PROGRESS UNDER PRESSURE:

THE MECHANIZATION OF THE AMERICAN FLINT GLASS INDUSTRY

1820-1840

by

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ABSTRACT

During the early years of the American republic, steam power and labor-saving devices promised the way to a productive and prosperous future. Glassworking was one of many trades affected by the new enthusiasm for technology. Motivated by aspirations for personal success, by a prevailing fascination with mechanical ingenuity, and by the idealized vision of a land where even the poor could afford inexpensive amenities, manufacturers began to use presses in the 1820s to shape and ornament glass. They were able to restrict the need for highly-skilled workmanship to the creation of production machinery rather than the crafting of the finished product. This machinery could be operated by relatively unskilled men, who would be easily replaced and whose activities could be carefully supervised. While the evolution of manufacturing techniques varied from one trade to another, developments in virtually all industrializing trades were united by a common impulse to reduce expenses, accelerate production, and standardize products. They also shared a growing pool of technological knowledge, for innovations in metal-working and machine-making could be applied, through the agent of the machinist, to the production of specialized tools for many different trades.

This thesis examines the mechanization of the American flint glass industry in the 1820s and 1830s. Using hitherto unpublished patent materials and other contemporary sources, it traces technological developments from the first rudimentary experiments with pressed glass furniture knobs to the production of complex and highly-ornamented pressed glass tablewares. Contrary to popular assumption, the glass press had little initial effect on the industry's pre-existing markets or products. Initially, the press allowed manufacturers to venture into new markets and to compete more effectively in markets traditionally dominated by other industries. The capabilities of the new process were rapidly extended, however, and a surprising number of innovations can be traced to a small group of machinists originating from Attleboro, Massachusetts. Through the study of these men, the extent of machinists' contributions to the mechanizing glass industry has been clarified, while a broader industrial context has been established for the technological changes they introduced.

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During the course of my research, many collectors were generous with their time and knowledge. I am particularly grateful to Joseph MacDougald and Ruth Rickard for introducing me to the brave new world of buttons. Mr. MacDougald generously placed at my disposal a number of glass fragments gathered in 1980 from the Robinson button shop in North Attleboro, Massachusetts. During my study of the lion-head lamp, Clark Pierce brought an especially important example to my attention, while Raymond Barlow allowed me to examine his collection of lamp fragments dug from the site of the Boston and Sandwich Glass Company.

Glass from numerous museum collections has provided historical information not readily available from other sources. This glass was made accessible through the efforts of museum curators and directors who, taking time from their busy schedules, opened cases, shuffled catalog cards, and often led me through the deepest, darkest, most remote corners of their storage facilities. Barbara Bishop, Dorothy Hogan, Martha Hassell, and Kauko Kahila were extremely helpful during my research at The Sandwich Historical Society and Glass Museum. Jane Shadel Spillman acquainted me with the extensive collections of The Corning Museum of Glass. Alice Cooney Frelinghuysen and William N. Hosley, Jr., took me through the glass collections of The Metropolitan Museum of Art and The Wadsworth Athenaeum, respectively. Susan Myers and Regina Blaskawitz helped me examine the lighting collection at The Smithsonian Institution, while Eugene Kosche and Ruth Levin provided important information about the glass collection at The Bennington Museum. Finally, William D. Wallace showed me examples from the extensive cup plate collection of Albert C. Marble at The Worcester Historical Museum.

Written sources, both primary and secondary, were located with the invaluable assistance of well-informed members of many library staffs. Those libraries which contributed most to this study include The Rakow Library of The Corning Museum of Glass, The Henry Francis du Pont Winterthur Museum Library, The Archives

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beneficial and I sincerely thank each of them for their contributions, direct and indirect.

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TECHNOLOGY AND PROGRESS

Most contemporary observers considered the burning of the United States Patent Office on December 15, 1836, to be a tragedy of catastrophic dimension. Americans had taken great pride in the achievement represented by its ten thousand patent descriptions, nine thousand drawings, and seven thousand models; "a pride," lamented one commentator, "which must now stand rebuked by the improvidence which exposed so many memorials ... of American genius to the destruction which has overtaken them."[1] The loss of the patent records threatened more serious consequences than a simple rebuke to American pride, however, for invention was commonly identified as a progressive or cumulative process. To many it seemed as though a vast stockpile of technical information had been obliterated and could no longer serve as the foundation for future inventions. The fire also seemed to threaten the functioning of the patent system itself, which required inventors to demonstrate the priority of their inventions if their claims were challenged in court. Without an accurate record of preceding inventions, this priority might have been very difficult to establish.[2]

While public concerns following the Patent Office fire soon proved to be unfounded, they nevertheless suggest the highly venerated position technology occupied in American culture. By the late eighteenth century there had emerged a growing conviction that the survival of the nation, which was perceived as the first large-scale experiment with the principles of republican government, would depend on its ability to participate in changing patterns of production and consumption identified today as harbingers of the Industrial Revolution. Labor-saving machinery and new sources of power would promote the well-being of the nation, it was argued, by allowing it to reap the full benefit of its abundant natural resources and to reduce its dependence on foreign powers. Although tensions arose between this new promotion of technology and Thomas Jefferson's widely-held view that farming should provide America with the foundation for its moral strength and character, the two positions were by no means irreconcilable.[3] For most Americans in the late eighteenth century, marvels such as the steam-powered engine or the spinning jenny were not greeted with suspicion, but rather, as John F. Kasson has observed, were hailed as "victories of the human mind and spirit, promising a grand new era of progress in which America would stand in the forefront."[4]

Concern over the vitality of the new republic had diminished by 1836, as confidence in the beneficial powers of technology rose to a fevered pitch.[5] Glassworking was one of many trades to experience the effects of technological innovation, and glass manufacturer

Deming Jarves linked those effects directly to the cherished ideals of republicanism. Jarves, who founded the Boston and Sandwich Glass Company in 1825 and played an active role in the development of the glass press in the late 1820s, portrayed glassmaking up to the nineteenth century as a profession catering exclusively to the whimsical pleasures of the rich:

> It has been reserved for the present age, however, to render the art of glass-making tributary to the comfort of man, - to the improvement of science, - and by its moderate cost to enable the poorest and humblest to introduce the light and warmth of the sun within, while excluding the storms and chilly blasts; to decorate his table with the useful, and minister to his taste, at a cost barely more than that of one of his ordinary days' labor. That which once was prized and displayed as the treasure and inheritance of the wealthy, and which, with sacred carefulness, was handed down as of precious value, may now be found in the humblest dwellings....[6]

Technology had made this great advance possible, according to Jarves, and no single development seemed more important to him than the introduction of the glass press in the 1820s.[7] First employed to manufacture simple forms such as bureau and door knobs, the press was being used by the late 1820s to make plates, dishes, bowls, and a variety of other tableware forms. Within a few years the process had been adopted by manufacturers in all the glass-making centers in the country, and by 1846 five workers operating one press could turn out "a beautiful tumbler in about forty seconds, or about one hundred in an hour."[8] Jarves maintained that the cost of glass had been reduced to such an extent by technological advances that consumption was multiplied tenfold.[9]

For Jarves the equation was simple: inexpensive glass stimulated consumption, and greater consumption signified a higher standard of living for the general population. It seems more likely, however, that demand for inexpensively-manufactured goods developed side by side with the technological ability to produce them, each stimulating the other and both reflecting the emergence of a new national culture. Christian virtue, an extensive lay education, and a strong emphasis on material display were the three outstanding components of this culture, which was formulated over the nineteenth century into the ideal of middle-class respectability.[10]

The possession of pressed glass and other commercially-manufactured goods became one of the hallmarks of the successful transition from vulgar to respectable. Pressed glass represented only one step in the hierarchy of ostentatious display, however, and was not, as Jarves suggested, "the former treasure and inheritance of the wealthy."[11] The cultural associations of this new product changed along with the technology that brought it into being and varied according to the social perspective of the critic. For those with elevated social pretensions, pressed glass could never serve as a substitute for more expensive wares. This point is made emphatically by "Miselle," a character in author Jane Austin's 1864 story of a family tour through the Sandwich glass factory. At one point during the tour, Miselle explains to her father that

> It is very easy to feel the difference, if not to see it, between cut and pressed glass. The latter always has these blunted angles to the facets, and has a

> certain vagueness and want of purpose about it; then it is not so heavy or so sparkling; there is a certain exhilaration in the gleam of cut glass that fits it for purposes to which the other would be entirely unsuited. Fancy Champagne in a pressed goblet, or tuberoses and japonicas in a pressed vase, or attar in a pressed flacon![12]

Individuals who recognized such distinctions nevertheless praised the new technology as an expression of the nation's democratic ideals, and their double standard is apparent in the comments of Miselle's father, who responds to her tirade against pressed glass, saying

> Fortunately ... the persons who consider Champagne, japonicas, and attar of roses necessaries of life are very well able to provide cut glass receptacles for them. But isn't it worth one's while to be proud of a country where every artisan's wife has her tumblers, her goblets, her vases, of pressed glass, certainly, but 'as good, to her mind, as cut,' to quote our friend? And don't you think it better that twenty-two thousand dozen pressed tumblers should be sold at ten cents apiece than one-third that number of cut ones at thirty cents, leaving all those who cannot pay the higher price to drink out of - 'clamshells?'[13]

In the late eighteenth and early nineteenth centuries, the courses followed by industrialization varied from one trade to another, reflecting the specific nature of the materials and processes each trade employed, as well as the specific demands of the markets each served. The effects of industrialization occurred within a common cultural milieu, however; one in which shared aspirations for political freedom, personal gain, and Christian virtue were not always in perfect harmony, but in which their differences could be reconciled through the idealistic role assigned to technology in the development

of the republic. By the second half of the nineteenth century, paeans to technology as a socially-leveling, democratizing influence became more rhetorical and less convincing, as social distinctions began to solidify. In the 1820s, however, the promise held by technology to uplift and improve civilization was still fresh and the possibilities it seemed to offer were pursued with vigor. The smallest technological "advance" could be hailed as a great triumph, while no image symbolized the progressive direction of the young nation quite so eloquently as the smoke-belching chimneys of a prosperous factory (figure 1).

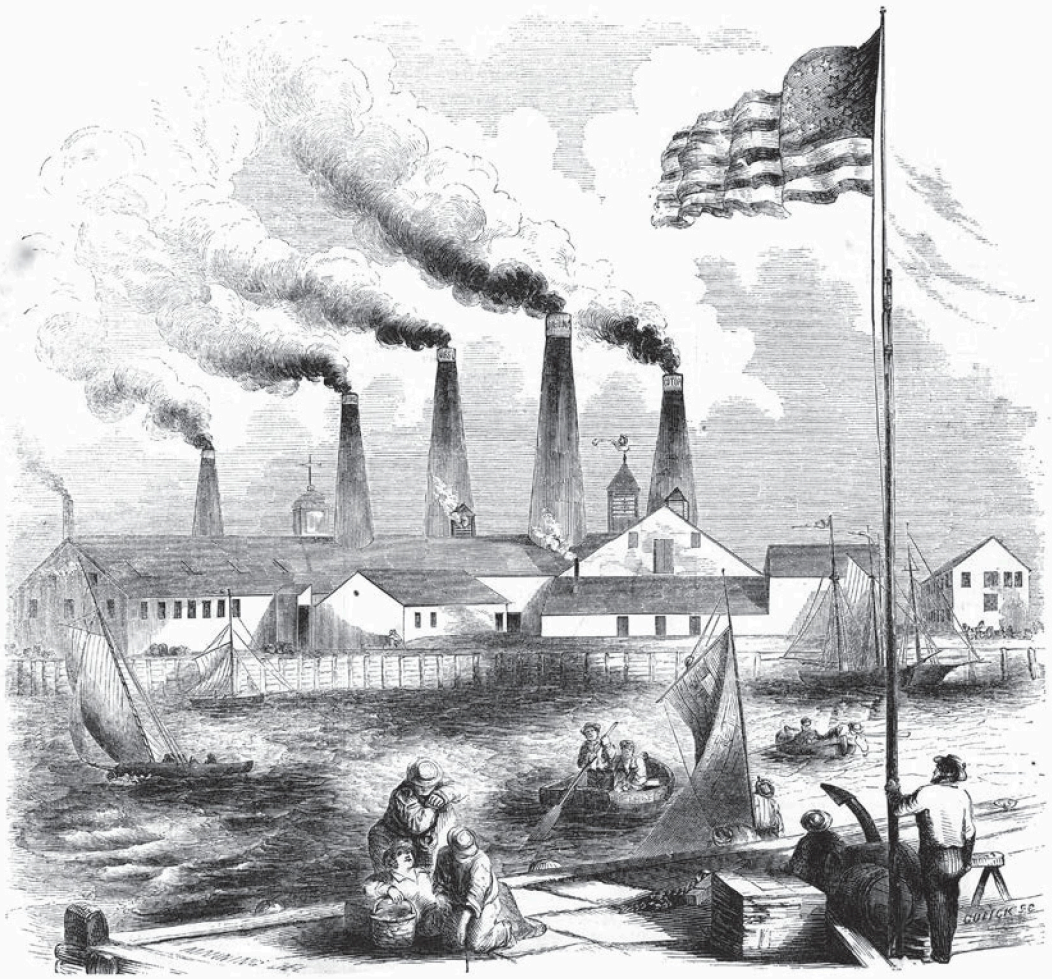


Figure 1: "View of the American Flint Glass Works, South Boston, From the Harbor." Gleason's Pictorial Drawing-Room Companion IV (April 23, 1853), p. 272.

ENDNOTES

Chapter 1

[1]"Mr. Ruggles' Report to the Senate, with a Bill," Journal of the Franklin Institute 19 (January, 1837), p. 23.

[2]These dire consequences never actually came to pass. Inventors generally based their ideas on personal experience rather than research at the Patent Office, while sources other than patents could be found to establish the date of an invention's earliest application.

[3]See John F. Kasson, Civilizing the Machine: Technology and Republican Values in America, 1776-1900 (New York: Penguin Books, 1976), pp. 6-10. Kasson cites a speech delivered in 1775 by Benjamin Rush, president of the newly-founded United Company of Philadelphia for Promoting American Manufactories, who argued that labor-saving devices and the employment of women and children would leave the vast majority of American men free to engage in agricultural pursuits.

[4]Kasson, Civilizing the Machine, p. 22. The actual percentage of the American population that identified with the values of the technological ideology discussed in this chapter has not been determined and remains a question for debate. Educated individuals controlling the printed media supported the ideology almost unanimously, and it was embraced with especially strong conviction in the relatively urban northeast. Merritt Roe Smith has found in his study Harpers Ferry Armory and the New Technology: The Challenge of Change (Ithaca: Cornell University Press, 1977), page 22, that the inhabitants of an isolated, rural community such as Harpers Ferry, Virginia, were less receptive to technological change, and floundered "between the two worlds of agrarian pastoralism and industrial progress. Mechanization is held suspect and the imperatives that accompany technological advance are tolerated only as long as workers are allowed to retain certain rights and privileges associated with pre-industrial traditions. In such a milieu, elements of scorn, ridicule, and apprehension are present. Yet, interestingly enough, there also exists a certain degree of wonderment, even tantalizing fascination with the changes taking place."

[5]The noted orator, William Everett, best expressed American enthusiasm for technology when he declared "There is no goal; and there can be no pause; for art and science are, in themselves, progressive and infinite.... Nothing can arrest them which does not plunge the entire order of society into barbarism." Kason, Civilizing the Machine, p. 45.

[6]Deming Jarves, Reminiscences of Glass-Making (New York: Hurd and Houghton, 1865), p. 3.

[7]"Soon after the introduction of the [glass] business into this country," Jarves recalls, "a very great improvement in the mode of manufacture was introduced. Pallat [sic], in his admirable work on glass, alludes to the American invention in only a few words, and passes it by as of but slight importance; but it has brought about a very great change, and is destined to exert a still greater; in fact, it has revolutionized the whole system of flint-glass manufacture, simply by mould machines for the purpose of pressing glass into any form." Jarves, Reminiscences of Glass-Making, p. 85.

[8]Pearce Davis, The Development of the American Glass Industry (New York: Russell and Russell, 1949), p. 84. Davis quotes an article in Hunt's Merchants' Magazine and Commercial Review 15 (October, 1846), p. 418, which provides an excellent contemporary description of the pressing process: "In the first place, the workmen have a brass mould, consisting of a solid mass, about as large over as a half-peck measure, containing a hollow in it exactly of the form of the tumbler to be made, with a follower of brass of the same form, but so much smaller as to fit the inside of the tumbler. When the two parts of the mould are put together, the space between them is the exact thickness of the vessel required. In the process of manufacturing, three men and two boys are required. The first thing done, is for one of the men to dip an iron rod in the melted glass, and move it about until he has a sufficient quantity of the fluid mass on the end of his rod; he then holds [it] over the hollow of the mould, and, with a pair of shears, cuts off what he judges to be just enough to constitute the tumbler. Instantly the other man brings down the follower with lever power, and the melted glass is so compressed as to fill the cavity of the mould. He then turns his mould bottom up, with a little blow, and the tumbler drops red hot upon the stone table. One of the boys, with an iron rod having a little melted glass on its end, presses it on the bottom of the tumbler and it slightly adheres. He then holds it in the mouth of a glowing furnace, turning it rapidly, till it is almost in the melted state, when the third man takes it, and whirling the rod and tumbler on a sort of arm of a chair, he holds a smooth iron tool against the edge of the tumbler, till all the roughness is removed

from its edges, when a boy takes the rod from him, and, by a slight stroke on the end of it, drops the tumbler, and places it in a hot oven to cool gradually."

[9]Jarves, Reminiscences of Glass-Making, p. 86.

[10]Richard L. Bushman developed the theory of a middle-class, respectable culture emerging from eighteenth-century traditions of gentility in his course "American Social and Cultural History, 1790-1850" (The University of Delaware, 1982).

[11]Jarves, Reminiscences of Glass-Making, p. 3.

[12]Jane Austin, "Cullet," The Atlantic Monthly 14 (September, 1864), p. 313.

[13]See Jane Austin, "Cullet," p. 315. At this point in the tour, Miselle watches the pressing of decanters "'sech [sic] as is used in bar-rooms, mostly, Ma'am,' as the principal workman confided to her. These were first moulded in the shape of great tumblers with an excessively ugly pattern printed on the sides, then softened in a glory-hole, and brought to a workman, who, by means of plyers [sic] and battledoor [sic], elongated and shaped the neck, leaving a queer, ragged lip at the top. The decanter was then passed to Miselle's confidant, who struck off this lip with the edge of his plyers.... These decanters were probably to be used in conjunction with some Gothic goblets, whose press stood in the immediate vicinity. These were greenish in color, thick and unwieldly in shape, and ornamented with alternate panels of vertical and horizontal stripes. Miselle was still lost in comtemplation of these goblets when Monsieur approached. 'No,' exclaimed she, pointing at them, - 'no true patriot should congratulate his countrymen upon the plentitude of such articles as that! Far better for the national growth in art that we should all revert to clamshells!'"

Chapter II

ADVENT OF THE GLASS PRESS

Two basic principles for manipulating hot glass underlie manufacturers' efforts to mechanize glass production in the 1820s and 1830s. Both principles had been known since ancient times and both involved the use of molds. The first consisted of forcing glass into its desired shape between two opposing surfaces. The second consisted of expanding glass into a mold through the use of compressed air.[1] Glass manufacturers in the eighteenth and nineteenth centuries became increasingly dependent on the use of molds as they endeavored to supply rapidly-growing markets with inexpensive glassware. Simple pliers-like tools were being used in Europe as early as the 1740s to pinch chandelier drops (figure 2), and by the 1780s glassworkers were using the pinching process to make salt dishes and feet for wines, lamps, and compotes.[2] Tableware forms that were too large to be pinched could be blown into full-size, hinged molds.[3] Through the extensive use of hinged molds and pinching tools, manufacturers found they could accelerate production and achieve an impressive variety of ornamental effects.

The introduction of the glass press in the 1820s represents the first major American contribution to the mechanization of glass-

forming techniques.[4] Presses employing either screw or lever pressure could bring the upper and lower dies of a mold together with much greater force and control than simple pinching devices. Their use eventually led to the mechanized production of large articles with complex shapes. The earliest products of the glass press were simple forms such as furniture and door knobs, however, while drinking vessels, decanters, and other traditional mainstays of glass tableware production were not pressed in quantity until the 1830s and 1840s. It could be argued, in fact, that the proliferation of the glass press in the 1820s had little effect on the glass industry's pre-existing markets, products, or manufacturing techniques. Initially, it allowed glass manufacturers to venture into new markets or to compete more effectively in markets traditionally dominated by other industries.

A review of surviving patent materials shows that, with the possible exception of a patent issued to Spencer Richards in 1822 for making buttons, the three earliest patents thought to address the subject of pressed glass describe the manufacture of knobs.[5] Knobs had come into popular use about 1810 with the demand for furniture in the Empire style. Blown glass knobs were introduced shortly after 1810. The memorandum book of Philadelphia hardware merchant A. Konigmacher lists an invoice for glass knobs dated July 15, 1815, and diarist Henry Fearson recalled seeing cabinetwork in New York City in 1818 "with cut glass, instead of

brass ornaments, which had a beautiful effect" (figures 3 and 4).[6] In the 1820s and 1830s manufacturers developed a variety of techniques for making knobs more efficiently and economically than they could with the blowpipe. Of the twenty-four known patents relating to the subject of mechanized glass production that were issued before the Patent Office fire, thirteen refer specifically to glass knobs.[7]

Furniture knobs were small, relatively simple forms. They provided an ideal subject for experimentation with the new manufacturing process and, as articles that looked and functioned well when highly standardized, they were especially well-suited to the benefits of mechanized production. The merits of the new manufacturing process, particularly the reduction of labor costs and achievement of greater standardization, were enumerated in the earliest surviving patent for pressing glass. This patent was issued to machinist Enoch Robinson and New England Glass Company agent Henry Whitney on November 4, 1826.[8] It covered the production of glass knobs for "Doors, Stoves, Drawers, Sideboards, Bureaus, Wardrobes, and all Kinds of Furniture ...," which could be manufactured

> much more easily expeditiously and neatly and by fewer hands than by any former mode and when thus manufactured, are more solid and better adapted to their ordinary purposes and are more readily made to correspond exactly in size shape and appearance one with another and require less finishing after their form is given to them in the first instance, and are more readily accommodated to the reception of spindles of the shape best calculated

> to secure them to the articles to which they are to be attached than glass knobs or trimmings manufactured according to any former mode.[9]

The Robinson/Whitney press featured a hand-operated lever, piston and plunger which, working together, were used to force glass into a hinged mold. The press undoubtedly was similar to one illustrated by Apsley Pellatt in 1849 (figure 5). The plunger die was cut with the pattern to ornament the knob's face, which could take the form of "circles, rings, hearts, roses, leaves, fruit, animals or any other fancy or ornamental shape which has been or may be used in brass or other ornaments...."[10] According to Robinson and Whitney, their press had been used successfully in 1827 and 1828 to manufacture 30,000 knobs, which were sold for approximately five thousand dollars in "the cities of Boston, Providence, New York, Philadelphia, Baltimore, Washington, Richmond, Charlestown, Louisville, New Orleans and generally the principal markets of the United States...."[11]

Glass manufacturers quickly recognized the potential advantages of the new process, and by the end of 1830 at least nine different patents for pressing glass had been issued to individuals in Cambridge, Pittsburgh, Jersey City, Boston, and Philadelphia. One patent that predates the Robinson/Whitney patent and possibly covers a technique for pressing glass knobs was described as an "Improvement in the method of making glass furniture, etc."[12] It was issued to John Bakewell of Pittsburgh on September 9, 1825, and

many authors have speculated that it described some technique for pressing glass, based on the existence of pressed glass knobs marked "Bakewell's Patent" (figures 6, 7 and 8)).[13] John Bakewell purchased the rights to the 1826 Robinson/Whitney patent in 1833, however, shortly after its validity had been successfully established in a Philadelphia court case.[14]

John Bakewell's purchase of Robinson and Whitney's patent rights suggests that his own patent, which predated theirs by one year, must have covered a process for pattern-molding or pinching glass knobs, or some technique for pressing knobs that was inferior to the Robinson/Whitney method.[15] On May 15, 1828, Bakewell was issued a second patent with Thomas Bakewell for an "improved method of making glass furniture knobs or handles.[16] The marked knobs probably were made under this patent rather than the earlier one, and the patent itself probably covered the knobs' distinctive design rather than the manufacturing process used to make them. The knobs feature a projecting, square end that, when fitted into a corresponding square hole in the wooden drawer front, prevented the knob from turning and loosening.

Regardless of the exact nature of the 1825 patent, credit for the "invention" of the glass press cannot be assigned to John Bakewell or to Enoch Robinson and Henry Whitney. Screw and lever presses were being used in other industries before 1825, and numerous individuals contributed to their glass-working applications

in the 1820s and 1830s. Surprisingly, some of the earliest applications of this technology apparently took place in Attleboro, Massachusetts. On August 19, 1822, an Attleboro machinist named Spencer Richards was issued a patent that, according to M. D. Leggett's 1874 Subject-Matter Index of Patents, covered a process for "finishing" glass buttons.[17] While this patent may have described a technique for affixing the glass center of the button to its brass setting, evidence suggests the possibility that some type of press was being used to make the glass centers. Evidence also suggests that Enoch Robinson was familiar with Richards' work in Attleboro before he and Henry Whitney patented their method for pressing glass knobs in 1826.

Attleboro was a leading center for textile production in the early nineteenth century. This industry had been one of the first to experience the effects of industrialization, and the mass production of textiles stimulated demand for commercially-manufactured buttons. On March 24, 1804, Enoch Robinson's father, George Whitefield Robinson of Attleboro, was issued the earliest patent for making buttons that Leggett records in his index. It covered the manufacture of coat and waistcoat buttons, and was followed by another patent on June 27, 1809, for securing buttons in a lathe.[18] A third patent was issued to George Robinson on May 14, 1812, for casting buttons in a mold.[19] Robinson was a skilled machinist and may have learned his trade with his brother

Obed, who worked first as a blacksmith, then as a manufacturer of gunlocks during the Revolutionary War, and later as a clockmaker, jewelry maker, and button maker.[20] George Robinson left Attleboro in 1824, and by 1830 he was being employed as a machinist at the New England Glass Company in Cambridge.[21] On October 1, 1830, he was promoted to oversee the company's entire glass-pressing operation.

George Robinson's son, Enoch, was born in Cambridge in 1801.[22] The Robinson family might have moved from Cambridge to New Haven, Connecticut, by 1812, and sometime before 1819 they relocated to Attleboro.[23] On July 3, 1823, Enoch married Harriet Irena Starkey in Attleboro, and tax records for 1824 list him as a partner with Harriet's brother, Willard Starkey, "for the Alanson Bishop privilege."[24] A machine shop almost certainly was located on the property, which was described in 1825 as the "Alanson Bishop shop and privilege," and which was purchased in 1825 or 1826 by John C. Dodge, one of the leading textile menufacturers in Attleboro.[25] Enoch was listed for the last time in the Attleboro tax records in December of 1825, and he probably moved to Cambridge early in 1826, where he and Henry Whitney were issued their patent for pressing knobs on November 4th.[26] Ten years later Enoch moved to Boston, where he took out two patents with Cambridge machinist Francis Draper and Boston merchant Joseph Lord for the manufacture of knobs with brass sockets attached to their feet.[27] On October 20,

1837, "Enoch Robinson and George W. Robinson, both of the city of Boston," were issued another patent for the production of knobs with metal sockets.[28]

The fact that Enoch Robinson worked closely in Cambridge with Attleboro native Spencer Richards is documented by their collaboration in the production of the original mold for the lion-head lamp (figure 9). One of the most ambitious examples of glass pressed in the late 1820s and early 1830s, the lion-head lamp occasionally is found embossed with the mark "N.E.G.Co./ E.R.:S.R." (figure 10). It is the only known example of pressed glass from this period to bear the initials of the mold makers in addition to those of the manufacturing company.[29]

Spencer Richards was born in Attleboro on February 13, 1798.[30] His grandfather, Edward, had served on various influential committees in Attleboro during the Revolutionary War and as a judge on both Inferior and Supreme Courts.[31] Ira Richards, one of Spencer's six brothers, was an important jewelry maker in Attleboro. John Daggett writes in his Sketch of the History of Attleborough (Boston, 1894), that before Ira took up jewelry making, he and his brothers Spencer and Calvin, Jr. "formed the Richards Manufacturing Company, which carried on quite a large business in the making of brass door knobs and 'ketches,' or fasteners."[32] Spencer later worked as a machinist in Cambridge, Massachusetts, where he took out a patent in 1831 for pressing glass knobs with embedded metal nuts

(figure 11).[33] This patent may have been the subject of a discussion referred to in the Minutes of the Directors' Meetings of the Boston and Sandwich Glass Company on June 21, 1831, when "Mr. Jarves and Mr. Andrew T. Hall were voted a committee to confer with the owner of a newly invented glass knob, upon the expediency of purchasing an interest in the patent."[34]

Spencer Richards' introduction to glassmaking apparently came through an association with Enoch Robinson's cousin, Richard Robinson. Daggett writes that the manufacture of glass buttons in Attleboro "was commenced in 1823 by Richard Robinson and Company, the firm consisting of Richard Robinson, Virgil Blackington, and Willard Robinson, the ingenious machinery they used being chiefly of their own invention."[35] Willard Robinson married Spencer Richards' cousin, Rebecca, in 1825, and it seems probable that the process patented by Richards in 1822 was among the "ingenious" machinery employed by Robinson's firm.[36] Daggett continues his history of the Robinson manufactory, writing

> The original company began the business on a small scale and met with many embarrassments and discouragements in its early stages, but after becoming thoroughly established it began to increase, gradually at first, and finally became very extensive. Richard Robinson appears for a time to have had sole charge of the business, but whether the other partners had retired or what was the cause is not known. In 1826 a new company was formed under the same style of Richard Robinson and Company, for the term of five years, which expired in May 1831. At that time the firm of Robinson, Jones and Company was formed, consisting of Richard and Willard Robinson, William H. Jones, and H. M. Draper. They commenced business in a small shop about 35 by 22 feet in size.

> An addition to this building had been made in the summer of 1826, and its machinery was carried by horse power.[37]

While it seems unlikely that glass was actually made in Attleboro, court records show that Richard Robinson did plan to establish a local glassworks. Sometime between April and July of 1822, Robinson, who was described at the time as a jeweler, filed suit against Thomas Cains of Boston.[38] In his bill of complaint, Robinson charged that on March 10, 1822, Cains met with Robinson and agreed to move to Attleboro to build and superintend "a Glass House for the purpose of manufacturing glassware and other glass materials."[39] The other "materials" presumably included buttons. Robinson was to pay Cains twenty-five dollars a week and provide him with a house to live in and pasturing for his horse. In preparation for Cains' expected arrival on the first of April, Robinson had purchased 120,000 bricks for the construction of the glassworks and 150 cords of wood to fuel the furnaces. In addition, "said Robinson dismissed many of his hands and cleared out a number of his tenements - yet the said Cains unmindful of his promise as aforesaid and wickedly contriving to defraud and injure the said Richard, did not come to said Attleborough...."[40] Robinson's suit was for the sum of one thousand dollars, and on July 15, 1822, a summons was delivered to Cains by sheriff Brandish Billings, who also attached the rights to two parcels of land owned by Cains in Boston. The outcome of the trial is left uncertain by the incomplete court records.

