"watching stockings, drawers and shirts make themselves."

Portsmouth, N.H. and New England's Knitting Industry, 1832 - 1875

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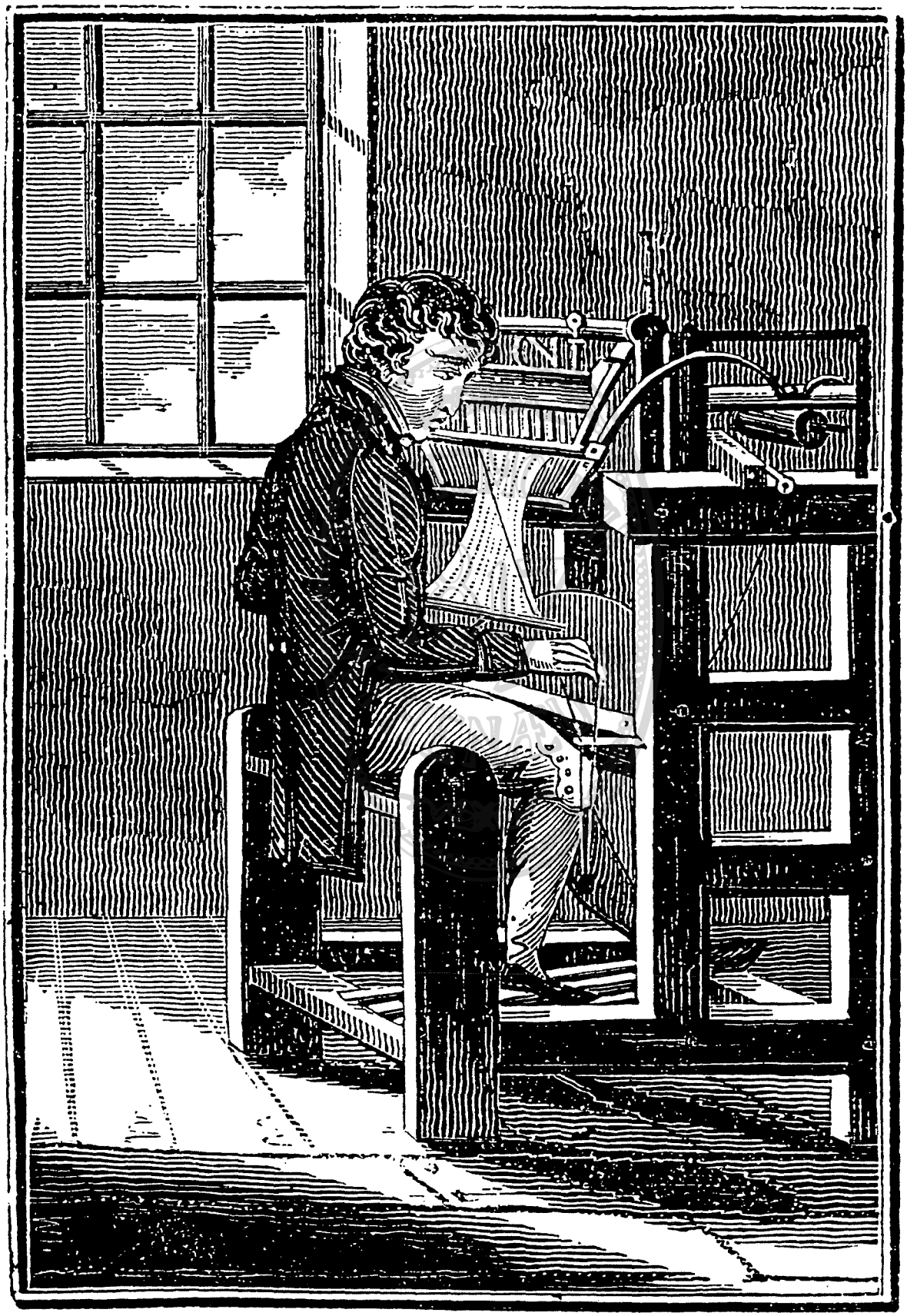
> "It was in the year 1849. My brother John Mee told me that he could make the perfect ribbed work... We were in Portsmouth, N.H. My brother was at work on the Pepper Knitting loom, and he described to me the mode of making the fabric. He knit a piece by hand to show me how he did it, about an inch in length."
>
> Deposition of George Mee, stocking weaver, Dec. 3, 1851

This study traces certain nineteenth century efforts to transform handframes worked at home by immigrant artisans into powered knitting machines in New England factories. John Mee's idea of how to perfect ribbed knitting, transcribed for his illiterate brother during an 1851 patent contest, was but one of several knitting machines constructed by Portsmouth, New Hampshire, mechanics. [1] The inventive atmosphere of this small, coastal, New England city made it one of the leading American machine-knitting centers in the 1830s and 1840s. Building on existing English and continental technologies, English framework knitters and American mechanics made incremental improvements to mechanize the region's earliest knit-goods factories. While the inventions of Portsmouth mechanics Richard Walker and John Pepper have occassionally been recognized, the role they and other mechanics played in creating a distinctly New England hosiery industry has not. [2] Over the 1850s and 1860s northeastern New England's knitting industry combined multiple forms of knit-goods production that employed foreign-born artisans, American factory operatives, as well as thousands of female domestic outworkers in intricate relationships that first evolved during Portsmouth's experiment with industrialization.



Stocking Weaver.

European and Early American Machine-Wrought Knitting

Commercial knitting in Europe, as opposed to individual hand knitting, had long been mechanized. The stocking frame (or handframe) was a sixteenth century invention that has been called "the most spohisticated textile machine in common use in western civilization" before the industrial revolution. By the late eighteenth century it might contain up to 2000 metal parts set on a wooden frame that also formed a seat for its operator. [Fig. 1] Often seen as "too complex to admit of description," the stocking frame knit whole rows of flat fabric instead of hand knitting one stitch at a time on a needle. It used multiple bearded needles whose springy hooks closed to catch and opened to cast off a continuous thread. Laying in the thread by hand, a knitter stepped on a treadle to extend sinkers between the needles to form the loops, pulled a sequence of levers to close the needle and knit the row, and lifted the metal frame up and down to vibrate it and begin again.

> All one can see is that the man holds a thread of worsted at one end, and then, one after another, a whole row of hooks jump up to catch hold of it and drag it out of sight. When this operation has been several time repeated, you find a piece of stocking wove. [3]

The flat pieces of knit fabric could be shaped by machine for the feet and calves of stockings by adding or binding off stitches at the end of each row. "While the hands are thus busy, and the feet moving at the rate of one hundred yards in a minute, " wrote William Felkin, the leading nineteenth century English authority, "the eyes much keep watch over the needles as to their soundness and uniformity, and upon the work, that it be free of blemish and irregularity in the line of loops." [4]

By 1806 thread twisted for knitting could be spun in England's steam powered factories. Factory-made thread soon replaced pre-industrial hand spinning by girls and women in rural homes as part of an integrated family system of framework knitting that had existed in the English midlands for more than a century. There

middlemen (called 'bag hosiers' or 'bagmen') linked rural framework knitter with merchant hosiers, bringing factory spun cotton thread, worsted yarns, or thrown silk to rural workers and collecting their machine-wrought knit goods. Workshops clustered multiple frames under a single roof, but this centralization provided little control over irregular hours and casual work habits inherited from the older cottage industry. Boys or girls called "winders" wound thread onto bobbins and put them on the frames. Knitters included men, women, and youths put to the trade as soon as their feet could work the treadles. But female 'seamers,' who joined the loops of the shaped flat knitwork along the back of 'full-fashioned' stockings, remained a domestic occupation. One seamer might keep pace with a single framework knitter, who traditionally paid the winder and seamer. Knitters earned piecework rates calculated by the dozen garments (after deducting rent for use of the frame and other labor) and were sometimes paid in "truck" -- shop credit toward a limited range of poor quality goods owned by the master or a relative.[5]

The introduction of heavier wide frames into knitting workshops during the second quarter of the nineteenth century affected this whole structure. Wide frames made multiple lengths of straight, rather than shaped, stocking fabric. While wide frame stocking legs could be transfered to narrow frames to add feet and tops, most of its product was cut with scissors, stitched by sewing (rather than flat seaming), and stretched on stocking boards to create the leg and foot shapes. Because knit edges unravel when cut, garments made by cutting and sewing were commonly derided as low quality "cut-ups." Moreover, the wide frame's size meant it was generally worked by men and fostered gender specific work roles. One historian finds that by mid-century in Leicester's urban shops virtually all women had left higher paid framework knitting for lower paid seaming. In the country full fashion hose continued to be machine wrought by both men and women on narrow handframes,

but they worked at reduced wages parallel to the lower cost of the mass-produced unfashioned stockings. [6]

In 1844 three East Midlands counties contained 43,140 out of all 47,582 British handframes of every size (of which 5,830 then stood idle). While these areas never knit just one type of goods, Nottingham was especially known for its lace and knit cottons, Leicester specialized in woolens and worsteds and the silk trade was concentrated in Derby. Parliamentary hearings generated widespread discussion of "gathering the hand-machines into factories" in the 1840s, but with an abundance of poor workers, hosiers and other frame-owners had little incentive to abandon this cheap efficient system for more heavily capitalized steam-powered factories. While the technology was available on both sides of the Atlantic, as we shall see, Nottingham's powered knitting factory was not built until 1851. [7]

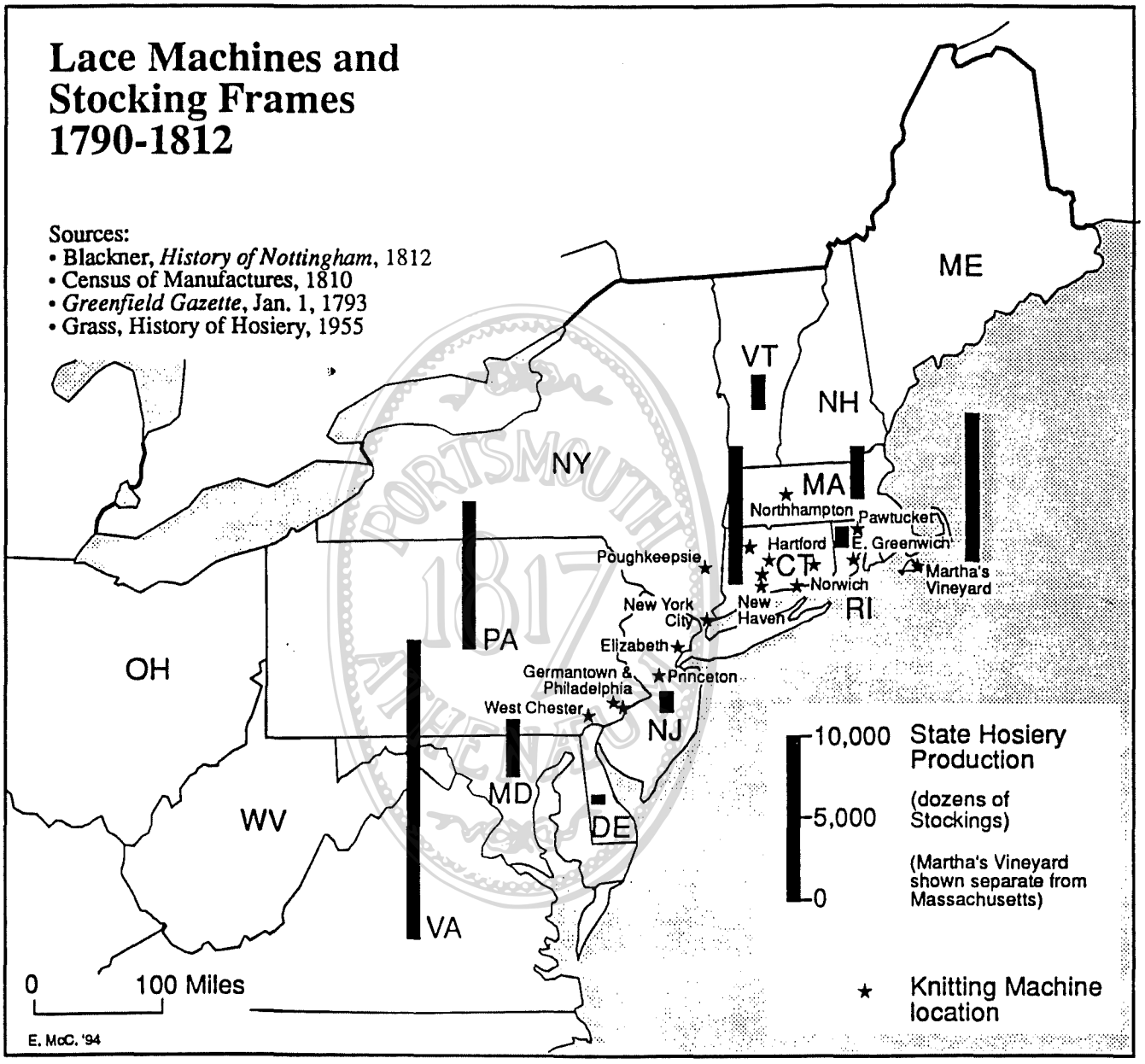
Knitting produced looped fabrics in the form of finished garments (primarily stockings) rather than lengths of cloth woven in America's more familiar waterpowered textile mills. Americans generally called framework knitters 'stocking-weavers' and the mechanical handframes 'looms' by analogy with the better-known textile process. Eighteenth century hosiery production in Germantown, Pennsylvania, and other towns near Philadelphia resulted from early settlement by artisans from central Europe where framework knitting had been known from the seventeenth century. Despite available improvements to the old stocking loom, like ribbed knitting using Dawson's wheel, by 1813 the industry there here had declined and, as it did "not appear to have been attempted on a large scale" elsewhere, Tench Coxe observed, it was "probable that about two-thirds of the clothing, including hosiery, ... worn and used by the inhabitants of the United States, who do not reside in cities, is the product of family manufactures." While this region continued to dominate American manufacture of machine-wrought stockings, a scattering of imported and locally-made handframes could also be found

along the eastern seaboard. [Fig. 2] In New England handframes built for merchant Christopher Leffingwell of Norwich, Connecticut, could be found in towns along the Connecticut River in the 1790s. By 1793 Samuel Slater's waterpowered spinning mill at Pawtucket, Rhode Island, contained three stocking frames, as Philadelphia entrepreneurs projected an even larger proto-factory of handframes supplied with thread by waterpowered spinning. [8]

The first American to transform the mechanical operation of the stocking frame to rotary power, a prerequisite for factory use of water or steam power, was John Bazin Jr. (1792-1860). The son of an Huguenot emigre´ from St. Helier on the Isle of Jersey, Bazin was as a machinist at Canton, Massachusetts. His hand-cranked 'stocking loom' patented October 28, 1814 preceeded by almost two decades all other known American attempts. This near-forgotten invention was used in a lace and handshop at Ipswich, Massachusetts, in the 1820s where it was seen in 1830 by an anonymous English visitor after the company failed. To a friend at home he wrote,

> these two frames you would think a great curiosity; they are composed principally of wheels and pinions, and have hooks instead of needles, and on the rotary principle, and are calculated to do an immense deal of work in a very short time, but they will only make straight pairs, and they will work up cotton or worsted as fast as a boy will wind it. They are of yankee invention, about 12 inches wide; I have seen one of them, but they are standing still.

One investor in this handcranked stocking factory written in 1834 described the inventor's aspirations: "In June last I was was reminded of the existance of your old friend Bazen (of whom I had lost sight for a year or two past)" when Bazin sued for $3000 over breaking his contract, "whereby he was deprived of the ability to perfect his stocking machine & to travel with it in Europe a year or two at our expense." [9] While the firm's failure destroyed Bazin's hope of selling his invention to British amanufacturers, many nineteenth century American knitting machine inventors shared his dream to not only patent their inventions in Europe.



The Language of Powered Knitting Machinery

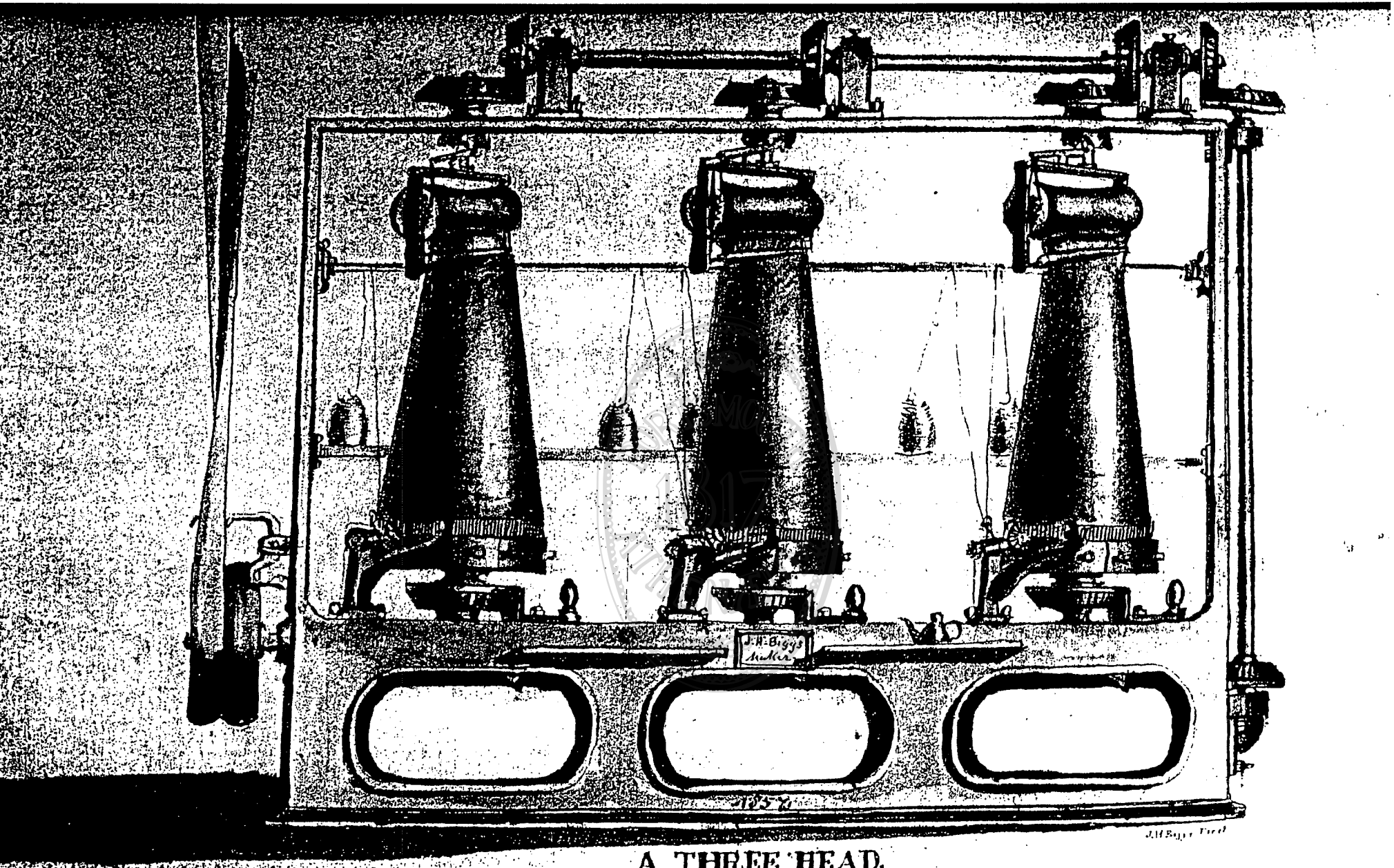
In the English speaking world, the first attempts to mechanize knitting for factory production began with the existing paradigm of machine wrought hosiery which skilled immigrant knitters understood. Bazin's hand-cranked rotary machine (in the sense that the its power source provided a rotray motion) tried to replicate the action and the flat product of traditional framework knitting. As early as 1769 inventors had linked handframe technology to rotary power and in Germany, at least, this became common in the 1830s. "Rotary frames" manipulated their straight row(s) of bearded needles to knit a flat fabric. The earliest of these machines could only knit plain (purl), and much effort was expended to find how to replicate the handframe's ribbing mechanism. Nor did the first rotaries fashion stocking fabric to the desired shape, so its straight flat fabric was cut and sewn into stockings. The first English rotary narrowing mechanism was patented in 1838 but was not perfected until 1857; the most successful full-fashion rotary was Cotton's Patent of the 1860s. Conversion of framework technology to waterpower was first acheived in 1831 by Timothy Bailey at Cohoes, New York, but his horizontal rotary system 'jack and sinker' machine was never patented and remained a shop secret. [10]

Warp 'looms' (combining features of handframes and weaving) allowed a pattern of stripes to be knit lengthwise rather than crosswise as did framework knitting's horizontal rows. Unlike the weft knitting of the stocking frame, in warp looms each needle had its own thread. Its origins are variously credited to British and continental late eighteenth century invention; in 1804 a hand-powered warp stocking frame was manufactured in Germany by Reichel. Warp knitting, too, came to be automated for rotary power by the mid-1850s. [11]

One alternative to these machine systems was an "endless chain" of hooked needles. The first successful British mechanized knitting machine powered by

steam adopted this system in 1834. The noted British mechanician and engineer, Joseph Whitworth, of Manchester patented with a John Wilde (said to be an American) in 1835 an 'endless chain' of hooks said to make "ten or twelve hose at once . . . stitch by stitch one loop at a time in each stocking, making 400 loops of 18-guage to 24-guage per minute, per stocking." By 1845, however, only six Whitworth and Wilde powered frames were actually working in England, "the cost being so much higher than that of ordinary frame-knitted hose." This mechanical system was more common in American mills during the 1840s and 1850s if we may judge from the number of patented improvements to what was known here as 'French rotary knitting' after American inventor Arasmus French. [12]

When circular knitting machines (or "round frames") of late eighteenth century French invention were first seen in England they were studiously ignored by framework knitters. Only in the late 1840s, when their role in the success of the Saxon industry was recognized, did a 'craze' for circular knitting hit the East Midlands. After seeing one with a typically French configuration of horizontal needles set radially toward an open center in 1845, Nottingham machine maker Moses Mellor built a circular needle cylinder or 'head' with spring bearded needles set in a vertical position. His needle cylinder revolved around a stationary cam and, over the century, all circular heads of this type are called "English," as opposed to the American preference for stationary needle cylinders with moving cams. Factory machines with multiple large heads [Fig. 3] knit wide tubes of cloth for underwear ('drawers' and 'shirts'), smaller ones produced goods for 'seamless' stockings. Circular knitting was further enhanced as 'self-acting' latch needles (also of French extraction) were patented on both sides of the Atlantic in the late 1840s and replaced the old spring bearded needle. [Fig. 4] By 1870 latch needle circulars were, perhaps, the most common knitting machines in American factories. [13]



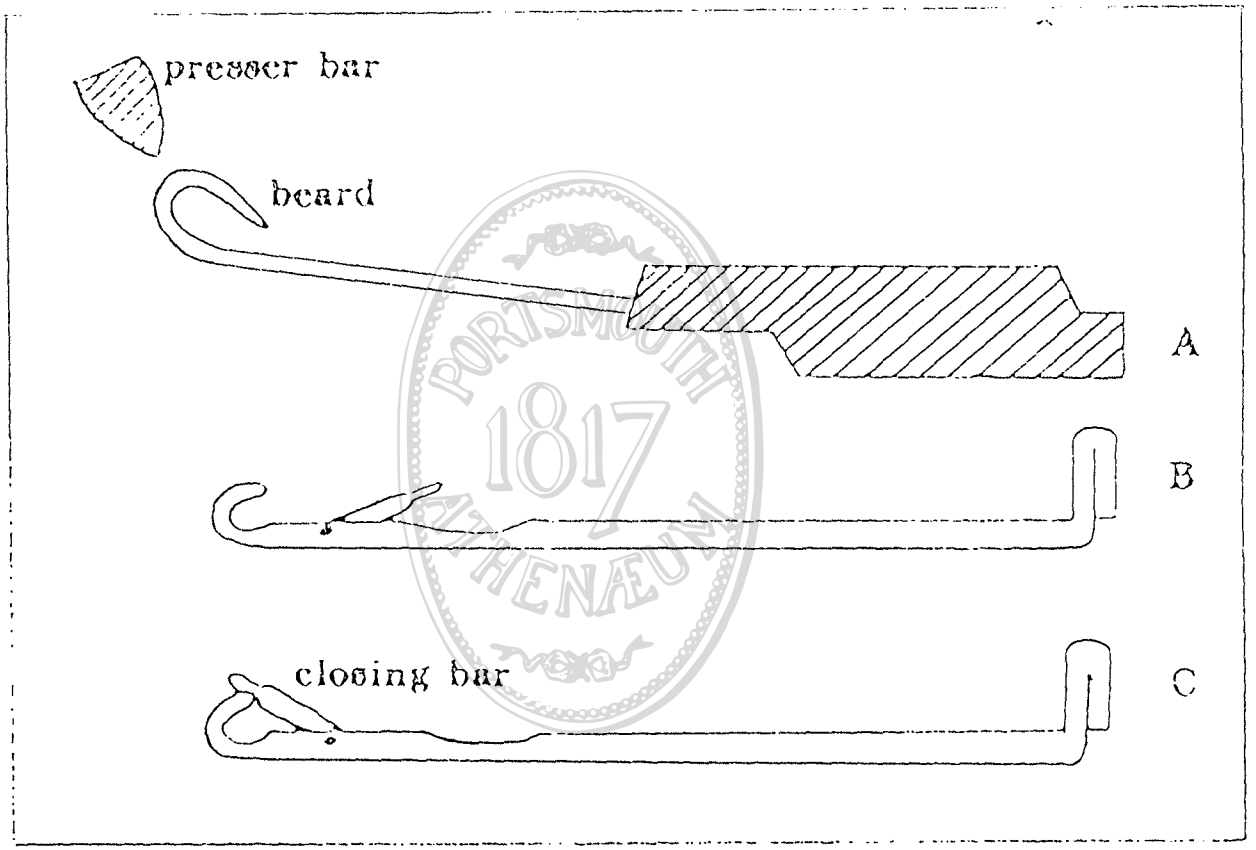
A. THREE HEAD.

