An Archaeologist's Guide to Nineteenth Century American Glass

DESSAMAE LORRAIN

The nineteenth century saw a vast increase in the amount and variety of glass produced in the United States. All of the manufacturing techniques used — free-hand blowing, blowing into molds, pressing, drawing, and casting - and the coloring and decorating methods were known at the beginning of the century. The changes during the nineteenth century consisted of new ways to improve the known techniques to speed and simplify production. A major stimulus to the increased glass output was the development of mass transportation systems which opened new markets among the ever expanding and growing population. The invention of the steamboat in 1807, opening of the Erie Canal in 1825, and the tremendous increase in numbers of railroad lines after 1830 were important in fostering the increased demand for glass products.

In 1800 there were but nine glass houses operating in the United States. There were 108 glass houses in existence by 1837 but these were reduced to 78 by the depression of 1837-1840. With a return to prosperity, the years from 1846 to 1860 saw the establishment of 72 new glass factories in this country.

The types of articles produced by the glass works changed through the century. The earlier glass houses produced chiefly bottles and window glass with minor quantities of tableware for the local trade. As the century progressed, there was a tendency for increased specialization. Factories specializing in tablewares, such as the Boston and Sandwich Glass Co. at Sandwich, Massachusetts were able to transport their products far beyond the New England region via rail and barge. The bottle and window glass factories in turn ceased production of tablewares except for the occasional pieces turned out by the workers for their family and friends (McKearin and McKearin, 1948: 132-137).

The improvements and innovations in glass manufacture during the century resulted in observable changes in the glass products. Many of these changes are important for archeologists working with nineteenth century material. Some of the more important ones will be described. Others can be found in the date list. Emphasis is put on bottles because a survey of published and unpublished material from nineteenth century archeological sites showed that bottles constituted the bulk of excavated glass artifacts.

Before describing the changes during the nineteenth century, however, it is necessary to describe some of the manufacturing techniques in use by 1800 and the characteristics of the glass produced by each. The most common method for producing bottles and tableware was by blowing. The glass produced is called hand-blown, free-blown, or off-hand-blown. The form of the hand-blown objects is determined by the skill of the glass blower without the use of molds. Surfaces of hand-blown pieces are smooth and shiny and are without impressed designs or letters. Design may be cut, engraved, or etched into off-hand-blown pieces after they are cooled but these are not an intrinsic part of the glass. Decorative globs or threads of molten glass may be added to the object before it is cooled but they will also

have smooth, shiny surfaces. The bases of off-hand-blown pieces will have a spot of rough glass, the pontil mark, in the center. The pontil rod is attached to the base with a glob of molten glass to hold the object while the blowpipe is struck off and the raw edge at the top is finished. Occasionally on fine wares the pontil mark is ground away or it may be smoothed over by fire polishing without completely removing it.

Another characteristic of blown glass is asymmetry. Free-blown bottles are frequently quite lopsided although a careful, skilled glass blower could make perfectly symmetrical pieces if he wanted to do so.

The most important thing to remember is that off-hand-blown glass will not have mold marks. Blown-in-mold bottles may or may not have mold marks but free-blown bottles cannot have them. Mold marks are the raised lines which result from blowing glass into hinged molds. The glass is forced into the seams where the sections of the molds are joined. These lines are rounded and feel quite smooth.

The form of mold-blown or blown-in-mold wares is determined by the mold rather than by the glass blower. Impressed design patterns or lettering are also effected by the mold. Two types of molds are used: full size contact molds and partial size pattern molds. In using the latter the gather of molten glass is inserted in the mold and blown to impress the pattern into the glass. The glass is then removed from the mold and free-blown to full size. The common term for such wares is "pattern-molded and expanded". There will be no mold marks and the designs appear quite diffuse with rounded edges. Some articles with over-all patterns blown in full size contact molds may look very similar to pattern-molded and expanded pieces but they may be distinguished by feel unless the glass is too thick. On glass with an impressed design blown in a contact mold, the curvature of the inner surface is a negative image of the curvature of the outer surface; that is, it is concave on the inside where it is convex on the outside and vice versa (Fig. 1a). On pattern-molded and expanded glass, the curvature of the inner surface is a positive image of the curvature of the outer surface. It is convex on the inside where it is convex on the outside and concave on the

