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The New England Village Mill

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BEFORE we examine the village mill of the early days of New England let us consider the economy and living conditions under which it developed. In any of the new settlements along Massachusetts Bay in the very early days each household was essentially self-sufficient. The main requirements of life, food and clothing, were produced by each family entity solely for its own use. Wool was sheared, carded, spun and woven at home, then sewed into clothing. No machinery other than the hand cards, the spinning wheel, and the hand loom were needed, and these same simple tools continued unchanged down to the early days of the nineteenth century.

Food consisted of such game as could be shot or trapped, fish, shellfish, pumpkins, Indian beans, wild berries and such, but primarily and basically life depended upon Indian corn. Wheat was grown in the early days, but it did not do well here. Rye did better, and by the mid-1700's it was being used mixed with corn meal to make a firmer, moister bread, but corn remained the basic staple. The "hog and hominy" of the South became fat pork, beans, cornmeal bread and cornmeal mush in New England.

Indian corn can be prepared for eating in various ways. The simplest is to crack the kernels between two rocks or in a wooden mortar. Hominy or grits result, which can be boiled and eaten as a porridge, but can hardly be made into bread. Moreover, pounding corn in a mortar was hard work and took plenty of time, particularly in view of the number of mouths the average housewife had to feed. A grist mill would process the corn much more quickly and easily, and, even more important, it produced a meal which could be made into bread. The grist mill was in general use in England, and it would be assumed that the settlers would build them here very shortly after the initial settlement. It is surprising that Plymouth waited until 1633 before starting a grist mill, and this was only a pounding mill rather than a grinding one.

Boston had a wind operated grist mill in 1632, but the first water operated grist mill appears to have been that of Israel Stoughton, built at the lower falls of the Neponset River at Milton (Massachu-

setts) in 1634. Another was built at Watertown at very nearly the same time. From this date on grist mills came into rapid use throughout the settled areas.

A new settlement in order to be self-sufficient required three necessities: a minister, a blacksmith, and a grist mill. Perhaps some of the settlers would have been happier without the first, but all would have agreed that the last two were essential to the success of the community. We can find many cases of special inducements offered to millers by new settlements, free land, tax exemption for a period of years, and labor to help build the dam and mill.

Water power was the most desired method of running a mill, and many villages developed around a favorable power site. Milton was an excellent example. Here, falling into navigable tidewater, was a river large enough for ample power and easy of access by boat from Boston. Stoughton's mill was built in the wilderness, some four miles either way from the nearest settlements at Braintree and at Boston, but it formed the nucleus of a new settlement which early became one of the industrial centers of the Bay Colony.

If a waterfall were not available, but there were tidal flats draining out through a suitable creek, a tide mill could often be built. This was a water mill in all its essentials, but was able to operate only over certain periods of the tide. As a last resource there was the wind mill, common on Cape Cod, in Rhode Island, and on Long Island, but the water mill usually was cheaper to build and certainly was less bother to operate.

A surprisingly small brook would run a grist mill. Grinding was apt to be a seasonal business, and little would be done in summer when the water was low. A millpond would hold the night flow of the brook, and allow it to be used during the day, thus effectively doubling the use of the current. There is a story that down Scituate way a miller had two mills on the same brook. He first would grind at the upper mill until he had used up his water. Then he would run down to the lower mill where the pond had caught the discharge from above. When the lower pond was emptied, the upper one was well on the way to being full again. Such expedients as this, plus the higher stream flow of those days,[1] allowed what today is a very small brook to run a mill.