Thomas Cains introduced the production of flint glass to New England in 1812 at the South Boston works of the Boston Glass Manufactory. He apparently was quite familiar with the use of pinching devices and the forming of glassware in metal molds. Lamps with pinched feet have been attributed to the South Boston Flint Glass Works (1812-1827), and also to the Phoenix Glass Works, which Cains founded about 1822 (figure 12).[41] Kenneth Wilson has even suggested that Cains was responsible for the introduction to America of the pattern-molded glass commonly referred to by collectors as blown three mold glass.[42] A news announcement published on July 31, 1816, described the production of decanters, wines, and tumblers "moulded and cut into all the varied forms of taste and fashion" at the South Boston Flint Glass Works, while "100 moulds, for Glass Makers" were listed among the equipment sold after the failure of the works in 1827.[43] Cains would have been well suited to the kinds of production Richard Robinson was contemplating in Attleboro. Lura Woodside Watkins writes that "according to his son William, Thomas Cains was invited to positions in Sandwich, in Richmond, Virginia, and in New York before he embarked upon his independent career."[44] Attleboro can be added to this list.

Spencer Richards' button patent was taken out four months after Cains' expected move to Attleboro, and several conjectures about the nature of the patent might be made on the basis of this timing. If his patent covered a glassworking operation, it might

have been put to use in Cambridge or elsewhere when plans for constructing the Attleboro works fell through. Buttons could have been pressed in Cambridge and shipped to Attleboro to be mounted in their brass settings. Another possibility is that, realizing the local glassworks would not be built, Richards developed a method for stamping or "finishing" the buttons from glass rods imported to Attleboro. Such an arrangement would entail the reheating of the glass rods, which seems quite impractical, yet glass fragments recovered from Robinson's Attleboro manufactory lend some support to this possibility.[45] Many glass rods, imperfectly pressed buttons, and glass trimmings left over from the pressing operation were among the fragments found in the attic of the Robinson button shop (figures 13, 14 and 15).[46]

No glass buttons presently can be attributed to the manufactory of Richard Robinson and Company, where they presumably were made using the "finishing" process patented by Spencer Richards in 1822. The identification of such buttons could lead to a better understanding of Richards' patent, or at least it could help to determine whether or not some form of pressing was being employed for the manufacture of buttons before 1828. Certainly Attleboro button centers were being pressed by the late 1820s or early 1830s. The pattern of one opalescent fragment found in the Robinson shop has a grid-like background similar to the stippled backgrounds popular in pressed tablewares of the 1830s (figure 16). Fragments

of this type have been found at the site of the Boston and Sandwich Glass Company.[47] They relate to similar buttons in the collection of the Sandwich Historical Society stamped "R.J. & CO'S/PATENT" (figures 17 and 18).[48] Daggett claimed this company was founded in 1831, yet Gertrude D. Adkins has written that "in the early part of 1828 it [Richard Robinson and Company] became Robinsons, Jones and Co., because in that year a diploma was awarded at the American Institute Fair held in New York City to Robinsons, Jones and Co., Manufacturers of Superior Gilt Buttons."[49]

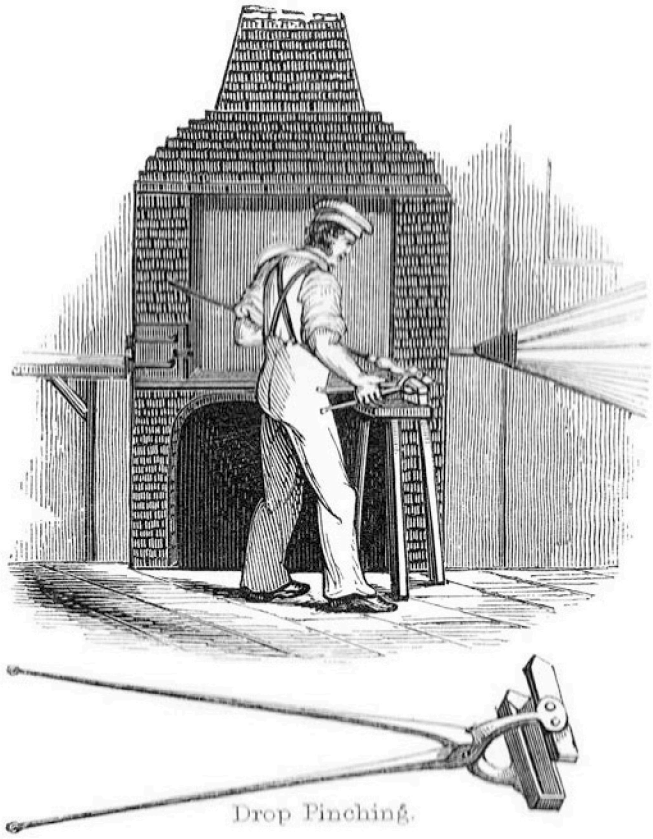


Figure 2: "Drop Pinching." Apsley Pellatt, Curiosities of Glass-Making (London: David Bogue, 1849), p. 123.

Figure 3: Blown glass drawer knobs. United States, 1815-1835. (Left) OH: 5.2 cm, OD: 5.5 cm, D. of foot: 3.9 cm. (Center) OH: 4.0 cm, OD: 4.4 cm, D. of foot: 3.3 cm. (Right) OH: 3.4 cm, OD: 3.3 cm, D. of foot: 3.2 cm. The Bennington Museum, Bennington, Vermont. Accession numbers 1987.62.12, 1987.62.13, 1987.62.14.

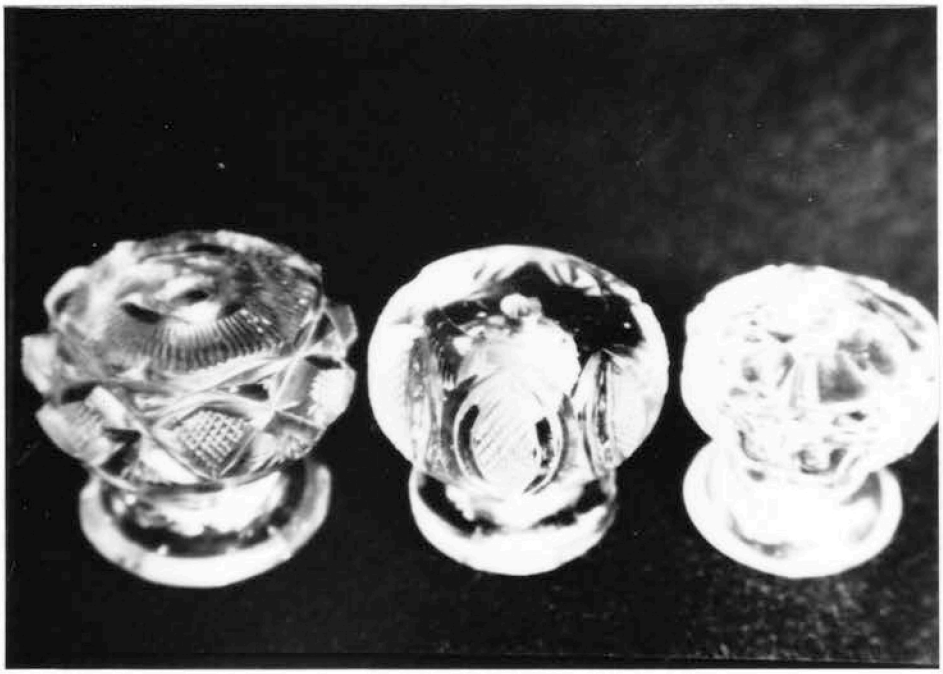
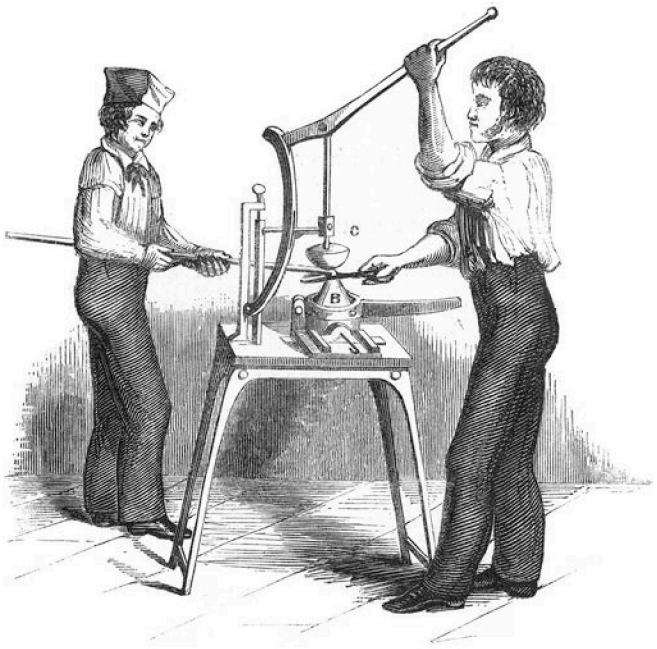


Figure 4: Cut glass drawer knobs. United States, 1815-1830. (Left) OH: 5.0 cm, OD: 6.0 cm, D. of foot: 4.5 cm. (Center) OH: 4.8 cm, OD: 5.3 cm, D. of foot: 3.7 cm. (Right) OH: 3.4 cm, OD: 4.8 cm, D. of foot: 3.2 cm. The Bennington Museum, Bennington, Vermont. Accession Numbers 1987.62.16, 1987.62.17, 1987.62.19.



Pressing Glass.

Figure 5: "Pressing Glass." Apsley Pellatt, Curiosities of Glass-Making (London: David Bogue, 1849), p. 121.

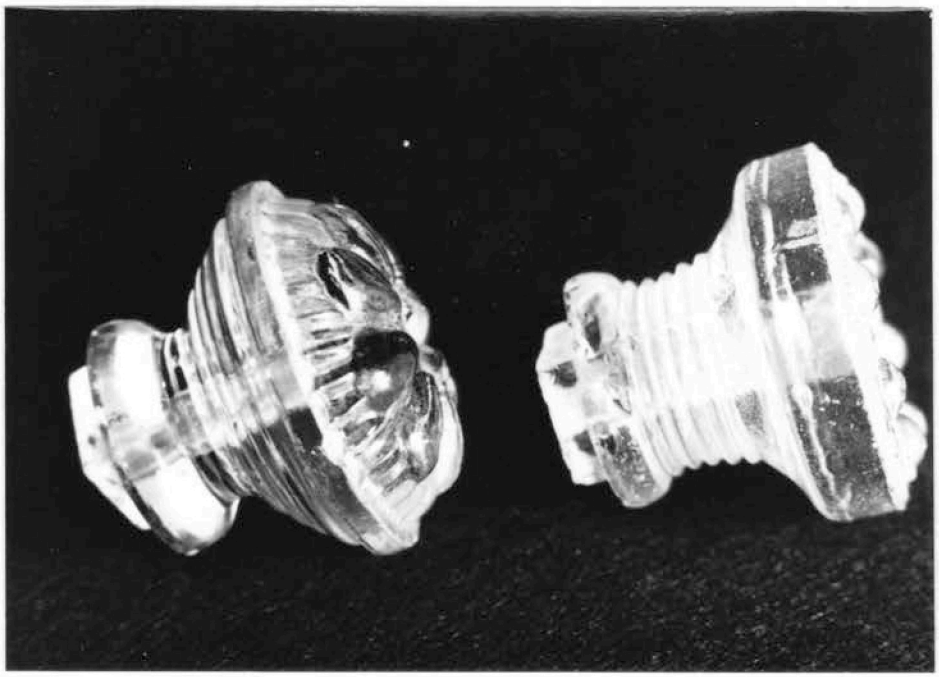


Figure 6: "Bakewell's Patent" pressed glass drawer knobs. Bakewell, Page and Bakewell, Pittsburgh, 1828-1832 or Bakewell and Anderson, Pittsburgh, 1832-1836. (Left) OH: 4.8 cm, OD: 5.5 cm, D. of foot: 3.5 cm. (Right) OH: 5.0 cm, OD: 5.5 cm, D. of foot: 3.5 cm. The Bennington Museum, Bennington, Vermont. Accession numbers 1987.62.3 and 1987.62.8.

Figure 7: Detail of the knob illustrated in Figure 6, left. The square end is embossed "PATENT/BAKEWELL'S," with one large star in the corner above the mark and one large star with two small stars in the corner below the mark.

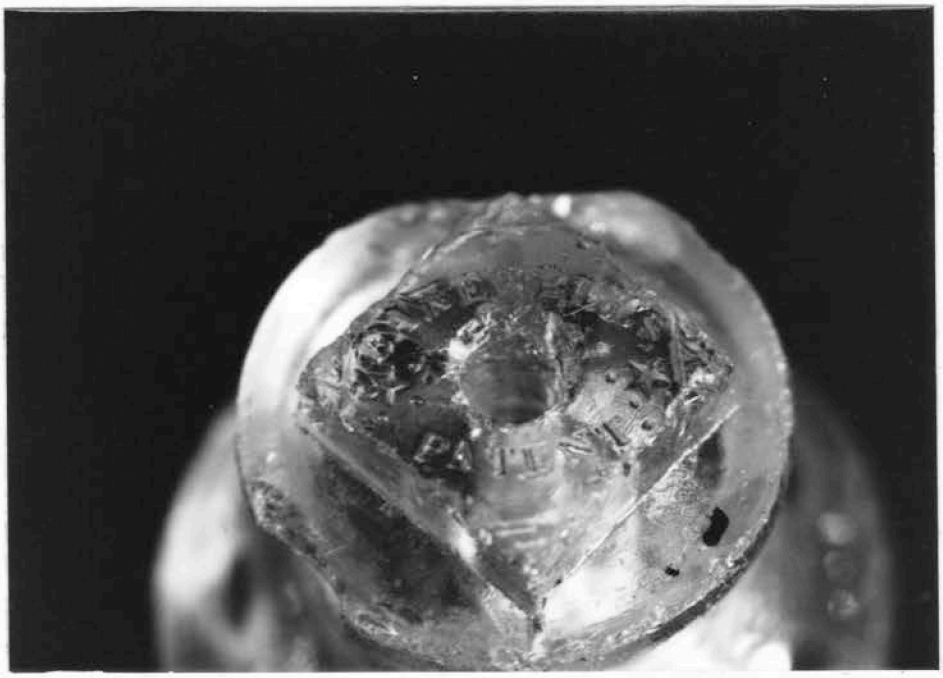


Figure 8: Detail of the knob illustrated in Figure 6, right. The square end is embossed "BAKEWELL'S/PATENT," with one large star and several small stars in the corners between the two words.

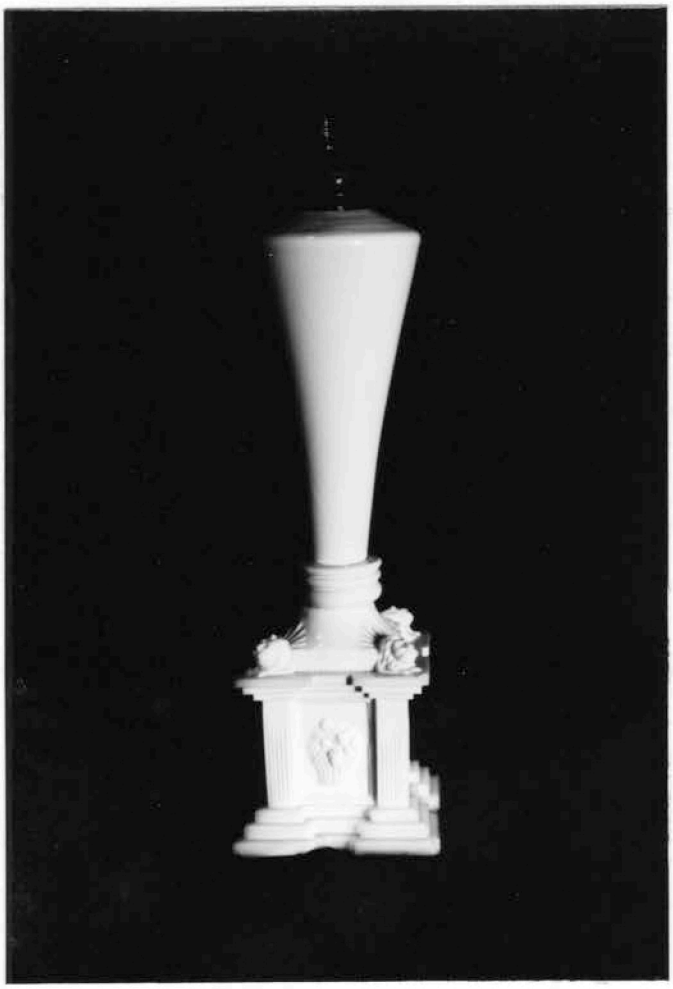


Figure 9: Lion-head lamp. New England Glass Company, Cambridge, Massachusetts, 1827-1835. Opalescent glass, pressed base, blown font. OH: 25.0 cm, OW: 8.0 cm, OD: 8.0 cm. The Bennington Museum, Bennington, Vermont. Accession number 1987.10.

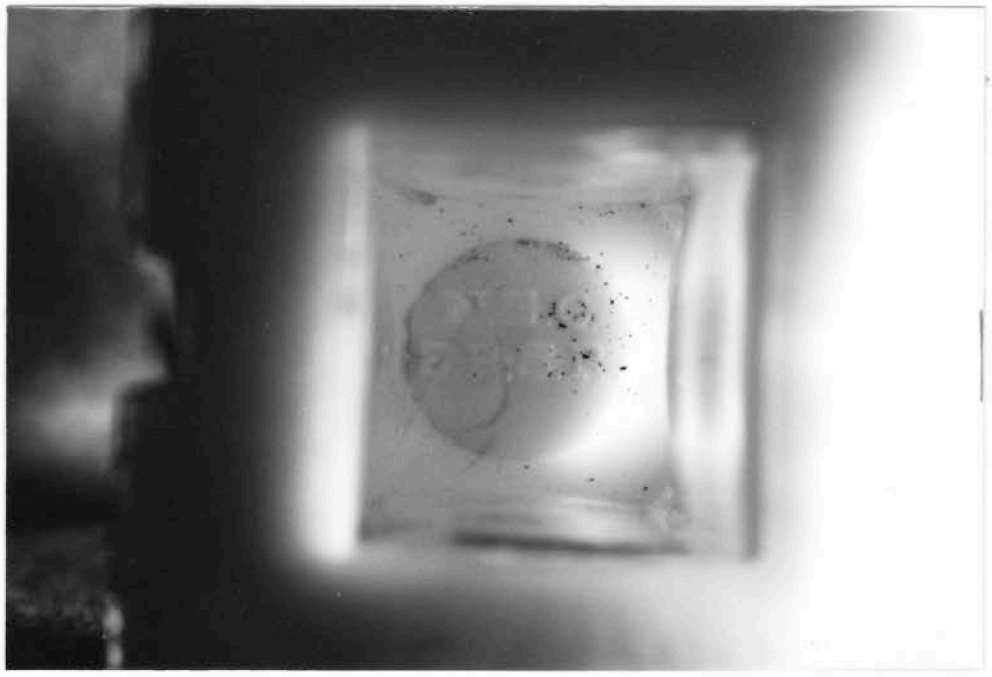


Figure 10: Underside of the lamp illustrated in Figure 9. The bottom of the plunger cavity is embossed "N.E.G.Co./ E.R.:S.R."

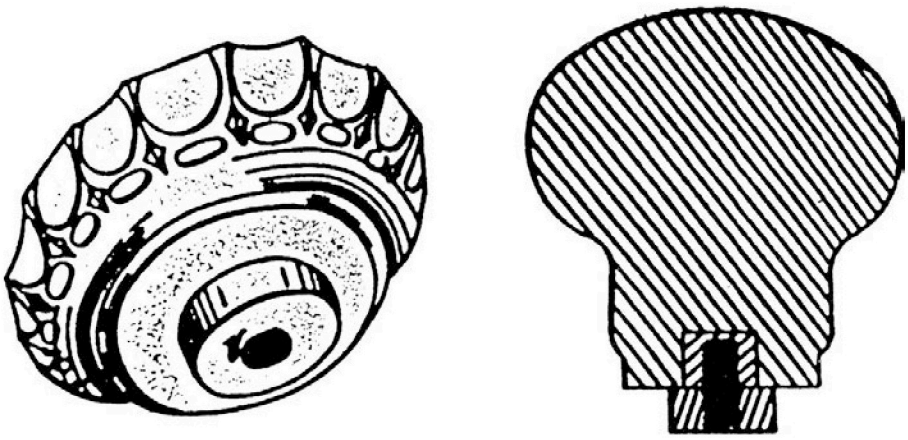


Figure 11: "Improvement in Making Glass Knobs." Letters Patent Drawing issued to Spencer Richards of Cambridge, Massachusetts, on October 31, 1831. United States Patents 1790-1836 (New Haven: Research Publications, Inc., 1980), reel 7 (microfilm, Boston Public Library).

Figure 12: Lamp. Attributed to Thomas Cains' South Boston or Phoenix Glass Works, 1813-1830. Colorless glass, pressed or pinched base, pinched stopper at top of stem, blown font. OH: 26.9 cm, D. of base: 8.5 cm. The Corning Museum of Glass, Corning, New York. Accession number 70.4.82.

Figure 13: Fragments of glass rods. Robinson, Jones and Company, Attleboro, Massachusetts, 1828-1837. Colorless glass. (Left) OH: 0.9 cm, OD: 0.8 cm. Collection of Joseph MacDougald.

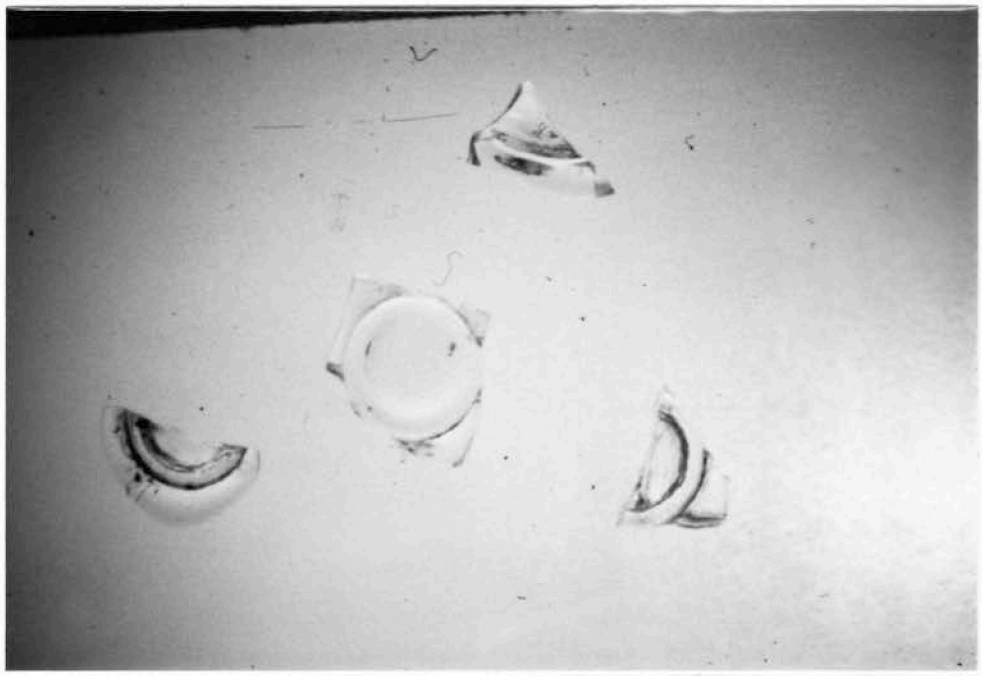


Figure 14: Fragments of imperfectly pressed button centers. Robinson, Jones and Company, Attleboro, Massachusetts, 1828-1837. Colorless glass. (Center) OH: 0.3 cm, OD: 1.3 cm, OW: 1.4 cm. Collection of Joseph MacDougald.

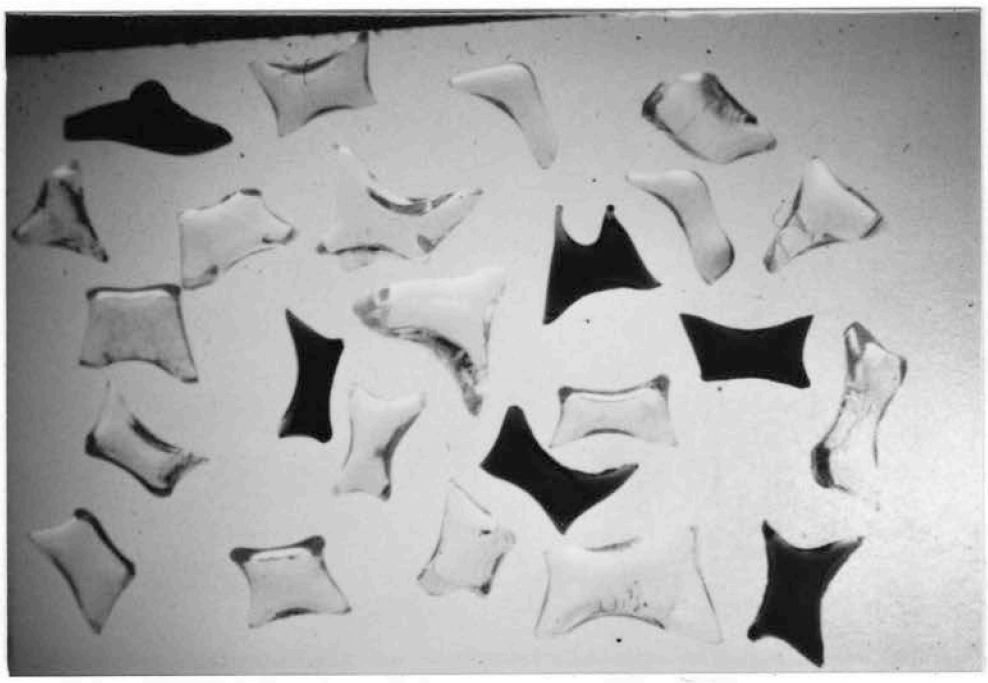


Figure 15: Trimmings formed during the button-making process. Robinson, Jones and Company, Attleboro, Massachusetts, 1828-1837. Cobalt-blue, canary-yellow and colorless glass. (Center) OH: 1.1 cm, OW: 1.2 cm, OD: 0.6 cm. Collection of Joseph MacDougald.

Figure 16: Pressed button center. Robinson, Jones and Company, Attleboro, Massachusetts, 1828-1837. Opalescent glass. OH: 0.2 cm, OD: 1.2 cm. Collection of Joseph MacDougald. Mounted buttons in this rosette pattern marked "R.J. & CO'S/PATENT" can be found in several private collections.

Figure 17: Button. Robinson, Jones and Company, Attleboro, Massachusetts, 1828-1837. Pressed, opaque black glass with brass mount. OH: 0.9 cm, OD: 1.0 cm. The Sandwich Historical Society, Sandwich, Massachusetts.

Figure 18: Reverse of the button illustrated in Figure 17. The brass is embossed "R.J. & CO'S/PATENT," with one large star and two small stars between each word.

ENDNOTES

Chapter II

[1]See Kenneth M. Wilson, "American Contributions to the Development of Pressed Glass," in Technological Innovation and the Decorative Arts, ed. Ian M. G. Quimby and Polly Ann Earl (Charlottesville: The University Press of Virginia for the Henry Francis du Pont Winterthur Museum, 1974), pp. 167-206. Wilson illustrates simple, low-relief articles pressed in shallow molds by Egyptian and Mesopotamian glassmakers as early as 1450 B.C. Glassworkers also learned to mold glass with compressed air (lung power), shortly after the introduction of the blowpipe about 50 B.C. In the nineteenth century this latter principle was mechanized through the application of mechanically-compressed air, which could expand glass into a mold with virtually the same degree of force exerted by the glass press. Miriam E. Mucha discusses pump-molding technology in "Mechanization, French Style Cristaux, Moule en Plein," The Glass Club Bulletin, 126 (September, 1979), pp. 3-8.

[2]Pinched chandelier fragments in the collection of The Corning Museum of Glass were excavated in the Lausitzer Mountains near Kreibitz (Chribska), in northern Bohemia, at the site of a factory that closed about 1740. The pinching technique later was used to form decanter stoppers and feet for bowls and other table-ware articles, which Kenneth Wilson dates to the 1780s ("American Contributions to the Development of Pressed Glass," p. 171). Deming Jarves undoubtedly was referring to similar articles when, on page 93 of Reminiscences of Glass-Making (New York: Hurd and Houghton, 1865), he recalled that "Fifty years back the writer imported from Holland salts made by being pressed in metalic [sic] moulds, and from England glass candlesticks and table centre-bowls [sic], plain, with pressed square feet, rudely made, somewhat after the present mode of moulding glass." Jarves had been a member of Henshaw and Jarves, Boston crockery dealers, in 1815, and some of the glass-ware he imported at that time undoubtedly was made with the pinching technique.

[3]Full-size, hinged molds also were used to make historical flasks early in the second decade of the nineteenth century.

[4]A number of sources can be cited to argue that the introduction of screw or lever pressure for molding glass was an American innovation. On page 176 of "American Contributions to the Development of Pressed Glass," Wilson quotes James Boardman, who, visiting the 1829 fair of the American Institute of the City of New York, observed that "The most novel article was the pressed glass; which was far superior, both in design and execution to anything of the kind I have ever seen in either London or elsewhere. The merit of its invention is due to the Americans, and it is likely to prove one of great national importance." Wilson also refers to the note on English glass manufacturer Apsley Pellatt's March 9, 1831, patent application for a "machine for pressing glass by the mode lately introduced from America." Sources that assigned credit for the innovation to Europe apparently were purposely or accidentally confusing pressed glass with pinched glass. Jarves, for instance, writes on page 94 of Reminiscences of Glass-Making that glass was made in England and Europe about 1815 "somewhat after the present mode of moulding glass." William Stutson, the superintendent of Jarves's glassworks, also might have been thinking of pinched glass when he claimed that glass pressing was introduced in the United States in 1817 (see Appendix D). His statement is consistent with a claim made by William Bennet in 1833 that glass pressing had been employed in Cork, Ireland, at least by 1816. Enoch Robinson and Henry Whitney had filed suit against Bennet and others for infringements on their 1826 patent for pressing glass. It was in Bennet's best interest to show that Robinson and Whitney were not the first to press glass, but a Court commissioner's trip to Ireland in 1830 did not substantiate his claim (Helen McKearin, "The Case of the Glass Knobs," Antiques 50 [August, 1958], p. 120).

[5]The patents referred to were issued on 8/19/1822, 9/9/1825, 11/4/1826, and 10/6/1827. See Appendix A.

[6]Konigmacher Memorandum Book, July 15, 1815 (manuscript, Joseph Downs Manuscript and Microfilm Collection, Winterthur Museum Library); Charles F. Montgomery, American Furniture: The Federal Period (New York: The Viking Press, 1966), p. 28.

