"THE SAWMILL," PAINTED BY THE DUTCH ARTIST, ALLAERT VAN EVERDINGEN, BEFORE 1675

The subject is probably in Norway, the landscape of which furnished the artist with many other subjects during his early career.

Courtesy of the Kunsthistoriches Museum, Vienna.

Mill Sawing in Seventeenth-Century Massachusetts

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> Those engines are most useful which are rather moved by Inanimate things [like water] than by Animals; because that Inanimate things want not nourishment and are never tired or wearied.
>
> —James Moxon and Venterus Mandy

I.

NEW Englanders have long been aware of the value and advantages of the sawmill. On May 6, 1646, the General Court of the Massachusetts Bay Company awarded the first patent issued in America to a prodigious ironfounder, inventor and blacksmith of Saugus. "That so his study and cost may not be in vayne or lost," it reads,

> the petition of Joseph Jenks [is granted], for liberty to make experience of his abilityes and Inventions for the making of Engines for mills to goe with water for the more speedy dispatch of worke then formerly . . . with a new Invented Saw-Mill, that things may be afforded cheaper then formerly, and that for fowerteen yeeres without disturbance by any others setting up the like invention. . . .[1]

The men of seventeenth-century New England looked at the forests with different eyes. Those with a spiritual bent, such as Michael Wigglesworth, saw only ". . . a waste and howling wilderness, / Where none inhabited/But hellish fiends, and brutish men / That devils worshipèd."[2] Other men, with a different kind of vision, saw in those forests a practical way to support the young colonies established on our shores.

As early as 1622 or 1623, the colonists at Plymouth were exporting "clapboards."[3] Although the records do not specify whether the oak, the pine or the cedar tree was selected for the honor of providing New Englanders with their first export item, these woods are suggested by English custom and the contemporary level of technology. If oak or cedar was the wood, then the clapboards were undoubtedly riven with wooden wedges and mallets; if, however, pine was made into "clapboards," the likelihood is that they were pitsawn, according to the common practice in seventeenth-century England.

Pitsawing, however, was by no means universally practiced throughout the rest of Europe. Sawmills are believed to have been introduced into Germany as early as the fourteenth century, certainly they were there in the fifteenth. Early in the seventeenth century, sawmills were operating in Norway and Holland.[4]

Perhaps the earliest recorded hint of interest in the possibilities of mill sawing in New England comes in the "Second Letter of Instruction" (1628/9) from the directors of the Massachusetts Bay Company to Governor John Endicott, in which are mentioned, "some things wee are desired by Mr. Whyte, the Minister, to recomend vnto yo^{r} care, viz . . . to give approbac[i]on and furtherance to Francis Webb in setting vpp his saw-Mill."[5]

It seems likely that Webb, a share-

holder in the Company to the extent of £50, never came to New England. His name does not appear on the company's list of freemen. Indeed, James Savage notes that in 1634 Webb was still in London, attending to his business interests there. Savage surmises that even though Webb was to have the milling privilege in the colony, he probably intended to carry on the enterprise through an agent, but died before a mill could be constructed.[6]

Sawmills were known to other Englishmen at that time. William Wood, when writing of *New England's Prospect* in 1633, says that, "here no doubt might be good done with sawmills."[7] Indeed, we may assume that mill sawing was familiar to that whole group of merchants and builders who bought and used the mill-sawn "deals" which had been imported into England from Holland for a generation.

Although subsequent history suggests that Englishmen would have been quick to seize upon the advantages the sawmill offered, mill sawing in England during the seventeenth century was far from common. When John Pressy came to Salisbury, Massachusetts, as an apprentice in 1651, he found that a sawmill was one of the sights to be seen "in the country." In later years he recalled that he did

> remember well that the saw mill at Salsbury was on[e] thing that was accompted a rare thing: & [having leave of my master] I did go to see it: & I did see it going & sawing bords that very somer.[8]

Indeed, the exhaustive Rhys Jenkins manuscript notes on the history of technology in the Science Museum Library, London, contain only two references to sawmills in England prior to the beginning of settlement in New England. The first quotes a letter, dated March 4, 1604, from George Saville of Thornhill to his uncle, the Earl of Shrewsbury, in which Saville states that his father has begun to set up a water-powered sawmill in Emsley Park, a village in the West Riding of Yorkshire, about 6 miles west of Wakefield.[9] Jenkins also quotes Rowland Vaughn's description in *Most Approved and Long Experienced Water Works* (London, 1610) of a sawmill in the Golden Valley, Herefordshire, that "those that are desirous to see a mill sawing timber, there shall their desires bee fully satisfied, seeing a mill by a watercourse keep a dozen sawes on worke together."[10]

By the time Thomas Powell published his unique work on the history of inventions entitled *Humane Industry* (London, 1661), mill sawing had apparently become somewhat more popular. Powell mentions Mr. [Robert ?] Morison, "an ingenious traveller of this Nation," who had seen "in Dantzick . . . a Mill which (without help of hands) did Sawe boards. . . . We heard of the like device set up in Kent here in England, and other places."[11] Powell, however, did not specify where.

The English use of water mills for driving many sorts of labor-saving devices has been recorded since the thirteenth century. The reason that sawmills were not built in any great number is a theme encountered again and again in the writings of Englishmen until the nineteenth century. Maurice Wynne of Gwydir, Wales, expressed it well in a letter to his father dated October 18, 1623, at Hamburg. "[I] would recommend the use of mills to saw timber in England [as it is used in Germany], were it not that it would hinder the employment of poor men."[12]

The ability to construct sawmills was

doubtless within the capacity of any competent English millwright.[13] The rarity of sawmills there is clearly based on non-technological factors. To appreciate what the reasons might be, the historian needs but to remind himself of labor conditions in England at that time. Improvements in farming practices and the general economy in the late fifteenth century had laid the foundation for something of a population explosion during the sixteenth century. By 1562/3—the date of the Statute of Artificers—the English labor force in rural areas exceeded the opportunities for employment. The result was a migration to the cities, especially London. The cities and incorporated towns, however, offered no relief. There the dying, but not yet dead, craft guilds still had enough power to discourage the employment of unskilled workers. By 1630, the problem had not abated a great deal. Seventeenth-century England was neither emotionally nor economically sympathetic to the sort of technological change which would aggravate an already troublesome situation, and mill sawing was one of the victims. Johannes Beckmann, professor of economics at the University of Göttingen, tells the fascinating story in *A History of Inventions and Discoveries:*

> It was found necessary to abandon a saw-mill erected by a Dutchman near London in 1663; and in the year 1700, when one Houghton laid before the nation the advantages of such a mill, he expressed his apprehension that it might excite the rage of the populace. What he dreaded was actually the case in 1767 or 1768, when an opulent timber-merchant, by the desire and approbation of the Society of Arts, caused a saw-mill, driven by wind, to be erected at Limehouse under the direction of James Stansfield, who had learned, in Holland and Norway, the art of constructing and managing machines of that kind. A mob assembled, and pulled the mill to pieces. . . .[14]

Conditions in New England were exactly the opposite. The amount of work to be done always exceeded the number of skilled artisans capable of doing it. Labor in the Bay Colony apparently was expensive from the outset. Only three years after he came to Massachusetts, John Winthrop complained that "the scarcity of workmen had caused them to raise their wages to an excessive rate, so that a carpenter would have three shillings a day,"[15] or roughly two or three times more than the comparable wage at that date in England.

Skilled labor continued to command a relatively higher price in Massachusetts than it did in England throughout the seventeenth century. This fact in itself suggests the reason—economy—that within a generation the countless streams that laced New England were harnessed to provide the power to run mills of all sorts. As the check list at the end of this paper demonstrates, by 1700 virtually every township in Massachusetts had at least one sawmill.

II.

Although there were many ways of accomplishing the individual details of mill construction—limited only by the ingenuity of the dozens of millwrights who lived in New England in the seventeenth century—all water-powered sawmills were undoubtedly alike in their general principles of operation. Their common elements consisted of a waterwheel, a crank, a frame saw attached to a rocker arm, a structure which held the saw frame and restricted its movement to the vertical plane, and a bed upon which the log to be sawn was advanced against the moving blade.

The great range of appraised values of these sawmills suggests, that the variation among them lay in the complexity of their equipment, their capacity, the

amount of land they occupied, and the extent of the timber rights of their owners. For example, the half of a mill John Elderkin owned at Reading in 1646 was valued at only £10.[16] It could not have consisted of much more than a "flutter" wheel, stuck into the moving water of a nearby stream or waterfall, and a bed upon which a log was pushed, without mechanical assistance, against the moving blade.