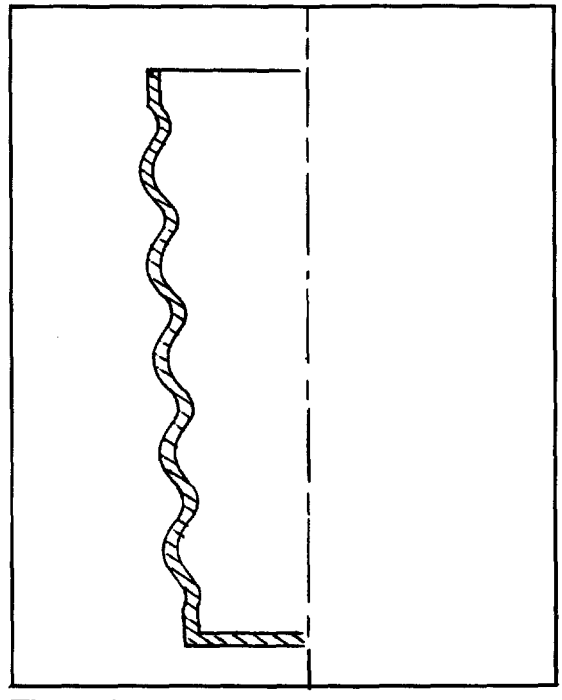

Figure 1a.
Cross-section of glass blown in contact mold.

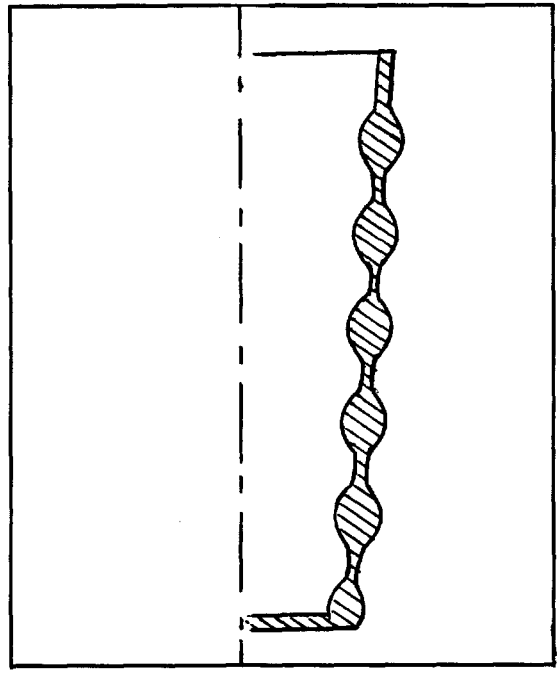

Figure 1b.
Cross-section of pattern-molded and expanded glass.

inside where it is concave on the outside (Fig. 1b). At the beginning of the nineteenth century, pattern molded and expanded glass was common but by 1850 it had practically disappeared in the United States. Modern pattern-molded and expanded pieces from Mexico have been imported in significant quantities into the border states recently.

In 1800 beads and glass tubing were produced by drawing as they had been for centuries and still are today. To draw a hollow tube the gaffer (glass blower) blows a small bubble in the gather to which the pontil rod is quickly attached by his assistant. The two men then walk rapidly in opposite directions pulling the glass bubble into a long thin tube. The hollow is extended throughout the length of the tube. The tube is then sliced into appropriate lengths for beads. Some beads were produced by pressing or other processes but these are quite rare in archeological sites. Beads in nineteenth century sites are less informative than other glass products.

Production of flat window glass in 1800 was by both the crown and cylinder methods. In the crown method a large glass bubble is blown, the pontil rod is attached, and the blowpipe removed. The bubble is reheated while the pontil is rotated rapidly. When sufficiently soft, the bubble is removed from the furnace and rapid rotation of the pontil continues until the glass bubble opens out into a large circular sheet. The size of the panes which can be cut from the sheet is restricted by the relatively small size of the sheet and the thick bull's eye of glass in the center where the pontil is attached. The bull's eye is translucent and cannot be used for transparent panes although it is sometimes used for decorative effect in windows or lamps. Crown glass varies considerably in thickness from the center to the edge of the sheet, so much so that the variation can usually be detected in sherds over an inch long. In larger sherds or whole panes, the curved distortion lines or waves can be seen in oblique light.

