

“THE FINISHING TOUCH”

A Primer on Mouth-Blown Bottle Finishing Methods with an Emphasis on “Applied” vs. “Tooled” Finish Manufacturing

Bill Lindsey

Author of the *Historic Glass Bottle Identification & Information Website*

Copyright © 2010

ABSTRACT

The final step in forming a mouth-blown bottle was to finish it by forming a lip (the “finish” in glassmaker terminology) which would properly accept some type of sealing closure. Many different processes were utilized to accomplish this task, from the simple to the complex. This paper looks at the major finishing techniques used for American made mouth-blown bottles produced during the late 18th, 19th, and early 20th centuries. Emphasis is given to the Applied and Tooled finishing methods which are defined and described in detail. Knowing how to identify the specific finishing methods of a mouth-blown bottle is a significant step towards the dating of these bottles based on observable, manufacturing related, diagnostic features.

(Author’s Note: This paper is a condensation of the bottle finishing methods information contained within the *Historic Glass Bottle Identification & Information Website* (or *Historic Bottle Website* for short) which is a part of the *Society for Historical Archaeology* web presence. The *Historic Bottle Website*’s primary goals are to guide users towards determining the approximate age of manufacture (“dating”) and typical use (“typing” or “typology”) of American-made bottles produced from about 1800 to the 1950s [Lindsey 2009]. Please consult that website for more information on the fascinating world of historic bottles at: www.sha.org/bottle/index.htm. The glass making terminology used in this paper is defined on the *Historic Bottle Website*’s “Glossary” page at: www.sha.org/bottle/glossary.htm)

Introduction

Simply put, the “finish” is the glassmaker’s term for the “top part of the neck of a bottle or jar made to suit the cap, cork, or other closure” (Jones and Sullivan 1989:78). This term originated with the mouth-blown bottle production process where the last step in physically completing a bottle was to “finish the lip.” Other alternative names for the finish besides “lip” were “top,” “mouth,” or “corkage” (Howard 1950; White 1978). Conversely, with semi-automatic and fully automatic bottle machines, the finish was (and still is) the first step in the bottle making process. The finish is fully formed in the “ring mold” as the remainder of the bottle is only pre-formed in the “blank” mold. Completion of the body shape occurs subsequently in the “blow” mold (Pearson 1929; Miller and Sullivan 1984; Miller and Moran 2004; Schulz and Miller, this volume).

Some authors, unfortunately, have included the entire neck above the shoulder as part of their definition of a finish (Ketchum 1975; White 1978:62). In hand production, however, the neck has already been completed before finish forming begins, and typically only its uppermost portion is affected. Consequently, it is not included as part of the finish (Toulouse 1969b; Deiss

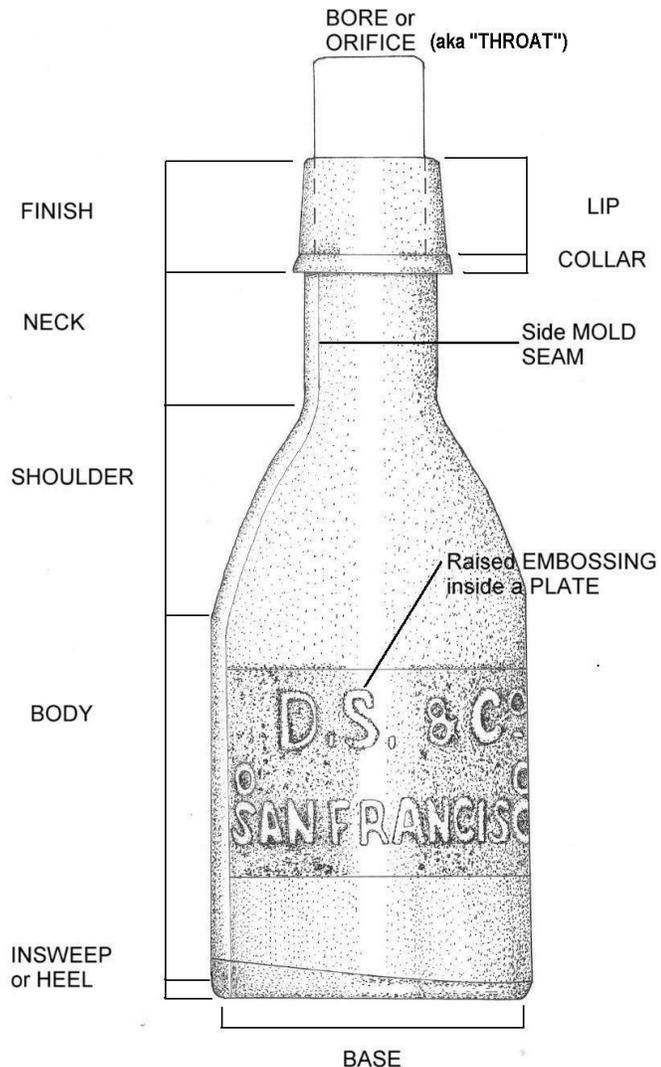
1981; Creswick 1987; Jones and Sullivan 1989; Fike 1998; Lindsey 2009; many others). The use of the word "finish" has carried on to this day and is the preferred term for describing the entire lip and collar, indeed everything clearly above the upper terminus of the neck, for all bottles, both mouth-blown and machine-made (Holscher 1953:304, 311-312; Owens-Illinois Glass Co. 2009). The components of the finish are illustrated in **Figure 1**.

(Figure 1 [to right]. The general morphological features—or anatomy—of a stylized mid-19th century mineral water bottle including the primary finish components. If a two-part finish, the lip is also frequently referred to simply as the “upper part” and the collar as the “lower part.” If the finish has three distinct parts, the middle part is referred to as such - the “middle part” [Jones and Sullivan 1989; Lindsey 2009].)

Determining the method employed in finishing a mouth-blown bottle can be one of the more useful diagnostic tools in determining its approximate manufacturing date range. Of particular interest – and an emphasis in this paper – are the Applied and Tooled Finishing methods and the time periods that these two distinctive mouth-blown finishing techniques were used. Before delving into those subjects it is useful to first briefly describe some glass making processes and early finishing methods.

Blowpipe Removal Methods

Prior to finishing a mouth-blown bottle, the fully expanded bottle had to be removed from the blowpipe. This was done by one of three primary methods: the “cracking-off” process, the “bursting-off” method, or by “shearing” (cutting) the neck off the blowpipe. These methods of blowpipe detachment are usually indistinguishable from each other on the finished item since the vast majority of bottles received post-blowpipe manipulation at the removal point, i.e., “finishing” (Munsey 1970). However, all three of these methods resulted in a cursory “finish” that was sometimes left as is with little or no further manipulation.



With the exception of the “bursting-off” method, in order for the blowpipe to be detached a bottle first had to be held securely by the base, typically with the use of some type of pontil rod (earlier) or snap or snap case tool (later). (These subjects are covered by Toulouse 1968 and Lindsey 2009) The following briefly discusses these three blowpipe removal methods.

Cracking-off

Cracking-off (or “wetting off”) was the process of applying a small amount of water—usually via a wet wooden paddle or a cold or wet piece of iron—to the point on the hot, just blown, bottle neck where the glassmaker wished to remove it from the blowpipe. This weakened the glass at the point of application, and a sharp tap on the pipe with one of the glassmaker’s tools severed the bottle from the blowpipe



(Modes 1887; Kendrick 1968; Innes 1976). The result was a variably rough and sharp tubular end to the neck (**Fig. 2**) that could be fire polished or otherwise finished as discussed in this paper.

(Figure 2 [above right]. A non-fire-polished, cracked-off finish on a 1850s era “scroll” flask [McKearin and Wilson 1978:422-423, 518-519].)

For some early American bottles this was the rough, but complete, finish. Based on empirical observations, American-made bottles with this most cursory of finishes rarely date after the 1850s.

Bursting-off

The bursting-off (or “blow-over”) blowpipe removal method resulted in a similar, roughly broken off, unfinished appearance to the bore. This process entailed the blowing of a relatively large bubble in the glass just above the mold top, i.e., above the upper end of the bottle neck beyond the mold edge. This thinned the glass sufficiently to allow the bubble to “burst”—with either a subtle twist of the blowpipe or a larger puff of air from the blower—detaching the blowpipe (Howard 1950). The bottle would then be removed from the mold using tongs, a metal rod, or wooden stick stuck in the bore. If further finishing was to be done (typically the case) then the bottle base would have to be held by either a pontil rod or a snap-case tool of some type while it was reheated and finished.

Sometimes, however, the burst-off necks were left unmodified (**Fig. 3**). While perhaps never common, the latter approach was used occasionally through the Civil War period (Russell 1998) and more rarely beyond (empirical observations). For example, three cases of such bottles were recovered from the Steamboat *Bertrand* which sank in the Missouri River in 1865 (Switzer 1974:61, 64). The author has also observed small schoolhouse shaped ink bottles with Burst-Off finishes which were produced by a Western American glass works in the 1870s.



(Figure 3 [to right]. A raw, non-manipulated, burst-off finish on an early 20th century English ink bottle. This looks very similar to the raw, cracked-off finish (Fig. 2) but does have some subtly differing characteristics.

These are described in Lindsey [2009]. The same source includes a period film clip [very early 1900s] of a mouth-blown "shop" blowing bottles using the burst-off method to detach the blowpipe.)

Shearing



As with the previous two methods, shearing was both a blowpipe removal method and a type of simple finish. It entailed detaching the blowpipe from the bottle with some type of shears—similar to tin snips or sheep shears—that cut the hot glass analogous to cutting thick plastic with scissors (Barber 1900:21). The resulting finish—which usually received some simple tool work to smooth out the edge—is called a Sheared Lip or Sheared Finish (**Fig. 4**).

