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The Great Northern Paper Company, Chapter 08: The Biggest Mill in the World

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C H A P T E R VIII

THE BIGGEST MILL IN THE WORLD

The new company wasted no time in getting going on the Millinocket project. As a matter of fact, Garret Schenck had not waited for formal completion of the arrangements for financing before starting on the preliminary work.

Charles Mullen had already done some exploratory surveying in connection with the water power, in 1894 or 1895, and in October, 1896, before the formation of the Northern Development Company, he had engaged the firm of D.H. & A.B. Tower, of Holyoke, Massachusetts, at that time the only engineering firm specializing in pulp and paper mills, to measure the flow of the river and make estimates on the power available.

Early in 1898, Garret Schenck hired Hardy S. Ferguson (1868-1956), a young engineer who had just gone into business for himself, to check these figures. This remarkable man, to whom was entrusted the design of what was to be the biggest paper mill in the world, and the greatest engineering and construction project ever undertaken in the State of Maine, was barely thirty years old at this time. His clear thinking and sound decisions were to have a profound effect upon the design not only of the plants of the Great Northern Paper Company but of pulp and paper mills in all parts of the globe.

Hardy Ferguson was born in Chelsea, Massachusetts; attended public schools in New Hampshire, and was graduated from the Thayer School of Civil Engineering (Dartmouth College) in 1891.

Upon graduation, he entered the employ of D. H. & A. B. Tower. His primary interest was in hydraulic and sanitary engineering, but this association led him into wider fields. His first assignment was as resident engineer on the construction of the Glens Falls Paper Company (later International Paper Company) at Glens Falls, New York. From this job he was sent, in 1892, to Rumford, Maine, as resident engineer on the construction of the plants of the Rumford Falls Paper Company and Rum Falls Sulphite Company. Here he met Garret Schenck.

In 1897, he set up his own consulting practice in Lewiston, Maine, specializing in pulp and paper mill design. His principal client was the Berlin Mills Company of Berlin, New Hampshire. It is not known whether he had anything to do with the studies made by Tower at Millinocket in 1896, but the work which he started in the spring of 1898 continued through August of that year, when he began to prepare a map of the area. In September, he was formally engaged to make surveys for the water power development and the proposed mill, and to prepare preliminary designs. At this time, he was still on a consulting basis.

The Millinocket Mill was built on a farm occupied by Charles T. Powers, a grandson of Thomas Fowler. The farmhouse was located on the hillside perhaps a little to the north of where the new boiler house was built in 1956. There were a barn and several out-buildings with it. The land was not forested, as has so often been said, but was cleared ground, scrub growth and old burn, although the townsite, a little to the east, was wooded. The farm was on a school lot belonging to the State, and no title to it had been granted to anyone up to this time. Charles

Mullen wrote to Garret Schenck on October 17, 1898 "I hope he (Ferguson) will not take it into his head to do any surveying on the Powers farm without first consulting as to whether it is the proper time to do it or not. This is a public lot as you will remember and we ought to organize the plantation and secure that piece before running surveys across it to show what can be done. Mr. Butterfield (Tower's engineer) took barometer levellings across this place in 1896 which show that about one hundered and sixteen feet head may be obtained altogether by going this way." The title to this property was, however, cleared in February 1899, as we will note later.

Hardy Ferguson's early plans were made for the Northern Development Company, but he seems to have been employed directly by Garret Schenck. His bill for services in September 1898, in his own writing, was at the rate of $6.00 per day. This must have been a "beginner's rate". The Bangor Whig & Courier of November 4, 1899, says: "Hardy S. Ferguson, of Boston, Chief Engineer, draws $20 per day for his services to the Company. He is a young man in whom great confidence is placed and upon whom great responsibilities rest".

On February 14, 1899, Hardy Ferguson, after making trips to Boston, Millinocket and Madison, moved his office to Boston and began work in earnest on the Millinocket project. This was of course within a few weeks of the reorganization of the Northern Development Company into the Great Northern Paper Company, and at this point he became chief engineeer of the new company, under an arrangement which allowed him to continue his private practice. At the time of the move, his whole staff may have consisted of

one man, Frank C. Bowler, of whom more hereafter. The new office, located temporarily in Boston to facilitate early work, was in the Devonshire Building, 194 Washington Street, where Garret Schenck had his headquarters.

All was at once feverish activity. Harry J. Hilliard, of Bangor, a civil engineer, was placed in charge of a survey crew at Millinocket. Engineers, surveyors and draftsmen were hired and assigned to Boston or Millinocket. The speed at which this quickly-assembled organization carried out design, prepared specifications and obtained bids is astonishing. Garret Schenck, Charles Mullen and John Decker were in frequent consultation with Hardy Ferguson. The first drawing was started on February 18 and the first blueprint, charged to Great Northern Paper Company, was made by B. L. Makepeace Company on March 10. What was probably the first contract, covering the steel penstocks, was signed with the Riter-Conley Manufacturing Company on March 31st, at a price of $.0337 per lb.; in place. On April 6, contract for the bulk of the structural steel was let to the Shiffler Bridge Company at $.0268 per lb. A general mill construction contract, covering excavation, masonry and brickwork, was awarded to J. B. Mullen & Company on May 3. While specifications were prepared for bids, there is no information as to whether there was competitive bidding on this contract. As late as April 4, Charles Mullen wrote to Garret Schenck: "I have had a great many inquiries from contractors who have done work under me in times past, as well as from other parties, as to when our work will be ready to let, also as to the manner in which it will be let. Now, please let me know whether or not you are going to advertise for

bids or just how you do intend to work it. There are several entirely responsible parties and I have repeatedly told them that I would let them know in due season, and of course I am very desirous to do so." Garret Schenck did not always keep Charles Mullen informed as to what he was doing, but the dates would seem to indicate that not much time was allowed for bidding. Unofficial figures are available on the prices provided for in this contract, as follows:

Earth Excavation, dry $.34 per cubic yard; in water $.72 per cubic yard.

Rock excavation, dry $1.00 per cubic yard; in water $1.60 per cubic yard.

Rubble stone masonry, Rosendale cement mortar, $4.95 per cubic yard; Portland cement mortar $6.00 per cubic yard.

Concrete masonry, Rosendale Cement $4.55 per cubic yard; Portland cement $6.10 per cubic yard.

Brick masonry $13.00 per thousand using mortar half Rosendale cement and half lime; $14.20 using Rosendale cement mortar and $17.00 using Portland cement mortar.

Contract for work on the dam and canals was signed with J. B. Mullen & Company on July 10th. Some of the figures:

Earth excavation, $.29 to $.34 per cubic yard.

Rock excavation, $1.30 per cubic yard.

Cobble paving, $.40 per square foot.

Concrete masonry, Rosendale cement $4.00 per cubic yard; Portland cement $6.35 per cubic yard.

This last figure applied to the dam and gate sections. Other contracts and subcontracts for materials and equipment were let

in rapid succession. The carpenter work, including windows, doors, roof planking and skylights, was not contracted until September, when Garret Schenck offered the job to J. B. Mullen & Company at cost plus ten percent. This offer was accepted with the provision that the Company buy the white pine roofing plank, hard pine timbers and the skylights.

In what was to become almost a tradition in the Boston offices of the Great Northern Paper Company, the crew worked through the two general holidays falling in this period. The diaries of Frank Bowler are the source of much of this early data, and at this time he wrote, rather wryly, on February 22: "No other office working. Elevators shut down P.M."; and on April 19th: "Patriots' Day legal holiday in Massachusetts. No elevators, 192 stairs."

Harry Hilliard was feeding field reports in to the Boston office. A camera, priced at $7.50, with a lens and shutter purchased separately, after much investigation, for $30, were sent to him for documentary photography. A construction office, also to be used as the Company's office, was designed, and plans for this were forwarded to Millinocket on May 6th, along with the yard track layout.

It has been noted that the general contracts for the mill and other work were awarded to J. B. Mullen& Company. This was a partnership, headed by James Mullen, formed for the purpose of doing this work. It included John N. Merrill of Bangor, masonry contractor, and J. T. Ward and Edward Ward, who constituted the firm of Ward Brothers, carpenter contractors, of Kennebunk. The Wards were cousins of the Mullens, and all three of the families

represented in the partnership originated in Greenbush. Associated with James Mullen were his brothers, John N. Mullen and Joseph T. Mullen. Both had been involved in construction for the Penobscot Chemical Fibre Company at Great Works, where John Mullen had remained as Yard Superintendent. Joseph Mullen was a construction man; had worked on pulp and paper mill construction on the Androscoggin River, and was at this time in charge of a groundwood mill in Rumford. In later years, he was to do a great deal of construction for the Great Northern Paper Company in his own name.

There is some evidence that Garret Schenck was a silent partner in this interprise. There is in existence copy of a letter written to him from Millinocket on July 12, 1899, evidently by James Mullen, reading as follows:

> "Replying to yours of recent date will say that we understand that you are to be interested with us in the construction of the following sections, viz: One, Two, Three, Four, Five, Six, Seven and Eight (Section eighth includes the Dam) as per contract signed by me July 10, 1899, with the Great Northern Paper Company, which takes in all the work to be done on the above-named sections. The different interests are divided as follows, if agreeable to you:
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> | | |
> |---|---|
> | J.B. Mullen | one-fifth)1/5) |
> | J. T. Ward | one-fifth (1/5) |
> | J. N. Merrill | one-fifth (1/5) |
> | Edward Ward | one-fifth (1/5) |
> | Garret Schenck | one-fifth (1/5) |
>
> Each is to bear his proportion of the loss or gain, which-

ever it may be.

The accounts for these particular sections will be kept strictly separate from our former contract, but will run under the same name. Everything that goes to these sections will be charged directly to them, and as the work is of an entirely separate nature and the estimate is given by the engineers separate, the account will be readily adjusted, as most of this work is of a different nature from what we are doing on the old contract."

This contract of July 10th covered only the work on the canals, the various dykes and the dam at the foot of Quakish Lake.

Charles Mullen was not in this partnership. However, he furnished much of the lumber for the construction of the mill and the building in the town of Millinocket in its early stages, from a sawmill which he built near the North Twin Dam. John and Joseph Mullen were on the payroll of J. B. Mullen & Co., but were not partners.

Hardy Ferguson's design for the power development, the heart of the project derived from one of Charles Mullen's several ideas. The latter's concept for Millinocket was, as has been noted, hydro-mechanical power for use by others, and while he almost surely would have envisioned a pulp mill to take some of the power, he probably saw this being built by someone else. In the two or three years after 1891, however, alternating current transmission systems were devised, and his thinking clearly became directed toward hydro-electric power, as indicated by the Northern Development Company's charter, and he had more than one

scheme for development in mind. Garret Schenck put the mill into the project, and this required new planning. The Northern Development Company prospectus indicates that there was a scheme to develop the power in three stages, two of which were to be hydroelectric, but this was not the way it was done. The plan adopted was based on another of the original concepts -- a partial development of the potential head by constructing a dam at the outlet of the swamp which was called Quakish Lake, raising the water level to Elevation 458.0 G.N. (456.2 U.S.G.S.) flowing about 1,000 acres; drying up the river between the dam and Shad Pond and diverting the flow of the West Branch, through gates, into a canal running easterly into a natural depression consisting of about 250 acres of peat bog, later called Ferguson Pond, and thence, through another canal and penstocks to water wheels discharging into Millinocket Stream, called at that time the "Millinockett River". This system, providing a maximum gross head of 114 feet, is still in use. The route of this construction followed roughly the line of the tote road over which Thomas Fowler hauled the river-drivers' boats around the Grand Falls, which probably followed the old Indian portage, although some say this was a little further upstream. The total distance from the dam at the foot of Quakish Lake, for some reason named the "Stone Dam", to Millinocket Stream, was a little more than a mile and a half, of which some 3,200 feet was canal.