[7]This group consists of patents issued on 9/9/1825, 11/4/1826, 11/14/1826, 10/6/1827, 5/14/1828, 6/13/1829, 10/19/1830, 10/31/1831, 12/14/1832, 9/19/1833, 10/17/1835, 9/20/1836, and 10/20/1836 (see Appendix A). Not counted among the twenty-four patents is one issued to Elijah Skinner on 6/11/1829. Although listed in 1831 as a patent describing the "Manufacture of Glass Commode Knobs" (Federal Document No. 50, Second Session of the 21st Congress), the actual patent covered the manufacture of wooden knobs with brass sockets (see Appendix B).

[8]See Appendix A. References are known to earlier patents which could have described techniques for pressing glass, but these references are too sketchy to be certain of the patents' contents.

[9]File Papers, Circuit Court for the Eastern District of Pennsylvania (October Session, 1829), Case No. 2, Henry Whitney and Enoch Robinson vs. William Emmett, William Bennet, Joseph Capewell, Charles B. Austin, Richard Synar, James Veneables and William Granville (Federal Archives and Records Center, Pennsylvania), p. 6.

[10]Pennsylvania File Papers (October Session, 1829), Case No. 2, p. 5.

[11]Pennsylvania File Papers (October Session, 1829), Case No. 2, p. 3.

[12]Letter from the Secretary of State, Transmitting a List of the Names of Persons to Whom Patents have been Granted for Any New and Useful Invention, During the Year 1822 (Washington: Gales and Seaton, 1823).

[13]See George S. and Helen McKearin, Two Hundred Years of American Blown Glass (New York: Crown Publishers, Inc., 1950), p. 80, and Lowell Innes, Pittsburgh Glass, 1797-1891 (Boston: Houghton, Mifflin Company, 1976), p. 41.

[14]Helen McKearin, "The Case of the Glass Knobs," Antiques 50 (August, 1951), p. 120. The newspaper advertisement in the Pittsburgh Statesman reads "Pressed Glass Knobs. The Subscribers, having purchased from the New England Glass Company the exclusive right to make Patent Pressed Knobs west of the Allegheny mountains, hereby caution all persons against making, buying, or selling the same, except such as are manufactured by the patentees, or Bakewell, Page & Bakewells. May 9, 1832." New England Glass Company agent Joseph N. Howe, Jr., recalled in 1853 that the Philadelphia case actually had been "carried on against powerful parties in Pittsburgh," and Bakewell undoubtedly was one of those parties (McKearin, "The Case of the Glass Knobs," p. 119).

[15]Helen McKearin writes in her article "The Case of the Glass Knobs," that Bakewell, Page and Bakewell were advertising "Patent Moulded Knobs" as early as November 1827. This advertisement cannot be used to prove that the 1825 patent was for blown-molded production, however, because the terms "moulded," "prest," and "pressed" were used somewhat interchangeably.

[16]The Franklin Journal and American Mechanics' Magazine 6 (August, 1828), p. 141. See Appendix A.

[17]M. D. Leggett, Subject-Matter Index of Patents for Inventions Issued by the United States Patent Office from 1790 to 1873 (Washington: Government Printing Office, 1874), p. 190. Leggett's complete description reads "Buttons, Mode of finishing glass."

[18]Leggett, p. 190. Leggett's description reads "Buttons, Manufacturing coat and waistcoat." No place of residence is listed by Leggett for the patentee in 1804. Although town historian John Daggett does not record George Robinson as an Attleboro button manufacturer in his voluminous Sketch of the History of Attleborough (Boston, 1894), J. Leander Bishop writes on page 108 of A History of American Manufacturers I (Philadelphia, 1861), that George Robinson "became, at Attleborough, Mass., the most extensive manufacturer of metal buttons in the United States." Bishop may have confused George with one of the many Robinson button makers in Attleboro; Early Unnumbered United States Patents, 1790-1836: Index and Guide to the Microfilm Edition (Woodbridge, Connecticut: Research Publications, Inc., 1980), p. 418.

[19]Leggett, p. 190. No place of residence is given in connection with Robinson's 1809 patent, but Leggett lists New Haven, Connecticut, as his residence in 1812.

[20]John Daggett, A Sketch of the History of Attleborough (Boston: Press of Samuel Usher, 1894), p. 581.

[21]Attleborough Valuation - State, Town and County Tax, October 1818 - October 1836 (Manuscript, Attleboro Town Hall); File Papers, Suffolk County Supreme Court, (October Term, 1823), Case No. 323, New England Glass Company vs. George W. Robinson (Massachusetts Archives). See Appendix F.

[22]Vital Records of Cambridge, Massachusetts, to the Year 1850 I (Boston, 1914), p. 606. The names of Enoch's parents are not recorded in the Vital Records, but evidence that he was the son of George Whitefield Robinson and Nancy Blake Robinson (who were married on September 8, 1799, according to the Vital Records of Attleborough [Salem: The Essex Institute, 1934], p. 546) is very strong. The middle name of Enoch's brother, Ezra Blake Robinson, is the same as their mother's maiden name. Another of Enoch's brothers was named George W. Robinson (will of Ezra Blake Robinson, No. 33097, Middlesex County Probate Court). Enoch left Cambridge

for Boston in 1836, where both he and George Robinson lived on Richmond Street, according to the Boston City Directory. The Index of Obituaries in the Massachusetts Centennial - Columbia Centennial, 1784-1840 IV (Boston: G. K. Hall Company, 1961), page 3859, records the death of George Robinson on March 27, 1838. One year later the Boston City Directory listed Enoch as a partner with Ezra B. Robinson in the firm of G. W. Robinson and Company, machinists. In 1841 Enoch lists himself as a locksmith, and in 1846 his listing reads "Enoch, locks and knobs." Enoch continued to pursue a locksmith's career in Boston until his death on February 11, 1888. His obituary in the Boston Transcript establishes the fact that he was born in Cambridge in 1801. Another Enoch Robinson, born in Attleboro to George and his first wife, Selena, on August 22, 1795, died as a young child.

[23]See Footnote 19; Attleborough Valuation, 1819.

[24]Attleborough Vital Records, p. 540; Attleborough Valuation, 1824.

[25]Attleborough Valuation, 1826. John Daggett writes on page 681 of his Sketch of the History of Attleborough that "on the Bishop farm many guns were forged which acted their part in the war for independance."

[26]Attleborough Valuation, 1825.

[27]United States Patents 1790-1836 (New Haven: Research Publications, Inc., 1980), reel 4, pp. 92 and 97 (microfilm, Boston Public Library). See Appendix A. Lord served as Boston agent for the New England Glass Company from 1829 to 1843 (Lura Woodside Watkins, Cambridge Glass [Boston: Marshall Jones Company, 1930], p. 175).

[28]United States Patent No. 434, "Method of Attaching Glass Knobs to Metalic [sic] Sockets," issued on October 20, 1837 (United States Patents, 1837 [microfilm, Boston Public Library], Appendix C).

[29]A jelly glass with a pressed foot marked "HHTP" is tenatively attributed to Providence, Rhode Island, moldmaker Henry P. Tufts by Lura Woodside Watkins in her article "The Providence Flint Glass Company" (Antiques 55 [March, 1949], p. 191).

[30]Attleborough Vital Records, p. 211.

[31]Daggett, p. 570.

[32]Daggett, p. 574.

[33]United States Patents 1790-1836, reel 2. See Appendix A.

[34]Ruth Webb Lee, Sandwich Glass: The History of the Boston and Sandwich Glass Company (Wellesley Hills, Massachusetts: Lee Publications, 1947), p. 77.

[35]Daggett, p. 349. Daggett also records on page 365 that "The manufacture of glass buttons and steps was commenced about 1828 by Richard Everett, and a few years later he was employing four hands. Virgil Blackington was also manufacturing glass steps at the same time and employed two hands."

[36]Attleborough Vital Records, p. 543. Rebecca was the daughter of Edward, Jr., and Amey (Bucklin) Richards. Edward, Jr., and Spencer Richards' father, Calvin, were sons of Edward and Mary (Fisher) Richards. See Attleborough Vital Records, pp. 208, 209 and 211; Richards' patent for finishing glass buttons is preceded in the 1822 government list by one issued on the same day to George W. Robinson for an "Improvement in the mode of making furnaces." It is tempting to speculate that both patents were associated in some way with Richard Robinson's plans to build an Attleboro glasshouse.

[37]Daggett, p. 349

[38]File Papers, Bristol County Supreme Court (March Term, 1823), Case No. 36, Richard Robinson vs. Thomas Cains (Superior Court Department of the Trial Court, Taunton, Massachusetts).

[39]File Papers, Bristol County Supreme Court (March Term, 1823), Case No. 36.

[40]File Papers, Bristol County Supreme Court (March Term, 1823), Case No. 36.

[41]Kenneth M. Wilson, New England Glass and Glassmaking (New York: Thomas Y. Crowell Company, 1972), pp. 198-228.

[42]Kenneth M. Wilson, "American Contributions to the Development of Pressed Glass," p. 172.

[43]Wilson, New England Glass and Glassmaking, pp. 205 and 210.

[44]Lura Woodside Watkins, "Glassmaking in South Boston, Part II," Antiques 48 (October, 1945), p. 216.

[45]Button collector Joseph MacDougald visited the Robinson button shop on Robinson Avenue, North Attleboro, in October of 1982. The glass buttons and button fragments he found during this trip were taken from between the floor boards of the attic shop.

[46]The edges of these trimmings are smooth and fire polished, suggesting that the buttons were entirely formed when the glass was hot, and not partially pressed from the rod at some distant glasshouse and shipped to Attleboro to be snapped apart and mounted.

[47]It is possible that button production was shifted at some point from Cambridge or Attleboro to Sandwich, or that it was carried on simultaneously at more than one location.

[48]On page 157 of The Big Book of Buttons (Boyertown, Penn.: Boyertown Publication Company, 1981), Elizabeth Hughes and Marion Lester write that "Molded centers of this type were known to have been made at the Boston and Sandwich glassworks in the 1830s. The centers were supplied to Benedict and Burnham and to Robinson, Jones and Company of Attleboro, Massachusetts, for insertion into their jeweled brass buttons. Scoville decided to copy this popular seller and made their own glass centers in the 1830s. Ives, Scott and Company may also have made their own glass centers." The "Glass Rosettes" listed as item no. 476 in the auction catalog of The Collection of the Late Edwin Atlee Barber (Philadelphia: Samuel T. Freeman and Co., 1917) undoubtedly were similar to the buttons described above. The catalog description reads "used at Wolcotteville, Connecticut, for Centres of Buttons and Picture Frame Nails. Probably made at Providence, R.I. by H. C. Luther."

[49]Gertrude D. Adkins, "Lesser Known American Makers," in a seminar handbook compiled by Sally C. Luscomb for the Just Buttons Museum, June 7th, 8th and 9th, 1973, p. 6.

Chapter III

DIRECTIONS OF TECHNOLOGICAL CHANGE

Patent records and other contemporary sources document the tremendous speed with which manufacturers perfected glass-pressing technology, entered new markets, and explored alternate modes of production. These three aspects of the mechanizing glass industry are closely interrelated, and each reflects the adoption of manufacturing principles that, by the 1820s, were dramatically altering the character of many trades. Machine technology allowed manufacturers to shift the focus of highly skilled workmanship from the crafting of the product to the creation of production machinery. This machinery could be brought together in a factory setting, where significant economies of scale could be realized. It also could be operated by relatively unskilled individuals, whose activities could be carefully supervised and who had little recourse to object to the conditions under which they worked. The actual evolution of manufacturing techniques and machinery varied from trade to trade, depending on the nature of the materials to be worked and the products to be made. These developments were united, however, by a common impulse to reduce manufacturing expenses, accelerate production, and standardize products. They also shared a growing

pool of technological knowledge, for new developments in metal-working and machine-making could be applied to the production of specialized tools for many trades.

Mechanical Developments

Economic historian Warren Scoville has written that few glassworking innovations made before 1880 were revolutionary in character. "The industry," he contends, "had improved its handicraft methods as much as possible, and, until the big hurdle of adapting the processes to machine principles had been cleared, little further advance could be expected."[1] By "machine principles" Scoville was referring to the utilization of fully-automated machinery and non-human sources of power. Such developments can be seen, however, as an extension of mechanical principles adopted by manufacturers when they began to press glass. In this sense, developments of the 1820s were far more revolutionary than those of the 1880s. More sophisticated applications of machine technology were made possible only by innovations which, beginning in the mid 1820s, dramatically extended the manufacturing capabilities of the glass press.

The press was being used to make a variety of tableware forms as early as 1827, and patent records suggest that the cap ring, a particularly important refinement in mold design, already had come into use by 1830. The patent issued on October 16, 1827, to Phineas

Dummer for "the construction and use of moulds with a core, for pressing glass into various useful forms; called Dummer's Scallop, or cover-plate," represents the first reference in patent materials to the pressing of articles other than knobs.[2] Dummer's cover-plate probably was a scallop-edged plunger. The possibility exists, however, that Dummer's patent described the design and use of the cap ring, which imparted a uniform thickness to the article's edge and thereby gave each article a uniform appearance, regardless of the amount of glass used to form it (figure 19).

A more probable reference to the cap ring appears in the patent issued to Deming Jarves on May 28, 1830. In this patent, Jarves explains that

> The plug or piston, which is to form the inside of the cup is made to fit exactly into a rim which forms the top of the mould, so that when it is pressed down, none of the fluid glass which has been put into the mould can escape at top, but will, by the pressure, be forced into the cavities described.[3]

Although Jarves appears to have described the use of a cap ring, his description is incidental to the principal subject of the patent, which was the production of cups with pressed handles (figure 20). Patent coverage may or may not have extended to the cap ring, and it certainly would not have covered the use of the cap ring for the production of plates, bowls, and hollowware forms other than cups with pressed handles.

Apparently a number of important developments in mold and press designs were introduced without patent protection and came

to be used widely by glass manufacturers. The cap ring probably was one such refinement, and a number of basic press designs also fall into this category. Only two patents issued before the 1836 Patent Office fire are known to describe the design or operation of a press. A third patent, issued on October 16, 1827, to George and Phineas Dummer and James Maxwell of Jersey City, New Jersey, also might have covered the design of a press, but unfortunately the description given by the Journal of the Franklin Institute is very brief. "Moulds with mechanical powers" also could refer to a process in which the closing of the mold generated the force for pressing.[4] A similar technique was described by Peter Barlow in The Encyclopedia of Arts, Manufacturers and Machinery (London, 1851):

> The pattern is given by placing a quantity of melted glass within an external metallic mould of the required form, and then bringing down an interior one, of the shape and dimensions of the required utensil, and pressing the melted glass between the two. The two parts of the mould are connected together by means of a hinge, which acts as a lever for imparting the requisite pressure. The lower section is composed of two pieces, which, being opened, the glass can be removed from the mould immediately after use.[5]

The earliest certain reference to a glass press comes from the patent issued to Enoch Robinson and Henry Whitney on November 4, 1826.[6] While no contemporary illustration of the press is known, a conjectural drawing was published by The Magazine Antiques in 1951 (figure 21). It is similar in many respects to the press illustrated by the English glass manufacturer Apsley Pellatt in Curiosities of Glass-Making (London, 1849), and to the drawing of a press patented

by Pellatt on March 9, 1831 (figures 5 and 22).[7] Power is transmitted from the lever through the piston and plunger to the glass. The Robinson/Whitney method of pivoting these elements to one side when placing glass into the mold seems needlessly elaborate, yet it is featured in both of Pellatt's press illustrations.[8]

A press of greater complexity was patented by Thomas and John Bakewell on January 14, 1829.[9] Like the Robinson/Whitney press, the Bakewells' press had three principal elements: a lever or crank, a piston, and a plunger. It is identified as a toggle-joint press, however, which means the connection between its lever and piston was more sophisticated than that found in an ordinary lever press. Knight's American Mechanical Dictionary (Boston, 1880) describes the toggle joint as "an elbow-joint. A joint formed by two pieces articulating endways, as the human knee. It is much used in pressing: the Stanhope printing press, and some hay presses, are instances" (figures 23-26).[10] Commenting on the Bakewells' toggle-joint press, the editor of the Journal of the Franklin Institute noted its similarity to presses already in use, observing that "it appears very similar to several of the modern printing presses, to many seal presses, working on the toggle joint, and various other machines."[11] His implication was that the patent for such a basic press design would not stand up in court. Toggle-joint presses could generate a great force over a short distance, and they came to be employed widely in the glass industry. A more complex version incorporating a

rocking carriage was patented by William O. Davis of Pittsburgh in 1854, and Deming Jarves appears to have depicted one in his 1854 illustration of "an American model glass factory" (figures 27 and 28).

The fact that many basic press designs had been used for years in one form or another, and consequently were not subject to patent protection, helps to explain the rapid dissemination of the press among glass manufacturers. Machinists and manufacturers were able to protect design refinements, such as Davis's rocking carriage, but if an innovation came into general use before a patent was issued, or if no patent were applied for, anyone could adopt it. This might account for some of the many small changes that marked the development of the press from designs illustrated by Pellatt to one depicted in the Scientific American on November 11, 1876 (figure 29). These include the substitution of a weight-balanced, curved steel handle for a straight wooden handle, the introduction of an adjustable mold guide, and the use of spiral springs to control the plunger's descent. One principle that does not show up in early glass patents, although it is referred to in an 1833 court deposition, is that of screw pressure.[12] An example of the screw press was illustrated about 1880 by C. L. Mateaux in The Wonderland of Work (figure 30).

Given manufacturers' ready access to various press designs, it seems unlikely that the patent issued to Deming Jarves on December 1, 1828, for pressing patterned sheets of glass was intended

simply as a "Yankee dodge" around previously-issued patents.[13] In this patent, Jarves describes a technique for shaping standardized sheets of glass into a variety of tableware forms by slumping the sheets into holding pans or receivers of different shapes. The process increased rather than decreased the amount of machinery Jarves needed, because a special "follower" was requied to force the sheet into its holding receiver. Nevertheless, Jarves must have felt that certain economies could be achieved from the supposed versatility the process would afford. That he employed the concept, at least to a limited extent, is suggested by several letters at the Sandwich Historical Society which refer to the use of a single mold to make either plates or dishes, depending on the shape of the receiver employed with it. In a letter written to William Stutson on January 23, 1829, Jarves explained

> T'is very possible that I might call the 20 doz. Harp 9 inch plates instead of dishes. But, on reflection, you must have perceived that I meant dishes, as you cannot with that mould make plates <u>even with receivers</u>....[14]

Jarves seems to document the use of holding receivers in a letter written to Stutson on January 7, 1829 (figures 31 and 32):

> The 5 and 6 and 7 in. heart patt[ern] last sent up, about 1/3 of the quantity will not set steady but rest on the center like a pivot. This must be corrected and no more come up with that fault by placing a button about 1/4 inch thick in the center of the receiver.[15]

If hot glass were pressed into a mold holding Jarves's button, it would have encapsulated the button. If the glass were pressed into

a sheet and then turned over into a holding receiver, however, a button placed into this second receiver could correct the problem of the pivot.

Jarves's 1828 patent for pressing patterned sheets of glass was not the only patent he received that might seem impractical today. On June 11, 1829, he was issued a patent for pressing glass drawer knobs with threaded glass shanks (figures 33 and 34). The knobs could not be used without cutting large holes into the wooden drawer fronts. Although the question of a possible "Yankee dodge" again arises, this patent actually was just one of many attempts by manufacturers to prevent the turning and loosening of the knobs once attached. The patent issued to the Bakewells on May 14, 1828, possibly covered the square end of the marked Bakewell knob, which was meant to fit into a corresponding hole in the drawer front. Jarves took out a patent on October 19, 1830, for knobs pressed with a square cavity in their feet. A square collet would be fitted into this cavity to prevent the knob from turning. Many knobs from the Pittsburgh area have two small bumps projecting from the foot, which would impede turning without greatly disfiguring the drawer front (figures 35 and 36). Another solution was to press the knob with a rough, grid-like pattern on its foot (figure 37), while patents issued to Enoch Robinson and Spencer Richards for knob designs with brass foot-plates or inset metal nuts also addressed this problem.[16] In all, a tremendous inventive effort was made to solve this seemingly insignificant problem. That technology was equal to the

task is demonstrated by the letter of a Baltimore merchant written to the Journal of the Franklin Institute on September 15, 1831 (figure 38):

> Sir - I have been plagued in my furniture by those glass knobs, now so much used, becoming loose; and I find that no successful expedient has hitherto been adopted to remedy this annoyance. After several fruitless efforts, I have at last hit upon a plan, which I have found to be completely effectual, and at the same time, it is very simple. The annexed cut being a section of the knob and spindle, will represent the contrivance.
>
> A, is the ordinary nut. B, an extra nut, which I form octangular, or hexagonal, to make a better finish. Putting on the knob and spindle, as usual, I screw up the nut A, until the knob has the degree of tightness at which I wish it to remain. Placing then a key, made of a plate of brass or iron, on A, to keep it from turning, I screw B strongly against it: and I find that on turning round the knob and spindle they carry with them both nuts, if properly put on. The reverse of this, in ordinary cases, is the cause of the knobs becoming loose.
>
> The use of two nuts clamping each other, is familiar to all persons conversant with machinery; all the merit I claim, is that of applying this well known contrivance to the remedying a domestic annoyance, which, by its frequent occurance, may be termed a serious evil.[17]

Manufacturers' inventive efforts quickly led to dramatic improvements in the quality of pressed glass. Their achievements were noted by judges at the Franklin Institute's 1833 exhibition, who awarded an extra premium "to the Boston and Sandwich Glass Company, for No. 216, various specimens of pressed glass; these the judges think have very considerably improved since our last exhibition."[18] An anonymous letter published in the Boston Tribune and dated July 29, 1831, also noted remarkable developments in glass-pressing technology:

> While on a journey to the Cape recently, I visited the glass works at Sandwich, and was much pleased with the great improvement evinced in this important branch of manufacture. The work of this establishment is said to equal anything of the kind imported; and, to judge from the specimens afforded, one would think the assertion abundantly sustained. Pressed glass is made here in large quantities and is now brought to much greater perfection than formerly; still, it seems to me susceptible of some further improvement in one respect - the selection of patterns or designs.[19]

Many of the technical difficulties that had to be overcome to achieve the above-noted improvements are discussed in letters written by Deming Jarves in the 1820s. The problem of flattening plate bases has been discussed in reference to Jarves's letter of January 7, 1829, and on February 12, 1829, Jarves wrote that "the Candle or short Pedestal will not stand steady, the same fault as formerly. They bear on 2 opposite nobs. The table on which they are flatted at the works must be rounding."[20] Another problem discussed in the Jarves letters concerned the lack of a tight fit where the various parts of the mold came together. On January 5, 1829, Jarves wrote "a few of the 9 inch oval dishes are gathered badly, full of blisters. Care must also be taken in cutting off the fin. Some are not well done."[21] Examples of the scroll-decorated nine-inch oval dish often are found with ground fins (figures 39 and 40). The Jarves letters also refer to the difficulty of regulating plate thickness. Before the introduction of the cap ring, cutting the correct amount of glass into the mold was important for the appearance of the finished plate. Even after the cap ring came into use, however, manufacturers could reduce expenses by using as little

glass for each plate as possible, and on June 8, 1827, Jarves wrote that "the 5 inch Plates sell well. Make them light even if you lose a few in making. Toy and Cup Plates are wanted, but have them made light."[22]

The lion-head lamp mold made by Enoch Robinson and Spencer Richards demonstrates the extent to which technological difficulties associated with the pressing of glass had been overcome by the late 1820s (figures 9 and 10). The mold was made in four hinged parts and turned out one of the earliest American examples of pressed, full-relief ornamentation. Separate models were made for casting each of the four sides, as slight differences occur from one to another, and one step is consistently larger than the corresponding step on the other three sides (figures 41 and 42). The earliest lamps from this mold were pressed with a plunger that carried the initials of the New England Glass Company and the two machinists. The mark, which appears at the bottom of the base cavity, is distorted on virtually all surviving examples (figure 43). The plunger was not forcing glass far enough into the mold, and workmen had to push a pointed tool down into the cavity after the plunger was withdrawn to complete the operation. Later lamps were pressed in the same mold with a redesigned plunger, into which no initials had been carved. The lion-head lamp sold well and soon was being copied by the Boston and Sandwich Glass Company (figure 44). Possible references to its production in 1827 have been found in a Sandwich account book, and

fragments unearthed at the factory site demonstrate a close similarity to the original lamp (figure 45).[23]

Market Extension

While a number of contemporary observers equated glass pressing with brass casting, the two processes are quite different.[24] Glass is much less fluid than molten brass and will not assume a molded shape as readily. By forcing glass into the cavities of a mold, however, the press made it behave more like brass, and the first markets opened to manufacturers by the press had been occupied largely by the brass industry. Buttons possibly provide the earliest example of the glass industry's expansion, through mechanization, into brass-dominated markets. Knobs provide another. John Bakewell's interest in clocks provides a third. Like buttons and knobs, clockworks were an important product for the brass industry. On October 1, 1830, Bakewell patented "an improvement in the manufacture of Wheels, Pinions, or Movements, to be employed in the construction of Clocks, Time-pieces, or other machinery."[25] These works were to be made "of glass, instead of the substances or materials which have been heretofore employed for that purpose ... by forcibly compressing a proper quantity of melted glass between moulds or dies...."[26]

The introduction and development of the press also gave glass manufacturers greater access to markets previously dominated by the ceramics industry. Earlier in the nineteenth century the use

of full-size, hinged molds for the production of blown, pattern-molded wares had made the production of glass decanters, pitchers, sugar bowls, and dishes more economically competitive. With the development of the press in the late 1820s, glass manufacturers were able to add plates to their list of important products. The Sandwich sloar book at the Henry Ford Museum shows that by March 9, 1827, toy plates were being made at the rate of 258 and 264 per move, while ten dozen "moulded split cup plates" were ordered on the 17th of October and twenty dozen seven- and ten-inch "scollop desert plates" were ordered on the 7th of November.[27] Enoch Robinson also had succeeded in pressing various "articles for table use" at the New England Glass Company by 1827.[28] These probably included plates and dishes, while eight- and nine-inch bowls were being ordered from the Sandwich manufactory on October 17, 1827.[29] A fascinating invoice for pressed cup plates sent by the New England Glass Company to William E. Mayhew of Baltimore on April 20, 1827, advises that "the plates we hope you will dispose of immediately as the So. Boston Co. have already copied our patterns and Mr. Jarves will do the same probably."[30]

Initially, the press had relatively little influence on the production of items traditionally associated with the glass industry. Until pressing technology had been developed more fully, certain items could be made more economically with the blowpipe. Luxury items also continued to be blown rather than pressed, yet it also is possibly that glass manufacturers intentionally were not pressing

articles important to the glassblower's livelihood. Glassblowers did feel threatened by the new technology, to judge from the following claim made by Jarves in a letter exhibited at the Centennial Exhibition:

> The glass blowers on discovery that I had succeeded in pressing a piece of glass, were so enraged for fear their business would be ruined by the new discovery, that my life was threatened, and I was compelled to hide from them for six weeks before I dared venture in the street or in the glass house, and for more than six months there was danger of personal violence should I venture in the street after nightfall.[31]

Certainly by 1830 manufacturers had the technological ability to press drinking vessels, yet only three types are known in the lacy style characteristic of the 1830s. All three are small and only one was produced in quantity. The New England Glass Company exhibited pressed four- and six-flute tumblers at the first exhibition of the Massachusetts Charitable Mechanic Association held in Boston in 1837. This suggests that some tumblers typically dated between 1840 and 1870 might have been made during the 1830s.[32]

One of the three lacy drinking vessels referred to above was the handled cup patented by Jarves on May 28, 1830 (figure 20).[33] This patent represents a significant step toward the fully-mechanized production of forms common to both the glass and ceramics industries. Creamers, handled trays, and a variety of miniature forms survive to document the use of this technique, yet the process of applying traditional handles to the body of the pressed vessel

after its removal from the mold also continued throughout the century.

John M'Gann's 1830 patent for pressing decanters and bottles represents another extension of the process toward the mechanized production of traditional glass products.[34] Vessels with enclosed cavities or necks such as lamp fonts, decanters, and bottles presented manufacturers with a difficult challenge. The plunger had to be withdrawn from the mold and could, therefore, only form a cylindrical cavity or one that tapered inward. M'Gann's solution was to press the decanter in two halves. After the plungers were withdrawn, the mold for the top half was turned over onto the bottom mold, bringing the glass edges of the two halves into contact to form the complete decanter. The alignment of the various parts of the mold had to be perfect, and the implementation of M'Gann's idea appears to have been quite limited. Blown-molding techniques continued to dominate this production for several decades. Later it was found practical to press the bottle or decanter upside down and then work the bottom closed by hand.[35]

Alternative Technologies

Although American manufacturers were employing a variety of techniques for pressing glass by the late 1820s, other modes of mechanized production could achieve essentially the same results. Miriam E. Mucha has shown that the French were following a different

technological principle in the 1820s than their American counterparts, one that employed mechanically compressed air rather than the pressure derived from press and plunger.[36] The first major contribution to this technology was made sometime in the 1820s by Ismael Robinet of Baccarat. His pump won a gold medal and an eight-thousand franc award from l'Academie des Sciences in 1832 (figure 46).[37] It was described as an "instrument to facilitate and perfect the blowing of glass into molds, aiding the health of the glassmaker and at the same time giving a more perfect product."[38] In 1832 Georges Bontemps patented a more sophisticated apparatus, which consisted of a bellows, blowpipe, copper tube, and stopcocks to control air flow (figure 47).[39] The "Moules en Plein" wares illustrated in the Launay Hautin and Company catalogs of the 1830s, 1840s, and 1850s undoubtedly were produced with a similar device.[40]

The design for Robinet's pump was transported to the United States quickly, for on September 16, 1833, Joseph Stouvenel and Francis A. Martin of Philadelphia were granted a patent for a virtually identical device.[41] Almost one year earlier, however, Joshua Laird of Pittsburgh had patented a much more sophisticated device for the compression molding of glass.[42] Laird was an independent mold maker who executed work for a number of glasshouses. One of his clients was John Robinson, a Pittsburgh glass manufacturer who had taken out a patent for pressing glass in 1827.[43] The molds for Robinson's Washington and Jackson flasks were initialed by Laird,

and the McKearins attribute the mold for Robinson's pressed plate to Laird on the basis of a characteristically-lettered "J" that appears on all three pieces.[44] Laird obviously was familiar with both mold-blowing and pressing techniques, and the device he patented in 1832 reflects this familiarity. Like glass presses of the period, Laird's apparatus is mounted on a table and operates on the principle of droping glass into a mold rather than expanding it with a blowpipe. His machine was designed to manufacture knobs, a fact that is particularly interesting given the Bakewells' announcement one year earlier that they had purchased the Robinson/Whitney patent rights for pressing knobs west of the Allegheny Mountains. Laird's experimentation with pump-molding might have been stimulated by the Bakewells' patent protection.

