

The Glamorous Applied Color Labels

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with contributions by Chris Weide and Russ Hoenig

Collectors called this labeling system Painted Labels; archaeologists had no standardized term but used more correctly descriptive names like “baked enamel.” The glass industry was no help; each glass house had its own name for the process, but soda bottle collectors eventually borrowed the name used by the Owens-Illinois Glass Co. – Applied Color Lettering (ACL) – while milk bottle collectors selected the name from the Thatcher Mfg. Co. – Pyroglazing. But, little has appeared in print about the history or the process of fusing this colored enamel onto glass bottles.

The Process

Originally, silkscreen printing was used to transfer designs or drawings to paper. The apparatus was a frame holding a mesh (originally made of silk) with a stencil to block the areas where ink was unwanted. A squeegee was then pulled across the mesh to fill the tiny squares with ink then a reverse stroke of the squeegee pushed the ink against the paper. As the screen sprung back into place the ink remained on the surface (Wikipedia 2019). The same process worked to apply ink to bottles with modifications to allow for the glass substrate and curved sides (Figure 1). Typically, only one color could be applied at a time.



Figure 1 – ACL bottle

A great video from the Owens-Illinois Glass Co. (courtesy of Phil Perry and Russ Hoenig) showed the process as applied to milk bottles, probably by the late 1930s or 1940s. The operator (always a woman in the video) received a bottle on her left side and placed it finish out (in front of her) on the ACL machine, hooking the base into the end of the receptacle closest to her. Just how the bottle was held in place was not shown, but a foot pedal may have pushed a cup forward to form a secure grip.

When she released the bottle, the silkscreen dropped down, and the bottle revolved around, applying the label. She then reached up with her right hand, setting the bottle onto a conveyor belt, where it joined others on its trip to the annealing ovens, where the enamel was baked to a permanent fusion with the glass. The actual process – prior to annealing – took only about a second per bottle. Another worker, male this time, inspected the bottles before they made their oven trip, setting aside ones that were not perfectly finished. Periodically, he discovered a bottle where the alignment was off, or something else was wrong with the ACL, and wiped off the non-baked enamel with a cloth – maybe a two-second process – before returning the bottles to the other side of the woman for re-application. The system – while appearing to be incredibly dysfunctional from an individual operator’s perspective – was incredibly efficient.

Of course, this description was only for the application of a single color. In the early days of the process, only one color could be applied at a time with a waiting period for drying before the addition of a second (or third, or fourth) color. The application of more than two colors proved too costly, so bottles with three or four colors are unusual. Toulouse (1939:1) described the process in more detail. What we might call “paint” or “ink” that created the color was actually “finely ground low fusing, lead, borosilicate glasses, to which an oxide or salt or other mineral pigments have been added” emerging as an “extremely fine powder . . . ground through a paint mill. Before the application to the bottle, the mixture had taken the form of a paste that was then forced through the fine mesh silkscreen onto the glass surface. The mixture was generally called frit.

Once the mixture had dried on the bottle, the container traveled through a lehr (at temperatures between 1,100 and 1,200 degrees Fahrenheit) – “a long, tunnel-like enclosure through which the bottles pass at a carefully controlled rate of speed and in which definite zones of temperature are maintained.” The highest temperature melted the ACL mixture (softer glass than the container) without deforming the bottle, fusing the mixture permanently to the glass surface. The finished bottle was then ready for the bottler (Toulouse 1939:1).

History and Development

Although the application of the process to glass is relatively recent, the silkscreen method, itself, is ancient.

Silkscreen

Around CE 221, the Chinese developed the use of the screen printing for transferring designs to cloth. The Song Dynasty China (960-1279 AD) used the system for printing the first paper money. The Japanese picked up the idea, making stencils from paper and using human hair to create the mesh. A stiff brush applied the ink then displaced it onto the fabric (Figure 2). The French had adopted the process by the 17th century, and one early use was the printing of colored playing cards. The French also seem to have pioneered the use of the process for decorating books, magazines, and journals about 1895 (Design Threads 2016; Sign Industry.com 2019; Skyline Printing).

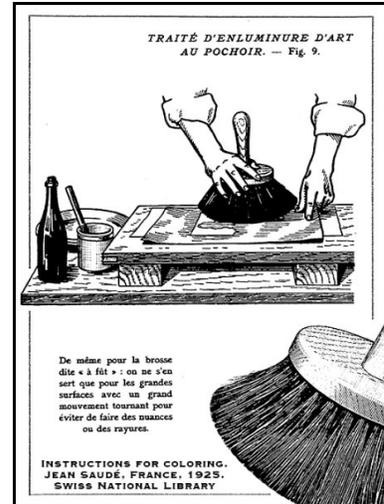


Figure 2 – French silkscreen brush (SignIndustry.com 2019)

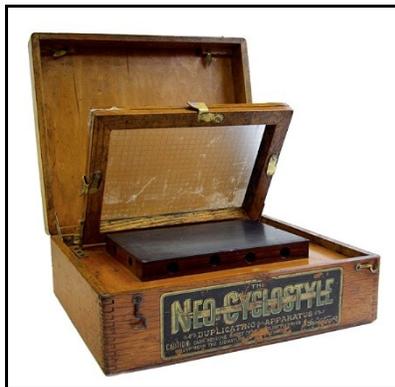


Figure 3 – Silkscreen box (SignIndustry.com 2019)

The use of a squeegee began in the 20th century, and the use of metal mesh became popular in the U.S. Several inventors improved the silkscreen process between 1902 and 1907 and several others improved the quality of the inks in the teens (Figures 3 & 4). The improvement of inks led to the development of screen printing of photographs. Throughout this time, silkscreening was predominantly used for fabric designs or on paper. In 1969, Michael Vasilantone developed a machine for screen printing on cloth that was initially used for designs on bowling shirts but became the medium for T-shirt designs (Design Threads 2016; Sign Industry.com 2019; Skyline Printing 2017; Wikipedia 2019). The silkscreen process was used to create the paper labels used on bottles.

The use of a squeegee began in the 20th century, and the use of metal mesh became popular in the U.S. Several inventors improved the silkscreen process between 1902 and 1907 and several others improved the quality of the inks in the teens (Figures 3 & 4). The improvement of inks led to the development of screen printing of photographs. Throughout this time, silkscreening was predominantly used for fabric designs or on paper. In 1969, Michael Vasilantone developed a machine for screen printing on cloth that

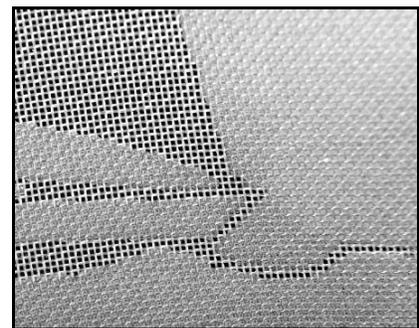


Figure 4 – Screen (Xinology 2019)

Etching

A similar process, requiring the use of a stencil was acid etching, one of two types of etching used occasionally on milk bottles. The acid etching process was dangerous, labor intensive, and time consuming, so it was rarely used on bottles of any type. Not only was the stencil applied to the glass item, the acid had to be added then washed off. Its use on glass was generally restricted to tableware and occasional druggists shop furniture – higher quality items that would be in use for long periods of time (Figure 5).



Figure 5 – Etched dose glass

A very specialized exception was the very limited use of etching on milk bottles. During the early days of the Massachusetts seal laws – 1900-1909 – state “sealers” checked the capacity of all milk bottles used in Massachusetts, rejecting the ones that held too much or too little milk. Condemned bottles were marked – usually acid etched – with the name of the sealer, the place, and the date (Figure 6). In 1909, the state shifted the onus from the dairy owners to the bottle manufacturers, and from late 1909 until 1947, glass houses selling milk bottles in Massachusetts had to emboss a “seal” labeled “MASS SEAL” plus the state-assigned logo of the glass plant. After 1909, acid etching virtually disappeared from bottles (Lockhart et al. 2017).