The demand for the products of sawmills in those communities which did not have a nearby waterfall, however, soon led to the damming of streams and the utilization of the head of water thus produced. Although this process greatly increased the cost of putting such a mill into operation, surer control of the water supply permitted a longer sawing season, and the greater permanence of the installation encouraged the construction of more sophisticated equipment. The mill on the Pawwus River at Salisbury owned by Anthony Colby and three partners in 1652 was doubtless of the better class. It was valued at £240 in 1660, had a breast wheel and a moving bed, powered by the waterwheel, which advanced the log against the blade mechanically.

Lawsuits involving this mill are mentioned in the Hampton Quarterly Court Records, and provide us not only with some clues as to how it worked, but also give us contemporary terminology for some of its parts. The bed was composed of a "head block" and a "hinder head block." These blocks were eventually ruined by repeatedly coming into contact with the blade of the saw. The contract between the owners of the mill specifies that any of them who makes a new head or hinder block is to receive 4 shillings a day for his labors ("if he be a good workman"). The rocker arm that transferred the power from the waterwheel to the mechanism for advancing the log bed was called a "sweep," and the lantern wheel which geared the mechanism to the waterwheel was called a "wallower."[17]

Additional information from which we can deduce the appearance and operation of a seventeenth-century New England sawmill is contained in the account book of Joshua Buffum, an ingenious builder and millwright, who was brought to Salem, Massachusetts, as an infant in 1638. According to the excellent transcription by Henry Wyckoff Belknap of Buffum's often indecipherable handwriting, Buffum formed a partnership on October 4, 1688, with John Nurse, Thomas Gould and Bartholomew Gedney to build, "a dam and saw mill att b[e]aver dam nere to m^{r} clarkes farm in Salem. . . . each [party is] to bare on[e] quarter of the hole charg of the dam, mill, and Iorne work . . . for sarvēs in sawing all sortes of tember as shall be brought for that end. . . ."[18] Buffum was to build the mill, Nurse the dam, Gould to provide the land, and Gedney, apparently, was to participate only financially.

On March 30 of the following year, Buffum entered in his book itemized expenses for the mill in the amount of "52 poundes 16 shelens and 6 pence." Part of the expense was for labor, as "for 7 days work for my nagor about digen for the foundation of the mill and cleren for the watter way at 2^{s} and 6^{d} pr day." Materials had also been brought to the mill site, as for example, "1 tonn of tember, 2^{s} 6^{d}." Other items reveal, however, the operation of the mill itself, "3 skedes [skids] to rowle the logs upon," are mentioned, but no cost is specified.

The "saw and 2 handes [handles ?]" are listed among "the Iorne work for the saw mill." It cost £2, which makes it the

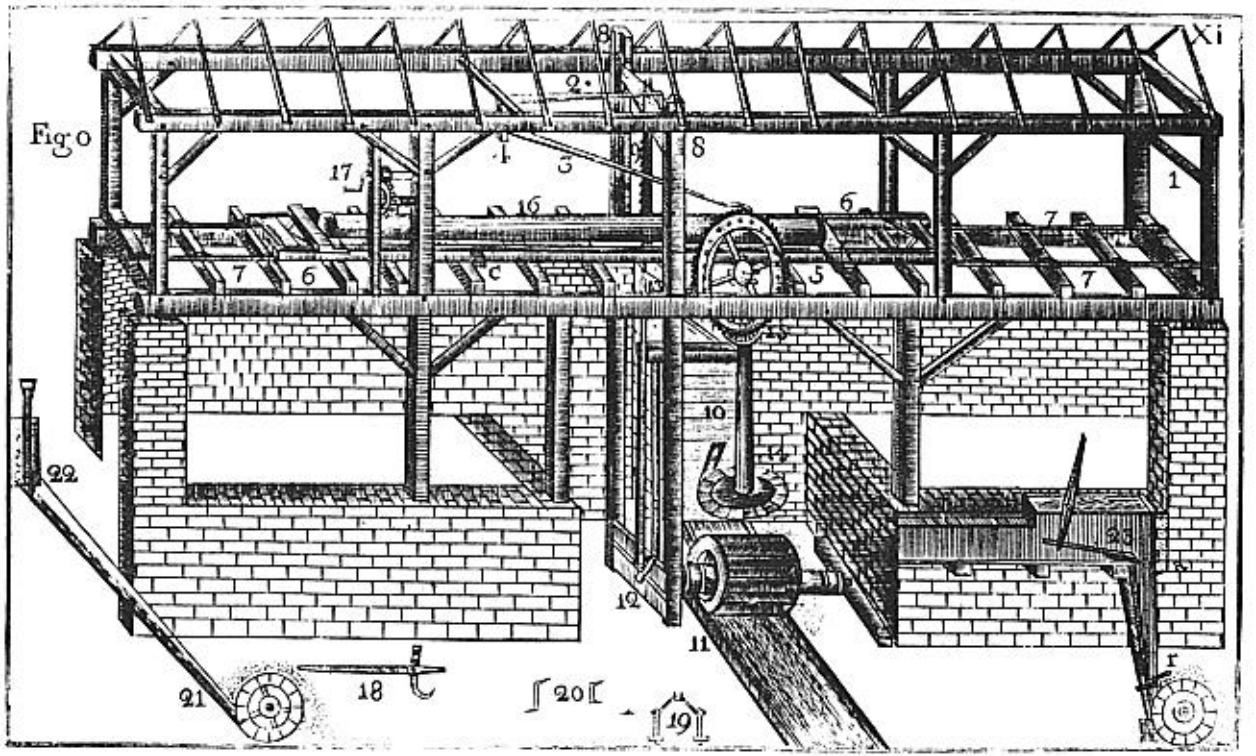


FIG. I. AMERICAN SAWMILL

Oliver Evans and Thomas Ellicott, *The Young Millwright and Miller's Guide* (Philadelphia, 1795). Courtesy of the Elutherian Mills Historical Library.

most expensive saw mentioned in the published records of seventeenth-century Essex County. Buffum spent almost a day "setting" the kerf of the mill's saw, and possibly hanging it, as his charge of 5s. to the partnership suggests. The blade was held in its frame by two iron "steurps" [stirrups].[19]

This mill also had a power-driven mechanism for advancing the log to be sawn against the blade. Its mode of operation can be inferred from the mention of "[reinforcing] houpes and gougens [gudgeons = pivots] for y^{e} rage whele." An iron "crank" which weighed 120 lbs. and cost £2-12-8, was the most expensive single item in Buffum's purchases. "Fouer dogs" and "spekes" [i.e. spikes = long nails] to fasten the log firmly to its bed complete the list of iron work.

While no contemporary illustration of an American sawmill has survived from the seventeenth century to show us how this mill may have worked, an illustration (Fig. 1) from *The Young Mill-Wright and Miller's Guide* (Philadelphia, 1795) by Oliver Evans and Thomas Ellicott illustrates, with very few refinements, the mechanism which Buffum probably built. The crank (12) was attached to the "pitman" (12-13) that raised and lowered the saw and its frame (9). The frame slid in the grooves of two "fender posts" (8). At the apex of its upward movement, the saw frame raised a lever or "sweep" (2), pivoted on a beam (above 4) and forced the "feeder" (3) to advance the rag wheel (5) geared to the bed (6) on which the log was fastened. After the log (16) was sawn almost to the hinder head block (6 at left), the forward motion was arrested automatically when a small block (c) attached to the bed, closed the sluice gate (10). The wallower (15) was engaged in the cogs whose butt ends are visible on the rag wheel (5), and the log was returned to its starting position.[20]

The skill necessary to transform this miscellaneous collection of iron, timber and labor into a working sawmill was a part of the everyday knowledge of a millwright such as Buffum, although it might well present an insurmountable problem to the modern student. The documentary evidence is important in itself, but takes on an added significance when one realizes that the materials for the construction of sawmills in New England required *no* items that could not be gotten from local sources. Even the saw blade could have been chosen from English models available in New England for pit-sawing, although in the case of the Buffum Mill, there was ample time to procure one from England. Perhaps most important of all, however, is the fact that Buffum himself was not trained as a millwright in England: his knowledge of building appears to have been acquired in New England.

III.

The beginnings of mill sawing in America have been considered by a number of historians in the past, but each has told only that part of the story which reflects his own primary interest. J. Leander Bishop wrote of it with pride in 1860 as the starting point of American manufacturing. James Elliott Defebaugh (1906) saw it as the beginning of the great lumber industry which had grown to immense proportions by his time. Robert G. Albion (1926) saw it as one of the elements which gave England her command of the seas in the eighteenth century, and Henry C. Mercer, three years later, saw in it the most elaborate "Ancient Carpenter's Tool" of all.[21]

Mill sawing in seventeenth-century New England was, in a sense, each of these things, and at the same time, something greater than any of them. Not only did the large mills of New Hampshire and Maine supply lumber for export, but *local* mills furnished virtually every township in Massachusetts, Rhode Island and Connecticut, with the boards and planks necessary for a growing New England. Their incidence, their ownership, the conditions and attitudes of the communities in which they were located, is a story neglected by all save the local historians of the nineteenth century.