The publication of the Laird and Stouvenel/Martin devices in the Journal of the Franklin Institute inspired Thomas and John Bakewell to patent a synthesis of the two on February 8, 1834.[45] The abstract for this patent, also published in the Journal of the Franklin Institute, directly referred to Laird's pump, the pressure from which the Bakewells applied to a conventional blowpipe. The Bakewells may have planned to purchase Laird's patent rights to use their technique, or perhaps they intended to sell the rights for their improvement to Laird. In any event, the large number of pump-molded knobs surviving from the Pittsburgh area proves that Laird's technique represented a viable alternative to pressing (figure 48).[46]

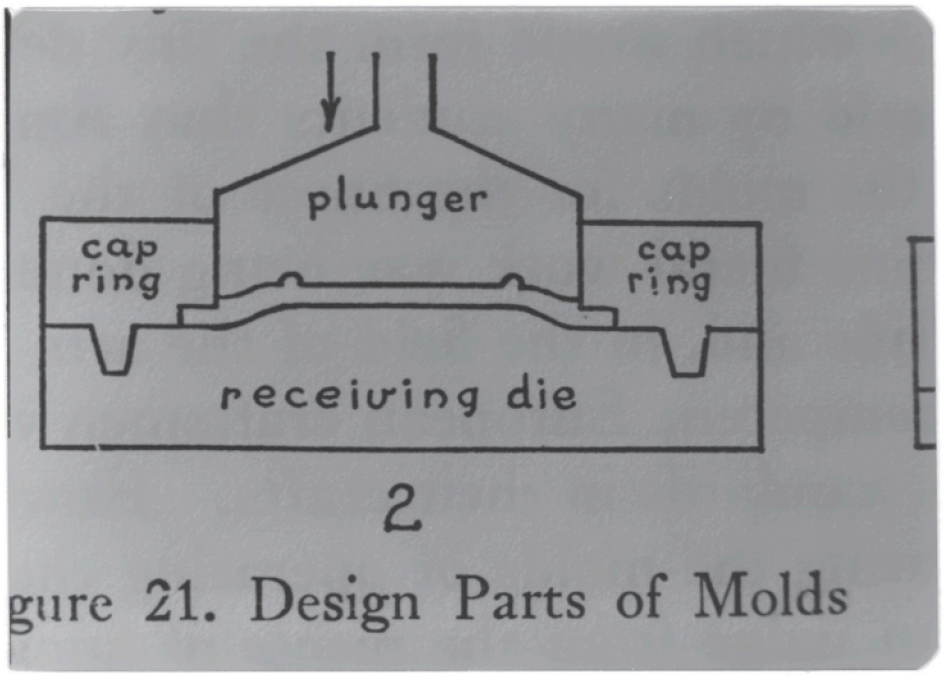


Figure 19: Cross section of a cup plate mold. George S. and Helen McKearin, American Glass (New York: Crown Publishers, 1948), p. 345. The cap ring is the circular ring of metal placed over the receiving die. The plunger fits exactly into this ring, and glass thickness directly under the plunger varies with the amount of glass placed into the mold. Glass thickness at the plate's edge never varies, as this part of the plate is formed under the cap ring.

Figure 20: Handled cup. Boston and Sandwich Glass Company, Sandwich, Massachusetts, 1830-1835. Colorless glass, handle pressed in one operation with the body. OH: 5.1 cm, D. of rim: 5.1 cm. The Bennington Museum, Bennington, Vermont. Accession number 1984.326.

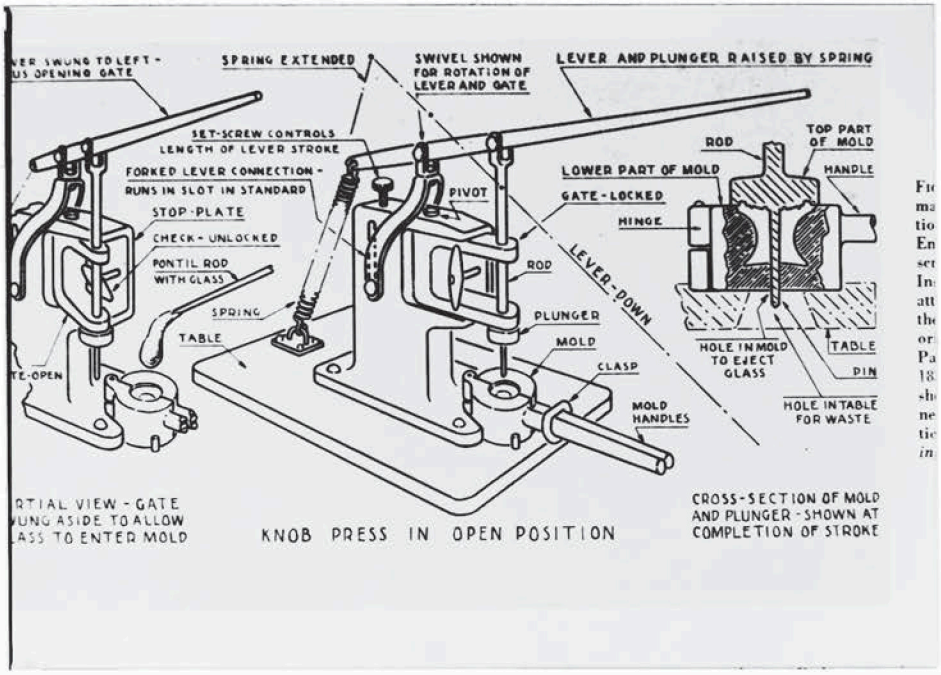


Figure 21: Conjectural drawing of the Robinson/Whitney glass press. Helen McKearin, "The Case of the Glass Knobs," Antiques 60 (August, 1951), p. 120.

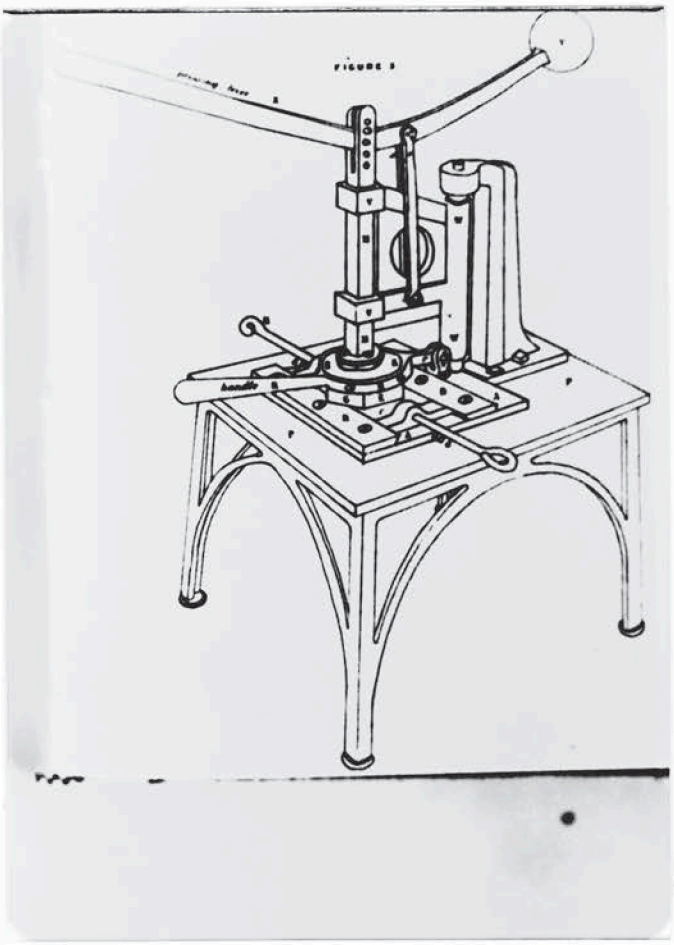


Figure 22: Glass press patented by Apsley Pellatt in 1831. Kenneth M. Wilson, New England Glass and Glassmaking (New York: Thomas Y. Crowell Company, 1972), p. 259.

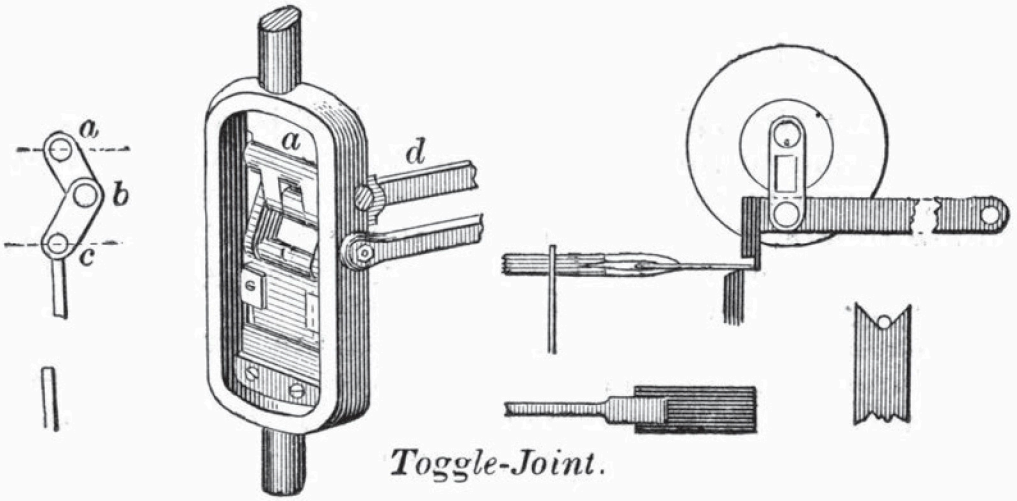
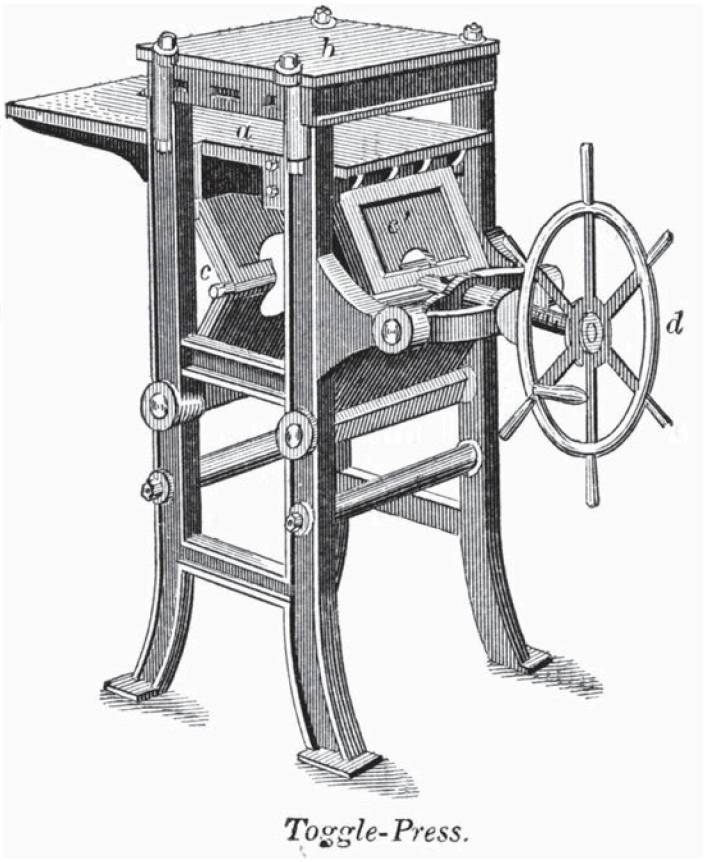
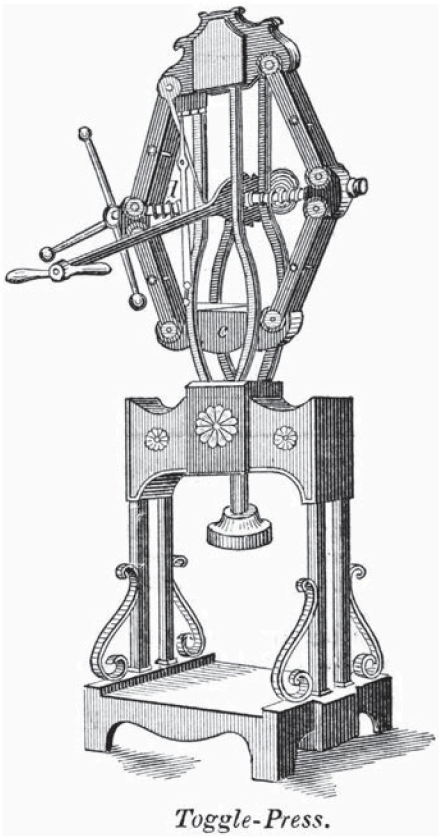


Figure 23: Illustration of a toggle joint. Edward H. Knight, Knight's American Mechanical Dictionary 3 (Boston: Houghton, Osgood and Company, 1880), p. 2586.



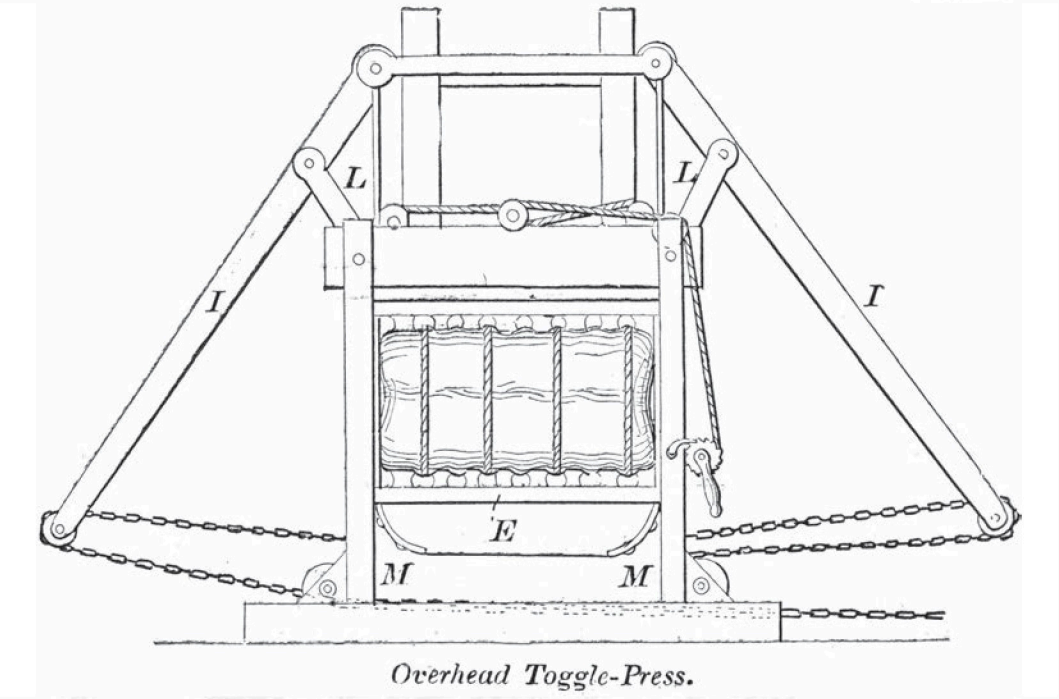
Toggle-Press.

Figure 24: Toggle-joint printing press. Edward H. Knight, Knight's American Mechanical Dictionary 3 (Boston: Houghton, Osgood and Company, 1880), p. 2586.



Toggle-Press.

Figure 25: Toggle-joint baling press. Edward H. Knight, Knight's American Mechanical Dictionary (Boston: Houghton, Osgood and Company, 1880), p. 2586



Overhead Toggle-Press.

Figure 26: Overhead toggle-joint baling press. Edward H. Knight, Knight's American Mechanical Dictionary 3 (Boston: Houghton, Osgood and Company, 1880), p. 2586.

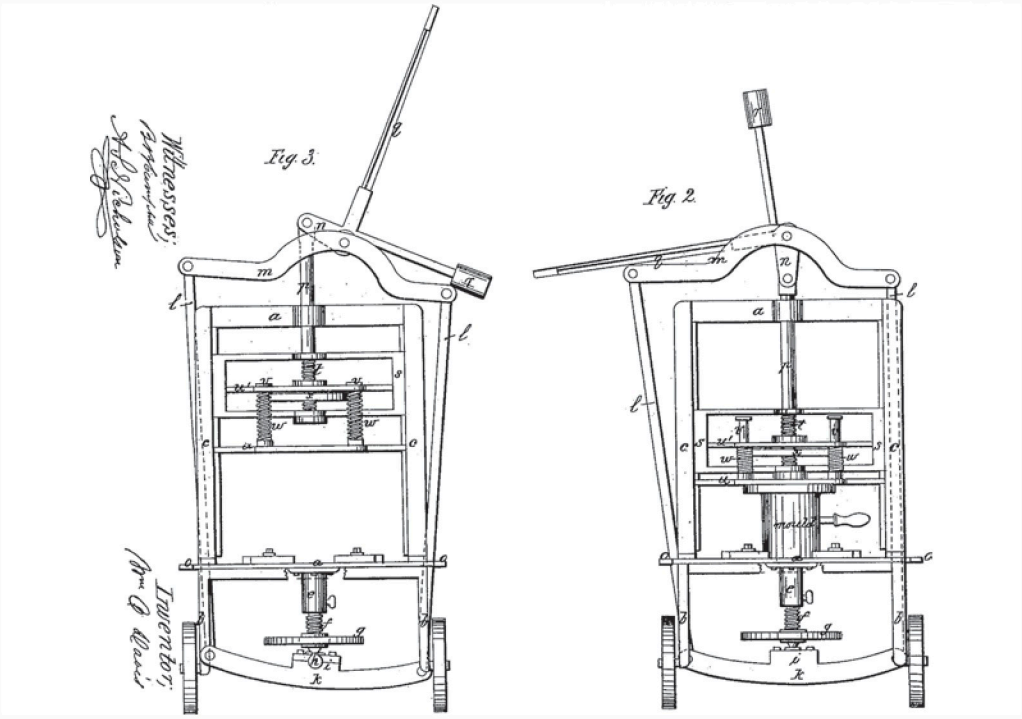


Figure 27: Toggle-joint glass press with a rocking carriage. United States Letters Patent #10,470, issued to William O. Davis of Pittsburgh on January 31, 1854 (United States Patent Office, Crystal City, Virginia).

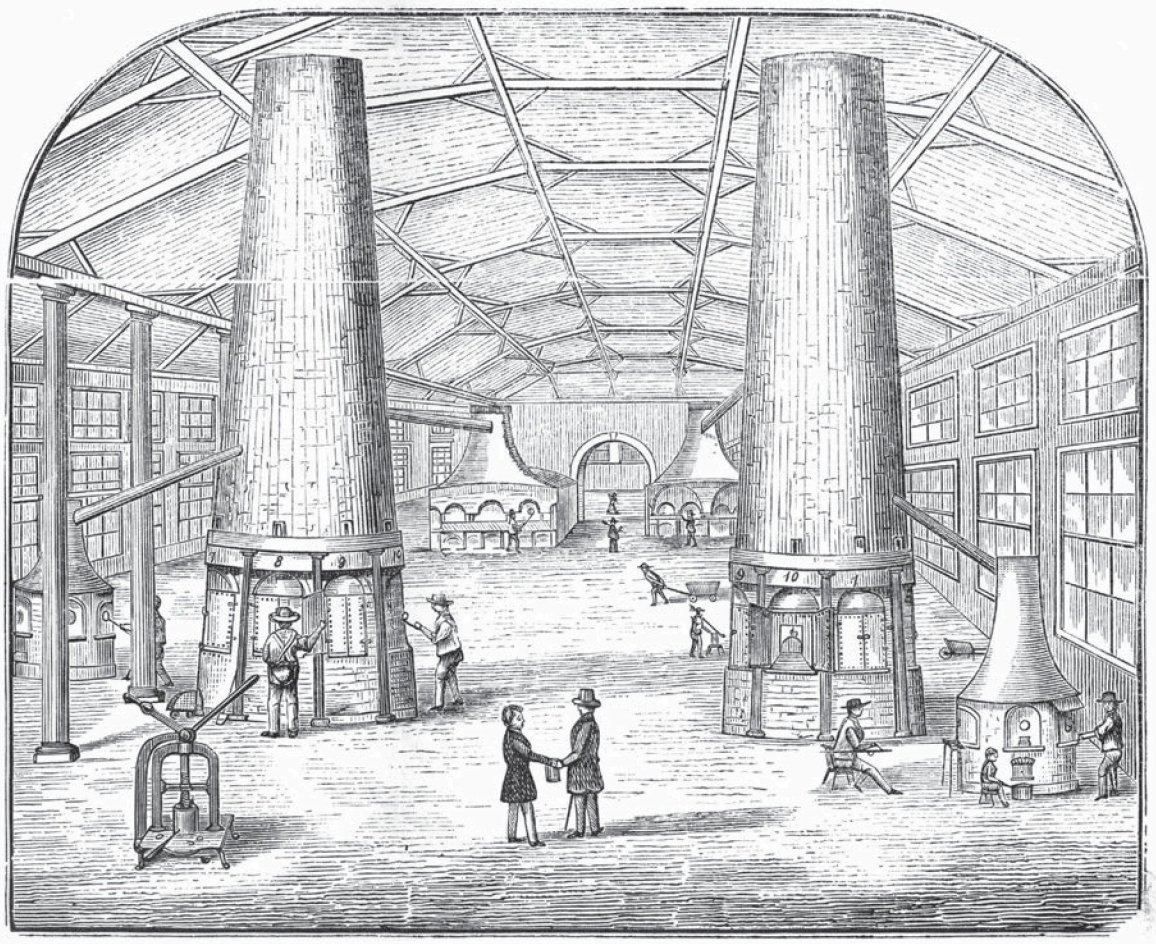


Figure 28: Toggle-joint glass press. from "An American Model Glass Factory." Deming Jarves, Reminiscences of Glass-Making (Boston: Eastburn's Press, 1854), inside back cover.

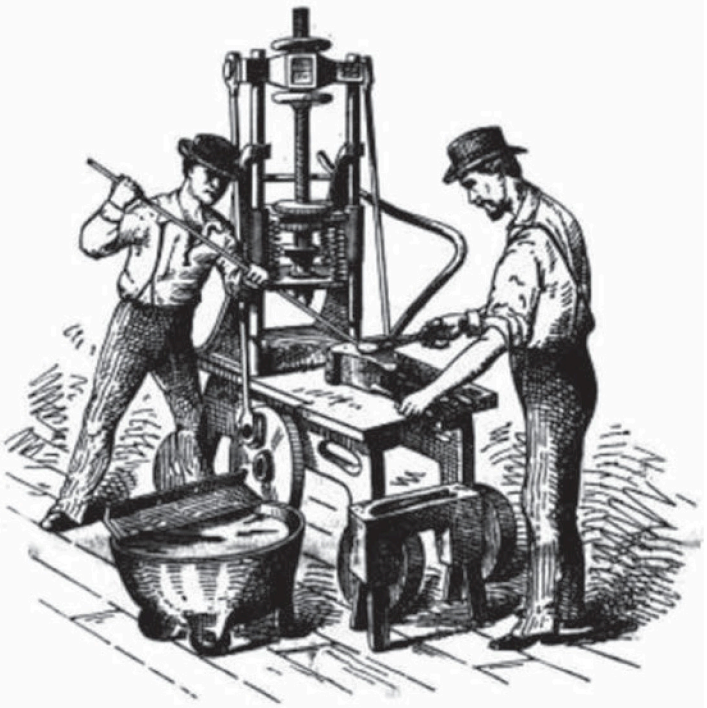
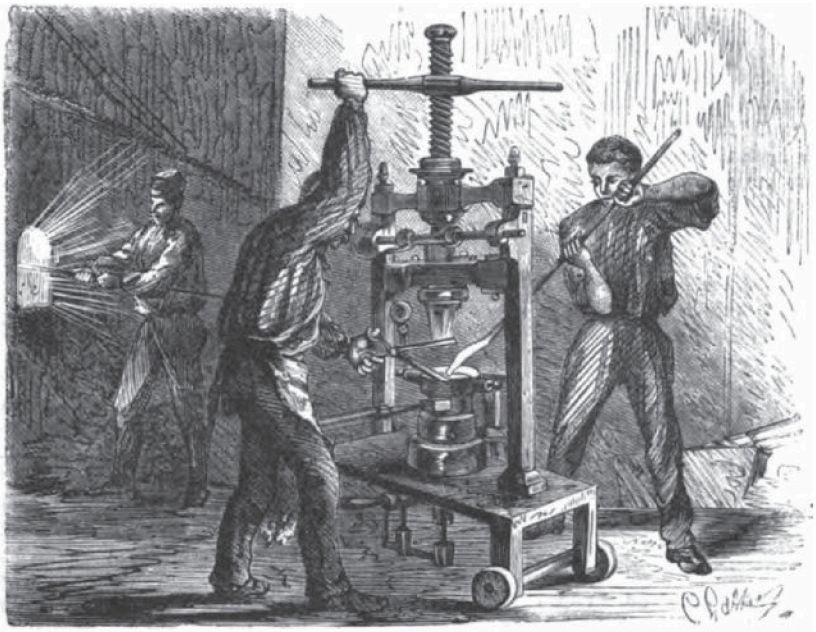


Figure 29: "Glassmaking at the Centennial." Scientific American (November 11, 1876), p. 11.



PRESS FOR MOLDING GOBLETS.

Figure 30: "Moulding Common Tumblers." C. L. Mateaux, The Wonderland of Work (London, Paris and New York: Cassell, Petter, Galpin and Company, 188[?]), p. 241. This same illustration was published in 1869 by Scientific American as a "Press for Molding Goblets" ("The Glass Works of the Departments of the Loire and the Rhone, France," Scientific American 21 [October 9, 1869], p. 1).

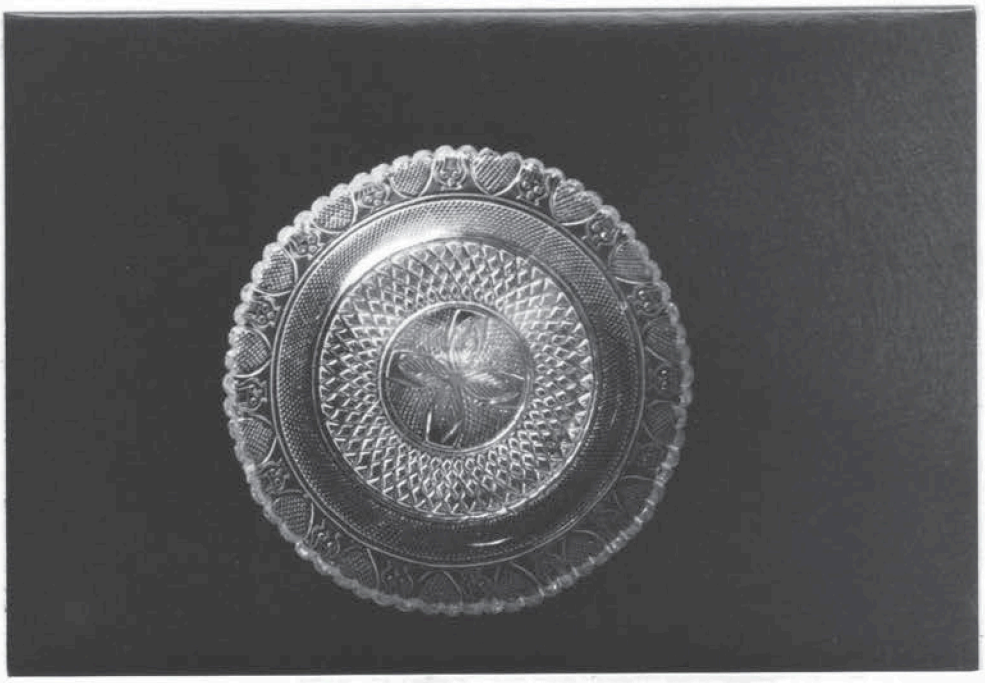


Figure 31: Heart-pattern dish. Boston and Sandwich Glass Company, Sandwich, Massachusetts, 1827-1835. Pressed, colorless glass. OH: 3.6 cm, OD: 19.5 cm. The Bennington Museum, Bennington, Vermont. Accession number 71.20.

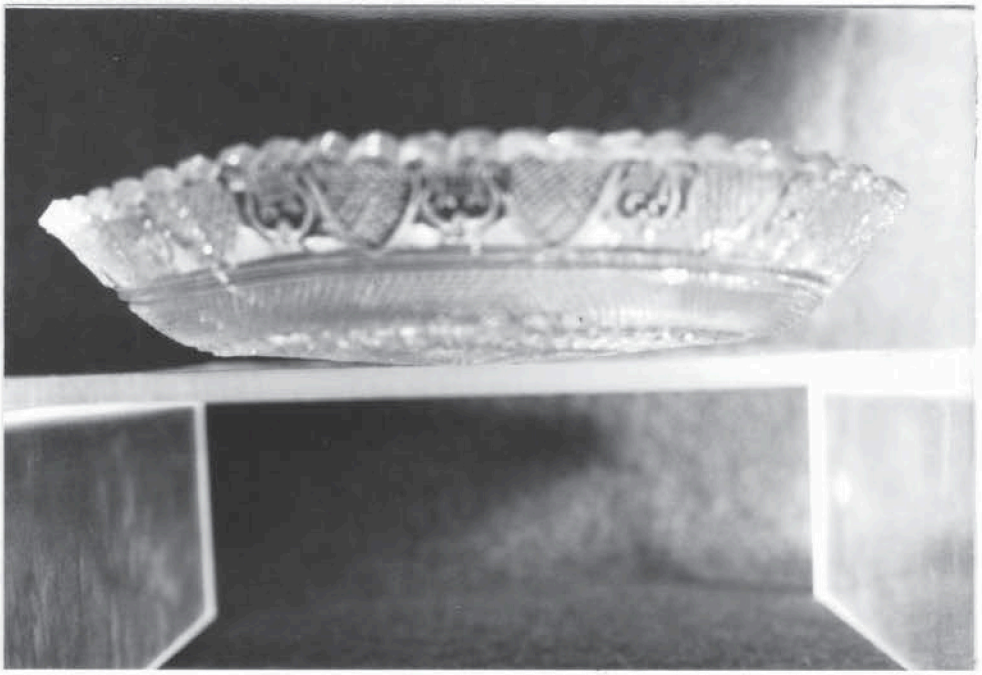


Figure 32: Profile view of the dish illustrated in Figure 31, which shows the rounded base of the dish.

Figure 33: Screw-shank knobs. Boston and Sandwich Glass Company, Sandwich, Massachusetts, 1829-1835. Pressed opaque-white glass. (Left) OH: 5.4 cm, OD: 5.0 cm, D. of foot: 1.8 cm. (Right) OH: 7.1 cm, OD: 6.4 cm, D. of foot: 2.5 cm. The Bennington Museum, Bennington, Vermont. Accession numbers 1987.62.24 and 1987.62.23.

Figure 34: Detail of the knob illustrated in Figure 33, left.