(Figure 4 [to left]. An early American pattern molded flask [ca. 1790-1830] with what is often referred to as a sheared finish, although that cannot be positively ascertained since it also received post-blowpipe fire-polishing and possible simple tooling.)

The term sheared lip is commonly used by collectors and archaeologists to refer indiscriminately to Cracked-Off, Burst-Off, and true Sheared Finishes which were subsequently fire polished—a process that typically makes the blowpipe removal method indeterminate (Munsey 1970; McKearin and Wilson 1978; Fike 1987). Sheared Finish bottles date similarly to the cracked-off finishes, usually prior to 1870 (empirical observations).

Once removed from the blowpipe, a vast majority of mouth-blown bottles received additional manipulation devoted to forming a finish that made the bottle opening (bore) more uniform and suitable for some closure method. The earliest of these methods are briefly described in the section which follows.

Early Simple Finishing Methods

Fire Polished Finish



Once the bottle was removed from the blowpipe, one additional finishing step was often taken, even if no specific finish type was to be formed. The upper neck of the bottle was reheated to smooth out the crude or sharp edges where the blowpipe was detached. The result of fire polishing (**Fig. 5**) is a finish or lip edge that is smooth and glossy with the rim being rounded and slightly thickened (Jones and Sullivan 1989:40). This method of completed finish--cracking-off, bursting-off, or shearing, followed by fire polishing—was commonly used on

figured flasks dating from the first half of the 19th century and is rarely found on bottles produced after the early to mid-1860s (Deiss 1981:20-21; empirical observations).

(Figure 5 [above]. A fire polished finish on an early American [1820s] “sunburst” flask produced by a New England glasshouse [McKearin and Wilson 1978:420-421].)

For clarity, fire polishing (or fire finishing) should probably be distinguished from reheating. In the forming of mold blown bottles, these processes were operationally identical (taking the bottle to the furnace or glory hole to soften the glass of the finish area), but differed in purpose and in the stage at which they occurred. *Reheating* was a necessary step carried out to prepare the glass for further tool manipulation to create a finish, including most of those discussed in the following sections. *Fire polishing* was a final treatment sometimes used to smooth out any irregularities in a finish that had already been formed, particularly in its sealing surface, and to achieve a polished appearance. It could be used on finishes as simple as the type just described, or on more complex finishes, and was probably an option as long as hand production continued. Even after the introduction of machines, fire polishing was used for some types of finishes (Lockhart et al. 2009:51).

Ground Rim Finish

Along with fire polishing, the grinding down of the burst-off (occasionally cracked-off; rarely sheared) top surface of the lip or rim was one of the simplest methods for finishing a bottle since the functional structure of these finishes were fully mold-formed and not tooled to shape. Once removed from the blowpipe and annealed, the rough rim was ground down flat and even to finish the bottle or jar (**Fig. 6**).

(Figure 6 [to right]. A ground finish rim on a Lightning canning jar dating from between 1882 and the early 1900s.)

Ground rims were very common on a wide array of mouth-blown canning jars—and occasionally other bottle types—produced from the late 1850s until the 1910s (Toulouse 1969a; Creswick 1987). The sealing surface for such jars was not the ground rim surface itself. Instead, a thin rubber gasket was placed on a lower horizontal ledge. This was a typical—although not universal—configuration for ground rim canning jars including the famous Mason 1858 Patent jar which sealed on the shoulder ledge below the external screw threads and likely where this type finish originated (Deiss 1981).



This finishing process produces the following diagnostic characteristics: the extreme upper horizontal surface of the lip (rim) is flat (not rounded at all) and slightly rough to the touch, like fine grit sandpaper; there are usually tiny chips or roughness along the inside and outside edges resulting from the grinding process; the ground surface has a slightly opaque appearance; and the vertical side mold seams end right at the top outside edge of the ground rim and do not curl over the top of the rim.

Laid-On Ring Finish

Once the blowpipe was removed, a string or band of glass could be laid around the outside of the extreme upper neck forming the Laid-on Ring or String Rim finish (**Figure 7**).

(Figure 7 [to right]. Laid-on finish on a mid-19th century French “Muscat” wine bottle showing the crudeness typical of this type finish where no post-application tooling was performed. This bottle was free-blown (not molded) and almost certainly cracked-off from the blowpipe leaving a rough, sharp rim that was not fire polished. There are many variations on the theme of the laid-on ring finish, and examples are illustrated in Jones [1986: 49-71] and Jones and Sullivan [1989: 95-96].)



Once applied, this string of glass received little if any tool manipulation though was often fire polished (Jones 1986; empirical observations). The entire finish is comprised of the applied glass and cracked-off, burst-off, or sheared bore. This ring of glass performed at least two functions: to give strength reinforcement to the bore of the bottle and to provide an anchor for wiring down a cork, if necessary (Jones and Sullivan 1989). This method of finishing produced primitive applied finishes which are the precursors to the true Applied Finishes covered later.

Laid-on Ring Finishes are particularly common on bottles made prior to 1850 and were first used at least as early as the mid-1600s (Deiss 1981; Jones 1986; Van den Bossche 2001). Be aware that there are many finishes that initially appear to be Laid-on Rings, but that actually were Applied or Tooled Finishes as defined later in this paper. The subtle variations differentiating these can be difficult to even the trained eye, although the true laid-on ring is usually crudely asymmetrical (**Figure 7**), has no horizontally concentric tooling marks in evidence, and simply looks as though a strip of glass was wrapped around the upper neck just below the bore with little other handwork done, which is just what was done.

Rolled or Folded Finish



This method of producing a finish entailed the use of some type of simple tool to turn the hot plastic glass at the neck terminus back onto itself. As with the other early finishing methods, the Rolled Finish did not involve the specialized lipping or finishing tools required for the Applied and Tooled Finishes discussed later. Once the blowpipe was removed from the bottle, the hot glass at the removal point was reheated as necessary, then either rolled/folded into the bore of the bottle or folded out onto the extreme upper neck, probably using a tool like a “jack,” to smooth out and form this simple finish (Jones and Sullivan 1989). This folding certainly provided extra strength to the rim and upper bore of the bottle by “doubling” over the glass.

This type of finish (**Fig. 8**) is most common on early figured flasks, and especially medicine and food bottles dating from the first decade of the 19th century to the 1870s (Deiss 1981; Jones and Sullivan 1989; empirical observations). When rolled to the inside, this finish is also called an “infolded” lip or finish (White 1978).

(Figure 8 [above]. A crudely rolled or folded-in finish on a 1850s era [the base is pontil scarred] hair tonic bottle. The finish on the pictured bottle is crude enough so that parts of it appear to be rolled outwards, although when in hand it is obviously rolled into the bore.)

Flared Finish

The Flared or Flanged Finishing method also entailed the use of some type of simple tool to manipulate the hot glass at the end of the neck, creating a relatively thin finish which projects away from the top of the bore at a more or less 90° angle (**Fig. 9**). According to Kendrick (1968:139, 142-143), the mouth of a bottle "...could be expanded to form the flared lip, either by the use of a jack, or by inserting a cone-shaped plug into the mouth of the bottle as the pliable mass [of glass] rotated." A "jack" was a simple tongs-like tool that appears to be the precursor to the later, more specialized, finishing tools discussed later (Lindsey 2009).



(Figure 9 [above right]. A flared finish on an ink or utility bottle produced by an eastern American glasshouse ca. 1840-1860.)

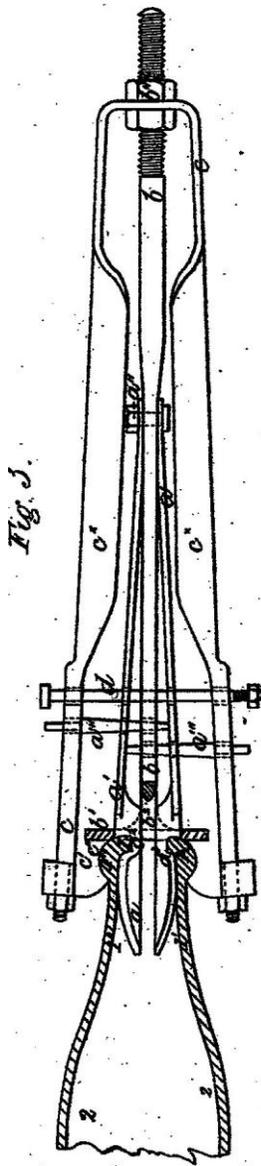
Based primarily on empirical observations, but also corroborated in Deiss (1981), this method of finishing was most commonly used in the United States between the 1820s and about 1870, though it can date back much further in Europe (Toulouse 1969b; Van den Bossche 2001). These early Flared Finishes can be difficult to discriminate from similar-appearing finishes produced by the methods covered later. To the experienced eye it can be distinguished from applied or tooled flaring finishes by the thinness of the glass that forms the flared portion - much thinner glass than produced by these other later finishing tool methods.

Although this type of finish was "tooled" in the sense that it was manipulated with a simple tool and formed from the reheated glass at the blowpipe removal point, the process and the results were quite different from the later Tooled Finishing method employing a specialized "finishing tool." Both the Rolled and Flared Finishes were formed by working the reheated glass at the blowpipe detachment area but did not involve the application of additional glass (Toulouse 1969b). This, in part, differentiates these simple tooling methods from the process covered next – the Applied Glass Finishing method.

Applied Glass Finishing Method

Manufacturing Processes

Between the early 1800s and the late 1880s - particularly between about 1830 and 1885 - the most common way of finishing an American-made bottle entailed an application of additional



glass which was then shaped with a specialized tool (Hemingray 1860; Howard 1950; Jones 1986). Specifically, a variably thick (depending on the finish type and size desired) strip of hot glass was added at the blowpipe removal point using a pontil rod or other tool ("ring iron"). This was done as the bottle was rotated by another glassworker holding it by the base using either a pontil rod or a snap ("snap-case") tool (McKearin and Wilson 1978:13-14; Jones and Sullivan 1989:21).