Occasionally sawmills were owned by a single individual, such as those of Robert Moulton of Salem Village or John Dodge of Beverly whose mills were in operation in the 1670's.[22] Individual ownership, however, seems to have been the exception rather than the rule, and a partnership arrangement involving a number of men was much more common. This was the case when John and Joseph Hutchinston built a sawmill on the land of John Porter beside Beaver Dam Creek (near present Nichols St.) to the northwest of Salem in 1670. The three men shared the proceeds of the mill equally, although Porter, a tanner by trade, merely provided the land on which it was built.[23] Porter must have been pleased with the results, for 22 years later we find his son building a mill near Wenham, indicating that he preferred the sawmiller's trade (and profit) to that of the tanner.[24]

Sometimes an individual might invest in a communally owned mill, which he probably had no hand in building or operating as a commercial enterprise. Lieutenant Phillip Watson Challis of Amesbury owned "three days interest per annum in a sawmill," in 1680. This right of usage was valued at £2.[25] In that same year, 13 men owned a corn and sawmill at Hull.[26] This may well be the greatest number of owners of any colonial enterprise short of the Saugus Ironworks.

While sawmills were usually built on private land, the timber that was to be sawn in them and the streams which powered them were considered assets of the community, and the community's interest in both was scrupulously protected. In 1656, the residents of Ipswich made an arrangement with an unnamed sawmiller to build that township's first mill on the "Chebaggo" River. The conditions of the agreement may be considered typical.

> Voted that there be a sawmill on Chebaggo River, with liberty to cut timber, if one-fifteenth of what is sawed there be allowed to the town, and that no timber be cut within three miles and a half of the meeting-house, and the inhabitants be charged no more than 4 per cent.[27]

This contract also reveals that payment to the sawmiller was made in kind, just as the gristmiller received a certain portion of the flour or meal he ground as payment.

It was not uncommon for a town to make a gift of land and other concessions to a sawmiller who was willing to set up a mill in the vicinity. The town of Dover, New Hampshire, made such a grant "at the Oyster River" to Valentine Hill of Boston prior to 1651.[28] The freemen of Saco voted Roger Spencer the right to set up a sawmill, presumably with the right to cut timber on common lands, on the double proviso that he pay 12,000 feet of boards to the town and "employ townsmen in preference to others."[29]

Andover was less fortunate in its attempts to get a sawmill on either the Shawshin River or Cochichewick Brook. In 1664, the townsmen "encouraged" that a corn and sawmill be built, the builder to have liberty to cut timber on common land not within two miles of the meeting-

house.[30] None seems to have been built at that time, for at a town meeting held 16 years later, the citizens again offered the same conditions plus free land to anyone setting up a "saw, fulling and grist mill on Shawsheen River."[31] This time the "sweetened" offer was accepted and in 1682 Joseph and John Ballard put their mill on Rogers Brook in Ballardvale into operation.[32] Soon after the first mill was built, what may be described as "sawmill fever" infected the community. In 1685, two more sawmills were built in Andover: one on Mosquito Brook, to the east of town, and the other on "Ladle Meadow Brook."[33] The same pattern repeated itself in Ipswich Township. After the first mill was built in 1656, five more were added in 1665, 1667, 1671, 1682 and 1687.[34]

Not all of New England's water mills were powered by streams and waterfalls. Many references to "tide mills" occur in the records. The water for these mills was impounded twice each day as the sea at high tide overflowed the walls of an especially built pond or dammed cove. After the tide had receded, the water in the pond was released through a sluice and as it flowed back to sea level, it turned a waterwheel.

No commentator has thought that tidal mills were very important or very efficient. Where the tides were of some size, however, such a mill could generate considerable power. A reliable estimate could be made today by simply measuring the extremities of the tides. Certain communities, such as Boston, had no other source of waterpower in the seventeenth century. The mills on the "Mill Pond" were probably the most successful tidal mills of their time: they ground much of Boston's grain for well over a century.

An insight into the operation of a tidal mill at Hingham was recorded on January 24, 1653, when Richard Church, carpenter, bought from Thomas Joy, carpenter, "one halfe . . . of . . . the Corne mill . . . and half the foundation of a saw mill adjoyning to It wth halfe the dam . . . on the townes cove," for the sum of £50. The partners in this mill very soon thereafter recorded an agreement concerning the allocation of the tides equally to each partner—a problem which never plagued their counterparts who built their mills beside running streams. "Two tydes shall be used for the Corne mill and two tydes for the sawe mill," the contract read, although the hope was expressed that both mills could be "sett to work at once at the spring tydes."[35]

IV.

While the local sawmills of Massachusetts were often inexpensive affairs with limited output, the mills of Maine and New Hampshire, producing lumber largely for the export trade to England and the West Indies, quite often represented a sizable capital investment. A mill at York was appraised *circa* 1660 at £750,[36] which may be compared with the original capitalization of the entire Saugus Ironworks at only £1000. The mill and lands of Humphrey Chadborne, Sr., of Kittery, were valued in 1667 at more than £1,713 —which made him one of the wealthier New Englanders of his time.[37]

One aspect of the operation of these northern mills which has not been explored by historians deserves serious consideration: the shipment of mill-sawn boards and planks to those coastal towns of Massachusetts whose demands exceeded local output.

Many historians have assumed that the extensive investment by Boston capitalists in the northern mills indicated a preoccupation with the export trade. It is, however, certain that many of these mer-

chants owned such mills with the primary view of shipping merchantable planks and boards to Boston and Salem. The mill built at Salem in 1672 was the first near that town, yet 18 years before, the inventory of Richard Hollingsworth, a Salem shipbuilder, listed 6 loads of sawn timber (unidentified) and 7,258 feet of sawn plank and boards.[38] The wharves of Boston were full of merchantable boards, too, but as far as the record reveals, there was *no* sawmill on the Mill Pond in the seventeenth century.[39]

Pitsawing could never have supplied the domestic needs of towns like Boston and Charlestown. The saw pits of those towns doubtless had their hands full supplying the shipyards, which required not only planking, but irregular structural shapes that sawmills could *not* supply. Boston's population was doubling every quarter of a century and its communal life was complicated by the fact that parts of the town burned down and had to be rebuilt nine times between 1630 and 1760—an average of once every fifteen years.[40]

That Boston provided a very real market for the output of the northern mills prior to the middle of the century is quite apparent from a lawsuit tried at the Ipswich Quarterly Court. In 1650, Edward Gilman, Jr., a sawmill operator at Exeter, New Hampshire, owed John and William Paine of Ipswich and Boston respectively, 209 pounds sterling. The parties agreed that to settle the debt, the Paines should get certain quantities of barrel staves, "bowlts" of white and red oak, and "all the boardes the which shall be sawn by the halfe of the mill belonging to Edward Gillman [Jr.]," from 1651 "untill the sayde sume of 209 poundes shall be payde." During further testimony in the suit, Thomas Chase deposed that in May, 1651, he paid a debt to Gilman, "in freighting . . . in carrying boards from Exeter to Boston."[41]

Another instance of the shipment of boards from Exeter to Boston is to be found in the Suffolk County Court Records. Joseph Smith of Hampton contracted with Roger Rose for the delivery to him or his agent of, "six thousand foote of Merchantable pine boards at Boston . . . according to a writeing given under his hand at Exitor bearing date the 15th of April, 1676."[42]

While comprehensive records of shipments of boards to Boston are difficult to find, Samuel Sewall records in his Diary on September 1, 1687, "This day we receive a Sloop Load of Boards from the Salmon-falls Saw-mill," that his wife had inherited from her father, John Hull.[43] In October, 1691, Sewall ordered "Three Thousand of good Boards; clear, sound, Inch and quarter cut" from Captain John Gerrish and/or Richard Waldron (see check list under 1686) for his own use.[44] In May, 1699, Sewall ordered 8,000 board feet of plank and boards for John Cunnable, a prominent Boston joiner, from Peter Coffin,[45] whose mill was probably in northern Essex County. Indeed, Curtis P. Nettles, the distinguished economic historian, has pointed out that "practically all the lumber that was used in Massachusetts seacoast towns was brought from New Hampshire by the Boston merchants."[46]

A survey made in April, 1682, for the purpose of assessing taxes, indicates that there were exactly two dozen mills operating in the area of present-day Maine. Of this number, one fourth were noted to be running four blades.[47]

Insufficient evidence makes it difficult to estimate accurately the output of a seventeenth-century commercial sawmill. However, we can document the production of a certain mill: the one owned by

the Gilmans of Exeter. During the lawsuit mentioned above, an unnamed deponent, who "knew the mill well," estimated that in 1650 and 1651, "the old mill at Exiter produced about four score thousand . . . boards and some planks . . . and about 60,000 in 1652 and 53." In his opinion, the mill could have produced even more if it "had been furnished as it ought to have been," for, he continued, "it should want neither timber nor anything else." One must remember that Gilman's mill suffered from mismanagement and in 1653 was forced into the seventeenth-century equivalent of receivership.