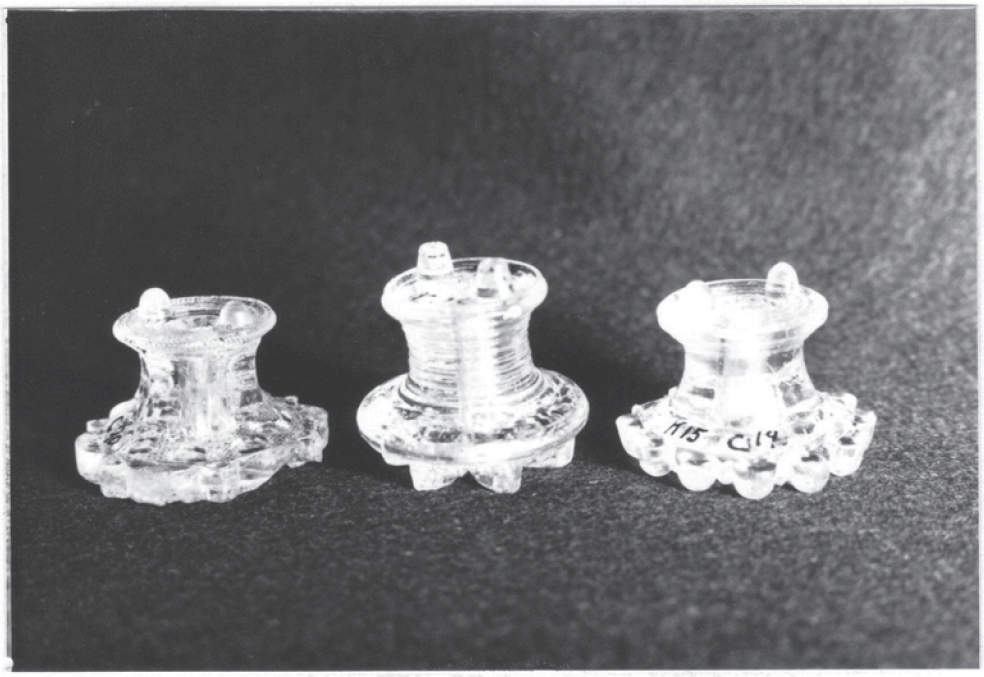


Figure 35: Drawer knobs. Midwest, 1827-1835. Pressed, colorless glass. (Left) OH: 4.0 cm, OD: 5.6 cm, D. of foot: 3.6 cm. (Center) OH: 5.0 cm, OD: 5.2 cm, D. of foot: 3.5 cm. (Right) OH: 4.4 cm, OD: 5.6 cm, D. of foot: 3.6 cm. The Bennington Museum, Bennington, Vermont. Accession numbers 1987.62.38, 1987.62.45, 1987.62.42.

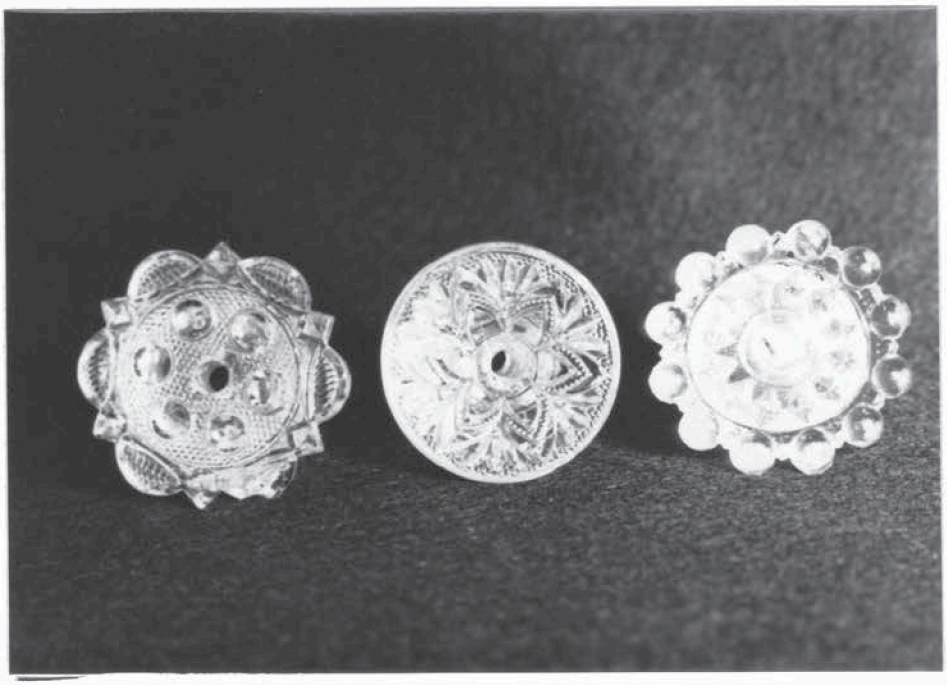


Figure 36: Face patterns of the three knobs illustrated in Figure 35.

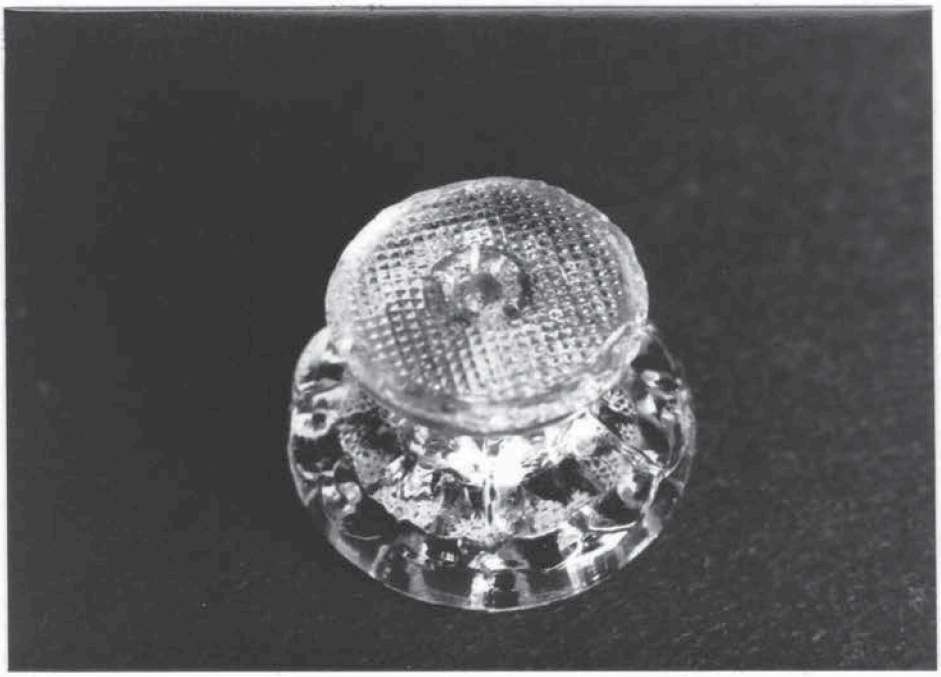


Figure 37: Drawer knob with grid-pattern foot. Midwest, 1827-1840. Pressed, colorless glass. OH: 3.9 cm, OD: 5.9 cm, D. of foot: 4.2 cm. The Bennington Museum, Bennington, Vermont. Accession number 1987.62.74.

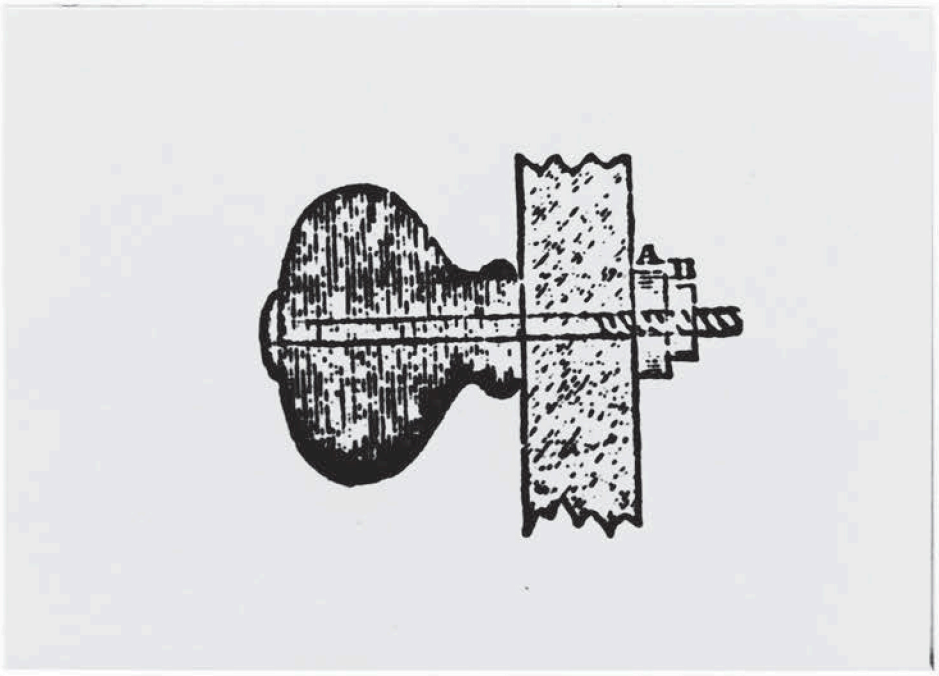


Figure 38: Illustration of an attached drawer knob. Journal of the Franklin Institute 8 (October, 1831), p. 247.

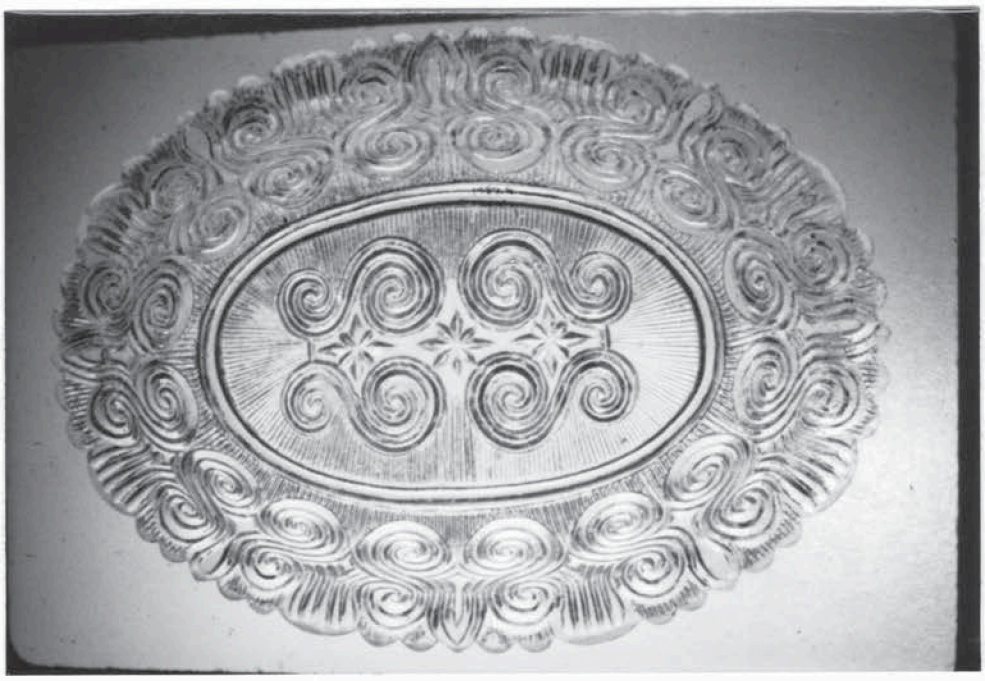


Figure 39: Oval dish. Boston and Sandwich Glass Company, Sandwich, Massachusetts, 1827-1835. Pressed, colorless glass. OH: 4.7 cm, OW: 16.6 cm, OL: 23.2 cm. The Bennington Museum, Bennington, Vermont. Accession number 1987.9.

Figure 40: Detail of the dish illustrated in Figure 39, which shows grinding at the joint of the plunging and receiving dies.

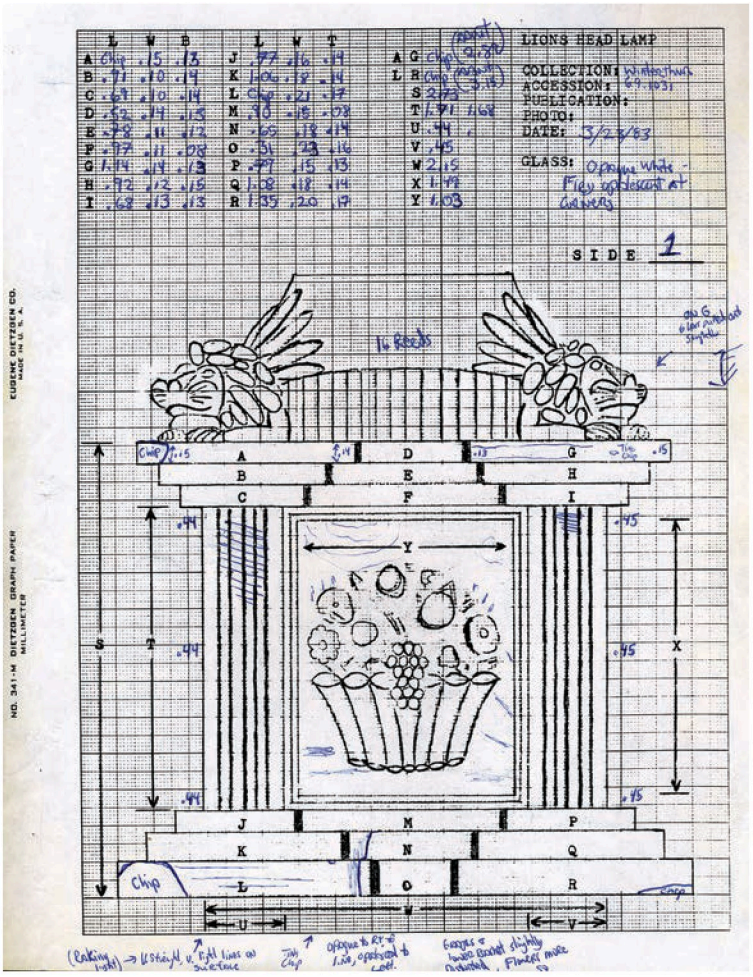


Figure 41: Lion-head lamp study sheet, obverse. One sheet was filled out for each side of the 15 lamps examined. The lengths of step "M" (lower center) on the four sides of all marked examples were .90", .97", .91", and .93". Unmarked examples pressed in the same mold exhibit the same measurements to within .01". Most other measurements were equally consistent from one lamp to another.

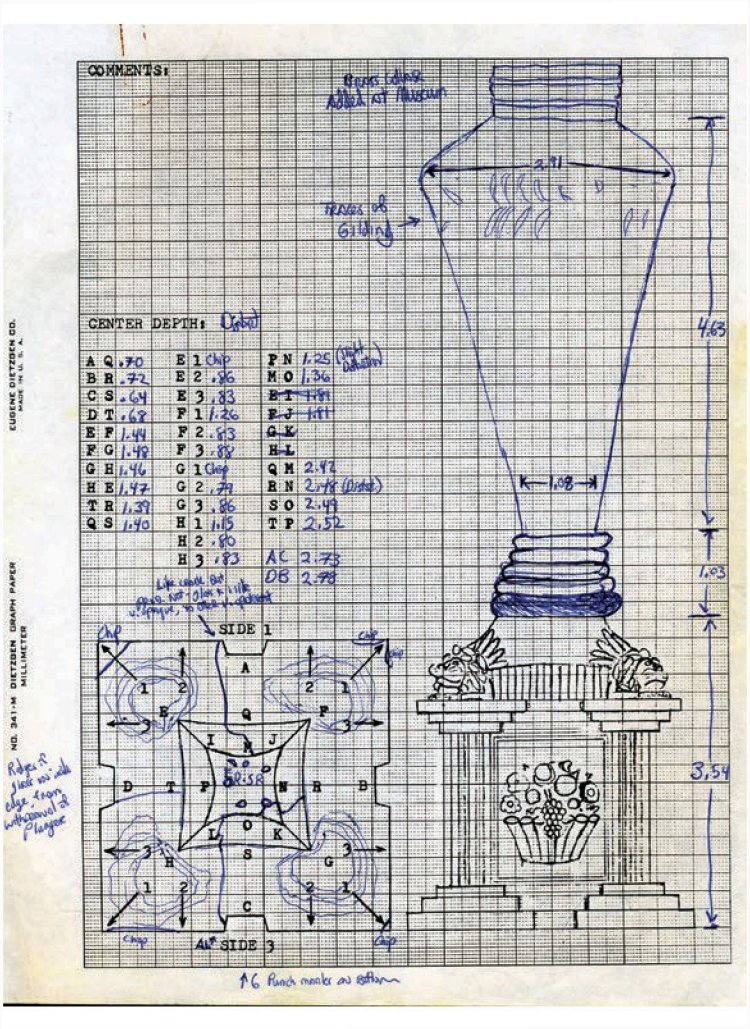


Figure 42: Lion-head lamp study sheet, reverse. One sheet recording base-cavity and font dimensions was filled out for each lamp examined.

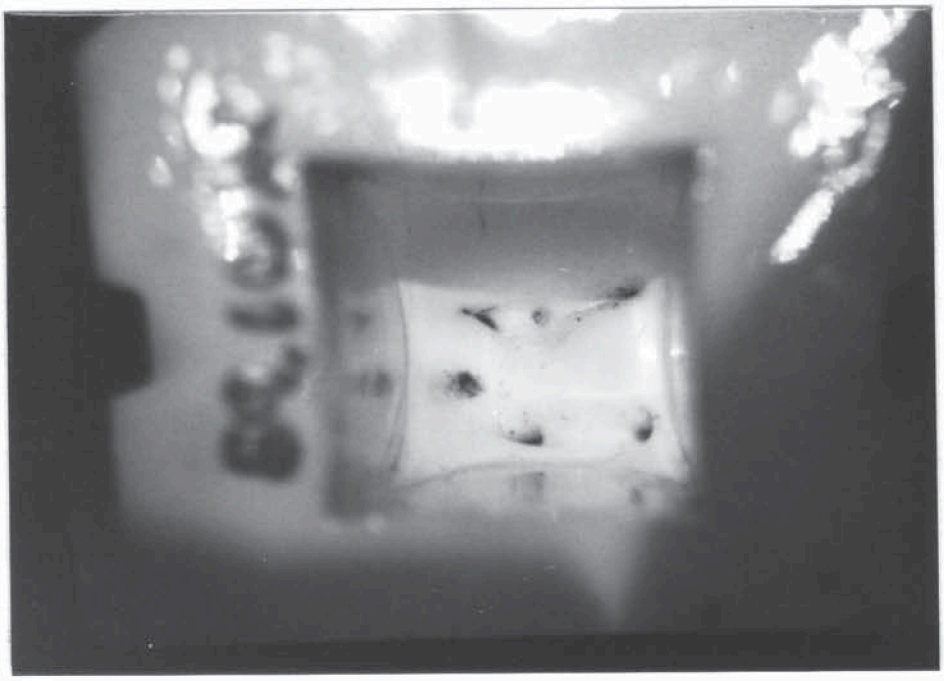


Figure 43: Base cavity of a marked lion-head lamp showing punch marks made by the pointed tool used to force glass deeper into the mold. The Henry Francis du Pont Winterthur Museum, Winterthur, Delaware. Accession number 69.1031.

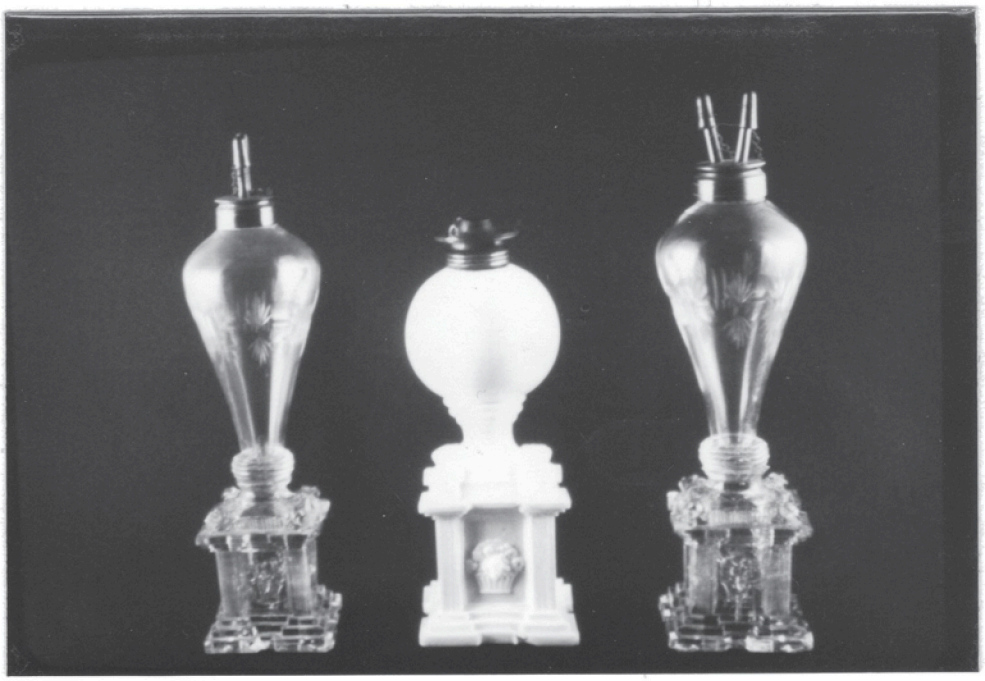


Figure 44: Lion-head lamps. (Left) Boston and Sandwich Glass Company, Sandwich, Massachusetts, 1827-1835. OH: 25.5 cm, OW: 7.0 cm, OL: 7.0 cm. (Center) Origin unknown, possibly the Phoenix Glass Works, South Boston, 1827-1835. OH: 22.0 cm, OW: 9.2 cm, OL: 9.2 cm. (Right) Boston and Sandwich Glass Company, Sandwich, Massachusetts, 1827-1835. OH: 25.6 cm, OW: 7.0 cm, OL: 7.0 cm. The Bennington Museum, Bennington, Vermont. Accession numbers 70.158(2)A, 1983.73, 70.158(2)B.

Figure 45: Detail of the lamp illustrated in Figure 44, left. These pad-like feet distinguish the Sandwich lion-head lamp from lion-head lamps made elsewhere.

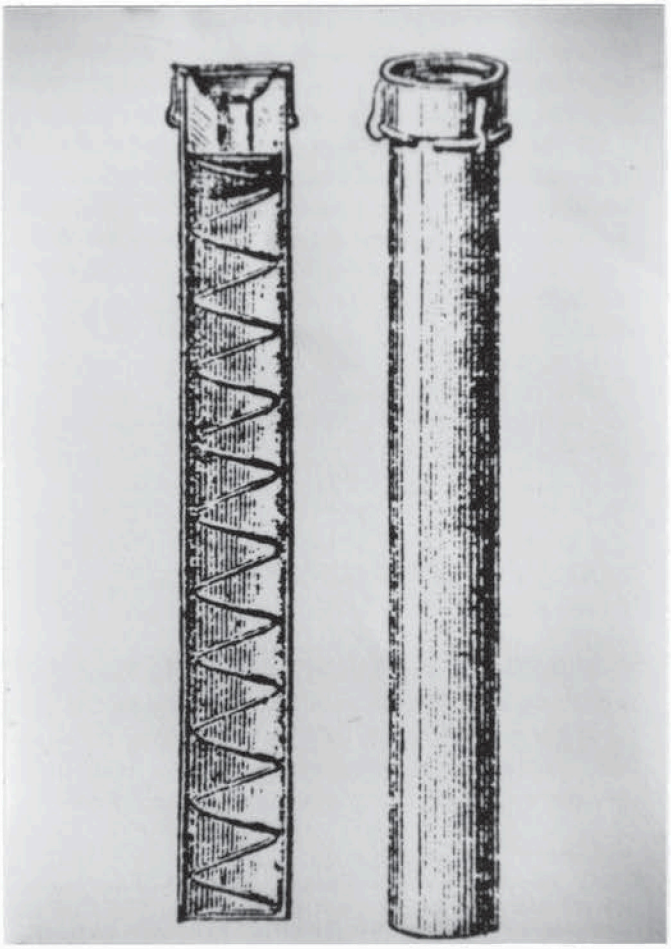


Figure 46: Robinet pump. Miriam E. Mucha, "Mechanization, French Style Cristaux, Moules en Plein," The Glass Club Bulletin 126 (September, 1979), p. 5.

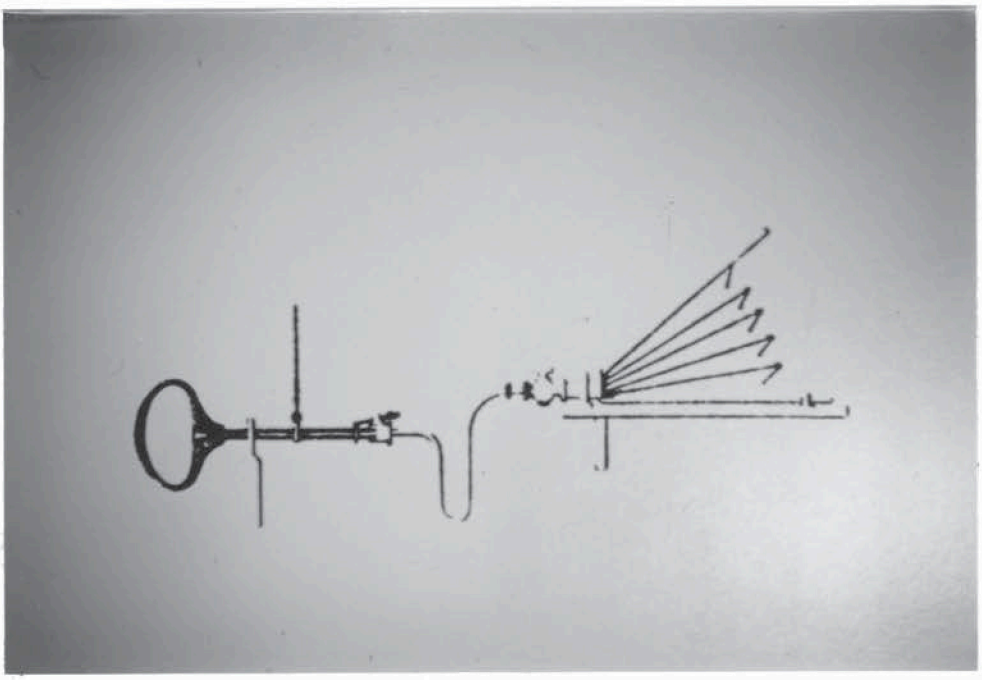


Figure 47: Bontemps pump. Miriam E. Mucha, "Mechanization, French Style Cristaux, Moules en Plein," The Glass Club Bulletin 126 (September, 1979), p. 5.

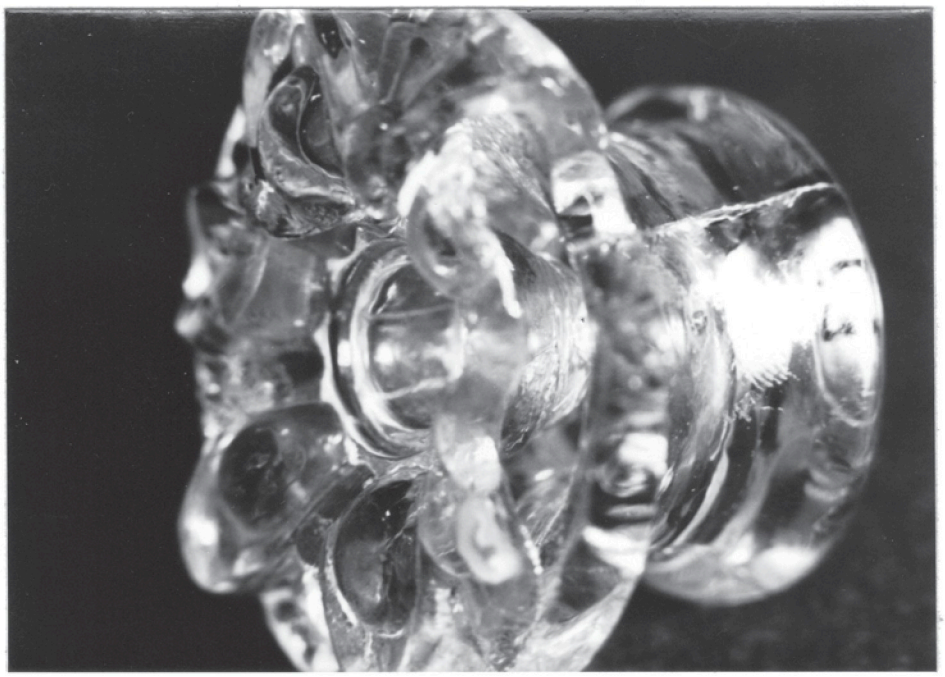


Figure 48: Drawer knob. Midwest, 1832-1840. Colorless, pump-molded glass. OH: 4.2 cm, OD: 5.4 cm, D. of foot: 3.9 cm. The Bennington Museum, Bennington, Vermont. Accession number 1987.62.48. A portion of the knob's face is broken away, showing the hollow cavity left by the expansion of compressed air into the glass.

ENDNOTES

Chapter III

[1]Warren C. Scoville, Revolution in Glassmaking: Entrepreneurship and Technological Change in the American Industry, 1880-1920 (Cambridge, Massachusetts: Harvard University Press, 1948), p. 65.

[2]The Franklin Journal and American Mechanics' Magazine 5 (March, 1828), p. 212. See Appendix A.

[3]Journal of the Franklin Institute 6 (September, 1830), p. 155. See Appendix A.

[4]The Franklin Journal and American Mechanics' Magazine 5 (March, 1828), p. 212. See Appendix A.

[5]Peter Barlow, The Encyclopedia of Arts, Manufacturers and Machinery (London: John Joseph Griffin and Company, 1851), p. 479.

[6]See Appendix A.

[7]Kenneth M. Wilson, New England Glass and Glassmaking (New York: Thomas Y. Crowell Company, 1972), p. 259.

[8]The swinging gate could be eliminated by filling the mold with glass before placing it under the plunger. This operation is illustrated by Ruth Webb Lee in Sandwich Glass (Wellesley Hills, Massachusetts: Lee Publications, 1947), plate 16, with an engraving from an unidentified source.

[9]Journal of the Franklin Institute 4 (April, 1829), p.258.

[10]Edward H. Knight, Knight's American Mechanical Dictionary 3 (Boston: Houghton, Osgood and Company, 1880), p. 2586.

[11]Journal of the Franklin Institute 4 (April, 1829), p. 258.

[12]Deposition of William Stetson [sic], File Papers, Suffolk County Superior Court, Case 156, November Term, 1833 (Massachusetts Archives). See Appendix D.

[13]See Ruth Webb Lee, Sandwich Glass: A History of the Boston and Sandwich Glass Company (Wellesley Hills, Massachusetts: Lee Publications, 1947), p. 92. Lee used the term "Yankee dodge" to characterize this patent, which she felt was so impractical that it must have been used to circumvent pre-existing patents. Even if all the known press designs had been covered by patent protection, however, Jarves's "improvement" would not have carried with it the right to use any of them.