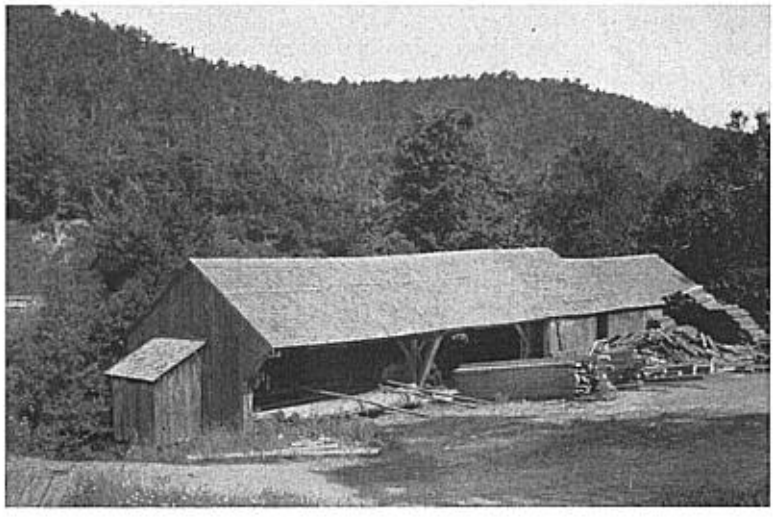
The paramount factor in the development of mills in New England was the ever-present shortage of labor. There was so much to do and so little time to do it in. Another winter was always just around the corner. Our local civilization took shape under this continual labor shortage which has ever since been reflected in our economic life. We never do by hand what can be done by machinery. This was not so in the South until relatively recent times, slave labor producing a different form of life. This labor shortage of the Northern Colonies was a new condition. It did not exist in England where hand methods continued until a much later date. As late as 1767 an English mob destroyed a saw mill, fearing that men would be thrown out of work. At a still later period early textile machinery was destroyed for the same reason. In the 1890's logs were still being sawed by hand by two men with a pit-

[1] The felling of forests and clearing of fields seriously reduces the stream flow. The rainfall remains the same, and the resulting runoff from the watershed totals nearly what it did before. Instead of being absorbed by the natural vegetation and the porous leaf and twig mold, and held as in a great sponge from which it slowly seeped out into the rivulets and brooks, the rain strikes relatively bare ground and runs off at once, making the condition even worse by the resulting erosion.

saw[2] in some places in England, a method which, except for special shipyard work, was abandoned in New England in the very early days of the colony.

The saw mill met a constantly growing need. Two good men with a pitsaw might get out about sixteen average boards in a day, but a simple saw mill, run by a man and a boy, could produce about five times as many. Here was a very great saving of labor in the production of an essential commodity.

In 1555 Bishop Ely, the English ambassador to Rome, examined a water driven saw at Lyons, and such mills are also reported to have existed in Norway at that time. Ramelli published a drawing in 1588 of a saw mill basically identical with an American one of 1800. In the England of the Puritan emigration the saw mill seems to have been nonexistent, yet it appears over here in use in the very early days. Weeden says that the first New England saw mill was built at Portsmouth in 1631, and that a number of Danes were employed there. This may be a hint that some immigrant Danish millwright established the art in this country.



SAW MILL, NEAR POLAND SPRINGS, MAINE

A large lumber business quickly appeared along the New Hampshire and Maine coasts. The logical development was to build mills at the falls near the head of navigation, and to ship the finished boards to market by water. Thus the major lumber trade early grew into the form of which we can still see the last lingering remnants. Just a few days ago (1951) I saw a small Nova Scotia motor ship unloading boards near the head of navigation on the Neponset River. Until just before the last war little lumber schooners used to unload there, but I fear they are gone forever. Thus developed the lumber business that served

[2] A pitsaw is about 5 or 6 feet long, with a cross bar handle at each end. A long, narrow pit is dug some 7 feet deep, and the log to be sawed is suspended over it on cross bars. One man stands on top of the log, the other works at the lower end of the saw while standing in the pit.

the Tidewater, but it was of no help to the back country, where little mills were built to meet the local needs. Where there was a good stand of timber near the coast it paid to set up a mill and saw for the local market and perhaps for export.

At this point it might pay to stress one factor which was of great importance in determining mill location, both for grist and saw mills. This was the question of transportation. In the earliest days this was by water. Footpaths and trails suitable for pack animals followed, but roads suitable for wheeled vehicles were long in coming, except for a few major through routes that had come into being by the early 1700's.

Water transport along the shores of Massachusetts Bay and to the eastward remained of great importance, as did that on the major rivers such as the Connecticut and Merrimack. Many an inland town, however, had neither river nor road; circulation was difficult and transportation of bulky articles impossible. Under such conditions it would often pay to establish a mill to serve only a small area within a town, with other grist mills operating in relatively nearby areas. Corn could be carried to the grist mill in a sack over one's shoulder, or on a pack horse, but timber or sawed lumber required at least a sledge or sleigh, and some sort of cleared road. As the road net improved the need for so many mills vanished and the one or two more efficient or convenient ones were those that survived in each town.