Figure 6 – Condemned (Al Morin)

A different etching process saw very limited use by small dairies from the 1920s to the 1950s. Periodically, a city or county would pass an ordinance requiring all dairies to use permanently labeled milk bottles. Many small dairies avoided the cost of embossed (or pyroglazed) milk bottles by only identifying their dairy on the ligneous or paper disk (or aluminum cap) that sealed the bottle. Thus, they would use any milk bottles they could find, including the embossed or ACL bottles that were the property of the larger dairies.

Since the larger dairies often had enough financial and/or political clout to influence local politicians, the governing bodies would occasionally pass a permanent labeling ordinance. In

most cases, a small dairy could meet the legal requirement by etching its name (a permanent marking) on its milk bottles. Virtually all of these used a diamond stylus, available at most hardware stores, to etch the dairy name onto the surface of the bottle. Some of these were neatly done, but others appear to have been the purview of the family children (Figure 7). For a local example (El Paso, Texas), see Lockhart (2014).

The Transition

By the early 20th century, glass makers had begun to consider the idea of acid etching as a method for labeling or applying designs to glass items. Walter R. Eimer may have developed the first



Figure 7 – Hand etching

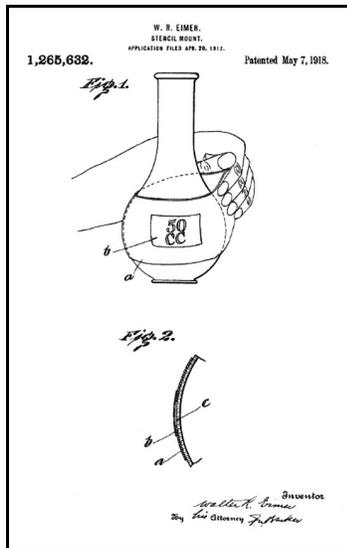


Figure 8 – Eimer 1918 patent

somewhat practical method for adapting the process to glass. On April 20, 1917, Eimer applied for a patent for a “Stencil-Mount” and received Patent No. 1,265,632 on May 7, 1918. Eimer used “a strip of soft surfaced material . . . such for example as chamois, fabric, or the like, whose character is such that it may be applied to a waxed or coated Surface for etching purposes, without scratching such surface” (Figure 8). Eimer’s target bottles were medicinal, although he noted that the process could be used for any glass container.

Almost twenty years later, another inventor moved the idea a notch closer. Edward A. Zeh filed for a patent on April 5, 1926, and received Patent No. 1,656,260 on January 17, 1928, for a “Method of Decorating Glassware and Article Produced Thereby” (Figure 9). Zeh’s invention related to

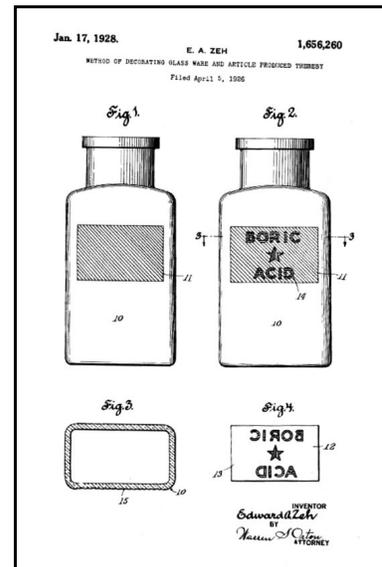


Figure 9 – Zeh 1928 patent

fixing designs permanently on glass, china or other fusible surfaces to be decorated, and the invention specifically relates to the firing into a glass or similar surface those forms of designs which are usually termed “decal comania”, and which are printed in glass colors and welded, fused or otherwise affixed to the front of the glass objects to be decorated by the usual firing operation.

Zeh applied the enamel through a stencil to form a background color then used a second stencil for the wording or design in a different color – after which the enamel was baked to fuse it to the glass. Like Eimer before him, Zeh’s intended bottle style was medicinal.

Creating the Silkscreen for Bottle Labels

As noted, the silkscreen process involved centuries of development. But the screens themselves that were eventually used to apply baked-on enamel labels to bottles were relatively simple in design. The earliest screens consisted of three primary components; the frame, stencil, and silk mesh. Later screens used steel or copper mesh instead of silk because of their longer life spans.

Regardless of what type of mesh was used, the first step was to create the artwork for a specific project. This was typically accomplished by trained artists who created the original artwork according to a bottler’s particular needs or whims. This was especially challenging in the early days because a bottler’s ideas could not easily be translated into a baked-on label. Once those details were worked out and agreed on, the artist would draw the design on stencil paper with the design being the exact size as it would appear on the bottle.

After the design was drawn, a special type of film, similar to waxed paper, was placed and secured on top of the figure which was then cut out with a razor-sharp stylus or stencil knife. Following this, the cut portion was removed, which essentially became a stencil. The removed portion allowed the paint to pass through the silk mesh, while the remaining portion of the film blocked the transference of the paint. Depending on the type of film used for the stencil, which were made of shellac during the early years of the process, it was then adhered to the silk mesh by means of a hot iron. The film and mesh were then ready to be framed.

Frames were typically made of wood, which were constructed to exacting detail so as to hold up under rigorous and numerous applications. The ready-to-be-used framed silkscreens then went through a series of test-runs to insure the design would transfer properly to the bottle. If any corrections were required, the silkscreens literally went back to the drawing board where they were either fixed or redrawn as necessary. If a bottle required more than one color, a separate silkscreen would be needed for each color. Typically, lighter colors, such as white, were applied first, followed by the darker colors such as red, dark blue, or black.

Applying Silkscreen to Curved Surfaces

It was up to Harry S. Brickell, an employee of the Hazel-Atlas Glass Co., to design the first machines to fully apply the silkscreen process to curved surfaces. On May 4, 1933, Bicknell applied for his first patent for a “Mechanism for Stenciling Glass or Other Ceramic Containers Having Curved Surfaces” and received Patent No. 2,014,372 on September 17, 1935. However, he applied to patent a similar machine the following day.

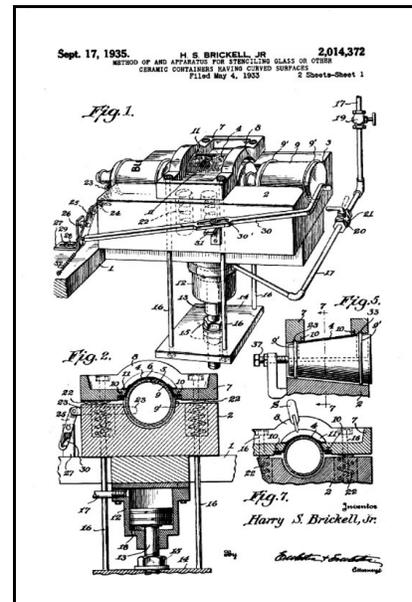


Figure 10 – Brickell 1935 patent

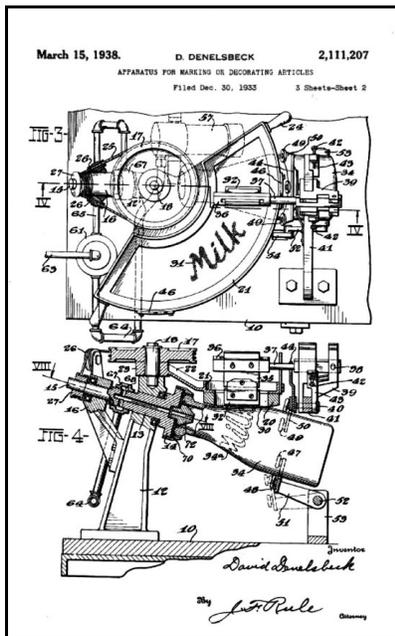


Figure 11 – Danielsbeck 1938 patent

Brickell applied for a second patent for a “Mechanism for Stenciling Glass or Other Ceramic Containers Having Curved Surfaces” on May 5, 1933, and received Patent No. 2,014,373 also on September 17, 1935. Brickell admitted that “it is old to stencil curved surfaces by rotating the object having the curved surface, but rather complex machines are required, the operation is slow, and numerous difficulties are encountered. In accordance with the present invention curve.” In addition, he noted that “silk screen stencils are old and well-known, but only for the purpose of stenciling flat surfaces.” His machine married the two processes to apply silkscreen technology to the curved surfaces of bottles (Figure 10).