The record of this lawsuit also informs us of other details of a commercial mill's operation. An additional charge, amounting to about one third of the cost of the lumber "at the landing place" was added if it was loaded onto a ship or "a flat bottomed boat," by employees of the mill. Boards were worth 4 shillings 6 pence per hundred board feet, and planks sold for 6 shillings per hundred. The cost of freighting lumber to Boston was reckoned at 18 pence per hundred board feet.[48]

These prices are of more than academic interest, for they indicate that even with these added costs, lumber could be shipped to Boston and sold at a profit.

Contemporary references to the number of feet of lumber the labor of two pit sawyers could produce in a day is difficult to find. Assuming that the method used in this arduous work was susceptible to little technological change in 200 years, a notion of the output in 1630 can be deduced from *The Builder's Price Book* (London, 1829). At that date, a pair of pit sawyers received 8 shillings per day in wages. Eight shillings would also purchase the labor (exclusive of the wood) to produce 336 feet of 10-inch pine boards, or "280 feet of boards," in board feet. Wider boards took proportionally more time and were charged for at a higher rate.[49] The relative capacity of a sawmill "if in good order," in contrast to the output that might be expected of a pair of pit sawyers, was expressed by Thomas Ellicott in 1795 thus: "One mill, attended by one man . . . will saw more than 20 men with whip saws, and much more exactly."[50]

American lumbermen preferred to do their logging in the winter. Two reasons for this are pointed out by Dr. William Douglass, the first historian to cite statistics demonstrating the extent to which Americans used their forests. In 1749 Douglass wrote that logging, carried out when the snow was "two feet deep," was "very good for the sledging conveyance,"[51] that is, for hauling the logs to the river with oxen and sleds. The second reason that Dr. Douglass gives for logging in the winter was that timber cut "with the sap up," that is, during the spring or summer growing season, "is like *foenum madide repositum*, it soon tends to putrefaction."[52]

Dr. Douglass's assertions are confirmed by the remarkable account book of Captain John Gerrish who operated a sawmill at "Bellamies Bank," near Kittery Point, Maine, in 1686 and 1687. Six men were hired for the winter between November 1 and December 20, 1686. The entries concerning one Will Sanders indicate how an average husbandman may have supplemented his annual income during months when he would normally have been idle:

> Hired will Sanders for 30s. pr. month untill the Last of february next; 10s of the holl in Mony: the Rest in goods as we sell others for mony; to begin the first of No. 1686.[53]

If Sanders' wages were typical, laborers at this sawmill received little more than 1 shilling per day—about 1/3 of what

they would have received for mowing hay the following August.

By modern standards, the efficiency of the seventeenth-century New England sawmills must seem ridiculously low. Dr. Douglass estimated that, "one man and a boy attending of a mill may in twenty-four hours saw four thousand feet of white pine boards."[54] But "efficiency" is a relative term. Of course waterwheels wasted *potential* energy, and the blade was generally designed to saw only on one stroke—but the water cost nothing and time itself was not a factor. In an age where less is possible, there is less to be done. The governing consideration in that bygone age was neither the cost of power nor the passage of time, nor that totemic word "efficiency," in terms of which modern man measures the accomplishments of the past. The governing factor was that mill sawing saved *labor*, and this made the effort productive, competitive and profitable.

V.

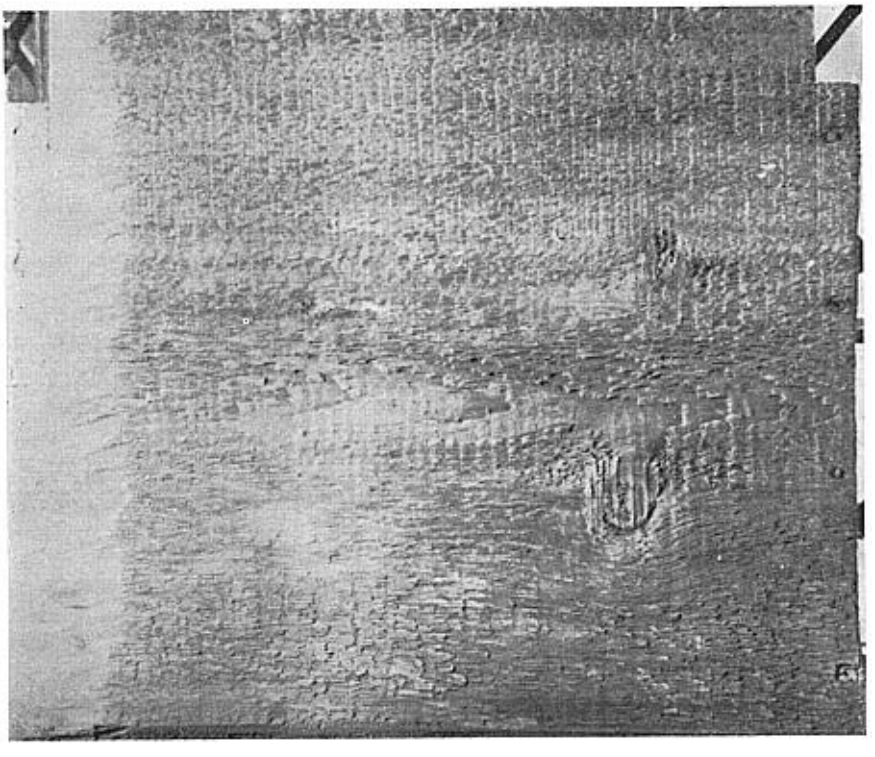
Our notion of the varieties of woods sawn in the early mills of eastern Massachusetts is as spotty as our estimate of their output. It is likely that white pine (*Pinus strobus Linnaeus*) was the wood most commonly sawn for two reasons: it existed there in great abundance and, as a "soft" wood, could be logged with relative ease and sawn relatively quickly at the mill. Similarly, much "yellow pine" (probably *Pinus Rigida Mill*, the one member of the Taeda family which grows in New England) was logged in the Connecticut River Valley.[55] Why this particular pine was chosen for sawing there is not yet fully understood. Known popularly as "pitch pine," this variety, when it is employed commercially at all in New England today, is generally used to make turpentine. Its high resin content would make it a sticky tree to handle, and its sap would literally "gum up the works" of a sawmill. The most obvious explanation may be correct: white pine simply did not abound there in the seventeenth century. Sylvester Judd, the historian of Hadley, writing in the late 1850's, confirms the fact that "from 70 to 100 years ago, yellow and pitch pine logs were [sawn in] much more plenty than white pine," and suggests elsewhere that the increase in white pine in the area was a phenomenon of relatively recent years.[56]

While the presence of mill-sawn pine has often been noted in the surviving furniture of the Connecticut River Valley, the significance of its presence, in quantity, in the furniture of *eastern* Massachusetts has until now not been properly evaluated.

Mill-sawn white pine forms the drawer bottom and back of the "Gregory Stone Cupboard," owned by the Concord Antiquarian Society, which probably originated within a dozen miles of Boston in the early 1670's. It forms the bottom of a chest (Fig. 2), which is thought to have originated in the South (Chebacco) Parish of Ipswich in the late 1680's or early 1690's. The chest is presently on display at the Whipple house in Ipswich. This white pine, especially when used in drawer bottoms, is generally sawn or planed much thinner than the pine used similarly in the Connecticut River Valley at about the same time. When used for the back of case furniture, a one-inch board is the norm in examples from both localities. Pine boards by no means occur in the furniture of every township in eastern Massachusetts. They are rarely found, for example, in the finest joined furniture of Salem. Despite the apparent reluctance of Salem joiners to use mill-sawn pine for

chest and drawer bottoms, at least one Salem chest (Winterthur Collection No. 58.688) has a lid which was not completely dressed on both sides and confirms the use of mill-sawn pine in the community. Pine lids, of course, are found on the very earliest Salem chests.

paper. Suffice it to say that mill-sawn wood is easily recognized: the marks left by the saw blade are regularly spaced, from ¼ to ¾ inch apart, and are always precisely parallel to each other. They are generally perpendicular to the margin of the board, although on occasion they may



UNDERSIDE OF CHEST BOTTOM, ESSEX COUNTY, MASSACHUSETTS, LATE SEVENTEENTH CENTURY

Courtesy of the Ipswich Historical Society.

