird in "fighting the Tunnel," his colleague in the "Third House," his companion at the Hoosac Mountain, and the guide of his inexperienced feet in the wilderness of facts and speculations of civil engineering. It is not so well known, but nevertheless true, that Mr. Harris is made director and president of the Connecticut River Railroad by the influence and vote of Chester W. Chapin, president of the Western road. His zeal in the service of his benefactor has been manifested by an active hostility to the Tunnel, as persistent and unscrupulous as that of Mr. Bird; and, were it possible for that gentleman ever to act from other than disinterested motives, or a sense of public duty, his intimate relations with Mr. Harris might justify a suspicion that the "sinews of war" might be supplied through that channel. At all events, we may be permitted to say that, if these two men have organized and led the opposition to the Tunnel every winter for the last ten years, printed thousands and thousands of pamphlets, and spent a considerable part of each year in the lobby, and all this at their own cost, from a sense of public duty, then they have better deserved statues in front of the State House than Webster or Mann; and the Western Railroad management is even meaner than it has been generally considered. A corporation must indeed be without a soul, which can look upon such sublime virtue, and suffer it to pay its own expenses. But enough of Mr. Bird and his motives.

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The statements we have made in regard to the necessity of a new route are, in every particular

fully confirmed by a memorial which has been recently addressed to our Legislature from the Albany Board of Trade, through a committee of seven of their number, The gentlemen comprising this board are not theorists, but practical, clear-headed and reliable business men, who have been compelled by the urgent demands of yearly increasing business, to appeal to the people of Massachusetts for aid and relief.

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From a table in their memorial, it appears, that, while the increase, during the last fifteen years, of miles of railroad in eleven other States through which Western products press to the seaboard, averaged 169 per cent, that of Massachusetts was only 26 per cent. But we proceed to quote from the memorial:

"Twelve years of experience have convinced us that the Western Railroad is wholly inadequate to the prompt, rapid and cheap transportation of the commodities so extensively consumed by the people of the New England States. To illustrate the diversion of trade from the natural route to Boston via Albany, occasioned by the incapacity of the Western road to meet the wants of commerce, we call your attention to the article of flour. We collate our facts from reports of the Boston Board of Trade and the official reports of the Western Railroad. In 1865, the Western road, according to its own report, transported from Albany and Troy to Boston, one hundred and fifty thousand barrels less than it did in 1847, nearly twenty years ago. During the thirteen years, including 1848 and 1860, the average of its transportation of this article, per annum, between the Hudson and Boston was 287,698 barrels. For the same period, there were received in Boston, via other and more circuitous routes, an average per annum of 670,233 barrels. The next four years, including 1861 and 1864, the average per annum by the Western road was 572,637 barrels. Boston received from other routes an average, per annum for the same period, of 824,937 barrels.

Now, we hold that, by the natural laws of trade, most of this vast quantity of flour, which reaches Boston in these roundabout ways, would have left the Hudson river at Albany and Troy, had the requisite facilities for a cheap and rapid transportation been afforded. About one-fourth of the average quantity received in Boston from other routes, for the four years named above, reached that place via the Grand Trunk Railway and Portland, aggregating 956,945 barrels. Taking Detroit as the starting point, the distance from there to Boston via Portland, is 228 miles greater than the route to Boston via Albany. Yet, owing to the inadequate railroad facilities between Albany and Boston, the consignors of this flour prefer to send it via Portland, and pay the charges on 228 miles of additional distance. What is true of the article of flour is equally true of all the staple commodities produced at the West and consumed by the New England States. Large quantities were last year turned aside at Rochester and other points in our own State, to say nothing of points west of Buffalo, and sent to Boston and contiguous localities via the New York and Erie Railroad. Boston is even now receiving flour from Albany, Troy and Schenectady, by way of Rutland, a distance of some fifty miles further than by the Western road."

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"We have no words but of commendation for the noble work which your State is pushing with such energy to open a still shorter route to the Hudson. We have no feelings of jealousy toward the new route, because it terminates in another city than Albany; a healthy rivalry will do more than moral suasion, to wake up the old route from that lethargy which seems so near akin to death. Had the Hoosac Tunnel been completed twelve years ago, we have reason to believe it probable that the people of Massachusetts alone would have saved an amount in the way of cheap transportation, nearly if not quite sufficient to equal its cost."

"We have spoken more freely in this paper than might be considered becoming in us, but for the fact that in the day of its need, Albany, along with Massachusetts, came to the aid of the Western Railroad. And now that we are suffering so much from its insufficiency to meet the public want, we trust the presentation of these views and facts will not be regarded as obtrusive, but rather as properly coming from those, who, with you, aided to produce a common benefit, and are now suffering with you from a common cause."

