

The Crown Cork Cap and Crown Soda Machine 1892 and 1898



**ASME International Historic
Mechanical Engineering Landmark**

**ASME Region III Baltimore Section
25 May 1994**

**INTERATIONAL HISTORIC MECHANICAL ENGINEERING LANDMARK
THE CROWN CORK CAP AND THE CROWN SODA MACHINE
1892 AND 1898**

ALTHOUGH BOTTLED CARBONATED BEVERAGES WERE POPULAR BY THE 1880S, SEALING THE BOTTLE WAS A CONSTANT PROBLEM. MOST “STOPPERS” WERE OF METAL AND INTENDED FOR REUSE. NONE SEALED ADEQUATELY, AND CONTACT WITH THE CAP OFTEN CONTAMINATED THE DRINK. WILLIAM PAINTER PATENTED A CHEAP, SINGLE-USE METALLIC CAP, CRIMPED OVER A LIP FORMED ON THE BOTTLE NECK AND LINED WITH A THIN CORK WAFER THAT BOTH FORMED A LEAKPROOF SEAL AND SEPARATED DRINK AND METAL. SOON THEREAFTER, HE PATENTED A MACHINE THAT FILLED THE BOTTLE SIMULTANEOUSLY WITH SYRUP AND CARBONATED WATER, THEN APPLIED THE CAP. THE TWO INVENTIONS—COMMERCIALY DEVELOPED BY PAINTER’S CROWN CORK & SEAL CO. IN BALTIMORE—WERE THE FOUNDATION OF TODAY’S VAST BOTTLING INDUSTRY.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS – 1994



Figure 1. William Painter (died in 1906), founder of the present-day Crown Cork & Seal Company.

Introduction

Pick up a bottle of soft drink or beer and you may never think about the considerable creativity, effort, design, and machinery it took to put that bottle into your hands. This brochure changes that by describing two mechanical items that played significant early roles in shaping today's beverage bottling industry. These two items reflect the huge effort it took to invent, develop, and produce the bottled and canned products we use almost every day of our lives.

The 1892 Bottle Cork Cap

The carbonated soft drink idea surprisingly is not new. Carbonated drinks were popular by the 1880s, and the first Convention of Bottlers and Exhibition of Bottler's Supplies dates back to that period.

In the late 19th century, one problem was acute for the bottling industry. The bottle caps ("stoppers," as they then were called) usually leaked or were not tight enough to hold the carbonation gas. Some stoppers were made from metals which interacted with the contents of the bottle, causing changes in their color and flavor. By the 1880s there already were some 150 US patents for bottle "stoppers," and techniques and designs for sealing bottles came in all sizes, shapes, and costs. None was effective, simple, or economical to produce. Stoppers were also made to be reusable, to be returned with the empty bottles after the drink had been consumed.

William Painter (Figure 1), an inventor with at least 85 patents to his name for devices ranging from a counterfeit coin detector to a railroad car seat, was not satisfied with this situation. In 1882, he obtained a patent for a bottle seal that was designed for a single use and then discarded. His idea was to create a stopper that consumers would throw away, thus insuring future demand and a continuing business. A business associate of Painter bought all rights to sell this Painter bottle stopper, and by 1889 had formed the "Bottle Seal Company."

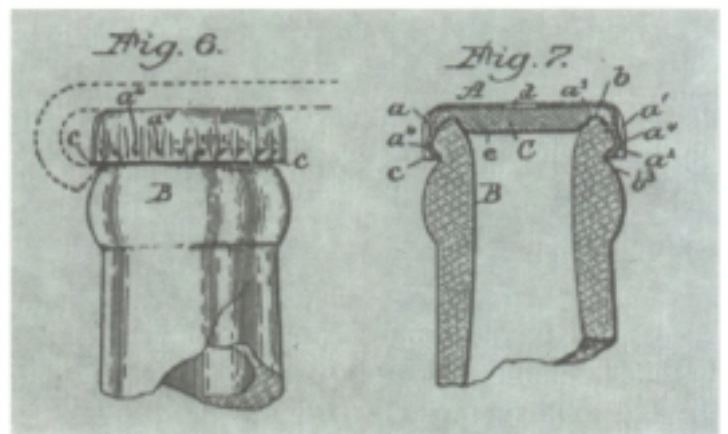


Figure 2. The Original Cork-lined Bottle Cap.