David Danelsbeck, of the Owens-Illinois Glass Co., took the process one step further with two new machines. On November 17, 1933, Danelsbeck applied for a patent for a “Method and Apparatus for Decorating Articles” and reapplied for the same patent on March 17, 1938. He finally received Patent No. 2,132,868 on October 11, 1938. Danelsbeck applied for a similar patent for an “Apparatus for Marking or Decorating Articles on December 30, 1933, and received Patent No. 2,111,207 on March 15, 1938 (Figure 11). Although he applied for the first patent a month earlier, he received it seven months later than the second one. These machines concentrated on applying the silkscreen to a curved surface that also slanted – specifically the shoulder area of a milk bottle. In both cases, however, the machine *only* applied the label to the shoulder – not the body of the milk bottle.

On August 6, 1936, Games Slayter applied for a patent for “Vitreous Enamel” – the frit or pigment mixture used to form the ACL. He received Patent No. 2,144,666 on January 24, 1939. Previously, frit was made by grinding the enamel powder to a uniform, fine consistency. Slayter discovered that this fine powder would not form a sufficiently thick paste to create a durable, vibrant color. He solved the problem by grinding the powder to different thicknesses and mixing those together.

Of course, not all machines were designed by glass houses. John C. Smith and George H Campbell applied for a patent for an “Apparatus for Stenciling Ware” on January 8, 1934, and received Patent No. 2,009,098 on July 23, 1935. Their machine applied silkscreen labels to both the body *and* shoulder of milk bottles (Figure 12). They assigned their patent to the Solar Laboratories of Monica, Pennsylvania.

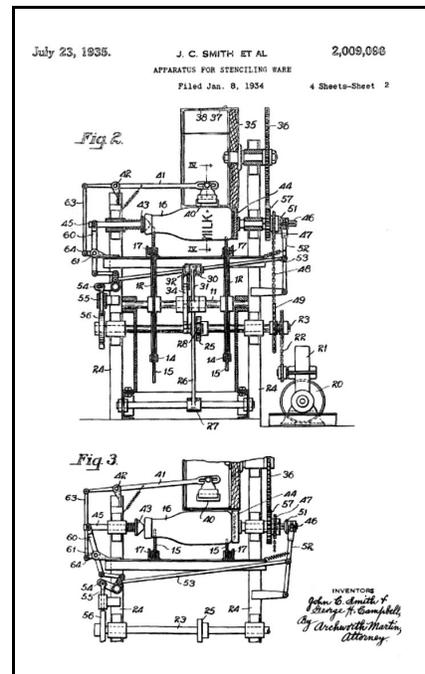


Figure 12 – Smith & Campbell 1935 patent

Initially, the process was limited to flat surfaces, but the early machinery was quickly adapted to round surfaces. As with other forms of glass technology, color decoration went through developmental stages. At first, the machinery was hand operated, and some glass factories continued to use hand-operated machines until at least 1949. By at least 1946, semiautomatic machines had become the norm, including the simultaneous application of

shoulder labels. By the end of the 1940s, the development of fully automatic machinery was well under way, and such machines were beginning to be used (Remington 1949:320-321).

By 1935, Owens-Illinois was using a hand-operated machine that could apply the ACL to either the body or the shoulder – but not both (Holscher 1965). Later developments improved the process, including Hot Melt color in 1947 and silkscreening “Organic” or “Cold” ink in 1963 (Owens-Illinois 1955). Eventually, the process was refined to the point where photo-quality silkscreens – in use for many years on paper – were adapted to bottles.

The operation of the 1935 Owens-Illinois machine followed predictable steps:

1. With the silkscreen frame secured in its proper position, and the silkscreen operating lever to the left, the neck of the bottle was secured in position by means of a chuck with the base of the bottle placed atop two rollers. At this point, the silkscreen and squeegee apparatus were in the up position away from the surface of the bottle
2. Assuming that the silkscreen frame had already been filled with the appropriate amount of paint, the silkscreen and squeegee were then lowered to come in contact with the bottle, followed by the operator engaging the handle to cause the silkscreen to travel over the surface of the bottle.
3. At the same time, by means of a cable and pulley device, the bottle rotated on the rollers the silkscreen handle was activated. During this aspect of the process the squeegee remained stationary and forced the pigment through the silkscreen onto the surface of the bottle
4. The operator then moved the handle back to the right, which automatically lifted the silkscreen and squeegee into the up position, allowing the bottle to be removed and another one placed in the machine so the process can be repeated.

The Beginning of Production

In 1931, the Owens-Illinois Glass Co. advertised “Baby Bunting” Layette Jars in its catalog (Owens-Illinois 1931) to hold such items as “Boric, Cotton, Powder, Baby Oil, Swabs, and Nipples” in the baby’s nursery. The jars had “glistening molded caps of pink or blue, smart black and silver labels and attractive decorations of little nursery-book animals.” The actual animals were very crude, obviously applied by a stencil but *not* by the use of a silkscreen (Figure 13). But, these sewed the seeds for better things to come.



Figure 13 – Baby Bunting jar

Beginning in 1933, Kraft Foods offered a series of “painted” tumblers made by the Hazel-Atlas Glass Co. under the brand name of Swanky Swig. The earliest of these were painted by hand (still baked enamel) and were very simple designs, notably three or more stripes encircling the tumblers (Figure 14). Hazel-Atlas shifted to the use of the silkscreen process by 1937, and the designs became much more sophisticated (Retro Reclamations 2019 – Figure 15).



Figure 14 – Swanky Swig (Jeri & Dan Tucker)

1933:41). An article in the February 1933 *Glass Packer* (1933:119) announced a new

Although Owens-Illinois announced “a method by which red, blue, green or orange trademarks of dairy companies can be fused directly on milk bottles” on May 15, 1933, Brockway beat them into production by three months (*Time* 1933:41). An article in the February 1933 *Glass Packer* (1933:119) announced a new “monogram” service from Brockway Machine Bottle Co. The company offered “special designs, trade marks or plain hand written script [cursive]” applied to its bottles. The article noted that “the enamel is baked or fused into the glass and, becoming an integral part of the container, will not rub or scratch off; nor is it the least affected by water or chemicals. The enamel may be applied in any color, and it retains its lustre during the entire life of the bottle.” Brockway initially offered the new service in prescription bottles but planned to expand the technique to food

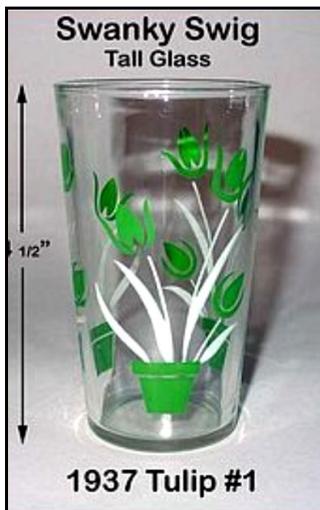


Figure 15 – Swanky Swig (Jeri & Dan Tucker)

and perfume containers (Figure 16). The optimism was premature. Although the baked enamel became popular in



Figure 16 – Brockway bottles (*Glass Packer* 1933:119)

soda and milk bottles, and was occasionally used for these bottle types, the process never achieved any notable success in any of the areas planned by Brockway.