Eventually the railroad brought flour from mid-western mills, and the local grist mill to a great extent disappeared. In recent times the portable saw mill has taken the mill to the timber and spelled, in most cases, the death of the little local saw mill, unless it enjoyed a particularly favorable location. The abandoned mill sites of New England are legion.

In 1793 a census reported 90 saw mills in Worcester County, Massachusetts, eleven of which were in Hubbardstown. This was probably a greater concentration than existed in most counties, but every town that had the necessary water power had at least one mill. In 1810 the two counties of Berkshire and Hampshire had 150 saw mills.

It is of interest in passing to note that the first saw mill in Canada is said to have been built about 1706 by a Lancaster man who had been "captivated" by the Indians.

These two mills, the grist and the saw, were the usual mills in use everywhere. There were other kinds, but they were more specialized and usually appeared only in special centers or regions. The fulling mill, however, was quite common. It took the homespun cloth as it came from the loom and pounded and kneaded it with power driven wooden mallets in a specially shaped wooden tub. This compacted the cloth and felted the fibers, resulting in a more finished product. It also shrank it considerably in size, sometimes as much as one-half. While the fulling operation could be done without machinery,[3] a power driven fulling mill was more effective and economical of labor. These mills were in common use in England and had existed there as early as A.D. 1117. Other operations which normally took place at the fulling mill consisted of scouring and cleaning with fuller's earth. (How many of us knew the derivation of the name of this still most useful mineral?) While still wet the cloth was then stretched on a tentering frame, and here we find our old friend the tenterhook, something we have all been on

[3] As late as 1930 homespun was fulled in Connemara by treading it with bare feet in a wooden tub.

at times but never knew just what it was. It was, and is, for I have a few in my pocket as I write this,[4] a little L-shaped piece of iron, pointed on both ends, one of which was driven into the wood of the frame, the other caught and held the cloth. When the cloth had dried it might be further finished by having its nap raised by teazels, or some other sort of burr, and then sheared smooth with hand shears.

GRIST MILL, ORWELL, VERMONT

The iron furnace and the forge were apt to be located as near as possible to where the ore was found. In Massachusetts this was usually bog iron, dug from the sides and dredged from the bottoms of ponds, particularly in the Carver, Plymouth, and Taunton country. How many Furnace Brooks and Forge Ponds are there in New England?

[4] They were found while prowling in dusty recesses at A. J. Wilkinson Co., Boston, itself a New England antiquity, a hardware store founded in 1842, and still having, I suspect, some of its original stock in trade.

Without going too deeply into technical details, it may be well to say a few words about early iron-making processes. Essentially the ore was an iron oxide. When heated in a charcoal fire some of the carbon in the charcoal united with the oxygen in the ore, forming a gas and leaving behind the more or less pure iron. The simplest form of furnace was a bloomery, really just a large, old-fashioned blacksmith's forge with bellows. The ore was heated in a charcoal fire and, when correctly handled, turned into a pasty mass which the fire was not hot enough to liquefy. This spongy lump consisted of iron with slag permeating it. When the lump was beaten with a sledge the liquid slag was squeezed out and the remaining iron compacted and welded together into a "bloom" of finished iron. This process could be and was often done entirely by hand, but it was much easier to run the bellows by water power. Now if we add a small amount of carbon to iron we get steel, which is capable of be-

ing hardened so that it will hold a cutting edge. If the iron ore were so heated and manipulated that it absorbed this additional carbon from the charcoal, a bloom of steel of a sort was produced. Great skill and experience was necessary to secure the right amount of carbon and distribute it uniformly through the bloom. If a still further amount of carbon were taken up by the bloom it became cast iron, which melted at a relatively low point and could be poured into moulds to make pots, frying pans and such like. Cast iron is brittle and weaker than iron, but it had many uses in the early days: cannon, andirons, firebacks and hammer heads, as well as hollow ware.

The iron bloom normally was forged into the bar and strap iron from which the blacksmith made the multitudinous tools and implements of the day. While the forging could be done by hand, it again was easier to use a water operated trip hammer and a second little open hearth furnace was needed to reheat the bloom before reforging. The bloomery and the forge were generally, but not necessarily, together at the same site.