An early study was made of a plan which would have put the mill and power house in an area which would now be north of Spruce Street and west of the Bangor & Aroostook spur running to the mill, near where the Millinocket Community Hospital was

later built. Under this scheme, Ferguson Pond would have extended quite a bit more to the north, to a dam built in the ravine west of the townsite, with penstocks leading from it to turbines discharging into a long railrace canal following the course of Little Smith Brook to Millinocket Stream. This location would account for Charles Mullen's comment about "going this way"; that is, the other way, across the Powers Farm. This was the plan preferred in the beginning; shown on "blueprint No. 1" mentioned earlier; an 1898 drawing referring to the canal on the Powers Farm as "Second Scheme". On February 21, 1899, F. W. Cram, then Vice President and General Manager of the Bangor & Aroostook, wrote Garret Schenck confirming verbal understandings to the effect that the Company would give the railroad land for a station, freight house, roundhouse and turntable, yard space and other right-of-way; that the railroad would build the spur track from their main lineto the mill yard boundary, and that the Company would do the grading and lay the ties on the mill property. In this letter he says:

> "I know that we understand each other alike, and I have never intended to state the case differently than is here outlined. I did use the expression that we were to lay tracks to your premises entirely at our expense, but this was when I supposed that your mill yard was to be very near to our tracks, and this I assumed because Mr. Mullen originally talked about the necessity of raising our track in order to get out of the way of the back water from your dam."

This is further indication that it had at first been intended to locate further to the northwest. Whatever other alternates,

if any, were considered, is not known.

The Bangor & Aroostook, of course, figured very prominently in this new enterprise, which it actively encouraged. The cost of transportation was a very large factor in a business located so far from the market, and involving a great volume of heavy traffic both in and out. Freight rates had been the subject of negotiations between Garret Schenck and the railroad at a very early stage, as noted in the Northern Development prospectus. The original agreement, dated March 30, 1898 listing the rates mentioned there, and others, is in existence. This apparently had not been arrived at without a certain amount of bargaining. Some years later, on May 3, 1904, F. W. Cram, at that time President of the Bangor & Aroostook, referred to this in a letter written to Garret Schenck about another matter, saying:

> "You made a devil of a fuss over the difference between paying $3.40 per ton paper Millinocket to New York, the rate we wanted and $3.00, the rate you got: said 'no three dollars, no mill. '"

The first permanent construction at the site was the building by the Bangor & Aroostook of the spur track from the main line near where their station was to be located southward to the mill yard, a distance of about a mile. This spur was nearly finished on May 3, 1899, when the Great Northern Paper Company's contractor put on his first crew, an additional fifty men to build the tracks in the mill yard, and a gang of carpenters to put up a temporary construction office and start housing for the construction crew, themselves living meanwhile in tents.

The Bangor Whig & Courier, now the Bangor Daily News, of May 2, 1899 says:

> "Active work toward the erection of the big paper mill at Millinocket will begin tomorrow morning. On Tuesday, Messrs. J. B. Mullen and C. W. Mullen of this city, John N. Merrill of Bangor and Edward Ward of the firm of Ward Bros. of Kennebunk, left for the scene of the operations and they passed the greater part of the day there making the preliminary plans for the beginning of the work. Accompanying them were two Boston men, one of them being an Italian labor contractor who went to look things over preparatory to sending a big gang of Italians to Millinocket.... Mr. Merrill says he expects to have between 500 and 1,000 men at work before many days. Most of the men will be Italians, although there will be Poles, Finns and Hungarians. Mr. Merrill says that on a big job like that at Millinocket this kind of labor is the best to employ because after the foreigners once arrive on the spot they will stay there until the work is done. On the other hand the kind of labor which can be had in this section is unsatisfactory because the men will not work steadily."

Excavation for the machine room was started on May 16th. At the same time, work began on a diversion dam at Quakish, and excavation was commenced at various points along the canals, including a channel through what was to become Ferguson Pond. The actual canal sections were 62 feet wide on the bottom; approximately 123 feet wide at the water line, and 14 feet deep, partly ditch and partly dyke, with the inside slopes rip-rapped with

stone to the water level. Work was also started about the same time on four earth side-dykes around the Ferguson Pond area, the largest of these being "Ward's Dam", cutting off the ravine running down into the area where the town was to be located. This dyke was built with a masonry core; the others with puddled earth cores in sheet piling.

Early in June, 1899, Hardy Ferguson and his people moved from Boston to Millinocket, the new office, a two-and-a-half story frame structure, located between where the mill was bing built and where the Administration Building was constructed later, having been completed. Frank Bowler arrived on June 15th, at which time he says there were 415 men at work. At about this point, a tower from which to take photographs of the progress of the work on the mill buildings was erected on the east side of Millinocket Stream. The job had by this time become an attraction for sightseers, with the Bangor & Aroostook running excursion trains from various points to Millinocket. The first such train seems to have been run from Caribou on August 22. There were many more, from Bangor, Houlton, Dover and other points, during the following year. Col. O.H. Payne visited the job a number of times, his party usually sailing from New York to Bangor on his yacht "Aphrodite", which incidentally was built in Maine by the Bath Iron Works and commissioned in March, 1899.

There appear to have been no more than the usual difficulties during the progress of the job, except that there was substantial delay in delivery of some materials, notably structural steel, but as Garret Schenck reported at the first annual meeting of stockholders: "The expenditure of money for building

the new mill and rebuilding the old mill (Madison) has far exceeded the amount at first thought necessary."

The dimensions of the principal parts of the original mill are as follows:

Filter House	53'0" x 138'0"
Wood Room	125'0" x 182'0"
Boiler House - Wood burning	64'8" x 119'0"
- Coal burning	75'10" x 191'0"
Generator Room	51'0" x 109'6"
Grinder Room (Wheel House)	174'6" x 211'0"
Screen Room	100'0" x 209'0"
Digester House	40'8" x 86'8"
Blowpit Room	79'2" x 83'10"
Sulphur Burner Room	56'0" x 57'0"
Lime Storage Room	42'4" x 58'0"
Sulphur Storage Room	42'4" x 57'0"
Acid Room	57'0" x 58'0"
Beater Room	72'0" x 294'6"
Machine Room	240'0" x 290'0"
Finishing Room	100'0" x 290'0"
Trainshed	50'0" x 290'0"

All the mill buildings were of brick, with nearly all roofs, and floors above the basements, supported on steel. A notable exception was the blowpit room, where roof and floors were entirely of wood. Most of the roof area was 3" white pine plank, but there was a concrete roof on the trainshed. Wet floors were of concrete, but in the dryer locations wood was used. All foundations, except around the blowpits, were quarry face masonry. The

blowpit walls and column footings throughout the plant were of concrete. Stone for foundations came mostly from the great granite boulders which littered the area. These were picked up on the farm, in the wooded area west of the townsite, and along Millinocket Stream, and were hauled on "stone boats" to two locations, one just south of Oak Street and the other along Millinocket Stream behind the site of the boiler house, where they were split and sized. A rock crusher, to provide stone for concrete, was one of the early pieces of equipment to arrive, and was started up on July 6th. Material excavated from the mill site was largely disposed of along the banks of Millinocket Stream, particularly on the low land where the mill parking lot was later built, then called "the swamp". A steam shovel, and as far as is known there was only one, was used in excavating, but most of this work was done with pick and shovel. Earth moving and other transportation on the job was of course done by horse-drawn vehicles.

A coffer-dam of log crib and sheet piling was built along the west bank of Millinocket Stream, from the boiler house to the screen room, to allow excavation of the railrace flumes and this was kept dry by steam pumps located at the screen room end. A multiplicity of wooden guy derricks, a few operated by hand winches, but most equipped with steam donkey engines, was used to handle construction materials. Steel in the larger buildings was placed by wooden double-boom stiff-leg "travelers" which, with their steam engines and boilers were mounted on carriages running on broad-gauge rails.

It may be of interest to note some of the dates which marked

the progress of the job. It is not known when foundation work was actually started, but the first stone laid was under the boiler house. Brickwork was started on this building on September 9th, the same day that foundation work was begun on the generator room. The first shipment of structural steel, for the boiler house, was received on September 10th. The first pour of concrete on the Stone Dam was made on September 22.

The bulk of the building construction was done during the winter of 1899-1900. Steel for the finishing room was erected in a little over eleven hours on November 13th and 14th. Machine room steel was started on December 5th. The plank roof on this building and timber-work in the blowpit room was begun on December 23d. Foundations for the wheel pits and the grinder room were finished on December 29th, the same day that the last brick was laid for the finishing room and trainshed. On January 10, 1900, steel for the digester building, which was large enough to hold four digesters, was started. The first brick on the machine room was laid a week later. Screen room steel was started February 11th; wood room steel February 23d; the crew shifting from the filter house, which had been completed on February 21st. Generator room steel was started March 5th. Brickwork was begun on this building on March 11th; on the digester house and blowpit room on March 23d, and on the wood room on April 24th.

The boilers were received on November 3, 1899, but little other machinery came in until the spring of 1900. The first car-load of paper machine parts arrived on March 20th, but erection of this equipment did not begin until May 29th. In the meantime, the boilers were being installed. The chimney, 235 feet high,

the tallest in the State at that time, with a 12-foot flue, had been started by Alphons Custodis Chimney Construction Company in the fall of 1899, but was held up for brick and other materials coming by sailing ship from Germany. This was finished, however, on June 18, 1900. This is the brick stack still standing in 1974. Installation of the boilers was completed on June 22nd, and the first shipment of coal was dumped from the storage trestle on June 27th. Boiler house, filter room and wood room steel was erected by the Boston Bridge Company, and most of the remainder by Shiffler Bridge Company. The latter completed its work and its crew packed up and departed on July 11, 1900.

Installation of the steel penstocks, which were to bring the water of the West Branch to the turbines, was started during the summer of 1899. The plans called for seven of these, six of ten-foot diameter for the wheels driving grinders and one eleven feet in diameter to supply the hydro-electric station. All seven wheel pits and tailrace flumes were constructed, but only five penstocks, the one for the generators and those for Nos. 1, 2, 3, and 4 grinder lines, were included in the initial installation. These penstocks were originally designated "A" through "G", the generator penstock being "A" and "G" being that for No. 1 grinder line. As they had to pass under the mill yard and trackage, they were buried in the ground. A single open pit was excavated between the grinder room and the location of the tracks now leading to the finishing room trainshed, and beyond this, trenches were dug up the hillside for the individual tubes. Concrete saddles, thirty feet apart, were built during the fall of 1899, and by November the upper sections, and the lower sections as far as the tracks, had been put in place. Steel plate was

received rolled to shape and punched, and was riveted together on the job, caulked and painted. Each penstock was then covered with selected fill, and the whole area was graded. The upper and lower sections of the last two were built into the gate house and grinder room foundations respectively, and were bulkheaded off for later completion. The original head-gates were of wood, and have long since been replaced, but all of the original penstocks are in use, after some 70 years.

