Appendix D – World War II Bottle Caps

Bill Lockhart and Bob Brown

World War II was an expensive fight for everyone involved. For a brief period, the U.S. instituted rationing of goods and raw materials deemed necessary to supply the military. On December 8, 1941, the day after the bombing of Pearl Harbor, the U.S. declared war on Japan and included Germany on December 11. Rationing of various food items began in May of 1942, and some rationing continued after the end of combat. Sugar, for example, remained a rationed item until June of 1947 – partly due to our continued occupation of the countries that lost the war. Germany surrendered on May 7, 1945, followed by Japan on September 2 – ending combat.

Production of Crown Caps Prior to (and Post) World War II

The design for the logos on the crowns began with large color sketches that were then enlarged and "photographically reduced to positives of actual size." At that point, a "photo composing machine" created "288 uniform prints on a sensitized zinc printing plate which [was] then chemically etched to produce the multiple design images." Each color of the logos required "a separate run through the printing process" (Hess 1950).

The crown, itself, was made from "a steel sheet that is closely controlled in gauge, temper, and ductility" then was "coated with a layer of metallic tin to prevent rust and to provide a base for exterior lithography and interior sanitary coatings." The color was then applied, baked in, and the sheets cooled. The cooled sheets were then "transferred to the 'punching' operation. Here a press weighing approximately eight tons punche[d] out sixteen individual shells with each stroke" (Hess 1950). That process required 18 separate punches to create the 288 crowns made from each sheet of tinned steel.

Wartime Restrictions to Crown Cap Production

Although rationing affected soda bottling is several ways – notably restrictions on sugar and bottle manufacturing – our focus here is limited to the bottle caps. Like "tin" cans, bottle

caps were made of thin sheet steel coated with tin or sometimes with terne – a zinc-tin alloy coating that provided corrosion resistance. Four months into World War II, the newly created War Production Board (WPB) issued Order M-104 on May 30, 1942, that "prohibited the use of tinplate and terneplate for the manufacture of beverage crowns and restricted the use of blackplate [black zinc] to 60 percent of the total prime plate used." Seven months later, on December 26, the board also banned blackplate use entirely (U.S. Department of Commerce 1953).

The *Sioux Falls Argus-Leader* for September 8, 1942, presented a capsule view of the situation during that period:

> At present say bottlers here, a black plate steel cap is being purchased and the industry is restricted to 70 per cent of its monthly quota of last year. Some firms are reusing caps in accordance with the regulations that they be sterilized and reworked. . . . The new black steel crowns are not as well suited for re-use as are the former tin ones. They are a lighter metal and subject to rust. A rusted cap, bottlers say, cannot be reused again.

Even though the WPB allowed four more weeks of crown cap production before crown manufacture ceased (until April 26, 1943), the beverage industry was clearly in trouble. On top of the limitations on sugar and glass bottle manufacture, the need for caps required a solution. Since the bottles were returnable, soda bottlers could use them for longer periods, but caps were only used once – or were they?

Many bottlers and breweries began reusing crown caps in order to continue in business. A Pepsi-Cola ad in the *Salisbury Daily Times* for June 7, 1942 (Salisbury, Maryland), admonished its readers to "Return That Cap . . . Metal must not be wasted these days—even bottle caps are precious. So please don't throw away the cap after you've enjoyed a bottle of Pepsi-Cola—Return it to you dealer" (Figure 1). The ad even had a better suggestion: "Put Caps Back on Empty Bottles . . . Just as soon as you've emptied the

Figure 1 – Pepsi Ad (*Salisbury Daily Times* for 6/7/1942)

big big Pepsi-Cola bottle—simply press the cap back on top. It's an easy and neat way to return cap and bottle to your dealer."


Figure 2 – Bates machine (*Popular Mechanics* Oct. 1942)

But, everyone knew that returning caps was only a stop-gap measure. By September 6, 1942, the *Nebraska Daily News-Press* noted that returning caps in that state had "been outlawed for sanitary reasons. Tests have proven that unless old cork is removed and a new sealer substituted before the cap is recrimped, all germs cannot be killed." But, a new machine, invented by Albert J. Bates, eliminated most of the used cap complaints. According to the October 1942 issue of *Popular Mechanics*, Bate's "reclaiming machine plus a sterilizing process . . . makes the second-hand steel crowns safe, sanitary and leak proof, on a mass production basis" (Figure 2). An unusual feature was to "deform" the cap, "stamping two concentric circles on top. These circles form a new seat that conforms to the seal-ring at the top of the bottle upon which it is pressed."