[14]Barbara Bishop and Martha Hassell, ed., Your Obdt. Servt., Deming Jarves (Sandwich, Massachusetts: The Sandwich Historical Society, 1984), p. 107. In this letter, Jarves suggests a method for obtaining plates from the dish mold: "If you recollect, I wrote you in a previous letter for a few of that [plate] shape and described a mode which I thought would answer without destroying a receiver by turning it down.... The dish receivers could be filled up even with clay or plaster and dried hard or sheet iron and give it the sweep wanted, instead of turning down a new receiver." When reading these descriptions, it is important to remember that the plates or dishes were pressed upside down. Jarves uses the word "mold" to describe the patterned plunger and "receiver" to describe that part of the mold which was filled with glass and placed under the plunger.

[15]Bishop and Hassell, p. 104.

[16]For full citations of the patents or patent abstracts referred to in this paragraph, see Appendix A.

[17]Journal of the Franklin Institute 8 (October, 1831), p. 247.

[18]Journal of the Franklin Institute 12 (November, 1833), p. 390.

[19]Frank W. Chipman, The Romance of Old Sandwich Glass (Sandwich, Massachusetts: Sandwich Publishing Company, Inc., 1932), p. 121.

[20]Bishop and Hassell, p. 110.

[21]Bishop and Hassell, p. 101.

[22]Bishop and Hassell, p. 54. In a letter written by Jarves on November 9, 1827, he reminds Stutson that "it is important to get the plates thin. Invoice the refuse plates as I may be able to sell [them] by the barrel" (Bishop and Hassell, p. 64). Some of the technical difficulties described by Jarves are fascinating but difficult to follow. Mold temperature had to be carefully regulated, for instance, and on January 5, 1829, Jarves wrote "I think it best to turn the Sugar out as soon as possible and cool the foot quick by blowpipe or can you keep the top of the mould hot by placing some metal on the rim occas[ional]ly or turn the Sugar with the mould over the receiver [to] relieve the edge without taking the mould off from [the] foot so much as to let it settle" (Bishop and Hassell, p. 102). Another problem Jarves had to deal with was crazing. These fine cracks in the surface of the glass might have been caused by improper mold temperature or some other condition associated with the molds. On December 19, 1827, Jarves wrote "the Salt Mould will require a steel plain plunger and it is likely some alteration will be required, but the crisling must be done away in all [illegible] moulds. It perhaps arises from the bottom of [illegible] two and which may make standard [illegible]" (Bishop and Hassell, p. 66). Mold alterations apparently were not unexpected, and on May 29, 1828, William T. Mayo wrote to Stutson "I spoke a few days since of altering [the] bottom to scallop cup plates (making it larger). Can Cutter [probably factory employee William F. Cutter] do it? If not, please send it up" (Bishop and Hassell, p. 87).

[23]Bishop and Hassell, p. 53. Lion-head lamp fragments excavated from the site may be seen in the collection of the Sandwich Historical Society.

[24]For references to glass pressing as a casting process, see Thomas Webster, An Encyclopedia of Domestic Economy (New York: Harper and Brothers, 1845), p. 332, and Ann Royall, Mrs. Royall's Pennsylvania, or Travels Continued in the United States 2 (Washington D.C.: by the author, 1829), p. 125.

[25]Journal of the Franklin Institute 6 (December, 1830), p. 385. See Appendix A.

[26]Journal of the Franklin Institute 6 (December, 1830), p. 385. No surviving examples of pressed glass clockworks currently are known.

[27]Bishop and Hassell, pp. 50, 61, and 63.

[28]Benjamin Silliman, The World of Science, Art and Industry Illustrated from Examples in the New York Exhibition, 1853-1854 (New York: Putnam, 1854), p. 154. Silliman wrote that "In 1827 Mr. Robinson, against the ridicule of the craft, succeeded in moulding a salt stand, and various other articles for table use, and from that time the invention, as one of general applicability, may be considered established." Silliman's possibly-biased source for this information was Joseph N. Howe, agent of the New England Glass Company.

[29]Bishop and Hassell, p. 61.

[30]Kenneth M. Wilson, "American Contributions to the Development of Pressed Glass," in Technological Innovation and the Decorative Arts, ed. Ian M. G. Quimby and Polly Ann Earl (Charlottesville: The University Press of Virginia for the Henry Francis du Pont Winterthur Museum, 1974), p. 179. Jarves himself was concerned that competitors might copy his patterns. On June 23, 1828, he wrote to Stutson "Be careful no one gets a clay impression of the new dish moulds. Better take the plunger away" (Bishop and Hassell, p. 92); An article published in the National Glass Budget on January 23, 1909, attributes the economic success of early pressed glass to the underdeveloped state of the American ceramics industry. Inexpensive, imported ceramics would have posed just as serious a challenge to pressed glass as a fully developed local industry, rendering the argument invalid. Nevertheless, recognition of the overlapping product functions and markets was perceptive.

[31]Lee, p. 88. Jarves might have exaggerated glassblowers' hostile reaction to the new technology.

[32]First Exhibition of the Massachusetts Charitable Mechanic Association at Faneuil and Quincy Halls, in the City of Boston, September 18, 1837 (Boston: Dutton and Wentworth, 1837), p. 26.

[33]See Appendix A.

[34]See Appendix A.

[35]Lowell Innes discusses the so-called "cut and shut" technique on pages 66 and 67 of Pittsburgh Glass, 1797-1891 (Boston: Houghton Mifflin Company, 1976).

[36]Miriam E. Mucha, "Mechanization, French Style Cristaux, Moules En Plein," The Glass Club Bulletin 126 (September, 1979), pp. 3-8.

[37]Mucha, p. 4.

[38]Mucha, p. 4.

[39]Mucha, p. 5.

[40]See Miriam E. Mucha, "How to Read and Date the Launay Hautin Catalogs," The Glass Club Bulletin 138 (Fall, 1982), pp. 13-16.

[41]Journal of the Franklin Institute 13 (March, 1834), p. 180. See Appendix A.

[42]Journal of the Franklin Institute 11 (June, 1833), p. 379. See Appendix A.

[43]The Franklin Journal, and American Mechanics' Magazine 5 (March, 1828), p. 211. See Appendix A.

[44]George S. and Helen McKearin, American Glass (New York: Crown Publishers, 1948), p. 347.

[45]Journal of the Franklin Institute 14 (September, 1834), p. 177. See Appendix A.

[46]Fifteen different patterns of pump-molded knobs are represented in the collections of The Bennington Museum, Bennington, Vermont.

Chapter IV

MACHINISTS IN THE GLASS INDUSTRY

> It may be safely asserted that no department of the glass industry has from its earliest period attracted so little attention and investigation, none involved so little a range of inquiry or been productive of more ingenious, interesting and beautiful results than the manufacture of moulds for glassware (National Glass Budget, 1913).[1]

In the seventy-five years since this observation was made, historians of glass have extolled machinists' contributions to the glass industry, yet they have presented little specific information about the nature of the machinist's trade or the extent of his accomplishments. Several authors have stated as a general observation that machinists supplanted glass blowers as the skilled artisans of the industry.[2] This is not entirely correct, for large quantities of glass were blown throughout the nineteenth century, while many pressed articles had not been traditional products of the glasshouse. Nevertheless, given the profound effect machinists from many different industries had on the character of American life, and given the importance of the new markets opened to the glass industry by their work, they would seem to deserve more than passing attention.

In the 1820s and 1830s the lines of distinction between the trades of the machinist, founder, mold maker, pattern maker, and inventor often were less pronounced than they became later in the century. Machinists' activities could encompass aspects of each of the trades listed above. The principal responsibility of the machinist involved with the glass industry, whether working in independent shops or those located right at the glasshouse, was the production and maintenance of molds and presses. Begining with a wooden model shaped exactly like the finished glass vessel, machinists created models or "patterns" of the various parts of the mold which, when hinged together, would fit precisely around the wooden model of the glass vessel. These mold patterns were packed in sand in a special casting box and then carefully removed, leaving cavities in the sand which would receive the molten metal. When the two halves of the casting box were brought together, the cavity inside corresponded exactly to the shape and size of the mold pattern. After casting, the machinist cut and drilled the finer details into each of the mold's parts, which were then polished and assembled into the completed mold.

Before the development of metal-working tools such as the milling machine in the 1840s, much of the machinist's work was performed by hand with chisels and files.[3] Brass, steel, and iron were used for casting molds in the 1820s.[4] Intensive labor was required to work these metals even as late as 1850, when Deming Jarves claimed that two machinists spent six months making the mold

for Daniel Webster's sixty-pound presentation bowl.[5] The labor-intensive nature of the work also is emphasized by the author of "Progress in Mould Making," who describes some of the difficulties faced by machinists:

> Brass was used some in [the] making of moulds but probably owing to the high cost it was not extensively used. At first the whole mould was made of this metal, then someone advanced the idea of having just a brass shell surrounded by iron, and while this reduced the cost considerably they were not generally used, probably owing to the shell getting loose or cracking. The use of iron for moulds for a great many years was in a large measure a very discouraging proposition owing to the uncertainty of the iron, it being what is now called common iron and we of today can readily appreciate the difficulty they encountered in trying to get a clean casting. After the mould was turned it was generally necessary to spend many hours in plugging and planing in order to get a smooth surface and the apprentice boys also spent many weary hours polishing, endeavoring to help accomplish this.[6]

Some of the specific duties of machinists working in the glass industry are outlined in a suit filed against George W. Robinson by the New England Glass Company in 1833. Robinson had gone to work for the company sometime after 1822, and his indenture, signed on October 1, 1830, stipulated that he was to continue his ordinary duties as a machinist, but that additionally he would oversee the company's entire pressing business and take responsibility for production standards and quotas.[7] His ordinary duties had included cleaning, repairing, and making molds, as well as actually pressing glass and "hanging" or attaching the molds to the press pistons. These duties were to be carried out in both the mold shop and the glasshouse. As foreman, Robinson was expected to encourage

the seven or eight hands under him to their greatest productivity as they tended the requirements of forty to fifty presses for making glass knobs and an unspecified number of presses and molds for other "common pressed glass articles."[8] By comparison, the Boston and Sandwich Glass Company in 1833 was operating between sixty and seventy presses for the manufacture of "salts, dishes, plates, lamps, lamp feet, window lights, deck lights, inks, wafer boxes, sands, inks and a variety of other articles."[9] At least two "mechanics" were employed to keep the molds and presses in order, but no actual mold making was done at the factory. Letters written by Deming Jarves indicate that such work was obtained in Boston. Also by comparison, William Raymond's glassworks in Brooklyn, which had an annual production valued between $100,000 and $200,000 in 1833, was operating about twelve presses and approximately one hundred molds for the pressing of "plates, dishes, bowls, nappies, etc."[10] No more than two hands were employed at any one time to maintain this machinery.

George Robinson was sued for leaving the New England Glass Company before his three-year contract had expired, and his lawyers went to great lengths to downplay the importance of his service to the company. The deposition for the defense was sent to William Stutson at the Boston and Sandwich Glass Company. The questions it posed were designed to emphasize the ease with which men like Robinson could press glass, and to show that the quality of the product was dependent on the quality of the machinery, not the skills

of the men operating it. Stutson's responses establish both points. According to Stutson, pressmen could be fully trained in from one to four weeks. No apprenticeship was needed, and he had "taken labourers out of the yard, and blacksmiths and others for that purpose."[11] The importance of the machinist's responsibilities for making and maintaining molds and presses was evaded by the defendant's lawyers. Nevertheless, Stutson did support their cause when he claimed that he never had trouble obtaining molds or finding mechanics to maintain them. Stutson also stated that a general supervisor of pressing was not required, further contributing to the defenses's effort to downplay the repercussions of Robinson's premature departure.

The plaintiffs' deposition, which was sent out six weeks after the defendant's, was addressed to John Gilliland or William Raymond of Brooklyn. With it, the New England Glass Company claimed priority for the introduction of the new glassworking machinery and demonstrated the vital importance of skilled machinists to the successful operation of their pressing department. The plaintiffs emphasized the novelty of the technique in 1830 and the lack of standardization between the presses and molds used in different glasshouses at that time. Raymond observed that each press was more or less unique, and that its maker would be better suited to keep it working than any machinist the company might hire to replace him. He also noted that in the three years since Robinson left the company, the technology for pressing glass had been developed to such

an extent that the great difficulties suffered by the New England Glass Company at his departure no longer would be encountered. "The business is better understood," Raymond observed, "and it is now more easy to provide for any difficulties or embarrassments that may occur."[12]

Even taking into account the probable bias of each deponent, the information they provide is very revealing. Just six years after the press was patented for the production of glass knobs, it was being employed extensively at both the New England Glass Company and the Boston and Sandwich Glass Company to manufacture a wide variety of articles. Other glasshouses, Raymond's among them, were employing the technique to a more limited extent. Still more surprising is the suggestion that by 1833 glass manufacturers could obtain competent mechanics without very great difficulty. This probably was true as early as 1830, the company's claims not withstanding, because the techniques necessary for making glass molds and presses were not radically different from those employed by machinists in other industries.[13] Machinists with a general competence in metal-working could have functioned effectively in the glass industry, which suggests that they did not occupy a particularly "aristocratic" position in the labor market. This impression is reinforced by the level of wages they received. Robinson was paid only ten dollars a week at a time when glass blowers could earn twice that amount, while Henry C. Morrison,

a machinist whose indenture with the New England Glass Company was signed in 1831, was paid nine dollars a week.[14]

The availability of machinists in the early 1830s might have suppressed their wages somewhat, but it did not in any way negate the importance of their work to glass manufacturers. Machinists and manufacturers together pursued solutions to the technological difficulties they encountered with an energy and conviction that extended beyond simple interests in monetary gain and commercial success. More than virtually anyone else, these men were caught up by a popular wave of excitement over the potential applications and beneficial effects of technology. They seem to have identified strongly with the values of what historian Bruce Sinclair refers to as the "scientific mechanic," an individual whose skill with tools was complemented by a thorough familiarity with scientific principles. The intellectual pursuits of the "scientific mechanic" encompassed a broad spectrum of knowledge, while community service and a strong interest in the arts rounded out his idealized character.[15] These values suffused publications such as the Journal of the Franklin Institute, which were read by many machinists and manufacturers striving to improve themselves and their understanding of the world. Edward Everett, one of the greatest orators of the day, characterized the popular excitement generated by the accomplishments of these men when he triumphantly exclaimed "there is an untold, probably an unimagined, amount of human talent,

of high mental power, locked up among the wheels and springs of the machinist; a force of intellect of the loftiest character."[16]

ENDNOTES

Chapter IV

[1]"Progress in Mould Making," National Glass Budget (June 7, 1913), p. 11.

[2]See George S. and Helen McKearin, American Glass (New York: Crown Publishers, 1948), p. 332.

[3]See John C. Rumm, "The Nineteenth-Century Machine Shop Apprentice: Acquiring Knowledge, Acquiring Culture." Course paper, The University of Delaware, 1981.

[4]Enoch Robinson's patented 1826 knob mold was to be made of "a combination of brass and copper, cast steel or other metal," for instance, while Deming Jarves's 1830 patent refers to molds "made in the usual manner, of brass, or other suitable metal" (see Appendix A); See Barbara Bishop and Martha Hassell, Your Obdt. Servt., Deming Jarves: Correspondence of the Boston and Sandwich Glass Company's Founder, 1825-1829 (Sandwich, Massachusetts: The Sandwich Historical Society, 1984), p. 82. On May 13, 1829, William T. Mayo wrote to William Stutson that "by this stage, have sent you a small Box containing cast iron salt mould."

[5]See "Glass Gatherings," The Glass Club Bulletin 25 (May, 1950), p. 1. Jarves wrote in his presentation letter that the bowl "claims the merit of being much the largest piece of flint glass made by machinery, in any part of the world. Two machinists were employed six months in forming the mould. This bowl is the first made in it, and it is called the 'Union Bowl.' The name will not render it any less valuable." The newspaper editor reporting the presentation stated that the bowl, which measured 21" high and 22" in diameter, was made with a press weighing between two and three tons.

[6]"Progress in Mould Making," p. 11.

[7]Indenture of G. W. Robinson, October 1, 1830. File Papers, Suffolk County Superior Court (November Term, 1833), Case No. 156 (Massachusetts Archives). See Appendix F.

[8]This estimate of the number of men working under Robinson is based on interrogatory number 16 posed to William Raymond by the plaintiffs. Although the question describes a hypothetical situation, the plaintiffs were trying to establish the degree of damage they suffered when Robinson left their employ. The estimated number of presses being used at the New England Glass Company is based on the plaintiffs' interrogatory number 11. See Appendix E.

[9]Deposition of William Stetson [sic], File Papers, Suffolk County Superior Court (November Term, 1833), Case No. 156 (Massachusetts Archives), response to plaintiffs' interrogatory number 5. See Appendix D.

[10]Deposition of William Raymond, File Papers, Suffolk County Superior Court (November Term, 1833), Case No. 156 (Massachusetts Archives), response to plaintiffs' interrogatory number 6. See Appendix E.

[11]Deposition of William Stetson [sic], response to defendant's interrogatory number 6. See Appendix D.

[12]Deposition of William Raymond, reponse to plaintiffs' interrogatory number 17. See Appendix E.

[13]Robinson had had extensive experience in the button-making industry before joining the New England Glass Company, and undoubtedly most machinists working in the glass industry before 1836 entered it with backgrounds in foundries, textile machine shops, and other industries. This movement of machinists from one industry to another and the operation of independent machine shops that serviced a number of different industries served to accelerate the pace of technological innovation in the 1820s and 1830s. A relatively small number of technological processes were common to many industries during these decades, and advances made in one quickly came to be employed by others through a phenomenon which historian Nathan Rosenberg has called "technological convergence."

[14]Indenture of G. W. Robinson; Indenture of H. C. Morrison, October 10, 1831. File Papers, Suffolk County Superior Court (November Term, 1833), Case No. 156 (Massachusetts Archives); Payroll Book for the Boston and Sandwich Glass Company, (manuscript, The Sandwich Historical Society).

[15]Bruce Sinclair, Philadelphia's Philosopher Mechanics: A History of the Franklin Institute, 1825-1865 (Baltimore and London: Johns Hopkins University Press, 1974), p. 14. The system of values

held by specific machinists working in the glass industry has been difficult to identify due to the relatively obscure nature of their personal and professional lives. A copy book kept about 1828 by mold-maker and pattern-maker Hiram Dillaway does suggest some of the characteristics of the "scientific mechanic." It contains many repeated lines of writing practice such as "slothful persons are commonly conceited and ignorant," and "with a viscious companion it is hard to retain innocence." These clearly reflect learning conventions of the period, yet the book also contains a long letter written by Dillaway in defense of phrenology, a drawing of a crank-operated press, and the following attempt at poetic expression: "The love of gaining is the worst of ills/ The ceaseless storm the blackened soul it fills/ Inveigh heaven neglecting ties of blood/ Destroys the power and the will of doing good/ Kills health, pawns honor, plunges disgrace/ And what is still more dreadful spoils your face" (manuscript, The Sandwich Historical Society).

[16]John F. Kasson, Civilizing the Machine: Technology and Republican Values in America, 1776-1900 (New York: Penguin Books, 1974), p. 47.

Chapter IV

MACHINISTS IN THE GLASS INDUSTRY

> It may be safely asserted that no department of the glass industry has from its earliest period attracted so little attention and investigation, none involved so little a range of inquiry or been productive of more ingenious, interesting and beautiful results than the manufacture of moulds for glassware (National Glass Budget, 1913).[1]

In the seventy-five years since this observation was made, historians of glass have extolled machinists' contributions to the glass industry, yet they have presented little specific information about the nature of the machinist's trade or the extent of his accomplishments. Several authors have stated as a general observation that machinists supplanted glass blowers as the skilled artisans of the industry.[2] This is not entirely correct, for large quantities of glass were blown throughout the nineteenth century, while many pressed articles had not been traditional products of the glasshouse. Nevertheless, given the profound effect machinists from many different industries had on the character of American life, and given the importance of the new markets opened to the glass industry by their work, they would seem to deserve more than passing attention.

In the 1820s and 1830s the lines of distinction between the trades of the machinist, founder, mold maker, pattern maker, and inventor often were less pronounced than they became later in the century. Machinists' activities could encompass aspects of each of the trades listed above. The principal responsibility of the machinist involved with the glass industry, whether working in independent shops or those located right at the glasshouse, was the production and maintenance of molds and presses. Begining with a wooden model shaped exactly like the finished glass vessel, machinists created models or "patterns" of the various parts of the mold which, when hinged together, would fit precisely around the wooden model of the glass vessel. These mold patterns were packed in sand in a special casting box and then carefully removed, leaving cavities in the sand which would receive the molten metal. When the two halves of the casting box were brought together, the cavity inside corresponded exactly to the shape and size of the mold pattern. After casting, the machinist cut and drilled the finer details into each of the mold's parts, which were then polished and assembled into the completed mold.

Before the development of metal-working tools such as the milling machine in the 1840s, much of the machinist's work was performed by hand with chisels and files.[3] Brass, steel, and iron were used for casting molds in the 1820s.[4] Intensive labor was required to work these metals even as late as 1850, when Deming Jarves claimed that two machinists spent six months making the mold

for Daniel Webster's sixty-pound presentation bowl.[5] The labor-intensive nature of the work also is emphasized by the author of "Progress in Mould Making," who describes some of the difficulties faced by machinists:

> Brass was used some in [the] making of moulds but probably owing to the high cost it was not extensively used. At first the whole mould was made of this metal, then someone advanced the idea of having just a brass shell surrounded by iron, and while this reduced the cost considerably they were not generally used, probably owing to the shell getting loose or cracking. The use of iron for moulds for a great many years was in a large measure a very discouraging proposition owing to the uncertainty of the iron, it being what is now called common iron and we of today can readily appreciate the difficulty they encountered in trying to get a clean casting. After the mould was turned it was generally necessary to spend many hours in plugging and planing in order to get a smooth surface and the apprentice boys also spent many weary hours polishing, endeavoring to help accomplish this.[6]

Some of the specific duties of machinists working in the glass industry are outlined in a suit filed against George W. Robinson by the New England Glass Company in 1833. Robinson had gone to work for the company sometime after 1822, and his indenture, signed on October 1, 1830, stipulated that he was to continue his ordinary duties as a machinist, but that additionally he would oversee the company's entire pressing business and take responsibility for production standards and quotas.[7] His ordinary duties had included cleaning, repairing, and making molds, as well as actually pressing glass and "hanging" or attaching the molds to the press pistons. These duties were to be carried out in both the mold shop and the glasshouse. As foreman, Robinson was expected to encourage

the seven or eight hands under him to their greatest productivity as they tended the requirements of forty to fifty presses for making glass knobs and an unspecified number of presses and molds for other "common pressed glass articles."[8] By comparison, the Boston and Sandwich Glass Company in 1833 was operating between sixty and seventy presses for the manufacture of "salts, dishes, plates, lamps, lamp feet, window lights, deck lights, inks, wafer boxes, sands, inks and a variety of other articles."[9] At least two "mechanics" were employed to keep the molds and presses in order, but no actual mold making was done at the factory. Letters written by Deming Jarves indicate that such work was obtained in Boston. Also by comparison, William Raymond's glassworks in Brooklyn, which had an annual production valued between $100,000 and $200,000 in 1833, was operating about twelve presses and approximately one hundred molds for the pressing of "plates, dishes, bowls, nappies, etc."[10] No more than two hands were employed at any one time to maintain this machinery.

George Robinson was sued for leaving the New England Glass Company before his three-year contract had expired, and his lawyers went to great lengths to downplay the importance of his service to the company. The deposition for the defense was sent to William Stutson at the Boston and Sandwich Glass Company. The questions it posed were designed to emphasize the ease with which men like Robinson could press glass, and to show that the quality of the product was dependent on the quality of the machinery, not the skills

of the men operating it. Stutson's responses establish both points. According to Stutson, pressmen could be fully trained in from one to four weeks. No apprenticeship was needed, and he had "taken labourers out of the yard, and blacksmiths and others for that purpose."[11] The importance of the machinist's responsibilities for making and maintaining molds and presses was evaded by the defendant's lawyers. Nevertheless, Stutson did support their cause when he claimed that he never had trouble obtaining molds or finding mechanics to maintain them. Stutson also stated that a general supervisor of pressing was not required, further contributing to the defenses's effort to downplay the repercussions of Robinson's premature departure.

The plaintiffs' deposition, which was sent out six weeks after the defendant's, was addressed to John Gilliland or William Raymond of Brooklyn. With it, the New England Glass Company claimed priority for the introduction of the new glassworking machinery and demonstrated the vital importance of skilled machinists to the successful operation of their pressing department. The plaintiffs emphasized the novelty of the technique in 1830 and the lack of standardization between the presses and molds used in different glasshouses at that time. Raymond observed that each press was more or less unique, and that its maker would be better suited to keep it working than any machinist the company might hire to replace him. He also noted that in the three years since Robinson left the company, the technology for pressing glass had been developed to such

an extent that the great difficulties suffered by the New England Glass Company at his departure no longer would be encountered. "The business is better understood," Raymond observed, "and it is now more easy to provide for any difficulties or embarrassments that may occur."[12]

Even taking into account the probable bias of each deponent, the information they provide is very revealing. Just six years after the press was patented for the production of glass knobs, it was being employed extensively at both the New England Glass Company and the Boston and Sandwich Glass Company to manufacture a wide variety of articles. Other glasshouses, Raymond's among them, were employing the technique to a more limited extent. Still more surprising is the suggestion that by 1833 glass manufacturers could obtain competent mechanics without very great difficulty. This probably was true as early as 1830, the company's claims not withstanding, because the techniques necessary for making glass molds and presses were not radically different from those employed by machinists in other industries.[13] Machinists with a general competence in metal-working could have functioned effectively in the glass industry, which suggests that they did not occupy a particularly "aristocratic" position in the labor market. This impression is reinforced by the level of wages they received. Robinson was paid only ten dollars a week at a time when glass blowers could earn twice that amount, while Henry C. Morrison,

a machinist whose indenture with the New England Glass Company was signed in 1831, was paid nine dollars a week.[14]

The availability of machinists in the early 1830s might have suppressed their wages somewhat, but it did not in any way negate the importance of their work to glass manufacturers. Machinists and manufacturers together pursued solutions to the technological difficulties they encountered with an energy and conviction that extended beyond simple interests in monetary gain and commercial success. More than virtually anyone else, these men were caught up by a popular wave of excitement over the potential applications and beneficial effects of technology. They seem to have identified strongly with the values of what historian Bruce Sinclair refers to as the "scientific mechanic," an individual whose skill with tools was complemented by a thorough familiarity with scientific principles. The intellectual pursuits of the "scientific mechanic" encompassed a broad spectrum of knowledge, while community service and a strong interest in the arts rounded out his idealized character.[15] These values suffused publications such as the Journal of the Franklin Institute, which were read by many machinists and manufacturers striving to improve themselves and their understanding of the world. Edward Everett, one of the greatest orators of the day, characterized the popular excitement generated by the accomplishments of these men when he triumphantly exclaimed "there is an untold, probably an unimagined, amount of human talent,

of high mental power, locked up among the wheels and springs of the machinist; a force of intellect of the loftiest character."[16]

ENDNOTES

Chapter IV

[1]"Progress in Mould Making," National Glass Budget (June 7, 1913), p. 11.

[2]See George S. and Helen McKearin, American Glass (New York: Crown Publishers, 1948), p. 332.

[3]See John C. Rumm, "The Nineteenth-Century Machine Shop Apprentice: Acquiring Knowledge, Acquiring Culture." Course paper, The University of Delaware, 1981.

[4]Enoch Robinson's patented 1826 knob mold was to be made of "a combination of brass and copper, cast steel or other metal," for instance, while Deming Jarves's 1830 patent refers to molds "made in the usual manner, of brass, or other suitable metal" (see Appendix A); See Barbara Bishop and Martha Hassell, Your Obdt. Servt., Deming Jarves: Correspondence of the Boston and Sandwich Glass Company's Founder, 1825-1829 (Sandwich, Massachusetts: The Sandwich Historical Society, 1984), p. 82. On May 13, 1829, William T. Mayo wrote to William Stutson that "by this stage, have sent you a small Box containing cast iron salt mould."

[5]See "Glass Gatherings," The Glass Club Bulletin 25 (May, 1950), p. 1. Jarves wrote in his presentation letter that the bowl "claims the merit of being much the largest piece of flint glass made by machinery, in any part of the world. Two machinists were employed six months in forming the mould. This bowl is the first made in it, and it is called the 'Union Bowl.' The name will not render it any less valuable." The newspaper editor reporting the presentation stated that the bowl, which measured 21" high and 22" in diameter, was made with a press weighing between two and three tons.

[6]"Progress in Mould Making," p. 11.

[7]Indenture of G. W. Robinson, October 1, 1830. File Papers, Suffolk County Superior Court (November Term, 1833), Case No. 156 (Massachusetts Archives). See Appendix F.

[8]This estimate of the number of men working under Robinson is based on interrogatory number 16 posed to William Raymond by the plaintiffs. Although the question describes a hypothetical situation, the plaintiffs were trying to establish the degree of damage they suffered when Robinson left their employ. The estimated number of presses being used at the New England Glass Company is based on the plaintiffs' interrogatory number 11. See Appendix E.

[9]Deposition of William Stetson [sic], File Papers, Suffolk County Superior Court (November Term, 1833), Case No. 156 (Massachusetts Archives), response to plaintiffs' interrogatory number 5. See Appendix D.

[10]Deposition of William Raymond, File Papers, Suffolk County Superior Court (November Term, 1833), Case No. 156 (Massachusetts Archives), response to plaintiffs' interrogatory number 6. See Appendix E.

[11]Deposition of William Stetson [sic], response to defendant's interrogatory number 6. See Appendix D.

[12]Deposition of William Raymond, reponse to plaintiffs' interrogatory number 17. See Appendix E.

[13]Robinson had had extensive experience in the button-making industry before joining the New England Glass Company, and undoubtedly most machinists working in the glass industry before 1836 entered it with backgrounds in foundries, textile machine shops, and other industries. This movement of machinists from one industry to another and the operation of independent machine shops that serviced a number of different industries served to accelerate the pace of technological innovation in the 1820s and 1830s. A relatively small number of technological processes were common to many industries during these decades, and advances made in one quickly came to be employed by others through a phenomenon which historian Nathan Rosenberg has called "technological convergence."

[14]Indenture of G. W. Robinson; Indenture of H. C. Morrison, October 10, 1831. File Papers, Suffolk County Superior Court (November Term, 1833), Case No. 156 (Massachusetts Archives); Payroll Book for the Boston and Sandwich Glass Company, (manuscript, The Sandwich Historical Society).