Booming privileges, not in the original charter, had been granted in the 1899 revision. Piers and booms for holding and sorting logs were built in Quakish Lake. A log sluice well out in the spillway allowed of putting the logs of other owners through the dam and down the old course of the river -- the "back channel" as it came to be called -- a procedure most wasteful of water in the early years. A logway 12 feet 6 inches wide in the headgate section of the Stone Dam allowed of floating the Company's logs into Ferguson Pond via the canal, and from Ferguson Pond a wooden sluice, V-shaped, 7 feet across the top and some 1,800 feet long was provided to carry them down the hillside into a second artificial pond in the mill yard.

The first drive of pulpwood was made during the summer of 1900, and the rear was brought into Quakish Lake on July 29th. This wood was in the form of logs, of course. Water was diverted from the West Branch into Ferguson Pond on August 17, 1900. Three days later, the log sluice was opened and the yard pond was filled. On August 31st, the first log came down the hill into the mill pond, and on this same day a boy, name unknown, fell into the sluice and came down with the logs. The account does not say

whether or not he survived.

On September 15th, the piling of the supply of wood for the winter was started. The logs were not barked or sawed up, but were dragged out of the pond by steam winches mounted on rafts, and were piled in tiers extending up the hillside toward the west and northward toward the townsite, the logs being arranged parallel to the pond so that they could easily be rolled back into it. Piling was completed in about a month.

Meanwhile, installation of machinery continued, and by early fall all efforts were being concentrated on getting the plant into operation. Fires were lit under the boilers on September 20th. On October 18th, water was turned into the generator penstock, and the hydro-electric plant began producing power. Number 8 paper machine was turned over on October 23, Number 7 on October 25. On October 29th, water was let into the grinder room penstocks, the water wheels were tried out, and the dream was a reality.

The Millinocket mill was officially started up by Garret Schenck on the evening of Thursday, November 1, 1900. While the Bangor Daily News reported occasionally to its readers on what was going on in Millinocket, it apparently did not cover this event. However, the issue of November 6th carried the following, taken from the "Paper Mill". It was written by the editor of the latter, L.D. Post, who as we have said was a close friend of Garret Schenck's, known to everyone throughout the paper industry as "Derb", and given somewhat to hyperbole:

"Millinocket, Me. Nov. 2

The Great Northern Paper Company's mill in this village, the

largest paper mill in the world, containing eight 152" Fourdrinier machines, was started up last evening at 8:20 o'clock. The hand of President Schenck first opened the gate that turned the water upon the turbines. Mr. Schenck then opened the switch that turned the electricity from the dynamos to the motor that set in operation the machinery in the wood preparing room of the mill.

He then walked to the wood room, mounted the platform of the saw and with his right hand pulled the lever of the log carrier that conveys the logs from the pond to the platform. He then with his foot pressed another lever that started the "kickers" and thus threw the log upon the live rollers that brought it to the saw. Then he pulled another lever that brought the saw down upon the log and sawed it in two-foot lengths. Mr. Schenck then barked one of the pieces of wood, threw it into the conveyor which carried it to the grinder room, placed the wood in the pocket of the grinder and pulled the lever that forced the wood upon the stone and ground it in a jiffy."

At this time, the mill was not quite ready to make paper. The sulphite mill had not been completed, and a supply of chemical pulp had probably been obtained from the Madison plant. The beaters for No. 7 machine were tried out this same day on that pulp. On the night of November 4th, the wood room went into operation. Two lines of grinders were started up on November 6th; stock was run to No. 7 machine the next day, and on November 9, 1900, at 9:00 A.M., the first set of paper to be made at the Millinocket mill was turned up on this machine. No. 6 was started

up on November 12th; and No. 5 on November 16th. There are no dates on the others. On January 31, 1901, six machines were running, but it is known that Nos. 1 and 2 did not start up until after that date. J.B. Mullen & Co.'s work was formally accepted on November 21, 1900.

It might be pertinent to note that the construction of the Millinocket mill seems to have been a safe job for those days. The writer has found no record of any major accident until July, 1899, when a man had a foot crushed by a block of granite. The Company had some form of insurance even at this time. The Whig & Courier of July 19, 1899 says: "Laborers are largely protected against accident by a system which entitled them to treatment at the Bangor Hospital in case of injury," but states that this particular man had not taken out the Company insurance. The arrangement was actually with the Old Town hospital. On March 8, 1900, there were two accidents, in one of which a man fell through a skylight to the machine room basement, breaking an arm and a leg. There appears to have been but one fatality, a workman being buried in a cave-in during some excavation on June 4, 1900. However, there must have been many minor injuries, and it is possible that there were other fatals and serious accidents which we have not found, there being no official record on the subject.

The Millinocket mill has of course been radically altered, but the appearance of the original plant differed greatly even from that known to many people over many years. As compared to that familiar view, the digester building was much smaller and there were no outside acid towers. The big steel pulp storage tanks

along Millinocket Stream were not in evidence. The boiler house was smaller even than the present "old" building, and there was only one chimney. There were no wood piling towers. The machine room was in four equal bays, No. 9-10 room not being added until much later, and the roofs of all the buildings were a jungle of skylights and cowl ventilators, as was the fashion. As all the power was generated in the mill, there were no transmission lines or transformer installations in sight, and there originally was no separate machine shop. With this brief description of the construction and start-up of the mill as background, let us now go back to the beginning and provide more detail -- interesting, amusing or instructive.

Wages paid by the general contractor were $1.35 a day for laborers, $1.50 for quarrymen, $2.00 for stonemasons and $3.50 a day for a teamster with a pair of horses. The number of men employed at the height of the job is not known. The Whig & Courier of November 4, 1899 says that 1,000 men and 150 teams of horses had been at work, but a figure of as high as 1,500 men has been mentioned. The employment of foreign laborers on industrial construction, outside of railroad jobs, was more or less a novelty in Northern Maine. These men were of many nationalities. The "Poles, Finns and Hungarians" included Letts, Lithuanians, Estonians, Czechs, Slavs and probably other ethnic groups all lumped together in the local parlance as "Polacks". Some of them were men who had come to America to work in the steel mills of the middle west and had gradually dispersed into construction and other industry, retaining a large measure of independence. The Italians, who made up the greater part of the unskilled construction crew, had a different standing. Sometimes just off the ships that brought

them from the old country, they were in virtual bondage to their "padrones"; men of their own nationality in the business of contracting for unskilled labor, who obtained employment for them, extracted part of their pay, and sold them necessities at extortionate prices. There was nothing unethical about this by the standards of the times. The "Dagos" were considered fair game for exploitation. The Italian laborers on the Millinocket job, many of whom had come from work on the construction of the Washington County Railroad, were employed under a modification of this system, which was then on the way out, but at that they received pretty rough treatment. The actual labor contractor on this job was one Marco Lavonia but not much was heard of him in Millinocket. The true head of the Italian community was Fred Peluso, who seems to have come to the job as the clerk for the Italian crew on foundation work, and was known as the padrone. His real name was Ferdinando Peluso. He remained in Millinocket after the work was completed, furnished labor to various contractors on other jobs in the State; built a store on the east side of Millinocket Stream to serve the Italian population, since many of these men had remained to work in the mill; acquired real estate, loaned money, and became one of the leading citizens of the community, a Director of the bank which was organized, and active in the Chamber of Commerce.

In 1973, Dorothy Bowler Laverty published a very competent history of the building and growth of the town of Millinocket, making it unnecessary for us to go very far into this aspect of the Company's story, and we will do so only where it seems to us that Great Northern was involved in some significantly important way. However, we should include for its interest a

little information about the construction period.

Arrangements for housing the construction crew and the other people who flocked to Millinocket would seem to have been pretty haphazard. The small crew on the job at the start lived in tents and some boxcars, but several frame barracks-type buildings, mostly for the engineers and supervisors, were erected on the hillside around the farm, and this area quickly grew into quite a community, with other frame structures, mostly temporary, a lot of small shacks and even a general store. This section, which must have been bisected by the penstock excavation, became known as "Shack Hill". We might say here that many of these structures, perhaps most of them, were removed before the mill started up, to permit the piling of logs around the yard pond. Some, further up the hill, remained for several years, but they were eventually all removed. At least one, the store building, was moved over into the townsite, but we believe that few if any of the others were salvaged.

Part of the townsite was laid out at a very early stage, with lots mostly 60 feet on the front, to hold down the cost of sewer and water services; the Company put in the sewers; arranged for a water utility company to be set up; built a few houses; gave some assistance to people who were building homes, and loaned some money, all of which we will take further note of later, but otherwise it looks as if it depended upon private initiative to take care of the housing problem. Garret Schenck was not in favor of a "Company town", with a lot of row houses such as had been built around textile mills, and he insisted that the Company retain control of the situation,and determine what was to

be built where, through its ownership of the land.

Immediately upon release of the news of the Millinocket development, inquiries about business opportunities in the new town had poured in. Rooming houses -- private homes letting rooms -- and boarding houses -- cheap hotels -- were very popular enterprises at that time, and we suppose it was reasonable to assume that people interested in this kind of thing would take advantage of the situation promptly.

The following advertisement appeared in the Bangor Whig & Courier on July 7, 19 and 26, 1899. This tells quite a lot about how the Company planned to manage things:

"GREAT NORTHERN PAPER CO."

WANTED

Responsible parties to erect 100 tenement houses at Millinocket for the employees of the Great Northern Paper Co. with whom special arrangements would be made. The designs and locations of houses to be acceptable to the Paper Co. who will guarantee rents and collection of same.

Special arrangements will also be made with responsible parties who will erect business blocks, and with tenants for same, for conducting the different branches of trade.

Also for the erection of a suitable hotel and boarding house. To the right parties, favorable terms will be made for building lots, rents and trade permits, which will insure a steady and fair rate of interest on the investment made.

For information apply to Chas. W. Mullen, Bangor, Me., or at the Company's office, Millinocket, Me. "

This produced some tenement houses, although nothing like one hundred, but within a very short time Millinocket probably had more boarding houses, hotels and eating places than any other town in the state. Meanwhile, people put up tents or shacks while they constructed permanent homes, and many men -- we do mean men; there were very few women in town during the early construction period -- found shelter there. Those who found no other place to stay built their own shacks, individually or cooperatively, out of anything handy. People with the same national or regional origins tended to hang together, and this was particularly true of the Italians, who, while they had differences among themselves, those from the north having little use for those from the south and vice-versa, established their own colony.

We have gone to the files of the old Whig & Courier, one of the antecedents of the Bangor Daily News, for contemporary accounts of conditions in Millinocket in 1899, and we quote from some of these for their interest as they bear on the things about which we have just written.

From the issue of July 19, 1899:

"I S R U S H I N G

WORK AT MILLINOCKET BEING PUSHED VIGOROUSLY

A GOOD BEGINNING

Liquor kept out and Peace Reigns. Tuesday was

Pay day there.

Buyers of lots protected effectively

from speculators."

"Today is payday here. The company pays but once a month, holding back fifteen days wages. This regulation

and the fact that liquor is effectively kept out of the place accounts for the quiet and sobriety which reign here after hours and Sundays.

"Across Millinocket Stream is what is called 'Italy'. The 'Dago' population seems to enjoy itself and takes the rough surroundings much better than do the Americans and people of other nationalities....

"Business lots can be obtained for a number of branches of business and so that the first purchase will be protected no other lots will be sold for the same line of business. The company requires that before titles are given one thousand dollars must be expended in improvement on the business lots. This will insure bona fide sales and will protect those who actually mean to come here to establish business against the holding of land by speculators...."

