TAPPAN WENTWORTH

REPORT OF THE HOOSAC TUNNEL AND TROY AND GREENFIELD RAILROAD, BY THE JOINT STANDING COMMITTEE OF 1866

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Report of the Hoosac Tunnel and Troy and Greenfield Railroad, by the Joint Standing Committee of 1866 / T. Wentworth — «Public Domain»,

Содержание

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Hon. Joseph A. Pond, *President of the Senate*.

Sir:—I herewith transmit to the legislature the Report of the Joint Standing Committee of 1866 on the Hoosac Tunnel and Troy and Greenfield Railroad.

I am very respectfully
Your obedient servant,
TAPPAN WENTWORTH, *Chairman* .

REPORT

The Joint Standing Committee of 1866 on the Hoosac Tunnel and the Troy and Greenfield Railroad, authorized to visit the tunnel and railroad, examine into the condition and progress of the work, and to report fully the result of such examination respectfully

REPORT:

That since the adjournment of the legislature the Committee in a body visited the tunnel and railroad in June, and again in October, and they continued their examination of the condition and progress of the work by sub-committees in the months of July, August, September, November and December; (one of the examinations being exclusively devoted to the operations on the railroad which were commenced late in October;) the others to the tunnel and the various structures and mechanical operations connected therewith, including an examination of the existing contracts, and an inquiry into the general organization adopted to carry out the laws and purposes of the State in regard to the enterprise.

The Committee have also examined the records and the doings of the directors of the Troy and Greenfield Railroad from the organization of the corporation until the surrender of the railroad to the State, and have made extracts from the records to show the financial condition of the corporation, its dealings with the contractors for constructing the road and tunnel, and also the embarrassed condition of the contractors and corporation from 1855 to 1861, which finally led to the practical abandonment of the contract on the part of Messrs. H. Haupt & Company, and the surrender of the road to the State under the mortgages which had been given to secure the loan advanced by the Commonwealth in aid of the road and tunnel. These extracts from the records, with extracts from some of the laws passed upon the subject of the railroad and tunnel, together with remarks of the Committee upon the legislation of the State, the doings of the directors, and their efforts and those of the contractors to prosecute the enterprise being too long for the body of this Report, will be found in the Appendix at A. And a synopsis of the action and condition of the corporation at the time of, and previous to the surrender of the road, and the relation of the contractors to the corporation and to the State, will be stated before entering upon the particular description of the condition and progress of the work the present year, as observed by the Committee.

The charter of the Troy and Greenfield Railroad was granted in 1848, authorizing the construction of a railroad from a "point on the Vermont and Massachusetts Railroad, at or near Greenfield," to the line of the States of New York or Vermont, to connect with any railroad that might be constructed from or near the city of Troy in New York. Its capital stock was limited to $3,500,000. Authority was given in the charter to contract with any contiguous railroad leading from either of the above-named States, for the use of the same or any part thereof, or for operating the two roads conjointly, or for hiring such other railroad, or for letting their own railroad to the owners of any other road which should compose a part of the railroad line between Troy and Boston, of which the Troy and Greenfield Railroad should be a part.

The corporation was organized June 1, 1848. April 11, 1849, the directors voted an assessment of three per cent. upon its capital stock, and this assessment was the only one that was substantially collected, and on the first day of October, in the same year, they voted to put the construction of the road under contract as soon as sufficient subscription should be obtained therefore, commencing at Pownal, Vermont, and Greenfield. In January, 1850, $2,203.94 had been received into the treasury, and $2,203.57 had been expended with the approbation of the president of the corporation, leaving in the treasurer's hand $0.37.

Sundry assessments was voted from time to, time, the last vote being in May, 1852, amounting in all to 75 per cent. upon the subscriptions, but they were rescinded in July, 1858, and a new series of assessments were afterwards made which the Committee understand were as unproductive of beneficial results as were the former, upon which only partial payments had been made by a portion of the subscribers.

A contract for constructing the road was made with Messrs. Gilman and Carpenter in October, 1850. At the close of the year 1850, stock to the amount of $250,800 had been subscribed, of which $72,000 was payable in land damages, and $50,000 was taken by the contractors.

At this period in the history of the corporation, with $138,800 of available cash subscription, of which three per cent. had been paid, the corporation applied to the State for aid by a loan to enable it to prosecute the enterprise it had assumed, and this application was continued without success until 1854, when the legislature passed the Act authorizing a loan of $2,000,000, upon conditions which are particularly set forth in the Loan Act, (see Appendix A and B,) which, modified by subsequent legislation, discloses the policy of the State in granting its assistance to the undertaking.

It is proper to state, that at the time this loan was granted, there was no prospect of opening this line of travel by individual efforts, and the amount of the loan, taking into consideration the then assumed estimates of its probable cost, shows that the State assumed to defray the cost of an enterprise to the completion of which available individual means had proved inadequate.

In 1855, a contract for the construction of the road and tunnel was made with E. W. Serrell. The capital stock of the corporation was fixed at $1,500,000. This contract was changed two or three times, and finally ended in one executed by H. Haupt and Henry Cartwright. For an account of these changes, and of the votes and transactions of the directors and the contractors, reference is made to Appendix A, where the same will be found in detail.

Upon a careful examination of these votes and transactions, the Committee come to the conclusion that the financial embarrassments of the corporation from the year 1855, when the first contract with E. W. Serrell was made to the time of the suspension of the works under the last contract with H. Haupt & Co., are apparent. And it is also apparent that during the same time, the contractors assumed, to a very great extent, the control and responsibility of the enterprise.

Under the first contract, and on the day of its acceptance, the direction of the engineering operations within the tunnel was left with the contractor; excepting measuring for estimates and the final acceptance of the work; and on his subscribing $600,000 to the capital stock, $800,000 (less the new subscriptions,) was added to the contract prices for the work.

Under the second contract with Serrell, Haupt & Co., the directors voted to substitute bonds for stock in payment of the work until 2,000 feet of the tunnel was completed, and to pay the discounts and losses to which the contractors might be required to submit, not exceeding fifteen per cent. per annum; and also, to issue to the contractors bonds to the amount of $100,000 in addition to payments. Said bonds were to be sold or pledged by Haupt & Co., to enable them to raise means to carry on their operations under the contract.