The pattern of the saw marks on mill-sawn woods varies considerably and suggests not only the different types of mechanical devices used to advance the log being sawn, but also the different ways in which the saw blade was toothed to cut. The interpretation of these various cuts does not come within the scope of this

be observed to tilt at a slight angle. This angular tilt is explained by Oliver Evans who suggests that "hanging the saw . . . with the upper teeth about half an inch farther forward than the lower ones . . . [gives] the saw liberty to rise without cutting, and the log room to push forward as it rises."[57]

Precise diagnosis of the type of mills which produced the boards used in furniture is complicated by the fact that one side of them is generally "finished" or dressed with a plane, and only one unfinished side retains its original saw marks. For this reason, it has not been possible to determine if multiple or single blade mills produced the boards. Cross-cut blades were sometimes used, but less often than logic would suggest since the blade of a waterpowered mill saw exerted an *equal* amount of force on either the upward or the downward stroke, and sawing time could have been reduced.[58]

Only occasional references to the sawing of hardwood by the seventeenth-century mills of Massachusetts are to be found. Perhaps the earliest occurs in the *Town Records of Cambridge* for February 1671/2 when the selectmen granted to David Fiske and his son "2 mapell trees for theare saw mill," from among those growing on the common.[59] Boards of mill-sawn sycamore (*Platanus occidentalis Linnaeus*) have been observed in furniture bearing the carved dates 1678, and 1680. Both examples are in the Winterthur collection. The Staniford-Heard chest of drawers (Winterthur, No. 57.541), also known as "The Vocabulary Chest," has two drawer bottoms of this uncommon wood. It was probably made in Ipswich. Sycamore, called "buttonwood" by John Josslyn when he observed it in Massachusetts in 1670,[60] was used much more extensively in the Peter Woodbury "winscut cupboard" (Winterthur, No. 66.1261). Sycamore forms the middle and lower shelves (the top shelf is a replacement), the drawer bottoms, the moldings framing the drawers, the floor of the enclosed cupboard, and its back boards. It was probably made in the Salem area.

Such mill-sawn sycamore doubtless came from local sources rather than the commercially minded mills of the north. Sycamore is a wood whose easy workability and close grain would appeal to the furniture maker more than to the house or shipbuilder, since it proves somewhat brittle when subjected to longitudinal stress. The rarity of its appearance in surviving seventeenth-century furniture suggests that it was neither milled in great quantities nor with frequency.

Oak, by far the most commonly used wood for fine furniture making in the seventeenth century, was rarely mill-sawn. Most joiners continued to rive this wood as their forefathers had. Some craftsmen left the rails and panels much as they were split out of the bolts of oak in the shop. Others (especially a group in Salem) squared this tapering, wedge-shaped wood with drawknife and plane. Regardless, we now know that oak was sawn in the Osgood-Colby mill at Salisbury, prior to 1658, as the contract made when Colby became a partner divides equally among the owners all saws already at the mill "except those for oak."[61] The earliest surviving example known to the author of mill-sawn red oak (*Quercus rubra Linnaeus*) which has been dated with some degree of accuracy, was almost certainly produced for his personal use in 1684 by Seth Storey, the owner of a mill at Essex Falls, near Ipswich.[62] Four years later, on April 6, 1688, Hannaniah Parker of Reading noted a labor charge in his account book, "for sawing 200 of oak planks . . . 8 s."[63] On the same page, Parker noted a labor charge for "sawing 1752 foot of pine boords," as £2:03:09. These entries permit us to calculate the relative costs for sawing the two woods: it works out to about 2 shillings 6 pence per hundred feet for sawing pine versus

4 shillings per hundred for sawing oak. Two factors account for this difference. First, oak is a denser wood and therefore cannot be sawn as quickly as pine. Second, in order to produce planks which minimize lateral warping, oak logs are generally quartersawn,[64] a process which necessitates more manual handling than plain-sawing.

The interpretation of the evidence of saw marks requires a great deal more documentation than is presently available. The reader should be cautious in attributing great age to pine boards merely because they bear the marks of a vertical sawmill. Such boards were recently observed, for example, in the pine sub-flooring of a row house at 30 Braddock Place in Boston's South End. The building was constructed in the mid-nineteenth century. It is not unreasonable to assume that these boards were shipped to Boston from a mill in Maine, many of which were still operating vertical blades as they had two centuries earlier. The studs in the same house were 3 inches square in section, with rotary saw blade-marks, and were undoubtedly sawn from larger planks by a steam-powered mill in Boston. An even more recent instance of vertical mill-sawing was brought to the author's attention when Mr. Horton Dudley Bradstreet of Topsfield recalled that a vertical sawmill had been in operation in Boxford as late as the mid-1930's.

VI.

The economy of early New England was predicated upon the consumption of wood, and mill sawing was an important ingredient in its success. But the systematic exploitation of the forests of eastern Massachusetts in the colonial period and of central Massachusetts in the first half of the nineteenth century—with little concern for the consequences—hastened the end of large-scale mill sawing there. As the forests were cut down, their ability to act as natural conservators of surface water was severely hampered. By the time Dr. Douglass published his *History* in 1749, this was the spectacle he described:

> New England abounds in saw-mills of cheap and slight work. . . . These mills mostly stand upon small streams, because cheap fitted, but with the following inconveniences. 1. As the country is cleared of wood and brush, small streams dry up. 2. In living [*sic*] small streams they do not afford water sufficient to drive the wheel in Summer.[65]

A typical example is Cochichewick Brook, at North Andover, which in 1815 supported five or six mills of various types. Today it is virtually dry. The same may be said of the Ipswich River, which is only a wide marsh where interstate route 93 crosses it.

Dr. Douglass noted that the forests, too, were almost gone. "Even the firewood near Boston is much exhausted," he wrote. "We are under the necessity of fetching it from the province of Main, and territory of Sagadahock."[66] Charles Sprague Sargent is reputed to have been the last man to have had the opportunity of observing the native ecology of New England. In 1905 he stated that the occurrence of red oak in the north Atlantic states is "comparatively rare."[67] The statement suggests that he was perhaps too late by 200 years to observe the original distribution of these trees and the profusion in which they had once existed. There can be little doubt that most of this once plentiful wood had been consumed during the first three generations of settlement in the manufacture of charcoal, potash, "hogshead staves," house frames, furniture, and for cooking, smelting, glassmaking, soap boiling, tanning, dyeing and firewood.

EPILOGUE

The nineteenth-century view of seventeenth-century life in New England dies hard. Each year, more research, done in a revisionistic frame of mind, chips away at old notions—some fondly cherished for over a century—all enshrined in the great mythology that was developed to deal logically with the countless artifacts which have survived, divorced from the way of life that produced and used them.

The contemporary trend of much historical scholarship embodies strong sociological overtones. A strong temptation often exists to discover the specific origins of American practices in the traditions, habits and customs of Elizabethan, Jacobean and Carolean England. Such scholarship, however, can be misleading if it does not also enunciate the ways in which those traditions were modified by the American experience.

Reality and myth are combined, for example, in the picture of New England's first settlers clearing the forests with the broadaxe, hewing the frames for their houses, and then laboriously sawing floorboards and clapboards in the saw pits assumed to have dotted the Massachusetts landscape. For two centuries the forests and the settlers, the broadaxe and the hewn beams are real enough. But there is some myth in the picture, and in the light of recent research, pitsawing must now be relegated to its proper place in New England life: a useful technique at the beginning of colonization by *Englishmen*, virtually abandoned for domestic uses within a few decades by *Americans*.

Samuel Eliot Morison in the early 1930's did much to free the thinking of historians from the specter of economic determinism as the prime motivation for the settlement of New England. All too seldom have historians since Morison taken advantage of that freedom by demonstrating how New England's abundant forests and streams affected the habitual ways of the first generation of English craftsmen. The immigrant settlers—reared in a way of life that was circumscribed by scarcity, dwindling forests, and growing population—broadened familiar techniques to include *new* techniques made possible by the abundance found growing in the forests of America.

It is common today to interpret the descriptive writings of the first authors who looked at America—John Smith, John Winthrop, William Wood, Edward Johnson, John Josslyn, to name but the most obvious—as the seventeenth-century equivalent of "Chamber of Commerce propaganda," designed to entice immigrants to the New World. It is less easy, for the present generation whose every material desire can be fulfilled, to recover the significance of the awe and wonder that each of these writers voiced upon viewing the luxuriant natural wealth with which a benevolent God endowed the New England "wilderness." No wonder those Puritans considered themselves a "chosen people." And no wonder that by 1700, the warm rewards of this world had made the old Puritan doctrine of self-denial to gain the next world seem less compelling.