From the issue of the next day, July 20th, these excerpts:

"M E A N S M U C H

PAY OUT $35,000 A MONTH AT MILLINOCKET

Accident there. A man's foot crushed on Wednesday.

A Case of Malicious Mischief

Women are scarce at new settlement. Game plenty."

"There are but few women here, probably not over thirty all told....."

"So great is the vigilance of the law here in regard to intoxicating liquors that the men tell one another that "they will take it right out or your pocket every time...."

"'Waldorf Astoria-European Plan' is the sign at the tent

cafe erected at Millinocket Station. This inscription is the very first thing to attract the attention of visitors to Millinocket for the first time...."

"There is such a place as the 'Wooly East'. This town represents the notion to perfection".

The issue of September 2nd mentions three boarding houses completed, or under construction, and that of November 4 says that there were at that time a drug store, a grocery store, a clothing store and two barber shops in the business district, and that the town had two doctors. It also notes that there were about 265 Italian workmen on the job, and we quote the graphic description of the conditions under which they were living:

"A Whig reporter who was in Millinocket on Thursday walked over the little bridge, which is of the Italians' own construction, and found himself in a new world. There were huts of every imaginable description, and such huts! Huts of sticks and grass, houses of barrel staves, slab wood and in fact anything that could be made with the greatest imagination even into any form of shelter. There was one hovel that certainly looked at least more comforatble than the rest. It was in the form of a tent, made of poles stuffed between the chinks with mud and grass until not an aperture remained except a hole in the roof to let the smoke out. It looked warm, and as the reporter stood there someone inside struck up a lively Italian air on a harmonica. They are very peaceful, these men, and live together in greater amity than can sometimes be said of their whiter brothers.

"The Italians do their own cooking, obtaining their supplies from their 'Padrones' who hire them for the contractors, look out generally for their welfare and charge them all they possibly can for the stuff they live on.

"The other men are of all the nations of the earth and live in boarding houses, huts, and anywhere a bed can be found. However, they are all very comfortable after their own fashion and few complaints are heard. There is one feature about the place that in Maine is almost phenomenal for a place of the kind. There is not a saloon in the place!"

An old photograph shows two or three fairly large and very rough buildings, made of sawmill slabs, in this area east of Millinocket Stream which the paper calls "Italy" but has always in the writer's time been "Little Italy", surrounded by a large number of small individual shelters, and older informants recall hearing of the "clay huts", one of which is described. Several references to the restrictions on liquor will be noted in these newspaper accounts. The Company was very serious about this, and we will have more on it later on. From the observations of some of the old-timers, Millinocket, during the construction of the mill, was far from being as peaceful and virtuous a place as some of these newspaper comments would seem to indicate. However, the Company did go to great lengths to prevent lawlessness or disorder.

Information is available from which a faily definitive description of the original mill and its equipment could be written. It does not seem profitable to attempt such study, but an effort will be made to establish a base for later developments.

It may be more interesting, and certainly will better capture the impressions of that time about what had been wrought on the Powers Farm, to use parts of the story as it was given to the industry by the inimitable Derb, in his "Paper Mill and Wood Pulp News" of November 24, 1900, with interpolation by the writer. He wrote:

> "At home, November 22 -- not quite seventeen months ago the Great Northern Paper Company started in to build at Millinocket, Me., the largest paper mill in the world, and also to establish there a town. Judging from the rapidity of its growth since the first tree was hewn and the first shovel of earth was thrown up, this town, or settlement as it is now, bids fair to become a small city within the next three or four years. When one stands upon the highest level between the head-gates and the tailrace and looks down upon the mammoth paper, pulp and chemical fibre manufacturing plant one is amazed at the progress that has been made. Seventeen months ago the land on which this greatest of all industrial propositions stands was practically a primeval forest, as wild and rugged as any virgin forest in the State of Maine; and yet in that short period of time there has been built a plant that covers nearly seventeen acres of land, and every department is in full operation.....
>
> "The more I walk through this great plant and over the ground, from the head-gates to the tailrace, the more I become convinced that the Almighty, when he made the world, intended to establish a hidden treasure in the way of an industrial site for the manufacture of paper and pulp in the dense forests of Maine, knowing full well that some one of

his chosen race would discover, develop and build, and I imagine five years ago this industrial treasure was as thoroughly hidden from the race as it was when Columbus discovered America. But when such enterprising men as those associated in the Great Northern Paper Company go out prospecting for paper and pulp mill sites and facilities they generally discover any hidden treasure before they stike their tents, and I am sure that Mr. Schenck and his associates have discovered, developed and built upon the greatest hidden treasures in the way of a paper mill site that was ever known, and its equal will never be discovered again in this country. This is conceded by nearly everybody who has seen the plant, and by a great many more who have been searching for localities in which to establish news paper plants that would enable them to compete with news mills built five or six years ago, let alone this gem of news paper mills, the Great Northern."

How about that? Actually, as we have seen the site was known to many people, and at this time it had been nearly ten years since Charles Mullen made this first purchase there. But to continue:

"Indeed the inhabitants of that great industrial State, the State of Maine, may well feel proud over the fact that this State today contains not only the finest news mills in the United States but also the largest news mill ever built in this or any other country. Seven years ago the State of Maine was classed as about third in the manufacture of newspaper, but I am safe in saying that today she leads them all. More than this, she can safely make the boast that within her

boundaries stands a mill today that can make a fair profit on its production on what it costs all the other news mills in this country to manufacture this grade of paper. This is easily accounted for when you take into consideration the Great Northern Paper Company's beautiful site and facilities in the way of a grand water power, virgin forests close at hand, and a mill built and equipped with all the modern machinery and appliances, and so constructed that the paper company is enabled to manufacture paper and pulp at nearly one-third less than can the news mills built a few years ago...

"Now I will endeavor to prove the statement that I have made regarding this great paper and pulp manufacturing establishment, and the advantages it has over all mills built in past years. From the many years experience that I have had in traveling around among the pulp and paper mills of this country, and also in looking over the sites and facilities before the mills were built, I have made up my mind that there are three fundamental principles in making a newspaper and groundwood pulp mill a success, as far as the natural facilities are concerned, and the three are: the water power, the wood lands and the railway facilities. When you have demonstrated the fact that you have a sufficient water power 365 days in the year to operate your paper mill and groundwood pulp mill, and produce the tonnage of paper and pulp you started out to manufacture, and that you have plenty of wood and good shipping facilities, the mill, if properly constructed and operated,is bound to be a success.

"Now, the Great Northern Paper Company is assured of these three things, and I do not believe there is anybody

connected with this industry who would question it. But it has another natural facility that a great number of modern mills have not, and it is this: the mill is built upon the banks of one river, and at an elevation of 114 feet above this river the dam is built across another. To be more explicit, the Great Northern Paper Company has built its mill on the banks of the Millinocket River, and it has built its dam on the West Branch of the Penobscot River, which is at an elevation of 114 feet above the Millinocket River. Therefore, it has a natural facility in the form of gravity that not more than one mill in a thousand has. Not only does gravity prove of very great service in creating power, but also in operating every department of the mill.

THE WATER POWER

"Beginning at the Millinocket River, you walk up grade to the huge dam built of solid concrete, 1,200 feet long and 22 feet high at the highest point. The average height of the dam is 12 feet, and the main head-gate is built upon the end of the dam."

These were the gates and logway at the entrance to the canal at the extreme east end of the dam. The rest of the dam and the first 225 feet of the canal was spillway, except for the down-river log sluice.

"Now I do not mean to suggest that the Penobscot River at this point is 1,200 feet wide, but the dam backs water over small islands and swamps and forests, submerging them under 22 feet, and none of this water can get away except over this dam, as the elevation of the land at each end of

the dam is equal to the height of the dam.

"From this dam the water is admitted into the canal... 1,500 feet long. The water flows through this canal into an artificial pond, which covers 260 acres of land. At the southeasterly corner of the pond there is located a set of head-gates which admit the water to another canal, which is about 1,800 feet long....At the lower end of this canal are located the penstock head-gates. There are four of these penstocks 10 feet in diameter and one 11 feet, which tap the canal at this point. These five penstocks run down the side of the hill, the lower ends being riveted to the wheel cases.

"These penstocks, which are approximately 1,100 feet long, were built by the Riter-Conley Manufacturing Company, of Pittsburgh, Pa. In addition, the company furnished and put in place short sections at the upper end and short sections at the lower end, ready for two future penstocks each 10 feet in diameter. The material of which these penstocks were built was 7/16", 1/2" and 9/16" thick; all horizontal seams being double riveted and circular seams single riveted. The entire weight of material in these penstocks was approximately 2,500 tons. The material for these penstocks was all made in Pittsburgh and was punched, formed and made ready for fitting together at the works there, so that the work in the field consisted of assembling and riveting. The entire work was coated with Detroit Graphite Manufacturing Company's graphite paint.

"The distance is about 900 feet from penstock head-gates to water wheels.....

"I have pictured the flow of water from the Penobscot

River through the canal and into the big artificial pond, and out of the pond into the canal, and to the penstocks, and down to the water wheels, and into the Millinocket River, which acts as a natural tailrace. Now for the branches from the pond and canals to other points. Before it goes into the natural tailrace enough of this water flows into a huge filtering plant a very short distance from the head of the penstocks and on the same level to supply the manufacturing department of the plant with pure, clean water. The filtering house is built of concrete, and I tell you the sides and bottom are as solid as the rock itself. The filtering house has a capacity for storing 12,000,000 gallons of water -- enough to supply a city of 200,000 inhabitants. The filtering plant contains eight filters built by the New York Filter Manufacturing Company, of a capacity to filter 8,000,000 gallons every twenty-four hours, and there is room in the house for filters to handle an additional 4,000,000 gallons per day. The water runs into this filter house by gravity, and the filtered water is conveyed to the mill in a separate pipe nearby the power penstock, with a pressure of 45 pounds to the square inch. This does away with all pumps, both for the grinders and all parts of the mill."

Some of these original 17'0" diameter sand filters, together with others of the same type installed a few years later, were still in use as this was written in 1969. For a great many years, one filter man after another kept a few trout in one of the tanks as pets -- maybe they still do. A 95,000 gallon elevated tank, just to the east of the filter house, provided pressure for sprinklers over the chip bins in the digester building.

THE WOOD ROOM

"I will now endeavor to describe the wood facilities of this great newspaper plant...The logs are floated from the log boom on the Penobscot River through a sluice built in the dam and then through the canal into the big artificial pond. This pond has a capacity for holding 100,000,000 feet of logs." (The name "Ferguson Pond" had apparently not been applied to it at this time) "They are then floated into the other canal and sluiced down the bank into an artificial pond No. 2. This pond is situated directly in front of the wood preparing room... Walking down from the head-gates to the paper mill the first building you strike is the filter plant, which I have described. Further down the grade you come to the wood preparing building, which is one story and basement...The wood room is a unique feature and something I have never seen before in mills for the reason that it is so well equipped with all the modern machinery, and so operated automatically that no men need apply for jobs. The cold fact is that inanimate forces prevail all through this mill.