Initially, all paint and the inner cork seal were removed, then the cap was stamped by the machine. Next, the crown traveled "on a belt to a painting machine for enameling inside and out, and immediately passe[d] under infrared heat lamps to bake the enamel," and a new disk was inserted. The June 28, 1942, issue of the *La Crosse Tribune* addressed the issue of logos on the caps: "No printing or label will be applied to them, according to Mr. Bates, as a war measure to conserve time and materials." Even with the Bates machine, however, used caps could be reclaimed only once because "steel . . . becomes fatigued if it is bent back and forth too many times and this would cause leakers to appear if reclamation were performed too many times on one cap."

On September 3, 1942, the WPB issued Supplemental Order M-72-a. This order allowed soda bottlers and brewers to "collect No. 10 or larger cans from hotels, restaurants, institutions and the like." These were the gallon-sized (or larger) cans used in these institutional settings. The bottlers (and brewers) were required to "clean and prepare the cans, stripping the ends and seam and sending these parts to the city's collection point or to a detining plant" (*Billboard* 1942).

The bodies of these cans were then shipped to the crown cap producers who would stamp out the caps and ship the remaining "skeleton" to the closest "detining" plant, where the tin would be removed, saving the remaining steel for the war effort. This method would save "approximately one-third of the can by weight for use in bottling and deliver the remaining for salvage" (*Billboard* 1942). While the cans allowed the bottlers to remain in business, they were slightly thicker and "much heavier" than the sheet steel typically used for crown caps, so they were a bit tougher to pop off with an opener (*Decatur City Review* 11/30/1942). The *Nebraska Daily News-Press* (9/6/1942) added that "only bright, shiny tin plate is accepted. Rust spots consign the can to the junk pile."

The use of the No. 10 cans as crown cap material was short lived. On June 16, 1943, the WPB revoked Supplementary Order M-72-a, with the proviso that "said order shall remain effective until the deliveries affected thereby have been completed" (*Federal Register* 1943). So, the use of cans to make crowns lasted a little more than nine months. The WPB revoked Order M-104 on January 4, 1944, although it was not until March or April that manufacturers resumed production of crown caps. The entire restriction of crown cap manufacturing was limited to 20 months.

Cork Liners

William Painter applied for his patent for what became the crown closure on June 16, 1890, not receiving Patent No. 468,258 until February 2, 1892 – about a year and a half later. Although soda bottlers and brewers were slow to adopt the seal, in less than a decade, it dominated the beverage industry and continued for well over a century. Although collectors and archaeologists typically pay the greatest attention to the tin-plated sheet-steel cap, Painter also described the "sealing disk" that "may be varied as to their component character; but I prefer the flat linoleum disk composed of granulated woody matter and a practically tasteless and odorless gum" – in other words, the well-known cork disk (Figure 3). The disk could be further protected with "a thin coating or layer . . . of properly prepared gutta-percha" so that it would be unaffected by the pasteurization process used in making beer, but that also added an extra layer of protection for soft drinks.

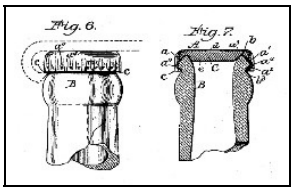

Figure 3 – Cork liner from Painter's 1892 patent

Despite Painter's suggestion, the original disks were made of sheet cork, but the cork-producing nations could not keep pace with the demand – *and* occasional holes led to "leakers" – causing the adoption of composition cork early in the 20th century. To make composition cork liners, the cork was "put through a grinding and classification operation and then mixed with suitable binders." Once the disk was prepared, it was applied with a "combination of pressure and heat" to assure "positive adhesion of the cork to the metal shell" (Hess 1950).

Although cork did not have a similar reaction to soft drinks, it affected the taste of beer, so the plants developed the aluminum spot (Figure 4). The spot covered the open mouth of the glass bottle but did not extend onto the glass rim. The top of the glass needed to seat against the actual cork to provide the proper seal (Hess 1950). According to Holscher (1965), foil spot liners were first used on crown beer caps in 1916, and paper slot liners followed in 1927. Although not fully relevant to this study, the WPB eventually eliminated the aluminum used for spots, forcing the creation of paper alternatives (Figure 5).