The Owens-Illinois 1937 Annual Report noted that “progress is also being made in the use of applied color lettering in the pharmaceutical and proprietary field and a substantial volume is indicated here also.” The report also claimed that “enough use has been made of this development in the liquor field to insure its feasibility and to indicate the possibility of steady growth” – another field where the ACL process achieved little actual use. Although we have found no company references, several glass houses offered ACL beer bottles by at least the 1940s – although the process was never as widespread in the beer venue as in milk and soda bottles. Baked enamel labels were also used on various types of household, kitchen, and other bottles, but these too were never very popular. Although not pertinent to the orientation of this study, the use of ACL on siphon bottles also began fairly early in the baked enamel era.

Enter the Milk Bottle

With help from Russell B. Wilhelm, Edward F. Glacken apparently began work on the color label process for Owens-Illinois at least as early as 1930. Glacken began his career with the Winslow Glass Co., moving to the Berney-Bond Glass Co., when that firm acquired Winslow and transferring to the Owens-Illinois Glass Co., when Owens-Illinois purchased Berney-Bond in 1930. Glacken had already designed a sure-grip milk bottle finish, patented in 1927, and was a primary developer of the Handi-Square milk bottle for Owens-Illinois (Owens-Illinois 1955).

As noted above, the Owens-Illinois Glass Co. announced the use of the new labels on milk bottles in May of 1933, but actual bottles apparently were not made until some point during 1934 (Figures 17-19). By at least September 14, 1934, the O.J. Weber Co., a milk bottle jobber, advertised “A Real Stimulant to Milk Sales; Applied Color Milk Bottles.” The process was “now made in Los Angeles exclusively by the



COLOR

NRA Milk for Health Applied Color Milk Bottles

... wins new sales for the dairy industry.

● VALUABLE free advertising space on both sides of your milk bottle can be used for advertising your milk and other dairy products. Let us help you plan an attractive color design. Your name or trademark can be permanently fused in any of ten brilliant colors. Let us help you sell more dairy products. Write or phone today.

Owens-Illinois Pacific Coast Co.
5120 So. Soto St. LOS ANGELES JEFFERSON 3281
SAN FRANCISCO

Figure 17 –Owens ad (California Milk News 1935:8)

Owens-Illinois Pacific Coast Co. (*California Milk News* 1934:6). In 1935, the Creamery Package Mfg. Co. catalog (1935:20-21) advertised Onized ACL milk bottles, including two-color combinations.

However, the Thatcher Mfg. Co. may have preempted Owens-Illinois. The *Elmira Star-Gazette* mentioned in a December 30, 1933, article on the Elmira plant that Thatcher was “now featuring a Pyroglaze bottle containing the name or trademark of the milk distributor in colored letters burned into the glass” (Figure 20). A spokesman noted that

Thatcher had spent the past two years designing the process but that it had “been in vogue in England for several years.” Thatcher, however, had introduced Pyroglaze to the U.S. “several months ago.” The process was only applied at Thatcher’s Elmira plant.



Figure 18 – Early ACL machine (Owens-Illinois 1935)

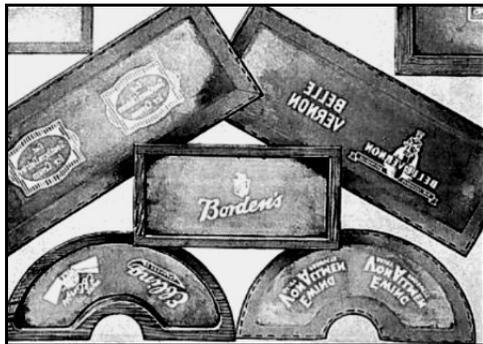


Figure 19 – ACL screens (Owens-Illinois 1935)

One of the authors (Bob Brown) conducted an exhaustive search for examples of the earliest ACL bottles. One of the earliest milk bottles was made by the Owens-Illinois Glass Co. for Kolb’s Dairy. In addition, the Kleinheinz Dairy of Wausau, Wisconsin, advertised “And Now The First . . . new beautiful applied colored letter bottles” in the *Wausau Daily Herald* on November 24, 1934. Another early example was used by Ewing Von Allmen (Figure 21 – also note the bottle’s silkscreen in Figure 19).

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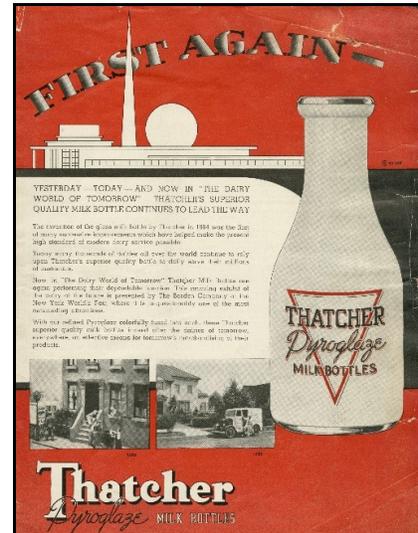


Figure 20 – Thatcher ad (Corning Museum of Glass)

Owens-Illinois also made the new process available for old milk bottles. In an experiment with “universal” (also called “store”) bottles in San Francisco, milk dealers were encouraged to return embossed bottles to the factory to have “colored lettering” applied. The *Milk Dealer* (1936:40) noted that

each distributor, as the old brown [the intended word was actually “blown”] lettered bottles were returned by the trade, sent them to the glass company, and various sales messages were applied in color to the plain side of the old bottle, after which they were again put into use.

The Bottle Research Group discovered examples of the pyroglaze application to embossed bottles in the milk bottle collection at the California Parks Service. We have not discovered whether this return-for-colored-letter proposal was available from glass houses outside California, but it seems unlikely. This transitional phase was probably not a success. This is a perfect example of why bottle dating is often not as simple and clear cut as many would like to think.

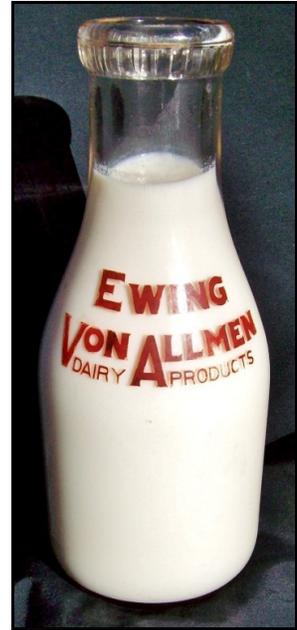


Figure 21 – Von Allmen bottle

The Owens-Illinois 1937 Annual Report announced that

noticeable progress is still being made in the development and in growth of applied color lettering. It was first introduced in the milk field and more than one-third of our very considerable tonnage of dairy containers carry owner and product identification in the form of applied color designs and merchandising slogans.

Soda Bottles

According to the Owens-Illinois 1937 Annual Report, “more recently applied color has spread to the beverage field and an ever increasing proportion of carbonated beverage bottles had applied color identification.” However, Owens-Illinois offered ACL on soda bottles by at least September of 1934. A bottle base for “Jumbo – A Super Cola” was embossed with a 1934 date code, and ads for Jumbo showed an ACL label on September 20 and 21, 1934, (Figures 22). This was the earliest example of an ACL soda bottle we have been able to find, so Owens-Illinois was almost certainly the first to use the process on bottles of this type. This should not be confused with another ACL “Jumbo” – a much later brand of soda with an elephant on the bottle – or with an early embossed Jumbo. As far as we can tell, none of these brands were related.