POWER CIRCULAR ROUND-FRAME FOR WOOLEN MATERIAL.
FLITED.
WITH SELF ACTING WINDING APPARATUS.

Powered factory knitting in America

Adapting the old stocking frame to power by the 1840s, by the end of the century American factories produced more machine-made knit goods "than all other countries combined." [14] In this technological transformation Portsmouth, New Hampshire, became one of three major centers of American knitting. By 1850 it had more than 100 handframes, the greatest concentration north of Philadelphia, while its early use of powered machinery rivaled Cohoes, New York, in factory knittting. At Cohoes merchant capitalist Egbert Egberts (1791-1869) established the first water-powered factory in 1832, allowing inventor Timothy Bailey to improve his unpatented horizontal rotary frame. In 1843, after protective tariffs allowed them to compete with English imports, Egberts and Bailey built a larger brick mill, and the next year Joshua Bailey, the inventor's brother, joined Egberts in forming the Cohoes Knitting Factory. In 1850 that company dissolved into Joshua Bailey's Troy Manufacturing Company and the Watervliet Mill owned by Egberts' nephew, Charles H. Adams. Timothy Bailey's "Cohoes Machine" was run as a factory secret and had little influence; in 1854 it was widely replaced by English circular machines. Just a handful of English framework knitters came to Cohoes and nearby Troy, and only one continued handwork beyond the 1850s. American machinists, however, were attracted to the industrial district in numbers and in 1848 *Scientific American* noted knitting was "done extensively by machinery at Cohoes, a thriving manufacturing village on the lower falls of the Mohawk, near Troy, N.Y." In 1860 eight firms for knit underwear were located at Cohoes and five more in Troy. [16]

Philip Scranton has demonstrated a very different pattern in Germantown, Pennsylvania. Over the 1830s an influx of skilled English framework knitters revived its flagging woolen stocking industry by establishing many small family-owned handframe shops, some of which continued into the next generation. By the 1840s one hosier had introduced steam powered rotary frames to manufacture



A bearded needle (A) with the pointed end bent into a loop which can be closed by means of the presser bar. On the latch needle (B and C) the hinged pin closes the loop when it is pushed across by the yarn travelling up the stem of the needle.

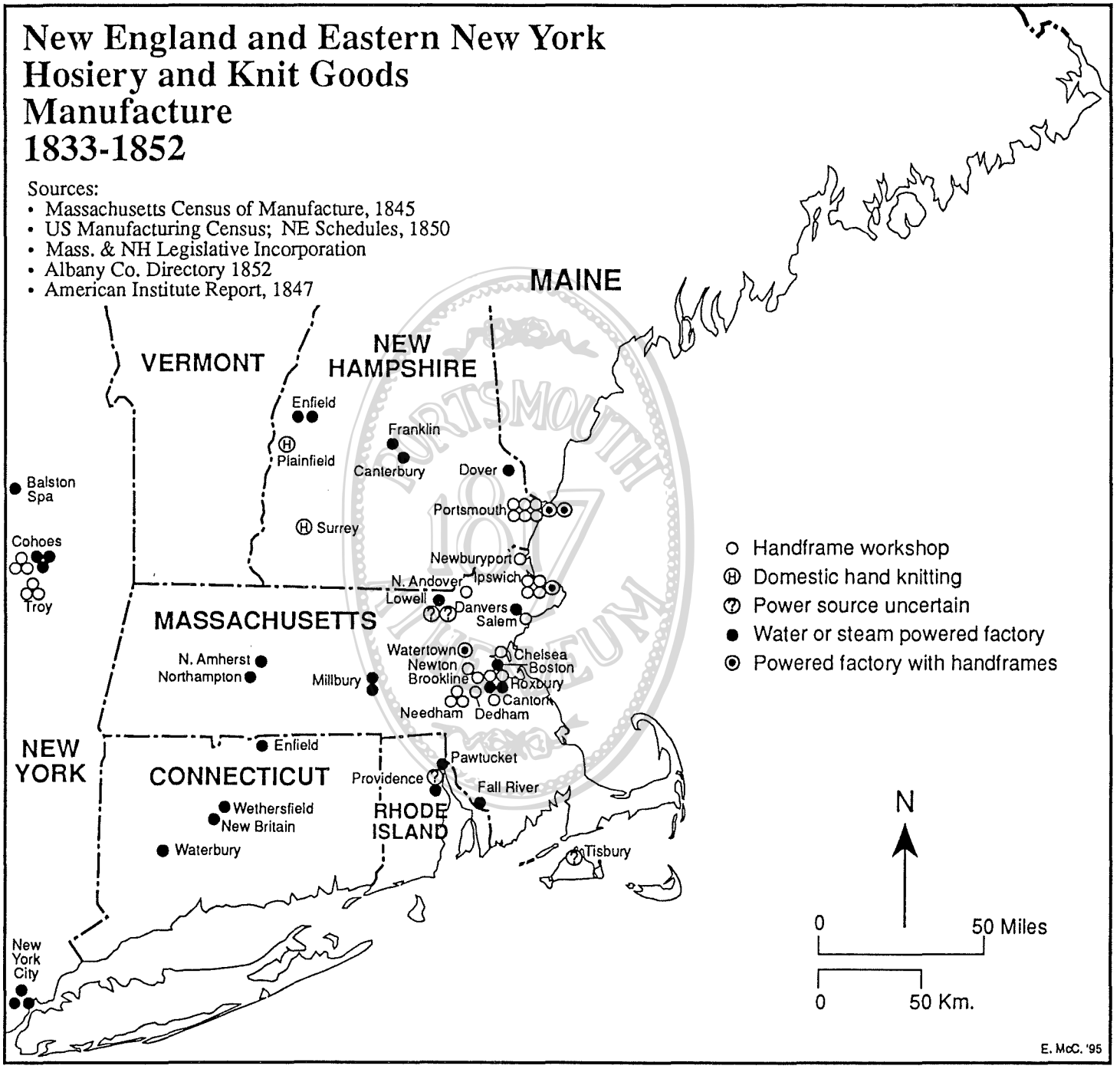
children's hose. In 1850 there were two large hosiery factories and seventeen smaller hosiers employing male framework knitters in traditional handframe shops. According to one American observer, half these workers had "no practical concern with the ten- hour" or factory system, but "work at such hours as they choose in their own homes." This estimate probably includes the extensive outwork system of women who knit, seamed and finished flatwork into stockings. A decade later the number of handshops swelled to forty, of which thirty five were new. Scranton credits this to the expansion of rail distribution, a growing local market, the protection of the wool tariff, and increased migration of "Nottingham and Leicestershire men." Those who succeeded in this Philadelphia system were all English-born artisans who followed a path "from shop rental to mill ownership" and, unlike their counterparts in the old country, gradually adopted mechanized steampower manufacture. But their attitude toward powered machinery contrasted with those who built the exclusively powered Cohoes factories:

> Early powered knitters were not only expensive, newfangled, and of uncertain capacity and reliability; they were linked with the degredation of the craft and thus involved a morally equivocal decision. Consequently, there were no sudden plantations of giant hosiery mills at Germantown, no mergers of shopmen to venture ahead on the path of industrial progress. [17]

English-born hosiers working in New England may have shared the same feelings, but the structure of the knitting industry was different. The anonymous 1830 Nottingham observer who described Bazin's machine was surprised at the insignificance of a New England stocking trade designed "just to supply their immediate neighbors." [19] As better distribution networks to Boston and New York became established English artisans established handshops, but the first integrated powered factories were almost exclusively capitalized by American merchant investors or managed by Yankee entrepreneurs. The manufacturing census of 1850 reported 85 hosiery firms in the United States; 59 in Pennsylvania, seven in New

New England and Eastern New York Hosiery and Knit Goods Manufacture 1833-1852

Sources:
- Massachusetts Census of Manufacture, 1845
- US Manufacturing Census; NE Schedules, 1850
- Mass. & NH Legislative Incorporation
- Albany Co. Directory 1852
- American Institute Report, 1847



York, New Jersey, and Maryland combined and 13 scattered across New England. By 1860 factory knitting generated a seven-fold increase in the value of knit-goods from 197 American manufacturers, almost a quarter (47) in New England. These statistics are low [see Chart 1]; many small handshops were missed and some woolen textile mills also engaged in powered knitting were not counted as hosiery factories.[18]

CHART 1: New England Hosiery Manufacturers 1850-1870

	1850	1860	1870
CONNECTICUT	1	18	16
MASSACHUSETTS	[14]	[24]	32
NEW HAMPSHIRE	5	[23]	24
RHODE ISLAND	[1]*	[2]	3
VERMONT	0	[4]	7
MAINE	0	0	0
	21	71	82

* numbers in [brackets] correct smaller US Manufacturing Census statistics based on J.B. Aiken sales records, population censuses, newspapers, local histories and business directories.

New England's nineteenth century knitting industry, then, was neither so completely factory-based and native-born as Cohoes nor as concentrated in English handshops as in Philadelphia. Using old and new technologies, it partook of both systems of production, scattering small American owned factories along its rivers and concentrating English handshops in or near urban centers. [Fig. 5] By the Civil War, moreover, some of the Boston Associate corporations began to integrate hosiery machinery into their large factories. Such corporate knitting mills often contracted with artisanal handshops or had extensive female outwork networks to finish their factory goods. How this distinctive structure of the New England knitting industry evolved can be explored by examining its development in Portsmouth and, especially, the impact its mechanics made on the introduction of powered knitting.

Anglo-American Handshops, 1830 - 1835

The only large New England handshop in 1830 was the Newburyport Hosiery Company, incorporated in 1825 and reorganized in 1829. It purchased English or American factory-made cotton thread and woolen yarns, as the coastal town had no steam spinning mill. Twenty imported handframes operated under the supervision of a few Nottingham framesmiths. The local owners hired only American women to work eighteen narrow frames, "for women can work cheaper than men"; only two wide frames required the strength and skill of male framework knitters. When the company closed its doors, in April 1834 it auctioned off thirty-five frames, a warp loom and suspender frame. [20]

Portsmouth's first handshop was the Portsmouth Hosiery Manufactory begun on May 20, 1832 by one Robert Johnson. Two weeks later Johnson (presumably an English immigrant) mortgaged "Three Iron Stocking Looms & frames . . . now at the Brick building owned by Langley Boardman on Court Street." Within a year the shop had relocated and advertised "Cotton Hosiery, either at wholesale or retail, . . . at the Portsmouth Stocking Factory, 10 State Street." That fall Johnson claimed "demand for his work is now greater than his ability to supply, although he has eleven frames in constant operation, which turn out 1200 pairs per month." The cotton, woolen and worsted hosiery knit here was "all made of double and twisted Yarn, and decidedly superior to the imported, and at low prices." Men's and ladies hose came in dark slate and 'Angola' wool, as well as 3-thread white cotton. Woolen ribbed 'half hose' (socks) for men and small "Misses and Children's HOSE of various colours" were also advertised. [21]

By 1834 Robert Johnson, like his counterparts in Germantown, had recreated a typical English workshop with "about 50 hands" making 150 dozen hose a month (or 21,600 stockings a year). Local women working part-time at home as seamers probably constitued the largest part of his 50 workers. Of Johnsons known English

male 'weavers' in 1834, at least three came from a failed lace and handshop in Ipswich, Massachusetts. Francis C. Jarvis, from Leicester by way of Ipswich, worked in Johnson's shop from the start; George Gadd and his son Thomas, immigrants from Nottinghamshire to Ipswich in 1827, followed in August 1832. Charles Glazebrook, also from Nottinghamshire, came to Portsmouth a year later. Besides three other English weavers, at least one American fourteen-year-old, Charles H. Gould, apprenticed here as a 'stocking weaver' in 1834. Together they account for most of Johnson's eleven frames. While most of these men remained, Johnson himself disappeared from Portsmouth by 1835.[22]

Portsmouth's Proto-Factory, 1835-44

A waterpowered carding and spinning mill with a large framework knitting workshop -- a first step toward integrated factory production -- replaced Robert Johnson's handshop in 1835. Portsmouth entrepreneurs converted a disused bleachery at the head of Islington Creek, the western margin of the urban center, to manufacture knitting yarns. While 'proto-factories' of mixed hand and powered technologies had long been envisioned, only a few experiments using a few frames in spinning mills as at Slater's in Pawtucket, Rhode Island, had actually occured.

The new factory combined skilled English frameworkers under American management. The carding and spinning mill operatives were from the local area and factory agent Hosea Crane (1802-1879), a Connecticut born textile worker, came from the nearby Great Falls Manufacturing Corporation's woolen mill. Nearly all the English knitters at Johnson's shop soon worked in this Portsmouth factory, but its woolen yarn was also distributed as far away as Ipswich domestic handshops to be machine-knit into stockings. Formed so soon after the failure of the Ipswich lace industry and Newburyport's stocking manufactory, Portsmouth continued to attract displaced English frameworkers from those communities. Both Daniel Pepper, a

Nottingham lacemaker who brought his 21-inch stocking frame to Newburyport in 1830, his two sons, and James A. Gadd were here by 1835; whole families of skilled workers came directly from the East Midlands over the next decade. [23]

In August 1837 the Portsmouth "Stocking and Yarn Factory" burned, a loss especially distressing for being "the only manufactory of hosiery upon a large scale in the country," that had "promised to open to the community a new source of industry and income."

> More than one hundred individuals are thrown out of employ by this calamity. The building was devoted to the manufacture of woolen hosiery of all descriptions; turning out 150 dozen pairs of hosiery, many of them of the most beautiful textures and dyes.

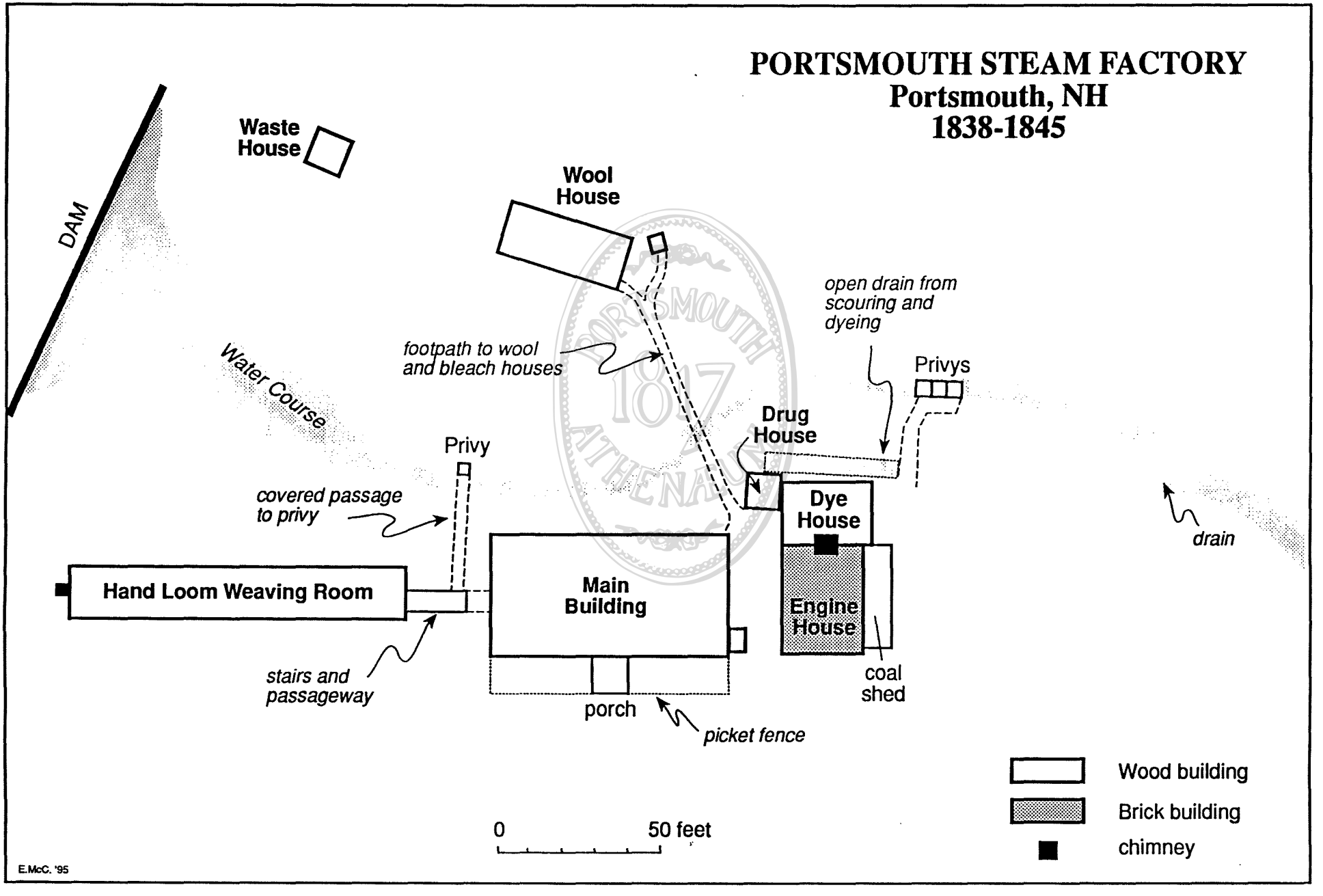
As industry lobbyist John L. Hayes later recalled, "factory operations at Portsmouth were confined to spinning the yarn, which was woven in the mill upon knitting frames, operated by the workmen, without power." While it used waterpower and a steam engine to run its carding and spinning equipment, insurance inventories after the fire confirm "51 Loom Carcasses" of the handframes. [24] Whether this number included Johnson's eleven frames and thirty-five others from the 1834 Newburyport auction cannot be determined, but the timing of the factory's formation after both earlier efforts failed is suggestive.

The mill was immediately rebuilt by local merchant-capitalists. An 1839 map shows the new Portsmouth Steam Factory complex with a long, narrow, one-story weave shed for the 51 handframes, a waterpowered factory building for carding and spinning, a brick steam engine house, an adjoining dye shop, and two small store houses. [Fig. 6] The new hosiery factory was expected "to do the business on a more extensive scale than elsewhere in New England," turning out "1200 pairs of woolen hose each week -- of the first quality." Even before the rebuilding was completed it gave employment "to about 70 hands, and will another year probably employ 200." While the 1839 *Portsmouth Directory* identifies fewer than a dozen 'hosiery

weavers' here -- all of them English born -- the company also hired many unlisted boys, girls, and women. Employment then totalled 220 hands "in and out of the factory" with American-born male workers running the steam engine, the power spinning and dyeing, and working as machinists, bookkeeper, or factory agent. In 1844 local minister Andrew Preston Peabody also noted, 'The stocking factory forms an exception" to the city's failure to provide female employment, for it hired "entirely or in part no less than 150" females. That year, spurred by protective tariffs, a second Portsmouth knitting proto-factory located along the Bow Street waterfront provided work to "50 men and boys and 30 girls" as well as domestic outworkers. [25]

So fine were the city's frame-knit goods, especially women's ribbed stockings, that 'Portsmouth hose' came to designate all high quality woolen stockings wherever they were made in America. [Fig. 7] The factory spun 100 pounds of wool yarn each day from which 3000 pairs of woolen hose were knit each week. Hand-frame operators were paid $1.20 for a dozen stocking legs while female outworkers earned 75 cents a dozen to seam and finish the foot. For ribbed shirts, the company paid $4.00 a dozen for the bodies, and $1.25 for the sleeves. (By contrast, after the Civil War boom in factory-knit goods, the cost of manufacturing stockings fell to 2 cents a dozen; drawers and shirts to about 12 cents a dozen.) As late as 1850 the Portsmouth company ran the only sett of woolen machinery for women's ribbed hosiery in New England. Yet, the 3,000 dozen expensive ribbed hose produced here each year "was considered so enormous, that the managers of the mill doubted if a demand could be sustained." [26]

Charles Warren, a Boston commission merchant, sold much of the mill's products. In September 1839 he exhibited at the Boston Mechanics Fair white, mixed, and colored woollen 2 & 3 ply yarns as well as some first rate woolen hosiery of "Highland Plaid. . . equal to any imported." Warren became so identified with the



Portsmouth factory that the sign of his Boston store was a "stocking about eight feet in length, well proportioned for a Brobdinag giant of thirty feet in height."

> The ornaments were woven entire, with the exception of a name, which was wrought afterwards. Near the top is an American flag, with its stripes and stars; lower down is a representation of a Scotch plaid shawl; below it the shape of a stocking the usual size -- and the foot and ancle [*sic*] of the great affair are woven in stripes. The whole is a grand display of workmanship. [27]

Walker and McIntire Patented Rotary Frames 1839 - 45

New England's machine shops and iron foundries provided the technical training ground for the young mechanics who would mechanize New England's knitting industry. Here Portsmouth's American mechanics interacted with skilled English framework knitters to equal and surpass the simultaneous mechanical advances at Cohoes. John Hayes later recalled that while the Portsmouth Hosiery Company used handframes exclusively in its proto-factory until 1844,

> important improvements were yearly made in [hosiery] manufacture at Portsmouth; such as adapting the frames for working ribbed goods, and in applying power with success. Portions of the frames, consisting of the inside work, were imported from England; certain parts were dispensed with; and simpler and more efficient machines were constructed, adapted to power. [28]

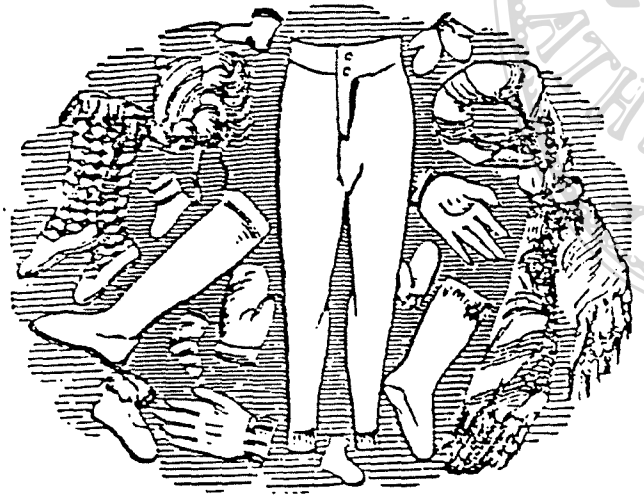
The earliest of these was Richard Walker's 1839 rotary powered knitting machine designed for either domestic hand use or factory power. [Fig. 9] Walker was an American mechanic who over the 1830s and 1840s patented several different inventions. But he was not, as others have asserted, an owner of the Portsmouth hosiery factory. Indeed, there were no powered frames in either knitting mill until the mid 1840s nor a patent assignment from Walker to the company. [29]

In 1834 Richard Walker was simply a pattern-maker in a new foundry located along the Bow Street riverfront. Established as the Portsmouth Iron Company in 1832 on a wharf along the Piscataqua River, its structure was an old sugar refinery since converted to various unsuccessful industrial uses. [see Fig. 20] By August 1832

PORTSMOUTH HOSIERY.