If cast iron were desired, a blast furnace produced it much more effectively. A bloomery, in fact, really made cast iron only by accident or poor management. The blast furnace was a squat stone tower perhaps twenty feet high and hollow down to the stone hearth which formed its bottom. Two great blacksmith's bellows forced air in through a hole at the bottom. A charcoal fire was made on the hearth and then a charge of ore and charcoal was loaded in at the top with the bellows puffing mightily. A second hole in the hearth was temporarily plugged with stones and clay. As the ore melted into iron and picked up the additional carbon it collected as molten cast iron in the hollow hearth. When a sufficient amount had collected the discharge hole was unplugged and the liquid metal ran out into the sand moulds which awaited it, or it might run into a large depression to form a "sow" of iron, or smaller ones to form "pigs." Once the blast was started it ran continuously day and night for many weeks unless something went wrong or the fuel gave out. Throughout this period fresh ore and charcoal was being fed in and cast iron being drawn out. Here at last we have found something that was exempt from the Sabbath day laws and was necessarily allowed to work seven days a week, a most unique privilege in Puritan New England.

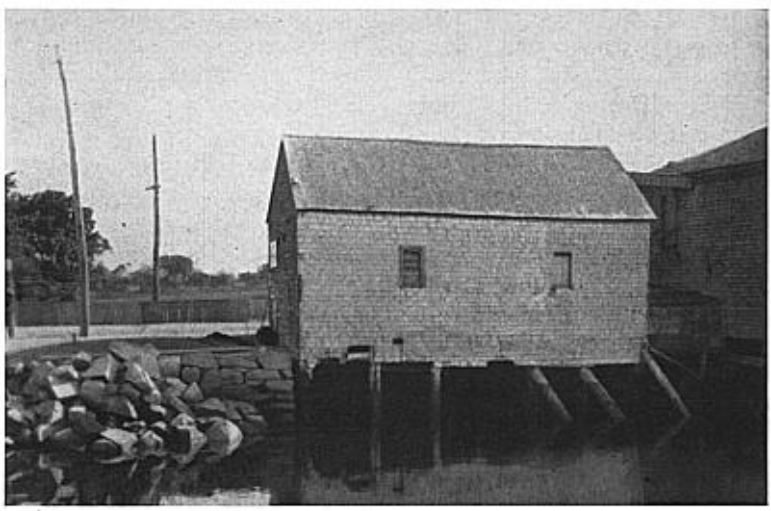
One more mill was used to process iron, the slitting mill. Nails were greatly in need everywhere. For certain technical reasons a trip hammer could not effectively form rods small enough for making nails. The slitting mill was really a great pair of power scissors which slit the larger bars produced by the trip hammer into small nail rods from which the nails were finished by hand.

These iron mills cannot perhaps be called village mills, for they were often considerably removed from the villages because of their need for proximity to ore, water power, and ample wood for their charcoal. They were common throughout New England, however, and served a most important need in the economy of those days and so should be included in our discussion. In 1731 New England had six furnaces for casting hollow ware and nineteen bloomery forges as well as one slitting mill, this last situated in Milton.

The paper mill was a village mill to the inhabitants of Milton after 1728, but in the early days such mills were very rare. Their raw material was old rags, not wood pulp, and partly for that reason

they would tend to be built in the more settled areas. Other unusual early mills were the powder mill, the snuff mill, the drug and spice mills, all essentially grinding mills and so not too different basically from the grist mill.

Such were the mills of the early days of the settlement and down, perhaps, to 1800, when various new little mills started to appear. These were really shops of chair makers, carriage makers, hatters and such who, by moving to a water power site, were able through power driven machinery to increase their output greatly. Technically, perhaps, they were mills in villages, but really they were the first factories of the industrial revolution, and as such are outside the scope of this discussion.



TIDE MILL, GLOUCESTER, MASSACHUSETTS

The early mills were probably built much like the houses of the time, simple, framed structures covered with clapboards or sawed boards. Governor Winthrop of Connecticut in about 1651 had John Elderkin build a grist mill for him in New London. What tradition claims is the original mill stood until recently, and probably still stands, in a park in that city. Its general appearance certainly is in keeping with that early period.