The cylinder method consists of blowing a large bubble of glass, then elongating it into a long cylinder by swinging. The closed distal end of the cylinder and the blowpipe are then removed, a lengthwise cut is made, and the cylinder is returned to the furnace and reheated until it falls open into a flat piece of glass. Cylinder glass is more uniform in thickness and can yield larger panes. The distortion waves, which result from the unequal size of the inner and outer surfaces of the initial bubble, are straight in cylinder glass rather than curved as in crown glass. A sizeable sherd is necessary to detect them however. The usual tiny fragments from an archeological site are seldom identifiable as cylinder glass.

Another method for making flat glass is casting. The molten glass is poured onto a sand covered table and rolled out evenly. It is not transparent until it is ground and polished. The resulting product is plate glass. The cost of hand grinding plate glass in the nineteenth century made it so expensive that it was seldom used for anything except small mirrors. It is distinguishable from other flat glass by its clarity and lack of distortion.

Among the first of the changes in the

Figure 2a.
Bottle blown in a dip mold for body form with hand finished shoulders, neck, and mouth. The horizontal mold mark at the point where the shoulders start their inward slope does not show clearly in this photograph. The bottle has a pontil mark on a kick-up base.

nineteenth century was the use of hinged molds for bottles (Putnam, 1965: preface; McKearin and McKearin, 1948: 427, 428). Hinged molds were known previously but did not come into widespread use until about 1810. From 1790 until sometime after 1810, bottles were made by forming the body in a one piece dip mold and hand finishing the neck and shoulders (Fig. 2a). The three part mold, which was developed around 1810, consisted of a one piece body mold and a two piece hinged mold for the neck and shoulder (Figs. 2b, b1). The lip continued to be hand finished throughout the century.

Another important discovery in 1810 was that of food processing by Appert in France (Lief, n.d.: 6, 7; Wyatt, 1966: 14, 15). He found that foods would keep if they were bottled and cooked thoroughly. This greatly increased the demand for glass bottles and jars.

Figure 2b.
Bottle blown in a three piece hinged mold with hand finished mouth. Note that the horizontal mold line is lower on the body than the one on the preceeding bottle and that there are vertical mold lines above the horizontal one. The bottles shown in 2a and 2b both have a hammered metal appearance which does not show in the picture. The base of this bottle is dished with no pontil mark. A snap case was used to hold it while the mouth was finished.

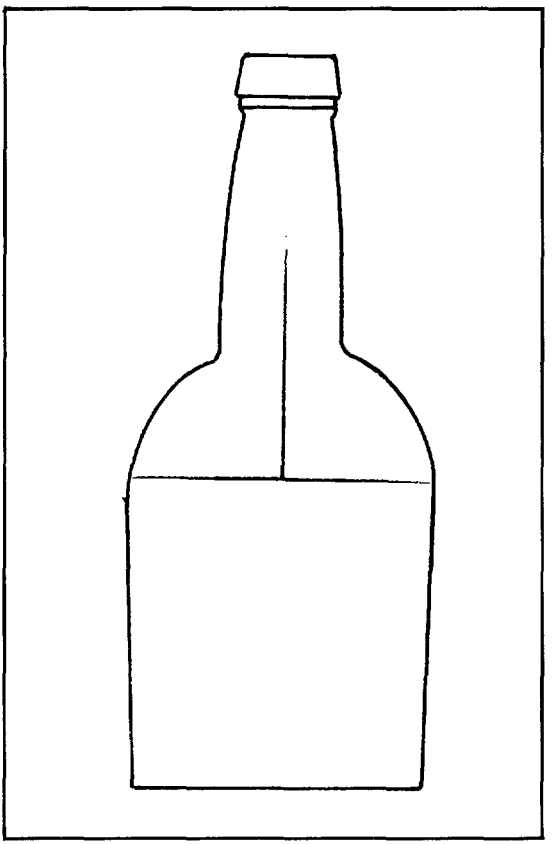

Figure 2b1.
Line drawing of bottle shown in 2b to emphasize the mold lines. Note their disappearance on the upper part of the neck due to reheating the neck to hand finish the mouth.