On the dissolution of the firm of Serrell, Haupt & Co., in July 1856, Serrell resigned his office as director and was chosen consulting engineer. At the same time, W. A. Galbraith, one of the contractors in the following contract, was chosen a director. Thereupon a new contract was made with H. Haupt, W. A. Galbraith, C. B. Duncan and Henry Cartwright. Under this contract the estimates were to be made by the company's engineer. In July, 1857, the records show that no payments had been made the contractors for more than a year, and that the work could be carried on only by the continued efforts and personal credit of the contractors.

In February, 1858, the contract was again changed, and Messrs. Haupt and Cartwright engaged with the corporation to complete the road and tunnel. At this time, the records show that no payments had been made under the previous contracts "for more than two years; that the work could only be carried on by the continued efforts, increased expenditures, and personal credit of the contractors."

By a provision of this contract, any revenue arising from the use of the road, or any portion of it, was assigned to the contractors until their claims upon the company were adjusted; and the payment of all the company's debts was to be deferred until that of the contractors was satisfied; and Haupt & Co. agreed to maintain the organization of the corporation, pay its bills for printing, and advance therefore a sum not less than $500,000.

The same year the Rensselaer Iron Company was allowed a lien on the iron delivered to the contractors until the same was paid for. In 1859, H. Haupt relinquished his pecuniary interest in the contract, and was appointed chief engineer of the corporation. (See Appendix A, page 62.) These transactions in which the contractors participated, (one of whom was on the board of directors,) show conclusively that they were fully apprized of the condition of the corporation, from the date of their first connection with the work to the time of its "suspension," no claim during the whole period having been made by them against the Commonwealth for any work done for the corporation.

The existence of the mortgages to the State were of course well known to the contractors. They were given in pursuance of laws passed by the legislature, and for security of the payments received by the contractors for their services. The right of the Commonwealth to take possession of the railroad under the mortgages, must have been well understood. Further, the corporation, in surrendering the road to the State, did no injury to the contractors, for the act of surrender did not take place until after the contractors had suspended work upon both road and tunnel, and practically abandoned the enterprise; thus leaving to the State the alternative, either to take possession of the work and complete the road and tunnel, or to abandon it; and, in addition to the loss of the advances already made, forego the anticipated benefits of an additional avenue for Western traffic.

The treasurer's books do not show any settlement between Haupt and Company and the corporation. The account standing upon the ledger shows a large balance against the contractors; but the Committee are informed that subsequent to May 30, 1863, a settlement was made upon the basis of Mr. Stevenson's report (see Appendix A,) and that Mr. Haupt received, in conformity with the contract of H. Haupt & Co. with the Troy and Greenfield corporation, payment for all labor done and material furnished by said H. Haupt & Co., for the corporation, and that all matters between the parties have been adjusted.

Although the accounts between the contractors and the corporation are understood to be settled, it may be interesting to examine the account of the Commonwealth with the enterprise and compare the value of the work done by the contractors at the time of its abandonment by them, with the payments made to them therefore, from the treasury of the State.

The amount paid from the State treasury for work and materials upon the tunnel,		$170,131 95
Amount paid upon the road west of the tunnel,		50,000 00
Amount paid upon the road east of the tunnel,		505,256 92
	$725,388 87	
Amount earned by contractors under the contract upon the tunnel,	$129,475 00	
Amount earned by contractors under the contract, upon the road west of tunnel,	50,000 00	
Amount earned by contractors under the contract, upon the road east of tunnel, including temporary work,	410,204 00	
		589,679 00
		$135,709 87
Overpayment in reckoning sterling exchange, say,		44,000 00
Overpayment when the work stopped in July, 1861,		$179,709 87
Further payments made upon the work by the State from July 1861 to January 1867,		140,226 95
Total amount paid more than earned,		$319,936 82

From the foregoing statement it appears that the contractors with the Troy and Greenfield Railroad corporation, have received from the State, three hundred and nineteen thousand nine hundred and thirty-six dollars and eighty-two cents more than the value of the work which the

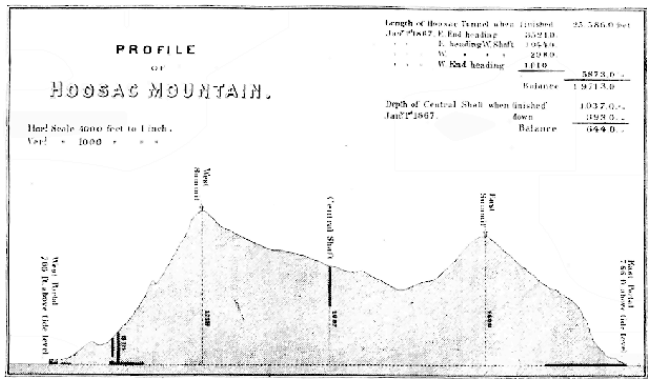
corporation surrendered under the mortgage, and that the State has lost that amount of money in its efforts to assist in the construction of the work. It is proper to add as the judgment of the very intelligent chairman of the commissioners (Mr. J. W. Brooks,) from whose statement to the Committee the foregoing figures are taken, that the loss to the State in the transaction by the failure of Messrs. B. Haupt & Co., to perform their contract in a proper manner, will reach the sum of three hundred and fifty thousand dollars. (See statement, Appendix C.)

The Commonwealth having taken possession of the road and tunnel, and by the legislation of 1862 and 1863 undertaken their construction with the free consent of the corporation, the directors by an appropriate vote, expressed their concurrence with the proceeding, and their reliance upon the "good faith of the legislature" to complete the enterprise which had exhausted the resources of its immediate projectors. The last act of the corporation, as appears by the records, was the choice of officers in August, 1865, when Alvah Crocker was chosen president and Wendell T. Davis, clerk and treasurer.

Description of the Tunnel.

The tunnel enters the eastern side of the Hoosac Mountain, in the town of Florida, a few rods from the right bank of the Deerfield River. The eastern summit of the mountain is 2,210 feet above tide-water, 1,499 feet above the Deerfield River, 1,429 feet above the grade of the railroad, and is distant from the East Portal of the tunnel 6,100 feet. The western summit is 2,510 feet above tide-water 1,788 feet above the Hoosac River, 1,718 feet above the grade of the railroad, and 6,700 feet distant from the West Portal. Each portal of the tunnel is 766 feet above tide-water. The summits are $2^{41}/_{100}$ miles distant from each other, and the valley between them at its lowest depression is 801 feet above the grade of the railroad.

