"The Smallest Bottle Ever Made On An Owens Automatic Glassblowing Machine"

Research Presented by Cecil Munsey

PROLOGUE

Some of the following history about Michael J. Owens and his invention of the automatic glassblowing machine comes from an unpublished manuscript and notes of the late Julian Harrison Toulouse (1899-1974).

Dr. Toulouse bequeathed an incomplete manuscript, and his notes regarding it, to me prior to his death on May 13, 1974. His plan was that when he felt the bottle collecting hobby was willing and ready to appreciate, and accept, the historical importance of bottles created by automatic bottle-blowing machines, that an article would be completed and shared with bottle collectors everywhere.

This article is my attempt, 30 years after his death, to complete his plan. Hopefully, the hobby of collecting historic bottles today is more receptive than it was in the early 1970s toward collecting automatically blown bottles - after all, such bottles are now 100 years old.

"The Smallest Bottle Ever Made On An Owens Automatic Glassblowing Machine."

The Toulouse material came to mind during a recent visit with Scott Grandstaff and Kitty Roach, founders (1990) of *Bottles and Extras* magazine.

As all bottle collectors will do, they shared their collection with my wife, Dolores, and me. The very first bottle shared was a paper-labeled miniature bottle that measured roughly 1" tall (exactly 1.071") by 1/2" wide (.254"). The obverse of the bottle featured a red label upon which is printed, in white lettering **[Figure 1]**:

A miniature Owens oval
The smallest bottle ever made
on an automatic machine.
Owens Bottles
Best for any purpose

The reverse of the bottle features a vertically embossed **OWENS**, see **Figure 2**.

I couldn't get the little miniature sample bottle out of my mind as we traveled home from our visit in Happy Camp, Calif., to the San Diego area. I kept wondering how the little bottle and Dr. Toulouse's files and history of the Owens-Illinois Glass Company were related.

The following attempt is to illustrate and explain that relationship.

Figure 1

Figure 2

Figure 3

MICHAEL J. OWENS

Michael Joseph Owens (1859-1923) invented the automatic bottle blowing machine (patents in 1895 and 1904), capable of blowing four finished bottles a second by 1904. He organized the Owens Bottle Machine Company in 1903. He received more than 45 patents for glass blowing apparatus before he died at the age of 64 in 1923, see **Figure 3**.

Recent reports reveal American manufacturers produce an estimated 50 billion glass containers annually for domestic use, averaging more than 200 containers for every man, woman and child in the United States. In addition, approximately 300 million bottles are shipped abroad.

Few people realize that this has only been the situation for the last 100 years. Fewer still know that Michael J. Owens is largely responsible for the safety, standardization, quality, and convenience of glass containers which millions of consumers around the world purchase every day.

Owens' invention of the automatic bottle-making machine in 1903 was the most significant advance in glass production in over 2000 years. The origin of glass making is lost in antiquity. After

that nebulous beginning, the people of the Eastern Mediterranean are credited with the discovery of the blowpipe in approximately 300 B.C. Methods of creating glassware changed little between then and 1608 A.D., when John Smith established a glass factory as the first industry in North America at Jamestown.

In the 19th century glassware was still produced by human skill and lung-power. Working in "shops" of three skilled glass blowers with three or four boys serving as helpers, craftsmen used a blowpipe and a few crude tools to create bottles, jars, and other glass objects.

To produce relatively uniform containers for beverages, food, drugs and other products, glass workers learned to use metal molds. For example, a bottle was produced by gathering a "glob" of molten glass on the end of a blowpipe and lowering the glowing mass into a mold. By blowing into the pipe, the glass worker formed a bubble that conformed to the sides of the mold. After the glass was removed from the mold, the neck and shoulder of the bottle were finished with hand tools.

Mechanization of the glass industry occurred in the latter part of the Industrial Revolution due to problems with the physical properties of glass and the dexterity and flexibility of the hand worker. But the increasing demand for bottles by major packaged-goods manufacturers was a strong stimulus to develop a mechanical means of producing glassware.

Inventors in the United States, the United Kingdom, France, and Germany tried to create a bottle-making machine. The earliest known bottle-making machine patent, dated March 17, 1859, was issued to Alexander Mein of the United Kingdom. British inventors Josiah C. Arnall, H. M. Ashley, and J. R. Windmill, as well as Americans Philip Arbogast, and Thomas B. Atterbury, all patented semi-automatic bottle machines in the late 1800s.