A major invention patented in 1827 was the pressing machine (McKearin and McKearin, 1948: 334). It enabled the glass houses to produce large quantities of attractive, inexpensive tableware. Pressed glass is identified by the sharply defined impressed patterns on the exterior and a smooth inner surface. The inner contour is produced by the plunger used to press the glass in the mold and thus has no one-to-one relationship to the outer curvature as in molded glass. Piece molds are used for

pressed glass so it will have mold marks, usually three or four. If examined closely, they will be found to differ from those on mold-blown wares inasmuch as they are normally narrow and sharply ridged rather than smooth and rounded. The early pre-1850 pressed glass has a grainy finish and the background is usually stippled — these are the familiar "Lacy" patterns (Fig. 3a). Later pressed glass was fire polished to give a smooth reflective finish. The background stippling was then eliminated (Fig. 3b). By 1845 pressed glass was common in American households.

The two piece bottle mold began to re-

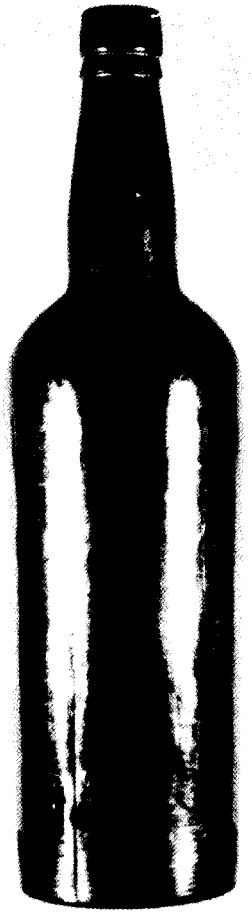

Figure 2c.
Bottle blown in a two piece hinged mold with hand finished mouth. Note that the vertical mold lines (2 of them on opposite sides) run the entire length of the bottle from base to neck. This bottle was made in a chilled iron mold and does not have the hammered metal look of the bottles shown in 2a and 2b. The base has no pontil mark; a snap case was used to hold it when the mouth was finished.

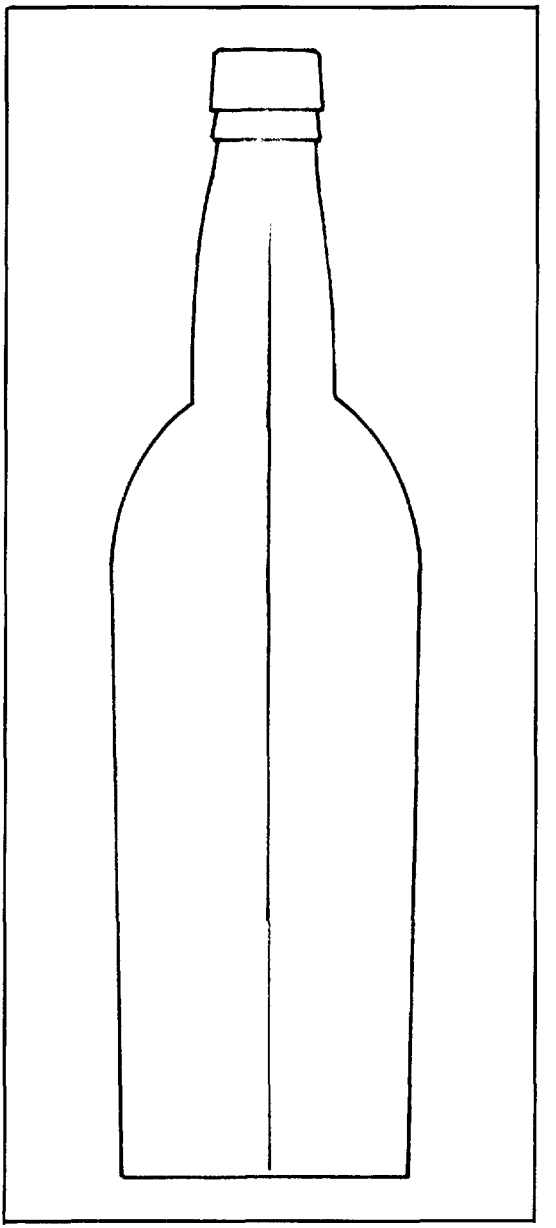

Figure 2c1
Line drawing of bottle shown in 2c to emphasize the mold lines and indicate their disappearance on the upper neck due to reheating when the mouth was finished by hand.