Painter still was not satisfied. In 1891 he invented the "crown cork cap" (Figure 2), a metal cap with a corrugated-flange edge, lined with a thin cork disc and a

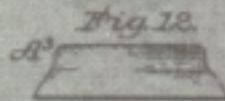
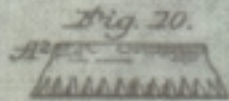
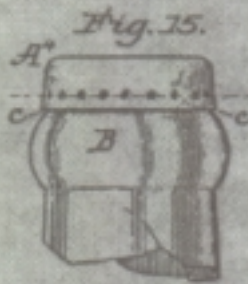
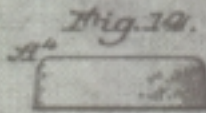
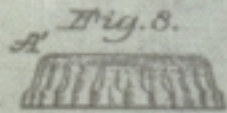
(No Model.)

2 Sheets—Sheet 2.

W. PAINTER.
BOTTLE SEALING DEVICE.

No. 468,258.

Patented Feb. 2, 1892.



Attest:
Philip J. Lanner

Inventor:
William Painter

special paper backing both to seal the bottle and prevent contact between the bottle contents and the metal cap that crowned it. Patent number 468,258 was issued February 2, 1892, and a new page in the history of the bottling industry was written. Some drawings from the patent are shown in Figure 3. The Crown Cork & Seal Company Inc. was established later that year in Baltimore, Maryland.

The crown cork seal design required the bottle to have a specific neck tip with a recess for the cap to grip, and Painter had to work hard to convince the many independent glass bottle makers to conform to that design. He succeeded during the following decade as the bottle makers came to realize the effectiveness of the cork cap design and adopted it.

The 1898 Soft Drink Mixing and Capping Machine

With the newly-invented cork cap and specific bottle tip design in hand, William Painter worked on designing a bottling machine to use it. After hard work and many trials, he obtained a patent in 1898 for the Crown Soda Machine, shown in Figure 4. This was the first machine of its kind to use a syrup-fluid line and a carbonated-water line where both fluids were mixed only at the outlet orifice where the operator held the glass bottle lip for filling. With the bottle filled, the operator inserted a crown cork cap by hand inside the bottom of a press - also part of the machine - placed the filled bottle under the press, and pushed down on the press foot-pedal. This crimped the cap over the bottle tip and the bottling process (mixing, filling, and capping) was complete. It is claimed that a fast worker could fill and cap eight bottles per minute, but the average worker is believed to have done about half that number.

Figure 3.
From the 1892 patent for the Crown
Cork Cap.



Figure 4.
The first Crown Soda Machine for soft drink mixing, filling, and capping.

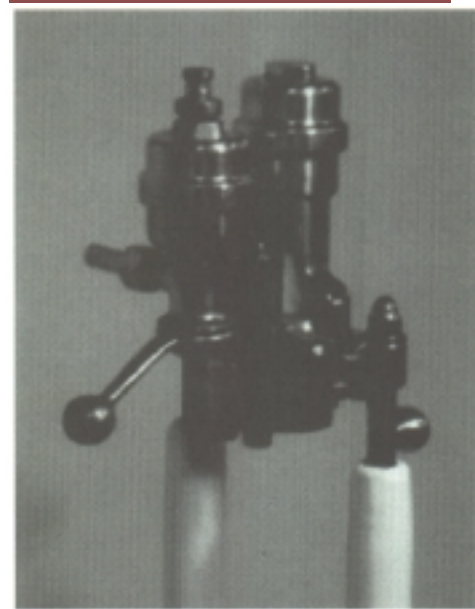


Figure 5
Close-up the brass top die of the Crown Soda Machine.