This applied hot glass was then manipulated with a specialized "finishing tool" ("rounding tool" or "lipping tool") to form a wide variety of different finish types that could be more complex and variable than the earlier finishes noted above which were formed with very simple but versatile tools (Stone 1855, 1856; Sheldon and Lynn 1893; Munsey 1970:32). The finishing tool (**Figure 10**) was clearly more specialized: not only was its use restricted to creating finishes, but the jaws of every such tool had to be specifically designed for a particular size and profile of finish.

(Figure 10 [to left]. Illustration from an 1876 patent showing a fairly typical, calipers-type finishing tool used to create a type of applied, one-part "blob" finish used for carbonated beverages, the purpose of this design being to create a throat wider than the aperture [Lamont 1876].)

This finishing method produced what is referred to as an Applied Finish, an example of which is illustrated by **Figure 11**. This image also shows the significant "slop-over" of the applied glass onto the upper neck beyond the reach of the finishing tool - a very common attribute

and diagnostic feature of Applied Finishes (discussed later).

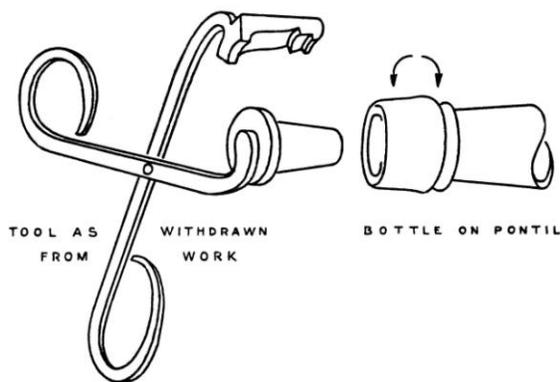
(Figure 11 [to right]. A two-part applied finish showing two characteristic features: slop-over of excess glass, and the vertical mold seam continuing to the bottom of the finish.)

The earliest finishing tools—that is, those for Applied Finishes—only formed the dimensions of the finish itself and generally did not affect the upper neck. This is an important distinction when comparing the Applied Finishes to the Tooled Finishes discussed later.



What is probably the earliest form of specialized finishing tool (**Fig. 12**) is described in an 1842 explanation of the process of applying and forming a finish, beginning from the point where the bottle is detached from the blowpipe:

The finisher then warms the bottle at the furnace, and taking out a small quantity of metal [i.e., glass] on what is termed a ring iron, he turns it once round the mouth forming the ring seen at the mouth of bottles. He then employs the shears [finishing tool] to give shape to the neck. One of the blades of the shears has a piece of brass in the center, tapered like a common cork, which forms the mouth [bore or inside of the finish], to the other blade is attached a piece of brass, used to form the ring [outside of the finish]. (quoted in McKearin and Wilson 1978:217)



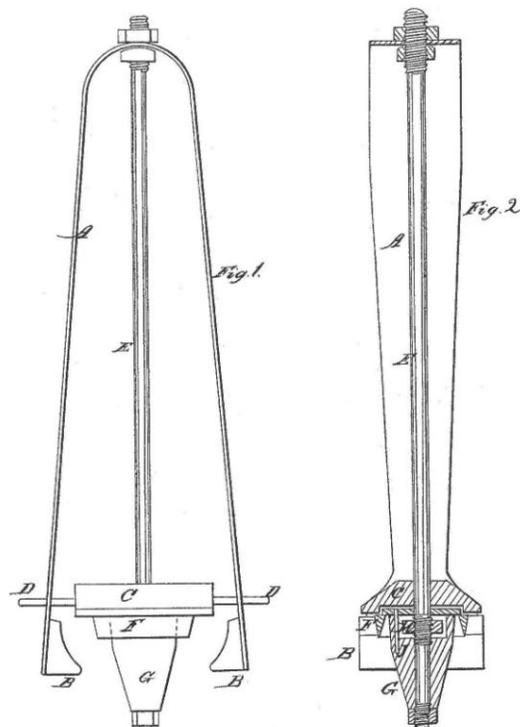
(*Figure 12 [to left]. Artist's rendition of the lipping shears, probably the first form of specialized finishing tool [McKearin and Wilson 1978:Fig. 53a].*)

These early finishing shears quickly evolved into the calipers-type finishing tools (**Fig. 10**) that dominated the industry by the 1850s. The “piece of brass in the center”—analogous to the plug shown on the illustrated caliper-type finishing tools—fit into the bore of the bottle. The “piece of brass used to form the ring” is analogous to the pair of jaws, one at the end of each

caliper arm. The various finishing tool illustrations in this paper help to visualize these parts.

The following excerpt from an 1860 patent describes the mouth-blown production of jars with Applied Finishes. At that time the most common finish type on jars was the groove ring wax seal finish (**Figs. 13, 14**) although the process for forming and finishing most bottle types at the time was identical to that described:

...it has been customary to mold the body and neck of the jar in molds of two parts... After the jar has been thus formed and removed from the mold a portion of melted glass is taken and united to the top of the jar and the...[finish]...is



then...[formed with]...the plastic glass by a tool adapted to the purpose. This process is necessarily slow and laborious and the work when completed is not so uniform and complete as when the jar is finished in the mold and at one operation...[the latter of which was the purpose of the specific patent] (Hemingray 1860).

(Figure 13 [previous page to right]. Illustration of a finishing tool for making grooved ring fruit jars [Stone 1856], one of the first two American finishing tool patents. B indicates the jaws of the tool, which form the outside of the finish; F is a wedge-shaped blade to form the groove in the upper rim [Fig. 13].)

This clearly describes the application of glass and subsequent tooling for an Applied Finish and even notes the crudity ("...not so uniform...") that is often a result of such an operation. The more advanced tools used for finish glass manipulation and generally more complex design of most Applied Finishes is what differentiates this method of finishing from the simple, one-part "laid-on ring" finish described earlier.

The first patents for finishing tools in the United States were issued in the mid-1850s, although similar domestic and imported finishing tools were already long in use (Stone 1855, 1856; Toulouse 1969b:533; empirical observations). The patents were not for the concept itself, since such tools were no longer patentable by that time. Rather the patents were for new ways of constructing



them, or for designs that were particularly useful for distinctive forms of finish. The 1856 patent (**Fig. 13**), for example, was for forming an applied, groove-ring finish on wax seal canning jars (**Fig. 14**). The patented tool was for producing the "groove" in the groove-finish (**Fig. 13: part "F"**). The "jaws" (**Fig. 13: part "B"**) of these tools formed the outside of the finish when rotated and just barely, if at all, touched the upper neck of the bottle.

(Figure 14 [above right]. A groove-ring finish on a fruit jar, the product of a finishing tool like that shown in the previous figure. The vertical lip of the cap fit into the grooves, which were filled with wax to affect the seal.)

Regardless of the particular design of these early finishing tools, their use after the application of added glass constitutes a distinctive category of finish. The diagnostic characteristics of Applied Finishes will be discussed after a brief note on the terminology.

History of Terminology

The term Applied Finishes has its basis as a collector term. These could also be termed Applied & Tooled Finishes since special tooling of the added glass was necessary to create the desired

finish shape and size (Deiss 1981:51; Roller 1983:463). This type of finish additionally goes by an array of collector-originated terms including "crudely applied lip," "glob top," "globby top," "drippy top," etc. It should be noted that applied finishes - especially earlier (1830s to 1860s) examples - tend to be more substantial, bulky and/or crude compared to later applied finishes, though there are many exceptions. This is likely because of the quickly improving techniques and tools during the last half of the 19th century, a period of explosive innovation in the American glass industry (Scoville 1948; Deiss pers. comm. 2003).

Some authors have criticized the use of the term Applied Lip as telling "nothing of the method" used to produce the finish (Toulouse 1969b:533) or that "...the term is so broadly interpreted as to render it meaningless" (Jones and Sullivan 1989:75). This certainly has been true. Many people - collectors and archaeologists alike—have too broadly used the term Applied Lip or Applied Finish in referring to any finish on a mouth-blown bottle where the side mold seam does not terminate at the very top of the finish. The origin of this broad interpretation appears to have come from Tibbitts (1964:3) who described an Applied Lip

...to include any lip or mouth that was hand worked after the bottle was broken off from the blowpipe. Among others, it includes sheared lip, rolled lip, applied collar on sheared lip, applied collar below sheared lip, applied blob, etc.

Tibbitts so broadly defined an Applied Lip as to include virtually any finish on a mouth-blown bottle including what is more properly referred to as a Tooled Finish. The production of a Tooled Finish entailed a different manufacturing process than an Applied Finish.

It is, however, important and useful to clearly differentiate Applied and Tooled Finishes from each other, and from other finishes, for dating utility. Simply expressed, and as described here, both of these finishes—and only these finishes—employed a finishing tool; an Applied Finish entailed the application of additional glass; a Tooled Finish did not.

Diagnostic Characteristics of Applied Finishes

The observable diagnostic characteristics of an Applied Finish include several or all of the following attributes:

1. The side mold seams end abruptly on the neck at the lower edge of the finish (Figs. 11, 15, 16). This feature is

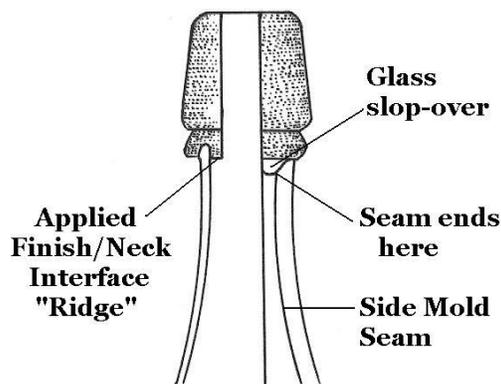


usually quite reliable, though there are exceptions. For instance, the mold seams in the upper neck portions of an Applied Finish bottle can be hard to detect due to neck reheating prior to the finish application process. In addition, sometimes—especially with bottles from the first half of the 19th century—all or a portion of the neck had been formed by the skill of the glassblower since only the base, body, and shoulder were formed in the mold. No neck side mold seam would be possible on these bottles. Conversely, if the side mold seams extend perceptibly into the structure of the finish itself—and the bottle does not have a ground rim or a sheared/cracked-off finish—it is always a Tooled Finish (next section).