New insights await contemporary scholars who are willing to explore the ways in which this abundance, and its exploitation, affected the culture of seventeenth-century Englishmen and caused them to produce a recognizably new way of life.

APPENDIX

The check list which follows is by no means exhaustive. It documents the dates when sawmills were first noticed in some Massachusetts and Connecticut communities. The emphasis is on the local mills of eastern Massachusetts and a few in New Hampshire and Maine, owned by Boston interests. For additional mills, an excellent list is to be found in J. L. Bishop, *History of American Manufactures* (Philadelphia, 1861), I, 93-115. The author acknowledges, with thanks, the help of friends who assisted in the compilation of this list, among them, Mr. S. Forbes Rockwell, Mrs. Lura Woodside Watkins, Mr. Charles F. Montgomery and Miss Patricia E. Kane.

There seems to be no documentary basis for the belief that a sawmill existed in the vicinity of York, Maine, in 1623, as mentioned by Bishop, I, 93, and I. S. and N. M. Kull, *Encyclopedia of American History* (New York, 1965), p. 26.

1634 "The Falls of the Newichewannock" between Berwick and the Cocheco branch of the Piscataqua River (near Portsmouth, N. H.): Ambrose Gibbons operated a sawmill (Adams, *Portsmouth*, p. 19).

1642 Rowley: Thomas Nelson "built a sawmill on Mill River, south of the Newbury line." Lura W. Watkins, "The Dummer Family," *Essex Institute Historical Collections*, CV (Jan. 1969), 13.

1644 Andover: Simon Bradstreet alleged to have a sawmill there (Henry W. Belknap, *Trades and Tradesmen of Essex County*, p. 40), but see next item.

1646 Reading: Valentine Hill sold "his halfe parte of a sawmill at Redding" to Simon Bradstreet of Andover (*Suffolk Deeds*, I, 106).

1646 Reading: June 27, John Elderkin mortgaged his half interest in a sawmill for £10 (*Suffolk Deeds*, I, 78).

1649 "Strawberry Banke" (Portsmouth): Sampson Lane granted to Ambrose Lane "one saw mill now in building at Sagamore's Creek in Pascataqua river," April 22, 1649 (*Suffolk Deeds*, I, 137).

1649 "Quechecho": October 2, Richard Waldren granted to James Wall of Exeter, carpenter, "all his right for erecting a saw mill at Quecheco [*sic*] . . . all the work that hath been done (both timber & yron work) . . . & fifteen hundred of trees." (*Suffolk Deeds*, I, 109).

1650 Salisbury, "on the Pawwaus River": William Osgood granted liberty to build a sawmill; finished before September, 1652 (*Q C R*, VIII, 374); still in operation in 1664, but "rotted down" *ca.* 1670 (*Ibid.*, 251); Osgood repaired this mill, in operation again 1682 (*Ibid.*, 252).

1650 Exeter: Edward Gilman's mill in existence (cited in text, above).

1651 "Oyster River" (Dover, N. H.): Feb. 18, Valentine Hill of Boston mortgaged for £150 "the Sawe mills standing & erected upon . . . the lands [granted to him by] the town of Dover . . ." (*Suffolk Deeds*, I, 182).

1651 "Sturgeon's Creek on the Piscataqua River,": Oct. 14, Hugh Gaile, William Ellingham and Nicholas Shapleigh of Kittery owned two sawmills there (*Suffolk Deeds*, III, 231, 249).

1652 Mystic, Connecticut: John Winthrop, Jr. granted "liberty to make a damn [*sic*] at the head of Mystic River . . . for the Saw mill," Feb. 14 (Connecticut Archives, Private Controversies, I, 286); still in existence, 1680; it was a tidal mill (*Ibid.*, 290).

1652 Ipswich: Jonathan Wade sued the town (March) "for interrupting him about a sawmill" (*Q C R*, I, 248).

1652 "Newitchewannock": Richard Leader had erected a sawmill there prior to April (*Q C R*, I, 251).

1653 Hingham: Thomas Joy and Richard Church partners in corn and saw mill at "the townes Cove" (cited in text, above).

1654 Hampton: Thomas Ruck owned a sawmill there; sued James Wall for "taking away [its] geers" (*Q C R*, I, 369).

1654 Salisbury (?): Samuel Dudley owned a sawmill in April (*Q C R*, I, 345-346).

1654 "Lamperelle [Lamprey] River," N. H.: Order by the general court to lay out lands and a sawmill for Deputy Governor Samuel Symonds, dated May 14 (Photostat of record from Mass. Archives filed under that date at Mass. Historical Soc.); same mill willed to his son in 1678 (*Essex Probate Records*, III, 265); "remains of a Sawmill late thereupon" mentioned 1682/3 (*Suffolk Deeds*, XII, 351).

1656 Scituate: Joseph Tilden's Mill in existence; destroyed by Indians, 1676 (2 *Mass. Hist. Colls.*, IV, 225).

1656 Ipswich, South Parish: (cited in text, above. Felt, Ipswich, mentions others under dates of 1665, 1667, 1671, 1682 and 1687).

1659 "Newichewanock, On Quampegon Falls" [near Portsmouth, N. H.]: two sawmills owned by Thomas Broughton were mortgaged to Henry Shrimpton, Hezekiah Usher, others, all of Boston (*Suffolk Deeds*, III, 249); perhaps one of them at "Salmon Falls" (see 1673, below).

1660 The same: Peter Cole, [bookseller ?], of London owned sawmill (*Q C R*, I, 251).

1660 Exeter Falls (?): Mr. [Thomas ?] Clark of Boston, and [Simon] Bradstreet owned a sawmill there (*Q C R*, II, 378).

1661 near Wells, Maine: sawmill mentioned in will of Edmund Littlefield (Sargent, *Maine Wills, 1640-1760*, p. 4).

1661 Gloucester: sawmill in existence (Belknap, p. 40).

1662 Haverhill: John Hutchins owned one-third of existing sawmill (*Q C R*, III, 57).

1663 Little River, New Hampshire: exact location unknown, sawmill in existence (Belknap, p. 12).

1663 Manchester (By The Sea): John Pickworth part owner of an existing sawmill (*Essex Probate Records*, I, 407).

1664 Hadley, Mass.: Thomas Meekins and Robert Boltwood built sawmill on Mill River, east bank of the Connecticut River (Judd, *Hadley*, 41).

1664 Plymouth Colony: the King's Commissioners reported "one sawmill for boards." Location: either Scituate (c.f. Tilden's Mill, above), or Duxbury (*Bishop*, p. 97).

1667 Springfield: John Pyncheon's mill built (C. F. Luther, *The Hadley Chest*, p. 61).

1667 Exeter, N. H., on "the Pascasit River": Edward Hilton owned a sawmill (*Q C R*, IV, 63).

1667 Andover: Stephen Johnson's mill (Helen L. Bailey, *History of Andover*, p. 151), probably the same one mentioned in 1669 (*Records of Andover Town Meetings*, microfilm at North Andover Historical Society, Reel 1, Frame 336).

1667 On brook between Hartford and Wethersfield: Thomas Harris had permission to build a sawmill (Bishop, 103).

1669 "Lampereele River": Nicholas Lissen (Leeson) owned a sawmill (*Q C R*, IV, 128), at "Mr. Symond's Falls," (*Ibid.*, 62); it had been "insufficiently built" by Robert Wadgley [Wadley] (*Ibid.*, 134).

1669 Hadley: Thomas Meekins builds mill on West bank of Connecticut River (Judd, *Hadley*, 41).

1670 Salem (Northwest of Salem): agreement signed between Porter and Hutchinson to build mill (cited in text, above).

1670 Hatfield: Allis's mill begins working (Luther, p. 61).

1671 Beverly (on Wenham-Beverly line): John Dodge's mill in existence (*Essex Probate Records*, II, 232).

1671 Braintree: Symon Lynde of Boston built a sawmill and fulling mill on land bought from Richard Thayer before November 16, 1672 (*Suffolk Deeds*, XI, 79, 80).

1671 Hartford: John Allyn's mill built (Bishop, 103).

1672 Woburn: Edward Johnson owned "the eigth [*sic*] part of a sawmill . . . £14:10:00" (Middlesex County Probate Records, Inventory dated April 20, 1672).

1672 Cambridge: David Fisk (and his son?) operated a sawmill, probably on Menotomy River (*Cambridge Town Records*, 201).