The Crown Soda Machine depicted in Figures 4 and 5, is approximately five feet high by three feet wide. The machine has a cast iron body and left and right extended trays, allowing the operator to pick an empty bottle from one side and place the filled and capped bottle on the other for other workers to collect. The foot pedal can be seen at the bottom of the machine, and the hand bar at the top is raised by the operator to let the fluid flow. The machine is fed by two separate lines (not shown in the photographs), one for the syrup and the other for the carbonated water. The top part is made of brass, which was the sanitary metal of the time as stainless steel was not yet invented. The supply of loose cork caps was put in a bowl near the machine. This bowl with sample loose caps can still be seen today near the machine at its exhibit.

There are only a few Crown Soda Machines known to exist today. Two are at the Crown Cork & Seal Company Machinery Division at 1200 South Newkirk Street in Baltimore. They both are silent now and are on exhibit in the lobby of the company. A brass nameplate on one machine reads "Patented 1898" (Figure 6). The two machines were restored for the company's centennial celebration held in February of 1992 to commemorate the Crown Cork Cap patent of 1892. One machine has recently been loaned to the Coca-Cola Company museum in Atlanta, Georgia.

The historical importance of these surviving machines is that they were the first machines that combined the filling and capping of bottles at the same time for faster and more economical bottling. The prevailing technology of their time was to put the syrup into the bottom of a bottle, move the bottle to another line to fill the bottle with carbonated water,



Figure 6.
The brass name plate of the 1898 Crown Soda Machine.

then move it to another machine for capping. The cap almost always leaked, rendering the soft drink distasteful. The Painter cork cap changed that and the Crown bottling and capping machine offered the first complete bottling process technology for industry.

The Crown Soda Machine of 1898 is the ancestor of all of today's automated carbonated drink mixing and capping machines. By 1902, Painter had introduced the eight-head automatic electric Crown bottling and capping machine with a capacity of 60-100 bottles a minute. The Crown Cork & Seal Company has been the leader in manufacturing soft drink bottling machines of all sizes and purposes to the present day.

The Crown Cork & Seal Company

After the 1902 introduction of the eight-head machine, the Crown company built cap-making factories in Germany, England, France, Japan, and Brazil. When Painter died in 1906, the company had a strong presence in the



Figure 7.
The Crown Company Machinery Division in Baltimore (top), and the Main Headquarters in Philadelphia (bottom).

global market. Painter's son-in-law then managed the company for sixteen years, although not particularly well. Also in this period, World War I(1914-1918) interrupted the world economy, and the supply of tin and imported cork. The passing of the Prohibition Amendment in 1919 killed the bottled beer industry, which then dominated the soft drink industry, and by 1925 the Company was on the verge of financial collapse.

Under a new company president (C. McManus), a patented cork-substitute was introduced to avoid the cost and unavailability of natural cork. Because of Prohibition only soft drinks were being processed. When the Great Depression hit late in 1929, the company diversified to include cork for car mats and engine gaskets, among other products. The company also began to manufacture tin cans for coffee, tea, biscuits, and pharmaceuticals, and acquired the "Western Stopper Company" to add the "Mason Jar Cap" products to its line. When Prohibition was repealed in 1933, the company was already growing again, and by 1936 management saw that the beer industry was shifting from glass bottles to tin cans and acquired the "Acme Can Company" of Philadelphia to move into that field. In 1937, Crown was producing 103,680,000 crown caps a day, and also introduced the quart cone-top beer can with its crown corrugated metal cap.

