The Commercial Evaporator an American Innovation in Drying Apples: The First Fifty Years—1864-1914

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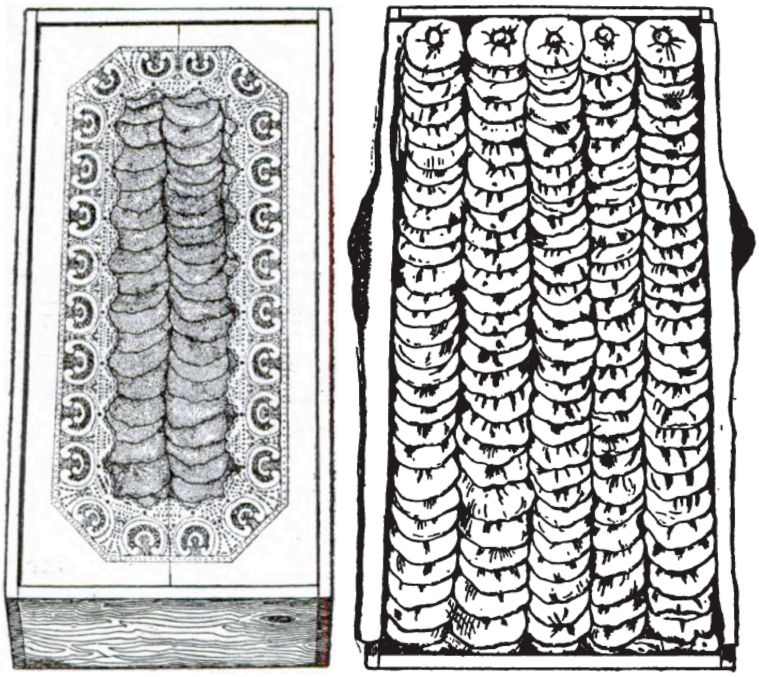

Fifty Pound Boxes of Fancy Evaporated Apples (Gould, 1907)

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Introduction

In a time span of less than half a century the American fruit drying industry grew at a dramatic rate and was considered, "one of the industrial phenomena of the times" (Hendrick, 1914, p. 1177). Evaporated apples played a significant role in these phenomena. The invention and perfection of the American evaporator transformed the dried apple industry into a commercial enterprise. This transformation was achieved through two avenues: the development of a mechanized, fruit drying process that could handle large volumes of apples and a product that was more appealing to the consumer. Many farmers could afford to build an evaporator, allowing apple drying to remain, in one sense, a home industry. The economic impact of the evaporator can be gauged by the proliferation of evaporators, invention of processing equipment, and significant increase in U.S. dried apple exports.

The Evaporator

Sun-drying and using heat generated from a stove in the kitchen or dryhouse were the only methods used to dry apples until the invention of the evaporator. Dryhouses were built tight to hold in heat while evaporators used hot air circulation to dry apples (Snyder, 1912). David Lippy and Samuel Linn of Mansfield, Ohio initiated the age of evaporators when they were granted a U.S. patent for their improved fruit-drying oven on September 20, 1864 (Lippy and Linn, 1864). Cabinet evaporators, designed to be placed on a home stove, and simple portable designs equipped with their own heater, proliferated after Lippy and Linn's invention (Warren, 1917, p. 174). Two basic designs for constructing a building-sized commercial evaporator were perfected in the late nineteenth century.

Elam Hatch is credited with constructing the first commercial tower evaporator near Webster, New York around 1873 (Favor, 1913, p. 7). Interestingly, Webster would

become the center of the apple drying industry in Western New York (Fraser, 1912, p. 10). Tower evaporators consisted of chimney-like structures made of wood or brick that extended from the basement of a building to a point higher than the roof. A stove or furnace provided heat that moved up the chimney. A cage fitted with screens gradually lifted and dried apples through the chimney (Warren, p. 176).

By 1890 commercial kiln evaporators were in operation. The kiln evaporator was a two-story building constructed of brick or wood (fig 1).