THOMAS WARDWELL,

MANUFACTURER OF



RIBBED HOSIERY,

SHIRTS,

Drawers & Gloves,

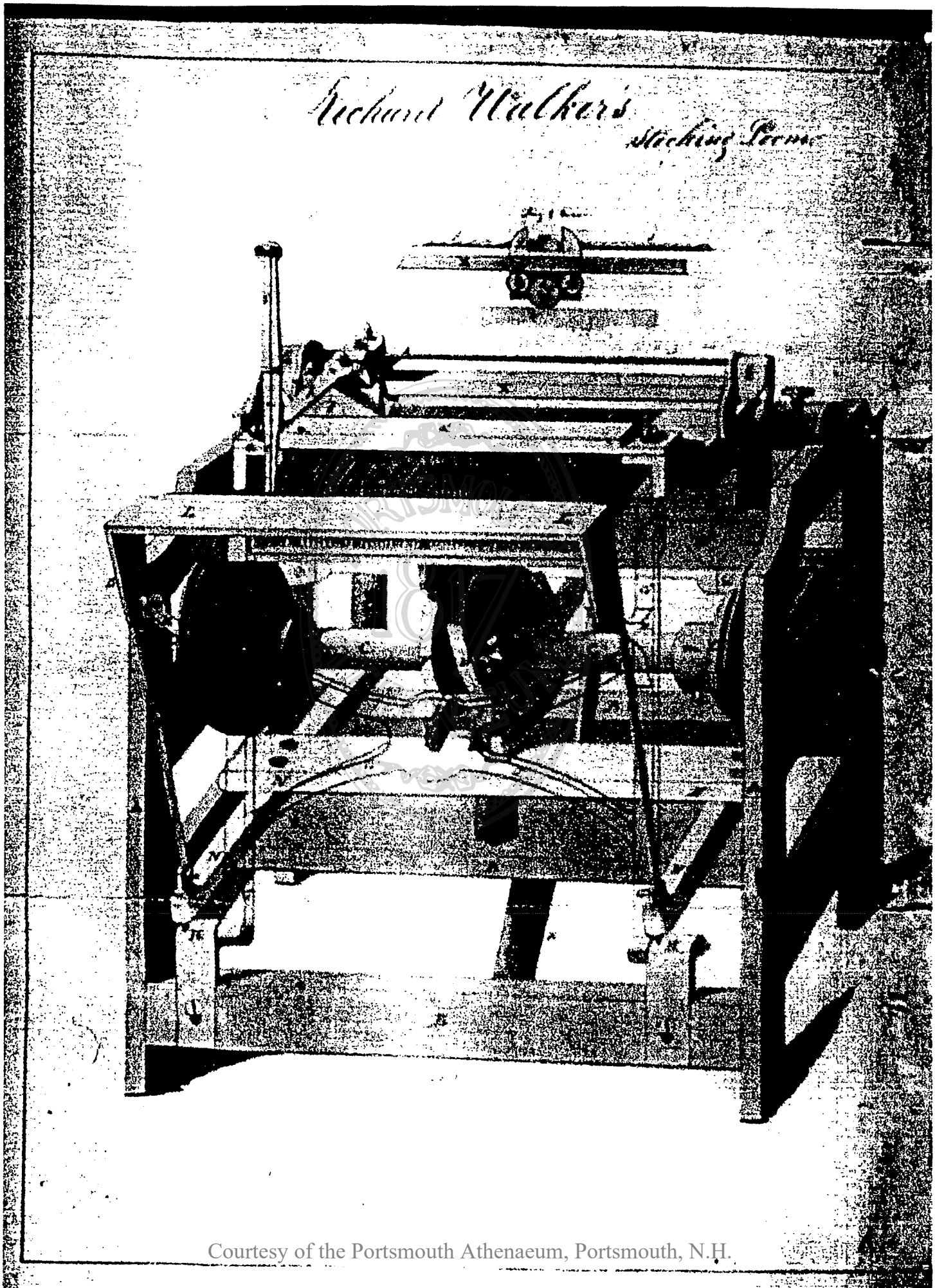
70½ Islington St., Portsmouth, N. H.

Ladies' and Gents' Woollen and Merino Underclothes made to order.

they "erected a spacious brick building" in which "a steam-engine of four-horse power for blowing the bellows" allowed them to cast two tons of iron a day. Incorportated in January 1833, the firm lasted only a year and a half; in 1836 Richard Walker was agent for the firm of Badger & Walker, manufacturers of "Patent Forge Hearths" in the rented "Portsmouth Iron Foundry." That October the foundry was leased "with all its tools and fixtures" to Jefferson McIntire & Company who announced plans to build cotton and woolen factory machinery, railroad cars and steam engines. Jefferson McIntire (1802-1857) was born in York, Maine, and came to Portsmouth by 1835. "Mr. McIntire has been, for a long time, employed as foreman in a Machine Factory, and intends to employ none but first rate workmen." Walker became one of McIntire's workers and his adaption of the stocking frame to power probably occured in this structure. Under American patent law Walker could have designed, built and tested a prototype, like his full scale patent model [Fig. 10], two years before his 1839 patent.[30]

Walker's "Rotary Power Stocking Loom" used a hand crank for "giving a rotary motion to a cam shaft which may be turned by a winch when a single machine is used; or may be operated by means of belts and pulleys or other gearing, when used in factories." As early as February 1839, while his application was being reviewed, he used his machine rights as collateral for a loan he repaid in May. The next month Jefferson McIntire & Company was dissolved and McIntire leased space in the second story of the Franklin Foundry, another iron works along the city's southern waterfront. Here he made "all kinds of MACHINERY for Cotton and Woolen Mills," which for the first time included "Stocking Looms of the latest improvement."[31] In September 1839, Walker's 'loom' won a diploma (a third level prize) at the Boston Mechanic's Exhibition. According to the judges,

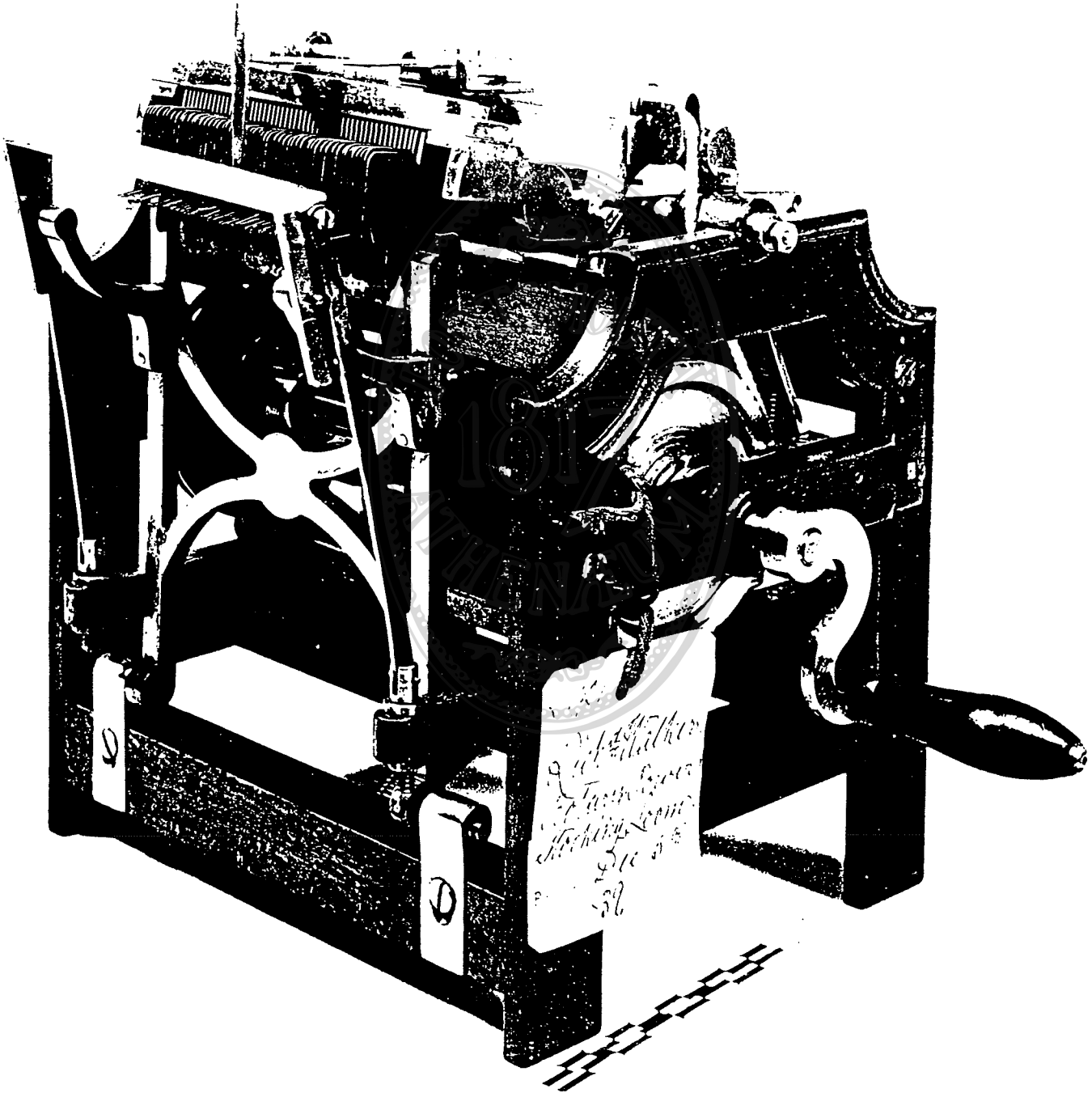
> This is an entirely new invention. No other machine, it is believed, can be found in this country that resembles it. It is extremely compact, occupying a



> cubic space of about eighteen inches. Unfortunately for the inventor he cannot offer any decisive proof concerning its performance for any great length of time. It will however, *knit*, and with extraordinary rapidity too, for a boy can make forty pairs of stockings in a day; or it will knit across the breadth of the web one hundred times in a minute. No interruption takes place unless the yarn is broken by a large knot interfering with the needles. The inventor has displayed great ingenuity in the construction of this useful machine. [32]

By December 1839, when he received his patent, Walker and McIntire had made further improvements. In January 1840 they advertised "a more perfect one completed for operation" which could "cast forty 'turns' or four thousand stitches on a stocking per minute." This, they said, "turns out its work in the same form as the English stocking loom now in use in this country," (that is, a flat fabric). Their new machine was only "twenty inches square in any position" and could "be used as a domestic Machine, operated by the hand, applied to a crank, or in Manufactories operated by a belt and pulley from any other power." Replacing the 'jacks' used in traditional handframes with a carriage and roller provided more equal pressure on "knit hand twisted yarn of any material" using very little power. Simplifying the stocking frame also made it "less expensive in construction and less liable to get out of repair." [33]

Assignment of patents was one way inventors profited from their legally protected claims and the use of Portsmouth's patented knitting machines in other places is one measure of their impact. [Fig.11] This was often done by selling rights for specific geographic areas like counties, states or even foreign countries. Thus Walker formed a partnership by assigning half his patent to McIntire and the two machine builders advertised for "proposals for looms with the rights for States or Counties." Walker and McIntire initially sold half their American rights for $5000; a year later both halves were recombined by Boston merchants Arthur and William Pitt Eastman, who paid the mechanics $20,000 for their remaining interest. Over the next two years the Eastmans sold a half the patent to one investor and assigned to



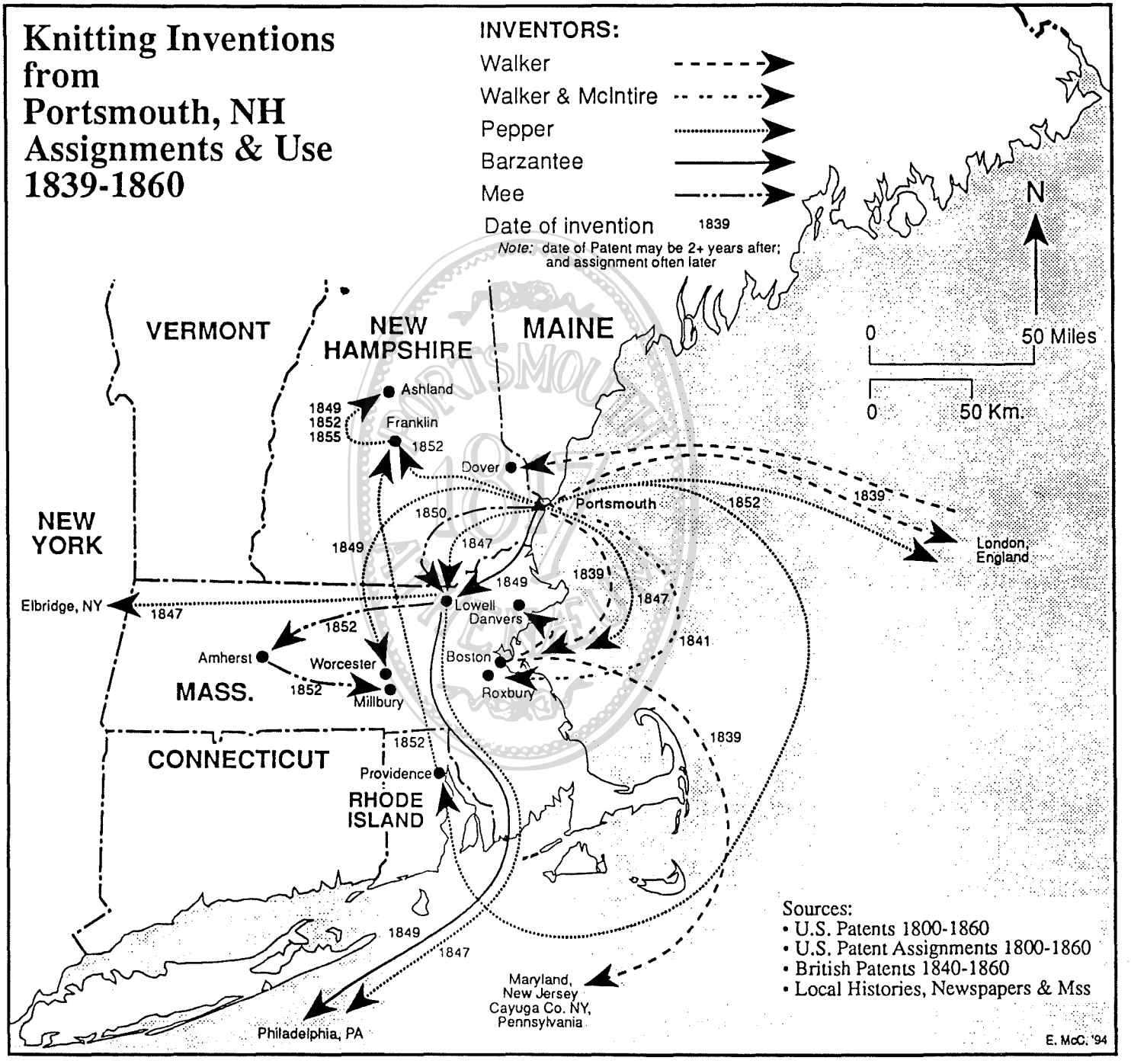
others exclusive use in Pennsylvania, Maryland, and Cayuga County, New York. In 1842, however, these limited assignees sold back their rights for "running said Looms now made or in progress of being made within said States," to Arthur Eastman who resold them to the American Hosiery Company of Watertown, Massachusetts. This company never operated, but profited from several Boston and Cambridge investors who bought the patent in 1844. They formed the Essex Hosiery Company, sold the patent to their company for $24,000, and put Walker's machines into a woolen stocking mill at Danvers, Massachusetts. [34]

Some speculation in Walker's patent stemmed from the September 1841 Boston Mechanics Exhibition where he and McIntire won a gold medal for their improved stocking loom:

> It was in operation during the whole time of the Exhibition, and the work was extremely well done. The proprietors assure the public that it will knit 40 pairs of coarse socks a day... or 12 pairs of drawers ... of the finest and nicest goods.
>
> The advantages of this loom over the best looms in use, are that one loom will "turn out" three times the work of any other. One girl can tend two to four looms, thus performing work equal to nine persons with the hand looms ... One set of needles will last six times as long. The machinery does not get out of order so often, and will wear much longer than that of any other loom. [35]

If a single girl could tend multiple looms, this machine was clearly designed for factory use. That this machine already had many improvements to the original patent (as advertised in 1840) can be demonstrated in a very odd way.

In August 1840, for $1000 Walker and McIntire sold one rotary machine and assigned all rights in the invention outside the United States to Benjamin Watson of Dover and Elijah Austin of Madbury, New Hampshire. As this seemed risky to these two successful local farmers, the inventors agreed to return their money or grant them half rights in the United States if the assignees could not recoup their capital in Europe. By November, Oliver L. Reynolds of Dover, Watson's 30 year old



son-in-law, was in London patenting the knitting machine as a "communication from a foreigner residing abroad." Living near the London offices of J. Heathcoat & Company, he may have tried to interest that lace manufacturer in his rotary frame. British patent drawings and specifications show his machine was not Walker's first machine but nearly identical to Walker and McIntire's second patent. [Figs. 12 & 13] The 1840 machine Reynolds took to England was already a substantial improvement on the original design well before the two American machinists were granted a second patent in February 1844. [36]

This also precipitated a law suit over who controlled their machinery. Within weeks of the 1844 patent Walker assigned his half to McIntire, who promptly sold it all to Boston commission merchant William G. Lewis for $21,000. In January Lewis recovered his investment by assigning to James A. Dorr of New York City half his interest and "five Knitting Looms now at Roxbury" in Charles Goodyear's India Rubber Factory. By the end of 1845 four investors sold the patent to the newly formed Dorr Manufacturing Company of Roxbury for $100,000. (In this speculative market, spurred on by the new protective tariffs, James Dorr made $21,000 and Lewis a $36,500 profit in one year.) The Essex Hosiery Company immediately sued Dorr Manufacturing for $30,000 as an infringememnt on their first Walker patent. Continued in federal court until October 1848, the case was finally dismissed. [37]

The Enlarged Portsmouth Stocking Factory 1844 - 1849

During the 1840s the scale of hosiery manufacture in Portsmouth was not only greatly enlarged, but ownership iof the factories shifted as power knitting was adopted. Stimulated perhaps by the woolen tariff that also led Massachusetts investors to establish power factories on Walker's patents, as well as by the railroad connecting Boston, Ipswich and Portsmouth by 1840, Hosea Crane purchased the stocking factory from its stockholders while his younger brother Jasper, an overseer

Sheet 1. 3 Sheets.

Walker & Mc Intire.
Knitting Mach.

No 3436. Patented Feb. 12, 1844.

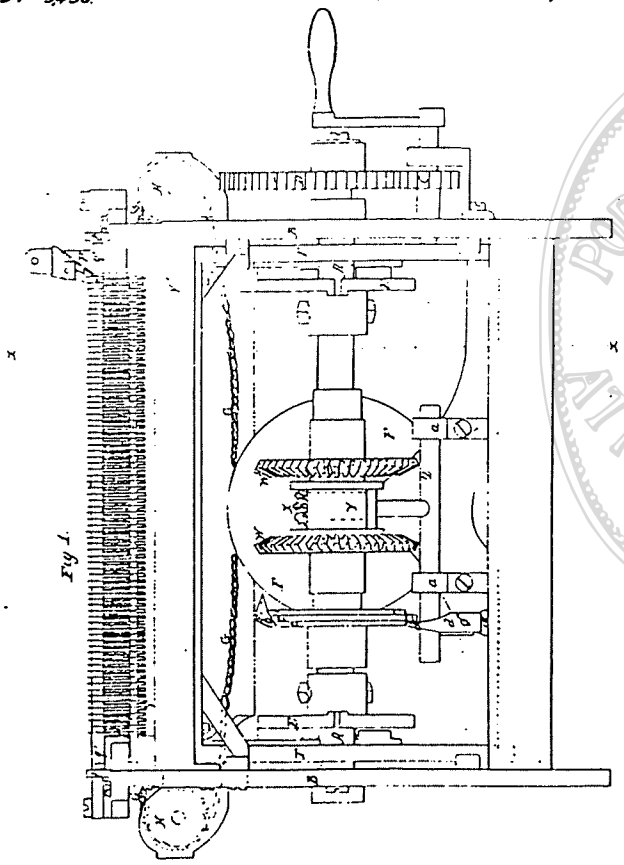


Fig 1.

Sheet 3. 3 Sheets.

Walker & Mc Intire.
Knitting Mach.

No 3436. Patented Feb. 12, 1844.

Fig 3

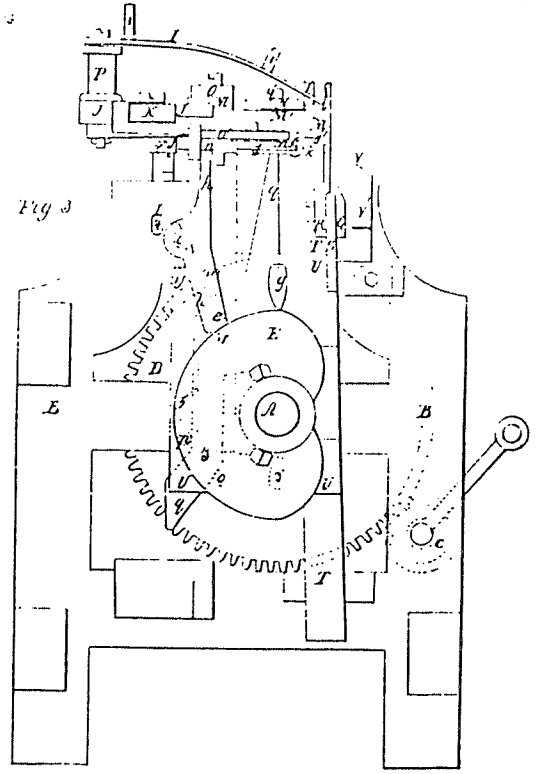


Fig 1.

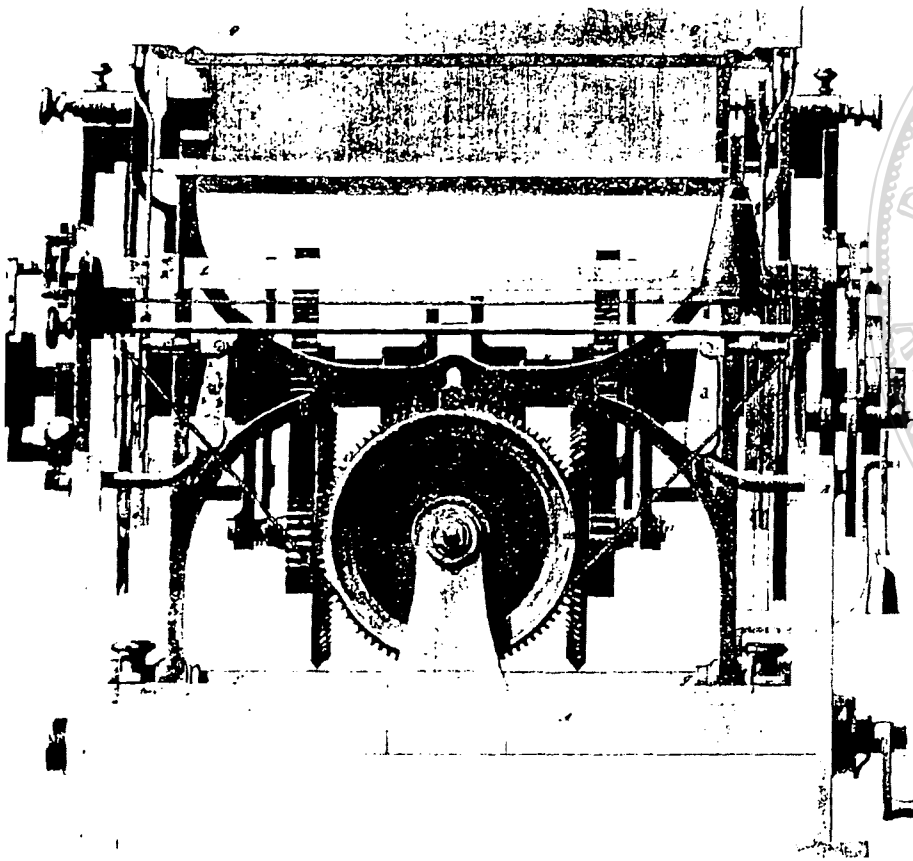
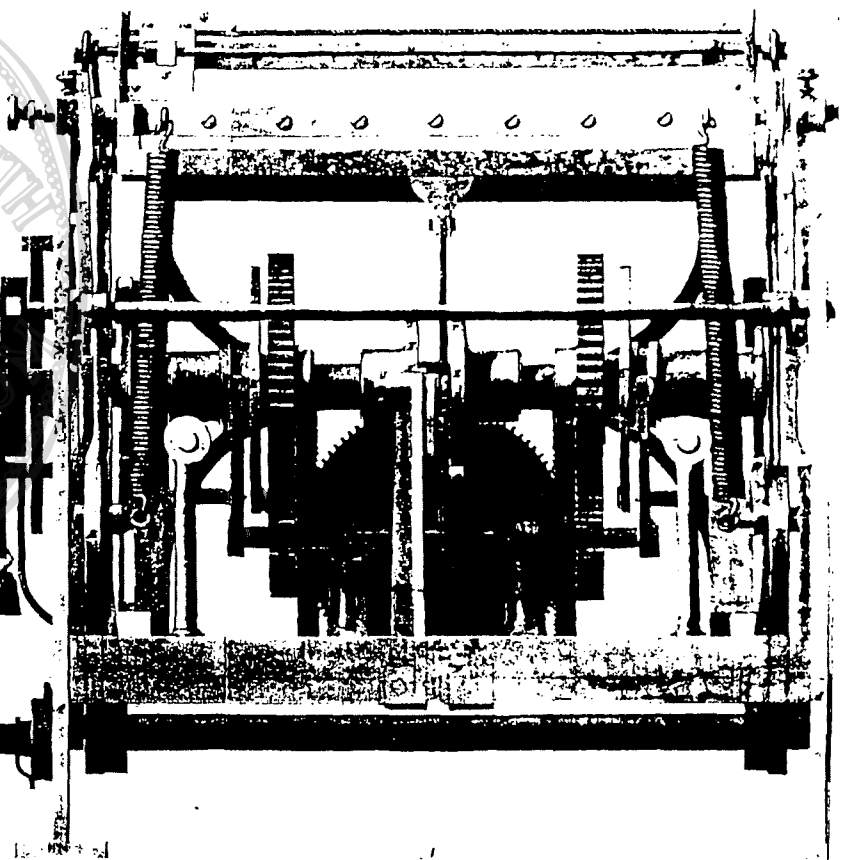


Fig 2.



in the factory, bought the Bow Street foundry in 1844 to outfit it with fifteen handframes and steampowered woolen carding and spinning machines. While they maintained separate ownership, they shared some common management and the pool of skilled native and immigrant workers. [Fig. 14] As the local newspaper later remarked about the building where Walker and McIntire had just finished inventing and building their knitting machines,

> The old Portsmouth Foundry has . . . changed name and occupation... having turned into the Portsmouth Hosiery Mill. The same steam engine below, properly repaired and improved, carries pickers, cards, spinning jacks, looms, cleansing machines, &c. in place of the fan of the old furnace. [38]

Industrial conversion and the introduction of powered kniting into the hosiery factory soon placed the Crane brothers in debt. By the end of the decade they lost their factories in their attempts to finance new power knitting technologies. In 1846 Jasper Crane was forced to mortgage all his property, machines and goods; by 1850 his mill was foreclosed. In June 1847 Hosea Crane's factory was sold to Charles Warren and his partner Horatio G. Sanford to pay its creditors.