The length of the tunnel, from the East End to the West End, as commenced by Mr. Haupt, is $4^{84}/_{100}$ miles. Its base is, at the East End, 70 feet above the Deerfield River, and at the West End, 70 feet above the Hoosac River. Its grade, from the East End to the Central Shaft, is 18 feet per mile; from the West End to West Shaft, $26^{4}/_{10}$ feet per mile; and from the West Shaft towards the Central Shaft, $21^{12}/_{100}$ feet per mile. These grades are calculated to allow the free passage of water from the centre. Should the quantity of water found in the tunnel render feasible a reduction of this grade, a change is contemplated.



Transcription of text

Profile of Hoosac Mountain

Length of Tunnel when finished			25,586.0 feet
Jan^{y}. 1867 E. End heading	3,521.0		
" " E. heading W. shaft	1,044.0		
" " W." " "	298.0		
" " W. End heading	1,010.0		
		5,873.0"	
		Balance	19,713.0"
Depth of Central Shaft when finished			1,037.0"
Jan^{y}. 1867 down			393.0"
		Balance	644.0"

The dimensions of the tunnel areas follows: The rock cutting is 24 feet high and 24 feet wide. The brick-work is 26 feet high and 26 feet wide. The bottom of the tunnel will contain a culvert three feet deep at the centre. Through this culvert the water from the tunnel is to be discharged. It now receives, in addition to the water accumulating in the tunnel, a 12-inch pipe, to carry air at a low pressure for ventilation; an 8-inch pipe to carry air for driving the drilling machines; and a 3-inch pipe for carrying water for use in the holes which are being drilled. Should it be found advisable to use gas in carrying on the work, provision is made for a 4-inch pipe to carry the gas from the place of manufacture. The track is to be placed $3^{1}/_{2}$ feet above the bottom of the rock tunnel, and $4^{1}/_{2}$ feet above the bottom, where lined with brick.

The distance by the highway, from the town of North Adams, or from the West End to the East End of the tunnel, is about nine miles. From the first named points to the Central Shaft is about five miles, and from the Central Shaft to the East End the distance is six miles.

The time necessary to travel from the West End to the East End, is two hours. Loaded teams from either end to the other perform the distance and return in a day.

Organization of the forces employed in the construction of the Hoosac Tunnel, June, 1866.

Chief engineer Thomas Doane, salary,	$4,000 00
Two assistant engineers, salary each,	1,350 00
One " " "	1,017 25
One " " "	900 00
[The assistants were assigned to different points upon the work.]	
One messenger,	469 50
One man in the stable,	626 00
Paul Hill, superintendent, salary,	2,400 00
One clerk,	1,200 00
One master mechanic,	1,800 00
One mechanical draftsman,	1,350 00
One pattern maker,	939 00
For Materials and Supplies:	
One cashier and paymaster,	$1,200 00
One purchasing agent,	1,200 00
One freight clerk and assistant paymaster,	1,000 00
One store-keeper at East End,	1,200 00
One assistant store-keeper at East End,	780 00
One store-keeper at West End,	1,000 00
One assistant store-keeper at West End,	900 00
One helper for do. at West End,	469 50
One store-keeper at Central Shaft,	720 00

The above were contained on the engineer's pay-roll.

Since the first visit of the Committee to the tunnel, many important changes have been made in the force above mentioned, to wit: The salary of the chief engineer was reduced to $3,600, he to provide his transportation to various points upon the work. One of the assistant engineers resigned and retired, and the office of two of them has been abolished. The salary of the superintendent has

been increased to $3,000. The office of freight clerk has been abolished, and its duties transferred to that of paymaster and cashier. The salaries of store-keepers and their assistants were not a charge to the State, but were paid from the profit of their respective stores.

At the commencement of the work, it was deemed necessary to provide stores at the three points where the operations were carried on, to supply the workmen readily with necessaries, so that no time might be lost by them in the important duty of making provision for their families. But in the present state of the enterprise, it is probable that private individuals would readily establish such stores, and relieve the State from a duty which, although it involved no pecuniary charge, diverted to some extent the attention of officers from their more legitimate avocations.

Foremen and Others under the Superintendent

At West End.				
One foreman	of labor,	$3.00	per	day.
"	of brickyard,	5.82	"	"
"	of carpenters,	3.00	"	"
One time-keeper,		2.50	"	"
West Shaft.				
One captain,		$3.50	per	day.
Two statisticians, who keep an account of articles delivered to the workmen, and also perform the electrical firing,		2.50	"	"
Central Shaft.				
One captain,		$5.00	per	day.
One time-keeper—acting statistician,		2.25	"	"
East End.				
One time-keeper,		$3.00	per	day.
One statistician,		2.50	"	"
One "		8.00	"	"
One foreman of masons at the East End, and inspector of do. at West End,		5.00	"	"
One foreman of carpenters,		3.00	"	"

Of this list the foreman of the brickyard is a temporary appointment. The foreman of carpenters at the West End has finished his work and retired. The foreman of masons was discharged by the commissioners, and has entered into the employ of Mr. Farren at the West End.

There are nine foremen of the heading gangs, two of whom have $100 per month, and the remainder $3.00 per day.

The heading gangs consist of eleven drillers each, including the foreman, and from three to five rockmen for removing stone. They work by shifts of eight hours, relieving each other at 8 A. M., 4 P. M., and 12, midnight. The blasts are made about the time of relief. The men working on the enlargement under private contractors make two shifts a day, each shift working ten hours. The Committee made a special examination of the number of men employed under the engineer and superintendent, with a view of considering whether the force actually engaged was necessary to an economical prosecution of the enterprise, intending to suggest any reform that might occur to them as essential; but learning that the engineer would in the course of the year make some reduction in the number of the men as well as of the teams employed upon the work, the Committee deferred taking up the subject until the anticipated reductions should have been made. And now understanding that the commissioners have the whole matter under consideration, and that they have already to some extent, acted thereon, the Committee for reasons that would be obvious, withhold any recommendations or remarks upon this point.

System of Operations.

The general superintendence of the labor on the work is vested in Mr. Hill. The reports are made to the engineer. The captains in the tunnel report weekly the proceedings of each day under the following heads, as follows:—

Number of days' work.
of holes drilled.
of inches of holes drilled.
of drills dulled.
of pounds of powder used.
of feet of fuse used.
of sheets of paper used.
of pounds of soap used.
of pounds of candles used.
of quarts of oil used.
of lamps used.
of pounds of wicking used.