In 1941 the company shifted to military production for World War II, producing metal cartridge links for ammunition, antiaircraft guns, tail fins for flares, aluminum fairings for fighter planes and other products. McManus died in 1946, and by 1954 the company was once

again on the road to bankruptcy. J.F. Connelly took over in 1957 focusing on business and economics, and in 1960 the company moved its headquarters to Philadelphia where it remains today (Figure 7). The bottling machine manufacturing division stayed in Baltimore where it is still located (Figure 7).

In the 1960s and '70s growth continued for the can-making market and Crown opened many overseas can-making plants to be close to the bottling and can markets. In 1980, the company opened its own aluminum Drawn-N-Ironed (D & I) can manufacturing facility. Today the Machinery Division in Baltimore manufactures high speed stainless steel bottle- and can-filling machines (Figure 8) which can fill 2000 cans or 1200 bottles per minute. These huge, fast machines all have their origin in the simple and modest 1898 "Crown Soda Machine," the first complete machine for the soft drink bottling industry.

Article prepared by: Ameer G. Mikhail, P.E., Past Chairman, History & Heritage Committee, 1992-1993 ASME Baltimore Section

Cover (from Reference 1): Some of the soft drink and beer bottle caps of the world.

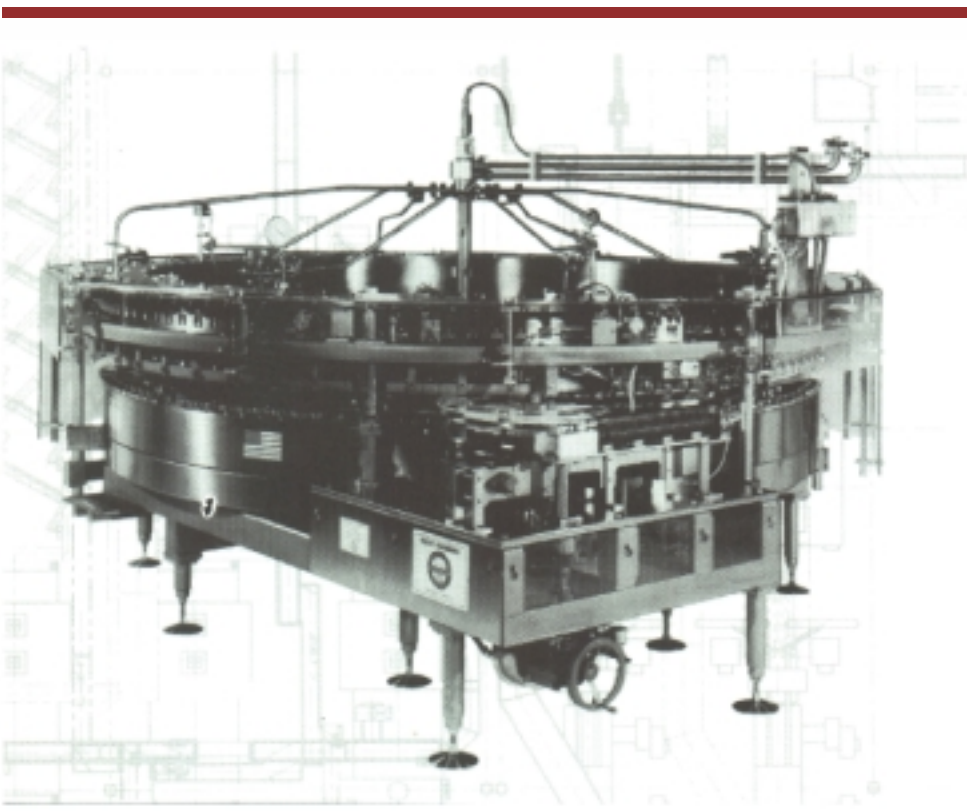


Figure 8.
The present day Crown high-speed automated soft drink/beer can filling machine.

Acknowledgments

The ASME Baltimore Section thanks Neill Mitchell and Frank Vanik, P.E., of the Crown Cork and Seal Company Machinery Division in Baltimore, for their cooperation and review of this article to ensure its historical and technical accuracy. ASME and the author also thank the Crown company for providing and allowing the use of pictures and material for this article, taken from the material given in Reference 1.