The cost of the whole work was estimated by the commissioners in their first report, at \$5,719,330, the estimate being based upon ordinary labor at one dollar a day, and of materials at a corresponding rate. Nothing has yet occurred to invalidate this estimate, excepting the advance of the cost of material and labor, an incidental misfortune common to every public, as well as private enterprise, requiring labor and material, which has been prosecuted during the last three years. It is certain that these high rates will greatly decline, perhaps nearly to their former level within a year; but admitting that the Commissioners' estimate should be swelled through these incidental causes to the sum of eight millions, would such an increase of expense justify the abandonment of this great enterprise, upon which so much has already been expended, and at the very period in its progress when the most formidable obstacles in its way have been surmounted, and its success become a certainty? Had the Western Railroad been utterly destroyed last year by a rebel raid, as were some Southern roads by the march of Sherman, or by any conceivable cause, would the consideration of twenty-five, or thirty, or even forty millions, prevent its being rebuilt at once? Why then should two millions stand in the way of the Tunnel line, which is now a greater necessity than the Western road was at the time of its construction?

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The time required to complete the work, without the aid of machinery, was estimated by the Commissioners at eleven years and four months; and with the aid of such machine drills and power as had already been applied with success at Mt. Cenis, at seven years and a half. The work at Mt. Cenis was commenced in 1857, and up to July, 1861, 2142 feet had been excavated by hand labor; the machine drills were then applied, and the Italian government has recently announced that the work will be finished by the close of the year 1870. It will be seven and a half miles long. The Hoosac Tunnel will be about four and a half miles long, and at the present time it has been excavated 4675 feet, and shafts have been sunk to the depth of 575 feet. The machine drills will be applied in a few days; but they are drills which will do twice, and possibly three times the work of those at Mt. Cenis.

To the sound judgment, energy, and untiring perseverance of Mr. Brooks, and the inventive genius and skill of Mr. Stephen F. Gates, of Boston, and Mr. Charles Burleigh, of Fitchburg,

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belongs the credit of perfecting a pneumatic drill, by means of which our great tunnel will be completed much within the time named by the Commissioners, and with a reduction of their estimate of its cost by hand labor of several hundred thousand dollars. We have seen this drill operated by compressed air, at the rate of two hundred blows a minute, each blow given with a force of more than five hundred pounds, cut an inch and a quarter hole in a block of Hoosac rock, thirty-eight inches in thirteen minutes, without changing its points. Its superiority over the Mt. Cenis drill consists in its lightness, automatic feed, and smaller size. The Mt. Cenis drill is eight feet long, and weighs six hundred pounds, and the whole machine moves forward in feeding. The Hoosac drill is four feet long, weighs two hundred and eight pounds, and can be handled by two men. In feeding, the drill alone advances, and in such manner as to accommodate itself to any kind of rock it may encounter, whether hard or soft. Its points are sharpened in a die by half a dozen blows of the hammer. It will do the work of twenty men; and, finally, sixteen of them can be applied to a surface upon which only nine of the Mt. Cenis drills can be used.

The operation of this drill has already been witnessed by hundreds of persons, among them machinists, engineers, and stone masons, and not one of them entertains a doubt that it will do all which is claimed for it by the inventors. But the carriages are nearly ready, and these little machines will shortly be put to their work. The friends of the Tunnel have no fears of the result.

Massachusetts has always led her sister States. At the call to arms, her sons have been first in the field, and first to die for the common good. Her schools and colleges, her institutions of charity, and her statutes have furnished models for the new states of the great West, and for foreign republics. In her manufactures and mechanic arts, in the products of her inventive genius, in maritime enterprise, in the building of canals and railroads, and in every undertaking to develop the resources and promote the prosperity of the country, she has been first and foremost. With so proud a record, and with almost exhaustless means at her command, we do not believe our noble state is yet ready to abandon the lead; nor that the consideration of a few millions of dollars will prevent her from breaking down the barrier which divides us from the West, and by which the great stream of Western traffic has been so long checked and diverted. Rather let us trust that, by wise legislation, a liberal policy, and a cordial support of the gentlemen to whom the conduct of this enterprise is entrusted, the great work of De Witt Clinton will be perfected, and the noble design of Loammi Baldwin executed, by the completion of the Hoosac Tunnel, before it shall be announced from Sardinia that the Alps are pierced and France and Italy have joined hands under the Grand Vallon.

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*** END OF THE PROJECT GUTENBERG EBOOK FACTS AND FIGURES CONCERNING THE
HOOSAC TUNNEL ***

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