"Now...you will see there a large platform with four saws, and the artificial pond of water outside of the wood room just beyond this platform. This is full of logs...A man stands there with two hand levers and a foot lever. The logs are hauled upon this platform by pulling one of these levers, and as soon as they reach the platform the foot lever is pressed and the kickers throw the logs over upon the live rolls, which carry them right under the saw. Then the other lever is pulled, and this causes the saw to cut the logs into four-foot lengths. Then the wood falls into a chute, and then

into a tank of water, running the full length of the wood room in front of two rows of barkers. All the barker man has to do is to lift the wood out of the tank of water and place it upon the barker. After it is barked, the wood is thrown on to carriers, which take it over to the grinder room, the next building opposite the wood room.

"At the other end of this room stand three large chippers, and as the wood is conveyed from the barkers to the grinder room by shifting a lever, it can be carried on to the end of the wood room and thrown into another large tank of water running across the wood room and in front of the chippers. All the chipper man has to do is to pick out the wood from the tank and throw it into the chippers. Thence the chips are carried upon an 18-inch Jeffrey screw conveyor to a Lombard chip crusher, and from there they are conveyed into a chip screen. Then they are again carried by a Robins conveyor up the incline and thrown into the chip bins at the top of the sulphite digester house.

"The wood room contains thirty-two barkers, part of which were built by the Holyoke Machine Company of Holyoke, Mass., and the rest by A. O. Lombard, and all of them are fitted with the Lombard attachments. The refuse and waste from these barkers...fall through chutes into the basement below, and upon the Robins Conveyor Company's belt, and are carried over into the boiler house. There they fall directly on a platform in front of the furnaces of two of the six batteries of boilers."

All of this sounds very efficient, but it was far from modern

automation. In reality, the wood room was alive with men. There were two single-strand haulups for the logs, one for each saw platform, and the logs could be kicked off to either side of the haulup to one of the two sets of live rolls feeding the two swing saws on each platform, four in all. The 60" saws were mounted on wooden arms which were pulled down and raised by air cylinders, and the kickers were air operated. The saw platform was in the northwest corner of the room. Sticks from the saws dropped down chutes into three wooden tanks extending lengthwise of the room, with the thirty-two barkers in four rows of eight each in the aisles between the tanks. These barkers were of the knife type, with blades in revolving discs in the manner of a chipper, and took off quite a lot of wood along with the bark. There was a barker man for each barker. Lifting the wood out of the water and onto the machine was wet, heavy work, and even with the Lombard attachments -- dogged chains that helped to hold the stick and rotate it against the knives -- running a barker was hard labor. There was a blower and an air separator for each barker, the waste being deposited on conveyors in the basement, delivering to a cross-conveyor just under the saws, running to the shavings burners in the boiler house. Between each of the two rows of barkers was a single chain block conveyor, lengthwise of the room. These carried the barked wood toward the south end of the room, delivering to a basement conveyor to the grinder room, or, by swinging a chute, over this cross-conveyor into another tank, this one crosswise the room, which was the supply for the chippers, located between it and the south wall. The two 88" Holyoke and one 82" Adirondack three-knife chippers were set on the main floor, and the wood had to be lifted out of the tank by hand and fed one stick at a time into the short spouts.

The chips fell onto another basement conveyor, and apparently all went through a crusher and then up a conveyor to a Lombard 6 ft. x 54 ft. cylindrical chip screen located along the east wall, discharging directly onto the uptake to the digester loft at the southeast corner of the room. Sawdust dropped into the basement, and was conveyed to the cross-conveyor going to the boiler house. Incidentally, all the above tanks were made of two-by-fours, spiked together on the flat, lined with tarred paper and covered outside with tar and wooden sheathing. There were four splitters spaced across the south end of the barker tanks, and basement conveyors to carry splitter waste to the cross-conveyor to the boiler house.

There are some questions about operations in the old mill that we have not been able to answer, and Derb raises one of them here by saying that the swing saws cut the logs into four-foot lengths. We do not believe that this is correct. The grinders took two-foot wood; there is no indication of a slasher between the swing saws and the block tanks, and our impression has always been that the knife barkers handled only two-foot wood. Some four-foot wood was being received even at this time. A spur track ran along the east side of the wood room, extending onto a short trestle against the wall of the building, and a conveyor, parallel to this track, entered the wood room at the northeast corner. These facilities were for handling short wood brought in on cars or by teams. There was a single 60" Lombard table saw "for four-foot wood", fed by an apron conveyor, and another conveyor from this to the block tanks. We do not know just where this was originally located, but a drawing of a little later date shows it in the northeast corner of the wood room, and its purpose was quite clearly to cut four-foot sticks into two-foot blocks. The whole arrangement

of the wood room indicates that all the wood, even that for the chippers, was cut two feet long for use. Anyway, this is all we can make of it, and indeed Derb, himself, in his November 2d article on the official start-up of the plant from which we quoted earlier says that the swing saws "sawed it in two-foot lengths". Incidentally, the original wood room building, while somewhat enlarged, is still in use in 1974.

> "Another (Robins) conveyor serves the chippers and finally conveys and elevates the chips to the huge storage bins at the top of the digester house. Here even distribution of the chips is accomplished by a tripper or discharging device, which is the most wonderful part of the belt system. This tripping machine, mounted on a car which runs on tracks along the entire length of the bins, takes its motion from the belt conveyor itself, and moves slowly back and forth, reversing automatically at either end, delivering its never-ceasing stream of chips into the bins more evenly and smoothly than could be done by many trimmers. Day in and day out it travels to and fro, requiring absolutely no attention. It is undoubtedly saves more labor than any other machine in the mill. In fact, the whole system of belt conveyors requires no attention."

Mr. Post must have been anticipating just a little here. The sulphite mill did not get into operation until January, 1901, and the chip bins were not filled until that time. He may of course seen a demonstration of the chip system.

THE BOILER HOUSE

"Directly across the road from the wood room is the

boiler house....The boiler house contains four batteries for burning coal of 4,000 horse-power on one side, and on the other side it contains two batteries of boilers of 1,000 horse-power for burning the shavings and waste from the wood room. The boiler house is so constructed that another battery of the same capacity can be added by simply securing the boilers and setting them up. These boilers were built by the Aultman-Taylor Boiler Company of Mansfield, Ohio.

"Adjoining the boiler house is a room ....which contains two large fire pumps, with a capacity of 3,000 gallons of water per minute. The boiler house also contains Green's economizers....purchased from the Green Fuel Economizer Company of Matteawan, N.Y.....also the pumps and hot water tanks and filters, with a double system so that if one system gives out the Company will have another to fall back upon.... There is a tunnel from the boiler house to the electrical wires, which are thus carried under ground....This tunnel, or subway, is another new feature in this great news paper plant....The temperature of that subway from the heat of these pipes is about 170 degrees, so you can readily see what a saving there will be of the coal bill. The steam system of this great plant was constructed under the supervision of A.N. Jaastad, mechanical engineer."

The boiler house was in effect two buildings. The structure housing the wood burning boilers was immediately across the roadway from the wood room, with its floor four or five feet lower than that of the wood room basement, and there was room in it for four batteries of boilers. This part of the building was centered on the west wall of the main boiler house, a common wall, with

the stack on the main room side and the economizers on the other. The floor of the main building, which also was built large enough for two more batteries of boilers, was 12 feet lower than that of the shavings burner room, but both buildings were thirty feet high. This configuration largely disappeared in subsequent rebuilding. The pump house, a one-story "wart", 22 ft. x 28 ft., at the southeast corner of the main building, contained two 20" x 12" x 18" Duplex steam driven 1,500 gallon fire pumps, taking water from Millinocket Stream. The boiler feed pumps were also Deane Duplex units, tandem compound, steam driven. The four batteries of two 375 h.p. boilers each, 3,000 h.p. total, were Babcock & Wilcox type, longitudinal drum, hand fired, and were probably good for 135 lbs. p.s.i., as were the two batteries of two 250 h.p. boilers each, hand fired with bark and wood waste. There was one coal unloading trestle, 30'6" high and about 350 ft. long, located between the boiler house and Millinocket Stream. This would store about 30,000 tons of coal. There were no overhead coal bunkers, fuel being brought into the building from the north end in small cars pushed by hand. Ashes were taken out the same way, and excavation almost anywhere in the older parts of the town will uncover these cinders, which were universally used for fill. No provision was made for generating electric power from steam. There does not seem to have been even an emergency steam-driven lighting generator, as at Madison. Steam was used for process, to drive the paper machine engines, and for a large number of small engines on heating and ventilating equipment, air compressors and a few other applications throughout the plant. A. N. Jaastad was a consulting engineer, not one of Hardy Ferguson's staff.

THE ELECTRICAL EQUIPMENT

"We now come to generator room....which is located just north of the grinder room...."

It may seem incredible that such a relatively short a time ago there was any controversy about the desirability of using electric motors to drive machinery in pulp and paper mills. This, however, was the case, and the first important installation of this kind was made by the Great Northern Paper Company. The electric power generating and distribution system installed in the new mill was of great importance to the industry, and it seems desirable at this point to depart from Mr. Post's description.

The General Electric Company was formed in 1892 by the union of Edison General Electric Company and the Thompson-Houston Electric Company. At that time, direct current was used almost exclusively. In 1890, alternating current apparatus was still in its infancy, as it was not until after Steinmetz joined General Electric in 1893 that he worked out the mathematics that gave alternating current its start. At the time the Great Northern Paper Company's early developments were in design, the New England District Engineer for General Electric was A. N. Bush. He was highly regarded by both Hardy Ferguson and Garret Schenck, who relied heavily on his opinions in matters involving the use of electricity. The electrical systems which he worked out for the Madison and Millinocket mills, while primitive by modern standards, were very advanced for those days.

Shortly after the Millinocket mill started up, A. N. Bush wrote a paper, apparently for presentation to the American Pulp & Paper Association, from which the following:

"For a period of approximately seven years there has been an ever increasing number of instances of power distribution by electrical methods in almost all classes of factories. While cotton mills, as a class, have been the largest users, woolen mills, thread, twine, duck and burlap mills, as well as print works and machine shops, all have their representative installations. There has been no especial boom in this industry, but a steady, wholesome growth, which, in itself, is an indication that there is sound reason and good business principle in its adoption.

"The two principal reasons for this are the rapid dissemination of the knowledge of its advantages among manufacturers, and the development by the electrical companies of machinery suitable for the purpose; machinery adapted for continuous operation, with a minimum of attention, depreciation and repair.

"Furthermore, it should be borne in mind that this growth is not, as it at first promised to be, one due to the adaptability of this system to 'special conditions'. While it is true that there are numerous instances where power can be carried from one point to another by this means more conveniently and economically than by any other, it is also true that an enormously larger field is steadily opening to the producers of this class of machinery, and it is not rash to predict that eventually other methods will have largely passed into history. It is to this larger application that I wish to call your attention."

After describing briefly a number of "special applications"

and the first full-scale steam-electric three-phase A.C. system in a Massachusetts textile plant, he outlines the advantages of such systems, mentions some of the power problems of pulp and paper mills, and goes on:

"The system recommended for this class of work embodies the use of three-phase revolving field generators and induction motors of the type having a starting resistance in the armature circuit, such resistance being placed in the armature spider. This form is essential in this class of work, to give a large starting effort without an excessive demand upon the generators, or the installation of friction clutches in the shafts driven by the motors.

"The first installation of any moment, excluding a very few comparatively small special applications of individual generators and motors; as you already know, was made by the Great Northern Paper Company, first at the plant in Madison, Maine, and a year later at its mammoth plant at Millinocket, Maine, and necessarily, so far as description goes, this paper treats of these two installations.