The captain at the shafts four times a month reports,—

The days' work of the engine-men.
The revolutions of the engine.
Number of pounds of coal used.
of feet of wood used.
of gallons of sperm oil used.
of gallons of kerosene oil used.
of pounds of tallow used.
of pounds of waste used.
of pounds of tar used.
of cages raised.
of cars of stone raised.
Size of pump-plunger used.
Length of stroke.
Number of strokes.
of gallons of water raised.
of boilers in use.

The materials furnished for the construction of the work are charged in their distribution to twenty-three accounts, as will be seen by the tabular statement of its cost. Requisitions for materials are signed by the immediate overseer, captain or foreman; they are handed to the superintendent for approval, and by him forwarded to the engineer. If the requisition is approved by both, the materials are ordered, and when furnished the applicant signs upon a duplicate his receipt for the same. This course is pursued as well for materials taken from the State lands as for those purchased. Suitable blanks for returns, requisitions, &c., are furnished to the several points, and the evidence of all the transactions is preserved in the office of the engineer. In addition to the above, a return of all material broken, or laid aside, is made to the engineer, at whose office a substantial account of all materials on hand, either in use, or out of use, may be found.

The organization of the working force, and the mode adopted for supplies and expenditures at the various points, appear well adapted to an efficient and economical prosecution of the enterprise.

Divisions of the Work.
East End

Deerfield Dam.—This structure is completed. Flashboards to be used in low stages of water may have to be occasionally renewed.

The canal is finished as far as wheelpit No. 3. The machine-shop is about 72 feet long, and 36 feet wide. It has three turbine wheels. A fourth wheel is designed, but is not required at the present time, and the pit to receive it is not completed.

In the basement of the machine-shop are two compressors. The first was put in January, 1866. It has four cylinders 13 inches in diameter, and 20 inches stroke. This compressor is used to drive the drills, and furnish air for the blacksmith shop. The second compressor was put in some time in October. It has four cylinders 25 inches in diameter, and 24 inches stroke, and is used for ventilation one-fourth of the time, two hours after each blast, viz., from 8 to 10, A. M., from 4 to 6, P. M., and from 12 to 2, A. M. The compressors work satisfactorily. The loss of power in the transmission of air from the machine-shop to the drills, a distance of 4,500 feet, being hardly perceptible.

In addition to the compressors, there is in the machine-shop the following machinery, viz.: three lathes, one of them worked by hand; a drilling machine; a planer; a bolt-cutting machine and a saw-table. Sixty horse-power is required to carry the machine-drills, the machines in the shop, and to furnish air for the blacksmith shop. When the large compressor is used, 75 additional horse-power is required. A circular saw at the east end of the machine shop, is occasionally used, driven by power derived from the turbine wheels.

The blacksmith shop, near the entrance of the tunnel, contains three forges. The hand-drills are made, and, together with the machine drills, sharpened at this shop. The ordinary repairs of the drilling machines are done in the machine shop. New parts of the same are furnished from Fitchburg.

The heading in the tunnel at this end when driven by hand was about 15 feet wide by 6 feet high. When driven by the machines it is 16 feet wide and 8 feet high. Its location is in the centre of the tunnel, $4^1/_2$ feet above subgrade, and $1^1/_2$ feet above the road bed.

The force employed at this point in July last was—

Mechanics in iron,	4
Engine-men,	2
Masons,	10
Manual labor,	58
Engine and compressor men, including firemen,	6
Carpenters,	5
Blacksmiths and helpers,	8
Statisticians,	2
Runners of machine-drills,	6
Sawyer,	1
Manual laborers,	63
Total in July,	165

The first day of November there were employed here 115 men. There are at this point, besides the shops and saw mill above mentioned, 2 small offices, 1 boarding-house, 2 carpenters' shops, 2 powder-houses, 1 temporary blacksmith's shop, 1 temporary horse-stable, 3 sheds, 1 engine-house, 1 barn, 1 instrumental station-house (all used by the State,) and 2 cottages; 6 first-class shanties, 13 common shanties, 10 temporary shanties, 1 store under school-room; with 1 cottage, 1 old store and 8 shanties, built by H. Haupt & Company, which are rented.

The cost of the shanties at the East End, excluding the Deerfield Dam, was, in July, 1866,	$28,052 94
In November, 1866,	31,688 99
The rents at the East End received by the State from shanties are, per annum. All rents are collected monthly.	1,698 00

A resident engineer was stationed at the East End in charge of the work.

The progress of the excavations at the East End heading for the year ending December, 1866, has been 569 feet; at the rate of 47.42 per month.

The progress during the six months ending May, 1866, was 338 feet; an average per month of 56 feet 4 inches. One week was lost in June in introducing the machine-drills, in consequence of which the progress that month was reduced to 50 feet 6 inches. During the five months ending November 30, the progress has been $219^1/_2$ feet; being an average of 43.9 feet per month. It will be seen by the table, that in July, the first month after the introduction of the drill machines, the progress attained was only 26.5 feet. As the men became better acquainted with them, the progress was increased to 48 feet in August, and in September it rose to 54.5, having nearly attained the average progress of the six months preceding their introduction. Had there been an adequate supply, there can be little doubt that the progress would have continued to increase, and would have shown the superiority of the machine-drill over hand-labor; but the supply fell off, and the progress in October was reduced to 34 feet and 6 inches.

Table showing the progress at East End Heading, from November 1, 1865, to January 1, 1867.

DATE.		Distance from Portal.	Progress.
Nov.	1, 1865,	2,839.0	
Dec.	1, 1865,	2,904.0	65.0
Jan.	1, 1866,	2.950.5	46.5
Feb.	1, 1866,	3,005.0	54.5
Mar.	1, 1866,	3,052.0	47.0
April,	1, 1866,	3,115.0	63.0
May	1, 1866,	3,176.5	61.5
June	1, 1866,	3,227.0	50.5
July	1, 1866,	3,253.5	26.5
Aug.	1, 1866,	3,301.5	48.0
Sept.	1, 1866,	3,356.0	54.5
Oct.	1, 1866,	3,394.5	38.5
Nov.	1, 1866,	3,431.0	36.5
Dec.	1, 1866,	3,473.0	42.0

The Central Shaft

There is at this point, used by the State in the prosecution of the work, the shaft-building, a carpenter's shop, a blacksmith's shop, a saw-mill, powder-house, gas-house, ash-house, wood-shed, and a barn; and in connection with the work, a store, a boarding-house, the Thacher farm-house and out-buildings, 4 first-class and 7 common shanties. The cost of buildings at the Central Shaft in July, 1866, was $11,080.13. The cost in November, 1866, was $12,026.83. The annual rent of that portion leased to operatives is $736.