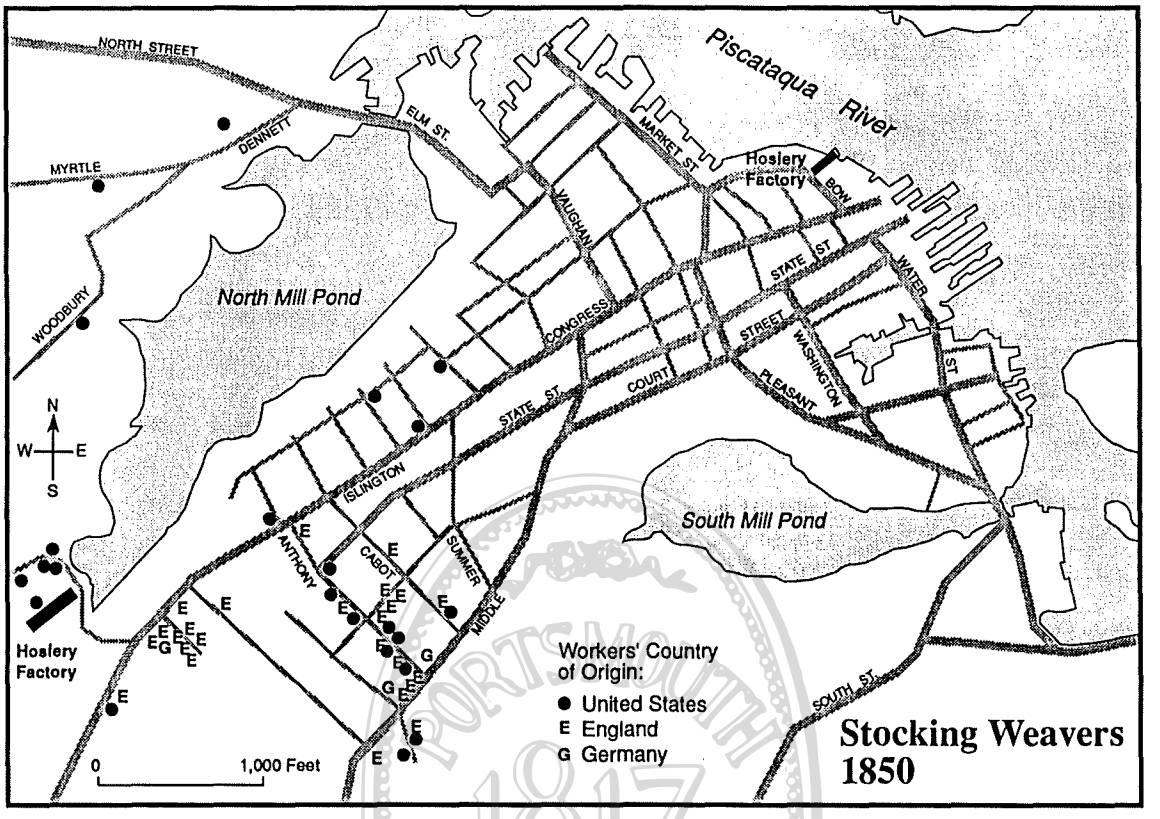
Insurance surveys and related documents describe the older hosiery complex and its 1846-1850 enlargement. A main factory building, handframe "weave room," boiler and dye house were "all of wood & built about 10 years since." [see Fig. 7] In the weave room were 60 stocking frames and one warp frame run by hand, while perhaps in the main factory was a "grocery store" where molasses, tea, sugar and other goods suggest that Crane may have paid in 'truck' or company store credits. [39] Over the next few years the new company built a dry house and press room, relocated the former 'drug room' for reuse as a bleach house, and added to the engine house a new dye house and storage building for the drugs used in bleaching and dying. But the most important of these was a new building erected in 1846 that contained "5 Power looms" valued at $800 the next year. While the company had a machinist only for repairs, they added what was called in 1848 "a Machine Shop for

the Manufacture of Power Looms etc. [that] employs eight hands." [40] [Fig. 15] By then there were seven powered frames and two powered warp frames in the new factory building.

John Hayes later recalled that some "inside work" of knitting machines was imported from England and we know one of the first powered knitting machines in Hosea Crane's factory may have resembled Whitworth and Wilde's 1835 endless chain machine. Charles H. Gould, the American-born stocking weaver who was an overseer at the Portsmouth factory, recalled in 1851: "The making of one stitch at a time by machines is no new thing as I have seen a machine making one stitch at a time at least ten years ago." Over that next decade Anglo-American mechanics in Portsmouth experimented with "simpler and more efficient machines . . . adapted to power." [41]

Portsmouth's most significant mechanical improvements, however, were those made by John Pepper (1824-1876), a son of the displaced English laceworker who came from Nottingham to New England with his narrow frame in 1830. John was 11 years old in 1835 when he first learned framework knitting from his father Daniel. The young inventor later recalled that he had given "much thought when at the looms . . . for several years, in the way of applying other than hand power for knitting." His success in "applying steam and water power to propel common stocking looms" was first reported in August 1847:

> three common looms, with slight variations, are now in successful operation in this town, and operate better than the most sanguine expectations of the inventor had anticipated. . . On Wednesday last, one girl attended the three looms, and spent much of her time in sitting to watch the operation, she presented at night 23 pairs of stockings and 22 pairs of drawers, as the result of her day's work. Twelve pair of stockings is a girl's day's work on the common hand loom. Some idea of the saving by the new invention may be formed from the fact, that the expense of knitting by it on Wednesday was less than a dollar, while the same work performed on hand looms would cost over five dollars. [42]



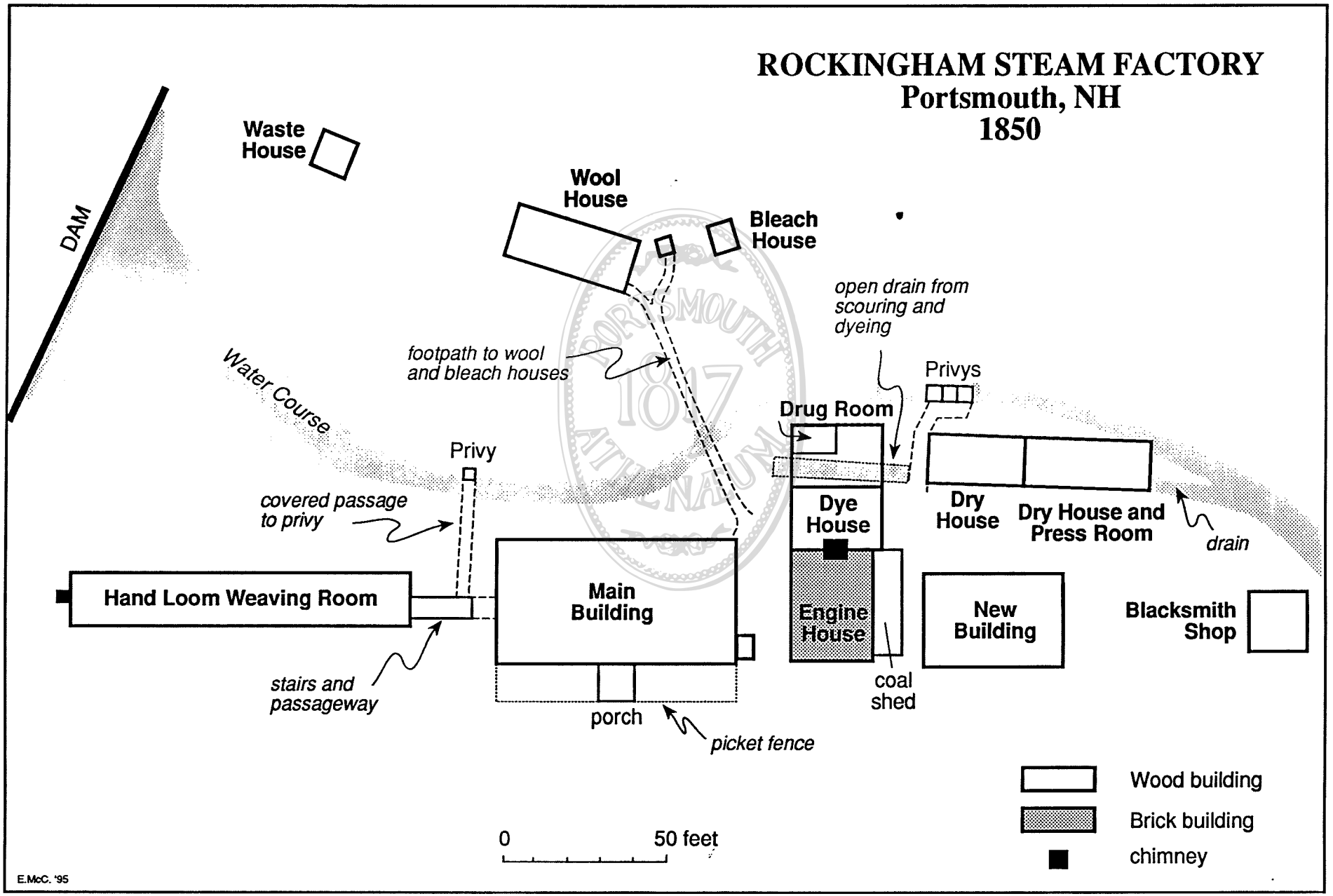
When Warren & Company won a gold medal for their "White, Mixed, and Fancy Colored, Woollen Yarns, Hosiery, Gloves, Shirts and Drawers," at the 1847 Boston Mechanic's Fair, the judges commended "Messrs. Warren, who are making extensive and valuable improvements in this important branch of industry." [43]

Pepper's machine experiments began in Jasper Crane's Bow Street factory, perhaps because of its prior use as a foundry and machine shop. Crane mortgaged his property and borrowed other funds to support Pepper's invention, patent application and model. The machines were then moved to Charles Warren's factory "where in connection with Mr. H. Crane," the newspaper reported, the three men "will go more extensively into the business." In June 1848 Pepper assigned all his rights in the invention to Warren and Sanford for $5000 and bought a cottage near his father. [44]

By 1849 Pepper made further improvements and his invention had been "tested by two year's experience," to correct problems discovered in production. Charles H. Gould, who helped set up and tend Pepper's machine, said it "made some good work but the motion was not rapid, and it was not wholly successful." When the local newspaper was invited to see the improved version in 1849, the company expressed satisfaction over the quality of the goods it produced.

> The *Plain Rotary Loom*, invented two years since by Mr. Pepper, a 44 inch machine, will produce per week by the attendance of one girl, 7 dozen shirts or drawers. -- His *Improved Ribbed Loom* of two years ago, with the attendance of one man will produce 5 dozen ribbed shirts or drawers per week.

By comparison, a common English stocking frame for plain knitting, "the most perfect machine that had been put into operation up to the time of Mr. Pepper's invention," made only two and a half dozen of shirts and drawers a week. Set up for Derby ribbed production, English handframes only produced two dozen ribbed shirts or drawers a week. [45] Powered knitting was thus nearly three times that by



hand and by 1849 had increaced almost one third over the two years. His machine's ability to power knit ribbed fabrics made Pepper universally recognized over the rest of the century as the first to successfully do so. According to Felkin, a Benjamin Baily obtained an 1847 British patent for a 'Derby Rib' machine that "could be driven by power instead of by the hands and feet of the operator as heretofore." The Portsmouth Stocking Factory was at least among the first in the English world to develop and also use power for ribbed knitting. While American factories were knitting plain goods by power, only Portsmouth had power rib machines.[46]

For example, just after Essex and Dorr companies installed Walker and McIntire's machines in Massachusetts, just up the Piscataqua River from Portsmouth the Belevue Hosiery Manufacturing Company at Dover, New Hampshire, was incorporated by Oliver L. Reynolds and some local mechanics. Returned from England by April 1847 Reynolds had "put into successful operation at the Bellamy Mills several of his very ingenious Knitting Looms" for the short-lived Hosiery Company of Salem. Nine looms are said to have knit plain goods of double width that were bleached and made into underwear. By 1850 they were knitting 800 dozen shirts and drawers a year (or seven dozen per machine a month), and Reynolds was reported making $5500 worth of knitting machines for sale. [47]

Pepper's Warp Frame & the Portsmouth Diaspora, 1849 - 1852

By early 1849 John Pepper had "turned his attention to the invention of some entirely new machinery." A reporter visited the machine shop that "Messrs. H & J. Crane and John Pepper just put into operation" that July. He claimed Pepper's new machine should be "regarded as the 'Ne plus ultra' in the manufacture of hosiery." It was "unlike in appearance to any other stocking looms we have ever seen, occupying just half the space of the improved looms, and will cost not half as much as those invented two years ago."

> The newly invented Plain Loom, of the same width of the old, by one third of the power and the attendance of one girl, will produce 28 dozen shirts or drawers per week. The newly invented Ribbed Loom will produce 18 dozen shirts or drawers per week. . . evidence of much labor and skill in the ingenious inventor, who is a young man only twenty-five years of age.

This was between three and four times the speed of Pepper's earlier invention and nine times the production of handframes; so assured of success were Pepper and his partners they announced that new machines "will soon be manufactured for orders." Equal patent rights in the invention were assigned to Pepper and the Crane brothers. [48]

Despite this enthusiasm for Pepper's second invention, it could not make saleable goods. It knit "very imperfectly," according to Hosea Crane; his brother added: "It was very open. The stitch was crooked on the back. The fabric ... was full of little holes, open small holes; It required filling up to make the fabric perfect." [49] The Cranes decided that machine manufacturing had more potential than making hosiery during the economic slowdown of 1850 and took Pepper's machine to where they might solve its mechanical deficiencies. In 1846 Jasper Crane mortgaged his Bow Street stocking mill to Hiram Parker of Lowell and in January 1850 he moved to Lowell as a "hosiery manufacturer." Hosea, while he remained in Portsmouth that year as co-agent with Horatio Sanford, began looking at industrial property for himself in Millbury, Massachusetts. [50]

Not long after Pepper's invention was noted in *Scientific American*, Warren & Sanford tried to incorporated their Portsmouth factory in New Hampshire as the New England Hosiery Company. That the Senate rejected the bill and the legislature created the Portsmouth Hosiery Company in 1850, suggests competing interests and doubts as to Warren's financial stability. Capitalized at $40,000, Henry Marchant, a mill owner and partner of cotton merchants Marchant & Hastings in Providence, Rhode Island, became president and Benjamin F. Whittemore, a Boston broker,

treasurer. Yet, in November 1850 all the company's property was assigned for debt to lawyer James Emery of Portsmouth, industrialist John Nesmith of Lowell, and merchant Walter Hastings of Charlestown and Boston as trustees.[51] In January 1851 the "Real Estate, Buildings and Machinery of the Portsmouth Hosiery Co." were offered for sale.

> This Company has heretofore been engaged in the manufacture of all kinds of hosiery and knit goods. The Machinery is in most excellent order, and consists of some improved kinds not found in similar establishments. Every convenience necessary to carry on that business conveniently and profitably may be found in the buildings and among the Machinery above named.[52]

In May the trustees sold the property to Tully D. Bowen of Providence, who later claimed Portsmouth Hosiery requested his help and were to buy it back. But the factory remained closed, 1852 tax assessors calling it the "late Stocking Factory." When its former owners could not perform, Bowen sold everything but Pepper's "three warp ribbed looms." to Nesmith, Francis S. Greenleaf of Boston and Henry Hastings of North Providence.[53] In December this was transfered to the Franklin Mills, a new corporation Nesmith, Hastings, Greenleaf and other investors formed to convert an old stone factory at Franklin, New Hampshire, for waterpowered knitting. They stripped the Portsmouth site of its new machines (some were "still in operation" elsewhere in 1867) and hired many of its mechanics.

They tried to sell the Portsmouth factory for six months, but in July 1853 auctioned it to John Pepper for $2400. Pepper never took title, but a group of German emigrants did. In November 1853 it was sold for $2500 to John Brugger (1802-1877) and two German partners, dry goods merchant Solomon Fisher of Portsmouth and Michael Siegman (aka Fisher?) a trader in Biddeford, Maine. Brugger, a hosier who emigrated from Germany, had revived the Bow Street mill earlier that year. Selling out to his partners for only $150 in August 1854 suggests the complex "occupied by us as a manufactory of hosiery" again failed. While Brugger went on to a career in

Manchester, Crane's old factory, "having been shut up for a few years," burned again and was razed about 1858 by Michael Fisher for a new brewery. [54]

After the Cranes left town with several factory workers in 1850, the absentee mill owners also offered some Portsmouth mechanics employment elsewhere. The career of John Pepper's brother, William H. Pepper (1830-1901), illustrates how itinerancy and a cross-fertilization of shop skills contributed to the development of new knitting technology. Nottingham born, William emigrated as a child with his family, settling briefly in Newburyport before moving to Portsmouth. In the 1830s and 1840s his father, Daniel, probably worked as a framework knitter in the stocking factory and William entered the trade about 1841. By 1850 his father owned his own shop as one of the "40 weavers who work their Frames at home." While John labored on his new machinery, William worked with his father until 1847 when he, too, went to Warren and Sanford's factory machine shop. In 1851 William briefly knit on his brother's power loom at Lowell before exhibiting it in Philadelphia for Hosea Crane. In 1852 he returned to work in Henry Marchant's Pawtucket mills and a rubber manufactory in Valley Falls, Rhode Island, before joining his brother and other Portsmouth men in the new waterpowered hosiery factory at Franklin, New Hampshire. [55] Portsmouth's diaspora of inventive machine workers played a major role in the subsequent mechanization of knitting in New England. [see Fig. 11] Before exploring further technical advances at Franklin, however, we must follow John Pepper's powered warp frame, the Crane brothers and several knitters to Lowell.

Marshall vs Mee and the Improved Pepper Loom, 1851 - 1853:

Mechanical problems of Pepper's invention stimulated other mechanics to improve its deficiencies. Two competing ideas for improvement of Pepper's loom at Lowell illustrate the incremental nature of invention on the shop floor, one of the

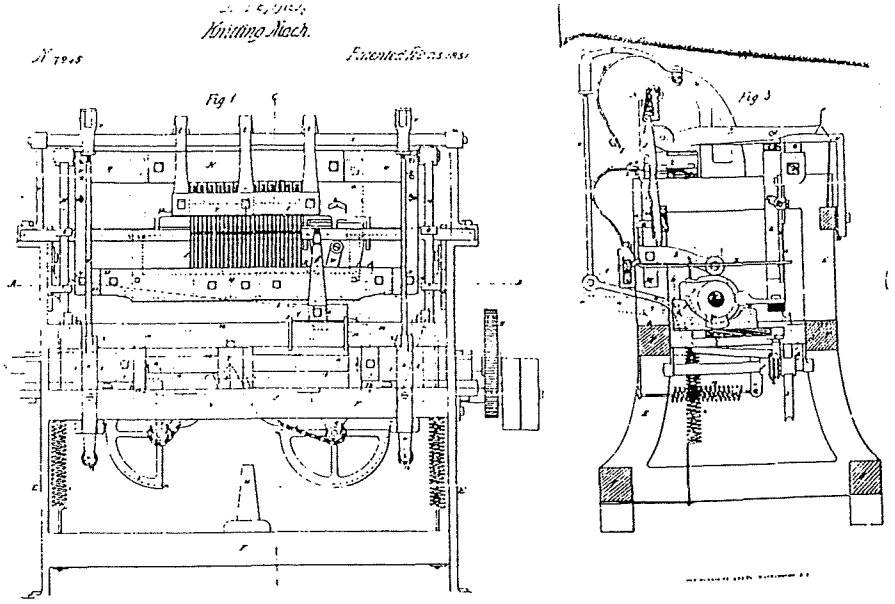
ways by which English stocking weavers transmitted complex knitting technology to American mechanics. Two patent applications arising from these improvements generated an interference case in 1851 and only resolved on appeal in 1853. Such a case permited one to question another's patent claims so the Patent Commissioner could determine who was actually the first inventor -- the status required for a patent. What constitued 'invention' was a legal issue of American patent law and administrative or judicial interpretation that historians describe as the social construction of invention. [56]

The Cranes took Pepper's new machine to Aldrich, Tyng & Co., a Lowell machine shop, whom they hired to build several more. According to Pepper, in January 1850 John Mee was sent to Lowell "by the Cranes to superintend the building and start up the loom." [57] Hosea Crane, however, emphasized that Mee "was employed as a weaver" :

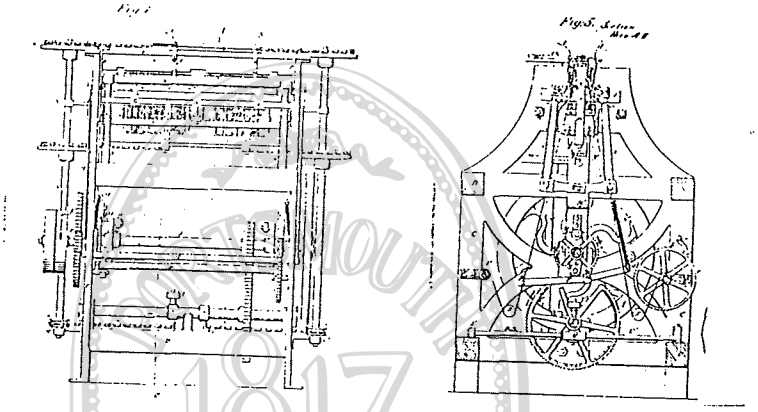
> He was sent to Lowell by us to start plain and ribbed looms as they were prepared for him. He never was considered a mechanic but a good workman at his trade. . . . He did, very little. We had a plain loom that was imperfectly got up at Portsmouth and improved on at Aldrich & Tyng's shop at Lowell. He was sent there to start the looms that were there as I understand it. We had three or four looms there that he had something to do with the weaving on them that have been abandoned. [58]

John Mee, while working for John Pepper in Portsmouth, had proposed an extra guide bar be attached to Pepper's loom to prevent it from making crooked ribs on one side. According to Pepper, it "was suggested in the shop a number of times ... where we were at work in Portsmouth. This was about the middle of the summer of 1849. " Describing that shop during the building of his invention, he recalled,

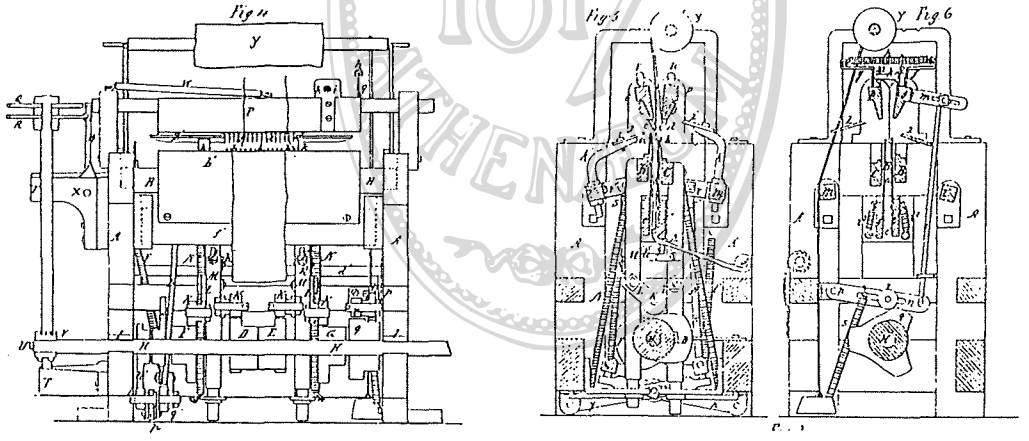
> Mr. Jasper Crane was there all the time and Hosea Crane was there once or twice a day. Mee's plan was talked of in the shop repeatedly day after day, but I cannot be sure that Mee or the other hands mentioned it to the Cranes. . . . It was a subject of common observation at the time. I told Mr. Mee that putting on the extra guide bar was adding more machinery to the looms than was necessary, and I thought I could do the same work without them.