place the three piece mold between 1840 and 1850. The mold lines on a bottle made in a two piece mold run from the base up to the neck before fading out (Figs. 2c, c'). The disappearance of the mold lines on the upper neck is due to the reheating of the neck when additional glass was added to finish the lip. Sometime before 1850 an applied glob of glass formed by a lipping tool had almost entirely replaced the simple laid on ring of molten glass. The lipping tool consisted of a plug which was inserted in the neck and two forming arms which were clamped around the outside (Fig. 4a). The tool was then rotated so that the mold lines were removed and the glass was left with a swirled appearance. It is hoped that a firm date for the invention of the lipping tool will be established.

One of the most archeologically significant of the nineteenth century inventions was the snap case which was introduced around 1857 (Encyclopedia Britannica, 1949, Vol. 10: 410). This device replaced the pontil rod for holding bottles while the neck and lip were finished, therefore bottles held in a snap case will not have a pontil mark. The snap case consisted of four curved, padded arms which could be clamped around the bottle (Fig. 4b). It occasionally left slight indentations on the side of the bottle but usually there is no mark. If a bottle has a hand finished lip and mold marks but no pontil mark, it can be assumed that a snap case was used.

Figure 3a.
Pressed glass bowl showing early "Lacy" type pattern with stippled background. (This is a modern reproduction.)

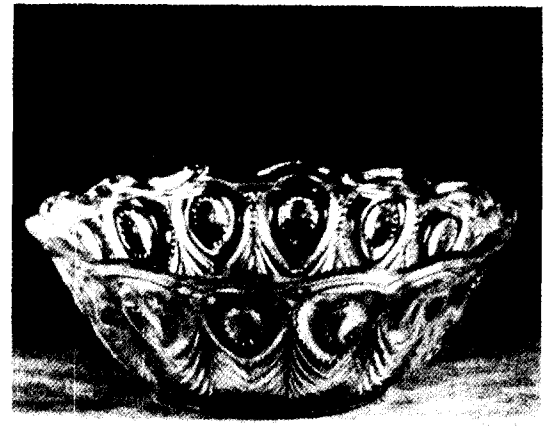

Figure 3b.
Pressed glass bowl with "peacock feather" design showing a typical later pressed glass design without background stippling.

The Mason jar for home canning was patented in 1858 (Lief, n. d.: 12). Most house sites occupied after that date should yield at least some Mason jars and their zinc caps.

About 1867 the first lettered panel bottles appeared (Moore, 1924: 255, 256). These were usually square or rectangular bottles with recessed panels on one or more sides on which were raised letters giving the name of the contents and frequently the city and state of the manufacturer of the contents. These bottles were most often used for patent medicines. The initials of the bottle manufacturer were sometimes impressed on the base but little work seems to have been done in tracking down the factories and determining when they operated and what years they used a particular imprint on their bottles.

Sometime around 1870 an improvement in the method of manufacturing the bottle mold resulted in the "chilled iron" mold (Ferraro and Ferraro, 1966:3; Watson, 1965:43). This process made it possible to

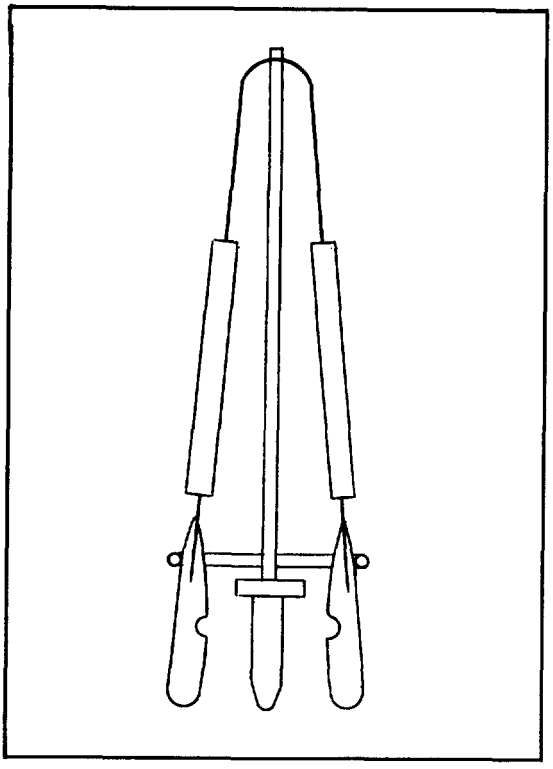

Figure 4a.
Line drawing of a lipping tool used for finishing bottle mouths. Note the central plug, the hinged patterned arms, and the band which clamped the arms together. When used the tool was rotated so no mold marks were left.