An old mill is always associated with a large and picturesque waterwheel, but many a New England mill, particularly in the later days, had no apparent wheel in sight and could be identified as a mill only by the canal or flume bringing the water into it. An outside wheel, particularly if of the overshot type, could be very efficient, but it had many disadvantages to balance this in a period when efficiency was usually of small importance. Such a wheel was rather expensive to build and to maintain, but the main drawback was our climate, which produced great trouble in the form of ice. In January-February, 1670, Samuel Converse of Winchester (Massachusetts) went out to chop ice off the wheel of the village grist mill. His coat caught on the wheel, which he had neglected to stop, he lost his balance and

was crushed to death by the wheel. Here is probably our first record of an industrial fatality, and the first reference to the ice troubles which always plagued those who operated water mills in the northern areas.

These outside wheels were relatively slow yet the millstones had to revolve quite fast, requiring cumbersome wooden gearing to build up the speed sufficiently. There existed from very early days another type of wheel, the tub wheel, and its many variants. This wheel was a very crude ancestor of the modern water turbine. It was relatively small, simple to build, was hung on a vertical shaft leading directly up to the millstone, and operated at a high enough speed to eliminate the need of gearing in most cases. Being underneath the mill, and compact, it was less subject to ice troubles. Certainly by the later period of the village mill this was the common wheel of the New England grist mill, until it was finally replaced by the early factory-made turbines. Farther south the large outside wheel continued in use.

The usual little grist mill had either one or two runs, or pair, of stones. The earliest millstones were very large, of granite or some local stone, with curved furrows on their faces. Later these furrows became straight and the stone decreased in diameter. The best stones, used somewhat in the early days but in practically general use here after the early 1800's, were composite stones built up of blocks of imported French burr stones strapped together with iron hoops. The mill was very apt to have an iron corn cracker, which cracked the corn used for feed. When wheat was to be ground sieving and bolting apparatus was usually added, but it was not required for corn meal.

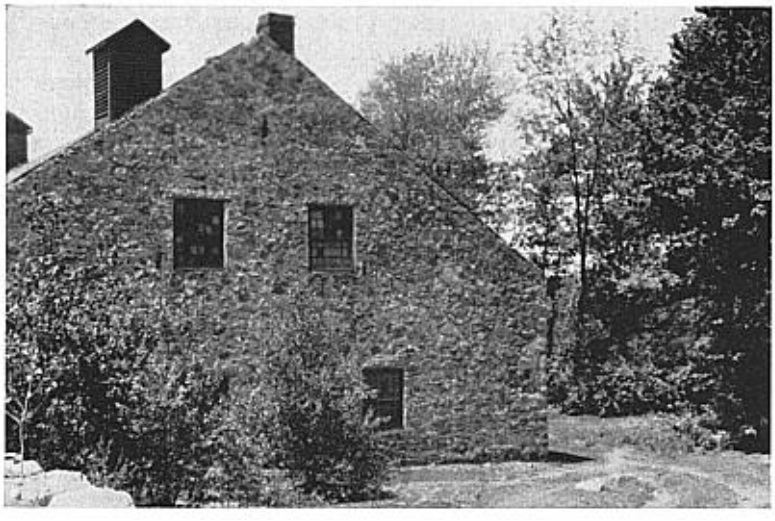
Saw mills had one basic characteristic, they had to be long, almost twice the length of the longest log to be sawed. There was no need for much width so they were usually long, narrow sheds, boarded up on the ends and one side, but open on the side by which they were entered. The sawyer and his helpers had to be hardy when winter sawing took place. The saw was always a straight one, held in a frame which oscillated up and down. Some otherwise meticulous historical novelists refer to the "scream of the buzz saw" in their novels, but the circular saw did not come into use until well into the nineteenth century. Sometimes the saws were "ganged," two or more stretched in one frame, thus producing two or more boards each time the carriage forced the log by the saw, but this was not usual in the smaller village mills.