Figure 4 – Spot (eBay)

Figure 5 – Aluminum & paper spots (eBay)

The WPB even limited the amount of cork used for the sealing disk via Amendment No. 3 to General Preference Order M-8-A, November 18, 1942. However, on July 6, 1942, the *McComb Daily Journal* announced:

> Several paper mills working in conjunction with crown manufacturers had undertaken the development of a satisfactory special composition paper insert to replace the cork insert formerly used as a seal inside the crown, since cork is an important item now on the war restricted list. Used crowns can also be sterilized and reprocessed without removal of the original cork insert in case it has not been damaged.

Insofar as we can tell, these paper disks were visibly no different from the cork ones. However, the development continued. The *Atlanta Journal* explained on August 30, 1943, that Herman M. Kulman had pioneered the use of peanut hulls as a substitute for cork. "Several

leading soft drink companies have tested and approved the new peanut-hull for use as bottle caps for beverages," the paper said, although the hulls actually were used as substitutes for cork disks – not for bottle caps.

By February 7, 1944, scientists had gone even further. The *Greenville News* reported that the scientists had "discovered another plastic called 'norseal' from peanut shell piths and farm products, designed as a substitute for cork in the thin disks that line crown seal bottle caps." By that time, however, most war restrictions were being lifted, and virtually everyone returned to the use of composite cork disks.

Wartime Crown Caps

While collectors claim that the World War II crowns were made in a "wallpaper" pattern – i.e., rows of multiple logos, hereafter referred to as multi-logo caps – we have been unable to find any actual primary source to confirm that claim. However, we know that there were differences in caps during three periods of the World War II years, and we also have some hints that should help us identify caps from each.

The Blackplate Period – (May-September 1942)

From May to September of 1942, crown cap manufacturers only were allowed to use blackplate (thin steel plate with a black zinc coating) to produce crowns for soda bottlers and breweries. As noted above, these caps were thinner and lighter in weight than pre-war (and post-war) crowns.

No. 10 Can Period (September 1942-June 1943)

From September of 1942 to June of 1943, bottlers were permitted to salvage the large (one-gallon) No. 10 cans from restaurants, cafeterias, and institutional users. Once collected, the bottlers removed the tops and seams, sending the flattened can bodies to the crown cap manufacturers, where they stamped out as many crowns as they could fit on each can body, processing them into new crowns and returning the remnants to war use recycling centers. These were thicker and heavier than pre-war or post war crowns.

Reused Crown Period (May 1942-January 1944)

During the entire period of the war restrictions – from the first war order in May of 1942 to end of the orders in January of 1944 – bottlers and brewers were allowed to collect used crowns from their customers and rework them for reuse. From June 1943 to January (actually March) 1944 (nine months), neither tinplate, blackplate, nor No. 10 cans were allowed, so, unless there was some other format that we have not discovered, *only* used crowns could have been employed during those nine months. One final consideration for this period was the Bates bottle cap machine, invented in July 1942 and maintained to restore used caps for reuse. These machines embossed two concentric circles on each cap to fit over the sealing ring of the bottles.

Identifiable Differences

So, we have three identifiable differences to help us determine which crowns were used during World War II. Blackplate caps should be lighter and thinner than the ones used before and after the war, while crowns made from No. 10 cans should be thicker and heavier. Finally, caps reclaimed by the Bates machine should have two concentric circles and *no* enameled logos. Since virtually no one collects generic caps, these plain crowns may be virtually impossible to find.

However, there are several caveats to using these data. The Blackplate crowns, only made during 1942, should have gone through the typical processes used in making a typical crown cap. But, we can speculate here just a bit. Prior to World War II, waste metal was a fairly minor concern. Of greater importance was stamping out each crown with a carefully centered soft drink logo – as discussed at the beginning of this appendix. These logos were enameled in sets of 288 on the sheets of tin-coated steel *before* the crowns were stamped out (Figure 6). In 1942, however, the emphasis was on saving every usable scrap of metal, even though that meant that the logos would no longer be centered on each crown. The solution was to enamel multiple smaller logos on the sheets of blackplate so that each crown would have several logos visible – regardless of where the stamps fell on the sheets of blackplate. If this hypothesis is correct, we

Figure 6 – Steel sheet – crowns (eBay)

would expect *some* of the multi-logo caps to be lighter than the typical crowns – identifying them as blackplate.