Because soda bottles needed to survive more rigorous cleaning and longer use, the process always involved metal mesh stencils which permitted thicker application of color. The process on milk bottles, tumblers, and tableware, however, was usually applied with silkscreen stencils. This was especially important where white ACL was screened onto amber or green bottles (*Glass Industry* 1944:353; Remington 1949:321).

Initially, ACL application was limited to the sides of a bottle with only one curve, the cylindrical portion of soda and milk bottles. Although early milk bottles could have the ACL or pyroglazing applied to *either* the neck/shoulder area *or* the



Figure 23 – 7-Up bottles (Chris Weide; authors)

body (but not both simultaneously), on soda bottles, any decoration on the neck/shoulder area remained embossed during the first few years that the technique was employed (Figures 23 & 24). According to empirical evidence from Seven-Up bottles, the embossed neck/shoulder labels were first replaced by ACL logos in 1938 – although some embossed neck/shoulder logos were in use as late as 1944 (see Lockhart 2005:21). As late as 1941, the application of a shoulder label still required a separate process on many ACL machines (*Glass Industry* 1944:352).

Although the use of ACL progressed steadily, it was hampered by the shortages during the US involvement during World War II (1941-1945). Even during the war years, however, the trend continued (*Glass Industry* 1944:351). By 1959, the ACL process was “limited to pressure beverage ware, milk bottles, and containers for toiletries and



Figure 22 – 1934 Jumbo ad (*Kingsport Times-News* 9/21/1934)



Figure 24 – ACL soda bottles (eBay)

cosmetics.” The use of automatic ACL machinery had increased by that time but had “not been fully solved,” although “considerable progress has been made” (*Glass Industry* 1959:18).

A Bewildering Variety of Names

The term, Applied Color Label, was coined by Owens-Illinois and was an indicator of Owens-Illinois products. The name may have derived from the “applied color” glass blocks that Owens-Illinois developed beginning in 1931 for the 1933 World Fair at Chicago, Illinois. The firm’s contractor used the blocks to construct a multicolored building for the fair (*Detroit Free Press* 10/30/1932).

Liberty Glass called its process Lustró Color and described it as “special designs permanently fused right into the glass. Last as long as the bottle. Won’t fade, scratch or dim out” (*Dairy Industries Catalog* 1947:327 – Figure 25). The Thatcher Glass Mfg. Co., however, called its process “Pyroglaze, the exclusive

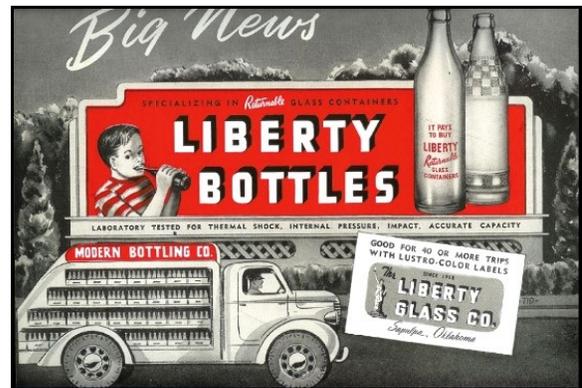


Figure 25 – Lustró Color (*Glass Container* 1946)

Thatcher method of fusing

colorful label designs right into the glass” (*Dairy Industries Catalog* 1947:293). A later ad noted that the process (and likely the term) was copyrighted (*Dairy Industries Catalog* 1954:209).



Figure 26 – Glenshaw ad (Digger O’Dell 1937)

It is interesting that soda bottle collectors almost universally call this glass fusion method ACL, while milk bottle collectors are equally adamant about using the term Pyroglazing. This may not be as surprising as it seems at first glance. Thatcher was the largest manufacturer of milk bottles, and Owens-Illinois made the most soft drink bottles. Each collecting group seems to have gone with its personal favorite.

Table 1 includes the names of the process as used by the glass houses that offered baked enamel lettering. Although the Chattanooga Glass Co., Gaynor Glass Works, Glass Container Corp., Lamb Glass Co., and Universal Glass Products Co. all offered some form of baked enamel, we have been unable to discover their brand names (Figure 26).

Table 1 – Glass Company Names for Baked Enamel Labels

Glass Gompany	Label Name	Year*
Ball Brothers	Applied Label or Fused Label	1939
Brockway Glass Co.	Monogram Service	1933
Buck Glass Co.	Color Labels	1938
Glenshaw Glass Works	Color Print	1937
Knox Glass Bottle Co.	Perma Lettered (Oil City Glass Co. Plant)	1935
Laurens Glass Works	Permanent 2-Color Labels	1939
Liberty Glass Co.	Lustro Color	1934
Owens-Illinois Glass Co.	Applied Color Lettering or Applied Color Labels	1934
Reed Glass Co.	Applied Lettering	1937
Thatcher Mfg. Co.	Pyroglaze	1933

* This was the earliest year we discovered in ads or articles. Each firm may have adopted the process earlier.

Lining up the Second Color

The ideal location for the labels on all bottles was on the face of the body (or shoulder) between the vertical mold seams. With the earliest use of the process, this alignment was only accomplished by hand and eye – as demonstrated by some of the early bottles having the labels applied across the seams. Soon, the industry tried a new method.

In 1948, the *Journal of the Society for Glass Technology* presented the following description of the way additional colors were added:

When two-colour labels are required it is necessary to dry the first colour before applying the second, and rapid drying may be obtained by allowing the bottles to pass through a heated tunnel. . . . some method of registering the individual colors of the design has to be employed. The most common method is to print a small dot on each side of the first colour print by making a tiny hole in the first colour stencil. When the first is applied the . . . the second colour registers with the first. Before the enamel label is fired on to [sic] the bottle the registration dots are removed by hand.

These dots only occur on bottles made by the Owens-Illinois Glass Co. and the Glenshaw Glass Co. – so these two may have used different machines from the others (see below). According to Chris Weide (personal communication 4/19/2019), 74 (27%) of a sample of 274 ACL bottles from the two firms had various forms of dot codes, almost always at the lower edge of the back labels (Figure 27). Dates of the bottles ranged from 1939 to 1971. These dots may initially have been the result of someone forgetting to wipe them off prior to permanently annealing the enamel, but the sheer labor cost of removing the dots by hand on hundreds of thousands of bottles probably resulted in just leaving them alone.



Figure 27 – Alignment dots (Chris Weide)

Indexing Guides

Indexing guides were variously called lugs, indexing buttons, indexing dimples, locating bars, or various other terms. There seems to have been little or no standardization of wording for these in the industry. These were molded on the heels of cylindrical bottles to orient the containers automatically on the production line (Hanlon 1971:6-18 - 6-19). By aligning the bottles, the labels were centered between mold seams. Prior to the use of the alignment lugs, the label occasionally landed atop the side seams – and on rare occasions managed a misalignment *with* the lugs.

These were originally made in a bewildering variety of styles and sizes. Indexing buttons protruded from the bottle surface. These were round, square or rectangular – sometimes with chamfered corners. Indexing dimples were recessed into the glass and could be round or square in shape. Occasionally, these were ramped to allow the male button on the machine to make easier engagement. At least one machine required bottles to have two heel ramps that allowed a button to engage the bottle from either direction (Figure 28). In March 1952 ad, Owens-Illinois called the one they used a “dimple registering lug” and referred to it as “a new feature” that “permits more accurate location of ACL label designs and more positive color registration” (Figure 29).