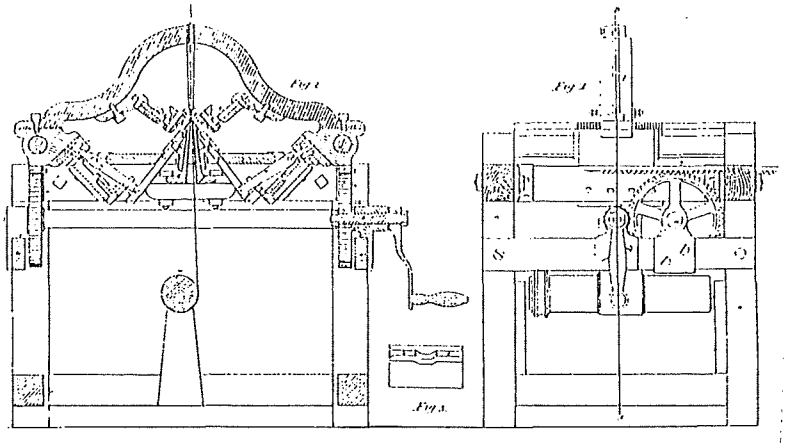
Pepper #1



Pepper #2



MEE



MARSHALL

When the machine's problems continued at Lowell, Mee reiterated his ideas to the inventor-mechanic Moses Marshall, the Crane brothers, as well as several machine shop workers. Benjamin D. Wallis, a young machinist "hired by Moses Marshall of Lowell to work for Aldrich Tyng & Co. . . [was] employed on a warp Knitting-loom invented by John Pepper of Portsmouth." Wallis later deposed he went to Mr. Marshall, the shop foreman,"to get direction, but after Mr. Mee came, Mr. Marshall told me to go to him, for he said that he, Mr. Marshall, knew nothing about a knitting loom." The fabric knit on Pepper's warp loom "was strait on one side, as to the rib, and crooked on the other," but Mee told Wallis "a loom could be made, that would knit strait on both sides." As Wallis recalled, "Marshall and [Jasper] Crane were there and John Mee was explaining his ideas of this plan of a loom to make strait ribs on both sides."

> Mr. Marshall said, he thought it could be done with one guide bar and did not think that it could be done with two. John Mee went on showed how the work would lie on the zig-zag loom and also on the strait work. He made a mark on the wall how the thread would lie. [59]

Jasper Crane testified that after almost a year using the Pepper loom "the work our looms were making was not what was wanted in the market." Only in November 1850 did he ask Moses Marshall, "if he could not make an alteration in the machine or make a machine that would make the stitch straight and more close." He wanted him to "improve upon the looms so as to make the work as near the hand loom work as possible."

> Soon after that Mr. Marshall told me he thought he could do it. . . Not long after that he showed me a draught on a piece of board, how he was going to do it. I did not understand exactly and he took some needles and showed me how he lapped it over to make the stitch. [60]

Samuel Adams, who ran the Aldrich Tyng & Company steam engine, then saw Marshall "sitting down with a plane [plain] board across his lap, drafting the new improved loom as he said."

> Mr. Mee was showing him how and where to put the cams in order to operate the needles and the guide bar. . . Mr. Marshall said "I will come as soon as I can gain a Patent for Mr. Mee on his draft." After he came down to help me, he said to me that Mr. Mee was forming an improvement to gain a strait stripe or rib on both sides of the cloth. [61]

George Butterfield, the machine shop's blacksmith, recalled Marshall said Mee "thought that he, Mee, had got up something new on Pepper's rib loom." In January or February 1851 Butterfield asked Marshall if new frame in the shop "was the loom they were putting Mee's improvement on to, and he said, 'part of it.'" [62]

While Pepper had been a partner with Hosea & Jasper Crane "during the summer of 1849," he remained in Portsmouth and disposed of his one-third interest to Warren & Company. Jasper Crane promised Marshall, if he solved the mechanical problems, "he could take Charles Warren's place in the loom." That John Pepper reassigned his patent rights about this time to Dr. Hiram Parker of Lowell, suggests that Crane's early backer bought Warren's interest after Marshall solved the machine's problems. [63]

Although Pepper had no direct financial interested in his invention, he had reason to be interested if a new machine infringed on his patent 'claims' -- the protected elements of his invention on any machine.

> At one time I was at Charles Warren & Co.'s counting room in Congress st., Boston, and went from there to Lowell in consequence of something H. Crane said to me about a loom. And I there at Lowell saw the loom. This was early last winter, as early as January 1851. I saw this loom in Aldrich & Tyng's shop, the loom with the double guide bars.

When he arrived at Aldrich and Tyng's, he told Jasper Crane"that I came to see the loom. He asked me how I knew they were building this loom. I told him I knew pretty much all that was going along. And he shew me the loom." Even in an unfinished state, Pepper recognized the principle underlying Marshall's new loom, "was the same as Mee proposed to me, so far as the guide bar was concerned." Upon

his return to Portsmouth, he wrote Jasper Crane to officially warn "him that I should not let him nor Hosea, nor any one else patent anything that belonged to me." Pepper claimed (although he lost the letter), Crane "wrote that the invention was none of mine, but that it belonged to John Mee."

When Pepper next saw the Cranes in February 1851, they told him "that John Mee did not attend to his work as he formerly had done. They thought he was getting up another model of these machines." Pepper soon confirmed that Mee was in Portsmouth building his own improved loom and the Cranes asked Pepper "what Mee could do about it as to getting a Patent." [64] In fact, on May 15, 1851 John Mee assigned two thirds of his machine rights to John Rourke, an English-born laborer at Lowell, and Gilbert McKennon, the English-born Portsmouth machinist who probably constructed their patent model. Two days later Boston patent attorney R. H. Eddy helped Mee file a patent application for his warp knitting loom and a week later a separate application for its warp knit fabric. [Fig. 14c] Perhaps to pay for the model and other expences, Mee sold one eighth of his remaining one-third interest to George Butterworth, foreman of Aldrich & Tyng's blacksmith's department, and another eighth to Lowell carpenter Peter Woodbury for $600 each. In July the Commissioner of Patents ordered patents issued to Mee, Rourke, & McKennon, but this was delayed when Moses Marshall filed a caveat against Mee's claim. [65]

Marshall's had only three months to complete his own machine, whose capabilities can only be reconstructed through the testimony of others. In September 1851, at Jasper Crane's request, Hiram Parker discussed the machine Marshall planned to exhibit at the local mechanics fair.

> Mr. Marshall then said to me that he was getting up a machine for knitting that would throw all other power looms into the shade. He shewed me the drawings and two patterns, and said that he had got out three patterns and believed someone had hooked one of them. He described his invention to me

> thoroughly. . . It was a power machine that would make ribbed work or plain work either, from a single thread. He explained to me the feeder that the thread was to run through, and the needle bar and the other parts of the machine. [66]

That September, too, Hosea and Jasper Crane assigned their rights in Pepper's machine and Marshall's improvements for use in Onondaga and Oswego Counties, New York. They guaranteed that it"will knit forty or more courses per minute on each side with perfect safety to the machine." Jasper Crane had by then relocated to Cohoes, and claimed with some authority that their machine produced "as good or better fabric than the 'Cohoes Machine' so called (sometimes known as Egberts & Baileys, or Baileys Machine) and. . . not be liable to get out of repair as said 'Egberts & Baileys machine.'" In October 1851, Moses Marshall filed his patent applications for this improved knitting loom and the warp knit fabric it produced. [67]

The conflict between Mee, Rourke & McKennon and Moses Marshall was quickly decided by Patent Office officials. They "found upon examination of the testimony filed by the parties that John Mee is the first inventor of the fabric in question and also of the improvement in Knitting Looms in dispute between them." Thus, in January 1852 Commissioner Thomas Eubank granted priority of invention to Mee, Rourke & McKennon as assignees of the inventor. Marshall's lawyer immediately appealed, but the hearing was delayed for almost a year by changes in the patent law. [68]

The features differentiating both the Mee and Marshall knitting machines from all others and on which their patentability depended, were two sets of needle bars and two sets of thread guides operating independently of each other. Under the law "The party first proposing to do this must be considered the first inventor, and not he who first arranged and placed these parts in a model or full working size machine." [69] Marshall's attorney argued that building a working machine first should have precedence. Investing his client with greater technical knowledge than

the illiterate Mee, he noted the Cranes selected Marshall "because he was a skillful mechanic at the head of those employed there." He also suggested that Mee could never have built his machine without Marshall's experiments. [70]

As patent law excluded testimony from anyone with direct financial interest in the case, neither Mee nor Marshall offered evidence beyond their respective patent applications. George Butterfield could testify for Mee only after he sold his eighth interest to Woodbury in September. Jasper Crane, who had already relocated to Cohoes, disclaimed any right in Marshall's machine. But because both brothers admitted that if Marshall won his profits would pay their debt to Aldrich & Tyng, all their testimony was tainted and Marshall's case collapsed. His application was denied and Mee's reaffirmed.[71]

There is some irony in the later history of the two machines. By 1855 John Mee, who moved to North Amherst, Massachusetts, while the patent was being decided, was an "operator " in a Millbury woolen mill probably owned by Hosea Crane. [see Fig. 9] The next year, Mee's patent was sold to Asa H. Waters of Millbury and Asa Abbott of Bennington, Vermont. Waters acquired Abbott's interest in 1857 and became Hosea Crane's partner in the hosiery business. [72] After Marshall lost his interference case against Mee, he invented an entirely different knitting machine while his appeal was pending. Although Mee challenged this invention, too, Marshall won his patent in March 1853 for the first knitting machine to use an inverted-v flat-bed with crossing needles. [Fig. 14d] In 1867 Marshall sold this patent and his right to sue for its infringement to the Lamb Knitting Machine Manufacturing Company of Chicopee, Massachusetts. The highly successful hand-cranked knitting machine the Rev. Isaac W. Lamb patented in 1865 (U.S. Patent # 50369) shared this otherwise unique form and was more than likely Marshall's chief infringer. [73]

Circular Machines improved for Ribbed Knitting: 1852-1855

Besides the power rotary, warp and endless chain knitting machines in Portsmouth of the 1840s, mechanics also experimented with 'round' or circular knitting machines. John H. Barsantee, a native of Portsmouth, was one of the machinists working with John Pepper and seems to have gone with William Pepper to Lowell. When Hosea Crane sent Pepper to Philadelphia to exhibit Marshall's improved machine, Barsantee also exhibited a circular knitting machine of his own there. In December 1851 the Philadelphia *Public Ledger* noted that Barzantee's Patent Knitter, "in daily operation" at the Philadelpia Exchange, could knit "380 stitches at each turn of a small crank." John Larand, a Philadelphia framemaker from Leicester, England, sold him latch needles "intended for a new machine made by said Barzantee." Larand claimed this happened in 1847 or 1848, but it may have been 1851 as Barzantee did not use latch needles in his first patent. However, he soon realized latch needles caught the thread and transfer loops better than spring bearded needles. By 1854 he had moved to Philadelphia, patented a second circular machine with latch needles, and entered into correspondance with James Hibbert, the American latch needle inventor. Barzantee claimed he made $6000 on his two inventions and proposed the two inventors combine patents and start a latch needle knitting machine factory. Only Hibbert's death in May 1854 and Barzantee's own dissapearance from Philadelphia prevented this. [74]

John Pepper, too, was at work on a circular knitting machine in Portsmouth. In March 1851, just before the Portsmouth Hosiery company was sold to its creditors, Pepper assigned a quarter of his "inventions and improvements of whatsoever nature," for the next three years, to factory agent Horatio G. Sanford. Sanford paid a quarter of Pepper's development cost in constructing and patenting his inventions. In October, after Sanford left Portsmouth, he sold Thomas A. Clark of Worcester his three-year agreement with Pepper. [75]

In February 1852, John Pepper also signed an indenture with Portsmouth Hosiery Company president, Henry Marchant, who agreed to test Pepper's newest idea for making cotton or wool ribbed fabric as soon as Pepper could "embody it in a machine" and forward it to him in Rhode Island. Should the machine prove a financial success, Marchant would have half interest ("whether the same shall be patented or not") or regain half the capital investment. In April Pepper received $150 for expences on the invention and William Pepper's brief tenure at Marchant's Pawtucket mill must have been to set up John's circular ribbed knitting machine. Marchant's partner, Henry Hastings, was an investor in the new hosiery factory in Franklin, New Hampshire with John Nesmith. And in November 1852 (while acquiring the Portsmouth Hosiery Company) Nesmith paid Pepper $1000 for all his interest in a circular machine for which the inventor had applied for a patent. [76]

Pepper's most important contribution to the powered knitting industry in the United States, and the basis for his later reputation, this was his first attempt at circular knitting machinery. Like Barzantee's machine patented about the same moment, it had a radial circle of sliding spring bearded needles "used in hosiery looms," that Pepper combined with a rotary sinker wheel "like those in use in the common French rotary knitting looms" and two rotary presser wheels. The horizontal needles intersected within the circular head with vertical needles turning over a stationary cam to cast off the loops and knit ribbed work. [Fig. 15] This sophistication of design suggests that Pepper had access to circular machines becoming popular in England [see Fig. 3] through recent English emigrés to the Portsmouth hosiery factory familiar with such machines. Imported circulars had been in a few American mills since 1846 when the Enfield Manufacturing Company of Thompsonville, Connecticut, spent $85,000 for the American rights to Jouve's Belgian circular knitting machines. Pepper's ribbing invention provided elasticity to the 'seamless' tubes circular machines produced and substituted for the narrowing

Sheet 1. 2 Sheets.

J. Penner Jr.
Knitting Machine.

No. 12,046. Patented Dec. 5, 1854.

Fig: 1.

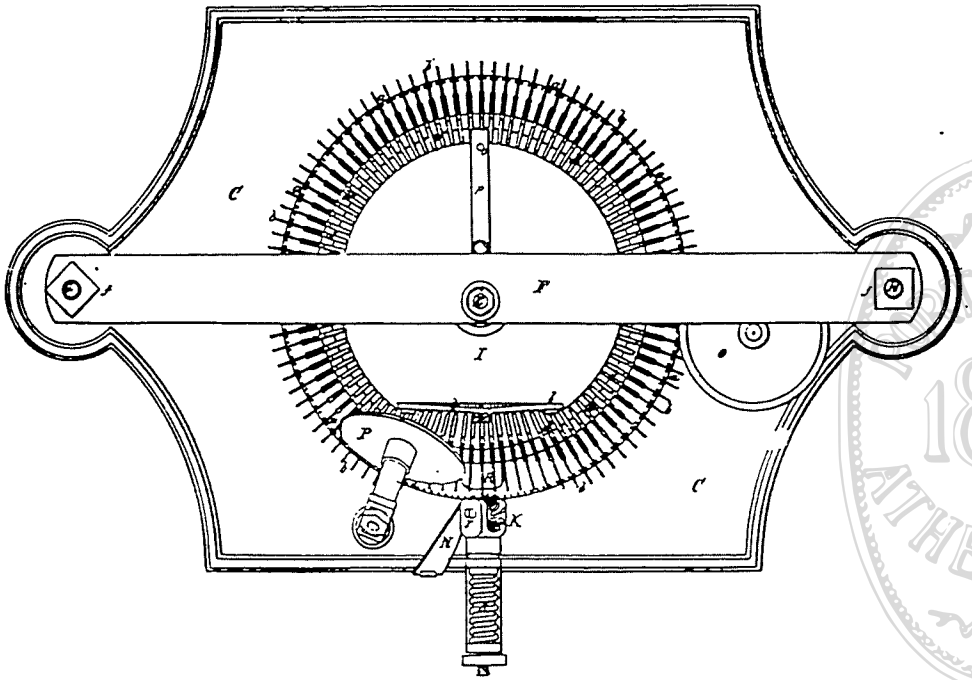
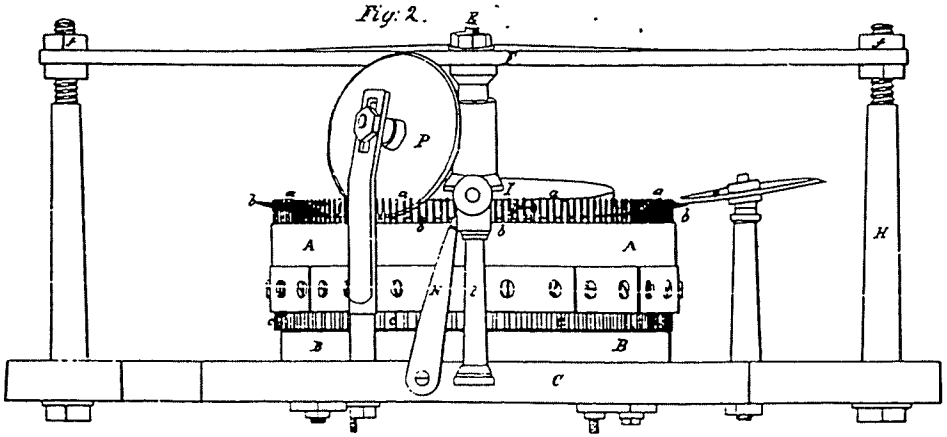


Fig: 2.



Sheet 2. 2 Sh.

J. Penner Jr.
Knitting Machine.

No. 12,046. Patented Dec. 5, 185.

Fig: 7.

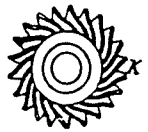


Fig: 8.

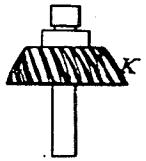


Fig: 4.

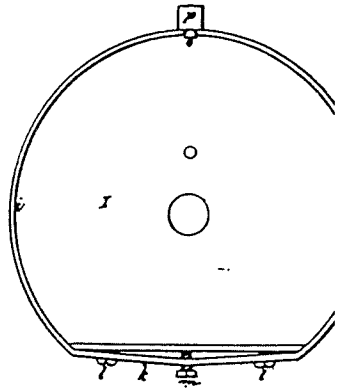


Fig: 6.

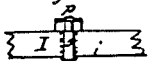


Fig: 5.

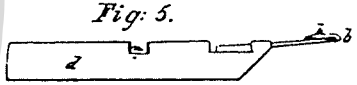
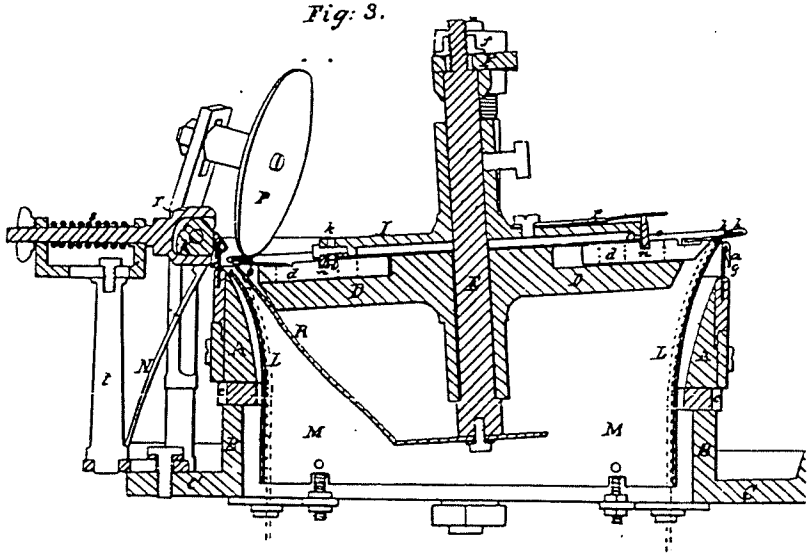


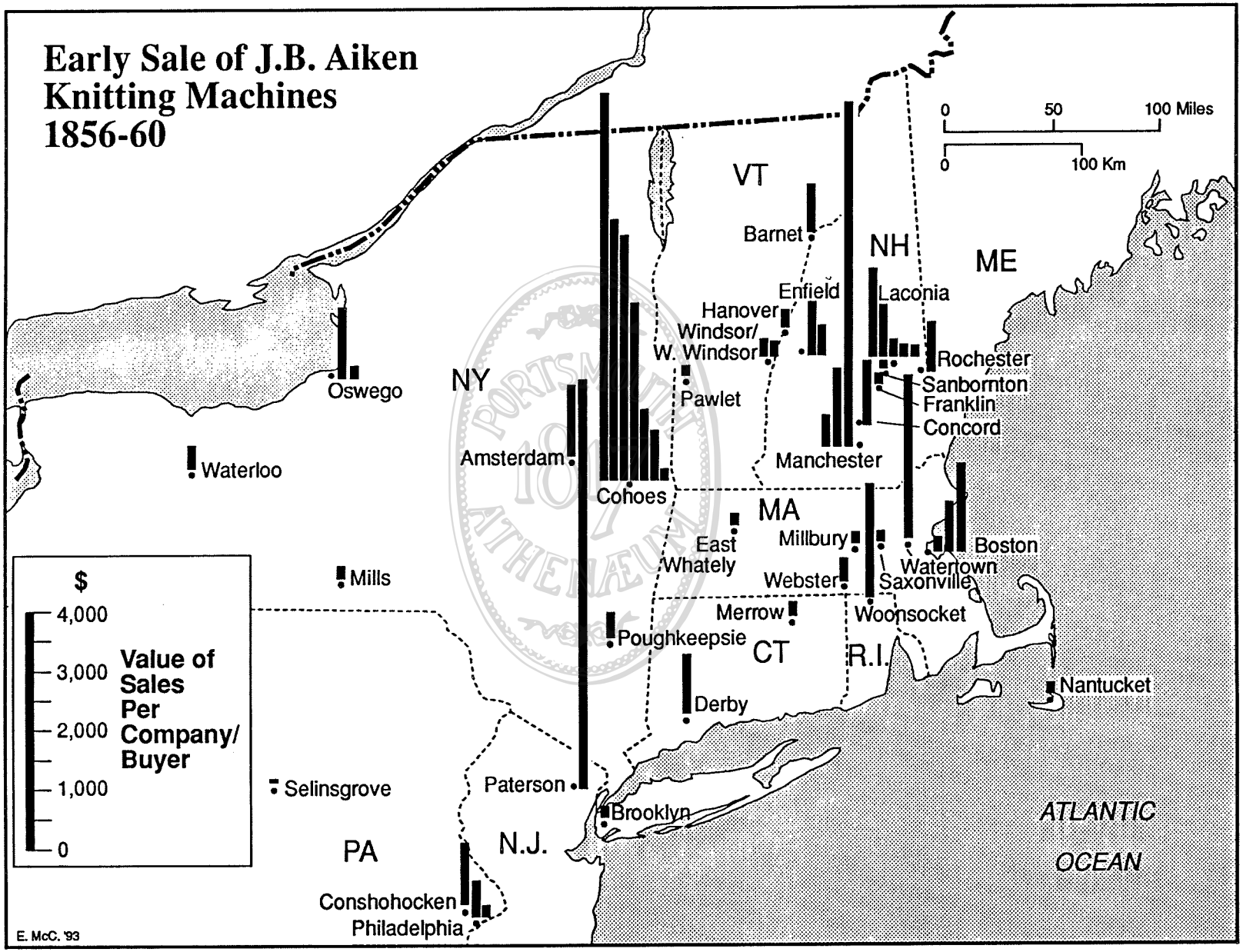
Fig: 3.



function of full-fashion hosiery. As inventor of arguably the first successful circular machine for ribbed knitting, Pepper knew its importance to the English market and, six days after assigning his American rights to the Franklin Mills, sought a British patent.[77]

In 1853 John Pepper became foreman in the Franklin Mills machine shop where Walter Aiken later testified that as a young man he worked under Pepper. Aiken's training at the Franklin Mills introduced him to knitting technology and provided him a career in machine manufacture. In 1853 he helped Pepper try latch needles in one of the factory's power frames built for the older spring needles. "They did not work to his satisfaction, and he took them out and replaced the spring needles."[78] Walter's father, Herrick Aiken, a noted inventor in his own right, purchased the latch needle patent from Hibbert's estate in 1854 and with his two sons began to patent their own circular knitting machine improvements.