Picture Credits

The photographs of Figures 1-3, and 7-8 and the cover were taken from Reference 1. The photographs of Figures 4-6 are by Dr. Jonathan Bornstein, past chairman of the ASME Baltimore Section.

References

- 1 - *One Hundred Years*, A Company Development History Booklet issued by the Crown Cork & Seal Company, Philadelphia, Pa., in late 1991 in preparation to commemorate its 100-year anniversary in February 1992.
- 2 - *Capping a Century in Baltimore Crown Cork Thrives with No-Frills Approach*, *Baltimore Sun* newspaper, Sunday February 2, 1992.

Additional Reading

- 1 - "Form Follows Failure," by Henry Petroski, *American Heritage of Invention & Technology*, Vol. 8, No. 2, Fall 1992, pp. 54-61. An article describing the serious design challenges and development of soft-drink metallic (steel and aluminum) cans of today.
- 2 - "The Razor King," by Howard Mansfield, *American Heritage of Invention & Technology*, Vol. 7, No. 4, Spring 1992, pp 40-46. An article detailing the history and development of the "Gillette men's razor blade." King C. Gillette started his career about 1892 to Painter's Crown company as a bottle cap salesman. Gillette was strongly influenced in his thinking and design philosophy by William Painter. Gillette left Crown to establish his own career and leave his own mark in history.

The History and Heritage Program of ASME

The ASME History and Heritage Recognition Program began in September 1971. To implement and achieve its goals, ASME formed a History and Heritage Committee, initially composed of mechanical engineers, historians of technology, and curator (emeritus) of mechanical engineering at the Smithsonian Institution. The Committee provides a public service by examining, noting, recording, and acknowledging mechanical

engineering achievements of particular significance. The History and Heritage Committee is part of the ASME Council on Public Affairs and Board on Public Information. For further information please contact Public Information, American Society of Mechanical Engineers, 345 East 47 Street, New York, NY 10017-2392, 212-705-7740.

Designation

The Crown Cork Cap and Crown Soda Machine is the 41st International Historic Mechanical Engineering Landmark to be designated. Since the ASME Historic Mechanical Engineering Landmarks Program began, 163 Historic Mechanical Engineering Landmarks, 6 Mechanical Engineering Heritage Sites, and 6 Mechanical Engineering Heritage Collections have been recognized. Each reflects its influence on society, either in its immediate locale, nationwide, or throughout the world.

An ASME landmark represents a progressive step in the evolution of mechanical engineering. Site designations note an event or development of clear historical importance to mechanical engineers. Collections mark the contributions of a number of objects with special significance to the historical development of mechanical engineering.

The ASME Historic Mechanical Engineering Recognition Program illuminates our technological heritage and serves to encourage the preservation of the physical remains of historically important works. It provides an annotated roster for engineers, students, educators, historians, and travelers. It helps establish persistent reminders of where we have been and where we are going along the divergent paths of discovery.

The American Society of Mechanical Engineers

- John H. Fernandes, P.E., President
- Robert A. Ellson, P.E., Vice President, Region III
- Dale E. Woomart, P.E., Chair, Region III History and Heritage
- Thomas D. Pestorius, Senior Vice President, Public Affairs
- Erwin Fried, P.E., Vice President, Public Information
- David L. Belden, P.E., Executive Director
- Carolyn Davis, Director, Eastern Regional Office

The ASME History and Heritage Committee

- Euan F.C. Somerscales, Chair
- Robert M. Vogel, Secretary
- Robert B. Gaither
- R. Michael Hunt, P.E.
- J. L. Lee, P.E.
- Joseph P. van Overveen, P.E.
- William J. Warren, P.E.
- Richard S. Hartenberg, P.E., Emeritus
- Diane Kaylor, Staff Liaison