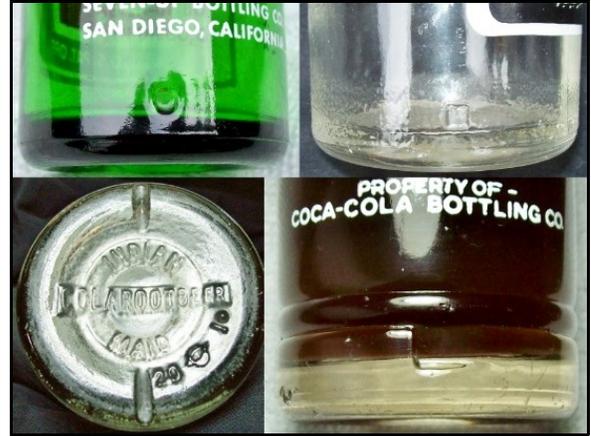


Figure 28 – Clockwise from top: Indexing dimple, button, ramp, and base slots

A few machines even used grooves in the base of the bottles. These were left over from an earlier technology that used basal grooves to align bottles for the application of paper labels. These could be slots across the center of the base or two slots at opposite sides of the base with a concave center. These were made for use on either hand operated or automatic machines. Some cold cream jars were even made with dimples or lugs on opposite sides of the heels to maintain the alignment throughout the filling and labeling process (Schulz et al. 2016:447). Although these last were never used on soda bottles, they may have been the forerunners of the single dimples or lugs that became the norm in some machines. ACL bottles with grooved bases are unusual, so very few of the slotted machines were converted for ACL use.

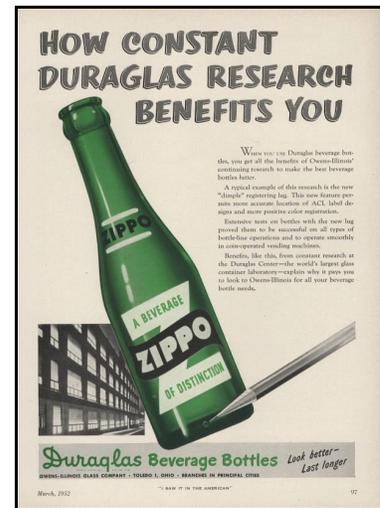


Figure 29 – Owens-Illinois 1952 dimple ad (eBay)

The Popularity Champs: Soda and Milk Bottles – Why?

To our knowledge, this question has never been addressed in print, and the answer is related to the advantages and disadvantages of paper, embossed, and ACL labels. Paper labels had a long history of use on virtually all bottle types, and they had several very positive characteristics. First, and possibly most important, they were cheap. The oldest printed labels were all located on a single sheet, which the user was required to cut into individual labels to glue by hand to each bottle. Although fairly labor intensive, this occurred at a point in history when labor was cheap, so it was probably not a major factor.

Paper labels were also expressive. At a time when the only alternative was embossed permanent labels, paper labels could include attractive decorations and a plethora of printed instructions and/or information. Virtually anything the imagination could render



Figure 30 – Embossed, paper, and ACL labels (eBay)

could be included on paper (Figure 30). Further, it could easily be changed. Important changes could be blanked over with new writing – such as an address change – typed or even hand written on remaining labels. Replacement labels were also comparatively cheap.

Both embossed and ACL, however, were permanent, and the minimum size of the font was limited – especially on an embossed bottle. Both were more costly compared to paper labels, and neither could be changed. Costs were so high that many bottle customers during the late 19th and early 20th centuries used an entire order of mis-marked bottles – often misspelling the user’s name or location – rather than incurring the high price of replacement. And, these error bottles and jars are tremendously popular with collectors.

It becomes quickly obvious that, from a business standpoint, the combination of lower cost and more information would make the choice of paper labels an excellent and obvious financial decision – all things being equal. However, if one were to require more permanence,

then the advantages of ACL versus embossing becomes the important point. Between these two, ACL has three distinct advantages.

First, color is more flashy and attention catching than embossing. From more than three feet away, embossing virtually disappears. Color remains notable. Second, smaller print with more information is *much* easier to apply with ACL – as mentioned above, an important point for advertising your product. Finally, embossing – raised above the surface of the bottle – tends to wear as bottles rub against each other in transport and in washing. This can make the bottle ugly – not a good selling point.

Two very important factors, however, insured that all things were *not* equal. The first of these was the use of returnable bottles. Both milk and soda bottles were returnable, making numerous trips between the dairy or bottler and the drinker. Studies of soda bottle round trips range from a low of 12 to a high of 52, with most in the center of that range. It is important to note, however, that bottle size must be taken into consideration. Six-ounce returnable soda bottles make many more round trips than larger ones (Lockhart 2004). Dairy bottles counts were similar, with 20-50 round trips. Again, smaller sizes survived the cycle better than larger ones (Lockhart 2014).

With returnable bottles, permanent labels were more desirable than constantly washing off old paper labels and gluing on new ones. The glue had to be strong enough to retain the label until after the bottle was purchased by the customer but sufficiently dissolvable to allow the label to be removed with a minimum of trouble. This paper label tightrope led to the final point – the one that led to the virtually industry wide adoption of ACL for soda bottle labeling.

The final issue requires a walk back in time to view a bit of the history of the soft drink industry. Like any other group, soda bottlers have gone through historic trends. Initially, carbonated soft drinks were sold almost exclusively at soda fountains, usually located in drug stores. When they were bottled, the bottles were usually generic with no labels because each town had its own bottler – but only one. By the end of the 19th century, most bottlers (except for small ones), used embossed bottles.

The trend shifted early in the 20th century. Most soda bottlers abandoned embossed bottles for those with paper labels. The paper label craze lasted into the mid-1920s and extended

into the 1930s. Prior to this time, people drank most bottled soft drinks warm, although soda fountains offered cold drinks.

As ice became more readily available, store owners began placing bottled soft drinks into ice-filled tubs. Buyers could pluck out a cold drink and purchase it at the counter. While this improved the taste of the drinks, it created a new problem. Unless a clerk rotated the ice almost constantly, enough of it melted to loosen the paper labels – which then washed off – leaving the buyer to wonder which drink he or she had in hand.

The obvious answer, of course, was a return to permanent embossed labeling. But, the need for a recognizable bottle led to the development of the style called specialty bottles by the industry, proprietary bottles by archaeologists, and deco bottles by collectors. These had distinctive embossed designs, pioneered by the famous hobble-skirt bottle by the Coca-Cola Co. in 1915. Soon, these bottles dominated the soft drink industry.

With the development of ACL, the more colorful bottles soon challenged the popularity of the specialty bottles. As noted above, ACL had obvious advantages over embossed specialty bottles, and many bottlers developed or adopted designs that included the best elements of both specialty bottles and ACL – usually with massive embossed designs and the colorful labels in an unembossed labeling area.

Dairy bottles, meanwhile, had always faced the challenge of wetness. Milk had to be kept cool, and that required ice or a damp environment until the development of dry refrigeration. Paper labels never became popular with the dairy industry. During the 1930s, waxed paper cartons began challenging the superiority of the bottle, with the advantages of color and greatly reduced fonts and decoration as well as lighter weight. The development of pyroglazing – with the combination of color and improved labeling – breathed a new breath of life into the lagging field of dairy bottles.

Two Late Adopters

It seems somewhat ironic that the two largest producers of soft drinks in the world – Pepsi-Cola and Coca-Cola – were both late adopters of the obviously superior labeling style

created by the ACL system. However, snippets from the histories of both companies may explain at least part of the delay – although a full history of these two giants is beyond the scope of this work.