Each of these machines required three skilled workmen and two boys to operate. Although the designs were not completely commercially successful at first, the development of the semi-automatic machines continued. Their popularity grew as the number of workers necessary to operate them was reduced and the rate of production increased. Only 20 machines were in operation in 1897, compared to 250 eight years later.

The Owens machine was the logical extension of the semi-automatic machines. Michael J. Owens, whose inventions were financed by Edward Drummond Libbey, produced the first commercially successful, fully automatic bottle-making machine in 1903, a goal towards which inventors had been working for more than 40 years. His machine could make bottles quicker, cheaper, and better than the semi-automatic machines.

Owens had already developed semi-automatic machines to manufacture light bulbs, drinking glasses, and lamp chimneys. However, all of these machines still required that the glass be gathered by hand for each piece and on a separate blowpipe, just as in the old hand practice.

In 1899, Owens turned his attention to the biggest challenge of all–a fully automated machine. The greatest obstacle was finding a way to machine-gather the glass in the proper quantities. His ingenious solution christened the "bicycle Pump" **[Figure 4]** because that is what it resembled both in form and function, gathered the glass by suction.

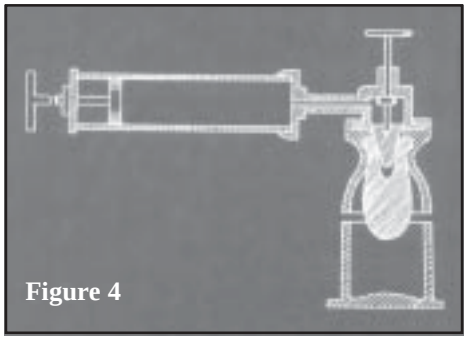


Figure 4

Withdrawing the piston rod on the crude hand pump created a vacuum that sucked up a charge of glass into a mold that formed the neck of the bottle. Suspended by the neck, the gather was then placed in a body mold, where the return stroke of the plunger blew the glass into the proper shape.

The first attempts to blow a bottle with the "bicycle pump" yielded distorted "freaks," but successive tries produced a perfect four-ounce petroleum jelly jar **[Figure 5**]. With the principle proven, work proceeded on the construction of a complete machine.

In 1903, the machine and a specially designed revolving gathering "pot" were ready for trial. The machine, called "number 4," had five of the "bicycle pumps" known as heads or arms mounted on a circular rotating frame. Each of these heads was a complete unit that dipped individually to suction up its gather of glass as it passed over the pot. Each head carried a blank mold, a neck mold and plunger for forming the neck, and a finishing mold.

Figure 5

In its first test, the number "4" made eight pint beer bottles (example: **Figure 5**) in a minute. What was remarkable about the test was not only did the machine make a satisfactory bottle but a narrow-necked one. Previously even the semi-automatics were confined to the production of wide-mouth ware.

The first commercial model, offered in 1905 for production and license, was the "A." This design used the experience gained in production runs and demonstrations of the number "4." The model "A" carried six heads each with the same blank mold, neck mold and plunger, and finishing mold of the number "4" but the "A" was built much more ruggedly. Stationary cams attached to the framework operated the parts. The entire revolving machine oscillated up and down each time when a head came in contact with the molten glass to suction another gather.

The "A" machine could manufacture twelve pint bottles per minute or 17,280 in a 24-hour period. This compared with approximately 2,880 produced in a day's

Figure 5

time by a shop of six men and boys. The machine was operated by two men on 12-hour shifts at a cost of 10 to 12 cents per gross. Hand blown bottles cost $1.80 per gross to produce.

Producing bottles in such large quantities required a new method of annealing, or tempering. Bottles allowed to cool too quickly shatter easily; the function of an annealing lehr is to provide a controlled environment where the glassware cools gradually. Instead of boys carrying the bottles to the lehr, an automatic conveyor was devised. The finished glassware was discharged onto an automatic conveyor, and slowly passed through a long heated tempering oven.

After the machine had been kept in operation long enough to insure that it was a commercial success, Libbey, Owens, William S. Walbridge, Clarence Brown, and Frederick L. Geddes formed the Owens Bottle Machine Company for the purpose of building and licensing bottle-making machines. They also applied for the patent rights in all of the countries outside the U. S. where glass was made, and formed the Owens European Bottle Machine Company in 1905 for these international operations.

