Art. XVIII.—*Some account of the Hudson and Mohawk Rail Road; by* S. DeWitt Bloodgood, Corresponding Secretary of the Albany Institute.

Without disparagement to similar works which have preceded that of the Hudson and Mohawk Company, it may nevertheless be considered as the most important, from its position, of any yet constructed in the United States. Albany, when in its infancy, was called by the appropriate title of "the net," since it caught all the travel,

and most of the business, of the northern and western parts of the state. The immense amount of transportation and commercial business, and the great number of passengers with which it unavoidably has to do. seem still to entitle it to its ancient name.

The Mohawk Rail Road is of course crowded with passengers, and it is thought will shortly be covered with cars bearing produce and merchandize. When it was first opened to the public, the cars traversed it six times a day; now they traverse it eight times a day.

Some account, therefore, of this interesting work, may not be entirely unacceptable.

The Company was chartered by the Legislature of New York, in 1826, with a capital of $300,000, with liberty to increase it to $500,000. This increase has recently taken place. Commissioners were appointed by the Governor under the act, to appraise the damages done by taking the land along the route of the road, and the amount of the appraisement was to be lodged in the bank to the credit of the owner.

Not till 1830 was any thing like a fair beginning made. By the spirited exertions of some few capitalists in New York, the stock was taken up and an impetus given to the project. The surveys were first made by Mr. Fleming, who left the employ of the Company in 1829. Mr. Jervis, the present intelligent engineer, succeeded him in 1830. He had previously acquired reputation in the service of the Hudson and Delaware Company. Lines were run at different periods north and south of the old Schenectady turnpike road, but all the surveys seemed to eventuate in favor of the southern route. There the approach to the river was easiest, the ground requisite for the termination of so important a work was to be had at a moderate price, and but one principal street of the city was crossed by the track. The route adopted by the Company upon the recommendation of Mr. Jervis, was generally three fourths of a mile north of Mr. Fleming's line, except at the two terminations. It is believed that no part of Mr. F.'s plan has been adopted.

In the month of June, 1830, an advertisement for contracts was published, and proposals were accordingly received on the 15th of July following. On the 17th of the same month, contracts were made for the grading, for the stone blocks, broken stone and part of the timber, &c. On the 12th of August, same year, the ground was broken at Schenectady, in the presence of a large concourse of people, and an address was delivered by C. C. Cambreleng, Esq. who

throughout the whole work has proved a persevering and efficient agent of the Company.

The work was divided into thirty sections. A large number of laborers was immediately employed, who lived in temporary buildings along the line of the road, and have enjoyed good health during their employment.

The prices paid by the Company for the different items of work and materials are, as nearly as can be ascertained, as follows:

Excavation of sand, 7 cts. per cubic yard.
Do. clay, 9 " " "
Embankment of sand, 8 cts. per cubic yard.
Do. clay, 11 " " "
Broken stone, $2,00 per cubic yard.
Stone blocks, containing 2 cubic feet, 45 cts.
Castings for chains and runs, 4 cts. per lb.
Spikes, 9 cts. per lb.; 5 per cent. discount for cash.
Grading, $7,500 per mile, single track.
10,000 " " for the two tracks.

To meet the expenditures, the capital was called in by instalments of 6 and 10 per cent. and the whole of the original capital was paid in on the 1st of August, 1831.

Twelve miles of the road were finished about the same time, and the whole of the single track will be completed on the 1st day of December next.

The character of the road. With two slight exceptions, the road between the Albany and Schenectady planes is perfectly straight. It however commences at the termination of the city line on the Hudson River, and about thirteen acres of land are now owned by the Company, in its vicinity, part of which will include the wharves now being constructed for the accommodation of the transportation business, and the earth of which is brought in small cars upon a light wooden rail road, from a hill above, through which the inclined plane is to pass.

The road crosses South Pearl Street, under a fine stone arch of durable materials and handsome construction, thence it passes up the hill with an inclination of one foot in eighteen until it reaches the summit one hundred and eighty five feet above the Hudson. At this place a building is erected which contains a double stationary engine estimated at twelve horse power. It is of the high pressure kind with two cylinders seven inches and a half in diameter, twenty six

inches stroke. To these is attached the apparatus for hauling up the cars which will presently be noticed.

The road then proceeds North Westerly up to the head of Lydius Street to strike which, it takes a curve of four thousand feet radius, and passes over two heavy and high embankments, and through some deep cuttings near the alms house.