Pepsi-Cola

Through most of its early history, Pepsi-Cola was a regional drink, mostly limited in its range to the American South and beset by repeated setbacks that delayed its entry into the national and international markets. Coca-Cola had begun earlier and was already a nationally recognized drink by the time Pepsi made its bid for national recognition.

Prior to 1933, the Pepsi company allowed its bottlers to select their own styles of six- or seven-ounce bottles, often embossed but frequently only identified by a paper label. Although some of these were slightly larger than the 6½ ounce Coca-Cola bottle, most people already drank Coke and were unwilling to try the rival. In a brilliant marketing ploy, Charles Guth began selling Pepsi in 12-ounce bottles for the same five-cent price that Coke charged for its bottle – almost half that size. This catapulted Pepsi-Cola into national recognition (Lockhart 2009).

The timing, however, coincided with the deepest part of the Great Depression (usually dated as beginning with the 1929 stock market crash). Although some Pepsi franchises elected to buy embossed bottles with a place for a paper label, most chose cheap, generic 12-ounce bottles, available in large quantities from used bottle dealers. Although many Pepsi histories repeat the myth that the franchises used discarded beer bottles, that was only true of a few of them. This was obviously not a good time for a fledgling national brand to initiate the new, untested ACL process (Lockhart 2009).



Figure 31 – Pepsi-Cola - paper & ACL

Even when Pepsi adopted a standardized bottle (called the Wave bottle) in 1940, it was embossed on the shoulder, leaving the body area free for a paper label (Figure 31). However,

when Pepsi moved to the ACL process in 1943, it was still able to use the same bottles, applying the ACL to the area previously occupied by the paper label. Prosperity was returning to the U.S., and the ACL process had now been tested. The timing was perfect (Lockhart 2009).

Coca-Cola

As mentioned above, the Coca-Cola Co. adopted the embossed, hobble-skirt bottle in late 1915 (although the franchises did not begin to use the new bottle style until 1917). Prior to that, the firm used bottles with some embossing plus a paper label (although a few franchises preferred more heavily embossed bottles with no paper). The main reason for the development of the hobble-skirt bottles was to create a container that would be distinctive *even when the customer felt for the bottle in icy water*. The last was a reference to the paper label problem discussed above (Lockhart & Porter 2010).

Coca-Cola had therefore solved its paper label issue with a bottle design and therefore felt no push to leap into the ACL trend. It was not until 1955, when Coke finally recognized a need for more than one product size that the firm also adopted ACL. The Coca-Cola plan had been one bottle, one size, one product, one price.

As more and more competitors offered large bottles, Coke finally felt enough pressure to change (Lockhart & Porter 2010).

By this time, virtually all the soft-drink bottle manufacturers included ACL designs as a normal part of bottle making. Although we have no direct evidence, it was almost certainly cheaper to make molds without the embossed lettering in the central labeling area and let a single-color (white) ACL take their place (Figure 32). The shift was so successful in the larger sizes that Coca-Cola added ACL to the label space on the smaller 6½ ounce bottles two years later in 1957 (Lockhart & Porter 2010).



Figure 32 – Coca-Cola - embossed & ACL

Discussion and Conclusions

Although called by a number of names, the ACL process – baked enamel lettering – followed a logical progression from hand stenciled (and poor quality) animal designs on baby jars to semiautomatic silkscreened applications on bottles and finally to fully automated machinery with improved pigments. Although the Owens-Illinois Glass Co. produced the Baby Bunting jars with hand-stenciled designs in 1931, the Brockway Glass Co. offered the first ACL labels on prescription bottles in 1933. The following year (1934) saw the first application to round bottles – ACL and pyroglazing on milk bottles by Owens-Illinois and the Thatcher Mfg. Co. Owens-Illinois soon applied the process to soda bottles, followed by other milk and soda bottle manufacturers. These colorful labels quickly dominated the market for soda and milk bottles – but failed to achieve notable popularity with any other containers.

One final point needs to be addressed. It is *very* likely that a few bottles somehow missed the quality check and made it to the bottlers with no added red pigment. We have discovered numerous other accidental errors – especially in embossing – from virtually all glass houses. We could expect various kinds of errors on ACL bottles from the hand and semiautomatic machine days. For example, there are bottles where the center or one side of the ACL label sits atop the side seams of the bottles. And, there is no question that bottlers used the error bottles of all types.

Acknowledgments

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Appendix A – Getting the Red Out The World War II Pigment Shortage Myth

In a discussion of the 1937 Seven-Up label, Lockhart (2008) wrote:

The exception occurred during World War II, but the exact dates have not been published that I know of. In some cases, the swim suit bottle lost its red-orange shield – probably, sometime between 1942 and 1945. The red pigment was saved for war use. With peace, the red-orange shield returned. There is no doubt that some bottles produced during the war retained the red shield.

In a footnote, he added, “This is contested by some collectors, supported by others. There is no question that the red color fades with prolonged exposure to the sun and can leave the white still quite visible.” This process requires a bit more explanation. Although ACL enamel was claimed to be “permanent,” virtually all of it will fade, sometimes almost completely disappearing, with too much solar exposure or with being buried in soils with certain chemical properties (Figure 33).

One of the authors conducted an unpublished study on bottles with red ACL pigment – that were made during the 1940-1945 period. He discovered that the vast majority of those bottles did *not* exhibit an absence of red pigment. This indicates the most important conclusion of the study: There was no red pigment shortage during World War II. In addition, we have been unable to find any documentation that suggests a restriction on red pigment during the War years, and numerous ads during the period offered red paint for sale in huge quantities. For example, a Mastercote House



Figure 33 – No red (Chosi)

Paint ad from May 18, 1944, issue of the *Harrisburg Evening News* noted that “we sell thousands of gallons annually . . . this superior paint where a heavy pigment dark red paint is desired (Figure 34).

Although probably not relevant to this topic, there was a shortage of soda bottles from 1943 to 1946 due to the war effort. The *Indianapolis Star* reported on June 5, 1943, that “recent government restrictions have been placed on the purchase of new bottles . . . a shortage . . . threatens a drastic reduction in the available supply” of soda bottles. The dealers were practically begging consumers to check their basements and garages for empty bottles and return them to stores to reclaim their deposit money (Figure 35).

Any bottles lacking the red color were almost certainly created by one of two processes. The most likely was the deterioration of the red through exposure to solar radiation or chemical processes while buried in soil (Figure 36). Second, quality control occasionally could have been lax at any of the factories. As noted above, errors of various kinds were common during the late 19th and early 20th centuries, and mistakes are more likely when processes are new. This may explain why a very few bottles lacking red pigment do not appear to have any “ghost” of red area.

He further found that the vast majority of bottles lacking the red ACL was composed of Seven-Up bottles made by the Owens-Illinois Glass Co. Oddly, milk bottles made by the same company showed little deterioration of red lettering. This is not to say that the red deterioration was limited to Owens-Illinois. Seven-Up bottles made by the Glenshaw Glass Co. also exhibited red deterioration as did other types of soda bottles made by other glass houses. But bottles made by



Figure 34 – Mastercote ad (*Harrisburg Evening News* 5/18/1944)



Figure 35 – Bottle return ad (*Akron Beacon-Journal* 5/17/1943)

Owens-Illinois seem to have had the greatest problem. Bottles with the missing red element ranged from 1937 to 1950.



Figure 36 – Red deterioration variation (Bruce Foran)

In the vast Owens-Illinois system, different factories produced different bottle types, so we explored the possibility that a single plant experienced a problem with red dye. Even a very tiny sample disproved that hypothesis. Red dye on Seven-Up bottles deteriorated in containers made by Plant No. 3 (Fairmont, Illinois), Plant No. 9 (Streator, Illinois), and Plant No. 23, (Los Angeles, California) and less often at three other factories – although most of the bottles with missing red in our sample were made at Plant No. 3.