As noted above, the *Nebraska Daily News-Press* warned on September 6, 1942, that the first Coca-Cola crowns being made from No. 10 cans would *not* have the logo enameled on them. Instead, each would be a "plain, bright crown." Although the newspaper gave no reason for the lack of logo, we can speculate that the bottler wanted a rush job. Remember that the local bottlers collected the cans and conducted the initial processes of removing the tops, bottoms, and seams before sending the resulting 6⅛ x 18 inch flat plates to the crown manufacturers. There, the crowns were painted and stamped out.

A typical painting process involved at least a two-step process. First, the sheet was painted with a background color, followed by each color in the cap's logo. For a rush job, the final colors were ignored. However, as supplies caught up, we could expect logos to return. As with the blackplate discussion above, we would expect multi-logo caps to save waste, but we can hypothesize that caps made from No. 10 cans would be *heavier* than typical crowns. In keeping with the multi-logo hypothesis, *all* of the caps we have found with the "wallpaper" designs had single-colored logos.

In addition (and possibly more importantly), the crown enameling machines and stamping machines had been created to fit huge sheets of 288 caps – *much* larger than sheets made from No. 10 cans. With all the emphasis on saving metal for war use, creating new stamping machines would have been impossible, so the standard machines, stamping out 16 crowns at a time would have been modified to work with the No. 10 cans. However, the placement would not have been perfect, another reason for the multi-logo arrangement.

With the exceptions of crowns revitalized by the Bates machines – each with the embossed concentric circles – recognizing reused crowns probably will be impossible. Reusing crowns was a local process. None of our source articles mentioned sending reused caps to the crown manufacturers. Initially, bottlers just cleaned the crowns to the best of their abilities, so these would have retained the original logos. Each bottler would have *only* used his/her own crowns – e.g., Seven-Up franchises would have only used Seven-Up crowns.

The Bates machines and the accompanying processes, however, removed the old seals from the bottoms of the caps and stripped the old enamel. This allowed the reuse of *any* crowns – no longer just the franchised brands. But, when these were enameled, it is highly unlikely that the local franchises could have rigged a system to repaint the logos. Therefore, all reclaimed caps after ca. mid-1942 would have been generic – i.e., no logos – as explained in the *La Crosse Tribune* for June 28, 1942, discussed earlier. That would explain why we have never found a Seven-Up bottle cap with the two concentric circles.

Testing the Hypotheses

Figure 7 – Multi-logo Root Beer cap

We were able to test one of the hypotheses – that a multi-logo cap made of blackplate will weigh less than the typical pre-war or post-war crown. Although the authors are not crown collectors, we managed to obtain a multi-logo cap with the words "Root Beer" repeated on it (Figure 7). We weighed a selection of pre-war caps, post-war caps, and the generic multi-logo Root Beer crown (all retaining the cork seal on the bottom) with the following results:


Figure 8 – Gray inside

Pre-war crowns – range of 2.9-3.1 grams, mean (average) of 3.0 grams
Post-war crowns – range of 2.9-3.2 grams, mean of 3.0 grams
Multi-logo Root Beer cap – 2.4 grams

The Multi-logo Root Beer cap was significantly lighter than the pre- or post-war caps (0.6 grams or 20.0% lighter), therefore made of blackplate – a thinner, lighter material than the typical (i.e., pre- or post-war) crowns, strongly supporting the idea that the multi-logo caps were used during the World War II period. In addition, the multi-logo Root Beer cap was painted a matte gray color on the underside but was a shiny silver color when a bit of the underside paint was scraped off (Figure 8). Typical (pre- or post-war) crowns were more of a golden color on the bottom side.

At this point, we have not obtained any other examples of multi-logo caps. Hopefully, future researchers can weigh a larger sample of those to discover if some (most?) will be heavier than the pre- and post-war crowns – therefore made from No. 10 cans.

In conclusion, we now have at least one example that supports our intuitive sense (and the collector wisdom) that the multi-logo design was used during World War II. That design eliminated the need to center a logo, thereby allowing for caps to be stamped in any way that saved the most space – especially on a limited venue such as the bodies of No. 10 cans. The multi-logo design seems to have been global – used by virtually every soda franchise – including Seven-Up, Coca-Cola, Pepsi-Cola, Royal Crown, and many others.