(Figure 15 [on previous page]. Applied finish on a proprietary medicine bottle, showing excess glass below the finish and relation to side seams, which end at the bottom of the finish.)

2. There is usually a small quantity of excess glass slopping over onto the upper neck of the bottle just below the finish (Figs. 11, 15, 16).

Sometimes the excess slop-over is not evident or the applied glass was inadequate in quantity resulting in a finish that is missing some portions. This is evidenced by unfilled spots on the finish rim and/or a ragged unevenness or waviness at the base of the finish. In general, the appearance of an Applied Finish is less vertically (and sometimes horizontally) symmetrical than a Tooled Finish.



(Figure 16 [to right]. Partial section of an applied finish showing the relationship of original and added glass [after Deiss 1981:Fig. 17].)

3. The presence of a horizontal line or ridge within the throat of the bottle that can often be felt by inserting the little finger into the bore, if it will fit. (Fig. 16)

This line or ridge marks the interface between the blowpipe severing point and the separately applied finish glass; it can vary from obvious to non-existent (Boow 1991:64).

4. Concentric horizontal tooling marks from the finishing tool may be present on the finish itself but not on the upper neck just below the finish (Fig. 22). The rotation of the finishing tool often left its mark on the outside surface of Applied Finishes very similar to those on Tooled Finishes. These tooling rings are rarely ever visible on the extreme upper neck of Applied Finishes – an extremely common attribute of Tooled Finishes – since the jaws did not extend beyond the base of the finish. Finishing tools for other Applied Finish types or styles (e.g., mineral finish, blob finish, etc.) had differently shaped "jaws" than that shown in this illustration.

5. Some applied finishes will exhibit a few to a grouping of small, short fissures or cracks ("crazing lines") in the area where the glass was applied to the raw neck end. This feature is very unusual, though not unknown, on Tooled Finishes and can be quite indicative of the

presence of an applied finish. This feature is the result of the difference in temperature between the applied finishing glass (hot from the glass pot) and the glass of the upper neck which, though reheated, would have been cooler than the new viscous glass being added.

Few Applied Finishes will have all five of the features above in evidence. A combination of features **1** and **2** is the most commonly observed, with feature **3** being felt frequently if a finger will fit into the bottle bore, and feature **4** frequently observed upon close inspection. Sometimes a very well executed Applied Finish ("neatly applied" in collector jargon) will only show the side mold seam disappearing at the base of the finish (feature **1**) with maybe some faint tooling marks on the finish itself (feature **4**).

The specific dating guidelines for bottles with Applied Finishes are covered after the next section on the Tooled Finishing method. The dating of the transition from Applied to Tooled Finishes is somewhat bottle-type specific and the subject of Tooled Finishes needs to be covered first.

Tooled Finishing Method

Manufacturing Processes

This finish manufacturing method is the result of the glass for the finish-to-be being blown with the rest of the bottle, not added in a separate hand application as with the Applied Finishing method described previously. Specifically, once the blowpipe was removed from the bottle neck, the finish was formed and made smooth and precise by the reheating of the end of the neck—*with no additional glass added*—and tooled to the desired shape with a finishing tool (Deiss 1981; Roller 1983; Ring and Ham 1998). Tooled Finishes are also called Wiped Finishes by some - a fairly descriptive term, for the process sometimes “wipes” out a portion of the upper mold seams; a subject discussed later in this paper (Preble 1987; Fike 1998).



It is important to note that the term Tooled Finish is not used here to describe the primitive tooling of the simple finishes noted earlier in this paper, i.e., the Flared Finish, Rolled Finish, and often the sheared/cracked-off and Fire Polished Finish. Indeed, these earlier finishes were typically at least partially formed with the use of simple tools so are in a sense a type of Tooled Finish. Instead, the term Tooled Finish here refers to the more distinctive finishes fully formed without adding new glass, by the use of compression finishing tools like those in **Figures 17** and **19**. This distinction has important ramifications for the proper dating of bottles.

(Figure 17 (three images on previous page)). A typical finishing tool used for tooled finish forming: (a): Complete tool; (b): Detail of jaws in open position allowing tool to be slipped over the unmodified bottle, and to be removed after forming the finish; (c): Detail of jaws in working position. The conformation of this tool indicates that it was used for the forming of a tooled finish as the jaws extend well beyond the base of the finish. This would have resulted in faint horizontal, concentric rings on the finish and upper neck.)

This process entailed an important change in the finishing tools themselves that permitted the forming of Tooled Finishes. In the forming of Applied Finishes the goal had been to align the base of the finish with the already existing neck, so the jaws were limited to the area of the finish itself. With the development of the tooled finish, this goal changed. Now the reheated glass of the upper neck itself had to be modified, in order to assure a proper transition to the new finish. Consequently, the jaws were lengthened to extend beyond the finish to the upper neck, and the central plug was extended with them to maintain alignment.

The result can be seen in a typical finishing tool for the new process, a tool for finishing demijohns from the *Illinois Glass Company* probably dating between 1890 and 1910 (**Fig. 17**). As with earlier tools, its central plug or spindle was inserted into the neck of the bottle and the bottle rotated with the finishing tool held steady while squeezing the jaws tightly against the plastic upper neck glass to compress and form the desired finish (Kendrick 1968:144). The conformation of this tool indicates that it was used for the forming of a Tooled Finish as the jaws extend well beyond the base of the finish. This would have resulted in faint horizontal, concentric rings on the finish and upper neck. The finish would have resembled **Figure 18**.



(Figure 18 [to right above]. A tooled single-part finish, such as would be produced by the tool in Fig. 17. Note the horizontal striations on the finish and upper neck.)

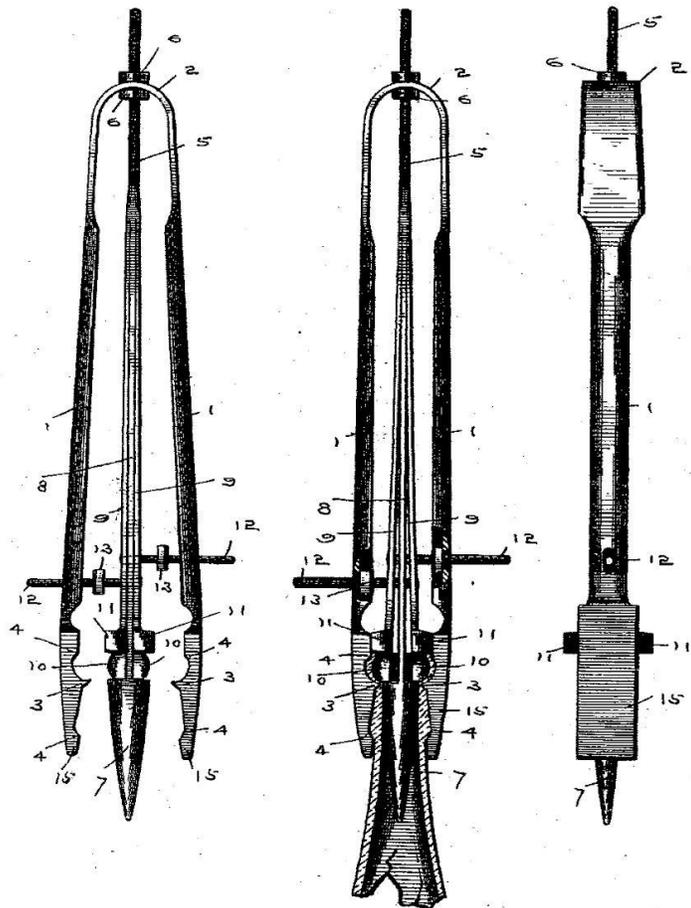
Another illustration of a tool of this type (**Fig. 19**) can be seen in an 1893 patent for a "Finishing-tool for Glass Bottles" (Sheldon and Lynn 1893). This tool was clearly designed to form Tooled Finishes with no application of additional glass. The patent narrative states the following about the tool's use, which includes an excellent description of the Tooled Finishing process:

The manner of operating our device is as follows: The bottles, which have been completed, and whose necks, mouths and extensions it is desired to finish, are heated to such an extent that the necks become soft and plastic to a degree as to be readily formed or molded in any desired shape. The spindle of the finishing tool is then inserted in the mouth of the bottle, and the spring jaws gradually closed until the finishing dies [i.e., the "jaws."] come in contact with the glass. At the same time the bottle is turned, the dies operating on the outside of the bottle neck, and gradually bringing it in the shape of the dies... After the end of the bottle has been finished off as mentioned, by releasing the pressure of the spring jaws [the tool] may be drawn out of the bottle, which is done and cold enough to retain its shape and may then be removed, and another bottle operated on (Sheldon and Lynn 1893; emphasis added)

(Figure 19 [to right]. Illustration from an 1893 patent for a finishing tool for tooled finishes [Sheldon and Lynn 1893]. The patent application notes that the tool was used without added glass, and the jaws extend onto the upper neck.)