Within a few years, Owens machines were in production in England, Germany, Holland, Austria, Sweden, France, Denmark, Italy, Norway, Hungary, Scotland, Ireland, and Japan. Patent rights had also previously been sold for Canada and Mexico.

The "A" model remained the standard until 1908 when the "AC" model was developed. The 1909 "AD" model was the first to have 10 heads. The "AL" model was built in 1909 and rebuilt in 1911. The "AE" model was built in 1911.

In 1912, an entirely new design, by Owens and Richard LaFrance, the "AN" model was introduced. The new "diphead" model had 10 arms and produced bottles ranging from a fraction of an ounce to around eight-ounce capacities. The improved design increased the speed of the machine to an average of 50 bottles a minute, or approximately 72,000 a day, with a maximum of 86,400 a day for half-ounce bottles.

Also designed and built in 1912 was the original "AR" machine. It was an enlargement of the "AN" model. It entirely replaced the outdated "AD" and "AE" machines. The "AR" design was enlarged to accommodate 15 arms, resulting in the "AQ" machine in 1914.

Between the years 1905 and 1926, 317 Owens bottle-making machines were put into production, with 64 shipped abroad. This included models "A," "AC," "AD," "AE," Al," "AN," "AQ" and "AV." In addition, 119 "AR" machines **[Figure 7**] were manufactured between 1912 and 1941, with 28 shipped overseas.

In 1923, just 20 years after the successful trial of the number "4" machine, a study commissioned by the National Association of Bottle Manufacturers reported that 94 out of every 100 bottles in the U. S. were being made by machinery–either semi-automatic or automatic.

The Owens machine not only revolutionized the glass industry, but had a great impact on society. The bottle-making machine drastically reduced the price of glass containers, making them readily available to the public for packaging and preserving food and beverages, pharmaceuticals, household cleaners, and other products.

The Owens machine made a superior quality product, producing glass containers that were more uniform in weight and content than those made either by hand or semi-automatic machines. This had two far-reaching effects. First, the government was able to establish standard specifications and requirements through the Pure Food and Drug Administration that helped safeguard health as well as guaranteeing a specific measure of product in the container. In addition, the uniform height and capacity of the Owens-made bottles allowed high-speed packing and filling lines to be developed.

Perhaps most importantly Owens' invention also ended child labor in the glass industry. The long apprenticeships and carefully guarded trade secrets of glass blowing made it one of the most highly paid crafts of the nineteenth century. To reduce costs, glass manufacturers hired boys to assist the skilled workers. In 1880, when glass blowers were earning $200 a month, 6,000 boys between the ages of 10 and 15, constituting one quarter of the total work force, worked 10-hour days for as little as 30 cents a day.