"When this subject was first broached, about two years ago, I did not have unstinted confidence that the electrical system would be adopted. The power to drive was within the mill itself. The length of the drive was not such that it could not be handled in some way mechanically, and the plant was to run continuously, year in and year out.

"The efficiency and flexibility of the system led the President of the Great Northern Paper Company to have made a most thorough investigation of the subject by his engineer, and this ultimately brought about its adoption. I am break-

ing no confidence when I state that both the President and his associates have been well satisfied with the results...."

From Mr. Bush's description, the generator room, the location of which has never been changed, contained three 1,000 k.w., three phase, 600 volt, 40 cycle horizontal generators, each direct connected to and driven at 400 r.p.m. by a pair of 36 inch water wheels, each pair rated 1,500 h.p. at 110 ft. head; and two 60 k.w. exciters, each driven at 600 r.p.m. by a 24" water wheel, rated 125 h.p. All of the wheels took water from the 11-foot penstock. The 24" wheels were supplied by Rodney Hunt Machine Company, and in addition to driving the exciters were arranged with a "groove friction" connection to two 1,000 gallon Hunt rotary fire pumps taking suction from the penstock. The generator wheels were also made by Rodney Hunt, although they do not show separately in the list of equipment, and may have been in the General Electric contract. About 60 ft. of the west end of the generator building was fitted up temporarily as a machine shop. This section had a plank floor on mud sills, and was equipped with a 72" boring mill, a milling machine, a 30" x 8' planer, a radial drill, a couple of small lathes and some woodworking machinery. This area is where the grinder room block tank was located later. A 28" x 26' engine lathe was set up in the adjacent grinder room. At the east end of the generator room there was a brick switch-board chamber.

Except for the paper machines and some individual pieces of equipment powered by steam engines, the entire mill was driven by motors, through belts, pulleys and shafting, as follows:

WOOD ROOM	2 - 250 h.p.	Each driving a log haul-up, live rolls, two saws, 16 barkers, two splitters, and a waste conveyor.
	1 - 30 h.p.	On Waste conveyor to the boiler house.
	1 - 250 h.p.	Driving three chippers.
GENERATOR ROOM (Machine Shop)	1 - 30 h.p.	On chain conveyor from wood room to grinder room.
	1 - 50 h.p.	Driving tools in temporary repair shop.
SCREEN ROOM	1 - 300 h.p.	Driving one groundwood stock pump, one white water pump and the bull screens.
	1 - 250 h.p.	Driving two groundwood stock pumps and one white water pump.
	1 - 75 h.p.	Driving one sulphite stock pump.
	1 - 250 h.p.	Driving 70 groundwood flat screens, 24 deckers and 6 wet machines.
	1 - 300 h.p.	Driving 60 sulphite flat screens, one water pump and 6 wet machines.
DIGESTER HOUSE	1 - 30 h.p.	Driving chip conveyor and tripper.
ACID PLANT	1 - 200 h.p.	Driving two vacuum pumps, one stock pump (?), one acid pump and one lime pump.
	1 - 100 h.p.	Driving one acid pump.
BEATER ROOM	4 - 300 h.p.	Each driving four beaters, two jordans and two chest agitators
FINISHING ROOM	1 - 10 h.p.	Driving roll grinder.
FILTER HOUSE	1 - 50 h.p.	Driving one water pump (for washing filters).
BOILER HOUSE	3 - 5 h.p.	Driving tube cleaners on economizers.

These 23 motors are all that are listed in two separate accounts. However, there were at least four more, connected by belts to the exhaust fans on the machine room roof. It is believed that the four 300 h.p. motors in the beater room were synchronous. The others were all 550 volt motors of the internal resistance type, and some of them were in service as spares up

until about 1950. There were undoubtedly some small loads hooked up to some of the motors in addition to those we have noted.

The mill was lighted by 80 arc lamps and 1,200 incandescent lamps, supplied with 120 volt current through transformers, but by later standards there was hardly enough light to see by, in most places. Exposed wiring was "lead covered in the sulphite mill, rubber covered in wet places, otherwise fireproof insulation".

Mr. Bush concluded: "Success depends upon deliberate and intelligent action, taking the best which is at hand for the purpose, and I cannot point to a more remarkable instance of this than the results achieved by President Garret Schenck and his associates in those first paper mill applications." A wise observation.

The success of the systems installed by the Great Northern Paper Company gave a great boost to General Electric's new heavy industrial power business, and so close was the relationship between these two companies that for nearly fifty years, with one single exception outside of a few small motors, no piece of rotating electrical equipment that was not made by General Electric Company was installed in a Great Northern mill.

The manufacturers of alternating current equipment were at this point experimenting with frequencies from 25 to 60 cycles or higher, and General Electric had settled upon 40 cycles as the optimum. A number of important installations were made in New England at this frequency, and in the next few years some 25 cycle installations were made in paper mills before the trend went the other way and settled at 60 cycles. Great Northern by this time had so much 40 cycle equipment that it could ill afford to change,

and retains this frequency in a large part of its system to this day. Now to return to Mr. Post.

THE GRINDER ROOM

"We now come to the grinder room....This grinder room contains forty-eight Holyoke Machine Company grinders and .... it is another most unique layout, as is the wood room. The grinder room is also fitted up with large tanks, running between two rows of grinders, and these tanks are full of water. When the wood conveyor brings the wood from the wood room to the grinder room, it shoots it into these tanks. All the grinder man has to do is to pick this wood out of the tank and place it in the pockets of the grinders.

"There are twelve grinders on a line, and the water wheels and tailrace running up the center of the grinder room divide the lines of grinders into lines of six on each side (of the water wheels) with a pair of water wheels developing 4,000 horsepower, to operate each line of grinders....This mammoth plant is equipped with ....the well-known New Pattern Hunt turbines....made and installed by the Rodney Hunt Machine Company, whose works are at Orange, Mass. The aggregate capacity of these turbines...is fully 22,000 horsepower under the normal fall. There are four units for the forty-eight pulp grinders, consisting of eight 57-inch special turbines, mounted in pairs on horizontal shafts...incased in cylindrical steel flumes and....running at 225 revolutions per minute... In view of the great strain due to the unusually high fall under which these turbines operate, the runner and guide buckets were necessarily made of steel and very thick, which is not considered conducive to high efficiency, and the excell-

ent showing in the ....tests....is noteworthy in view of this fact."

One grinder wheel and one generator wheel were tested at the testing flume of the Holyoke Water Power Company before installation at Millinocket, and showed efficiencies averaging 84.7 percent at three-quarters to full gate. The grinder wheels were rated 3,300 h.p., but developed 3,900 h.p. on test. Water entering the cylindrical casing was discharged from the two wheels through a 90 degree elbow at each end into the tailrace flumes, which, as a matter of interest, were floored with 4" hemock planks laid on 12" x 12" timbers over the concrete bottom. The generator flumes were similarly floored.

The Holyoke grinders were of the three-pocket type, taking two-foot wood, each producing about five tons of pulp, A.D., in twenty-four hours. The stones were of course natural sandstone, and were 27" face and 54" diameter when new. Hundreds of these stones were broken over the years, and many were cut into three pieces and used to build retaining walls, which may be seen around the mill. There was a 200-ton hydraulic press in the grinder room for installing and removing the pressed-on fittings on the grinder shafts. At a later date, a few thirty-inch face stones were installed to handle wood slightly over length, but as far as is known, there were none of these in the first installation. Pressure water for the grinders was apparently at first taken from the penstocks, but pressure pumps, driven by belts from the water wheel shafts, were installed very shortly. There was no separate governing system on the grinders, speed regulation being entirely by the water wheel governors. A trolley beam, with a 6-ton hoist,

served each line of grinders.

It is interesting to note that in spite of the emphasis placed on the utilization of gravity, wood was conveyed from the wood room to the grinder room at that time by a chain conveyor which ran along the west wall of the grinder room and discharged into two long tanks, a little less than waist high, running across the room between what became Nos. 5-6 and Nos. 3-4 lines, there being only four lines in the original installation, although the room was built for six. Wood was lifted out of the tanks and piled in wooden racks close to the grinders, for checking consumption and to facilitate loading. An indicator rod, attached to the pressure foot, showed when each pocket had been ground down. There were lathes on these grinders for stone sharpening. Now back to Derb and the screen room, about which he is a little sketchy.

SCREENS AND WET MACHINES

"The basement under the screen room....contains the rifflers for groundwood and also the...pumps for both the groundwood and sulphite pulp. Above this is the screen and wet machine room (for groundwood) which ....contains 80 improved Decker screens with room for 40 more; also 24 Decker feltless wet machines (gravity deckers) with ample room to put in 12 more; also six Sandy Hill Iron & Brass Company's wet machines....The Decker screen has proven itself to be a remarkable screen. The Great Northern Paper Company gave it a thorough trial under all conditions in its mill at Madison, Me., and after it had thoroughly demonstrated that it was the best screen they had ever used in the Madison mill, it replaced

all the other screens in the Madison mill with Decker screens. Hence this world beater of an order of screen was given to John A. Decker, who is the Superintendent of the Great Northern Paper Company's plant. Of course the Decker Feltless wet machines are now used in nearly every paper and pulp mill in this country. This machine was also invented by John A. Decker, and its usefulness is established...The basement of the screen room is quipped with large retaining tanks that receive the pulp from the Decker wet machines.

"Above the main screen room is the sulphite screen room... and it contains 60 more of the Decker screens. This room is also equipped and in perfect order for 30 more of the Decker screens. It also contains six of the Sandy Hill....wet machines for handling the sulphite pulp."

The groundwood bull screens may have been inclined perforated plates, with chain-mounted sooden scrapers for removing slivers; at least, this type of screen, although not the original installation, was in use for a very long time. The groundwood pulp went from these to a 200 ft. x 6'10½" riffler in the basement, and was pumped up to the flat screens. There were actually 70 twelve-plate groundwood screens in the first installation, and this number was increased to 95 within the next year or so. Sulphite pulp went through knot screens of an unknown type, and flowed directly to a 100 ft. x 4'1½" riffler, also in the basement, from which it was pumped up to the screens, of the same 12-plate flat variety. It is not known on what basis the order for screens was given to John A. Decker. They and the gravity deckers were built by J. W. Penney & Sons Company. The wet machines were for taking off sulphite and groundwood pulp in laps, for reserve storage outdoors. There

were no save-alls for white-water in the original installation. Groundwood, sulphite and white-water pumps were centrifugal, but the stuff pumps in the beater room, mentioned next, were Triplex plunger pumps. Old notes mention an elevator in the screen room, and it is shown in the list of equipment supplied, but there is no other information on it.

THE BEATER ROOM

"The basement of the beater room....contains the motors for driving the beaters and also eight steam engines for running the eight...paper machines; also the Jordans, stuff pumps and chests. There is also a new feature here, as one chest stands above another. The beaters empty into these chests and from these chests the pulp flows by gravity to the Jordans and then by gravity to the machine chests. This does away with one pump for every Jordan. From the machine chest the pulp is pumped to the machines. All the piping for both sulphite pulp or groundwood pulp is either copper or cast iron, which will never need replacing, as acid has no effect on it....

"Above this basement is the beater room....It contains 16 Jones Beating Engines, which have a capacity of 1,500 pounds to each beater. These beaters are all made out of cypress, in hardwood finish, with a patent curve. There is no other machinery of any kind in this room, and as you will see.... the beaters are set lengthwise instead of crosswise, which saves a great deal of room...."