A farm, containing 250 acres of land, with a dwelling-house and barn, has been purchased, adjoining the Central Shaft, for the sum of $3,000. The land was well covered with timber, about one-half of which has been cut for the purposes of the shaft and tunnel. There is estimated to be one million feet of hemlock timber still standing, which will be wanted in the progress of the work. This purchase was an advantageous one for the State, there having been already realized from it an amount equal to its cost.

The working force at the Central Shaft in July, 1860, was comprised of—

Engine-men and firemen,	5
Mechanics in iron,	4
Carpenters,	5
Blacksmiths and helpers,	4
Pump men,	1
Manual laborers,	39
Total in July,	58

On the first day of November there were employed at this point, in all, 81. Of this number, 40 were engaged out of the shaft, and 41 in the shaft.

The above enumeration does not include the resident engineer and time-keeper, stationed here in November.

The depth of Central Shaft, when completed, will be 1,037 feet from the surface; its form is an ellipse, whose axes are 27 and 15 feet. On the fifth day of May it had reached the depth of 300.5 feet. At this time the hoisting apparatus was removed from the shaft, and the work of excavation ceased. The new hoisting apparatus was fitted on the first day of August, and the drilling commenced at midnight on that day.

Previous to the change in the hoisting apparatus, the monthly progress had averaged about $18^1/_2$ feet per month. The advance in October and November was 46 feet; the gain over the previous rate of progress is attributable to the practice of simultaneous blasting.

On the first day of January, 1867, the shaft had been sunk 393 feet, leaving for excavation 644 feet.

Table showing the progress at Central Shaft from November 1, 1865, to December 1, 1866.

DATE.		Distance	Progress.
Nov.	1, 1865,	200.8	
Dec.	1, 1865,	220.1	19.3
Jan.	1, 1866,	232.5	12.4
Feb.	1, 1866,	250.7	18.2
Mar.	1, 1866,	264.1	13.4
Apr.	1, 1866,	280.9	16.8
May	1, 1866,	297.1	16.2
May	5, 1866,	300.5	3.4
June	1, 1866, [A]	300.5	
July	1, 1866, [A]	300.5	
Aug.	1, 1866, [A]	300.5	
Sept.	1, 1866,	311.9	11.4
Oct.	1, 1866,	331.1	19.2
Nov.	1, 1866,	354.0	22.9
Dec.	1, 1866,	377.0	23.1

[A] Work suspended to put in new hoisting apparatus.

The present hoisting apparatus is expected to be sufficient to finish the shaft. It has two wire ropes, each 1,260 feet long. The time for a round trip is seven minutes. The engine here is of 100 horse-power. The blacksmith shop contains two forges. At the small machine shop the repairs required here are made, as also some repairs for the West Shaft.

The Central Shaft, though designed to aid in ventilating the tunnel, was intended also to accelerate its construction by affording to the process of excavation four faces instead of two during some portion of the work; and the former chairman of the commissioners expected by the aid of machine-drilling, the shaft might be completed in one year from the time such drilling should commence within it. In this anticipation, ten vertical drilling machines were constructed to work in the shaft area and a compressor with two cylinders was provided to furnish the power for operating them. The want of drilling machines at the East End became so urgent, that these vertical ones were changed to horizontals, and used at that point, and the sinking of the shaft by hand-drilling still continues. But if the experiments now in progress at the East End with the new drilling machine shall demonstrate its superiority over hand labor, the machine will doubtless be introduced into the shaft.

West Shaft

This shaft has an area of about 8 by 13 feet, and was excavated by Messrs. H. Haupt & Co. Its depth is 316 feet.

The buildings here used by the State are the West Shaft house, the New Shaft building, a blacksmith shop containing two forges, a powder-house, a horse-shed, ash-house and tank-house. The buildings owned by the State and leased to operatives are a boarding-house and four old shanties built by H. Haupt & Co., four first-class shanties, eight common shanties, and a double cottage. The buildings at the West End, are connected on the books with those at the West Shaft, and will be here enumerated. They consist of a carpenter's shop, time-keeper's office, a blacksmith shop containing one forge, tool-house, powder-house, horse-shed, brickyard shed, brickyard, engine-house, artesian wells Nos. 3 and 4, buildings, and two-thirds of a barn, which are occupied by the State. One boarding-house, store, one-third of a barn, the Harrington farm-house, barn and out-buildings, twenty-seven common shanties and brickyard boarding shanty. These buildings, with part of blacksmith shop, part of carpenter's shop and time-keeper's office, are rented to operatives and to Mr. Farren, the contractor for constructing the brick arch.

The cost of the structures, as reported in July, at both places, was	$35,550 94
As reported in November,	40,010 13

This large increase was mainly occasioned by the construction of a double cottage and necessary buildings at the brickyard and West End.

The amount of rents at these two points is $2,462.60 per annum. Fifteen of the tenements at the West End are leased to Mr. Farren, in accordance with his contract.

The working force at the West Shaft in July was,—

Engine-men and firemen,	4
Carpenters,	2
Blacksmith and helpers,	8
Masons,	2
Truckman,	1
Pump-man,	1
Manual laborers,	105
Total,	123
November 1st the working force at this point, including one resident civil engineer, was	103

At this point there is one engine of 100-horse power and one of 40-horse power, and one compressor having four cylinders of a diameter of 13 inches and 24 inches stroke. The West heading from this shaft was advanced 293 feet, and the East heading 1,042, on the first day of December, 1866. The progress for the year ending November 1, 1866, at the heading at this point was 636.7, being a fraction over 53 feet per month. For the last four months, ending December 1, 1866, the progress was 322.1, being a fraction over 64 feet per month, which exceeds by four feet per month the highest estimate for hand-drilling by the engineers in 1862, and by thirty and one-third feet the estimate of Mr. Latrobe. The progress of the work at this heading during the last six months, making allowance for the influx of water in November, having exceeded the highest estimate for hand-drilling,

should be regarded as evidence alike of the skill of the miners and the good management of the engineer and his subordinates.

Table showing the progress at West Shaft, East Heading, from November 1, 1865, to December 1, 1866.