It is clear that Owens-Illinois produced its own ACL frit (pigment mixture); therefore, the pigment issue was internal rather than with an outside supplier. While interesting, however, this is of less importance than the obvious fact that Owens-Illinois (as well as Gayner) seems to have discovered the rapid wear issue and dealt with it in future bottles, at least slowing down the rate of red frit deterioration.

A possible explanation may be derived from a comment by Russ Hoenig, an Owens-Illinois retiree and local bottle and factory historian. Always curious and interested in every aspect of bottle and jar production, Hoenig began “nosing around Clarion’s ACL dept.” in the late 1980s – discovering that the “masks, pigments, [and] soaking tank [were] kept in a locked, secure room.” He was told that the red pigment contained “real gold” (personal communication 5/8/2019). The addition of the precious metal may have been the solution to the red deterioration problem.

One other possibility had to do with a *real* wartime reduction – that of organic pigments used in paints and dyes. Under the heading of “Color Going to War,” the *Allentown Morning Call* (and other U.S. newspapers) discussed the new restrictions on January 23, 1943. Organic pigments were not entirely withdrawn from the market, but the available amounts for civilian use were greatly limited. The restrictions, however, did not apply to *inorganic* pigments.

The Games Slater 1939 patent (Owens-Illinois) called for organic pigments for ACL use. Possibly, Owens-Illinois used inorganic pigments when the organics were depleted, causing an inferior red ACL (but apparently not other colors) that wore off more quickly. This inorganic enamel may even have deteriorated without leaving the usual “ghost” traces.

In conclusion, soda bottles found with the red pigment missing were very limited, and the chances that they were produced intentionally are very slim. The overwhelming evidence – provided by the ACL bottles, themselves – shows that there was certainly no red dye or frit shortage during World War II. Instead, the vast majority of ACL bottles appeared the same as they had been prior to the war and after. All of the bottles with missing red pigment were much more likely the result of prolonged solar exposure or chemical reactions in buried bottles due to soil composition. The final salient points are:

1. Thousands (probably millions) of ACL bottles were made with red pigment during World War II; therefore, there was NO red pigment shortage.
2. Even though the bulk of the bottles with missing red ACL were made by Owens-Illinois Glass Co., Plant No. 3, the factory nonetheless produced other bottles *with* intact red pigment.
3. Therefore, the missing red on Seven-Up bottles wore off via some currently undocumented process that did not affect the white pigment.
4. The only possible alternative explanation is that quality control broke down at Plant No. 3 (and, occasionally, at other factories), allowing a limited production of bottles without the second ACL application (red pigment).

Appendix B – A Brief History of Painted Label Soda Bottle Collecting

While bottle collecting has been an exciting hobby for many years, it was not until the mid-1970s that some collectors began to shift their focus to the colorful ACL bottles – although

Cecil Munsey wrote some articles about soda bottles – including ones with ACL – as early as the late 1960s and very early 1970s (e.g. Munsey 1970). Prior to that time, collectors concentrated on embossed bottles. In 1972, J.J. Jones published *Soda and Mineral Water Bottles – Over 2,000 Varieties*, the first bottle collecting book to devote about 30% of its listings to ACL soda bottles (Figure 37).

Rick Sweeney inspired ACL collectors when he started the Painted Soda Bottle Collectors Association and began the publication of the *Soda Net* in 1988 (Figure 38). The magazine became the main vehicle for articles on ACL bottles. When Sweeney retired from the magazine in March 2002, Kathy Sathe (née Hopson) became the editor, changing the magazine name to the *Soda Fizz* in September of 2003. Unfortunately, the publication ceased existence when Sathe suffered a series of strokes in early 2009.

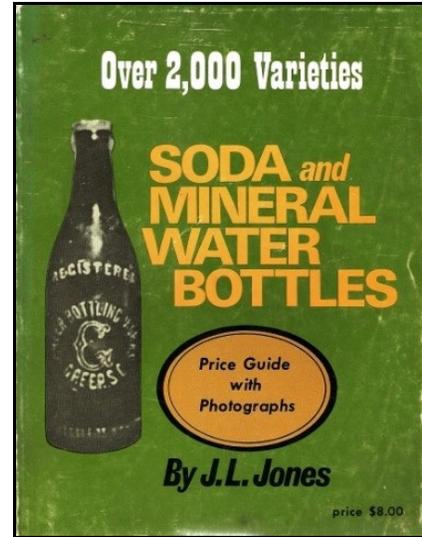


Figure 37 – Jones soda bottle book



Figure 38 – Rick Sweeney

Sweeney also stimulated collector interest when he published the first volume of *Collecting Applied Color Label Soda Bottles* in 1995, followed by a second book in 1998 and the final volume in 2002 (Figure 39). These books listed thousands of ACL soda bottles, many of them illustrated in full, vibrant color. These became a must-have reference for most serious ACL soda bottle collectors.

ACL soda bottle collecting greatly expanded when the internet grew in popularity, especially with the introduction of eBay, the popular online auction site. Although eBay (and later Etsy, Worthpoint, and other similar vehicles) offered a huge variety of items, collectors could use the program's



Figure 39 – Sweeney's first ACL book

search function to narrow down the listings to fit their own specific needs. No longer were they forced to rely on bottle shows and antique shops to find their sought-after bargains. An amazing number of exciting bottles were now just a few mouse clicks away.

The sheer volume of available ACL bottles, however, caused most collector to begin specializing. Since soda bottlers took advantage of the easily available technology to order a variety of designs and make relatively frequent changes, a collector could really narrow down a particular field. Topics can center on designs (animals, buildings, natural scenes, etc.), specific brands (Seven-Up, Pepsi-Cola, Barq's, etc.), locations (regions, states, or even individual cities), or any number of other combinations – limited only by the collector's imagination (Figure 40).

Like all technology, the internet also created new problems. In the pre-internet days, most ACL bottles were cheap – just a few dollars at antique stores with desirable bottles a bit higher at bottle shows. Sites like eBay and various bottle forums changed all that in two ways. First, collectors now had a way to discover some of the endless variations within their specialties and learn which of those variations were the least available. The combination of scarcity and desirability, of course, drove up prices.

While auctions like eBay increased availability of bottles, they also increased awareness of competition. Bidding battles often became the norm. A seller never needed to know the value of a bottle; the bidders took care of that for him or her. For example, one of the authors watched the price of El Paso milk bottles literally increase over night. Prior to a single day in 2004, a typical price for almost any El Paso milk bottle was under \$15, usually less than \$10. Then, two regional dairy owners began collecting those bottles. Their initial bidding war escalated the price of a bottle from \$6 to \$280 – before one of them backed off. Collecting would never be the same. As another example, a “Big Hit” ACL soda bottle (Baseball player theme) can now sell for more than a thousand dollars. In less than 40 years, collecting ACL soda bottles has grown from being virtually ignored to becoming a major facet of bottle collecting.



Figure 40 – ACL bottle (eBay)

Appendix C – A Personal Note from Bob Brown

As a 45-year collector of ACL soda bottles, I feel an article of this nature is long overdo and am honored that Bill invited me to assist with the research. As most bottle enthusiasts know, Bill and his team of researchers have published numerous articles over the years, all of which have been for the explicit benefit of bottle collectors worldwide, including myself. As such, I take my hat off to Bill and want to take this opportunity to personally thank him for his unequalled devotion to the hobby of collecting and researching vintage bottles. It is our combined hope this article will be received with the same level of enthusiasm as Bill's earlier articles and that everyone who reads it will learn something new and helpful about those highly collectible and glorious ACL bottles.

With appreciation,

Bob Brown
Sodapopbob and Sodabob

Last updated 7/9/2019