1673 Topsfield: Francis Peabody's mill on Mile Brook (*Topsfield Historical Collections*, VIII, 81).

1673 York, Maine: Sept. 3, Henry Sayward, millwright, sold 1/3 of a sawmill and grist mill at York to John Leverett of Boston for £135:17:00 (*Suffolk Deeds*, VIII, 241, 242).

1673 "Salmon Falls" on the Piscataqua River: John Hull of Boston owned a sawmill operated by Roger Plaisted and Thomas Broughton (Herman F. Clarke, *John Hull, A Builder of the Bay Colony*, p. 91).

1675/6 Danvers (?): existing sawmill mentioned (*Q C R*, VI, 8); located between land of Nathaniel Putnam and farm of Zerubabel Endicott; no longer in operation in 1682 (*Q C R*, VIII, 314).

1675 "Lamperelle River": [Robert] "Wadley's Mill" mentioned; probably not same as Lissen's mill (1669, above; *Q C R*, VI, 22).

1676 Exeter River: "Pickpockett Mill," a sawmill, mentioned (*Q C R*, VI, 209).

1677 Salem: Thomas Flint owned a sawmill (*Q C R*, VII, 423).

1678 Salem Village (Danvers): Robert Moulton's existing sawmill bewitched by Giles Cory (*Q C R*, VII, 91).

1679 "Lamprele River": William Hilton owned a sawmill (*Q C R*, VII, 191); sold 10,000 feet of boards to Hugh Marsh [March] of Newbury, joiner (*Q C R*, VII, 423); probably not the same as 1667, Edward Hilton Mill, above.

1679 Amesbury: sawmill in existence (*Essex Probate Records*, III, 330).

1680 Norwich, Conn.: Capt. Fitch had permission to build a sawmill (Bishop, 103).

1680 Lynn: John Collins part owner of existing sawmill (*Essex Probate Records*, III, 372).

1680/1 Hull: Samuel Baker and 12 others owned a corn and saw mill at "Straits Pond," prior to March 7 (*Suffolk Deeds*, XIV, 68-70).

1682 Braintree: John Hubbard, of Boston, built a sawmill (Weeden, I, 306) on the "Monotoquad River between Braintree and Weymouth." It included, "Iron Works, Forges, Dam and Pond, fflume & Sawmill." Hubbard sold 1/6 share to Jeremiah Dummer, goldsmith, of Boston, March 14, 1684/5. (*Suffolk Deeds*, XIII, 361).

1682 Ballardvale (south of Andover): Joseph and John Ballard had a sawmill on "Shawshin River at Rogers Brook" (Fuess, *Andover*, 250).

1683 Dedham: Inventory of Capt. Daniel Fisher mentions his "cedar Swamp near the Sawmill," (*Suffolk Probate Records*, IX, 149); perhaps the same mill owned by Ezra Morse in the winter of 1692 valued at £26 "with the tools & land belonging to it." (*Ibid.*, XIII, 124).

1684 Hadley: Town grants privilege of three mills, 1.) at Mill River, 2.) South of Mt. Holyoke, and 3.) on Fort River (Judd, *Hadley*, 42).

1684 Worcester: Capt. John Wing owned a sawmill "at the north end of the main street" (Bishop, I, 101).

1685 (North) Andover: Henry Ingalls granted permission to build a sawmill on Mosquito Brook; Henry Holt the same on Ladle Meadow Brook (Andover Town Meetings, microfilm, reel 1, frame 371).

1685 Weymouth: John Vining's sawmill mentioned, April 1. (*Suffolk Deeds*, XIII, 302).

1686 "Bellamies Bank," (Kittery ?): Capt. John Gerrish's mill in operation (cited in text).

1686 Capiscott (Maine): "Capt[n]. Silvanus Davis's Mill at Capiscott in the Town of Falmouth [Maine]," mentioned ("Dudley Records," 2 *Proceedings Massachusetts Historical Society*, XIII, 277).

1688 Reading: Hananiah Parker had mill (probably working in 1685); noted on April 6, 1688, item for "sawing 200 of oak planks." (New England Historic Genealogical Society, MS. "Account Book of Hananiah Parker," p. 23.)

1689 Salem: Buffum, Gould, Gedney, Nurse, sawmill built (discussed in text).

1690 Middletown, Mass.: mill in existence (Lura Woodside Watkins, "Water Mills in Middletown," *Essex Institute Historical Collections*, XCIX [October, 1963], 312).

1691 Wenham: John Porter (Jr.) and James Freind [*sic*] granted permission to set up a sawmill "near Lord's Hill" (*Wenham Town Records*, I, 94).

1692/3 Hingham: Inventory of John Jacob mentions "His Sawmill, Fulling Mill, Ponds & uplands on both sides of the River with two great Lots . . . all at £400," January 14, 1692/3. (Suffolk Probate Records, XIII, 395).

1693/4 Dorchester: Inventory of John Withington, dated March 2, included: "Part of a saw mill . . . £6." (Suffolk Probate Records, XIII, 395).

1695 Medfield: Inventory of John Barber, dated October 9, included: "1 part of a Sawmill apprized . . . at £6." (Suffolk Probate Records, XIII, 697).

NOTES

[1] Nathaniel B. Shurtleff, ed., *Records of the Governor and Company of the Massachusetts Bay in New England*, 4 Vols. (Boston, 1854-1858), II, 149.

[2] "Gods Controversy with New England," *Proceedings of the Massachusetts Historical Society*, XII, 1871), 83.

[3] James Leander Bishop, *A History of American Manufactures from 1608-1860*, 3 Vols. (Philadelphia, 1861), I, 95. Henceforth cited as Bishop.

[4] William Johnston, Trans., [Johannes] Beckmann, *A History of Inventions and Discoveries*, 3 Vols. (London, 1797), I, 370-374. Henceforth cited as Beckmann.

[5] "Records of the Company of the Massachusetts Bay," *Transactions and Collections of the American Antiquarian Society* (Cambridge, Mass., 1850), III, lxxix.

[6] James Savage, *A Genealogical Dictionary of the First Settlers of New England*, 4 Vols. (Baltimore, 1965), IV, 445-446.

[7] E. M. Boynton, ed. (Boston, 1897), p. 18.

[8] *Records and Files of the Quarterly Courts of Essex County, Massachusetts*, 8 Vols. (Salem, 1911-21), VIII, 374. Henceforth cited as *Q C R*.

[9] Rhys Jenkins MS. folder, "Sawmills and Sawing," Science Museum Library, London, item 27, No. 8, folio 1, recto. Henceforth cited as Jenkins. The author is greatly indebted to Mr. E. C. Winser, Research Assistant, for making the Jenkins MSS. available to him.

[10] Ellen Beatrice Wood, ed., *Rowland Vaughn, his Booke* (London, 1897), p. 157.

[11] P. 33.

[12] Jenkins, *loc. cit.*, verso.

[13] The woodcut in the second part of Edward Williams, *Virginia: more especially the south part thereof, richly and truly valued . . .*, 2nd ed. (London, 1650), p. 75, is the earliest illustration of a sawmill in an English book that the author has so far discovered. It appears likely that the illustration was copied from an as yet unidentified continental work on mechanics. The same mill appears in George Andreas Böckler, *Theatrum Machinarum Novum* (Nuremberg, 1662) as plate 63, where it is described as a sawmill "in the French manner." It again appears in John Evelyn, *Sylva*, 2nd ed. (London, 1670), p. 177. The method of converting the rotary motion of a mill wheel into the reciprocal motion needed to operate a sawmill is illustrated in [James Moxon and] Venterus Mandey, *Mechanick Powers*, 3rd ed. (London, 1709), Fig. LXVI, following p. 82. Because mill sawing was not popular in England, the illustration shows the technique applied to a smith's bellows. On p. 72, the authors note that the same method may also be applied to a sawmill. After the first edition (1696), Moxon's coauthorship was suppressed. The quotation at the beginning of this article will be found in any edition of *Mechanick Powers*, p. 70.

[14] Beckmann, I, 375-376. The 3rd edition of the *Encyclopedia Britannica* (Edinburgh,

1797 has an exhaustive essay on *Mechanicks* in which many types of mills are discussed, with the notable exception of "sawmills."

[15] James Savage, ed., *The History of New England* [John Winthrop's Journal], 2 Vols. (Boston, 1835), I, 116. The increase in apparent wages throughout the colonial period should not be confused with the inflationary trend caused by the emission of paper currency. This inflation made wages seem higher than they actually were.

