The 1 millionth Frigidaire refrigerator is proudly displayed as it comes off the assembly line in Dayton, Ohio, in 1929.

Keeping Cool

The refrigerator evolved from an expensive and dangerous appliance to a household necessity

BY EUGENE FINERMAN

Early in the 20th century, when most physicists were engrossed by the discovery of the atomic structure or theory of relativity, Frenchman Marcel Audiffren was concerned with temperature variations in wine cellars. So he designed an appliance that chilled wine at a consistent temperature.

Audiffren's work was based on the principle that heat is drawn toward cold. Ice attracts and dissipates the heat in a surrounding space. Of course, the ice melts and overall temperature gradually increases. To combat this law of nature, Audiffren used an engine and a compressor to create a steady flow of coolant through pipes in an insulated cabinet. The cabinet's temperature could be controlled by regulating the coolant's flow.

General Electric was interested in Audiffren's machine and redesigned it to preserve perishable food. In 1911 GE introduced the Audiffren Refrigerating Machine. It was an extravagance—costing $1,000 when the average American's salary was $750 a year. Aside from its intimidating cost, the machine was a behemoth. It consisted of three separate components: the "cold box," a steam engine and compressor. The engine and compressor were installed in the basement under the kitchen. The machine also used a toxic gas, sulfur dioxide, as the coolant; leaks were a serious hazard.

In 1911, the icebox was the standard for keeping food cool and half of America's households had one. The traditional icebox was the size of a small cabinet with a single block of ice at the top or bottom. As the ice slowly melted, the icebox's interior temperature varied and increased the risk of spoilage. But in those days, no one expected food to have an indefinite shelf life—people just didn't want it to spoil overnight. The icebox inexpensively served that purpose.

But not for long. In 1916, Alfred Mellowes built the first self-contained refrigerator. Its electric engine, compressor and cold box were built into a single unit. General Motors was so impressed that it bought Mellowes' invention in 1918, and began a refrigerator division called Frigidaire.

By the mid-1920s, mass production and a competitive market had lowered the price of refrigerators, but a formidable problem remained. Refrigerators ran on electricity and less than one-third of American households had that utility.

And refrigerators were still dangerous: Leaking toxic coolants caused several deaths. But in 1930, when DuPont introduced Freon, a non-toxic coolant, the refrigerator became safe. By the end of the decade, 2 million American households had one. That, however, was less than 10 percent of the population. A decade-long Depression had discouraged sales. Then, World War II literally stopped the manufacture of refrigerators. But when the war ended, everything changed.

Every veteran was entitled by the G.I. Bill to decent, affordable housing. In 10 years, 15 million new homes had been built and each had a refrigerator. By 1955, 80 percent of U.S. households had one and the rest of the world noticed. But other countries were not so quick to adopt the American phenomenon. In fact, in 1963, only 30 percent of Italian households had refrigerators.

In the past half-century, however, the refrigerator has become a standard item in homes throughout the world. A refrigerator can now be found in virtually every kitchen in the United States, Europe and Japan, and even, according to a 2004 *AgExporter* article, in 90 percent of urban Chinese households. After an unwieldy and dangerous beginning, the refrigerator has solidified its place as a necessity in our lives.