produce a very smooth interior surface on the mold and therefore a smooth exterior surface on the bottle. Before this, bottles blown in contact molds usually had an irregular surface resembling hammered metal. A bottle with a wavy or pebbly surface resembling hammered metal was blown in a contact mold whether mold lines can be found or not. Hand-blown or pattern-molded and expanded bottles never have such a surface but are instead smooth and shiny because all small irregularties are erased when the bubble is expanded to form the bottle.

Between 1860 and 1895 a large number of stoppers or closures were invented and patented. Most died a-borning but a few achieved widespread popularity and may be encountered in the excavation of nineteenth century sites. The almost universal

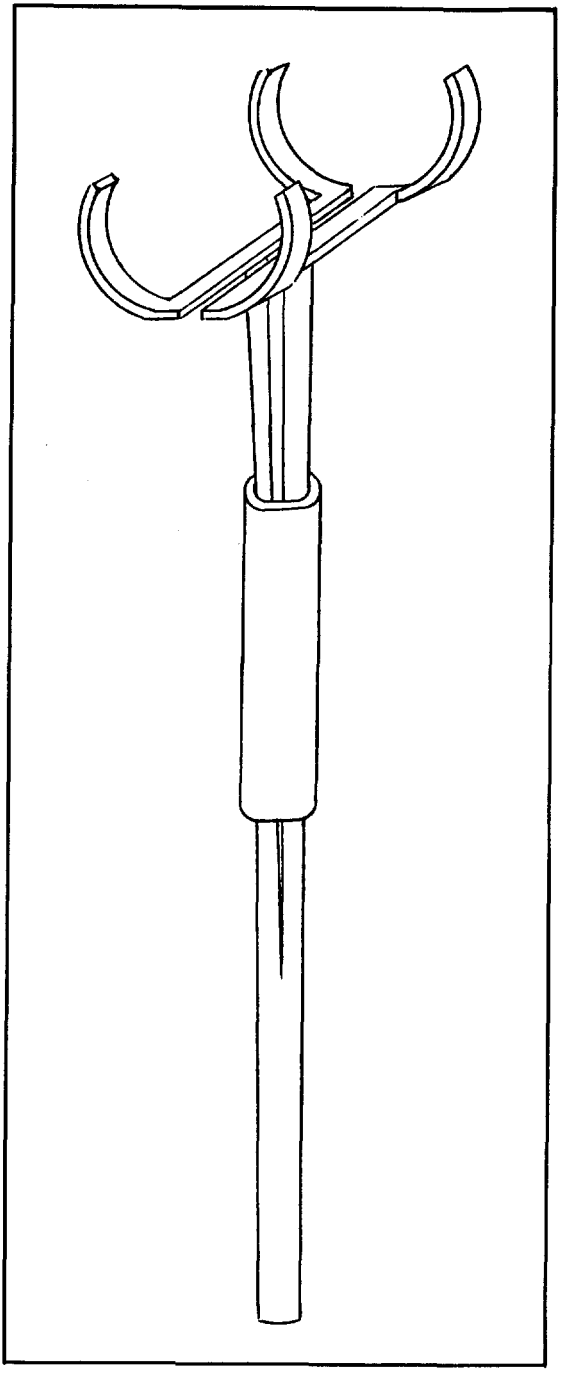

Figure 4b.
Line drawing of a snap case used to hold a bottle while the neck was reheated and finished by hand with the addition of molten glass. The snap case arms were closed around the bottle by the moveable ring clamp shown on the shaft.