DATE.		Distance from shaft, feet.	Progress, feet.
Nov.	1, 1865,	367.5	
Dec.	1, 1865,	414.4	46.9
Jan.	1, 1866,	459.4	45.0
Feb.	1, 1866,	503.0	43.6
Mar.	1, 1866,	546.5	43.5
April	1, 1866,	584.8	38.3
May	1, 1866,	623.3	38.5
June	1, 1866,	682.1	58.8
July	1, 1866,	746.1	64.0
Aug.	1, 1866,	810.5	64.4
Sept.	1, 1866,	871.4	60.9
Oct.	1, 1866,	945.4	74.0
Nov.	1, 1866,	1,004.2	58.8
Dec.	1, 1866,	1,042.0	37.8

The West heading at this shaft was at first driven 6 feet by 11. It has been found advisable to enlarge it to the dimension of 10 feet 6 inches by 15 feet. This work has been performed by contract. The first letting was at the rate of four dollars per cubic yard, the State furnishing the materials used and removing the stone. The contractors at this rate could not pay their expenses. It was raised to six dollars per yard which was found not to pay, and in July the price was advanced to seven dollars and fifty cents. The State pay the men, charging the same to the contractors, and keep their time. Good progress is made and the work is done to the satisfaction of the engineer.

The East heading at this point was being enlarged also by contract, from 6 feet by 15, to $10^1/_2$ by 15. The work commenced on the 15th of July, 1866; the price paid is seven dollars per cubic yard; the contractors load their own stone and also that coming from the heading. The State provides the materials used, and hoist the stone to the surface. While the work of the miners at the East heading and of the contractors upon both enlargements was progressing in a very satisfactory mariner, the whole was arrested by an unexpected and somewhat sudden influx of

Water in the Tunnel

On the 27th of November the miners working east from the West Shaft struck a seam running across the stratification of the mountain. Water soon issued from the seam at the rate of twenty-three gallons per minute. On the 29th, the water had risen at the foot of the shaft to two and a half feet above grade, and the work was stopped. The usual speed of the engine working the pump was forty-two revolutions per minute; it was increased to fifty-six, and at that rate it succeeded in preventing any further rise of the water. It became necessary to increase the power of the pumps. The plunger was enlarged from eight to ten inches, and a third lift pump was added. To affect this arrangement the pumps were stopped from 9 o'clock, A. M., December 7th, to $3^1/_2$ P. M. on the 8th. At this time the water was four feet and eight inches above grade. On the 12th the water was so much reduced that the miners recommenced work. The next day, at 2 P. M., the water was struck in large quantities, the whole flow from the heading being 100 gallons per minute. On the 14th, the work was again suspended, and unsuccessful attempts made to stop the water by means of wooden plugs driven into the seam. The pumps working with the longest stroke and at increased speed, were just able to keep the water from rising.

On the 19th, at 10.30 A. M., one of the trunnions of the pump-bob broke, and seriously injured the pump gearing and boxes. On the 21st a new trunnion was put in, and the pump was attached to the small hoisting engine, the water now being seven feet above grade. On the 28th, at noon, the breakages being all repaired, the large engine was again attached to the pumps, the water then being nine feet and eight inches above grade. And, on the first day of January, at 4 P. M., the water stood nine feet ten inches above grade at the foot of the shaft.[1]

[1] At the time of the presentation of this Report, the Committee understood that the water was entirely removed from the shaft and tunnel.

The New Shaft

This shaft is located about 264 feet westerly of the West Shaft. Its dimensions are six feet by thirteen in the clear. The rock to be removed from an area of eight feet by fifteen. The labor is done by contract. The first price was $40 per foot; increased July 1, 1866, to $50 per foot. The State furnishes all the materials for construction, and the power to raise the stone and water from the shaft. The depth of the shaft will be 277 feet when open to grade. On the first day of December, the miners working down had progressed 180 feet, and those working from the tunnel up 45 feet. It was then calculated that the shaft would be excavated in two months. Plans for permanent pumps had been prepared; to furnish the pumps according to the plans, would take several mouths. In the meantime, a temporary pump was to be made at North Adams, under the direction of the engineer.

On the first day of January, about thirty-eight feet of stone remained for excavation in this shaft. The water in the tunnel stopped the work from below, and the work is driven upon one face only at the present time.

There are two small engines at this point, one of fourteen and one of ten horse power. The pumps at this shaft, if constructed agreeably to the design of the engineer, will discharge sixty-five gallons to a stroke and are to be worked by a bull engine. The lift of the water will be eighty feet less than at West Shaft, being discharged about 40 feet below the surface.

The West End

The work at the West End of the tunnel is under contract. Mr. B. N. Farren of Doylestown, Bucks County, Pennsylvania, by an agreement dated May 1, 1866, contracted to put in a stone and brick arch of the dimensions before stated, 26 feet by 26, for the following prices, viz.:—Earth excavation $3.50 per yard; brick masonry, $12 per perch; stone masonry, $6 per perch. Contractor planks the bottom and sides when necessary at $15 per lineal foot. The State furnishes the bricks at $9 per thousand and the timber at $16 per thousand for hemlock, and $18 for spruce and hard-wood. The length of arch contracted for is 174 feet, the whole of which is open. The State also furnishes the cement, which costs in Troy, New York, from $1.65 to $1.70 per barrel, to which is to be added the freight at 30 cents per barrel. A barrel of cement is used for a perch of masonry.

The contractor agrees to construct two hundred feet of under ground tunnel, and as much more as he can before August 1, 1867, at the following prices, viz.:—Earth excavation at $6.50 per yard; brick masonry at $13 per perch; stone masonry at $6.50 per perch. The timbering, from $40 to $50 per foot, lineal, depending upon the thickness of the wall. He may, under permission from the engineer, take stone and sand from the State's premises, without making compensation.

Payments are to be made about the 12th of each month for the work done the preceding month, at the rate of 80 per cent. of the finished work.

The decision of the engineer as to the method, quality, quantity and classification of the work to be final and conclusive. In order to facilitate the progress of the work and with a due regard to economy, the State has purchased the following lots of land in the vicinity of the West End, to wit:—A wood lot, containing sixty acres, at a cost of $9,900; the Harrington Farm; 130 acres with the buildings, inclosing the West End and West Shaft; and running half way up the mountain. This purchase was made January 26, 1866, price $3,000. The Kingsley lot, purchased March 16, 1866, at $2,793.87.

The timber used by Mr. Farren is obtained from these lots. The tops of the trees are cut into wood and used at the brickyard. About five hundred cords of wood has been cut on the Harrington, and one thousand cords on the Kingsley lot, for the use of the brickyard, and is now on hand.