[16] *Suffolk* [*County, Massachusetts*] *Deeds*, 14 Vols. (Boston, 1880-1906), I, 78. Henceforth cited as *Suffolk Deeds.*

[17] *Q C R*, VIII, 253; George Francis Dow, ed., *The Probate Records of Essex County, Massachusetts*, 3 Vols. (Salem, 1916-1920), I, 407. Henceforth cited as *Essex Probate Records. Q C R*, IV, 191-193, and V, 25-29, detail what happened to impounded streams during the Spring floods.

[18] Henry Wyckoff Belknap, *Trades and Tradesmen of Essex County* (Salem, 1929), p. 57. Henceforth cited as Belknap.

[19] Belknap, p. 58, transcribes this word as "stouesup ?"—for which a meaning cannot be found. The author is indebted to Mrs. Charles Potter, Librarian of the Essex Institute, in whose collection the manuscript is preserved, for deciphering this word. Stirrups, are similar to what is in present-day terminology called a "u-bolt." It is possible that using them to go on the "handles" mentioned with the saw blade, the blade of the Buffum mill was not strained in a frame, but was stabilized in another manner. Such alternative methods are illustrated in Edward H. Knight, *American Mechanical Dictionary*, 3 Vols. (New York, 1877), III, 2387-2388. The use of stirrups in colonial America is further documented by the inventory of Richard Eagles of ————————, North Carolina, whose estate was appraised on July 1, 1769, and contained "2 Saw mill Stirrups." See J. Bryan Grimes, *North Carolina Wills and Inventories* (Raleigh, 1912), p. 489.

[20] For a more complete description, see Ellicott's text in Evans' book, part V, pp. 77-86. Henceforth cited as Ellicott/Evans. This mill is of the type illustrated in Jacob Leupold, *Theatrum Machinarum Molarium* (Dresden, 1767) plate XXIX (first ed., Leipzig, 1735). The method of construction, however, was at least 150 years old at the time that Leupold reported it. The Ellicott/Evans engraving is in no way derived from the Leupold engraving, but the method of making a sawmill as illustrated by both Leupold and Ellicott unquestionably derive from the same tradition. Although the Ellicott/Evans rendering may lack finesse in its execution, it has the enormously redeeming virtue of suggesting that it was drawn from actual observation and experience, rather than plagiarized, as appears to have been the usual custom of the times.

[21] James Elliot Defebaugh, *History of the Lumbering Industry in America* (Chicago, 1906); Robert G. Albion, *Forests and Sea Power* (Cambridge, Mass., 1926); Henry C. Mercer, *Ancient Carpenters Tools* (Doylestown, 1929).

[22] *Q C R*, VII, 91; *Essex Probate Records*, II, 232.

[23] Sidney Perley, *The History of Salem, Massachusetts*, 3 Vols. (Salem, 1916-1920), II, 429.

[24] William P. Upham, comp., *Wenham* [*Massachusetts*] *Town Records, 1642-1760* (Wenham, 1930), I, 94.

[25] *Essex Probate Records*, III, 418.

[26] *Suffolk Deeds*, XIV, 68-70.

[27] Joseph Felt, *History of Ipswich . . .* (Ipswich, 1966), p. 95, *et passim.* The timber referred to was on common lands.

[28] *Suffolk Deeds*, I, 182.

[29] Bishop, I, 98.

[30] See microfilm, "Town Meeting Records, 1656-1708," North Andover Historical Society, Reel I, frame 330. Henceforth cited as Andover Microfilm. This statement in the town records leads me to believe that the sawmill assumed in Belknap, *Trades*, p. 40 to have been owned in Andover by Simon Bradstreet was actually the mill Bradstreet owned in Reading. See *Suffolk Deeds*, I, 106.

[31] Andover Microfilm, frame 362.

[32] Claude M. Fuess, *Andover: Symbol of New England* (Andover, 1959), p. 250.

[33] Andover Microfilm, frame 371.

[34] Felt, *Ipswich*, p. 95 *et passim.*

[35] *Suffolk Deeds*, II, 77, 84-85.

[36] William B. Weeden, *An Economic and Social History of New England*, 2 Vols. (Boston, 1890), I, 201. The late nineteenth-century copy of the pertinent Suffolk Probate Records does not include docket numbers and makes it

virtually impossible to verify Weeden's assertion.

[37] William M. Sargent, *Maine Wills, 1640-1760* (Portland, 1887), pp. 45-53.

[38] *Essex Probate Records*, I, 172.

[39] Justin Winsor, *The Memorial History of Boston*, 4 Vols. (Boston, 1880), I, 529, 533, mentions the Mill Pond and states that a sawmill was constructed there in the seventeenth century. This assertion is not to be confirmed by an exhaustive search of the appropriate Town Records, Selectmen's Records and Suffolk Deeds. See *Report of the Record Commissioners of the City of Boston*, II, VII, VIII, XI; *Suffolk Deeds*, I-XIV. The sawmill on the Mill Pond mentioned by Nathaniel B. Shurtleff, *Topographical and Historical Description of Boston* (1891), p. 113, seems to refer to one that existed within that author's memory, and not an ancient one. The error was apparently repeated by Samuel Adams Drake, *Old Landmarks and Historic Personages of Boston* (1900). The assertion has been repeated since.

[40] Oliver B. Stebbins (review), "A Complete History of the Boston Fire Department . . . ," *New England Historical and Genealogical Register*, XLIV (April, 1890), 224. The years were 1653, 1676, 1679, 1690, 1691, 1700, 1711, 1759, 1760.

[41] *Q C R*, I, 296.

[42] Samuel Eliot Morison, ed., *Records of the Suffolk County Court, 1671-1680*, in *Collections of the Colonial Society of Massachusetts*, XXX (Boston, 1933), 711. This and subsequent references to quantities may be assumed to have been reckoned in "board feet." See William Leybourne, *A Platform for Purchasers . . . A Mate for Measurers* (London, 1685), p. 172.

[43] *The Diary of Samuel Sewall, 1674-1700*, in *Collections of the Massachusetts Historical Society*, 5th Ser., V (Boston, 1878), 187. Henceforth cited as Sewall, *Diary*, I.

[44] *The Letter Book of Samuel Sewall, 1686-1712*, in *Collections of the Massachusetts Historical Society*, 6th Ser., I (Boston, 1886), 124. Henceforth cited as Sewall, *Letter Book*, I.

[45] Sewall, *Letter Book*, I, 211.

[46] "The Economic Relations of Boston, Philadelphia and New York," *Journal of Economic and Business History*, III (1930-1931), 191. Dr. Nettles also quotes the opinion of [John ?] Usher, writing to the Board of Trade in London, Feb. 25, 1704, that "most of the boards exported from New Hampshire went to Boston." It is likely that many such boards were transshipped to the South and the West Indies.

[47] *Maine Historical Collection*, I (Portland, Maine, 1836), 179. One of these mills was "Mr. Sawyer's singular saw mill," at York, which Sewall noted on Sept. 15, 1687 (*Diary*, I, 188-189). Its singular character doubtless derived from its great size and the fact that its multiple blade saw sliced a log into five or six boards at one time.

[48] *Q C R*, I, 296. To produce 100 board feet of either planks or boards would require approximately the same cubic amount of timber. Since boards are thinner than planks, they would command a higher price because of the additional time needed to saw them. The author's impression of the prices quoted in the earliest records is that very little consideration, if any, was given to the value of the logs themselves (which mostly came from common land). The method of computing the cost of mill-sawn lumber was exactly the same as that formerly used by sawyers to compute the cost of pit-sawn lumber. See George Fisher, *The Instructor or Young Man's Best Companion*, 21st ed. (Burlington, N. J.: Isaac Collings, 1775), p. 196.

[49] Pp. 142, 145.

[50] Ellicott/Evans, Pt. V, p. 77.

[51] William Douglass, *A Summary Historical and Political of the First Planting, Progressive Improvements and Present State of the British Settlements in North America*, 3rd ed., 2 Vols. (London, 1760), II, 54-55. Henceforth cited as Douglass. This remarkable book was first published serially 1749-1752. A second edition was issued in book form in 1752. Douglass was born at Gifford, Scotland, *ca.* 1691, emigrated to Boston in 1718, where he was a "practitioner of physick" until his death in 1752. He wrote books on medical subjects in addition to his *History*.

[52] Douglass, II, 70. Modern methods of kiln-drying lumber have removed this once cogent objection to year-around logging.

[53] Frank W. Hackett, "Captain John Gerrish's Account Book," *New England Historical and Genealogical Register*, XXXVI (January, 1882), 73-74.

[54] Douglass, II, 55. Although Dr. Douglass does not note the source of his information, his statement is exactly corroborated by the deposition of Phillip Greeley and John Allen given at Hampton Quarterly Court in March, 1682 (*Q C R*, VIII, 252). This was "with a full

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