[15]Bruce Sinclair, Philadelphia's Philosopher Mechanics: A History of the Franklin Institute, 1825-1865 (Baltimore and London: Johns Hopkins University Press, 1974), p. 14. The system of values

held by specific machinists working in the glass industry has been difficult to identify due to the relatively obscure nature of their personal and professional lives. A copy book kept about 1828 by mold-maker and pattern-maker Hiram Dillaway does suggest some of the characteristics of the "scientific mechanic." It contains many repeated lines of writing practice such as "slothful persons are commonly conceited and ignorant," and "with a viscious companion it is hard to retain innocence." These clearly reflect learning conventions of the period, yet the book also contains a long letter written by Dillaway in defense of phrenology, a drawing of a crank-operated press, and the following attempt at poetic expression: "The love of gaining is the worst of ills/ The ceaseless storm the blackened soul it fills/ Inveigh heaven neglecting ties of blood/ Destroys the power and the will of doing good/ Kills health, pawns honor, plunges disgrace/ And what is still more dreadful spoils your face" (manuscript, The Sandwich Historical Society).

[16]John F. Kasson, Civilizing the Machine: Technology and Republican Values in America, 1776-1900 (New York: Penguin Books, 1974), p. 47.

Appendix A

UNITED STATES PATENTS
ISSUED PRIOR TO THE PATENT OFFICE FIRE OF DECEMBER 15, 1836,
FOR SUBJECTS RELATING TO THE MECHANIZATION OF GLASSWORKING

Feb. 2, 1821
Deming Jarves
Boston, Massachusetts

Machine for opening the mould of glass blowers (Letter from the Secretary of State, Transmitting a List of the Names of Persons to whom Patents have been issued for Any New or useful Art, or Machine, Manufacture, or Composition of Matter, or Improvement Thereon, For one year, prior to the 1st of January, 1822 [Washington: Gales and Seaton, 1822]). This patent presumably refers to the use of full-size, hinged molds for the production of pattern-molded wares.

Aug. 19, 1822
Spencer Richards
Attleborough, Massachusetts

Imp't in the method of finishing glass buttons (Letter from the Secretary of State, Transmitting a List of the Names of Persons to whom Patents have been Granted for Any New and Useful Invention, During the Year 1822 [Washington: Gales and Seaton, 1823]).

Sept. 9, 1825
John P. Bakewell
Pittsburgh, Pennsylvania

Improvement in the method of making glass furniture, etc. (Letter from the Secretary of State, Transmitting a List of the Names of the Persons to whom Patents have been Issued, for the Invention of any New or Useful Art, or Machine, Manufacture, or Composition of Matter, or

Any Improvement thereon; From January 1st, 1825, to January 1st, 1826 [Washington: Gales and Seaton, 1826]).

Nov. 4, 1826
Henry Whitney and Enoch Robinson
Cambridge, Massachusetts

Schedule A. Copy. The Schedule referred to in these Letters Patent & making part of the Same Containing a description in the words of the Said Henry Whitney & Enoch Robinson themselves of their improvement in the mode of manufacturing by machinery at one operation Glass Knobs or Trimmings for Doors Stoves, drawers Sideboards bureaus Wardrobes And all kinds of furniture & other things where Glass handles knobs, or ornaments may be used & fastened by Spindles running through the Centre of them without the aid of blowing.

To all Persons to whom these Presents Shall come Henry Whitney Agent of the New England Glass Company & Enoch Robinson Mechanician both of Cambridge in the County of Middlesex & State of Massachusetts Send Greeting

Be it known that we the Said Henry Whitney & Enoch Robinson have invented Constructed made & applied to use, a new & useful improvement in the mode of manufacturing by Machinery at one Operation Glass Knobs or trimmings for doors Stoves, drawers Sideboards, bureaus, wardrobes, And all Kinds of furniture & other things where Glass handles, Knobs or Ornaments may be used & fastened by Spindles running through the Centre of them, specified in the words following to wit. -

This improvement in making Knobs, Consists in compressing them in moulds in the manner following: - The mould is made of a composition of brass & copper, Cast Steel or other metal of a Size & Shape Suitable to Contain the Knob, of which mould a model & drawing is deposited in the Patent Office. It is in two parts - A top & bottom part - the lower or bottom part is to receive the melted Glass & form the main part of the Knob, And the top part is to press the Knob, form its ornamental face, & to perforate it with a pin longitudinally. - The bottom part is made in two pieces fastened together with a hinge on the backside with handles on each side in front to open & shut it & a clasp to fasten it together while receiving the melted Glass & the impression - The bottom part terminates upward by a tube Cylindrical or nearly So from one eighth to four eighths of an inch high according to the Size of the Article to be made into which the top part of the Mould enters to Compress & form the Knob & Stamp its face. - The top part is of a Size & Shape Suitable to enter & fill the Cylindrical Space at the top of the bottom part; on its face or underside is a die figured with Circles rings hearts roses leaves fruit Animals or any other fancy or ornamental Shape which has been or may be used in brass or other Ornaments, or the face may be made plain. -

Into the top part is fastened a Steel pin of a Square round or any other shape projecting from it perpendicularly downward of a length Sufficient to penetrate Quite through the Article to be made - To reject the surplus quantity of Glass & prevent its accumulation in the mould from the quantity displaced by the pin in perforating the Knob, a hole nearly of the Size & Shape of the pin is made perpendicularly downward through the under part of the bottom piece of the mould, through which the Surplus Glass is driven by the expression in forming the Article.

To use the mould we place the bottom part on a Table on which is perpendicularly erected a Standard twelve or fourteen inches high for the purpose of attaching to it a Lever to force down the top part & give the impression & to hang a Gate turned on a Pivot to which the top part of the mould is fixed - On the end of the Lever behind the Standard a spiral or other Spring is fastened which is also fastened to the table to suspend the top part of the mould when it is raised by the Lever - The position of the top is so adjusted with reference to the bottom part of the mould by a guide fastened to the Standard that when the power is applied to the Lever to Compress the Glass, the top exactly Shuts into the bottom part & forces the pin through the Knob into the hole below it.

The mould being thus prepared for use, the top is raised by the Lever & turned a little on one side by the gate to give room to drop the melted Glass into the bottom part of the mould - The Glass is then gathered from the pot And dropped into the bottom part of the mould which is already closed & secured against opening by the clasp, the Gate is then turned back Against the Guide so that the Top of the Mould is brought directly over the bottom, &, by the application of power to the Lever, the Article is at once Compressed, formed & finished; the top is then raised by the lever, the clasp on the bottom part is unfastened, the mould is opened by the handles & the Knob taken out So entirely finished that it only requires fire polishing to make it a neat article fit for immediate use -

We do not claim to be the original Inventors of the mould as applied to the formation of Glass Wares but admit that for many purposes it has been heretofore used. - Our Invention Consists in this. - A new Combination of the various parts of the mould, with the use of the pin & machinery before described, in Such a manner as without any blowing to produce a finished Knob with a hole perforated thro' it & a neck or Enlargement So that it will not come out of the mould without opening it, at one operation by Compression merely.

In Testimony that the above is a true Specification of our said Improvement as above described we have hereunto set our hands & seals this twenty Second day of August in the Year of Our Lord One thousand eight hundred & twenty Six. Henry Whitney, Enoch Robinson. Witnesses Wm. G. Andrews, Augustus Peabody (File Papers, Circuit Court for the Eastern District of Pennsylvania [October Session, 1829], Case No. 2, Henry Whitney and Enoch Robinson vs. William Emmett, William Bennet, Joseph Capewell, Charles B. Austin, Richard Synar, James Veneables & William Granville [Federal Archives and

Records Center, Philadelphia]). An abstract of this patent was published in the Journal of the Franklin Institute 3 (March, 1829), on page 203.

Nov. 14, 1826
William Price
Pittsburgh, Pennsylvania

Knobs, glass, mode of fastening (A Digest of Patents, Issued by the United States, from 1790 to January 1, 1839 [Washington: Peter Force, 1840], p. 64).

Oct. 6, 1827
John Robinson
Pittsburgh, Pennsylvania

In the mode of making pressed glass knobs, for furniture, etc., at one operation; John Robinson, of Pittsburg [sic], Pennsylvania, Oct. 6 (The Franklin Journal, and American Mechanics' Magazine 5 [March, 1828], p. 211).

Oct. 16, 1827
Phineas C. Dummer
Jersey City, New Jersey

In the construction and use of moulds with a core, for pressing glass into various useful forms; called Dummer's scallop, or cover-plate; Phineas C. Dummer, of Jersey city [sic], New Jersey, Oct. 16 (The Franklin Journal, and American Mechanics' Magazine 5 [March, 1828], p. 212).

Oct. 16, 1827
George Dummer, Phineas C. Dummer and James Maxwell
Jersey City, New Jersey

In forming glass by the combination of moulds with mechanical powers; George Dummer, Phineas C. Dummer, and James Maxwell, of Jersey city [sic], New Jersey, Oct. 16 (The Franklin Journal, and American Mechanics' Magazine 5 [March, 1828], p. 212).

May 14, 1828
Thomas Bakewell and John P. Bakewell
Pittsburgh, Pennsylvania

In the improved method of making glass furniture knobs or handles, for which letters patent of the United States, bearing date the 9th day of September, 1824 [sic], were granted unto John P. Bakewell, of Pittsburg [sic]; Thomas Bakewell and John P. Bakewell, Pittsburg, Pennsylvania, May 14 (The Franklin Journal, and American Mechanics' Magazine 6 [August, 1828], p. 141). This patent is listed in A Digest of Patents, Issued by the United States, from 1790 to January 1, 1839 (Washington: Peter Force, 1840), on page 64 as "Knobs, glass, (improvement on Bakewell's,)."

Dec. 1, 1828
Deming Jarves
Boston, Massachusetts

Specification of a patent for an improvement in the art of manufacturing all articles formed by Pressing Melted Glass into Moulds. Granted to Deming Jarves, Boston, Massachusetts, December 1st, 1828.

To make articles of pressed glass, by the method in which they now are, and heretofore have been manufactured, a mould, giving the shape and ornamental impressions, has been required for each article manufactured; and the shape of the article or vessel intended to be made, is preserved during the cooling of the metal, in a receiver of like shape as the mould, and thus the manufacturer is obliged to possess and use, a mould and receiver for each article, of different size and shape, which he makes.

The improvement for which I ask an exclusive privilege, consists in pressing all the glass, intended for the various articles and vessels to be manufactured, into sheets by a mould, which impresses upon the sheet of glass, all the ornamental figures intended for the article or vessel to be made. I thus obtain, by the use of one mould, sheets of ornamented glass, and out of these sheets the article to be manufactured, as to size, shape, and figure, is to be produced by receivers of the size, shape, and figure required. The sheets of glass, (being impressed as aforesaid,) are placed upon the receiver, in so heated a condition, as to sink or settle into the receiver, and thus acquire its particular form and figure; and, should these sheets become too cool to settle readily into all the slopes and angles, and take the true shape and figure of the receiver, a follower of same shape with the receiver, is used to force the metal into all the parts of the receiver. Any excess of glass is removed, or cut, from the edges of the receiver in the usual manner (Journal of the Franklin Institute 3 [March, 1829], p. 208).

Jan. 14, 1829
Thomas Bakewell and John P. Bakewell
Pittsburgh, Pennsylvania

For an improved Press, formed by a new and powerful combination of cranks, or wheels, and levers; Thomas Bakewell and John P. Bakewell, Pittsburgh, Allegheny county, Pennsylvania, January 14.

The principle upon which this press operates, is that which is usually known by the name of the toggle joint. The patentees state that it consists of 'three principal moving parts, by which the effect is produced, and the combination of which we claim as our invention.'

'These three parts we denominate, first, the lever, or crank, by which the power is applied. Secondly, the pitman or connecting rod, by which the power is transmitted to the third part, or sliding piece, or head, by which the effect produced by the other parts of the press is communicated to any substance exposed to its action.'

To us it appears very similar to several of the modern printing presses, to many seal presses, working with the toggle joint, and various other machines, in which the power of the lever, as it vanishes, becomes infinite; that is, when a right line extending from one of the extreme points of action to the other, would pass through the fulcra. It is said in the specification, 'a different combination of the above described principle may be applied, in case it shall be found more convenient, by substituting for the above described first part, or lever, a crank, or cranks, which are to be connected with the sliding head, by means of one pitman rod, or more, and joints as above described, care being taken to regulate the said pitman rod, or rods, so that it, or they, shall form with the crank, or radius thereof, if the crank be curved, a right line between the axis of the crank, and the base of the press, at the time the greatest pressure is required' (Journal of the Franklin Institute 3 [April, 1829], p. 258).

June 11, 1829
Deming Jarves
Boston, Massachusetts

For an improvement in the manufacture of Glass Knobs for Drawers, Doors, Shutters, etc.; Deming Jervis [sic], Boston, Massachusetts, June 11.

The glass knob, instead of being perforated, in the usual manner, for the reception of a metallic screw, is pressed into a mould, so made as to form the knob with a shank of solid glass, furnished with a screw. On account of the brittleness of the material, the shank is made large. The claim is to the making of glass knobs, 'having a glass shank, with a screw upon the shank'

(Journal of the Franklin Institute 4 [September, 1829], p. 171). This patent is listed as having been issued on June 13 in the Letter from the Secretary of State, Transmitting a List of Patents, with the names and residence of the Patentees, granted for the invention of any new or useful art or machine, manufactures, or composition of matter, or improvement thereon, from the first of January to the thirty-first of December, 1828, inclusive (Washington: Gales and Seaton, 1829).

May 28, 1830
Deming Jarves
Boston, Massachusetts

For an improvement in Glass-makers' Moulds; Deming Jarves, Boston, Massachusetts, May 28.

The improvement claimed is the forming of a handle, or handles, or other similar projections, on glass cups, by pressure, at one operation, instead of attaching them to the cup after it has been blown, in the way heretofore practiced.

The mould is to be made in the usual manner, of brass, or other suitable metal, excavations being provided for the formation of the handles. The plug, or piston, which is to form the inside of the cup, is made to fit exactly into a rim which forms the top of the mould, so that when it is pressed down none of the fluid glass which has been put into the mould can escape at top, but will, by the pressure, be forced into the cavities described.

The claim is to the forming the mould in the manner above indicated (Journal of the Franklin Institute 6 [September, 1830], p. 154).

Oct. 1, 1830
John P. Bakewell
Pittsburgh, Pennsylvania

Specification of a patent for an improvement in the manufacture of Wheels, Pinions, or Movements, to be employed in the construction of Clocks, Time-pieces, or other machinery. Granted to John P. Bakewell, Pittsburgh, Allegheny county, Pennsylvania, October 1, 1830.

The said improvement consists in making the said wheels, pinions, or movements, of GLASS, instead of the substances or materials which have been heretofore employed for that purpose. Which object may be obtained by forcibly compressing a proper quantity of melted glass between moulds or dies, in which an indentation, or cavity, has been made of the form and size which is

intended to be given to the wheel, pinion, or movement, in such a manner that the said wheels, pinions, or movements, shall be formed with the requisite number of teeth, cogs, or leaves, and shall require little, if any dressing off, to fit them for use.

The holes by means of which the arbors, or axles, and the various springs, pins, etc. are intended to be attached to the said wheels, pinions, or movements, may either be made by corresponding cores, or piercers, of the required shape and size, placed within the moulds or dies, or they may be drilled through the said wheels, pinions, or movements, after the glass is cold.

It is to be observed, that in some cases it may be more economical and convenient to make the wheel and pinion in one piece, with a hole through the centre for the arbor or axis, which may be done by constructing the moulds, or dies, accordingly. And that the said wheels, pinions, or movements, may either be used alone, or combined with others made of any of the materials heretofore employed for that purpose.

As no claim is made to any particular construction of moulds, or dies, it is considered unnecessary to describe them minutely; but any person who has been accustomed to construct the moulds or dies which are used for the purpose of making glass plates, etc. by pressure, can readily construct such as would answer for making glass wheels, pinions, or movements. And as the relative size of the wheels, pinions, or movements, and the mumber of teeth, cogs, or wheels in each, must depend upon the judgement of the clockmaker or machinist, no specific size can be designated, and the claim is therefore for making wheels and pinions, or movements of glass, of any size, and with any number of teeth, cogs, or leaves, and applying the same to the construction of clocks, time-pieces, or other machinery, either alone, or combined with others made of any of the materials which have been heretofore employed for that purpose (Journal of the Franklin Institute 6 [December, 1830], p. 385).

Oct. 19, 1830
Deming Jarves
Boston, Massachusetts

For an improvement in the mode of making Glass Door Knobs; Deming Jarvis [sic], Boston, Massachusetts, October 19.

These knobs are perforated in the usual way, to receive the spindle, which is to be square. A square cavity, about a quarter of an inch deep is sunk at each end of the knob, to receive a square collet, which will prevent the knob from turning. In all other respects the knob is made in the common form (Journal of the Franklin Institute 7 [February, 1831], p. 77).

Nov. 26, 1830
John M'Gann
Kensington, Pennsylvania

For an improvement in the art of Manufacturing all kinds of Bottles, Decanters, and other pressed hollow Glassware, with the neck or apertures smaller than the cavity or inside diameter of the vessel; John M'Gann, Kensington, Philadelphia county, Pennsylvania, November 26.

When a decanter, or similar vessel, is to be made, there are to be two moulds, with their proper presses. In one mould the lower part of the decanter is formed, in the other, the upper part and neck. One of the moulds is fixed to a hinge in such a way, that when the cores of the two parts are withdrawn, one mould will turn over upon the other, and bring the edges of the glass into exact contact, when, by a slight pressure, they are made to adhere; the moulds are than opened, and the decanter removed from it.

The claim is to that construction of the cores and moulds which enables the operator to form vessels of glass, in the way above described (Journal of the Franklin Institute 7 [March, 1831], p. 169).

Oct. 31, 1831
Spencer Richards
Cambridge, Massachusetts

The schedule referred to in these Letters Patent and making part of the same, containing a description in the words of the said Spencer Richards, himself of his improvement in making Glass Knobs. To all to whom these presents shall come

Be it known that I Spencer Richards of Cambridge in the County of Middlesex & State of Massachusetts, have invented a new and useful improvement in the formation of Glass Knobs, for drawers, bureaus, and other articles of furniture, curtain pins, doors, shutters, etc. of pressed or cast glass, and that the following is a fair and exact description of the construction and operation of said glass knobs as improved by me.

Said knobs are formed of melted glass pressed or cast in a mould and die made of any figure or pattern. They are made by placing on the shoulder of the spear or spindle rising from the bottom of the mould a metallic nut, on which the melted glass is placed, and by pressing down the top of the mould, the metallic nut is left bedded in the glass with a hole or aperture from the end or bottom of the knob, formed by the spear or spindle rising from the bottom of the mould on which the metallic nut is placed, for the purpose of screwing in a metallic rod or spindle with a binding nut to prevent the spindle unscrewing, of sufficient length

& strength to pass through the side of drawers; or can be screwed into shutters without having the screw pass through the wood and no nut is then required.

What I claim as new and as my own invention in the above described manufacture, and for the use of which I ask an exclusive privilege, is the production of a glass knob, having a nut or ferrule screw bedded in the glass knob in which a metallic screw can be inserted and not requiring the same to pass through the knob, as heretofore. Spencer Richards. Witnesses, Eph. Buttrick, Ira Wadsworth (United States Patents 1790-1836 [New Haven: Research Publications, Inc., 1980], reel 2, p. 223 [microfilm, Boston Public Library]). For the Letters Patent Drawing that accompanies this patent description, refer to figure 11, page 33. An abstract of Richards' patent was published on page 243 of the Journal of the Franklin Institute 9 (April, 1832), with an editorial comment that "Pressed knobs have been frequently made with screw shanks imbedded in them, but they are apt to break the knob, an objection which will probably be removed, or much lessened, by inserting them into a nut in the manner proposed."

Dec. 14, 1832
Joshua Laird
Pittsburgh, Pennsylvania

For a Machine to be used in the art of Blowing Glass; Joshua Laird, Pittsburgh, Allegheny county, Pennsylvania, December 14.

The machine above named is intended for blowing glass knobs for bureaus, and other detached pieces of glass, which are blown in moulds; the main part of the invention consists in the application of a forcing, or condensing, pump, to the blowing of articles of the foregoing description. A table of a suitable height, has a top formed of a plate of cast iron, upon which are proper fixtures for sustaining the mould into which the detached piece of glass is placed. The cylinder of the pump is secured vertically at one end of the table, and the air from it is conveyed through a leaden, or other flexible, pipe, to a hole [in] the centre of the table, exactly under the mouth of the mould; a pipe, or nozzle, of brass, or other metal, attached to the flexible tube, passes up into the glass to be blown, and is retracted when the operation is completed, it being attached to a jointed handle, fixed for the purpose below the table. The mould, and its handles, are made in the usual way, excepting a cap plate, attached to the table, and which turns back upon a joint, when the mould is to be removed. The centre of the under side of this plate is excavated so as to form the upper part of the mould, and is perforated so as to admit a pin to pierce the knob.

The claim is to the application of the pump in the blowing of glass, and to the crown, or cap piece, as above described (Journal of the Franklin Institute 11 [June, 1833], p. 379).

Sept. 16, 1833
Joseph Stouvenel and Francis A. Martin
Philadelphia, Pennsylvania

For an Apparatus for Blowing Glass, denominated an Artificial Glass Blower; Joseph Stouvenel, and Francis A. Martin, Philadelphia, September 16.

A metal tube is to be made which may be sixteen inches long, and one and a half in its interior diameter. This is to be open at one end, and closed at the other; a spiral spring is to fit within it, the coils of which may be half an inch apart, when extended, in which case it occupies the whole length of the tube. A piece of wood, covered with leather, is to form a piston, which may be inserted in the open end of the tube, and fits it air tight, whilst it will slide freely in it. This piston has a hole through it, to receive the mouth end of a blow-pipe, which it must surround accurately. By pressing upon the metal tube, when the blow-pipe is so placed, the air within it will be forced through the pipe, with a power, it is said, four or five times as great as can be excercised by the lungs. Articles in open moulds may be blown by the mouth at one operation, which could be accomplished by the mouth in the old way (Journal of the Franklin Institute 13 [March, 1834], p. 180).

Sept. 19, 1833
Theodore F. Abbott
Canton, Massachusetts

For an improvement in Knobs of Glass, for Doors, Furniture, etc.; Theodore F. Abbott, Canton, Norfolk county, Massachusetts, September 19.

The introduction of a pin of iron or steel into the mould used for forming glass knobs, is the subject of this patent. This pin is to be about one-fourth of an inch in diameter, and is to extend from the bottom of the knob towards its centre, to the distance of five-eights of an inch, leaving, when removed, a hole of that size; 'the other end may be easily broken off when the knob is cold, and a perfect hole will then be formed.'

The drawing of the mould is without written references, and the description, from this cause, is wanting in clearness; perhaps, however, it may be sufficiently clear to the adept (Journal of the Franklin Institute 13 [April, 1834], p. 255).

Feb. 8, 1834
Thomas Bakewell and John P. Bakewell
Pittsburgh, Pennsylvania

For an improvement in the Machine for Blowing Glass; Thomas Bakewell and John P. Bakewell, Pittsburgh, Allegheny county, Pennsylvania, February 8.

On the 14th of December, 1832, Joshua Laird obtained a patent for a machine for blowing glass, and the present patent is for an improvement thereon, which improvement is said to consist in the application of the air condensing apparatus of his machine, and its flexible tube, in connexion [sic] with a common glass blower's pipe, upon which a portion of melted glass has been partly fashioned, previously to the introduction of it within the mould or die in which the required article is to be formed.

The insertion of the claim will give a sufficiently clear idea of the improvement. 'What we claim as our invention and improvement on the "machine for blowing glass, patented by Joshua Laird, on the 14th day of December, 1832," is, the application of air compressed in a cylinder, or by a pair of bellows, as described by him in the specification attached to said patent, conveyed through a flexible or jointed tube, or pipe, to the end of a common glass blower's pipe, upon the other end of which a portion of melted glass has been previously collected, and the article partly fashioned, which piece of soft glass, when placed in a suitable mould, is by the air so compressed, forced into the cavities of the mould, whilst it is in connexion with the said common glass blower's pipe' (Journal of the Franklin Institute 14 [September, 1834], p. 177).

Oct. 17, 1835
Orrin Newton
Pittsburgh, Pennsylvania

The schedule referred to in these Letters Patent and making part of the same containing a description in the words of the said Orrin Newton himself of his improvement in the screw for Glass Knobs.

To all to whom these presents shall come. Be it known that I Orrin Newton of the City of Pittsburgh in the county of Allegheny and state of Pennsylvania have invented a new and useful improvement in the manufacture of Glass Knob screws and that the following is a full and exact description thereof. In the manufacture of this kind of knob screws the head is cast in a mould onto a wire shank headed in order to secure the cast head more firmly on. The sample herewith sent is made of a compound of block tin and copper but may be made of any compound that can be cast in a mould. The great advantage of this kind of screw over all others is its being easily cleaned and always sustaining its original colour and is more quickly made. In

testimony that the above is a true specification of my improvement as above described I have hereunto set my hand this first day of October A.D. 1835. Orrin Newton. Witnesses John Seelin [?], Wm Rippey (United States Patents 1790-1836 [New Haven: Research Publications, Inc., 1980], reel 3, p. 555 [microfilm, Boston Public Library]). The patent illustration can be seen at the end of this appendix, following the written patent descriptions (figure 49).

Sept. 20, 1836
Enoch Robinson, Francis Draper and Joseph H. Lord
Cambridge and Boston, Massachusetts

The schedule referred to in these Letters Patent and making part of the same, To all to whom these presents shall come - Enoch Robinson & Francis Draper, both of Cambridge in the County of Middlesex and Commonwealth of Massachusetts and Joseph H. Lord of the City of Boston and Commonwealth aforesaid, Trader send greeting

Be it known that we the said Enoch Robinson, Francis Draper and Joseph H. Lord, have invented and put in use a new and useful improvement in the manufacture of Door commode furniture and other knobs by which the knob is securely fastened to the plate or socket without any spindle or screw being inserted into the knob and which we call our socket knob, which said invention is specified by us as follows to wit. -

This improvement consists of a combination of the common Knob, having a neck or shank between and smaller than the head and foot of the knob, with a socket or plate either made wholly or having an edge or ring made of some soft metal capable or being set round the foot of the knob by turning in a Lathe or otherwise without the application of heat.

This socket is cast or otherwise made with a face, corresponding in form to that of the foot of the knob, and with a perpendicular edge or ring of soft metal round the outside of a depth somewhat greater than the thickness of the foot of the knob, the foot of the knob is then to be inserted into the cup thus formed by the face and edge or ring of the socket and the edge or ring is then to be turned down and set either in a lathe or otherwise close round the foot of the knob above the largest part of the foot so as to confine the knob, closely & securely to the socket or plate. If the use of the knob requires it, it may be made more secure from turning in the socket, by fitting the foot of the knob and the face of the socket together by a corresponding projection in the one and depression in the other or by making the foot of the knob, of some angular form with a corresponding hollow in the socket in the manner already practiced, or otherwise.

We do not claim as our invention the knob properly so called, but admit that it has been known and used before in the form above mentioned, nor do we claim any part of the socket or plate

except the edge or ring of soft metal after it is turned down & set as aforesaid round the foot of the knob, as a new means of combining the knob and the socket, but our invention and improvement consists in the combination of the knob with the socket by means of the said edge or ring of soft metal turned down and set round the foot of the knob, and we claim nothing more; -

The said parts, and the socket knob, when completed will be more fully understood by reference to the annexed drawing, in which No. 1 is the socket before the knob is inserted. No. 2 is the knob, and No. 3 is the socket knob after the same is finished and ready for use.

In testimony that the foregoing is a true specification and description of our said improvement we have hereunto set our hands this twenty second day of June in the year of our Lord, one thousand eight hundred and thirty six. Enoch Robinson, Francis Draper, Joseph H. Lord. Witnesses, Geo. J. F. Allegre, Franklin Dexter (United States Patents 1790-1836 [New Haven: Research Publications, Inc., 1980], reel 4, p. 92 [microfilm, Boston Public Library]). This patent was reissued on December 2, 1836, as patent number 98. The patent illustration can be seen at the end of this appendix, following the written patent descriptions (figure 50).

Oct. 20, 1836
Enoch Robinson, Francis Draper and Joseph H. Lord
Cambridge and Boston, Massachusetts

The schedule referred to in these Letters Patent and making part of the same. To all persons to whom these presents shall come, Enoch Robinson & Francis Draper both of Cambridge & County of Middlesex and Commonwealth of Massachusetts, Machinists & Joseph H. Lord of the City of Boston and Commonwealth aforesaid Trader, send Greeting -

Be it known that we the said Enoch Robinson, Francis Draper & Joseph H. Lord, have invented and put in use a new and useful improvement in the manufacture of door, commode, furniture, and other knobs by which the knob is securely fastened to the plate or socket without any spindle or screw, being inserted into the knob, and which we call the Ferrule Knob which said invention is specified by us as follows. To wit. This improvement consists in the combination of the following parts viz.

1st. A knob whether of Glass, Ivory, Stone, metal or other material fashioned in the manner heretofore known & practiced that is with the neck or shank, ending in a foot larger than the neck and either cut into an octagonal square or other form to be inserted into a hollow or to fit a projection of corresponding form in the plate or socket or in any other manner fitted to the socket, so that the knob shall not turn in the socket.

2nd. A socket or plate with an octagonal square or other hollow, or projection fitted to a corresponding projection or hollow in the foot of the knob, or in any other manner fitted to the foot of the knob, so that the knob shall not turn in the socket.

3rd. A ferrule or ring of metal or other material proper for the purpose just large enough to be fastened over the foot and so round the neck of the knob, and to be fastened to the plate or socket after introducing an elastic split ring between the ferrule and the foot of the knob. The fastening of the ferrule to the socket may most conveniently be made by a screw cut on the inside of the ferrule fitting into a corresponding screw, cut on the outside of the socket, or may be made in any other manner.

4th. A split Elastic ring of metal or other proper material which will open so far as to admit of being passed over the foot of the knob, and being then pressed together between the ferrule and the foot of the knob, in screwing or otherwise fastening the ferrule to the socket or plate, prevents the knob from drawing out, through the ferrule and thus confines it to the plate or socket.

We do not claim to be the inventors of either of the said four parts or pieces viz. the knob, the socket, the ferrule, and the split ring, all of which we admit to have been used in various machines or manufactures either separately or otherwise combined, but we claim as our invention the combination of the said four parts or pieces in manner aforesaid as a new and useful improvement in the manufacture of Door commode furniture and other knobs, and the knobs so made by the combination of said four parts or pieces we call our ferrule knobs.

The said four parts separately and the mode of combining the same will be more fully understood by reference to the annexed drawing, in which No. 1 is the knob, No. 2 is the socket, or plate, No. 3 is the ferrule, No. 4 is the split ring & No. 5 is the ferrule knob put together ready for use.

In testimony that the foregoing is a true specification & description of our said improvement, we have hereunto set our hands this twenty second day of June in the year of our Lord one thousand eight hundred and thirty six. Enoch Robinson, Francis Draper, Joseph H. Lord. Witnesses, Geo. J. F. Allegre, Franklin Dexter (United States Patents 1790-1836 [New Haven: Research Publications, Inc., 1980], reel 4, p. 97 [microfilm, Boston Public Library]). This patent is listed by the Journal of the Franklin Institute 18 (December, 1836), on page 431. It was reissued as patent number 65 after the Patent Office fire. The patent illustration can be seen at the end of this appendix, following the written patent descriptions (figure 51).