The necessity of making the bricks required for the arch tunnel is apparent. They could not be furnished by individuals at North Adams. 120,000, before the yard at the West End was fitted up, were purchased at Springfield at $9 per thousand; the freight of which to North Adams was $6, and the teaming to the West End $2 per thousand. If to these prices be added the depreciation and waste from handling, the cost will reach $18 for all that could be used in the work. It is the opinion of the engineer and superintendent of labor, that the bricks made by the State will cost less than $9 when delivered to the contractor.

Mr. Farren began work under his contract June 7, 1866, and early in December the brick-work at the top of the arch had entered the mountain. The masonry was commenced about, twenty-five feet west of the point first selected, so that the open masonry will in fact be 200 feet long. About thirty feet of invert is left uncovered the present season, under an apprehension that the bricks on hand will only supply what will be wanted in the drift, in order to prosecute the work with dispatch. The invert has been properly protected, and its preservation may be expected.

At the beginning, the invert and the sides to the spring of the arch was laid with five courses of brick, and the arch with six. The masonry has been strengthened to meet the effect of the soft ground and increased pressure to eight bricks thick all round. Where rocks are found, it will be reduced at the bottom, and perhaps at the top.

The excavation of the drift is in progress and is carried on with two galleries. The lower one is of timber, and is at the bottom three feet below the grade of the road. This gallery is ten feet wide and ten feet high.

The upper gallery, also of timber, is ten feet wide and four feet high, and the space between the galleries is about ten feet. As the arch is driven in, the top of the invert is 41/2 feet below the grade of the road, and 18 inches below the timber of the lower gallery. The top timbers of the upper gallery constitute the top timbers of the tunnel during the excavation. They are supported above the masonry and the arch is turned under them.

Side drains, six feet high and four feet wide, are excavated ahead of the galleries, to assist the drainage of the ground through which the galleries and tunnel are driven. The water from these drains is let into the tunnel through its sides, and runs out with the general drainage upon the invert below the road-bed. Holes are left in the invert at proper intervals to facilitate this drainage.

The side drains are hereafter to be filled with stone, which will constitute a blind drain, and also afford a proper support to the masonry.

The work at this point is of difficult prosecution, but the performance of the contract may be confidently expected.

The Brickyard.

The expenditures at the brickyard on the first day of July, 1866, had reached,	$15,091 98
Of this amount the brick machines, shafting, gearing, &c., cost	$5,048 68
And the engine,	2,255 50
	$7,304 18

Twenty-four thousand bricks can be moulded daily. The drying yard is 300 feet long and 120 feet wide. The kiln shed is 300 feet long and 50 feet wide, and of capacity to burn all the bricks that can be moulded. There are six brick machines, four of which are in use. They are driven by an engine, and used alternately, two each day. The making of bricks at the yard commenced June 26 and closed October 24, 1860. About 1,700,000 bricks were made, of which 80 per cent. are sufficiently hard for use in the tunnel, which is estimated to be sufficient to complete the 374 feet of tunnel now under contract.

The clay for the bricks is found near the yard, and hitherto a sufficiency of sand has been found in the vicinity; but it is less abundant than the clay.

Miscellaneous

In addition to the property enumerated under the preceding heads, the State has at North Adams, a freight house, cashier's office, engineer's office, stable and two coal sheds, and opposite the West End on the Pittsfield and North Adams Railroad, an additional freight house. There are also two instrumental station houses on the east and west summits respectively, all of which are occupied by the State for the purposes of the enterprise. There is also one seven-horse engine and three small compressors. Tho State has also four mule teams, three of four, and one of two animals, making fourteen in all. There were also used on the work in the early part of the year, twelve or fourteen horses, employed in hauling clay, sand, wood, &c. Six of these have been sold to Mr. Farren, and the remainder are to be disposed of. To this enumeration should be added five horses and three or more carriages kept at the stable at North Adams for the transportation of the engineers, superintendent, master mechanic, &c., from point to point along the line of operations wherever their presence and services might be needed.

The expense of the stable, including the pay of the keeper, for the past year, was,		$1,900 00
which covers the price of three carriages,	$500 00	
and one harness,	40 00	
		540 00
Leaving,		$1,360 00

for the expense of keeping five horses, and the repairs; which is about five dollars per week in all. The charge for keeping horses at the stable in North Adams, is five dollars per week for feed; and the cost for the use of one horse and wagon from North Adams to the East End, is four dollars. These horses were also used to transport the commissioners and the committee visiting the tunnel, when required for that purpose.

The Road between the Tunnel and North Adams

It is proposed to change the course of, the road as it emerges from the tunnel, and two lines have been surveyed, which, diverging near the approach cut, unite again about midway from thence to the village. The difference in length is about thirty feet. The northerly line is the least expensive to construct, and best favors the landholders on the route. It has the recommendation of the engineer, and the approval of the consulting engineer, and will probably be selected. There are reasons for an early location of this portion of the road which call for a prompt action in this behalf on the part of the commissioners, which will undoubtedly be taken.

The following table shows the expense of the tunnel and the land and works connected therewith under the administration of the commissioners, as found November 1, 1866:—

Deerfield Dam,	$127,982 80	
Race,	23,417 54	
Excavation and Masonry at East End of Dam,	12,802 46	
Wheel pits,	70,723 23	
Gates and Overflow,	9,986 26	
		$244,912 29
East End Heading,		103,731 45
East End Enlargement,		80,317 10
East End Heading Enlargement,		17,559 46
Central Shaft,		144,423 75
West Shaft,		179,041 69
West Approach,		247,900 75
Building East End,		31,688 99
Building West End and Shaft,		40,010 13
Building Central Shaft,		12,026 83
Building General Account,		9,537 37
Engineering and Superintendent,		84,840 48
Machinery West Shaft,		57,111 73
Machinery East End,		87,032 38
Machinery Central Shaft,		51,364 01
Machinery Deerfield Dam,		10,820 93
Machinery General Account,		62,600 76
Machinery West End,		539 89
Land and Land Damages,		17,513 21
		$1,482,973 20

The following table shows the cost of the works under the classification of outside and inside expenditures, as given by the consulting engineer.