Categories of Tooled Finishes

Empirical observations by the author indicate that there were two distinct manufacturing methods for Tooled Finish formation based on mold conformation and finishing activity. These were the "Standard" and the "Improved" Tooled Finishes—both of which can be accurately referred to as Tooled Finishes. By distinguishing between the two variations, further bottle dating refinements are possible. The two methods are described as follows:



"Standard" Tooled Finish: This tooled finishing method is typically just called a Tooled Finish." The older of the two varieties, this method involved a mold in which the finish conformation was not significantly pre-formed in the mold. The shape of the base, body, and neck of the bottle were formed by the mold but not the precise shape of the finish. To put it differently, there was limited (or no) pre-forming of the finish by the mold itself as the finishing tool was utilized to completely form the finish conformation. Although the earlier of the two tooling methods, it also continued in use until hand production was replaced by machines, overlapping the "improved" tooling method described next. The Standard Tooled Finish was first used as early

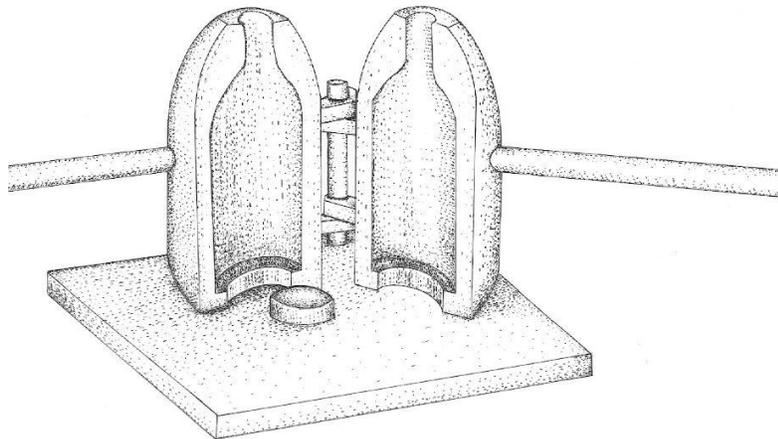
as the 1860s with some smaller bottles, although it became the dominant finishing method on just about all bottles by the 1890s. (More on dating later in this paper.)

The Standard Tooled Finish is identified by a side mold seam that ends or fades out on the neck distinctly below the bottom edge of the finish (Figs. 20, 22a). Bottles with such finishes are formed in two-piece "open molds" (Fig. 21) where the upper portion of the mold only forms the neck, not the finish (Kendrick 1963). This type of mold could have produced a bottle finished with either an Applied Finish (using glass applied to the neck end which was tooled to shape) or a Tooled Finish (by re-heating and compression tooling the end of the straight neck without additional glass added). With the latter process, the glassblower would have removed the blowpipe in a way which left enough "extra" glass to work with in creating the finish by reheating and compression tooling.



(Figure 20 [to right]. Neck of a bottle, showing horizontal striations eliminating the upper end of the vertical side seam below the finish, a characteristic indication of a tooled finish.)

(Figure 21 [below]. Drawing of a two-piece "open" mold, in which the entire neck, but not the finish, is formed in the mold.)



Two-piece "post bottom" mold with separate base plate.

The Standard Tooled Finish could be considered a transition type of Tooled Finish that was easily adapted to bottles produced in molds that were previously finished with an Applied Finish. **Figure 22** shows the finishes of two mid-1880 *Peruvian Bitters* bottles (San Francisco, CA.) which were blown in the same exact mold but one has an Applied Finish (right) and the other (left) a Standard Tooled Finish (Wilson and Wilson 1969;

Wichmann 1999; empirical observations). Bottle molds produced with the intention of using the Tooled Finishing method were almost certainly made with a slightly longer neck in order to provide adequate glass for the process. The following quote is from a 1904 publication (*National*

Glass Budget) indicating such along with a reference to the former method of producing Applied Finishes:

Formerly the bottle lip was finished by laying on a thread of hot glass, and each blower finished his own bottle. This method of finishing was slow, and required skill and strength of arm, *so that when the neck was lengthened and the bottle finished at the glory hole by stoving back the reheated neck so as to form the ring*, it increased the output, and made the work lighter (Anonymous 1904; emphasis added).

(Figure 22 [to right]. Two 19th century bottles [Peruvian Bitters] showing the different effects of tooled and applied finishes.)



"Improved" Tooled

Finish: Towards the end of the mouth-blown era (late 1890s through the 1910s) many bottle molds did form most or all of the finish, because the upper portion of the mold cavity had the finish shape included. Kendrick (1963) called this type mold a "closed mold" as versus an "open mold"

(Fig. 21) which did not form any of the actual finish. After the bottle was removed from the

mold, the finish shape and bore conformation was made more precise—to ensure proper closure fit—with minor re-firing and/or tooling of the extreme upper portion of the finish (Deiss 1981).

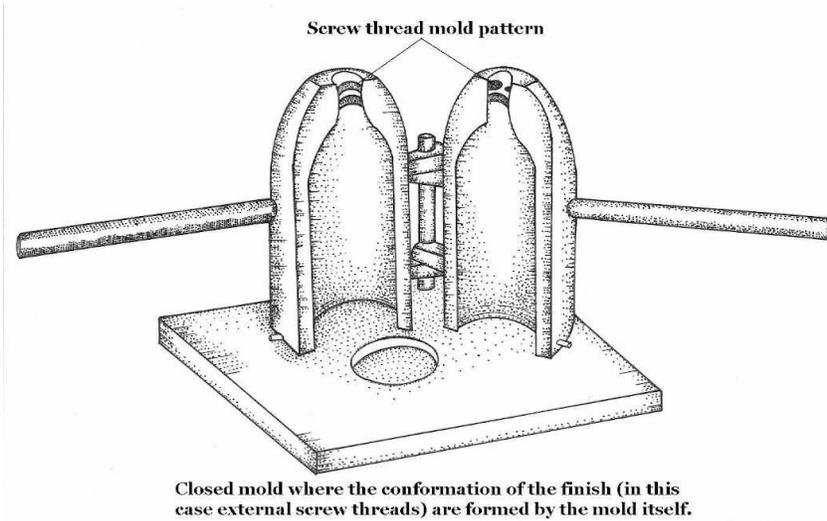


(Figure 23 [to left]. An improved tooled finish on an early 20th century liquor bottle. The lower part of the finish is formed in the mold, and only the upper portion is tooled.)

The Improved Tooled Finish is identified by a side mold seam that ends or fades out well into the conformation of the finish itself, often just short of the finish rim. **Figure 23** shows the Improved Tooled Finish characteristics close-up. The location of the seam on this bottle makes it readily apparent that the basic finish form, including the lower ring, was formed by the mold without the addition of added glass. Horizontal tooling marks are evident only in the upper portion of the finish where the finish received

cursory tooling to standardize the conformation and, in particular, the bore size in order to facilitate efficient corking with one size of cork. The pictured finish is on an *Oregon Importing Company* (Portland, OR.) cylinder liquor bottle that dates from between 1904 and 1915 (Thomas 1998a). The Improved Tooled Finish almost always identifies a bottle as having been produced after about 1895, with most dating after 1900 (empirical observations).

(**Figure 24 [below]**. Drawing of a two-piece “closed” mold in which the details of the finish (in this case external screw threads) are formed in the mold.)



An example of this type of production can be seen in an illustration of a “closed mold” which has the conformation of an external screw thread finish incorporated into the mold itself (**Fig. 24**)—a type of Improved Tooled Finish. A bottle produced in this type of mold would have required either some post-blowpipe reheating and/or tooling to the extreme upper portion above the screw

threads, or the lip surface (i.e., rim) would have been ground flat to remove the rough edges created when the blowpipe was removed. One of these processes would have been necessary to make the upper finish suitably smooth and consistent enough to reliably seal with a screw cap (**Fig. 25**).

(**Figure 25**. Improved tooled finish on a 1905-1915 liquor flask with screw threads formed in the mold [Wilson and Wilson 1968:46, 49]. Tooling affects only the area above the threads.)

Additional Tooled Finish Information

As already noted, Tooled Finishes usually show some concentric tooling marks, with the Standard Tooled Finish having these marks extending onto the neck below the finish. Due to the amount of tooling on most bottles produced with this finishing method, the upper side mold seam is often substantially “wiped out” making it difficult to determine how much shape forming the finish received in the mold versus how much was purely from the tooling actions. Empirical evidence indicates that

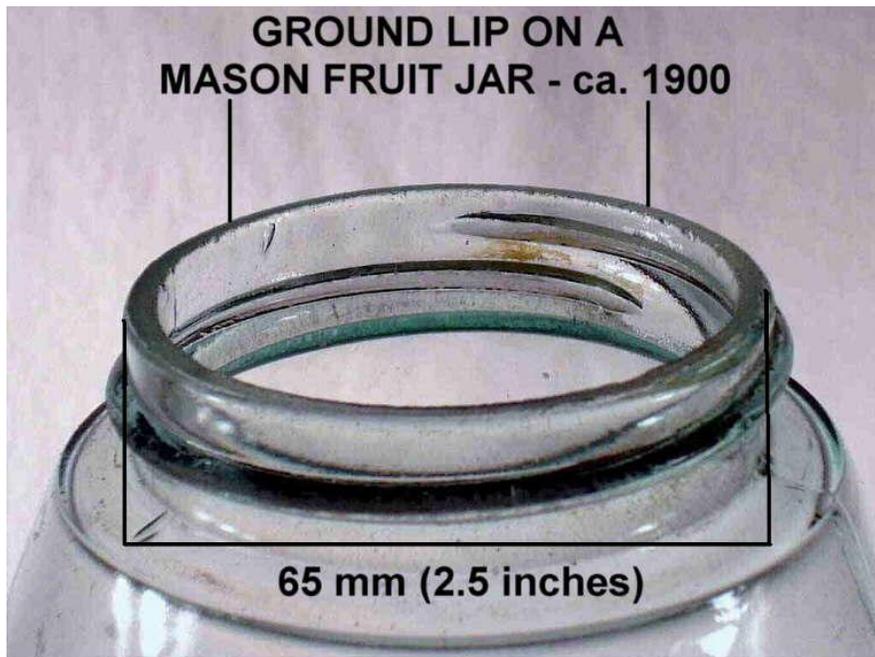


many bottles with Tooled Finishes had at least the basic finish conformation pre-formed in the mold. However, the subsequent re-firing and finishing tool action to complete the finish eradicated most or all of the signs of the side mold seam for as far as the tool reached on the outside of the neck. The absence of the mold seam in the finish itself likely makes many Improved Tooled Finishes actually appear to be Standard Tooled Finishes. In other words, if the mold seam is evident within the finish, one knows that it is an Improved Tooled Finish; if the side mold seam is not evident in the finish then one can not say for sure that the finish was not partially molded; only that physically it is a Tooled Finish. This is belaboring a fine point, but it does have dating implications which will be summarized later.