From the head of Lydius Street, (where the travel at present terminates) it proceeds in the same direction, crossing the heavy embankment, called the Buel viaduct, ascending a plane for about three miles, of one foot in two hundred and twenty five. Afterwards ascending by two other planes at different points, and crossing several waterways, upon embankments it proceeds to the Schenectady summit. There are in all six principal embankments.

About four miles from Schenectady, there is a curve in the road, (radius twenty three thousand feet) which with most people passes unnoticed. Just at the summit is a smaller curve with a radius of one thousand one hundred feet. Besides the plane last mentioned, there is another of three miles, where the ascent is one foot in two hundred and seventy, and another of one mile and a half, where it is one in four hundred and fifty feet. The descent from the Schenectady summit, to the level of the Hudson is three hundred and thirty five feet. At this point, to which we have in imagination conducted our readers, a beautiful view is obtained of the Canal, the Mohawk river, and the ancient city of Schenectady. A double stationary engine is placed here, and may thus be described. In the cellar of a house which is built on stone foundations across the road, and on the North side are placed the boilers. The steam is conducted into two horizontal cylinders, firmly secured, of the size already mentioned. The shackle bars are connected with an axis on the extremity of which is a crown wheel, working in another at right angles, on a shaft placed vertically. This vertical shaft carries at its upper end, which is near the surface of the road, and directly in its center, a larger wheel around the circumference of which the hauling ropes pass, and run on rollers placed at regular distances down the plane. The plane overcomes a height of one hundred and fifteen feet, with an inclination like that near the Hudson, and running down a heavy embankment, strikes the canal about half a mile from the principal street in Schenectady, but the track is prolonged upon a level to within sixty rods of the same.

The soil through which the road passes is generally sandy. Some considerable elevations are cut through, and several ravines crossed. The slopes left by the cutting or formed by the embankments, are partly covered with sods, and will be entirely so in the course of another season. No settling of the road has taken place except to a very slight degree in some of the embankments which is easily rectified.

Construction of the Road.—After the grading was finished, the residue of the work was done in the following manner. Under each line of the rails, which is very accurately ascertained by means of a transit instrument, square holes are dug at the distance of three feet from center to center, capable of containing nine cubic feet of broken stone. In clay, the holes are connected by a neck, and in these holes, in either case, the broken stone is placed, and rammed down so as to form a solid mass. The stone which is principally grauwacke, is broken into pieces that will pass through a ring of two inches diameter. On this foundation the stone blocks are placed, quarried either on the canal twelve miles above Schenectady, or at Singsing on the Hudson, about double that distance from New York. They are dressed on the upper side only, but have a flat bottom in order to lie evenly upon the broken stone. They are very quickly laid down and leveled, and firmly seated. A little practice enables even an ordinary workman to adjust them to their places.

A massive wooden pounder, with four arms, managed by the united strength of four men is applied to them to bring them exactly to their level, after the broken stone has been moved in such a way as to give them their proper position. The next step is to drill the holes in the face of the stone, and by means of a simple adaptation of an old principle which may hereafter be noticed, four holes can be drilled at once, two in each block, with great ease and much economy of labor and time. In these drillings small plugs of locust wood, about four inches long, and about an inch in diameter, are loosely placed. Into these plugs, are driven the iron spikes which pass through, and hold down the cast iron chairs. The chairs are pieces of a peculiar shape, being double or single, secured to the stone block by a spike, and clasping the rail on each side. The double chairs are of sufficient length to pass across, beneath the rail, and are used in the proportion of one to three single chairs, which are on each side of the rail also, but do not pass under it.

The rails are pieces of wood from twenty one to twenty four feet long, and six inches square, hewed out of Norway and white pine* brought from the vicinity of Seneca lake, and which, in its quality, is considered, by the engineer, equal to yellow pine. These rails are placed in the iron chairs, and are wedged with wooden wedges on the outer side into a perfectly true line. On these lie the iron rails which are made of the best of wrought iron, and were manufactured at Wolverhampton, Staffordshire.

They are are two inches and a half wide at bottom, and rounded off to one inch and seven eighths on the top. Their thickness is only nine sixteenths of an inch. The weight is twenty one tons per mile. These bars are tongued and grooved, and are secured to the wooden rail by iron spikes driven through oval openings. The expansion and contraction of the metal are provided for in these openings, and also by the tongues and grooves. Where the bars join, an iron plate is placed underneath and it is remarked that although additional strength is gained by this, yet the iron rails seem to wear faster at these places than at any others. After the road was used, these bars upon examination made by the writer, were found to be magnetic.

At the distance of twenty one feet, tie pieces, as a farther security, are laid down, to bind the rails to each other and keep them in proper parallelism. Broken stone is also laid down between, and at the side of the rails, and this is again covered with earth.