Outside Expenditures.		
Deerfield Dam,		$244,912 29
Buildings East End,	$31,688 99	
Buildings West End and West Shaft,	40,010 13	
Buildings Central Shaft,	12,026 83	
Buildings General Account,	9,637 37	
		93,263 32
Machinery East End,	$87,032 38	
Machinery West End,	539 89	
Machinery West Shaft,	57,111 73	
Machinery Central Shaft,	51,364 01	
Machinery Deerfield Dam,	10,820 93	
Machinery General Account,	62,600 76	
		269,469 70
Land Damages and Land,		17,513 21
Engineering and Superintendence,		84,840 48
Total outside expenditures,		$709,999 00
Inside Expenditures.		
East End Heading,	$103,731 45	
East End Enlargement,	17,559 46	
East End Bottom,	80,317 10	
	$201,608 01	
Central Shaft,	144,423 75	
West Shaft Headings, &c.,	179,041 69	
West End approach cut, drifting and arching,	247,900 75	
Total inside expenditures,		772,974 20
Total expenditures to November 1, 1866,		$1,482,973 20

The exact correctness of any classification of the expenditures is not very important, inasmuch as the sum total is chargeable to the construction of the tunnel; but the Committee do not see the propriety of charging the engineering and superintendence exclusively to the outside expenditure. They have seen a classification which gave,—

Amount put into buildings machinery, &c.,	$673,531 24
Spent in the work,	809,441 96
Total,	$1,482,973 20

General Summary of the Force Employed on the Tunnel,

November 1, 1866.	
Thomas Doane, Chief Engineer, salary, He providing his horses.	$3,600 00
Paul Hill, Superintendent of Labor, His horse furnished to him.	3,000 00
In the Chief Engineer's Office.	
H. G. Burgess, Master Mechanic, soon to leave,	$1,800 00
John Christiansen, Mechanical Draftsman,	1,500 00
Austin Bond, Clerk, &c.,	1,500 00
Edward Stowell, temporarily engaged in making fuse,	1,000 00
Roswell Houghton, hostler in village, $2.00 per day. Charles P. Bradley, hostler at T. Doane's house, $18 per month. Roger Tappan office boy and rod-man for Mr. Granger, $1.50 per day.	
West End.—Wages from $1.25 to $3 per day,	5
Brick-Yard.—Wages from $2 to $5.89 per day,	13
New Shaft.—Wages from $1.78 to $3 per day,	31
West Shaft.—Wages from $1.50 to $3.50 per day,	102
W. P. Granger, civil engineer, is resident in charge of West Shaft, New Shaft and West End. Salary $1,350,	1
Central Shaft.—Wages from $1.50 to $5, This number includes the time-keeper and H. G. Coolidge, resident engineer.	83
East End.—Wages from $1.50 to $:1.25,	115
F. W. D. Holbrook, resident engineer, in charge at a Salary of $1,350,	1
Add force in general charge and not confined to any particular point,	8
Total in the employ of the State,	359
Add at the West End in Mr. Farren's employ, about	100
Total employed upon the tunnel,	459

Experiments

The interest awakened by the magnitude of the undertaking to tunnel the Hoosac Mountain, and the anxiety manifested for its early completion, prompted the commissioners to the discovery of means to accelerate the progress of the work. Their attention was naturally directed to the operation of drilling, and with a view of improving upon the machine drill used at Mont Cenis; scientific mechanics have been employed to devise and construct a drill that should attain that end.

As a first step Gouch's patent of the hollow piston-rod, was purchased for New England, for the sum of five hundred dollars. After which, a Mr. Gardner was employed to construct a drill; but his efforts failed of success after an expenditure of thirteen hundred dollars. A Mr. Butler was engaged to devise a machine, but in the course of studying the subject, his health failed and his services were lost.

A Mr. Hanson completed a machine which promised some success; but on trial it proved a failure.

A second machine called the Brooks, Burleigh and Gates drill, was made under the direction of the commissioners at Fitchburg. This machine was put upon the works and used for several months.

A third machine, called the Burleigh drill, an improvement upon the preceding one, was next produced, which is now at the works on the East Heading.

About $13,000 was spent upon these experiments, resulting in the construction of the Brooks, Burleigh and Gates drill, and the manufacture of four of them. About one-half of this expenditure may be charged to these last drills; the other was unproductive of anything of value.

The Brooks, Burleigh and Gates drill was patented, but the Commonwealth has the right to use them in the construction of the tunnel.

These machines will now be described.

The Hanson Machine

This machine has a cylinder and valve motion, similar to a steam-engine. The piston is hollow, the drill-bar which may be of any required length, passing through it, is moved with the piston, by means of four wedges or cams on each end of the piston; these cams are pressed on the drill-bar by means of sliding collars forced upon them by a complex arrangement operating alternately. The drill-bar is rotated by means of a ratchet operated by a spiral groove in the shield of the machine. The main difficulty in this machine was in the complex arrangement for forcing the collars upon the cams or wedges. It did not work well in a horizontal position. The machine consisted of one hundred and twenty pieces, and weighed five hundred and ninety-five pounds.

The Brooks, Burleigh and Gates Machine

This machine has a hollow piston, the drill-holder being a screw passing through the piston, moving with it, and fed through it, by means of a nut on the end of the piston-rod. This nut is held by means of a cap or union nut, as it is called, the union nut being screwed on to the coupling, and the coupling nut screwed to the piston-rod. The feed-nut protrudes through the union nut, and is allowed to turn round in it. On the end of this feed-nut is a ratchet gear covered by a ratchet-band with an arm upon it, all moving with the piston. The ratchet arm moves up and down in a spiral groove, the groove being in a shield attached by screws to the cylinder; on the ratchet-band there is a pall and two springs, one under the other. One of the springs holds the pall in gear, the other holds it out of gear. As the piston moves down, the outer spring comes in contact with a trip which is on the shield and is lifted up, allowing the under spring to throw the pall into the ratchet, and as the piston is moved back, turns the nut round, thereby feeding the screw forward. At the extremity of its backward stroke, the pall comes in contact with another trip on the shield which lifts it out of gear, the outer spring having a catch upon it which holds the pall when thus lifted out. The rotary motion is given by a ratchet on the coupling-nut, covered by a ratchet-band the arm of which moves in a spiral groove in the shield similar to the other, only having a spring to hold the pall in the ratchet; this rotates all the parts on the piston except the ratchet-bands and cross-head. The latter is held between two check-nuts on the coupling-nut. To this cross-head is attached a bar which communicates with a valve which opens the port when the piston moves back, and shuts it when it moves forward; the air is always on during its backward stroke. The piston having a greater area on the forward than on the backward stroke, overcomes the backward pressure and moves the piston ahead, and when cut off, the continued pressure forces the piston back.

Конец ознакомительного фрагмента.