In any event, the actual finish glass for Tooled Finishes was not added to the neck terminus as with an Applied Finish. To picture the difference in these finish classes another way, the blowpipe detachment point on an Applied Finish was at or just above the point where the finish and neck meet in the finished bottle. The blowpipe detachment point on Tooled Finishes was (or became) the top surface of the finish. The Tooled Finish was a major innovation in that the bore and upper neck of bottle could be made smoother, more properly tapered, and of more uniform dimensions as compared to the Applied Finish. This allowed for more reliable sealing of the bottle with a cork in particular since more of the inside surface of the finish was in contact with the closure (Deiss pers. comm. 2003).

(Figure 26 [below right]. Ground lip on a Mason jar.)

Almost certainly the first important, fully molded finish was in 1858 with the invention and production of the Mason canning jar (Deiss 1981). (Fig. 26) These revolutionary jars were produced in a blow-over mold where the outside screw thread finish was molded along with the body and base. This was a mold conformation very similar to Figure 24 except for a



differently shaped bottle with a wider mouth or bore. The rough cracked-off top surface of this finish was subsequently ground off to make it uniform and flat, i.e., a ground rim. In general, with the exception of simple straight finishes (simply sheared or cracked-off upper neck ends which were mold-formed) and canning jars, bottle molds with incorporated finishes (in whole or in part) were little used until the late 1870s, receiving only limited use until the 1890s when they

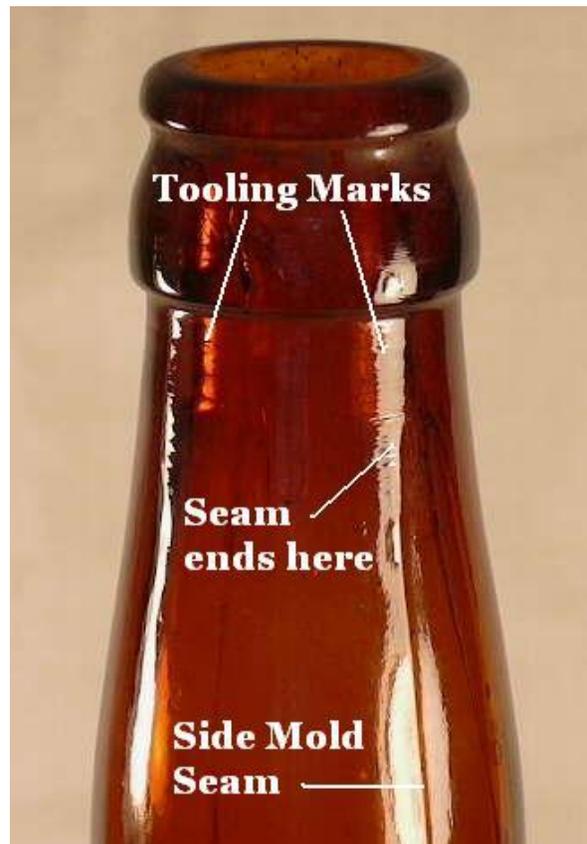
became fairly common with some bottle styles until machine manufacture dominated the bottle making world by the mid to late 1910s (Deiss 1981; empirical observations).

Diagnostic Characteristics of Tooled Finishes

The observable diagnostic characteristics of a Tooled Finish include several or all of the following:

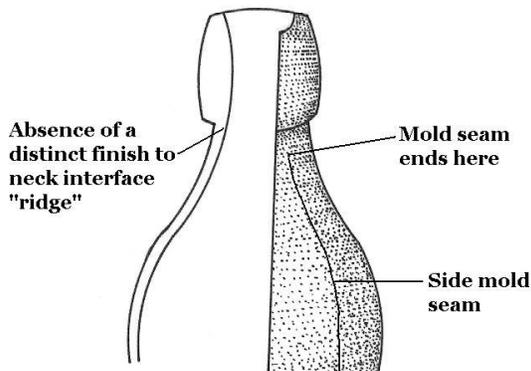
1. The side mold seam distinctly fades out on the neck of the bottle, usually below the bottom of the finish (Standard Tooled Finish; Figs. 20, 27). Frequently, with later mouth-blown bottles (early 20th century), the side seam will disappear *within* the confines of the finish itself (Improved Tooled Finish; see Figs. 23, 25), though it will not touch the outside edge finish rim unless the rim is ground down. (Note: There are some later, press-and-blown machine-made milk bottles that have fading upper side mold seams, and that, upon first appearance, appear to have Tooled Finishes.)

(Figure 27 [to right]. A crown finish illustrating the characteristics of the tooled finish.)



2. Concentric horizontal tooling marks are usually present on both the finish and the upper portion of the neck above where the side mold seam fades or disappears (Fig. 27).

Sometimes the side mold seams can be observed faintly "underneath" or within the tooling marks or rings. The side mold seam can also occasionally proceed faintly almost all the way to the top of the finish. This residual side mold seam is likely a result of the glass beginning to cool and solidify while being hand tooled, allowing mold seam traces to remain in the finish. The presence of the side mold seam in the finish itself on a mouth-blown bottle positively identifies the finish glass as having been mold blown and not applied.



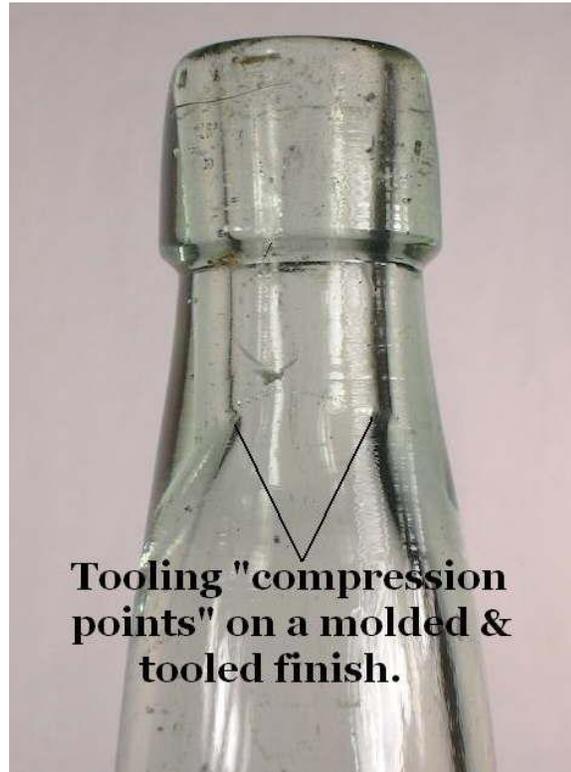
(Figure 28 [to left]. Illustration of the characteristics of tooled finishes.)

3. The absence of a distinct line or ridge inside the finish - as would be found on an Applied Finish - since there was no separate application of finishing glass. (Fig. 28) The glass inside the neck at the finish/neck interface feels smooth to the touch with no distinct ridge or groove evident. Do not mistake the hump discussed next for the applied finish/neck interface ridge (#3 in the Applied Finish diagnostic characteristics noted earlier).

4. When viewing the upper neck and finish from the side, there is often a visible change in the thickness of the glass on each side of the bottle neck in the vicinity of where the side mold seam disappears and the tooling marks begin. (Fig. 29) Often this is just a subtle smooth "hump" on the inside surface of the glass within the throat or bore where the central plug or spindle of the finishing tool stopped.

(Figure 29 [to right]. Tooled finish of a Hawaiian export style beer bottle dating between 1908 and 1911 [Elliot and Gould 1988]. The compression points in the throat left by the spindle of the finishing tool, shown clearly here, are usually difficult to photograph.)

5. The absence of any glass drip or slop-over immediately below the base of the finish - as is commonly observed on Applied Finishes - since there was no separate application of finishing glass.



Bottle Type Specific Dating Guidelines

The changeover from Applied to Tooled Finishes was a relatively significant technological shift in bottle manufacturing. This changeover can often provide a useful dating break for bottles made during the last quarter of the 19th century. However, there was considerable time variation in making this transition depending on the specific type or class of bottles. There were also variations among the different glass makers, although these are usually impossible to ascertain as most bottles can not be firmly attributed to a particular glass factory during this era. Empirical observations indicate that the mid 1870s was when the transition from Applied Finishes to the more technologically advanced and efficient Tooled Finishes significantly commenced. Few bottles known to pre-date the mid-1870s have the Tooled Finish as defined here. Those that are known are primarily smaller bottles – a subject discussed below. Likewise, by the mid-1890s the changeover from Applied Finishes was largely complete, and a very large majority of American-made bottles dating after that time have Tooled Finishes. (Foreign bottles followed a different timeline; this is briefly covered later.)

The following information provides general dating guidelines for the transition from Applied to Tooled Finishes categorized by types or classes of bottles. It is based on the author's extensive empirical observations in conjunction with a wide array of published references which provide relatively precise company dating for various types and styles of historic bottles. (Major sources are noted in the "References" section of this paper.) As there are many exceptions to these general trends, dating accuracy can only be achieved by using these date ranges in conjunction with other diagnostic features (Lindsey 2009). However, the following information is considered accurate for a majority of bottles within the classes listed. Readers interested in this complex subject are encouraged to visit the various *Bottle Typing (Typology) & Diagnostic Shapes* pages on the *Historic Bottle Website* (Lindsey 2009) for much more in-depth finish manufacturing related dating information pertinent to specific bottle types.