closure before mid-century was the cork stopper. The few internal and external screw thread tops were produced would be rare and unexpected in an excavation. Some of the more popular closures invented in the second half of the century were the internal glass-ball stopper patented by Hiram Codd in England in 1860 (the U. S. patent was issued in 1873), the Hutchinson stopper consisting of an internal rubber gasket and a wire loop (Fig. 4c) which was a U. S. invention patented in 1872 or 1879; the Lightening stopper for jars and bottles which was patented in Europe by Charles de Quillefeldt in 1875 and an improved version of which was patented in the U. S. by Henry Putnam in 1882 (Fig. 4d), and the Crown cap — so common today on soft drink and beer bottles — which was patented by William Painter of Baltimore in 1892 (Fig. 4e), (Lief, n. d.: 13-19; Ferraro and Ferraro, 1966:15-18).

A semi-automatic bottle machine was developed in 1881 (Meigh, 1960:3). Bottles produced by this machine will have mold

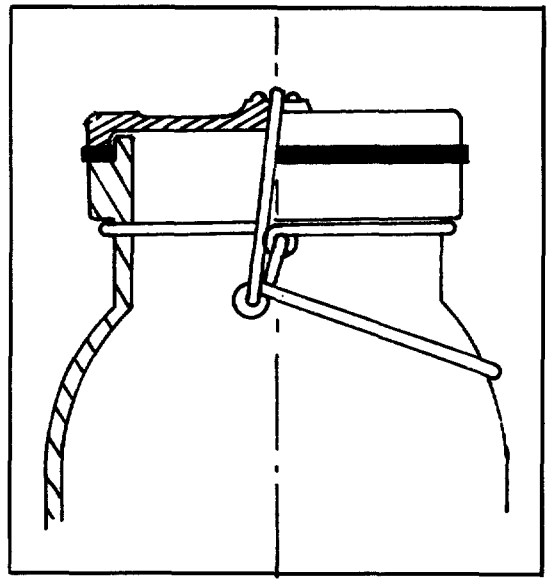

Figure 4d.
Lightening type closure with iron bail and lever.

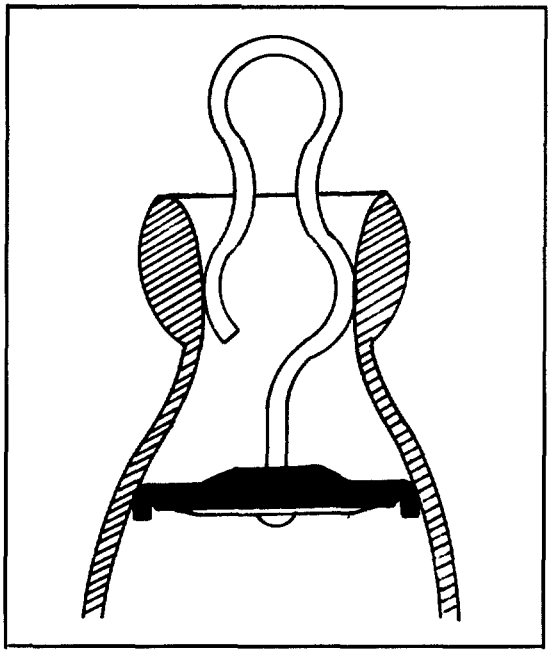

Figure 4c.
Hutchinson type stopper. To open a bottle so stoppered, the iron wire loop was struck sharply driving the stopper into the bottle. The resulting sound gave rise to the term "pop" bottles.

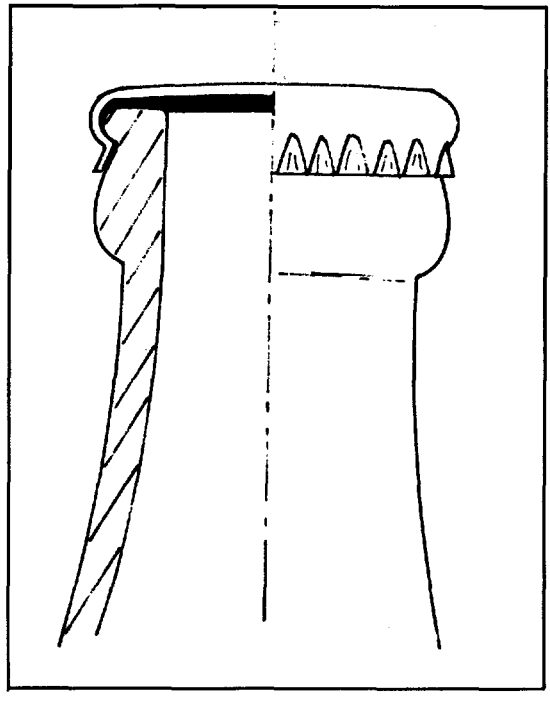

Figure 4e.
Crown type closure.

lines running up to the lip but not on the top of the rough lip. The machine was not widely distributed however, and the bottles produced were comparatively few in number.