Characterized by later local industrialists as merely a 'loom fixer' and itinerant inventor, Pepper was far more important than that to the Aikens. Walter Aiken began to build factory kniting machines and in July 1856 purchased the right to make any "plain looms with sliding needles," paying Pepper $10 for each of Pepper's circular machine without the ribbed knitting component. In October Henry Marchant Jr. (who had purchased his father's half right in Pepper's machine), agreed Walter Aiken might build as many Pepper machines as he wanted, paying Marchant $10 each. But if Aiken built "any large circular looms other than stocking looms," that is, for making under drawers or shirts, he was to pay the younger Marchant $20 for each machine.[79] The licensing agreements demonstrate that Pepper's machine, for which a patent was granted in December, underpinned improvements the Aikens patented in 1855. Moreover, by 1860 the sale of Aiken circular knitting machines nearly defined the distribution of factory knitting in the northeast. [Fig. 16]

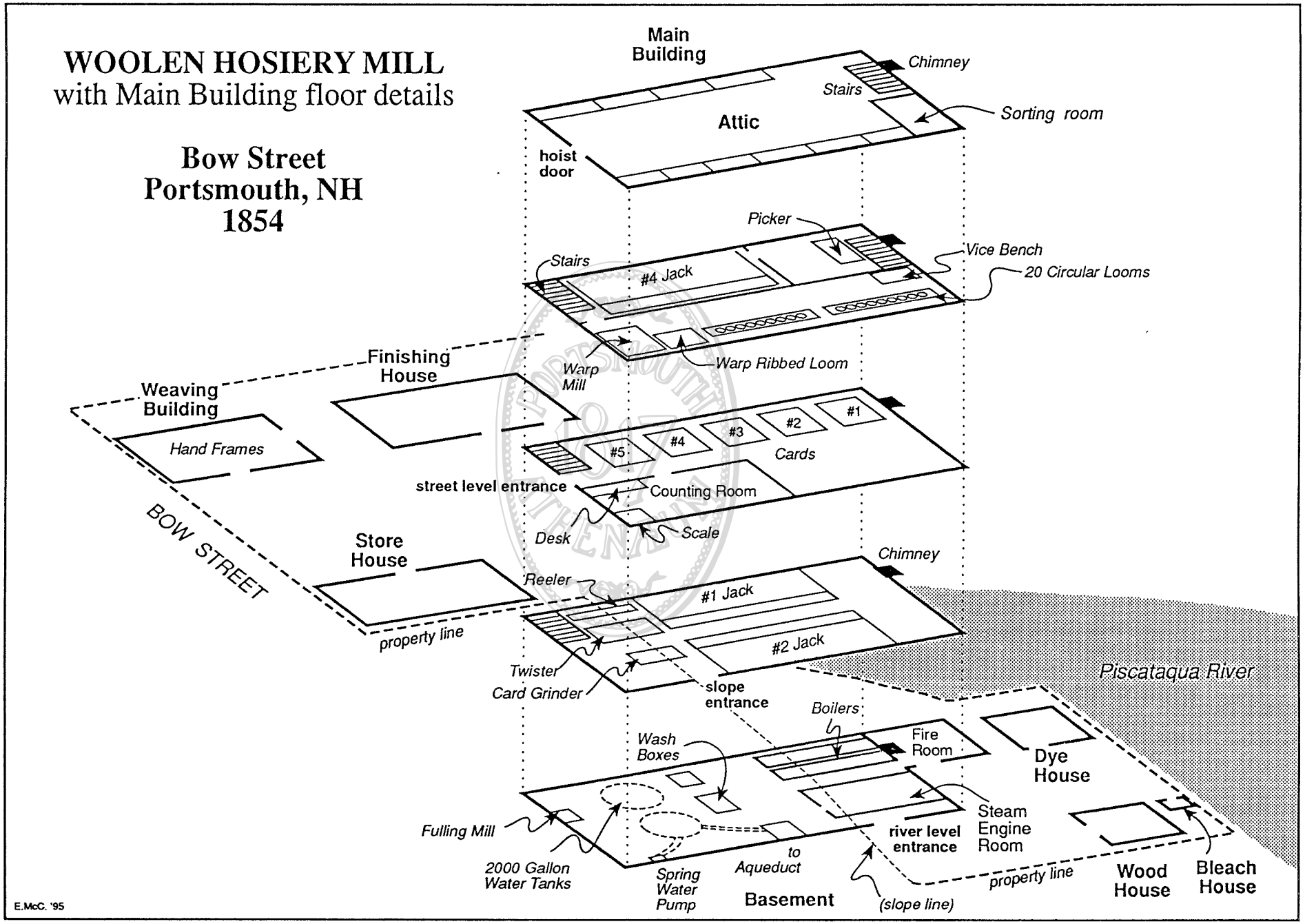


In February 1855 Pepper assigned the Franklin Mills all rights to a new rotary machine for straight ribbed knitting -- his first using latch needles -- for which he received an American patent in July 1855. (Walter Aiken later adapted this to knit toes and heels of factory stockings.) The Franklin Mill agent ,Thomas Appleton, was a former hosier from Manchester, England, and that same month in Manchester merchant Charles Hodges submitted drawings and specifications for a British patent for this invention "communicated to me by John Pepper and Thomas Appleton." Pepper also sent Charles James Appleton of Manchester drawings and specifications for a simple English-type circular frame with a cylinder of vertically positioned latch needles working in grooves, a simple varient of part of his ribbed circular. In December 1855 Appleton sought a British patent for this American circular machine that was among the first to use latch needles vertically in a needle cylinder and a progenitor of later domestic knitting machines. [80]

Circular knitting seems to have been introduced to Portsmouth factories in 1853 by John Brugger, a hosiery weaver from Germany where 'round' frames were already used. In Portsmouth by 1850, he was a stocking weaver in the Rockingham factory the next year, although in 1853 "Jn° Brugger & Co., Hosiery" was still considered by R. G. Dun's mercantile agent (credit investigator) to be "entire Strangers." He was backed by New York capital who, the agent reported, put "a quantity of machinery in a Stock& factY" on Bow Street. The newspaper, too, reported a"new company putting steam power and machinery . . . for spinning," into "the high building formerly used as a sugar house, and afterwards for a time as a stocking factory by Mr. Crane." [Fig. 17] Brugger apparently told the paper he planed to install 30 or 40 "looms, of the most modern and approved construction." Some of these the paper reported were "to be of Mr. Pepper's invention, and made here," but, it turned out, "the new looms in the hosiery manufactory in Bow street" were not to be Pepper's looms, but "those of some other inventor and maker." The

mill was working by September (when its "woollen yarns, Hosiery &c." won a silver medal at the Boston Mechanic's Fair) and it advertised for seamers that December. An 1854 insurance policy to Charles Rubens of New York shows that the factory, then managed by Simon Strauss and Lawrence Gould, employed 27 men and 18 girls. Sketches of its layout, redrawn for clarity [see Fig. 18], illustrate how the circular knitting looms fit into the factory. [81]

A small dye and bleach house sat along the river next to a wood house; in front were a store house, a weaving building with seven handframes for unpowered parts of the process, and a finishing shop where garments were readied for market. These filled the "large lot of land in front" of the factory, described in 1826 as big enough "for one or two tenements for the workmen to live in." [82] The factory then had "a good well of water under the building" and the cellar plan shows a well that still fed a cistern. It was also connected to the town's aqueduct system for the fulling mill, wash boxes and the steam engine boilers. As the site drops off sharply to the river, all four stories and attic were exposed with doors along the eastern wall to two floors below grade. An eight-inch brick chimney stack ran up the rear and towered twenty feet above the roof with its square factory belfry. With only two and a half stories showing at the street level, a hoist lifted raw materials to a door in the gable and the main door led into the middle story with its counting room. This office contained not only a desk but a safe where they stored friction matches to light the gas lamps as work began at 6:30 am and ran til 6:30 at night. The mill ran "chiefly on orders for fulfilment from abroad" and its goods, "except coarse grades, are 'all wool' -- cotton being introduced for large and heavy goods only." In the storehouse, "besides the common varieties of goods" were "new and beautiful styles of children's parti-colored hose" and extra "fine shirts for elderly men, containing *a pound* of wool each." Where once iron workers sweated, the paper wrote, "we find



men and women watching stockings, drawers and shirts make themselves."[83] [Fig. 18] This mechanization is reflected the manufacturing sequence:

> The wool, purchased in New York, is opened and sorted in the upper story, thoroughly "picked" in the next, and passed down by a tunnel to the card room. A given weight is fed into the first or coarsest carding machine, by which it is wound for the next, and the finishing machine gives it out ready for the spinning jacks. These cards are wonderful machines, combining actions and motions of all sorts. The three we have named form a set -- and it would require a regiment of grand dames to keep pace with the two sets running in this mill -- which are, however, able to supply the twenty power looms in the weave room. [84]

As few hosiery factories in the United States in 1853 used circular knitters, this refitted Portsmouth mill was quite up-to-date. The twenty circular power looms "which rattle off a web for a man's body, his legs, or his feet, according to the size of the loom" knit a long tube of stocking material that required hand knitting of toes and heels for stockings or seaming for underwear. The size of the 'regiment' of female outworkers needed to finish circular goods was determined by the number of 'sets' in a woolen mill. According to contemporary industry estimates, one "woman can heel and toe four pairs per day, giving her whole time to the work." Each set required ten factory hands and produced enough wool for thirty-five dozen socks a day. Hand knitting the heel and toe required the additional "labor of one hundred and five women at all times for each set" or the full-time equivalent of 210 women in this factory and at home. That few women worked full time, prefering to knit when "not required for ordinary domestic duties," their numbers must have been much larger. [85]

Challenge and Accomodation to Factory Knitting: 1857 - 1875

In March 1857 the Franklin, New Hampshire hosiery factory was destroyed by a fire resulting from spontaneous combustion. While the power looms were saved, more than 1000 individuals (including the outworkers) lost their employment. This

event led the *Portsmouth Morning Chronicle* to note the "Portsmouth Stocking Factory has burnt twice," once from the same cause "and part of the buildings probably by incendiary." Franklin's tragedy offered a chance for Portsmouth to regain its lost importance as a major center of hosiery. "Now is a fine chance to set the machinery flying again. Let the weavers who emigrated to Franklin, set their looms to humming in Old Portsmouth again -- the home of the stocking business." But Laconia and Lake Village, New Hampshire, rather than Portsmouth ultimately attracted most of Franklin's displaced workers.

Ever since Bazin and Reynolds dreamed of foreign markets for their knitting machines, patenting in Europe had become common. John Pepper eventually joined his brother William at Lake Village, but in May 1857 he boarded the steamer *America* for Europe to sell his inventions. According to the Portsmouth newspaper he had "already sent some of his patent knitting machines to England, France and Germany, and has orders for more."

> They were introduced into Germany over a year ago, to which place he now accompanies a number of his machines, and ere he returns, will fulfill orders from all the countries above mentioned. We hope he will meet the fullest recompense for his ingenuity and enterprise. [86]

Jonas B. Aiken, Walter's brother and sometimes partner, offered his 1857 circular machine patent to buyers in England, France, and Germany through Munn & Co., patent agents and publishers of *Scientific American*. Through correspondence, travel, machine import, and direct immigration New England inventors and manufacturers were, as Felkin noted in 1867, "perfectly cognizant of and use our latest improvements, as well as their own." [87]

The export of Pepper knitting machines to Europe in 1856 and his 1857 trip came just as circular knitting machines were becoming more common in the few large English factories. In 1858 Robert C. Gist was granted a British patent for the American circular machine he sold to Hines and Mundella, factory hosiers of

Nottingham. Thomas Thompson, an English mechanic there, substituted latch needles for bearded ones in Gist's machine to make himself Pepper's near rival "for being the first to adapt the circular frame to produce Derby ribbed work." The 1857 visit also provided Pepper with important contacts. He would negotiate with several Nottingham machine makers in 1864, when he returned to buy British knitting machinery for the Lawrence Manufacturing Company of Lowell. [88]

The Franklin Mills fire also produced the first direct challenge by English-born artisans to their domination by American factory knitting. William H. Carter, a newly arrived framework knitter, came to Portsmouth in the spring of 1857 because Job Cartledge, who lived next door to him in Radford (near Nottingham), had relatives in the Portsmouth hosiery trade. Carter soon began working for the Cartledges, but then "came a strike" and he left town while still owed money. [89] On July 3, 1857 the *Portsmouth Morning Chronicle* gave public notice of "the present Strike of the Stocking Weavers in this city," who "refuse to work at the present prices paid for their labor." The editor claimed that "it is new to us, and probably to most of our readers, that there *is* such a strike -- which, we are told, has existed for a couple of weeks or more. There are said to be upwards of thirty weavers who have refused to fly the shuttle longer, at the old prices." [94]

Five English-born handframe workers addressed the community through the newspaper. That these strikers were all foreign-born framework knitters suggests both class and ethnic solidarity, while their statement shows a well-developed artisanal grapevine with other hosiery centers.

> The trade is spread, more or less, through the States; and for the kind and quality of work as made in Portsmouth, nowhere can we find that the workmen are making it at so low a rate as here. In Massachusetts, where the same kind of work is made, and with one and the same market, the workmen receive at the rate of 20 per cent and upwards over us.

They published this notice,"to awake your sympathy when we place before you the reasonable excuse for such strike."

> If we have submitted to a reduction of prices in times past, can we not with confidence ask for a renewal of the former rates, or at least an equal right with others? We have born the grievance too long -- but now necessity has forced it upon us to remonstrate. House rent, fuel, food, clothing -- all these have steadily increased in price; in fact, it has become a problem with us how are we to live by our labors? [91]

A conflict over piecework rates, this strike targeted the jobbers from Boston and New York, perhaps even the Franklin Mills, who purchased the work of domestic shops for distribution. Like Leicestershire bagmen who paid low rates for rural hand-wrought goods, New England's increased factory production forced Portsmouth's artisans to accept lower rates for their finer goods.

Rejecting 'de-skilling' and displacement by the unskilled female labor hired to work powered machines, Portsmouth's stocking weavers reverted to domestic industry and accomodated their handframes to the unautomated parts of the factory process. As Portsmouth's innovative mechanics began to move away the 1851 city directory noted "100 hands in the Factory" and another "40 weavers who work their Frames at home." [see Fig. 14] In that year's fourth of July parade, "FRAME WEAVERS appeared in a shop in which one of the craft was employed at a loom, the cart being hung with specimens of their manufacture." While the old stocking factory as having been "hanged, drowned or burnt" three times, "and started and stopped at least a dozen," an 1853 writer saw "the grand thing" that kept the local craft "alive, has been the steady, industrious, patient character of the workmen, principally English and Scotch immigrants, who ... choose with their descendants and successors, to make hosiery *here* rather than any where else." By 1857 the factory was gone for good and, although "this unobtrusive branch of domestic industry is not prospering so well as at some former periods" it was now "all in the hands of

private individuals, most of whom *cant* well fail." [92] By 1860 the craft was entirely foreign-born; the only American-born handframe workers in Portsmouth were the sons of English parents in the trade. [see Charts 2 - 3]

CHART 2: Stocking Weavers & Hosiery Mill Workers, Portsmouth 1850-1870

	1850					1860			1870		
origins	*US*	*Can.*	*UK*	*Ire.*	*Germ.*	*US*	*UK*	*Other*	*US*	*UK*	*Canada*
occupation											
stocking weavers	12	1	49	1	6	5	34	0	1	22	1
operatives / mfr's	16								1	14	
female oper./seamer	5	1									
machinists	2		6							2	
engineer	1										
dyers	3		1								
managers	7						1			1	

source: U.S. Census, Portsmouth, NH, 1850 -1870
supplimented by city directories and mss

A close knit group of English families, many of Portsmouth's knitters were already related by marriage before they immigrated. Several of William Cartledge senior's daughters married English hosiers who settled in Portsmouth during the 1840s and 1850s: Ann became the wife of George Turner before the two families came to Portsmouth, and Harriet married William Clow in Derbyshire. Karen Cartledge married framesmith Stephen Lester here; Sarah married machinist John Critchley; Eliza married James Murby, whose father helped lead the 1857 strike; and Emma wed hosiery dyer James Walley. William Cartledge Junior married Ellen Jarvis, daughter of Francis C. Jarvis, the most progressive hosier in town. [93]

With its several handshops, Portsmouth now finished machine goods made elsewhere. New England factories still needed handframes inside the factory itself or put-out to domestic shops, to toe and heel stockings, or knit gloves, shawls, and sweaters. Frank J. Cartledge recalled of his grandfather's shop before the Civil War, that the "most serious handicap was getting needles." Thus, when John Pepper set

CHART 3: Portsmouth Hand-powered Knitting Shops 1850 - 1865

master	*1850-55*	*1857-59*	*1860-65*	*1865-69*	*handframes*	*knitting looms*
Charles Adams	y	y	gone		1850: 5	
Thos. Moore	y	[died 1856]			1850: 4	
John D. Odams	[with Moore]	y	dyer / navy yard			
Daniel Pepper	y	grocer	drocer		1850: unknown	
Thos. Kennedy	[mill to 1853]	y	y	[1861-74 in Ipswich; returned 1874]	1860: 3 1875: 11	
Jarvis Bros	y	y	y	y	1860: 30	1870: 18 power
Thos. Wardwell	y	y	y	y		
Wm. Cartledge	y	y	y	y	1870: 6	+ 6 hand*
Wm. Clow	y	y	y	y	1870: 9	
John Forknell			y			
Thos. Lester				y	1870: 6	+ 10 hand*

Source: 1850-1870 Manufacturing Census Returns

* hand cranked (circular?) 'looms'

up the new hosiery department for the Lawrence Company at Lowell in 1864, he hired William Cartledge to make cuffs and "furnished him needles." [94]

Pepper also gave work to Portsmouth's forgotten hosiery workers, the "large class of women and children called seamers." From 1868 to 1871 he was agent of A.A. Lawrence's Ipswich Mills, the first corporation to successfully compete with English cotton hosiery. Circular stockings made at Ipswich Mills had feet "of two parts, a sole and an instep. It was necessary to join these together along the sides and across the toes, as well as close the bottom of the leg."

> Part of this work was done on looping machines at the mill, but the greater part was sent outside to be done by needle work. Much of this footing was sent to Portsmouth, New Hamphire, Eliot and Biddeford, Maine, to be distributed among farmers wives and daughters. [95]

By 1870 in New Hampshire alone 13,000 women worked outside the factory "knitting on the heels and toes, earning $1 per dozen for this work," while in Maine, New Hampshire and Vermont, "nearly the whole female population, within a radius of twenty miles" of a knitting mill could be seen at home finishing "goods partially fabricated by machinery." [96]

The *Portsmouth Journal* reported in 1875 that, "although comparatively small quantities of goods are now woven here, a large number of persons find employment as seamers." Thurza Turner (1828-1904), came from England about 1845 with her extended family. Her father Thomas (1802-1870), a stocking weaver on Middle Street, worked in the adjoining handshop of Thomas Moore and John D. Odams. By the time he died Thurza was the distributing agent for several New England factories to "families in this city, and in Rye, Greenland, New Castle, Kittery and Eliot." [Fig. 19] The Dalby Mills in Watertown (where Franklin Mills' Francis Greenleaf was involved) and the Highland Mills in Needham (where several Turner relatives worked) sent:

> large quantities of hosiery every week to Miss Thurza Turner . . . by whom it is distributed to different seamers, who do the seaming and return it for transmission to the places of manufacture. The reception, giving out, and return of these goods require considerable care, and constant supervision.

All the seamers were "persons known to the distributing agent, or properly vouched for by someone known to her." In her small office addition to her father's house [Fig. 20], Turner kept accounts "with each seamer, to whom the work is charged on a set of books when it goes out, and credited with the price of the labor upon a pass book when it is returned, so that every pair of hose is accounted for, and of the large number received and issued, there can be no loss."

> During the busy season, while goods are being manufactured for the fall sales, in July, August and September, from eleven to twelve hundred dozen pairs of hose are sent out each month. Children with arms full of many colored stockings, looking in the distance like huge bouquets of bright flowers, are seen wending their way to and from Miss Turner's office. [97]

Until the last quarter of the nineteenth century, New England's hosiery industry occupied a complex middle ground between craft and corporation. Its foreign-born hosiers ran their handshops and in the next generation a few would expand into small family-owned factories like their Philadelphia counterparts.

GIVING OUT HOME WORK FROM THE
IPSWICH MILLS IN 1870

Partnerships of Boston's domestic commission merchants and these small manufacturers provided one alternative to the coming domination of the region's knitting industry by Lowell-style corporations. But the industry's overproduction, falling prices, and a depression after the panic of 1873 closed many mills.

Francis C. Jarvis (1807 - 1876), alone of the English-born Portsmouth hosiers made the jump to a steam factory. A frameworker in Johnson's handshop he became a machinist in the Portsmouth hosiery factory and in 1844 Hosea Crane sold him land next to the stocking factory. By 1851 Jarvis and his brother Robert built a handshop where ribbed woolen stockings, shirts and drawers were "made to order." In 1860 they employed 15 men and 35 women, including female framework knitters. After the Civil War they became agents for Barry Brothers of Boston, increased their capital from $5000 to $20,000 and enlarge their factory with steam power for 18 knitting machines. With only twenty more women in 1870, the new machines quadrupled the hose manufactured annually and increased their products value from $18,000 to nearly $110,000. This paralleled the pattern of successful English hosiers in Philadelphia, but before Francis Jarvis died in 1875 the mill was closed and "offered for sale". When his family tried to continue the business it failed. [98]

The mechanics who contributed to industrial knitting, on the other hand, did so in a region already structured by large scale industrial capitalism and mechanized textile production. After the Civil War northern New England's Derby ribbed hose were generally factory "made on Aiken's and Pepper's patent speedy circular frames" and the Pepper brothers in Lake Village and their yankee counterparts, the Aikens of Franklin, remained major factory knitting machine builders. As the son of an English artisan John Pepper tried to be a stocking manufacturer and let others build his machines. This most "thoroughly Americanized" mechanic spent much of his life, however, working between the two cultures. He explored new factory technologies for Massachusetts corporations, imported experienced English workers,

and set up hosiery mills with both English and American machinery. Selling his patents to a corporation dominated by Walter Aiken, he leased one of Lawrence's hosiery mills in Lake Village and continued inventing there. But after Lawrence's retirement and a depression in 1874, new corporate managers foreclosed Pepper's factory and he died bankrupt in his early fifties two years later. [99]

His brother William, on the other hand, weathered this economic crisis and became a prosperous machine-builder in Laconia. After John's death he ran the Pepper Knitting Machine Company, served as a local bank director, and took on the trappings of a self-made businessman. The company was absorbed after his death by Scott and Williams after they moved to Laconia from Philadelphia. John Pepper's yankee brother-in-law, Orison Twombly of Portsmouth (1828-1897), followed a similar path. Overseer in a knitting mill in Ashland, New Hampshire owned by former Franklin Mills investors and managed up by John Pepper in 1860, Twombly moved to Laconia in 1870. He had "a genius for mechanical inventions" and between 1868 and 1873 patented improvements in knitting machines, "some of which were very successful machines and quite valuable." By the 1880s the Twombly Knitting Machine Company was headquartered in Boston. [100]

The mixture of hand and power technologies and related labor patterns distinguished knitting from New England's woven textiles and gave the region's industry a special character. Large factories, modest rural mills, and small shops combining hand and powered knitting might all exist in towns with framework knitters. Factories combined powered machines with extensive outwork until the turn of the century, when improved technology brought all processes within the mill. Increasingly men and women, foreign and native-born, found distinct roles in the new industrial order. While skilled handframe workers persisted into the second and third generation, mechanization and factory production begun in Portsmouth and other early centers increasingly characterized American knitting.

Endnotes

1. Deposition of Geroge Mee, Dec. 3, 1851, Marshall vs. Mee, Rourke, & McKennon (1852), Patent Interference Case, RG 241, National Archives, Suitland, MD. George Mee, a recently arrived 34 year old, illiterate, immigrant artisan to Portsmouth, New Hampshire, may be the person of that name born in 1815 at Loughborough, who married Eliza Cooper there in 1843. His 'brother' John Mee was four years younger is hard to identify, but in 1850 his wife was 28 and they had three English born children between 1841 and 1846.

2. See Richard W. Sulloway, "New Hampshire's Part in the Evolution of Modern Knitting Machinery," *Historicial New Hampshire*, XII (Dec. 1956): 3-17; Milton N. Grass, *History of Hosiery*. [NY]: Fairchild Publications, Inc., 1955: 202-205.

3. Peta Lewis, "William Lee's Stocking Frame: Technical Evolution and Economic Viability 1589-1750," *Textile History*, 17: 2 (1986): 129-148; "The Stocking Weaver," in *The Book of English Trades*, London: 1827 ed.: 311-15, reprint Peter Stockham, ed. as *Early American Crafts and Trades; Old-Time Crafts and Trades*; and *Early Nineteenth-Century Crafts and Trades*, Dover Press, 1992; Rev. Isaac Taylor, *Scenes of Wealth or Views and Illustrations of Trades -- Manufactures -- Produce and Commerce*, Hartford, CT: Oliver B. Cooke, 1826: 107.

4. William Felkin, *A History of the Machine-Wrought Hosiery and Lace Manufactures*. (1867) reprint ed. with new preface by Gordon Hanes, NY: Burt Franklin for American Society of Knitting Technologists, 1967: 48.

5. Stanley D. Chapman, "Enterprise and Innovation in the British Hosiery Industry, 1750-1850," *Textile History*. 5 (Oct. 1974): 14-37; "Hosiery Manufacture," *Knight's Cyclopaedia of the Industry of All Nations*, London: Charles Knight, 1851: 1034; also see *Four Centuries of Machine Knitting*. John Millington and Stanley Chapman, eds. Leicester: Knitting International, 1989.

6. Nancy Grey Osterud, "Gender Division and the Organization of Work in the Leicester Hosiery Industry," in *Unequal Opportunity: Women's Employment in England, 1800 - 1918*. Angela Johns, ed., London: Basil Blackwell, 1986. For gender organization of the industry elsewhere, see Evelyn Gibson Nelson, "The Putting-out System in the English Framework-Knitting Industry," *Economic and Business History* 2 (1930): 467-94; Sonya O. Rose, "Proto-industry, Women's Work and the Household Economy in the Transition to Industrial Capitalism," *Journal of Family History* 13: 2 (1988): 181-194; Sonya O. Rose, "Gender Segregation in the Transition to the Factory: the English Hosiery Industry, 1850-1910," *Feminist Studies* 13: 1(Spring 1987): 163-184.