Upon the embankments stone blocks have not yet been put down, in order to give time for them to settle. When any settling is observed, the timbers, on which the rails at present rest, are pryed up and secured, and the level is maintained.

The other track, which is on the south side of the one now in use, is in a state of active preparation.

Passengers are carried upon this road in coaches, drawn by horses, and by the locomotive engines, whose powers are not yet conclusively tested. The DeWitt Clinton, on the plan of Mr. Hall, is an American engine, from the West Point foundry, and the Robert Fulton, an English engine, is from the shop of Robert Stephenson. The former is about eleven feet six inches in length, and mounted on iron wheels of four feet eight inches diameter. The boiler contains one hundred and fifteen gallons of water, and will sustain a pressure

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* Pinus resinosa and Pinus Strobus of Linnæus, the latter known in England as the Weymouth pine.

of several hundred pounds to the inch, although it is intended to work at a pressure of fifty pounds only.

There are two cylinders, one on each side of the engine, towards the rear of the boiler, each of five inches and a half diameter, and sixteen inches stroke. The pistons move on the inside of the wheels, which is an improvement on some of the English engines. The shackle bars are connected with the axle of the front wheels, which is bent into the shape of a double crank. There is a safety valve on the top, of the usual description.

The power of the engine is over ten horses, and its weight is six thousand seven hundred and fifty eight pounds and a half, being much less in proportion than that of the best English engines. As it stands on the rails, it can be very easily moved by a single hand! The tender is a carriage mounted on smaller wheels, and carries a square box with an awning upon it, in which are apartments to hold an iron tank, and the requisite quantity of fuel. It is dragged next to the locomotive, and has a stout spring in front to keep it at the same distance relatively from the engine. Behind these come the coaches for the passengers. These run on iron wheels constructed like the rest, with a flange or inner edge, which makes it impossible for them to run off the rails.

The coaches are built like the common post coaches, peculiar to our own country, and will carry inside and out, about twenty passengers each. They are very comfortable and convenient, but others of the English pattern, are in contemplation.

The following difficulties occurred upon experimenting with this engine. The surging of the water in the boiler was so great, that it passed over into the cylinders. This was remedied by building a high steam chamber upon the top of the boiler. The eduction pipes terminated too low in the chimney, and injured the draft, and the chimney itself was too large. All this was remedied. The anthracite coal was found to pack, and required a blast. An artificial blast was given, and then the heat seemed too great in one place, and too little in others. It did not diffuse itself, but melted the grates, and the nozzle of the pipe from the wind reservoir. At present it consumes wood; the experiments are not complete, in relation to fuel. The *average* speed of this engine with three loaded cars, equal to about eight tons, is fifteen miles an hour, but it has frequently accomplished with the same load, *thirty miles an hour*. The writer of this communication, has travelled with it at that rate.

The Robert Fulton has a much more compact appearance, and weighs twelve thousand seven hundred and forty two pounds, of which eight thousand seven hundred and forty five pounds, rest on *one* pair of wheels. It was made as we have said, by Robert Stephenson, the celebrated English Engineer of New Castle upon Tyne. The frame is as long as that of the DeWitt Clinton, and is mounted on wooden wheels, strongly bound with iron. There are two cylinders each of ten inches diameter, and fourteen inches stroke; these are in the lower part of the chimney, and are kept warm by the smoke and hot air. The pistons are connected with the axis of the hind wheels. The fire is made in a cylindrical furnace, hanging down between them, and the heat passes directly through eight rows of horizontal tubes of the length of the boiler. The steam pipes pass through the boiler just above the tubes, and by a simple contrivance, the steam ascends to the top of a steam chamber, and there enters a funnel-mouthed tube, connected with the steam pipes. Any bad effects of the surging of the water are of course prevented. The safety valve is of the ordinary kind.

The eduction pipes, are carried partly up the chimney, and powerfully assist the draft. It has been tried and found to succeed admirably. Its great weight renders its usefulness somewhat problematical upon a wooden rail. There are yet some accurate experiments to be made on these subjects, and therefore we shall dismiss this part of our subject with a quotation from the original description of this engine, now before us in the hand writing of Mr. Stephenson. "As to the power of this engine, it would take twenty tons without difficulty, but with twelve it will be much better. The small inclination of one in two hundred and twenty five, will affect the motion of the engine very little."

Some experiments will shortly be made in relation to friction and velocity on this road, by some gentlemen connected with the Albany Institute, in connection with the Engineer, which will probably throw some light upon this fruitful subject of calculation.

The stock of this company has stood deservedly high in the market, and will undoubtedly produce to its proprietors, large and increasing dividends.