A fully automatic bottle machine was patented in 1903 by Michael Owens (Meigh, 1960:7). Bottles produced by the automatic machine have continuous mold lines all the way up the sides and onto the top of the lip. By 1920 the changeover to automation by the commercial glass industry was complete. A few hand-blown or mold-blown bottles may still be produced as novelties by small glass houses but they cannot compete with the machine-made bottles in the commercial market.

The dateable changes in nineteenth century glass involve manufacturing techniques. It therefore behooves archeologists to learn the distinguishing characteristics of the products of these techniques so they can be identified and dated when encountered in the course of excavation. A description of glass pieces in a site report should include the manufacturing process used and the criteria used to determine it. This is often overlooked or ignored. Many descriptions list only the color and degree of patination and are virtually useless for identification and comparison. Throughout the nineteenth century all colors of glass were produced. Color should be mentioned in a description, preferably by using a standard color chart, but it should be considered one of the minor attributes. The degree of patination depends on the glass formula and the conditions of the environment to which the glass object is exposed (soil, water, air, sun, etc.). Some glass patinates very rapidly unless carefully protected; some will patinate hardly at all. Unless the glass formula is determined and the environment analysed, the degree of patination is not very informative but should, of course, be mentioned.

The following hierarchy of categories has been found useful for describing and classifying glass collections from archeological sites. It does depend on complete specimens or large segments of complete pieces. A handful of small sherds is not very informative and can be dismissed in a few short sentences in most cases.

I. **Storage Vessels** (or Table Service, Flat Glass, Beads, Miscellaneous Glassware)

II. **Bottles** (or Jars)

III. **Hand Blown** (or Blown in Contact Mold, Pattern Molded and Expanded, Machine Made)

IV. **Description** (manufacturing marks, form, design, color, patina, size, etc.) See Wilson (1961) for an example of a useful descriptive classification.

DATE LIST OF NINETEENTH CENTURY CHANGES

ca. 1810	Three piece hinged bottle mold introduced.
1810	Appert discovers how to preserve foods for storage, uses glass jars and bottles with wired on cork stoppers.
ca. 1820	First historical flasks.
ca. 1825	Octagonal medicine bottles, later followed by oval shapes, tooled lips.
1827	Pressing mold machine patented.
1827-1850	Period of Lacy pressed glass patterns
1830	No Masonic pictorial flasks after this date.
ca. 1840	Two piece hinged bottle mold.
before 1850	Lipping tool for finishing bottles (Ferraro and Ferraro, 1961, say 1850-1860 but I have seen earlier bottles finished with a lipping tool).

after 1850	Very little crown (flat) glass produced after this in U. S.
1857	Snap case introduced to replace pontil rod for finishing bottles.
1858	Mason jar patented.
1850-1880	Glass balls for trap shooting.
1860's	Kerosene lamps appear.
1861	First lead glass medicine bottles. Shortly after this "French squares" — tall, four-sided bottles with beveled edges — were put on the market.
1867	First lettered panel bottles.
1860-1900	Heyday of bitters (patent medicine) craze.
after 1868	Most figure bottles are post civil war.
ca. 1870	Chilled iron mold introduced.
after 1870	Historical flasks are rare.
1871	Pressed glass bottle fire extinguisher patented.
1872 or 1879	Hutchinson stopper patented.
1873	U. S. patent for internal glass ball stopper. (Patented in England in 1860).
1879	Edison's first light bulb — hand-blown.
1881	Semi-automatic bottle machine.
1882	Lightening fastener patented in U. S.
Mid 1880's	First milk bottles.
1892	Crown caps for bottles patented.
1891-1893	Safety glass with imbedded wire mesh produced.
1903	Owens automatic bottle machine patented.

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