No consistency regulators or metering devices were in use at this time, and the beaters were used for proportioning, mixing,

coloring and sizing the pulp and for control of consistency. A size preparing system was provided as part of the original equipment. Hand trucks were apparently used for bringing in lap pulp from the piles, which were in the area where Nos. 9-10 machine room was built. Four of the original beaters in this room were in use up to 1964.

The chests which Derb mentions were horizontal, cylindrical wooden tanks, the beater chest being immediately under the pair of beaters which served each machine, and its twin, the machine chest, in the basement. These wooden tanks had an incredibly long life, some of them being in service for fifty years.

THE SULPHITE MILL

> "The sulphite mill contains four steel digesters, 15 feet in diameter and 54 ft. 6 inches high. There are nine large sulphur burners. The (gas) coolers are of the Burgess type....The sulphur burners, digester shells and the Burgess coolers were built by the Portland Company of Portland, Maine....
>
> "The(acid) storage tanks are....completely lined with lead. All the coolers and storage tanks were built by John Vollmer. There are thirty tons of lead in each one of these tanks. The coolers contain fifty tons of lead. The sulphite digesters are lined by an entirely new invention, nothing like the linings that have heretofore been set up in digester shells.'

As has been noted, the sulphite mill was not in operation when this report was written. The digester house was built for four units, but only three were installed at this time. There was an

open court about 120 feet wide between the digester house and the machine room. The original Nos. 1, 2 and 3 digesters were in the places presently occupied by Nos. 3,4, and 5, in the same order. They were 16'0" diameter inside the shell, and 54'6" high, flange to flange, made of 1-1/8" plate, with triple-riveted longitudinal seams and single 1-1/4" buttstraps, double riveted. The first floor above the blowvalves was thirty feet up. The blowpit house was also built for four separate concrete blowpits, 16'4" x 59'10" inside, with the walls and drain floor planked. Again, only three of these were finished. They were vented through two wooden vomit stacks, 14'6" square. The acid plant was more or less in its present location, with the burner room, acid room, sulphur and lime storage all in one building. There were eight flat stationary sulphur burners, with room for a ninth, together with the Burgess gas cooler, in the present burner room area. The milk-of-lime acid system was in a room to the south of this. The lime and sulphur storage rooms were to the west of the acid and burner rooms respectively. Two rectangular wooden acid storage tanks, 39'0" long, 25'8" wide and 17'6" deep, lined with 1/4" lead, were located about where Nos. 1 and 2 digesters were installed later. The name of John Vollmer does not appear in the list of contractors, but he apparently did all the lead work around the sulphite mill.

Burned lime, not lime rock, was used at this time. Lime was slaked in two iron tanks, was pumped into a mixing tank, from which it ran through a riffler 43 ft. long and 4 ft. wide and was pumped to a storage tank. There were two agitated absorbing tanks, 12 ft. in diameter and about 25 ft. high, and acid was pumped from them to the storage. There was a Drewsen reclaiming system, with two water cooled separator tanks, separated gas being returned to the

gas cooler and the liquor to one of the storage tanks. Warm water produced by the separators was piped to the mill. Most of the piping around the acid plant was lead -- a little copper and bronze here and there, and iron in the lime system.

The nature of the "entirely new" digester lining is not known, except that it was a special brick and cement type, 10" thick. There were a number of developments about this time in the search for satisfactory linings, and there were several patent controversies. In April, 1899, Col. A. G. Paine assigned to the Great Northern Paper Company an option held by the New York & Pennsylvania Company for the purchase of the rights to install linings under patents held by a firm with the curious name "Non-Antem Sulphite Digester Company". This patent was in conflict with the Russell patent owned by American Sulphite Company and the International Paper Company, but at the April , 1899, meeting of the Board of Directors it was agreed that the Company would not join with others in contesting the Russell claims, the feeling being that the Non-Antem patent was sufficiently strong. Incidentally, this was likely the first of a very great number of occasions when the Great Northern Paper Company, for years probably the industry's number one non-joiner, refused to participate with anybody in doing anything. In September, 1899, the Company purchased from Eastern Manufacturing Company the F. W. Ayer patent, which was also doubtful in view of the Russell claims. Which of the several types of lining was finally adopted is not known, but whatever it was, it resulted in a suit against the Company by American Sulphite, which was finally settled in 1907 by payment of $7,000. The linings were installed by the firm of Spillane & Lanzoendorffer. The sulphite

mill was started up on January 7, 1901, the first cook being made in what would in 1974 be No. 4 digester.

Derb oddly devotes little space to what he called the "banner room" of the plant, the machine room. This was the largest ever built, and the eight 152" paper machines, purchased from Rice, Barton & Fales Machine & Iron Company, of Worcester, Mass., represented perhaps the greatest number of paper machines ever ordered at one time, before or since. They were installed side by side in one big room, divided into four 72-foot bays by the three rows of roof columns, and were set on steel, except for the stacks, which were on brick foundations. These machines were of standard design for the time, incorporating all the proven advances in machine construction, but not some of the more or less untried innovations. For instance, suction couch rolls were available, but were not used, as not having been perfected. These eight machines were duplicates in all respects, other than that four were right-hand and four left-hand, and a description of them will be of interest to many.

Each machine was equipped with four Decker flat screens, and old paper makers have recalled many a long session pounding slivers out of these with wooden clubs. There was an "overflow box", with adjustable overflow pockets at each end. This was connected to the 8" turbine type fan pump, but there was no head box or flow box such as were used later. There was a single brass slice, with a vertical front plate 8 inches high, and an apron.

The breast roll was of gun metal, 18" diameter, 154" face. Table rolls were 4-1/2" diameter, and wire return rolls 7-3/4"

diameter, all of brass. The wire was 70 feet long, and flat. Deckles were endless rubber "straps", 2" x 2-1/2" in section, running on flanged pulleys, with brass "shields", with drain spouts, supporting the return side about half-way up the wire. The fourdrinier frames were of the fixed type, making it necessary to remove the suction boxes and all inside rolls when changing a wire. However, one of the machine tenders, in a letter written shortly after the mill started up, said: "would rather put a wire on one of these 152 inch machines than put one on that 86. There is more hard work on the 86" -- a comparison with some other machine on which he had worked. The table rolls were mounted on brass covered shake rails, and the breast roll and entire table roll section were shaken, the shake arm being cast integral with the breast roll support and actuated by a cam mechanism driven from the main line. There were six bronze suction boxes with 1-1/2" maple tops -- "plates" they called them then -- and these were not oscillated. A ten-inch dandy was mounted between the second and third boxes, carried on two "needful rolls" -- any table roll not in the forming surface was a "needful roll". Wooden saveall trays were provided under the entire wire. These were five inches deep, and were made sectional for easy removal. Both couch rolls had gun metal shells on internal spiders, the bottom roll 20" in diameter and the top roll 24" and fitted with a felt jacket. The top roll had a compound lever weight arrangement, and a heavy, trussed "coucher board" or doctor, later called a "guard board".

The specification called for three presses originally, but the third press was eliminated when the order was placed, to allow of using longer felts, and only two presses were installed. The

first and second press bottom rolls were 24" in diameter, rubber covered. The first press top roll was of gumwood, 26" diameter, and the second press top roll of gun metal, 24" diameter. The felts were each 65 feet long, the first press felt being provided with a suction box and a whipper, the second felt with a whipper but no suction box. Both presses were mechanically weighted, and the top roll doctors, which had wooden blades, were oscillated by a worm gear device. Some of the felt rolls were of brass, some of steel, and all were 8" diameter.

There were twenty-eight four-foot dryers, 148" face, in two sections, all the bottom dryers and the last top being fitted with doctors. As on the Madison machines, scoops inside the dryers were used instead of syphons. There was a receiving dryer, about 23" diameter, but no felt dryers. The felts had hand and automatic guides, hand stretchers and automatic tension rolls, the latter mechanically weighted. Gears were of cast iron "all very heavy, well fitted and nicely keyed."

Each machine had one stack of calender rolls, the frames being made for twelve rolls but arranged with ten -- one 28" bottom, one 16", seven 12" intermediate rolls and one 14" top roll. These heavy stacks were customary at that time, as it was the practice to try to iron all the difficulties out of the sheet, there being so little control at the wet end. All the calender rolls were solid, none being bored for steam or water. The stack had a hydraulic lift, and top and bottom roll bearings were water cooled. The reel was of the upright type, with two 18" diameter lagged spools, one above the other, on 34-1/2" centers, an indication of how small were the reels of paper made at that time, and was driven by a slip-belt

arrangement. The spools were not removable, and while it is hard to visualize, the sheet was re-wound directly from one while the other was being filled. There was of course no reel-off stand. The winder was in two parts -- a slitter section with six pairs of slitters and a 15" stationary drum, which presumably was for frictional stabilization of the sheet, and a Farnsworth single drum winder, slip-belt driven, with a 24" drum and a rider roll. Air cylinder hoists were used for removing rolls from the winder.

A 350 horsepower Harrisburg reciprocating steam engine, connnected by a 16" belt to a basement line shaft drove the machine through belting, cone pulleys, friction clutches and a bevel gear and pinion at each section. The gears were of the mortise type, the cast iron rim being filled with hardwood teeth fitting into dovetails. Many of the bearings around the machine were bronze bushed and ring oiled. Dryer bearings were babbitted and lubricated with block grease. The only mention of anti-friction bearings is in an appendix to the specification, calling for roller bearings on two brass paper rolls ahead of the second press. The machines were designed to run at speeds of from 300 to 500 feet per minute, speed changes being effected by changing clamp hub pulleys on the main drive, a set of pulleys furnished with the machine being graduated to give fifty foot per minute speed steps. The engines were located in the beater room basement, the driven pulleys on a skeleton floor, later made into the mezzanine. The bearings for the basement line shaft were on piers, so that the entire basement was broken up by the eight lines of shafting a few feet above the floor -- not high enough to walk under.

There were of course no paper handling devices on the machines.

The lead strip had to be dug off the couch and press rolls by fingernail, and the end was passed over into the next section by hand. There were no carrier ropes on the dryers, and the back-tender took the end through by hand, guiding it down into the lower nip and tossing it up into the upper nip as it came up around the bottom dryer. The sheet was passed from the last dryer into the stack by hand, the end being caught, wadded and "fisted" into the proper nip with the closed hand in one quick motion. At such slow speeds, there was not much danger around the dryers, but in spite of the closed hand technique there were a lot of jammed fingers at the stack. These injuries were not usually serious, as the end of a nipped finger burst before the rolls could get hold of it, but spatulate finger-ends were the mark of a paper-maker. While a very early drawing shows a broke beater in the basement for each pair of machines, it is believed that these were not in the first installation, and that dry broke was hauled out into the aisles, loaded in broke carts and wheeled back to the beater room. Each machine produced initially about 30 tons of paper per day, indicating that they started up at a speed of 350 feet per minute.

We do not know why it was decided to install Rice Barton machines, but the purchase of ten units -- two for Madison and eight for Millinocket -- was the beginning of an extremely close association between Rice Barton and the Great Northern Paper Company, and until 1953 no paper machine equipment of any consequence made by any other manufacturer was installed in a Great Northern mill.