Saw mills normally had a tub wheel to run the log carriage back after completing a cut, but a special type of wheel was used to drive the saw and to feed the carriage forward. This was a flutter wheel, a long, narrow undershot wheel, located under the center of the building. When running, the action of the water on the blades produced a fluttering noise, hence its name. Later, after the circular saw came in, an outside wheel or turbine might be installed, but the flutter wheel was the normal one used with an up and down saw. The millwright who built Ramelli's saw mill of 1588 would have been entirely at home in a New England saw mill of 1825, so little change was there until the circular saw came in.

The earliest grist mills were never built of stone. The Henry Ford mill in Sudbury is an almost perfect example of what the typical New England mill was not. In the later period we find brick and stone mills. Farther south both were more common, but the cheaply built wooden struc-

ture seems to have been what the New Englander preferred. The saw mills, to the best of my knowledge, were always of wood.

There was one basic characteristic of the construction of these early mills, an absolute minimum use of iron. In a grist mill the gudgeons, or shaft bearings, were



IRON FORGE, CANTON, MASSACHUSETTS

of iron set into the ends of wooden shafts and strapped with iron hoops, as were the pieces which held the revolving millstone. The waterwheel and gearing were all of wood, often with some iron strap reinforcing. The corncracker, if one were installed, would be of cast iron. Beyond this only some spikes and nails would be required for the building itself. The saw mill, of course, required a steel saw and iron gudgeons and shaft hoops as in the grist mill, but it had one further and rather specialized piece of iron, the crank which operated the saw. This was a heavy piece of iron shaped like the usual crank. The inner end was driven into the wooden waterwheel shaft and reinforced with iron bands while the outer end, the place where your hand would grasp a crank, had a long piece of wood called the pitman[5] connecting it and the oscillating saw frame. This crank had to be quite strong and it was heavy, perhaps 150 to 200 pounds. It was the only piece of iron in either a grist or a saw mill that was beyond the facilities of a competent local blacksmith, although gudgeons were normally of cast iron and of larger diameter than could be easily forged by the smith. The crank and perhaps some of the other iron work might have to be brought to the new mill site from a very considerable distance. For example, a saw mill built near Marietta, Ohio, in 1789 had the crank made for it in New Haven and carried west by packhorse and water transport.

This use of wooden shafts and wooden

[5] The pit man originally was the unfortunate soul who labored at the lower end of the old pit saw, and got all the sawdust down his neck.

gearing was quite satisfactory and needed few apologies if they were well made. Long after cast iron came into general use in mill machinery, wooden toothed gears persisted, made with separate wooden teeth wedged into place around an iron rim. Wooden teeth, often of apple wood, wore themselves into approximately correct tooth form and ran more smoothly than cast iron teeth. The machinery of these mills might be considered crude today, but it was simple, effective and easy to repair. Only ordinary carpenters' tools were required to build it.

The mill was owned and built by a capitalist for profit and it entailed a fairly sizable investment. The return on the investment was, in the case of a grist mill, normally received in kind; a certain portion of the ground meal was retained by the miller for his own consumption or trade for other goods. In England in 1538 this toll was from 1/12 to 1/24, while at Plymouth in 1633 the miller retained one pottle, or liquid half gallon, per bushel ground, and there is a record of 1/9 being the charge at Hadley in 1661. Although the saw mill cut the inhabitants' logs for toll (at Scituate in 1656 it was a mere half of the boards sawed!) the miller also probably had woodlands of his own from which he produced boards for sale or barter.

Unfortunately we know very little about the early millwrights who designed and built these mills. We do know a little of John Elderkin of New London. Apparently he was a general builder as well as a millwright and built bridges and meetinghouses in Connecticut. It is probable that a millwright operated over a fairly large district and he may normally have run a mill of his own, occasionally bossing the layout and erection of another in his general neighborhood. Later there were professional millwrights who travelled far. There was nothing in the design and construction of these simple little mills that a reasonably clever handy man could not pick up by studying a going mill and asking questions. He might make some mistakes and have to learn the hard way, but I believe that many a mill was built by a man who had had no training or experience in millwrighting. By 1795 Oliver Evans had written and published his *Young Millwright and Miller's Guide*, which was quite a complete treatise on the art of building saw and grist mills.

The millwright was the first man to work with heavy machinery, just as the watch and clock makers were the first to deal with delicate machinery. It was the work of these two trades or arts, for they really were arts in the early days, that laid the foundations upon which our machine age rests.