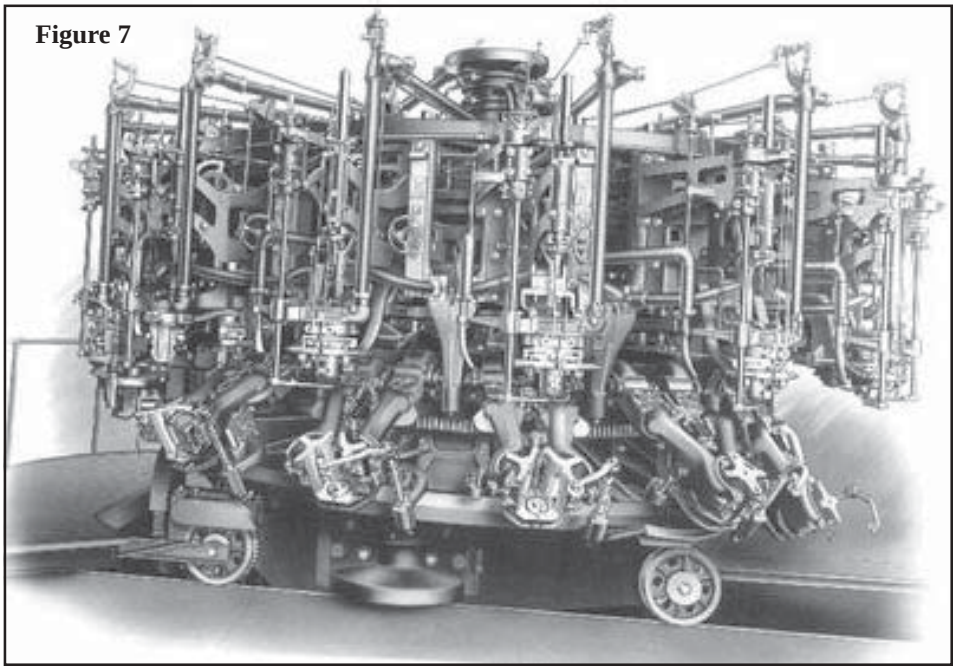
EPILOGUE & TOULOUSE RESUME

Dr. Julian Harrison Toulouse was born in Marne, Iowa in 1899. He served two years in the U.S. Navy during World War I (1917-1919). He earned his bachelor's degree in 1926 from Iowa State University and a doctorate degree in 1929 from the same institution. Both degrees qualified him as a chemical and glass engineer.

He first became interested in bottles in 1931 when he opened and headed a research and service laboratory for the **American Bottlers of Carbonated Beverages** in Washington, D.C. It was during his four-year tenure with this firm that he began to collect bottles "...for scientific reasons."

In 1935 Owens Illinois Glass Company employed Dr. Toulouse in Toledo, Ohio. He worked with this firm until his retirement, because of health reasons, in 1958. Throughout his long and distinguished career as a glass engineer he continued to collect and study bottles. His position as

Figure 7



Chief Engineer and Manager of Quality Control and Operations Research for Owens Illinois Glass Company gave him the opportunity to collect and study bottles even more and it was his collection and knowledge that he drew information for his later writings for bottle collectors.

Dr. Toulouse was especially proud to have been selected as Chief of the Glass Container Section of the **War Production Board** in Washington, D.C. during World War II. He was designated as what was then prestigiously called a "dollar-a-year-man," which meant that he was on loan from Owens Illinois for a dollar a year for the duration of the war.

In 1958 just before his retirement he was named "Engineer of the Year." After his retirement he consulted with glass manufacturing firms throughout the United States and other areas of the World.

He was a "Fellow" in numerous national and international scientific organizations. He was listed in a number of "WHO'S WHO" books. He was a member of several bottle collecting clubs and the Federation of Historical Bottle Collectors, and was very active in **GLASFAX**, a group devoted to research of Canadian glassmaking history.

Throughout his career and his active retirement he wrote over 300 technical and historical papers for glass industry and hobby periodicals. He was a regular contributor of bottle collecting articles to **Western Collector** magazine and **Spinning Wheel** magazine.

Dr. Julian Toulouse will probably be remembered mostly by serious bottle collector/historians for his pioneering book on fruit jar history and his second book dealing with bottle makers and their marks which has become a mainstay for anyone involved in identifying and dating bottles. Both of his books (listed below) and articles important to bottle collecting (also listed below) are the result of 40+ years in the glass industry and over 35,000 miles of travel to all parts of the world for research. Many of those miles were expended in the United States visiting bottle collectors and studying their collections. He also lectured to bottle collector clubs throughout the nation.

CONSULTANT

1972 Owens Illinois Glass Company classic **"Bottle Re-Creation Program"** (with Mr. Charles B. Gardner, Dr. Cecil Munsey, and Dr. Kenneth Wilson).

BOOKS

1969 **Fruit Jars**, Thomas Nelson & Sons, Camden, New Jersey (542 pages)

1971 **Bottle Makers and Their Marks**, Thomas Nelson Inc., Camden, New Jersey (624 pages)

MAGAZINE ARTICLES

1939 "**Bottles Applied Color Labels**," *First Annual Blue Book of the National Carbonator and Bottler*, (February 1939).

1966 **"Whittled Molds,"** *Western Collector*, (October 1966).

1968 **"Empontilling: A History**," *The Glass Industry*, (March-April 1968).

1968 **"The Men Behind the Fruit Jar**,**"** *Spinning Wheel Magazine*, (September 1969).

1969 **"A Primer on Mold Seams**, **Part I**, **"** *Western Collector*, (November 1969).

1969 "**A Primer on Mold Seams, Part II**," *Western Collector*, (December 1969).

To help readers determine approximate bottle age, "Age Identification Mold Seams of Bottles," chart is offered here as **Figure 8**. [Reprinted with permission from "MERCHANTS OF MEDICINE" by Dr. Dewey R. Heetderks (see reference below).]

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Cecil Munsey
13541 Willow Run Road
Poway, CA 92064-1733
(858) 487-7036
cecilmunsey@cox.net

Figure 8