7. Tench Coxe, "Manufactures" 1813, and "Digest of Manufactures" 1814 [based on 1810 US Mfg. Census] *American State Papers, Finance II*, (series vol VI,

Washington: Gales & Seaton: 1832) : 427, 671; Felkin, *History of Machine-Wrought Hosiery*: 463-71; W.H.G. Armytage "A.J. Mundella and the hosiery industry," *Economic History Review*, 18 (1948): 91-99. For one description of frame rent and the poverty of framework knitters see *The Life of Thomas Cooper*, reprint ed. with introduction by John Saville, NY: Humanities Press, Leicester University Press, 1971: 133-43.

8. Milton N. Grass, *History of Hosiery*. [NY]: Fairchild Publications, Inc., 1955. Grass cites Frances M. Caulkins, *History of Norwich, Connecticut*, Norwich: Thomas Robinson, 1845 for evidence of the Leffingwell frames. "Knitting by Machine," *The* [Old Slater Mill] *Flyer*, 2:8 (Aug. 1971) 6; Anthony F. C. Wallace and David J. Jeremy. "William Pollard and the Arkwright Patent." *William & Mary Quarterly*, 3rd ser., XXXIV, 3 (July 1977): 404 - 425.

9. John Bazin Jr., Reconstructed US Patents, Oct. 28, 1814, 3: 311; "State of the Nottingham Trade in America," *Nottingham Review*, July 23, 1830; F.J. Oliver, Boston, to Augustine Heard, Canton, China, Oct. 1, 1834, Heard I Collection: QM-2-3, Baker Library, Harvard Business School, Boston, MA. Bazin had already traveled to the English Midlands in 1826 to recruit framework knitters and lacemakers for the Ipswich lace factory. Benjamin Fewkes to M. Rudkin, Quordon, Leicestershire, undated mss written after Bazin's return after July 1826 and before Feb. 1827, Benjamin Fewkes Papers, Darling Papers, Ipswich Archives, Ipswich Public Library.

The next American rotary knitting machine was that of two Pennsylvania inventors who won an 1835 premium from the Franklin Institute for a small hand-powered machine, U.S. Patent #126 1/2, McMullen and Hollen, Feb. 11, 1837. John McMullen and Joseph Hollen, Jr., licensed its manufacture and use in several parts of the country. "Incorporating Knitting" *New England Farmer and Gardener's Journal*, Jan. 27, 1836 : 229 cited in Anne L. Macdonald, pp. 50-1 opposed to "a man's company to do all the knitting in the state." This did not stop the incorporation of the New England Knitting Machine Company to sell and make "McMullen and Hollen's Patent Knitting Machine," and manufacture hosiery and other knit work in Boston; *MA Special Acts*, 1836, ch. 148. Their "Patent Knitter" was "turned by a small crank" and knit 400 stitches a minute; "A child of eight years old is capable of understanding and operating on it, and can produce . . . Hosiery, such as gloves Mittens, Socks, Stockings Shirts, Drawers, &c." 1838 broadsheet in Ira Joseph Haskell, *Hosiery Through the Years*. Lynn, MA: Carole Mailing Service, [1956] facing p. 22.

10. Felkin, *A History of the Machine-wrough Hosiery* : 490-93; John Chamberlain, *Manufacture of Knitted Footwear*. Leicester: Alfred Tacey, 1930: 8-10; Glass, *History of Hosiery*, 196-7. For a detailed discussion of international developments in the rotary frame see Gustav Willkomm, *Technology of framework knitting for technical schools and self-instruction*. Trans. by W.T. Rowlett. Leicester: F. Hewett, [1884-85]: 138-141, 242-90.

11. Willkomm, *Technology of framework knitting*, 94-130, 300-312.

12. Felkin, *A History of the Machine-wrough Hosiery* : 543; he thought Wilde 'the inventor from New York.'. Whitworth was granted an 1848 American patent in his own name for an improved version of the earlier machine. US Patent # 5,432 to J. Whitworth, Feb. 1, 1848. Whether Wilde was American, or simply an Englishman who took advantage of British patent law allowing him to patent foreign inventions is unknown. In America Arasmus French was granted a US patent (#2493) on 18 March 1842 for such a knitting machine improving the 1840 endless belt single-stitch invention of Benjamin Hutchinson (#1834) of Springfield, Massachussets. French was living in the same city when he patented his machine two years later. While both held their needles perpendicular to the belt, Rufus Ellis, formerly of nearby Northampton, in 1851 patented (#8,163) an arrangement of needles vertically, but its earlier date is evidenced by his prioir assignment to William M. Chase as early as 1837.

13. Felkin, *A History of the Machine-wrough Hosiery* : 496-500, 511-12, 519-543. For the differences of American and English technology, see John Henry Quilter and John Chamberlain. *Framework Knitting and Hosiery Manufactur*, Leicester: "Hosiery Trade Journal" Office, 1911-14, 2: 1-19.

For German changes see Karin Zachmann, "Die sachsische Strumpfwirkerei in Spannungsfeld von Tradition und Anpassung. Eine Falluntersuchung zur Modernisierung vorindustrieller Gewerbelandschaften in 19, Jahrhundert"offprint from *Neus Archiv für sachsische Geschichte*, 64. Band 1993, Weimar: Verlag Herman Bohlaus Nachfolger, 1994. Zachmann's paper "The Transformation of of Preindustrial Modes of Production : a Case Study on the Development of Machine Labor in the Knitting Industry" (typescript, 1991) compares German production with circular frames with British manufacture at mid-century. According to the 1870 census there were some 2500 knitting machines of all types in New England factories alone.

14. S. N. Dexter North, "American Textile Mills," in *One Hundred Years of American Commerce*, Chauncey M. Depew, ed., New York: D.O. Haynes & Co., 1895, 2: 483.

15. Portsmouth handframes include 61 in one factory noted in John Hayward, *A Gazetteer of New Hampshire* (Boston: 1849): 119, plus 15 in a failed second mill, some of the latter may have been among the "40 weavers who work their Frames at home" or in small handshops noted in the 1851 *Portsmouth Directory*: 187. This replicates estimates of some 107 frames (based on male workers) among a dozen of the 17 Germantown frameshops in Philip Scranton, *Proprietary Capitalism: The textile manufacture at Philadelphia, 1800-1885*. Cambridge: Cambridge Univ. Press, 1983: 227-231.

16. Albany County *Business Directory* and Troy city directories 1850-1860; *Scientific American* 3 (Jan. 25, 1848): 17; William R. Bagnall, "Sketches of Manufacturing Establishments in New York City, and of Textile Establishments in the Eastern

States,"(1880-1890) edited by Victor S. Clark 1908, v. 2: 1290-98; 1309-10, microfilm at Old Sturbridge Village Research Library. For the impact of tariffs, see "The Knit-Goods Industry and the Tariff," *Bulletin of the National Association of Wool Manufactureres*, 11 (1881): 62-72.

17. Scranton, *Proprietary Capitalism*: 140-41, 224-36; Edwin T. Freedley, Philadelphia and its Manufacturers, Philadelphia: Edwin Young, 1859: 241-42, 254-5.

18. *Abstract of the Statistics of Manufactures of the United States in the Seventh Census* (1850). Joseph C.G. Kennedy, compiler, Ex. Doc. 39, 35th Congress, 2nd Session. Washington: 1851: 61. *Manufactures of the United States in 1860; compiled from the original returns of the Eight Census*. Washington: Government Printing Office, 1865 : xlv. Bulletin of the National Association of Wool Manufacturers, edited by John L. Hayes. Boston: for the Association, 1873: 474. The failure of census takers to list hosiery production as a category before 1870 make a definative list in earlier decades hard to confirm. I have used manuscript sales records of J. B. Aiken's Knitting Machine Company (1859-1867) and *The New England Mercnatile Business Directory* (Boston: 1849), the *Vermont Business Directory* (1856 and 1860) and local histories to supplement 1850 and 1860 census records. Frames continued to be used in Manchester, Portsmouth, and Laconia, NH as well as Ipswich and Needham, MA, all towns where English and German framework knitters settled. For patents I have used the appendix listing all knitting patent in Wehle, The United States Knitting Industry. Unfortunately, her 1991 list of assignments is inaccurate and I have relied on the original Patent Office records.

19. "State of the Notttingham Trade in America," *Nottingham Review*, July 23, 1830.

20. "State of the Notttingham Trade in America," *Nottingham Review*, July 23, 1830; Newburyport factory also see, Acts of Massachusetts 1824-5, ch. 88; Acts 1828-9 ch. 50; "NEWBURYPORT STOCKING FACTORY," *NY Journal of Commerce*, Aug. 8, 1829; advertisement, "VALUABLE SALE," *Newburyport Herald*, Ap. 15, 1834.

21. Personal Property Mortgages, City Clerks Office, Portsmouth, NH, City Hall, mss. 1(1832): 1; advertisements, *Portsmouth Journal*, Sept. 28, 1833; April 20 - July 27, 1833; and May 25 thru Nov 23, 1833; Advertisement, 1834 *PortsmouthDirectory* : 98 and alphabetical listings: Robert Johnson, living at his State Street domestic 'factory,' Samuel Dunham, George Gadd, Charles Glazebrook, John Jenkinson, Francis Jarvis and John Masling worked there and boarded or rented houses in town. For Charles H. Gould, see his mss deposition Nov. 11, 1852, Marshal vs Mee, RG 241, National Archives, Washington, DC; John L. Hayes, "Protection A Boon to Consumers" (Boston: 1867): 10 reprinted in *Memoirs Relating to the Wool Industry* (Boston: 1872) erroniously stated the forst stocking knit in Portsmouth was in 1834 by Daniel Pepper; "State of the Nottingham Trade in America," *Nottingham Review*, July 23, 1830.

22. Crane geneaology in *Centennial History of the Town of Millbury, Massachusetts*, Millbury, The Town, 1915: 538-541; "Father works for Portsmouth," Jesse Fewkes (Ipswich) to Henry & Edwin Fewkes (Newton), Feb. 20, 1837, Jesse Fewkes Collection, Jackson Homestead Museum, Newton, MA. Three Gadd family knitters moved from Ipswich to Portsmouth by 1837 and both Daniel Pepper and Henry Fewkes married Portsmouth women.

23. *Portmouth Journal*, 29 Aug. 1837: 2; "Report, Portsmouth Manuf& Compy....to value the real Estate, Steam Engine, Water power, & other personal property now on the land where the building for manufacturing lately stood," May 22, 1837 Wendell Mss, Baker Library, Harvard Business School, Boston, MA, case 14, folder, Misc. 1804-1864; Hayes, "Protection A Boon to Consumers": 10. These 51 frames were rebuilt and remained the same in number through 1844, cf. Hosea Crane to A.W. Haven, D.R. Rogers, I. Goodwin, *Personal Property Mortgages*, Portsmouth, City Clerk's vault, vol. 1841-45: page 312-314 (1844).

24. *Portsmouth Journal*, Dec. 22, 1838; *Portsmouth Directory*, Portsmouth: 1839: 167-8; Andrew Preston Peabody, *The Wealth, Industry, and Resources of Portsmouth: Lecture at the Portsmouth Lyceum Nov. 12, 1844.* Portsmouth: 1844.

25. Hayes, "Protection A Boon to Consumers": 9-11; Hosea Crane to A.W. Haven, D.R. Rogers and I. Goodwin, Personal Property Morgages (1844) 3: 312-14. For an extended discussion of the later industry, see Ruth J. Woodruff, "The American hosiery industry from 1873 to 1895, with special reference to the downward trend of prices." *Journal of Economic and Business History*. vol. 4: 1 (Nov. 1931): 18.

26. *The Second Exhibition of the Massachusetts Charitable Mechanics Association at Quincy Hall... Septembr 23, 1839* (Boston: Isaac R. Butts, 1839): 39, 55-6; Two years later the Portsmouth factory won a diploma for its hosiery, while Charles Warren won another for woolen yarn. See *The Third Exhibition of the Massachusetts Charitable Mechanics Association at Quincy Hall... Septembr 20, 1841* (Boston: T. R. Marvin, 1841): 57; the only other Portsmouth entry in 1841 was a group of shirts and drawers by one T. Hunt, an independent framework knitter.

27. "Large Stocking," *Portsmouth Journal*, 10 Sept. 1842: 2.

28. John L. Hayes, "Protection A Boon to Consumers" (1867): 9.

29. Haskell, *Hosiery Through the Years*: 48 and Grass, *History of Hosiery*: 202 mistakenly call Walker the owner of the Portsmouth hosiery factory, and Haskell mistakes the 'rotary' for a 'circular' knitting machine rather than the powered straight bar type it was. Mss insurance policy to Charles Warren & Co., Hosea Crane Agent, Sept 16, 1847, Wendell collection, Portsmouth Athenæum.

30. "The Old Warehouse" *Ports. Morning Chronicle*, May 2, 1860; Portsmouth Iron Foundry to Ichabod Rollins, July 27, 1839, Rockingham County Deeds, 294: 363-4;

Portsmouth Directory, 1834; advertisements *Portsmouth Journal*, August 4, 1832, June 7, 1836, and Oct. 1, 1836.

31. Richard Walker to Geo. Huntress Jr., Feb. 23, 1839, U.S. National Archives, Patent Assignments, Liber C: 297; Huntress Jr. to Walker, May 11, 1839, Patent Assignments, Liber E: 181; U.S. Patent # 1421 5 Dec. 1839 to Richard Walker of Portsmouth, mss specifications and drawings, New Hampshire Historical Society, Concord, New Hampshire; advertisement, "Franklin Machine Shop," *Portsmouth Journal*, April 20, 1839.

32. Sept 1839 *The Second Exhibition of the Massachusetts Charitable Mechanics Assoc. at Quincy Hall Septembr 23, 1839* (Boston: Isaac R. Butts, 1839): 10. When the *Journal of the Franklin Institute* New Ser. vol. 1 (1841): 98 reviewed the invention, the editor also noted "an attempt is made, and we think not without success, to give the machine greater simplicity without sacrificing any of its good qualities." For later improvements see US patent # 1421, Dec. 5 , 1839 to Richard Walker for rotary knitting machine and #3436, Feb. 12, 1844 to Richard Walker & Jefferson McIntire of Portsmouth for improvements.

33. "Rotary Power Stocking Loom," *New Hampshire Gazette*, January 7, 1840; U.S. Patent # 1421 Dec. 5, 1839.

34. Walker to McIntire, Patent Assignments, Liber E: 181-82;Walker and McIntire to Arther and William P. Eastman, Aug. 13, 1841, Patent Assignments, Liber G: 386; Eastmans to Woodbury, Nov. 15, 1841, Liber I: 140; Eastmans to Bradford, Dec. 27, 1841, Liber I: 215-16; *Massachussetts Acts of 1845*, ch. 18, Incorporation of Essex Hosiery Co. Jan 29, 1845; J.W. Hanson, *History of the Town of Danvers*. Danvers: Author, 1848: 131. A full list of Walker's assignments forms an appendix to *The Essex Hosiery Company vs. The Dorr Manufacturing Company*, Circuit Court of the United States, Boston: S.N. Dickenson & Co., 1845: 8.

35. *The Third Exhibition of the Massachusetts Charitable Mechanics Association at Quincy Hall... Septembr 20, 1841* (Boston: T. R. Marvin, 1841): 22.

36. Richard Walker MSS patent assignment to Watson and Austin, August 19, 1840, New Hampshire Historical Society, Concord, NH; British Patent # 8719, Nov. 25, 1840, to Oliver Louis Reynolds; U.S. Patent # 3436 to Richard Walker & Jefferson McIntire, Feb. 12, 1844.

37. *The Essex Hosiery Company vs. The Dorr Manufacturing Company*, 1845 and mss Massachusetts Federal Circuit Court records, October 1848, Federal Record Center, Waltham, MA. If the Essex bought the 'improved' machines demonstrated in 1841, they may have believed those improvements were covered in Walker's first patent rather than the second.

38. John L. Hayes, "Protection A Boon to Consumers" (1867): 9; "Hosiery Manufacture," *Portsmouth Journal*, Aug. 12, 1854; Portsmouth Steam Factory to Hosea Crane Jan. 9, 1844, Rockingham Deeds 312: 371-72; J. G. Crane to Haven, Rogers and Goodwin, Personal Property Morgages (1844) 3: 312-14; heirs of John H. Sheafe, Andrew W. Bell, Ichabod Rollins, Samuel Hale to J. G. Crane Sept. 2, 1844, Rockingham Co. Deeds 314: 340, 341, 342, 343; mortgage Crane to Sheafe and Emery, Deeds 314: 173; "Home Operations. Raising the Steam in Portsmouth," *Portsmouth Journal*, Oct. 18, 1845; Jasper G. Crane, to Hiram Parker of Lowell, Dec. 31, 1846, Personal Property Mortgages 1845-49, 3: 167-68.

39. Agreement between Hosea Crane, James W. Emery, and all the creditors of Hosea Crane, Jan. 13, 1846, Rockingham Deeds 326:35-6; Company to H. Crane June 16, 1847, Deed 325: 344, quitclaimed to C. Warren June 17, 1847 by Crane Trustee J.W. Emery, 326: 224. The 1847 *Boston Directory* listed C. Warren & Co. on Water Street as "Importers & Jobbers," but from 1848-55 as Charles Warren & Co.(H. G. Sanford) as "manufacturers and wholesaler, dealers in hosiery, gloves, drawers, shawls, and crevats. Also woollen, knitting, and weaving yarns, &tc."; Mss insurance policy, Charles Warren & Co., H. Crane agent, Sept 16, 1847, Wendell collection, Portsmouth Athenaeum.

40. Insurance policy, Sept. 16, 1847; "Plan of Portsmouth Hosiery Company," (also called 'Ground Plan of the Rockingham Steam Mills') ca. 1850; Jacob Wendell, "Industry" 1848 MSS text for Hayward's 1849 *Gazetteer of NH*, all in Wendell collection, Portsmouth Atheaeum.

41. Mss deposition of Charles H. Gould, Nov. 11 1852, Marshall vs Mee (1852), Patent Office Interference Case, National Archives, Suitland, MD. See Felkin, *History of Machine Wrought Lace and Hosiery* : 543 for a single stitch knitting machine introduced in England about 1834 by Joseph Whitworth and John Wilde in Manchester, England, and U.S. Patent # 5,432 to J. Whitworth, Manchester, England Feb. 1, 1848 for a description of Whitworth and Wilde's system; Hayes, "Protection A Boon to Consumers" (1867): 9.

42. " Important Invention," *Portsmouth Journal*, 28 Aug. 1847: 2.

43. *The Fifth Exhibition of the Massachusetts Charitable Mechanics Association at Fanueil and Quincy Halls...September 1847* (Boston: Dutton & Wentworth, 1848): 89.

44. J. G. Crane, to H.Parker, Dec. 31, 1846, Personal Property Mortgages 1845-49, 3: 167-68; Alfred W. Haven mss ledger, Portsmouth Athenaeum: 52; U.S. Patent # 7945, John Pepper, Improvement in Knitting Machines, Feb. 25, 1851, assignor to C. Warren and H. G. Sanford (June 4, 1848) from an application Sept. 16, 1848.

45. C. H. Gould deposition, Nov. 11 1852, Marshall vs Mee (1852); "NEW AND VERY IMPORTANT IMPROVEMENT IN HOSIERY WEAVING," *Portsmouth Journal*, 7 July 1849: 3

46. "Tiffany & Cooper, Builders of Flat Rib Knitting Machinery," advertising broadsheet, Bennington, VT: [ca. 1870?], Vermont Historical Society; for Europe see Felkin, *The History of Machine Wrought Hosiery*: 507 and Zachmann, "Transformation of of Preindustrial Modes of Production (1991).

47. Belevue Hosiery Manufacturing Co. incorporation, July 9, 1846, *NH Laws* 38:123; 'STOCKING FACTORY" *Dover Telegraph*, April 1, 1847; 1850 Manufacturing Census, Dover, New Hampshire; William R. Bagnall, "Sketches of Manufacturing Establishments in New York City, and of Textile Establishments in the Eastern States," (1880-1890), Edited by Victor S. Clark [Washinton, DC]: 1908, 4: 1205 microfilm, Old Sturbridge Village Research Library. Reynolds also patented an 1850 sewing machine with an "adaptation of the bearded needle, such as is used in knitting or stocking frames, in combination with the manner of closing the beard or hook previous to drawing it back with the thread to prevent the point tearing the cloth." He died in 1862 still owning one model sewing machine, a model knitting machine, and "9 Knitting Machine Benches" worth only $27. Oliver Reynolds sewing machine, May 14, 1850, U.S. Patent # 7,369; O.L.Reynold 1862 Strafford Co. Probate #2034.

48. "NEW AND VERY IMPORTANT IMPROVEMENT," *Portsmouth Journal*, 7 July 1849: 3; U.S. Patent # 8172, June 24, 1851, to John Pepper of Portsmouth assignor to Crane, Pepper, & Crane described as "a Machine for Knitting Hosiery, called the Double Acting Knitting-Machine."; Daniel Pepper to John Pepper, 1849, Rockingham Deeds 340:387 and J. F. Sheafe to John Pepper, May 1850, 340:388.

49. Hosea Crane deposition, Dec. 10, 1851 and Jasper Crane deposition, Dec. 16, 1851, Marshall vs. Mee, Rourke, & McKennon (1852).

50. The *Lowell Directory*, 1851, lists Jasper Crane as a boarder at the Washington House; Haven Ledger, p. 266; *Centennial History of the Town of Millbury, Massachusetts*, Millbury: The Town, 1915 : 421.

51. "Improvement in Knitting Looms" *Scientific American* 1 Sept. 1849: 396; Warren & Co. to Rockingham Steam Mills, Nov. 1, 1849, Rockingham Deeds, 337: 354; *Journal of the Senate and House of Representatives*, Concord, NH: State Printers, 1849: 214,220; New Hampshire *Acts*, 42: 81; *Portsmouth Directory*, 1851: 187. Court judgements for unpaid debts plaqued both Warren & Co. and the new corporation; see Rockingham Superior Court cases #1636 (Joseph Robinson vs Warren & Co) and #1630-1532 (various local creditors vs PHC). Five large Boston commercial creditors forced the indenture between Portsmouth Hosiery Co. (formerly Rockingham Steam Mills) and James Emery Esq., of Portsmouth, John Nesmith of Lowell, and Walter Hastings of Charlestown, MA, November 23, 1850, Rockingham *Deeds* 343: 79-80.

52. Advertisement "Assignee's Sale" *Portsmouth Journal*: Jan. 18, 1851: 3 for an auction Tuesday, March 25, 1851, postponed on March 22 to April 8th and on April 5 to April 12, 1851.

53. Attachment, Tully D. Bowen vs Portsmouth Hosiery Co, Rockingham Superior Court, case #2002; Assignees to Tully D. Bowen, May 1, 1851, Rockingham Deed 353: 49 ; Bowen to Nesmith, Greenleaf and H. Hastings, Oct. 22, 1852, Deed 353: 50; Nesmith, Greenleaf & H. Hastings to Franklin Mills, Dec. 28, 1852, Deed 353:177

54. Portsmouth Tax Records, 1850-1860, Portsmouth Public Library; *The Portsmouth Guide Book*, Portsmouth: Joseph H. Foster, , 1876: 29; Hayes, "Protection A Boon to Consumers": 9; "Real Estate for Sale," *Portsmouth Morning Chronicle*, Nov. 19, 1852 through June, 16,1853; "Preemptry Sale of Valuable Real Estate at Auction," Portsmouth Morning Chronicle, June 18, 1853: 3; "Real Estate Sale," July 18, 1853: 2. J. Brugger & Son (Sebastian Christophe), bankruptcy case # 767 (1876), National Archives and Record Center, Waltham, MA identifies Brugger was from Bremen, a painting of Brugger is in the collections of the Manchester (NH) Historic Association says his birthplace was Berne; 1850 U.S. census, Portsmouth, NH. ; 1851- 54 John Brugger worked in the Manchester print works before he and his son formed a hosiery company in 1861 using both Pepper and Aiken machines. Solomon Fisher, one of four German-born brothers, lived at the Franklin House before leaving for New York City by 1861. Charles Warren left Boston by 1857 (perhaps for Germantown) and J. B. Aiken wrote him September 1859 at NYC, asking if he thought it profitable "to knit my ribbed stockings footed on hand looms– and if you know of hand weavers that you can employ to do it? Aiken to Warren, Letterbook I: 318. For issues of waterpower control that surrounded Nesmith's formation of the Franklin Mills, also see Theodore Steinberg, *Nature Incorporated: Industrialization and the waters of New England*, Cambridge & NY: Cambridge University Press, 1991.

55. *Portsmouth Directory ...1851*: 187; "William H. Pepper," *Biographical Review vol. XXI containing life sketches of leading citizens of Strafford and Belknap Counties, NH*. Boston: Biographical Review Co., 1897: 419-20. Besides the factory operatives and domestic English and German framework knitters, there were "175 to 200 females in addition to the foregoing, living in the city and neighboring towns, are employed in seaming &c for the Factory, at their places of abode." Those in Portsmouth's 1850 U.S. Census are located on the map at addresses in the 1851 city directory.