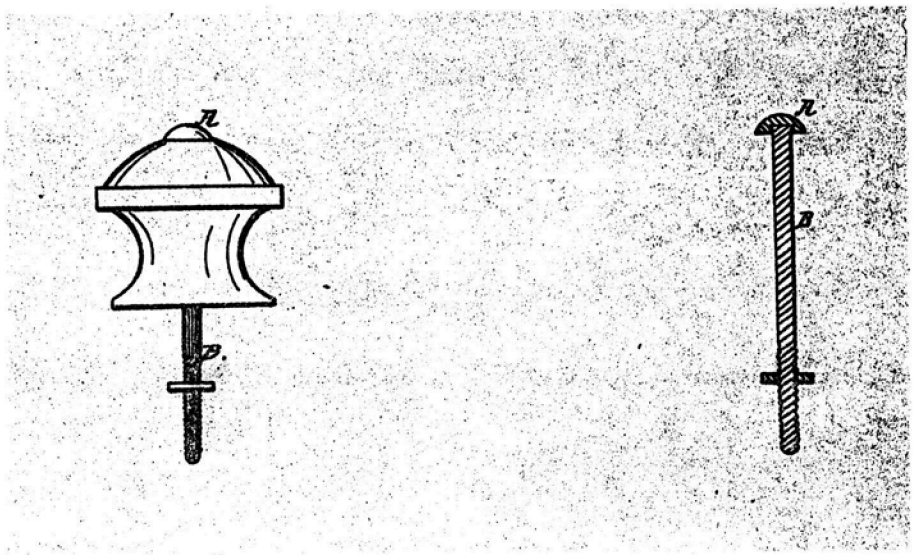


Figure 49: "Improvement in the screw for Glass Knobs." Letters Patent Drawing issued to Orrin Newton of Pittsburgh, Pennsylvania, on October 17, 1835. United States Patents 1790-1836 (New Haven: Research Publications, Inc., 1980), reel 3, p. 555 (microfilm, Boston Public Library).

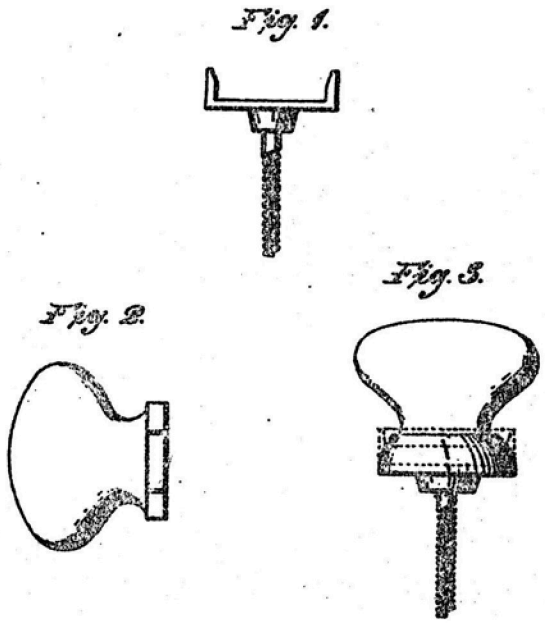


Figure 50: "Improvement in the manufacture of door, commode, furniture, and other knobs." Letters Patent Drawing issued to Enoch Robinson, Francis Draper and Joseph H. Lord of Cambridge and Boston, Massachusetts, on September 20, 1836. United States Patents 1790-1836 (New Haven: Research Publications, Inc., 1980), reel 4, p. 92 (microfilm, Boston Public Library).

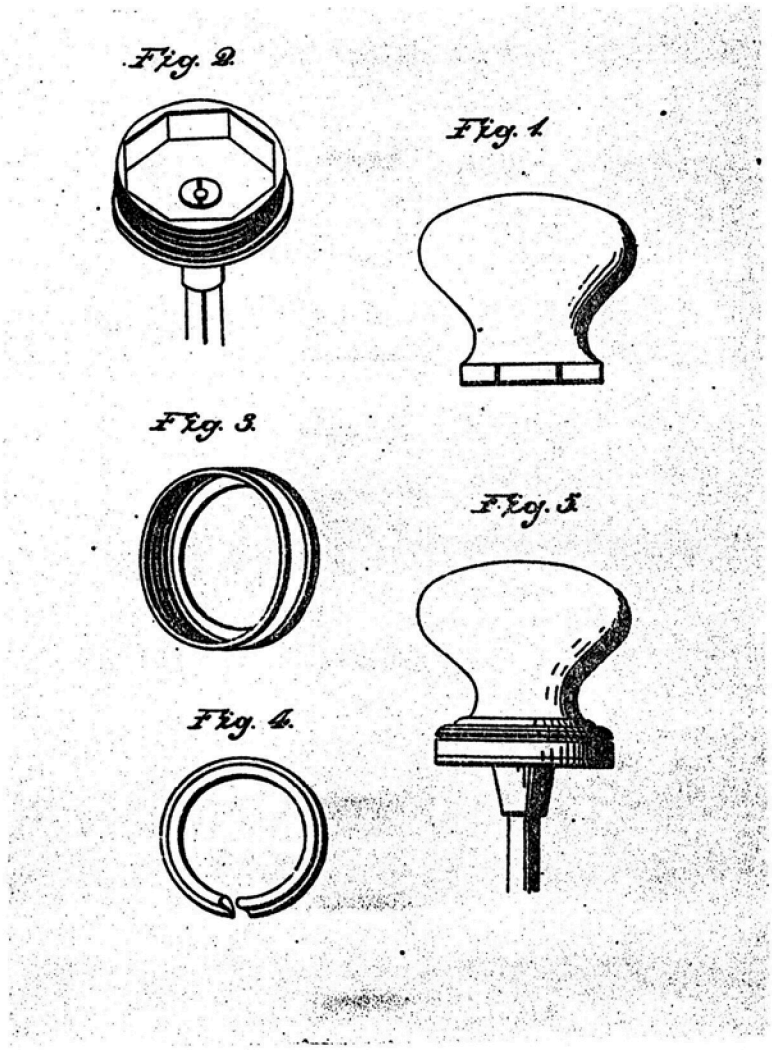


Figure 51: "The Ferrule Knob." Letters Patent Drawing issued to Enoch Robinson, Francis Draper and Joseph H. Lord of Cambridge and Boston, Massachusetts, on October 20, 1836. United States Patents 1790-1836 (New Haven: Research Publications, Inc., 1980), reel 4, p. 97 (microfilm, Boston Public Library).

Appendix B

PATENT ISSUED TO ELIJAH SKINNER OF SANDWICH, NEW HAMPSHIRE, ON JUNE 11, 1829, FOR HIS IMPROVED WOODEN KNOB

The schedule referred to in these Letters Patent & making part of the same containing a description in the words of the said Elijah Skinner himself of his improvement in the common wooden knob, called the "improved commode knob" -

To all to whom these presents shall come: Be it known that I, Elijah Skinner of Sandwich, in the County of Strafford & State of New Hampshire have invented a new & useful improvement in the common wooden knob, called the improved commode knob for the purpose of more acceptably bringing it into use for drawers of furniture & other purposes, & that the following, I think, is a full & exact description of the construction & application of the said knob as improved by me. In the first place, I turn a knob of some kind of suitable wood of just proportion & of various sizes & figures which knob may remain of the natural colour of the wood, or be stained to suit the fancy, & ornamented with thin plated brass, or any other suitable metallic substance that can be kept bright. A tenon is then turned upon one end of the shaft of the knob, of suitable proportion & strength to support it in the drawer or work wherein it is pinned, screwed, glued, or wedged. At the other end is turned the head or capital forming a proportionate moulding with a raised bead projecting over the face or capital of the knob, which face is turned either plain, concave, or convex. Then on the face of the capital within the circle of the bead, is laid and cemented or fastened a thin plate of burnished brass or metal, plain or figured, & made to conform to the same, & at the shoulder of the tenon or base of the knob is turned a small raised bead or sometimes a moulding of the size and figure of the capital or face. This back moulding or bead may in some cases be turned separate & fixed on the shaft of the knob, then between this bead or back moulding & the capital is turned a straight proportionate neck, around which is laid & fastened a wide ring of polished metal covering the whole neck, or cemented, nailed or brazed separate & slipped on - if the latter, then the back moulding should be turned separate & glued on the shoulder of the tenon closing to the neck. For a more elegant & expensive knob, a plate of brass or other metal is laid on the face of the back moulding within the circle of the bead similar to that on the face of the capital, & in the same manner on the back of the capital if I choose. The back moulding or washer may be wholly of brass. The wood should be well filled with oil & varnished, &

the brass may also be varnished, but I think it best when kept clean by polishing. For cheap furniture the face of the capital may alone be ornamented with brass. I make ornaments for the back boards of the furniture of the same figure of the face or capital of the knob, with a short tenon turned on the back to enter the work. A.A. in the drawing represents a plate & ferrule of brass. What I claim as new, & as my own invention or discovery in the above described knob, & for the use of which I ask an exclusive privilege, is firstly, in constructing the common wooden knob of so perfect a symmetry & proportionate figure as easily & securely to receive brass or metallic ornaments. Secondly, by putting on brass or metallic ornaments, as described in the specification, so that the common wooden knob now little used for furniture may supply the place of brass knobs for handles for the same. The advantages of this improvement are, first, so to construct & embellish the common wooden knob with metallic ornaments, that by reason of its beauty, cheapness, & durability, it may be brought into common use for cabinet furniture & the mechanic may manufacture handles for the furniture he makes. Second, it is cheaper & more durable than the brass knobs commonly used, & not so likely to fall in pieces, the brass or metallic ornaments being confined to the solid wood. Third, it is more easily kept clean & bright being handled by the wooden bead or moulding instead of brass, which better secures the metal from tarnishing. Fourth, it is more substantially fastened than the common brass knob, having a solid wooden tenon to enter the drawer, instead of the small metallic nut and screw. Elijah Skinner. Witnesses, Aaron B. Hoyt, Warren Dearborn (United States Patents 1790-1836 [New Haven: Research Publications, Inc., 1980], reel 1, p. 197 [microfilm, Boston Public Library]). The patent illustration can be seen at the end of this appendix (Figure 52).

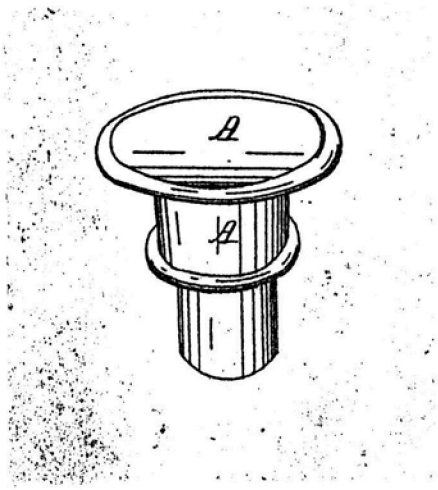


Figure 52: "Improved commode knob." Letters Patent Drawing issued to Elijah Skinner of Sandwich, New Hampshire, on June 11, 1829. United States Patents 1790-1836 (New Haven: Research Publications, Inc., 1980), reel 1, p. 197 (microfilm, Boston Public Library).

Appendix C

PATENT ISSUED TO ENOCH AND GEORGE W. ROBINSON OF BOSTON, ON OCTOBER 20, 1837, FOR THEIR METHOD OF ATTACHING GLASS KNOBS TO METALLIC SOCKETS

Be it known that we, Enoch Robinson and George W. Robinson, both of the city of Boston, in the county of Suffolk and State of Massachusetts, machinists, have invented a new and useful Improvement in Making Glass Door and other Knobs: and we do hereby declare that the following is a full and exact description thereof.

The glass knob is made in the common form except that near the foot and round the neck a groove or channel is made, either in the original manufacture of the knob, or afterward cut, which may be from a sixteenth to an eighth of an inch in depth, or more or less according to the size of the knob: if the foot of the knob is round, this groove may be cut into some angular or polygonal form to prevent the knob from turning in the socket, but if the foot of the knob be angular or polygonal the groove may be of even depth all round. The neck of the knob so far as it is covered by the socket must be of the same diameter with the foot. The knob thus formed is to be inserted to the depth of an inch, more or less, into a metal socket of which the upper part or edge is just large enough to receive the foot and neck of the knob, but the lower part of the cup of the socket must be made larger, that is the cavity must be of greater diameter than the foot and neck of the knob, so as to leave a space between the knob and the socket greatest at the bottom and diminishing to nothing toward the top or edge of the socket where it must fit close to the neck of the knob. A hole is to be made through the side of the socket so as to meet the groove in the neck of the knob, when the knob is inserted; this hole may be from an eighth to three sixteenths of an inch in diameter or more if necessary to admit the melted metal.

The knob and socket being both heated to such a degree as to enable the glass to bear the heat of melted metal without cracking, the knob is to be inserted into the socket, and then melted tin or other metal is to be poured into the hole in the side of the socket until it has filled the groove in the knob, and the space between the knob and the socket: by this melted metal the knob and the socket are securely fastened together.

The bottom of the socket should be made of a thickness sufficient to admit of a hole being drilled through the side to receive a pin by

which the socket may be fastened to the shaft passing into the lock or door.

We claim as our invention - Only the combination and fastening of the metal socket and glass knob by means of melted metal introduced between them, and the adaptation of the forms of the knob and socket to effect that purpose in any manner similar in principle to the one above described.

In the drawing accompanying this specification, A.A. is the glass knob, B.B.B. is the socket, c is the groove in the neck of the knob, d is the hole into which the melted metal is poured, and e is the hole for the pin to fasten the socket to the shaft. Enoch Robinson, G. W. Robinson. Witnesses: Franklin Vexter [sic], J. L. English (United States Patents, 1837 [microfilm, Boston Public Library], reel 2. The drawing for this patent could not be located for microfilming).

Appendix D

DEPOSITION OF WILLIAM STUTSON,
TAKEN BY SETH F. NYE, ESQ., OF SANDWICH,
MASSACHUSETTS, ON JANUARY 22, 1834

Interrogatories preposed [sic] to William Stetson [sic] of Sandwich (Map) glass maker on behalf of the defendant in above actions.

1. What is your occupation, place of residence, age, and how long have you worked at your business?

2. How long has the art of pressing glass been known? When was it introduced into this country?

3. Describe the operations of pressing glass, the machines used, & the manner of using them.

4. Does the beauty & finish of the manufactured article depend most upon the quality of the moulds or upon the skill of the workman using them?

5. Is the improvement in pressed glass articles within the last two or three years to be chiefly attributed to the improvements in the manufacture of the moulds & manner of preparing the metal or to the improvements in the manner of using the mould?

6. What degree of skill is requisite in the person who fills & uses the moulds, compared with that of the person whose duty it is to prepare and keep the moulds in order?

7. How long an apprenticeship is requisite to make a good glass presser?

8. What proportion of the workmen in glass pressing establishments with which you are acquainted have been brought up to the business?

9. Please give your opinion as to the necessity of having a person in a glass pressing establishment, whose particular province it is to superintend the pressing of the glass, & state whether there is such a superintendent in any of the factories with

which you are acquainted & if so in how many of them.

10. With what proportion of the workmen in a glass factory does the owner have contracts for service?

11. Do you find it difficult to procure persons competent to make the moulds for pressing glass?

12. Do you find it as difficult to procure a sufficient number of hands to press the glass?

13. Of what material are the moulds made and to what description of mechanical business does the making them belong?

14. Does it require any and if any, how much instruction or practice in that particular branch to enable a good mechanic of the description named in your last answer to make the moulds and put them in order for working?

15. Is there any and if any what difficulty in supplying the place of a superintendent of the pressing business, or, of one who makes & fits the moulds?

16. At what rate of wages could such a person ordinarily be procured?

17. Do you know anything else which may benefit the Defendant in this suit? Will please state the same at large.

Answers to the Defendants Interrogatories.

I William Stutson of Sandwich in the County of Barnstable of lawful age to give evidence do say in answer to the first question put by Defense Council I am a superintendent of a Glass Factory in the town of Sandwich County of Barnstable aged forty-six years - worked at the business between eight and nine years.

Answer to 2d Question. The act of pressing salts and small dishes was introduced in the factory in Sandwich between six and seven years since. The act of pressing was introduced into this country in the year 1817.

Answer to 3d Question. The operation of pressing glass is by two surfaces coming together on one surface. The machines used for pressing glass are by screw and lever press.

Answer to 4th Question. The beauty & finish of the manufactured article depends mostly on the finish of the mould as it requires but little skill in the presser.

Answer to 5th Question. The improvement in pressed work is in the moulds and the manufacture of glass and not in the pressing.

Answer to 6th Question. I have never considered much skill required in the persons who fill the moulds. All I considered necessary was a steady man of common capacity & practice from one to four weeks would be sufficient to make a good presser of glass as I have taken labourers out of the yard, and blacksmiths and others for that purpose. To keep the moulds in order it requires a mechanic.

Answer to 7th Question. From one to four weeks.

Answer to 8th Question. I am not acquainted with any other glass establishment excepting that of the Boston and Sandwich Glass Co. and they have never brought up any person to the pressing business.

Answer to 9th Question. I have never considered it necessary to have a person particularly appointed to superintend the pressing house. I have given the work out to the men pressing glass. If the moulds get out of order they are handed over to the mechanic whose occupation it is to keep them in repair.

Answer to 10th Question. In the pressing house I do not know of any person under contract, as men for that purpose are so easily obtained. We never considered it necessary.

Answer to 11th Question. I have never employed any person to make moulds to press glass but have never found any difficulty in obtaining them when wanted.

Answer to 12th Question. I have never found any difficulty in procuring hands to press glass.

Answer to 13th Question. Of how and composition as I have never employed persons to make moulds I cannot answer further.

Answer to 14th Question. I cannot tell as I have never employed any person to make moulds.

Answer to 15th Question. I have never employed any person as superintendent of the pressing business therefore cannot say and having never employed any person to make moulds I cannot say.

Answer to 16th Question. As I have never employed superintendent or mould maker I cannot say.

Answer to 17th Question. I do not.

Cross interrogatories on behalf of the Plaintiffs to be submitted to William Stetson, a witness to be produced sworn and examined on behalf of the Defendant.

First. Please to state all the places where you have laboured in the glass making business, and how long were you employed in each? In what particular departments of the business have you been employed? Were you brought up as a glass blower? Or in what business were you brought up, and what business did you pursue before you went to work in a glass establishment?

Second. Are there not the same reasons for having a good, intelligent, faithful superintendent over the glass-pressing department - that exist for having such a superintendent over the glass-blowing department? If not, state wherein exists the difference.

Third. Is it not essential that the superintendent of the glass pressing department should be practically acquainted with that business & himself be a skillful glass presser?

Fourth. Is it not necessary that a superintendent of a glass pressing department, in order to be most useful to his employers, should be a mechanic, skillful in hanging, adjusting, keeping in order and repairing the machinery for pressing glass?

Fifth. State how many machines for pressing glass are there now in common use in the factory where you are engaged. Describe the kinds of wares produced by them, and the kind of power by which each of the machines is operated.

Sixth. If you state in answer to the Defendant's 8th interrogatory, the "preparation of workmen" - who were "brought up to the business" - please to state whether by workmen you mean only glass-pressers; or all the labourers & others employed in and about the business - and whether you mean that they were brought up to glass-pressing - or glass-blowing business.

Seventh. Was it as easy in the fall of 1831 to procure persons skilled as superintendents of glass-pressing, in making,

adjusting, repairing & keeping in order the machinery as it is now? And was it or not at that time easy to find the same person skilled in all the business mentioned in this interrogatory? If there were many such persons in the fall of 1831 please to name & state where they resided.

In answering all direct and cross interrogatories you are cautioned to confine yourself to stating facts within your own knowledge, and the Plaintiffs now object to each of the direct interrogatories wherein you are required to give your opinion, and they will object to all your statements of your opinion, or to what you heard from others. Augustus Peabody for Plaintiffs.

Answer to 1st Question put by Plaintiff's Attorney. I have never labored in any other glass establishment other than the Boston and Sandwich Glass Co. and have been employed as superintendent of their glass establishment at Sandwich. I was not brought up as a glass-blower. I was brought up to the sea and previous to taking charge of this establishment I commanded a ship.

Answer to 2d Question. I do not consider it necessary to have a superintendent particularly over the pressing house.

Answer to 3d Question. I should not think it necessary.

Answer to 4th Question. I should think not, as when the moulds get out of order from use they are handed over to the person specially employed to keep them in order who is a mechanic.

Answer to 5th Question. From sixty to seventy. The ware made by these moulds are salts, dishes, plates, lamps, lamp feet, window lights, deck lights, inks, wafer boxes, sands, inks, and a variety of other articles. The power is by screw and lever pressure.

Answer to 6th Question. I mean only glass pressers and other labourers employed about the business excepting those who keep the moulds in order.

Answer to 7th Question. As I have never employed any superintendent of the pressing house I cannot say. I never found any difficulty in finding mechanics to keep the moulds in order. (File Papers, Suffolk County Supreme Court, Case 156, November Term, 1833 [Massachusetts Archives]).

Appendix E

DEPOSITION OF WILLIAM RAYMOND
TAKEN BY ROBERT SEDGWICK, ESQ., OF NEW YORK CITY,
ON FEBRUARY 5, 1834

Interrogatories to be submitted on behalf of the Plaintiffs to John L. Gilliland [or William Raymond], a witness to be produced, sworn, and examined to testify in said case.

1. What is your age, trade, occupation, and place of business, and to what extent do you carry on the business in which you are engaged?

2. State whether or not the business of glass-pressing is a distinct and different business from that of glass-blowing, and whether the art of glass-blowing is a prerequisite to the knowledge of the art of glass-pressing.

3. Whether or not is the business of pressing in moulds glass plates, dishes, bowls, salts, knobs, etc., & that which is denominated glass-pressing, of foreign invention? Was it known & practiced by foreign glass makers before their arrival in this country? Or is it an American invention, and was it or not invented and brought into use by citizens who were not skilled in the art of glass-blowing?

4. How long is it since the business of glass-pressing was introduced into the glass-manufactories in this country, and in what particular manufactory in this country was it first known and used?

5. Whether or not has the glass-pressing business undergone improvements since its first introduction, and are improvements in that department still in progress, or are they not?

6. How many presses or machines have you in your manufactory for operating in pressing glass, and how many moulds, and of what kinds or denominations, do you use for that purpose?

7. Is the same mode of working moulds adopted in all the factories, or are there different modes in different factories? Are single presses used for each mould, or are a number of moulds sometimes

so arranged as to be used under the same press? State which of these modes, or if both are in use.

8. State whether or not the same person who makes the moulds usually or sometimes also makes the press by which the glass is pressed in the mould, and whether he also afterwards works the mould, [and] orders or superintends the pressing.

9. Are the articles of pressed furniture, drawer, and door knobs manufactured in your establishment?

10. In making small articles requiring little power, such as furniture knobs, etc., is it or not found expedient to have a press for each mould to avoid loss of time by shifting?

11. Please to describe as well as you are able, the value and importance of the services of a superintendent, who is well skilled & experienced in pressing glass, directing the operations of other pressmen, and in making, adjusting, and repairing moulds & presses, in a factory where common pressed-glass articles are extensively made, and also forty or fifty moulds with seperate presses to each are in operation for pressing glass.

12. If an experienced superintendent in a factory, such as are described in the last preceding interrogatory, should suddenly & without previous notice leave his employment, please to state and describe minutely as practicable the evil & loss his employers would sustain by his desertion from their service.

13. Could the place of such a superintendent be made good by a stranger? If not, please to state why not, and explain all the particulars in which his employers would sustain loss by the change.

14. Please to state, from your knowledge of the glass-pressing business, whether a manufacturer who lost an experienced and well qualified superintendent of his glass-pressing department, could obtain another who was qualified, unless he took him from a similar situation in another factory; and if he could not, please to state the reasons of it?

15. Please to state the ordinary duties of such a superintendent.

16. What are the services of a superintendent of glass-pressing, such as is above described, worth per week in a large manufactory where seven or eight hands are employed under him? What do you pay such a superintendent, & how many presses and how many workmen does he superintend?

17. Please to state what was also the value of the services of such a superintendent in and about 1831. In your answers to the seven preceding interrogatories you are requested to answer in reference to October 1831 & to state the damages & difficulties as applicable to that time, and also the present.

18. Please to state every other fact, matter, or thing which will be for the benefit of the Plaintiffs in the above described case, as fully as if you had been specially interrogated the same concerning. Augustus Peabody, Attorney to the Plaintiffs.

Have examined these interrogatories and object to the eleventh, twelth, thirteenth & fourteenth as leading and involving the answer, and also as vague & indirect. Have no cross interrogatories to propose. F. Dexter for Defendant.

City & County of New York William Raymond named in the Commission hereto annexed being sworn saith, as follows:

To the 1st Interrogatory the witness saith. I am thirty years old and upwards. I reside at Brooklyn, Long Island, carry on the flint-glass manufactory and do business from one to two hundred thousand dollars per annum.

To the 2d he saith. The business of glass-pressing is different from that of glass-blowing. The art of glass-blowing is not an art prerequisite to that of glass-pressing.

To the 3d he saith. The business of pressing in moulds glass plates, dishes, bowls, salts, knobs, etc., called glass-pressing is not an art of foreign invention. To my knowledge or belief it was not known by foreign glass-blowers previous to their arrival in this country. It is as I believe an American invention and was invented & brought into use by American citizens not skilled in the art of glass-blowing.

To the 4th he saith. I cannot say exactly how long since it was first introduced, or in what factory it was first introduced, but the first glass which I ever saw that was pressed came from the New England Glass Factory as I understood and believe. This was about six years ago. I frequently saw glass of this kind in the way of my business which was said to have come from the New England Glass Factory.

To the 5th he saith. That improvements in the art of pressing glass have been constantly made and going on since the art was first introduced.

To the 6th he saith. That he has about a dozen machines in his manufactory for operating in pressing glass. He has a great number of moulds, cannot say how many, probably more than one hundred. The moulds are of various kinds for pressing plates, dishes, bowls, salts, nappies, etc.

To the 7th he saith. The modes of working moulds in the different factories are different. They depend upon the press or machine. Sometimes presses are used for single moulds, sometimes a number of moulds are used under the same press. Both of these modes are used.

To the 8th he saith. That sometimes the person who makes the mould makes the press, and also works the mould. He also superintends sometimes the pressing with it.

To the 9th he saith. The articles of pressed furniture, drawer, and door knobs are not manufactured in my establishment.

To the 10th he saith. That as he does not make such articles he cannot speak with certainty, but he should judge that in making such small articles it would be found expedient to have a press for each mould to avoid loss of time by shifting.

To the 11th he saith. That the services of a pressman such as is described in this interrogatory would in this deponent's opinion be of great value and importance. Deponent would consider the services of such a person worth twenty dollars per week.

To the 12th he saith. That if such a person should thus leave his employers suddenly the evil resulting would probably be great inasmuch as such a person in case a press or mould gets out of order which very frequently happens can repair the same immediately and the consequence of the repair not being made would be that one or more hands amounting to the number of presses or moulds out of order would have to stop work, and Deponent is of opinion that the loss resulting in such circumstances might probably amount to one hundred dollars per week.

To the 13th he saith. The place of such a person could not be filled by a stranger. The reason is that the one who made the machine and moulds would understand the nature of them and a person who was not thus acquainted with them, even though equally skilled in the general business, could not go into a factory where he was a stranger and supply the place of the previous superintendent above supposed.

To the 14th he saith. That a manufacturer who lost an experienced superintendent of his glass pressing department could not obtain another unless he took him from a similar situation in another factory. The reason is that there is a difference in the presses and moulds of different manufacturers, both in the construction and working of the presses and it would be almost impossible to obtain a person to supply the place of the one formerly employed, so as to make his place good. And as almost all such persons are in employ it would be very difficult to obtain one unless he was taken from another factory.

To the 15th he saith. The ordinary duties of such a superintendent are to prepare the moulds & presses, and direct the men in working them, and to see that when the moulds or presses get out of order in the slightest degree that they should be immediately repaired.

To the 16th he saith. That the services of such a superintendent are worth twenty dollars per week in such a manufactory. I have never paid higher than sixteen dollars per week, but I have seldom more than two hands pressing at a time, & my superintendent therefore has much less to do than the one supposed in the interrogatory.

To the 17th he saith. That in his previous answers he has had reference to the period of October 1831. The damages and difficulties in relation to such a case would not be so great now. The wages are about the same now as then, but the business is better understood and it is now more easy to provide for any difficulties or embarassments that may occur.

To the 18th he saith. I cannot answer further than I have already done. (File Papers, Suffolk County Supreme Court, Case 156, November Term, 1833 [Massachusetts Archives]).

Appendix F

INDENTURE OF GEORGE W. ROBINSON

Memorandum of an agreement made & entered into this first day of October 1830 between Geo. W. Robinson of the one part & the New England Glass Company of the other part, viz. The said Robinson for a consideration which will be hereafter named agrees to serve the said Company for a period of from one to three years as they may elect at the end of each year, to use his best exertions in whatever may be given him to do, to promote the best interest of the company, and on all occasions to let his conduct & deportment be a good example to those who may work with him & to the others about the works. He will attend to any description of work himself in the pressing of glass the four first days in the week & the two latter days also if wanted. When not at work in the Glasshouses he will go into the Mould Shop to work & there employ himself in adjusting, cleaning, repairing, & getting up new moulds, & hanging them, and any other kind of work wanted & shift from the Glasshouse to the Mould Shop whenever occasion calls for it, and work in either place, & as long as said company may wish. The foregoing is the ordinary duty that said Robinson has been performing. In addition thereto he now agrees to take upon himself that of a general overseer of the whole pressing business under the manager, particularly to take the charge of all the moulds used by the pressers & to keep them in a constant state of preservation & in perfect order for immediate use. Should any mould require cleaning, or adjusting, or repairing, when in use, or not in use, it will be his business to put it in order forthwith, & not suffer a mould to be used when it will not turn the work out in a perfect state, nor let any delay in the work take place by not seasonably attending to it. As it is important as a Foreman that he do everything to encourage and stimulate the other workers, he will always feel it a duty to exert himself to the utmost in that Glass-house to make a good move of work in regard to the number of articles made, that the others may have a good example before them at which they may aim. For the above services he expects to be paid ten dollars per week at the end of every fortnight. It is understood that all lost time from whatever cause is to be borne by himself.

The New England Glass Co. on their part covenant with the said George W. Robinson to pay him as above ten dollars per week wages during the time he may serve them, and at the end of the first year a further sum if he gives satisfaction to the Agent of the Company of

one hundred & four dollars and if he continues the second year, the sum of one hundred and fifty-six dollars at the end of that year, and if he continues a third year the sum of two hundred & eight dollars at the end of that year, on his performing all his covenants as above stipulated.

And it is mutually agreed if either party fail of truly & faithfully performing the covenants herein contained he or they shall forfeit & pay the sum of five hundred dollars to the other party of this Indenture on demand.

In testimony whereof the parties have hereunto set their hands & seals the first day of October 1830, in presence of A. J. Pimock. George W. Robinson. Henry Whitney, Agent, New England Glass Co. (File Papers, Suffolk County Supreme Court, Case 156, November Term, 1833 [Massachusetts Archives]).

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