The finishing room building extended across all eight mach-

ines, and was 100 feet wide -- twice the width of the present room in front of the machines. There were four small doors, wide enough for only one roll of paper, entering the finishing room, one between each pair of machines. About midway of the room there was a ramp down into the machine room basement, in which there was a Link-Belt conveyor, running at a speed of 67 feet per minute. This was probably for storing paper in the basement, but its use is not known for sure. The finishing room was unexcavated, and originally had a 3" hard pine floor on mud sills, with a birch finish floor. Various things were done to the floor in this room later, but it would never stay flat, and gave a lot of trouble. The 24" Farrell roll grinder was located along the machine room wall in the finishing room, and the mill superintendent's office was partitioned off at the northeast corner, along with an office for the Paper Room Foreman. The trainshed extended the length of the finishing room, and there were two loading tracks. There is no hard information on the finishing and loading operations of those times, but they must have been similar to those which prevailed for many years afterwards. Wrapper must have been purchased. Old photographs show rolls finished with a light body and darker bands, almost surely the same natural and brown combination that Great Northern used for fifty years. Rolls were wrapped by rolling them over the body wrap and bands laid out on the floor; the ends were crimped, paper heads were glued on, the wrapped roll was upended by hand and a wooden weight was placed on top to hold down the top head while the glue set. Trucking to the cars was probably done with the stevedore type trucks which were in use for a long time, and the loads were secured in the cars with wooden

toe-blocks spiked to the floors.

The mill was heated and ventilated by a Sturtevant air system, heat being furnished by six large blowers -- two in the machine room and one each in the grinder room, screen room, beater room and finishing room. These were driven by direct connected steam engines and took in either outside or room air, through pipe coils heated by live steam, discharging it through ducts under the roofs and along the walls where it would seem to do the most good. The wood room does not appear to have been heated, nor was the digester building, but a duct extension was run from the screen room into the blowpit building. This system proved to be inadequate, and changes, which have been going on ever since, were started almost immediately. There were no hoods over the paper machine dryers, vapor being discharged directly into the room, but there were four exhaust fans on the roof, one between each pair of machines. In addition, four 56" and four 60" swivel cowl ventilators were provided to assist in removing the moist air. The grinder room was ventilated by ten 36" swivel cowls.

In early accounts of visits to the Millinocket mill, there is much comment about the small amount of belting. This was relative. while the design made an attempt to minimize countershafting, almost every piece of driven equipment was belted. A section of the beater room showing the belting, looks like a spider web, and the order placed with Boston Belting Company for the new mill was the largest order for rubber goods ever placed in this country up to that time. In this mill, as in other mills of that time, the oiler had a hazardous job, and had to know his business,

as there were a tremendous number of plain bearings, many in hard-to-get-at places.

There must have been toilet facilities of some kind here and there in the mill, but no mention of them has been found. As far as is known, there were no locker rooms, the men hanging their clothing wherever they could find a place, and there is no indication of washrooms or showers. The lack of provision of these facilities, or of space for them, caused a lot of headaches later, when things began to become more civilized.

Let us turn now to one final description of the mill, written to his brother by an unknown paper maker, in pencil, on a strip of trim, on February 9, 1901. The spelling and punctuation are his:

"Dear Tom:

I didn't get your letter of the 23rd till this morning. I was glad to hear from you and I thought I would answer your questions. thair is 8 machines in the mill. you can stand at one side of the mill and see every stationary Roll on the 8 machines. the hole 8 are all in line. the machines are all 152 inch. thair is 4 dryer felts, 28 dryers, 1st and 2nd felts are both 65 feet long. the wire is 70 ft. 4 ins. long. thair is 4 of the Decker screens on each machine. thair is 4 men on each machine 4th hands get $1.50, 3d hands get $1.75, Backtenders $2.25. Machine tender $3.50. They say they are going to pay $4.00 and $2.50 next month, we get 15 days every 2 weeks, time and half for all extry time. I am running No. 5. they say it started the worst of any of them. it is the safest running one of them all now, we run the clothing the longest of any of them. thair is no girls or cutters in the

mill or rewinders. if anything happens to a roll of paper it is sent to the beater room. the rolls weigh from 300 to 1200 pounds. I dont know much about the finishing room, all they do is wrap the Rolls. the beater engineer gets $4.00 a day I dont know what the helpers get but I think $1.50. thair is 2 beaters to each machine. thair is 2 men on the beater for each machine. the ground wood is pumped in to the beaters, they use about 12 per cent sulphite. Tom it is worth the fair from Gardner to see this mill. thair is paper makers here from all parts of the world thair is lots of the fellows here that worked with me in Augusta. the machines are all running about 340 feet. our machine has ran a number of times for 24 hours without a skip and the paper all right. I changed size the first day I went on and we have not changed size sense. the weights are from 30 to 32 lbs. Well Tom I like here very much they have got a nice little church here. I went to mass last Sunday for the first time. I was up one day to see Father Clary he gave me a cigar and we smoked and talked I guess an hour. he lives in the vestry. he is a young man and seems verry nice. it is 60 miles to Houlton from here. thair is a broke hustler for every 2 machines and a swiper for each machine.

"Tom this is some of the paper we are making I am sitting on the floor writting this. it is 11:30 P.M. now I will close with love to all the family

"remember me to all the boys

Rod"

Great Northern e'lan shows already in this man, who on January 31, 1901, according to another letter, had worked exactly one

month, 12 hours a day, and those wages he mentions are per day, not per hour.

It may be of interest to note the names of some of the contractors for construction and equipment, some of the quantities and some of the prices.

American Stave & Cooperage Company	7 wooden tanks
Abendroth & Root Mfg. Co.	Galvanized pipe and exhaust heads
American Tube Works	Brass and copper pipe
Aultman & Taylor Mchy. Col	8 coal burning boilers 4 wood burning boilers
Badger, E. B. & Sons	Copper bends
Boston Belting Company	Belting, deckle straps, roll covers
Boston Bridge Works	Structural steel, mostly roof trusses and supports for equipment.
Brooks Brick Company	Brick
Bullard, G. B. & Co.	Head gate racks
Carman-Thompson Company	Piping labor
Carthage Machine Company	Splitter
Chadwick Lead Works	Small lead piping
Cheney Bigelow Wire Works	28 Cylinder molds
Custodis, Alphons Co.	Tile chimney
Davis & Farnham	Cast Iron Pipe
Deane Steam Pump Co.	25 Pumps
Dillon Machine Co.	16 stuff chests, 130 calender doctors, 10 jordans, 16 chest agitators
Dodge Manufacturing Co.	Rope drives
Eastern Bridge & Structural Co.	Structural steel for supporting various pieces of equipment.

Farrell Foundry & Machine Co.	Hydraulic calender lifts, roll grinder.
Filer & Stowell Company	Sawmill machinery (wood room)
Foster, F. W. Mfg. Co.	Boiler grates
General Electric Company	Installation of electric generating plant, motors, wiring and lighting.
General Fire Extinguisher Co.	Sprinkler system
Goulds Manufacturing Co.	Centrifugal pumps
Harrisburg Foundry & Machine Co.	8 steam engines for paper machines.
Harrison Safety Boiler Co.	Feed water heater
Hill Clarke & Co.	Machine tools
Holyoke Machine Co.	Head gate housts, 48 grinders, 48 sharpeners (lathes), 3 chippers, 30 barkers.
Hunt, C. W.	Industrial railway
Hunt, Rodney Machine Co.	Water wheels and pumps
Jeffrey Manufacturing Co.	Wood conveyors
Jones, E. D. & Sons Co.	16 beaters
Jones & Laughlin	Shafting
Knowles Steam Pump Works	Paper roll hoists, air compressors.
Lombard, A. O.	Wood room machinery
Lombard Water Wheel Governor Co.	Water wheel governors
Ludlow Valve Mfg. Co.	Valves
Manufacturing Paper Company	Grindstones
Megquier & Jones	Spiral stairways and equipment supports.
Moore & Company	Fire protection underground piping and town sewer system.
Mullen, J.B. & Co.	General contract
McKim, R. B.	Barker and chipper knives, circular saws.

New England Bolt & Nut Co.	Bolts and nuts
New England Felt Roofing Co.	Roofing
New England Tel. & Tel. Co.	11 telephones
New York Filter Co.	Water and steam filters
Penney, J. W. & Sons Co.	Pulp screens, wet machines, splitters, elevator, dampers, valves, shafting.
Portland Company	Sulphur burners, bronze work, three digesters.
Rice Barton & Fales Machine & Iron Co.	8 paper machines
Richardson Dana & Co.	Hardwood flooring
Riter-Conley Mfg. Co.	Steel penstocks
Robins Conveying Belt Co.	Belt conveyors
Sandy Hill Iron & Brass Works	12 wet machines
Scranton Supply & Machine Co.	Cranes and hoists
Shiffler Bridge Co.	Structural steel and erection
Spillane & Lanzoendorffer	Digester Linings
Stetson, E. & I. K.	Hard pine timbers
Sturtevant, B.F. Co.	Heating and ventilating apparatus.
Trainer, C. W. Mfg. Co.	Pipe covering
Union Iron Works	Castings, dampers, fire engine.
Union Machine Co.	Screen plates
Van Noorden, E. Company	100 skylights
Walworth Manufacturing Co.	Steam piping, soil pipe, gas cooler pipe.
Winslow & Company	Firebrick, drain tile
Woods, S. A.	Woodworking machinery

Excavation for the Quakish (Stone) Dam amounted to 9,112 cu. yds., and for the canals 152,000 cu. yds. There were 11,000 cu. yds. of

concrete in the dam and 241,000 cu. yds. of earthwork in the various dykes and embankments. The penstocks contained 2,500 tons of steel plate. The mill buildings covered about 5-1/2 acres. For them there was 114,000 cu. yds. of earth excavation and 23,000 cu. yds. of rock. In them there was 14,000 cu. hds. of stone masonry, 15,000 cu. yds. of concrete, 6,500,000 brick and 255,366 sq. ft. of tar and gravel roof. There is a figure of 2,679.37 tons of structural steel, but it is believed that this is only the part of it that was furnished and erected by Shiffler Bridge Company. Their total contract ran to $149,626. The penstocks were contracted at 3.37¢ per lb., erected; structural steel was 2.68¢ per lb. erected, and roof work was 4.25¢ per sq. ft.

The General Electric contract was for $105,348. Concrete floors cost nearly as much -- $84,799.36. The contract price for the twelve boilers was $45,669.55, and for the chimney, erected, $11,200. The grinders were purchased for $1,000 each, the digester shells for $12,000 each, beaters for $1,150 each and the paper machines for $44,500 each. The estimated contract figure for the construction of the mill buildings, the Stone Dam and the canals and dykes was $743,000.

There is perhaps no better way to bring this chapter to an end than to quote Derb's closing remarks:

> "I am positive that I could sit and write about this great news mill for the next twenty-four hours and at the same time give good, solid information regarding it. But no man...can realize what an enormous industrial establishment this is unless he goes to Millinocket and sees it. And there is one thing above all for which I take off my hat to the

Great Northern Paper Company; and that is, it refuses no one admittance into this plant. You don't see any 'No Admittance' signs stuck over the doors of the mill or office. You are welcome to walk through the Great Northern Paper Company's plant and see anything and everything you please. There are no secrets for the simple reason that they have none that they are ashamed of."

This was a great mill, crude, it may be, by our standards, but the first of the big integrated pulp and paper manufacturing plants. If any of the comments on its construction and equipment seem to be frivolous they are not intended to be, but are meant to emphasize the great differences between modern facilities and what was considered the latest thing in 1899, and to hint at the probably even greater differences that will show up when some writer yet to come compares our new mills with those which will be built in the future.