56. Carolyn C. Cooper, "Making Inventions Patent," and "Social Construction of Invention through Patent Management: Thomas Blanchard's Woodworking Machinery." *Technology & Culture* 32 (Oct. 1991): 837-845, 960-998. For efforts to change the definition of invention through law see Robert C. Post, " 'Liberalizers' versus 'Scientific Men' in the Antebellum Patent Office," *Technology and Culture*, 17 (1976): 24-54.

57. "Deposition of John Pepper of Portsmouth. . . Machinist," Dec. 10, 1851, Marshall vs. Mee, Rourke, & McKennon (1852).

58. Deposition of Hosea Crane for Moses Marshall Dec. 10, 1851, Marshall vs. Mee, Rourke, & McKennon (1852).

59. Deposition of Benjamin D. Wallis of Lowell for John Mee, Dec. 3, 1851, Marshall vs. Mee, Rourke, & McKennon (1852).

60. J. G. Crane deposition, Dec. 16, 1851, Marshall vs. Mee, Rourke, & McKennon (1852).

61. Deposition of Samuel Adams of Lowell, Dec. 3, 1851, Marshall vs. Mee, Rourke, & McKennon (1852).

62. Deposition of Geo. F. Butterfield of Lowell, Dec. 12, 1851, Marshall vs. Mee, Rourke, & McKennon (1852).

63. John Pepper deposition, Dec. 10, 1851, Marshall vs. Mee, Rourke, & McKennon (1852); Patent assignment, Pepper to Hosea & Jasper G. Crane of Portsmouth & Hiram Parker of Lowell, Dec. 2, 1850, Patent Assignments, Liber G-2: 172. Parker provided a a mortgage loan to Jasper Crane in 1846 and their continued involvement explains the Lowell physician's 1852 testimony that "I have been concerned in knitting power looms for three or four years." Parker deposition, Nov. 11, 1852, Marshall vs Mee. Crane tried to hide his insider trading, testifying about his offer of Warren's third: "What I meant by that was that Charles Warren would have no claim and Marshall could take his place and be our third interested in the new loom."

64. Pepper deposition for John Mee, Dec. 10, 1851, Marshall vs. Mee, Rourke, & McKennon (1852).

65. "First Argument of Patent Office" S. H. Hodge to Judge James Dunlop, Feb. 28, 1853; R. H. Eddy to Thomas Eubank Esq. Commissioner of Patents Oct. 25, 1851, Marshall vs. Mee, Rourke, & McKennon (1852). By 1856 John Rourke moved to Gilmanton, NH.

66. Deposition of [Dr.] Hiram Parker of Lowell, Nov. 11, 1852 in Marshall vs Mee (1852).

67. US Patent Assignment, J. & H. Crane to Lucius Mellen, Alonzo N. Mellon & Chas. G. McGowen all of Elbridge, NY, Sept. 26, 1851, Liber N-2: 304-5; The date of Marshall's application is found in the "First Argument of the Patent Office," Marshall vs. Mee, Rourke, & McKennon (1852), file #25.

68. "First Argument of Patent Office" Hodge to Dunlop, Feb. 28, 1853; Thomas Eubank Jan 12, 1852; Ezra Lincoln, Feb. 1852, Marshall vs. Mee, Rourke, & McKennon (1852).

69. "First Argument of Patent Office" Hodge to Dunlop, Feb. 28, 1853, Marshall vs. Mee, Rourke, & McKennon (1852).

70. Brief of Mr. R.H. Gillet, Counsel for Moses Marshall appeal, opening argument, March 7, 1853, Marshall vs. Mee, Rourke, & McKennon (1852).

71. Judge J. Dunlop decision Marshall vs. Mee, Rourke, & McKennon, *Reports of Cases arising from Applications for Letters-Patent for Invention, Determined in the Circuit and Supreme Courts of the District of Columbia*, Frank MacArthur, ed. Washington, DC: William H. Morrison, 1885, vol 1: 229-238.

72. *Amherst Express*, July 25, 1852; *Daily Hampshire Gazette*, Oct. 25, 1853; "*GREAT FIRE*," *Hampshire & Franklin Express*, Nov. 10 1854; John Mee, 1855 Millbury, MA census, microfilm, Massachusetts Archives, Boston; Mee, Rourke, McKennon & Woodbury to Asa Waters of Millbury & Asa Abbott of Bennington, VT, June 27, 1856, Patent Assignments, Liber C-4 : 89; Abbott (through attorney John Tenny) to Lorenzo D, Millard, Liber G-4: 237 and Millard to Waters, April 11, 1857, Liber N-4: 14; US Manufacturing Census, 1860, Millbury, MA, Massachusetts Archives.

73. Commissioner of Patents to Marshall, Marshall vs. Mee (1852); U.S. Patents #9621 and 9626, to Moses Marshall, March 15, 1853; illustrated in *The Annual Report of the Commissioner of Patents for 1853*, Washington: 1854: 154. Marshall to Lamb, March 16, 1867, Patent Assignments, Liber S-10: 425-427.

74. *Walter Aiken vs. Thomas Dolan. Bill, Answers and Complainant's Proofs. In The United States Circuit Court, Eastern District of Pennsylvania, In Equity. No. 15 April Session, 1866.* Philadelphia: E. C. Markey & Sons, 1866: 102-117; U. S. Patent # 8262, to John Henry Barsantee of Portsmouth July 29, 1851. Barzantee criticized Pepper's and other knitting machines: "I am aware that rotary knitting machines have been constructed having needles rise and fall simultaneously and having their points closed or depressed by a fixed ring and also using a separate thread for each needle, but such machines...have only been capable of producing coarse and loose work." He claimed a pair of radial style needle cylinders with bearded needles fixed in a single block of pewter cast on their stems & a yarn carrier with separate threads to each needle so a whole circular row knit at one time. U.S. Patent # 10980 John H. Barsantee "of Philadelphia" May 30, 1854, a latch needle circular knitting machine.

75. John Pepper to Horatio G. Sanford, March 1, 1850, and Sanford to Thomas A. Clark, Oct. 7, 1851, Patent Assignments, Liber S-2: 248-49. After the factory closed, in May 1852 Sanford applied for a patent from Worcester, Massachusetts, on a stop motion for the French (or endless chain) rotary knitting machine. This he pre-assigned to machinist John Firth and Thomas A. Clark of Worcester. U.S. Patent

#9434, to H. G. Sanford, Nov. 30, 1852 (patent application May 12, 1852, Aiken Collection, New Hampshire Historical Society); Sanford to Clark and John Firth, Jan 22, 1852, Liber V-2: 270; the assignees transfered their rights with another related improvement by Daniel Tainter of Worcester (#9435), see Tompkins vs Gage (1865), 24 Fed. Cas. 35-37. Leaving the partnership and mill, Sanford was of Worcester when his patent was granted in 1853. That year he leased a mill in nearby North Oxford, where Portsmouth stocking weaver Charles Gould worked, and manufactured knit goods and stockinetts. George F. Daniels, *History of the Town of Oxford, Massachusetts*. Oxford: Author, 1892: 204

76. U.S. Patent # 7,509 to Joseph Hollen, July 16, 1850, assigned to Nesmith, reissued Ap. 10, 1866 & extended, assigned to Pepper Knitting Machine Co. Feb. 24, 1869, Liber C-13: 408; John Pepper of Portsmouth and Henry Marchant, Feb. 28, 1852, Patent Assignments, Liber T-2: 426; U.S. Patent # 12,049, Dec. 5, 1854 to John Pepper (Junior) assignor to the Franklin Mills, Nov. 16, 1852, Liber S-2: 397.

77. For Enfield, Connecticut in 1846, see *Fifth Annual Report of the American Institute* (Albany: C. Van Benthuysen & Co., 1847): 169. At Cohoes "about 1850 the Bailey Company began to use a power knitting machine for underwear, the first in this country. It was a circular spring needle machine and produced flat goods." Wm. H. Carter "History of the Knitting Business," typescript Jan. 8, 1936, Needham, Historical Society, Needham, Massachusetts; British Patent, 1852 # 817 to John Pepper Jr. of Portsmouth, N.H.; final specifications dated Feb. 2, 1853 (with Henry Hastings, witness) and approved May 5, 1853. Pepper bought back his American patent in 1863 and re-issued it with even broader claims; U.S. Patent Reissue #1555, Oct. 27, 1863.

78. Deposition of Walter Aiken, *Aiken vs Dolen*: 146-49; other associations with Pepper can be seen in the Aiken's machine shop accounts of 1853-54 and January 1856 with "John Pepper Jr.", Ledger, Aiken Family Papers, New Hampshire Historical Society. Evidence of the migration from Portsmouth is suggested by the names associated with Pepper in later years who disappear from the Portsmouth tax lists between 1852 and 1853. Mss Portsmouth Tax List 1852-53, Portsmouth Public Library.

79. Pepper to Walter Aiken, July 27, 1856, Patent Assignments, Liber S-3: 397 and Merchant to Marchant jr., Liber B-5: 103; Walter Aiken mss agreement with Henry Marchant Jr., Oct. 9, 1856, Aiken Family Papers, NH Historical Society; Also see Sulloway, "New Hampshire's Part," 11-16 and George A. Parsons, "The Knitting Machine Needle Industry in New Hampshire," *Historical New Hampshire*. XII (Dec. 1956): 18-25.

80. U.S. Patent #13289, July 17, 1855, John Pepper assignor to Franklin Mills; British Patent, 1855 # 1707 to Charles Hodges of Manchester, July 27,1855 , sealed Jan. 25, 1856 (Hodges also bought Aiken's patents in England, see J. B. Aiken to Robert Froelich, Sept. 3, 1861, Letterbook 3: 200) British Patent (1855 #2893), Dec. 21, 1855 to

Charles Appleton of Manchester. Pepper designed in the American system of moving cams, but Appleton's specifications note the same design could be modified for the English preference for a revolving needle cylinder. For home knitters see Kathleen Kinder, "400 Years of Domestic Machine Knitting," in *Four Centuries of Machine Knitting*. John Millington and Stanley Chapman, eds. Leicester: Knitting International, 1989: 38-57 and Richard Candee, 1994 typescript, "Inventing the Machine/ Promoting the Invention: the 'Family Knitting Machine' and the Sewing Machine Enter the Victorian Home," projected for *Getting the Goods*, Shirley T. Wajda, ed., Washington, DC: Smithsonian Press, forthcoming.

81. "Plan of Premises of Woolen Hosiery Mill," undated [c. 1853]; "Woolen Hosiery Mill" plan June 13, 1854; "SALE THIS DAY," *Portsmouth Journal* August 24, 1850: 3; *Portsmouth Directory;* R. G. Dun Collection, 16: 99, 104, Baker Library, Harvard Business School, Boston, MA; *The Seventh Exhibition of the Massachusetts Charitable Mechanics Association at Fanueil and Quincy Halls...September 1853* (Boston: Damrell and Moore & Geo. Coolidge, 1853): 3;"Hosiery Manufacture," *Portsmouth Morning Chronicle*, April 18, 1853:2; "The Hosiery Looms," *Morning Chronicle*, April 20, 1853: 2; advertisement, *Morning Chronicle*, Dec. 12, 1853: 3. For comparison with German hosiery production methods see Zachmann,'The Transformation of of Preindustrial Modes of Production : a Case Study on the Development of Machine Labor in the Knitting Industry" (typescript, 1991).

82. Protective Fire Insurance Co. Survey, Policy #240, "Portsmouth Hosiery Mill, Bow Street," Wendell Mss Collection, box 9, folder 12, Portsmouth Athenæum, Wendell Mss Collection, Portsmouth Athenæum; advertisement, "Portsmouth Sugar House" *Columbian Centinal* , Sept. 20, 1826. I want to thank Jane Nylander for showing me this Boston newspaper advertisement.

83. "Portsmouth Sugar House," *Columbian Centinal*, Sept. 20, 1826; "Portsmouth, N.H. from the Navy Yard, Kittery, Me. 1854" sketched and Lithographed by C. Parsons; "Simon Strauss Agent for the Bow Street Stocking Manufacturing establishment" was taxed in 1854, but not in 1855, in Portsmouth Tax Lists; "Hosiery Manufacture," *Portsmouth Journal*, Aug. 12, 1854: 3.

84. "Hosiery Manufacture," *Portsmouth Journal*, Aug. 12, 1854: 3.

85. Insurance Policy #240, Wendell Collection, Portsmouth Athenaeum; Charles H. Adams, George C. Bosson, and J. R. Scott. *Letter Exhibiting the condition and necessities of the Knit-Goods Manufacture, addressed to Hon. Justin S. Morrill, Chairman of Committee of Ways and Means, May, 1866.* Boston: John Willson & Sons Press, 1866, reprinted in J. L. Hayes, *Memoirs Relating to the Wool Industry* (1872): 7. For comparison with other outwork, see Thomas Dublin, *Transforming Women's Work: New England Lives in the Industrial Revolution*, Ithaca and London: Cornell University Press, 1994: 29-76.

86. "Hosiery Business," [Portsmouth, NH] *Morning Chronicle*, March 25, 1857: 3;

Morning Chronicle, Portsmouth, NH, May 7, 1857: 3.

87. Clark's British Patent 1859 #1197; "New Knitting Machines," *Scientific American*, XIV, 39 (June 4, 1859): 328; Felkin, *The History of Machine Wrought Hosiery*: 507. Aiken's 1859 British patent went to patent agent William S. Clark; he transfered it to Charles Hodges, as told by Jonas B. Aiken to R. H. Atwell, Esq. 7 Nov. 1861, J. B. Aiken Letterbook 3:101, Franklin Public Library, Franklin, NH. Aiken's machine was the subject of a patent application in Saxony by a Mr. von Prittwitz of Berlin on August 31, 1859 although there is no evidence it was granted or placed in production. I thank Dr. Karin Zachmann of Technische Universitat Dresden for this, as well as for evidence for German patents on the Kilborne Brothers machines of 1859, in a report by Julius A. Hülsse, Saxony State Archives, Dresden [SLHA], MdI, 1479 c, Bl. 190/b. Zachmann to Candee, Jan. 6, 1995.

88. William Felkin "Hosiery and Lace," in *British Manufacturing Industries*. G. Phillips Bevan, ed. 2nd ed., London: Edward Stanford, 1877. British Patent, 1858 #1826 to Robert Clark Gist. Its not clear if Gist was an American or a British assignee as there is no American patent to him. For Pepper's at Lowell see Steven David Lubar, Corporate and Urban Contexts of Textile Technology in Nineteenth Century Lowell, Massachhusetts: A Study of the Social Nature of Technological Knowledge. Ph.D. diss, Univ. of Chicago,1983: 87-94 and Heidi Vernon-Wortzel, *Lowell: The Corporations and the City*. Garland Studies in Entrepreneurship, NY & London: Garland Publishing, 1992: 122-170.

89. William Carter autobiography, quoted in *Sticking to our knitting (and yours) for 100 years: The story of the William Carter Company on its 10th birthday 1865 - 1965* (Needham, MA: Carter Co., 1965): 3. He and another knitter went to Massachusetts towns still using handframes and later formed his own company in Needham.

90. [Tobias H. Miller], editorial, *Portsmouth Morning Chronicle* July 3, 1857.

91. "STOCKING WEAVERS' STRIKE," *Portsmouth Morning Chronicle* July 3, 1857.

92. *Portsmouth Journal*, July 12, 1851; "Hosiery Manufacture," *Morning Chronicle*, April 18, 1853: 2; *Morning Chronicle*, Oct. 13, 1857.

93. U.S. Manufacturing Census, 1850-1870, mss returns, NH State Archives, Concord, NH. Small Portsmouth handshops are obscured in the federal manufacturing census before 1870. Only one of six was listed in 1860 as census takers seem to have discounted domestic shops as insufficiently "industrial." William Cartledge Sr., will (written 1876, probated 1883), Rockingham Co. Probate, # NS 4201; marriages and spouses determined in 1850 - 1860 censuses.

94. Haskell, *History of Hosiery*, p. 19 ; N.V. Ward to William S. Southworth, Dec. 5, 1864, Lawrence Mfg Co. letter book MA-9, Baker Library, Harvard Business School.

95. *Portsmouth Journal*, 20 May, 1871; *The Hosiery Industry of Ipswich, 1822-1922*, [Boston]: Ipswich Mills, 1922: 18.

96. *Portsmouth Journal*, May 20,1871: 3; Adams, *et al*, *Letter* : 7-8.

97. "Portsmouth Hosiery Manufacture" July 24, 1875: 2.

98. *Portsmouth City Directory*, 1850-1875; advertisement *Portsmouth Morning Chronicle*, Aug. 4, 1857, p. 1; R.G. Dun, Jarvis Bros / Barry & Bros. 16: 151; *Portsmouth Journal* May 5, 1872; Francis C. Jarvis will, dated 1874, probated Jan. 9, 1877, Rockingham County Probates, NS #2119; Barlow Insurance Survey #3908, Sept. 1875, Museum of American Textile History; Obituary, James H. Jarvis, *Portsmouth Herald*, Nov. 24, 1909.

99. Felkin, *The History of Machine Wrought Hosiery*: 542n; for Pepper in Lowell see note 92 above; for Ipswich see the Lawrence & Co. Collection, Cases 26 and 27, Pepper folders, Baker Library, Harvard Business School; J.B. Aiken to Francis Daher & Co., Nov. 8, 1873, Aiken Letterbook 4: 703 noted "Mr. Pepper is a native of England and returned to his family last year." NH District Federal Circuit Court, Bankrupts under 1867 Act # 669, John Pepper, February 1875, Federal Records Center, Waltham, Massachusetts.

100. "William H. Pepper," *Biographical Review*: 419-20. *The Illustrated Laconian: History and Industries of Laconia, NH*. Charles W. Vaughan, comp. Laconia: Louis B. Martin, 1899: 97; U.S. Patents, # 79,789 (1868), # 141,836 (1873).

CHART 4: New England Hosiery Machinery, 1870

	factories	cards	frames	knitting machines	sewing machines
CT	16	70	9	430	293
MA	32	79	180	1,116	312
NH	24	58	20 *	832	102
RI	3	6	5	33	0
VT	7	23	0	49	53
ME	0				

* wrong: 27 in Ports. 1870; 86 in Manchester 1875; 24 in Laconia 1-co

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WORKERS IN PORTSMOUTH KNITTING / HOSIERY FACTORIES & SHOPS

1834 ENGLISH Workers identified in Johnson hosiery manufactory, State St:
Dunham, Samuel. weaver, hos. mfy., bdg at John Clark's [= moulder iron fdry, bdg. ho. State St.]
Glazebrook, Charles. hosiery mfy., 1834 h. Whidden Lane [nr. So. Mill Pond]
Jenkinson, John. weaver hose mfy., boarding at Weller's [=oyster celler, bdg ho. Church St]
Jarvis, Francis. weaver, hosiery mfy, boarding at Weller's

1834 AMERICAN
Chas. H. Gould who in 1851 deposed he apprenticed age 14 (1834)

1839 ENGLISH
Francis C. Jarvis, machinist at hos. fac., 43 Islington [from Leicester, Eng?]
George Gadd, hosiery weaver, 7 Anthony St. [has own shop?]
Chas. Glazebrook, hosiery weaver, Middle next Danielson tavern
Thomas Moore, hos. weaver, 15 Austin [has own shop]
Daniel Pepper, hosiery weaver, 15 Austin [has own shop]]

1839 AMERICAN
Hosea Crane, agent, hosiery factory, [#?] Islington
Joseph D. Pillow, bookeeper hos fac. & guager, 27 Islington
Jasper G. Crane, overseer at hos. fac., 37 Islington St.

1850 US CENSUS, PORTSMOUTH

AMERICAN name	street	age	occupation	birthplace
Barber, Daniel S.	Prospect, 9	28	Hose weaver	NH
Barsantee, Eloa	Islington, 56	47	Hose Weaver	NH
Barsantee, Alphonso	Islington	18	Hose Weaver	NH
Barsantee, Geo	Islington, 56	15	manufacturer	NH
Barsantee, John H.	Islington, 56	24	stocking weaver	NH
Brown, Ira	Creek near R.S.M.	47	manufacturer	NH
Cate, William	Creek, rear R.S.M.	41	"at RSM"	NH
Chapman, Leonard	Woodbury, 1	20	manufacturer	NH
Crane, Hosea	Islington Rd.	44	manufacturer	CT
Flint, Jonas	Anthony, 18	51	dyer, R.S.M.	NH
Gould, Chas. H.	Creek	29	overseer, R.S.M.	NH
Gould, Lawrence	Wibird, 4	27	stocking weaver	NH
Johnson, John	Sagamore Rd.	22	stocking weaver	NH
Johnson, Napoleon B.	Sagamore Rd.	24	stocking weaver	NH
Kelley, Andrew K.	Anthony, 7	26	stocking weaver	NH
Knox, Ephrian R.	Anthony, 21	43	overseer, R.S.M.	ME
Manning, William	bds. Gideon Walker's		stocking agent RSM 1851	
Plimpton, Uriah	Islington, 43	28	stocking weaver	NY
Sanford, Horatio G.	Islington, 26	42	stocking agent, R.S.M.	MA
Smith, Charles	Anthony, 3	6	stocking weaver	NH
Trafton, Varranus M.	Creek	25	dyer at R.S.M.	ME
Tuttle, Peter K.	Anthony, 6	26	spinner R.S.M.	NH
Twombly, Amos H.	Sparhawk, 4	30	hosiery weaver"	NH
Varney, Eliphelet	Creek	33	engineer, R.S.M.	NH
Varney, Rockwell C.	Islington, 43	24	stocking weaver	NH
Woodworth, Nathaniel	Ann, 8	35	stocking weaver	NH

Boss, Joseph	Middle, 32	20	hosiery weaver	Germany
Piper, Valentine	Middle, 32	20	hosiery weaver	Germany
Trickler, Joseph	Middle, 41	25	stocking weaver	Germany
Viser, Augustus	Middle, 30	20	stocking weaver	Germany
Viser, Caspar	Middle, 30	33	stocking weaver	Germany
Adams, William	Sagamore Rd.	22	stocking weaver	England
Arnold, Joseph	Madison, 1	56	stocking weaver	England
Arnold, Joseph [jr?]	Austin, 19	24	stocking weaver	England
Bowles, James	Jewell"s Ct., 1	42	stocking weaver	England
Adams, Charles	Sagamore Rd.	53	stocking weaver	England
Despond, John	Middle, 40	40	stocking weaver	England
Turner, Elisha	Jewell's Ct., 3	12	stocking weaver	England
Adams, Charles J.	Sagamore Rd.	19	stocking weaver	England
Adams, Wm	Cabot, 14	22	stocking weaver	England
Bancroft, Right	Jewell's Ct., 2	27	stocking weaver	England
Cartledge, Wm	Jewell's Ct., 2	51	stocking weaver	England, Derby
Cartledge, Wm jr	Jewell's Ct., 2	18	stocking weaver	England, Derby
Cleighton, John	Madison, 1	16	stocking weaver	England
Faulkner, James	South Rd.	24	manufacturer	England
Gadd, Geo.	Anthony, 7	60	stocking weaver	England
Glazebrook, Chas	Islington, 41	57	stocking weaver	England
Graves, Wm	Austin, 19	28	stocking weaver	England
Glazebrook, Thos.	Islington, 41	21	stocking weaver	England
Jarvis, Francis C.	Islington, 75	42	stocking weaver	England
Jarvis, Robert E.	Islington, 75	39	stocking weaver	England
Jenkinson, John G.	Wibird, 3	40	stocking weaver	England
Jones, William	Middle, 28	40	machinist	England, Leicester
Marshall, Thomas	Jewell's Ct., 4	38	stocking weaver	England
McKennon, Gilbert	Boyd's Rd	39	machinist	England
Mee, George	Jewell's Ct., 4	34	stocking weaver	England
Mee, John	Jewell's Ct., 4	30	stocking weaver	England
Mee, John	Middle Rd.,	28	hosiery weaver	England
Middleton, Wm	Middle, 28	40	stocking weaver	England
Moore, Thos	Middle, 41 rear	36	hosiery manufact'r	England
Odams, John D.	Middle, 41	30	stocking weaver	England
Pepper, Daniel	Austin, 16	55	stocking manuf'r	England, Notts.
Pepper, John & Wm	Austin		machinist	England, Notts.
Pollard, Wm	Anthony, 5 1/2	50	stocking weaver	England
Radford, George	Jewell's Ct., 1	29	stocking weaver	England
Rush, Robert	Islington, 70	60	stocking weaver	England
Smith, William	Jewell's Ct., 5	28	stocking weaver	England
Turner, Benjamin	Middle, 38	26	stocking weaver	England
Turner, Edwin	Jewell's Ct., 3	42	stocking weaver	England
Turner, George	Jewell's Ct., 3	15	stocking weaver	England
Turner, George	Middle Rd.	70	hosiery weaver	England
Turner, Joseph	Jewell's Ct., 5	27	stocking weaver	England
Turner, Joseph	Islington, 41	34	stocking weaver	England
Turner, Richard	Middle, 40	33	stocking weaver	England
Turner, Thomas	Middle, 38	45	stocking weaver	England
Vernon, John	Islington, 67	39	stocking weaver	England
Walley, James	Islington, 57	21	dyer";hose weaver	England
Wardwell, Thos.	Cabot, 6 rear	42	stocking weaver	England
Wardwell, Wm	Cabot, 6 rear	20	stocking weaver	England
Wilson, Jabez	South Rd.	31	manufacturer	England