Dating notes on the transition from Applied to Tooled Finishes

1. In general, it is clear that the smaller the bottle, the earlier that Tooled Finishes were first used. The total transition time from Applied to Tooled Finishes is from the mid-1870s to the mid-1890s in the United States. This is discussed in the points that follow. Why smaller bottles were tooled sooner than larger ones is not known, though the trend is very evident in the observation of many thousands of bottles by the author. It is, however, certainly related to some type of manufacturing efficiencies inherent in the production methods of different bottle sizes.

2. Smaller drug store bottles appear to have almost completely made the changeover to Tooled Finishes by the late 1870s. The author has studied hundreds of examples of Oregon druggist bottles in conjunction with business directory listings and has found that tooled "prescription" style finishes dominate such bottles by the late 1870s (Whitall Tatum & Co. 1879, 1880:7). Prior to the mid-1870s druggist bottles tended to have either a distinct Applied Finish or the older thin Flared Finish described earlier. These latter bottles are also often pontil scarred (Davis 1949; Deiss pers. comm. 2003; empirical observations). A typical late 19th century "Philadelphia Oval" style druggist bottle (embossed *BLUMAUER & HEUBNER / PHARMACISTS / PORTLAND, OREGON*) is illustrated as **Figure 30**. This example has a tooled finish, no evidence of mold air venting, and is known to date from 1878-1879 based on the short partnership period of the proprietors noted in period business directories.



(Figure 30 [to right]. Pharmacy bottle (1878-1879) with a tooled finish.)

3. Ink bottles and small (<7 inches tall) patent medicines appear to have followed a transition timeline similar to druggist bottles. Tooled Finishes dominate these classes of bottles by the late 1870s.

4. Larger, narrow bore medicinals (>7-8 inches tall) and soda and mineral water bottles appear to fall in the change to Tooled Finishes in the mid-1880s. Very few Applied Finishes were being produced on these types after about 1890.

5. The majority of medium sized (8-10 inches tall) oval, rectangular, cylindrical, "flask" shaped, and square medicinals, bitters, liquor, and other relatively narrow bore bottles appear to have changed to Tooled Finishes by the mid to late 1880s. For example, it appears that all of the liquor bottles from the South Carolina State Dispensary-- made from 1893 to 1907 and largely in this size and shape range—have exclusively Tooled Finishes (Huggins 1997; Teal and Wallace 2005).

6. Larger (>10 inches tall or with wide or large capacity bodies) liquor, beer, mineral water, and most sizes of wide-mouth food bottles—including wax sealed canning jars—seem to have begun the change to Tooled Finishes in the mid-1880s, with the majority tooled by the early to mid-1890s. Large capacity beer bottles (22-26 oz.) in particular were almost certainly still being produced by some factories with Applied Finishes as late as 1895 (Lockhart 2007). These are some of the latest American-made bottles to commonly incorporate Applied Finishes. Bottles within these types that are known to date after 1900 and have Applied Finishes are most likely imported bottles, as discussed below.

7. Any bottles exhibiting the features of the Improved Tooled Finish—and which do not have molded external screw threads with a ground rim—will virtually always post-date 1895 and most likely date from between 1900 and the end of the mouth-blown era in the early 1920s. Not all mouth-blown bottles from this era have the Improved Tooled Finish, but virtually all bottles with this finish are from the early 20th century.

Note on European-made mouth-blown bottles

(Figure 31 [to right]. Early 20th century [1914 or later] Dutch gin bottle with an applied finish.)

European-made mouth-blown bottles tend to have Applied Finishes much later than American-made bottles, lasting into at least the second decade of the 20th century. For example, the crudely applied one-part finish in **Figure 31** is on a Dutch gin bottle that bears a label identifying it as



having been bottled no earlier than 1914 when an elephant became the trademark for *H. H. Melchers* - the Schiedam producer that utilized this bottle (Vermeulen 2000; Vermeulen pers. comm. 2008). This bottle also has additional body crudity to it (wavy bubble laden glass), a lack of mold air venting along with an absence of a pontil scar that would diagnostically date it from the 1860s to 1880s if produced in the U. S.

One of the many dating exceptions is the occasionally encountered bottles with obviously American company and/or product embossing and/or labeling that were actually manufactured in and imported from Europe. Of particular note are some soda, beer, and liquor bottles. For example, some cylinder bottles made for California liquor companies display diagnostic characteristics of American-made bottles from the 1870s or early 1880s—even though they were actually made in Germany as late as the early 1900s (Thomas 2002).

Summary

As previously noted, the dating of historic bottles is a complex subject that emphasizes the need to consider as many physical manufacturing-related diagnostic characteristics as possible—as well as product or company research where possible—in arriving at a reliable likely manufacturing date range. Being able to identify the finishing methods for mouth-blown bottles is but one of an assortment of attributes that can be used to help date bottles with a relatively high degree of reliability.

As with most of the discussions in this paper, the *Historic Bottle Website* (Lindsey 2009) may be consulted for an in-depth discussion of finish shapes or styles (not the subject of this paper). That website also has a full overview of other manufacturing related diagnostic features that can be quite useful in arriving at an approximate manufacturing date for just about any American-made bottle. For those interested in more information on finishing methods, please visit the following *Historic Bottle Website* pages: the “Bottle Finishes & Closures” main page at www.sha.org/bottle/finishes.htm and the “Glassmaking & Glassmakers” page at www.sha.org/bottle/glassmaking.htm.

Acknowledgments

I would like to thank Peggy Corson for the excellent illustrations prepared for the *Historic Bottle Website* – only a few of which were used in this paper. Also thanks must go to Dr. Pete Schulz who provided much warranted (and appreciated) critiques, suggestions and feedback on this paper.

References

Anonymous

1904 *Finishing a Bottle*. National Glass Budget 19(40):1

Barber, Edwin A.

1900 *American Glassware Old and New*. David McKay & Co., Philadelphia, PA.

Boow, James

1991 *Early Australian Commercial Glass: Manufacturing Processes*. The Heritage Council of New South Wales.

Borton, Warren

1988 *Historical Bottles of Wyoming 1868-1915*. Privately published, Midvale, UT.

Burggraaf, Mike & Tom Southard

1998 *The Antique Bottles of Iowa 1846-1915*. Privately published, Ohio Wholesale Copy Service, Northfield, OH.

Chapman, Tom L.

2003 *Bottles of Eastern California*. Hungry Coyote Publishing Company, Bishop, CA.

Clint, David K.

1976 *Colorado Historical Bottles & Etc. 1859-1915*. Antique Bottle Collectors of Colorado, Johnson Printing Co., Boulder, CO.

Creswick, Alice M.

1987 *The Fruit Jar Works Vol. 1 & 2*. Privately published, Grand Rapids, MI.

Davis, Pearce

1949 *The Development of the American Glass Industry*. Harvard University Press, Cambridge, MA.

Deiss, Ronald W.

1981 *The Development and Application of a Chronology for American Glass*. Master's thesis, Illinois State University, Normal, IL.

Elliott, Rex R. and Stephen C. Gould

1988 *Hawaiian Bottles of Long Ago*. Hawaiian Service Inc., Honolulu, HI.

Feldhaus, Ron

1986 *The Bottles, Breweriana and Advertising Jugs of Minnesota 1850-1920, Volume 1: Beer, Soda, Household*. Privately published, Edina, MN.

1987 *The Bottles, Breweriana and Advertising Jugs of Minnesota 1850-1920, Volume 2: Whiskey, Druggist, Medicine*. Privately published, Edina, MN.

Fike, Richard E.

1987 *The Bottle Book: A Comprehensive Guide to Historic Embossed Medicine Bottles*. Gibbs M. Smith, Inc., Peregrine Smith Press, Salt Lake City, UT.

1998 *A Guide to the Identification and Dating of Historic Glass Bottles*. Bureau of Land Management, Montrose, CO.

Fletcher, Johnnie W.

1994 *Kansas Bottles - 1854 to 1915*. Privately published, Mustang, OK.

2006 *Oklahoma Bottles – 1889 to 1920*. Privately published, Mustang, OK.

Fowler, Ronald R.

1981 *Ice-Cold Soda Pop 5¢ - An Illustrated History of Oregon Soda Pop Bottling*. Seattle History Company, Seattle, WA.

1986 *Washington Sodas – The Illustrated History of Washington’s Soft Drink Industry*. Seattle History Company, Seattle, WA.

Frank, Himan

1872 Tool for Forming Mouths of Bottles, &c. Patent 130,207, patented Aug. 6, 1872. United States Patent Office, Washington. [Patent available at Lindsey 2009]

Hemingray, R.

1860 Mold for Glass Jars. Patent 30,063, patented Sept. 18, 1860. United States Patent Office, Washington. [Patent available at Lindsey 2009]

Holabird, Fred and Jack Haddock

1979 *The Nevada Bottle Book*. Privately published, Reno, NV.

Holscher, Harry H.

1953 Feeding and Forming. In *Handbook of Glass Manufacture*, edited by Fay V. Tooley, pp. 299-387. Ogden Publishing, New York.

Howard, George E.

1950 Glass Containers. *Glass Industry* 31(4):183-190, 214, 216, 218.

Huggins, Phillip K.

1997 *The South Carolina Dispensary: A Bottle Collector's Atlas and History of the System*. Sandlapper Press Co., Inc., Columbia, SC.