Very few of these crowns have survived, only a handful that we have discovered for Seven-Up. This, too, supports the wartime, limited use of the multi-logo caps. Use of these would have begun with Order M-104 in May of 1942, continued with Supplementary Order M-72-a in September of that year (or slightly later), and maintained at least until the order lapsed in June of 1943 – just 16 months.

We may even have discovered a possible sequence for the use of crowns made from No. 10 cans. As noted above, on September 6, 1942, the *Nebraska Daily News-Press* provided some interesting information: "If in a few days you find your bottle of Coca-Cola capped with a plain, bright crown don't sneer at it. . . . the familiar Coca-Cola imprint will be missing." This was because Coca-Cola was preparing to receive its first shipment of the new crown caps made from No. 10 cans. The use of tinned steel for cans had been banned since May (four months) with only reused caps available since then, so the bottler was pretty desperate for caps by that time. The firm did not want to wait for the crowns to be enameled.

The other franchises (Seven-Up, Pepsi, etc.) likely followed the same pattern, so the first wartime Seven-Up caps made from No. 10 cans likely only showed the shiny tin finish as well. We have discovered two other variations: multi-logo caps with silver background and white background. It makes sense that the "silver" background actually was the shiny tin finish with only the logos in baked enamel (Figure 9). A bit later, the white coating would have been added. Then, at the end of the war, (at least after the end of M-104), Seven-Up returned to the typical single-logo cap.

Figure 9 – Silver & White backgrounds (eBay)

Another Observation

While not scientifically perfect, we discovered another demonstration that multi-logo caps were made from No. 10 cans. As noted above, blackplate (zinc coating) was thinner and lighter than normal crowns, while No. 10 cans made caps that were thicker and heavier than normal. Our hypothesis was that *both* types used the multi-logo format.

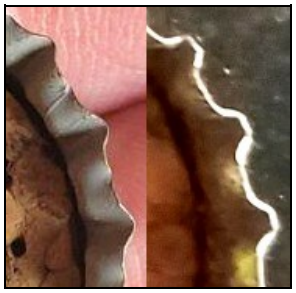

Figure 10 – Comparison of crown edges

Our weight test (see above) showed that the multi-logo Root Beer cap was significantly lighter than normal crowns. In addition, the inside coating was light gray. When we found examples of multi-logo caps with visible cork liners, one of those also had a light gray inner coating.

Figure 11 – Comparison of crown edges

In addition to the cork, those photos all showed the edges of the crown skirt, so we cropped sections of the edges for comparison. Figure 10 compares the Root Beer cap that we used in the weight test – the one with the gray inner coating – a multi-logo Seven-Up cap from eBay. Figure 11 compares another Root Beer multi-logo crown (also with gray inner coating and also from eBay) with a different multi-logo Seven-Up cap from eBay.

Even though this is not a perfect measurement, the difference is pretty obvious to the naked eye. In each case, material composing the crown in the left photo (gray inner coating) is MUCH thinner than the one on the right. Ergo, we have blackplate to the left and No. 10 can to the right. As noted above, the evidence would be much stronger if we could weight a No. 10 can example, but this at least provides *some* evidence.

Seven-Up Wartime Crown Variations

Our searches have turned up several variations of the multi-logo Seven-Up crowns, made by the three leading crown cap manufacturers. The Armstrong Cork Co. used a Circle-A logo to mark its crowns; the Hoosier Crown Corp. applied the initials HCC; and the Crown Cork & Seal

Co. used CCS. Oddly, the Circle-A logos on our examples were upside down in relation to the Seven-Up logos. All three typically applied soda brand logos large enough that four of them showed in a view of the top of the cap, flowing over onto the skirt (Figure 12). The cap background could be white or silver. However, Crown Cork & Seal also made a smaller pattern, so eight logos and parts of two others showed on the top – although this size apparently was only tried once – at least in our sample (Figure 13).

Figure 12 – Multi-logo 7-Up caps (eBay)

Figure 13 – Smaller pattern (eBay)

All three manufacturers placed their marks between the multiple logos of the soda firms. Typically (pre- and post-war), logos of the crown manufacturers were placed on the skirts of the crowns (Figure 14). We have only seen the silver background on Crown Cork & Seal caps, although white backgrounds appear on crowns made by all three firms.

Figure 14 – Crown skirt logo (eBay)

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