Illinois Glass Company

1906 *Illustrated Catalogue and Price List, Illinois Glass Company - Manufacturers of Bottles and Glass Containers of Every Kind*. Illinois Glass Co., Alton, IL. (Scans of this entire 1906 catalog are available on the *Historic Bottle Website* at the following URL:

http://www.sha.org/bottle/igco_1906.htm)

Innes, Lowell

1976 *Pittsburgh Glass 1797-1891: A History and Guide for Collectors*. Houghton Mifflin, Boston, MA.

Jones, Olive R.

1986 *Cylindrical English Wine and Beer Bottles, 1735-1850*. National Historic Parks and Sites Branch, Parks Canada, Ottawa, Ontario.

Jones, Olive and Catherine Sullivan

1989 *The Parks Canada Glass Glossary for the Description of Containers, Tableware, Flat Glass, and Closures*. Studies in Archaeology, Architecture, and History. National Historic Parks and Sites Branch, Parks Canada, Ottawa, Ontario.

Kendrick, Grace

1963 *The Antique Bottle Collector*. Western Printing & Publishing Co., Sparks, NV.

1968 *The Mouth-Blown Bottle*. Edwards Brothers, Ann Arbor, MI.

Ketchum, William C. Jr.

1975 *A Treasury of American Bottles*. Bobbs-Merrill, New York.

Kyte, David L.

2005 *Early Utah Soda Bottles: 1870-1915 – A Bottling History & Guide*. Privately published, Midvale, UT.

Lamont, John

1876 Improvement in Glass-Tools. Patent 183,267, patented Oct. 17, 1876. United States Patent Office, Washington. [Patent available at Lindsey 2009]

Lindsey, Bill

2009 *Historic Glass Bottle Identification & Information Website*. Contained within the Society for Historical Archaeology Website, University of Montana, Missoula, MT.

<http://www.sha.org/bottle/index.htm>

Lockhart, Bill

2007 The Origins and Life of the Export Beer Bottle. *Bottles and Extras* 18(3):49-57, 59.

Lockhart, Bill, Bill Lindsey, David Whitten, and Carol Serr

2005 The Dating Game: The Illinois Glass Company. *Bottles and Extras* 16(1):54-60.

Lockhart, Bill, et al.

2009 The Dating Game—Southern Glass Co. *Bottles and Extras* 20(6):50-61.

Markota, Peck and Audie Markota

1994 *Western Blob Top Soda and Mineral Water Bottles – Second Edition*. Privately published, Sacramento, CA.

1999 *A Look at California Hutchinson Type Soda Bottles*. Privately Published, Sacramento, CA.

McKearin, Helen and Kenneth M. Wilson

1978 *American Bottles & Flasks and Their Ancestry*. Crown Publishers, Inc., New York, NY.

Miller, George L. and Catherine Sullivan

1984 Machine-made Glass Containers and the End of Production for Mouth-Blown Bottles. *Historical Archaeology* 18(2):83-96.

Miller, George L. and Ed Moran

2004 A Household Cleanup Assemblage from Ca. 1938-1941, Raritan Landing, New Jersey, site 28Mil78: Feature 8, the well. Unpublished notes from Miller & Moran dated June 14, 2004.

Miller, Michael R.

1999 *A Collector's Guide to Arizona Bottles & Stoneware – A History of Merchant Containers in Arizona*. Privately published, Peoria, AZ.

2008 *A Collector's Guide to Arizona Bottles & Stoneware – A History of Merchant Containers in Arizona*. Privately published, Peoria, AZ. (Expanded 2nd edition.)

Modes, William F.

1887 Mold for Blowing Turned Bottles. Patent 364,840, patented June 14, 1887. United States Patent Office, Washington. [Patent available at Lindsey 2009]

Munsey, Cecil

1970 *The Illustrated Guide to Collecting Bottles*. Hawthorne Books, Inc. New York.

Odell, John

1997 *Indian Bottles & Brands*. Privately published.

2000 *Digger Odell's Pontil Medicine Encyclopedia: A Look at America's Pre-Civil War Medicine Bottles*. Privately published.

Oppelt, Norman T.

2005 *Soda and Mineral Water Bottles and Bottlers of Colorado, 1860 to 1915*. Oppelt Publications, Greeley, CO.

Owens-Illinois Glass Company

2009 *O-I Company North American website*. O-I (Owens-Illinois) Glass Co., U. S. A.

Pearson, B. M.

1928 Aspects of Bottle Machine Operations. *Glass Industry* 9(7):145-148.

Peters, Roger M.

1996 *Wisconsin Soda Water Bottles 1845-1910*. Wild Goose Press, Madison, WI.

Pollard, Gordon

1993 *Bottles and Business in Plattsburgh, New York: 100 Years of Embossed Bottles as Historical Artifacts*. Clinton County Historical Association, NY.

Preble, Glen R.

1987 *Impressed in Time – Colorado Beverage Bottles, Jugs, etc. 1859-1915*. Antique Bottle Collectors of Colorado, Johnson Printing Co., Boulder, CO.

2002 *The Rise & Demise of Colorado Drugstores 1859-1915*. Antique Bottle Collectors of Colorado, Englewood, CO.

Ring, Carlyn and Bill Ham

1998 *Bitters Bottles*. Boyertown Publishing Co., Boyertown, PA.

Roller, Dick

1983 *The Standard Fruit Jar Reference*. Acorn Press, Paris, IL.

Russell, Mike.

1998 *The Collector's Guide to Civil War Era Bottles and Jars*. Privately published, Herndon, VA.

Sheldon, Thomas K. and M. N. Lynn

1893 Finishing Tool for Glass Bottles. Patent 500,960, patented July 4, 1893. United States Patent Office, Washington. [Patent available at Lindsey 2009]

Shimko, Phyllis

1969 *Sarsaparilla Bottle Encyclopedia*. Privately published, Aurora, OR.

Stone, Amasa

1855 Forming Screw Threads, &c., in the Necks of Glass Bottles and Similar Articles. Patent 13,402, patented Aug. 7, 1855. United States Patent Office, Washington. [Patent available at Lindsey 2009]

1856 Tool for Making Glass Bottles. Patent 15,788, patented Sept. 23, 1856. United States Patent Office, Washington. [Patent available at Lindsey 2009]

Switzer, Ronald R.

1974 *The Bertrand Bottles – A Study of 19th Century Glass and Ceramic Containers*. National Park Service, Washington, D.C.

Synnott, Thomas W.

1875 Improvement in Bottles. Patent 162,117, patented April 13, 1875. United States Patent Office, Washington. [Patent available at Lindsey 2009]

Teal, Harvey S. and Rita Foster Walker

2005 *The South Carolina Dispensary & Embossed S. C. Whiskey Bottles & Jugs 1865-1915*. Privately published, Columbia, S.C.

Thomas, John

- 1974 *Picnics, Coffins, Shoo-Flies*. Preuss Press, San Luis Obispo, CA.
- 1977 *Whiskey Bottles of the Old West*. Maverick Publications, Bend Oregon.
- 1998a *Whiskey Bottles and Liquor Containers from the State of Oregon*. Privately published, Capitola, CA.
- 1998b *Whiskey Bottles and Liquor Containers from the State of Washington*. Ananta Printing & Publishing, Soquel, CA.
- 2002 *Whiskey Bottles of the Old West*. Boyertown Publishing Company, Boyertown, PA.
- Tibbitts, John C.
1964 *1200 Bottles Priced: A Bottle Price Guide, Catalogue, and Classification System*. The Little Glass Shack, Sacramento, CA.
- Toulouse, Julian H.
1967 When Did Hand Bottle Blowing Stop? *Western Collector* 5(8):41-45. San Francisco.
- 1968 Empontilling: a History. *Glass Industry* 49(3):137-142, (4):204-205.
- 1969a *Fruit Jars*. Thomas Nelson & Sons, New York.
- 1969b A Primer on Mold Seams. *Western Collector* 7(11):526-535, (12):578-587. San Francisco.
- Van den Bossche, Willy
2001 *Antique Glass Bottles: Their History and Evolution (1500-1850)*. Antique Collectors Club, Suffolk, England.
- Vermeulen, Peter
2000 Melchers. *Antique Bottle & Glass Collector* 16(10):34-37
- Whitall, Tatum & Co.
1879 *Whitall, Tatum & Co. Glass Ware 1879*. Whitall, Tatum & Co., Philadelphia.
- 1880 *Whitall, Tatum & Co. 1880*. Whitall, Tatum & Co., Philadelphia. Reprinted 1971 by Pyne Press, Princeton.
- White, John R.
1978 Bottle Nomenclature: A Glossary of Landmark Terminology for the Archaeologist. *Historical Archaeology* 12:58-67.
- Wichmann, Jeff
1999 *The Best of the West: Antique Western Bitters Bottles*. Pacific Glass Books, Sacramento, CA.

Willis, Keith

1972 *Antique Bottles Book 1: Washington-Oregon Whiskies*. Privately published. Duvall, WA.

Wilson, Bill and Betty Wilson

1968 *Spirits Bottles of the Old West*. Henington Publishing Co, Wolfe City, TX.

1969 *Western Bitters*. Northwestern Printing Co., Santa Rosa, CA.

1971 *19th Century Medicine in Glass*. 19th Century Hobby & Publishing Co., Amador City, CA.

Wilson, Joseph B.

1884 Tool for Forming Bottle Lips and Necks. Patent 295,848, patented March 25, 1884. United States Patent Office, Washington.

Wilson, Rex L.

1981 *Bottles on the Western Frontier*. University of Arizona Press, Tucson, AZ.

Zumwalt, Betty

1980 *Ketchup, Pickles, Sauces - 19th Century Food in Glass*. Mark West Publishers, Fulton, CA.

Bill Lindsey

Bureau of Land Management (BLM - retired) &

Author of the SHA/BLM *Historic Glass Bottle Identification & Information Website* – www.sha.org/bottle/index.htm

Klamath Falls, OR.