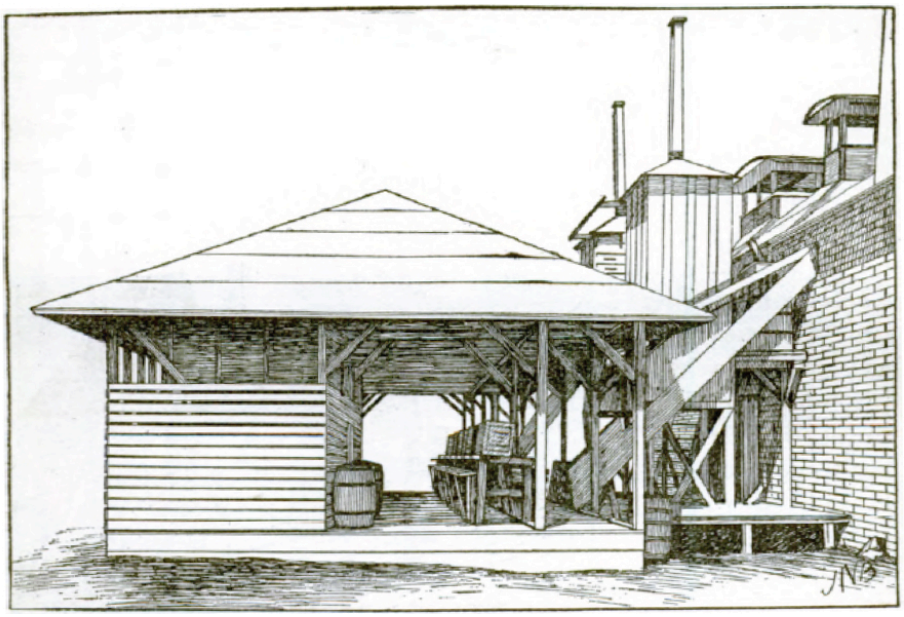

Figure 1: Paring shed and bleachers of a brick Kiln Evaporator (Gould, 1907)

The first floor housed a furnace with pipes that circulated heat in a room typically 18 square feet. The 12-foot ceiling of the furnace room was the slotted-kiln floor on which apples were spread to a depth of four inches. As heated air passed through the slotted-floor, the apples dried (Favor, p. 38). The circulation and convection of air, along with the release of moisture, were controlled by vents on the walls of the furnace room and roof of the kiln room. Apples waiting to be processed were stored in outside bins or

grassy fields. The processing of apples in commercial evaporators involved several steps (Favor pp. 7, 38 & 39; Warren, pp. 175 & 176).

1. Fruit was brought inside a paring room in which a battery of parers was run by power or by hand. Apples were trimmed of extra skin and blemishes by hand.
2. The apples were fed through an automatic slicing machine forming rings a quarter inch in thickness. Sometimes apples were left whole or sliced in quarters.
3. The fresh sliced apples were exposed to the fumes of burning sulfur or washed in a sulfur solution to bleach the apples so that they would not turn brown. In large evaporators bleaching often occurred before slicing (Fraser, p. 11; Gould, 1907, p. 28).
4. Apples dried on the kiln floor for roughly 12 hours (usually at night). Men carefully monitored the drying apples, turning them over with wooden shovels every two to three hours to ensure uniform drying. Dried apples were gathered and allowed to "sweat"—sit to let moisture in the mass of apples to become more uniform.

In California, the dry weather reduced the need for commercial evaporators and, as a consequence, the apples were exposed to sulfur fumes and then sun-dried. California apples processed by dry weather were marketed as "evaporated" instead of "sun-dried" because they had the same appearance as apples dried in an evaporator (Barrows, 1917, p. 165).

Many evaporators were designed with separate rooms connected by a network of belts and lifts so that apples could be moved to workers in an automated fashion (Gould, pp. 8-16). Women and girls typically ran the parers, slicers, and then packed the apples for shipment, (fig 2). In 1913, Favor reported that girls at the Chastain & Goddard evaporator in Bentonville, Arkansas were paid four cents a bushel for running the paring machines by hand (Favor, p. 40). The skins and cores were also utilized. Skins were dried and sold for the production of jellies and apple butter, while cores were sold for the making of cider, vinegar, and even champagne (Favor, p. 39; Fraser, p. 11).

Figure 2: Women using Triumph apple parers at Carson's evaporator (Favor, 1913)

The commercial evaporator was primarily developed as a way to make a profit from low-grade or surplus fruit. Although fresh apples were worth much more than dried apples, the percentage of a crop that could be sold as fresh varied from year to year. In a well-managed orchard, a third of the crop might be of high enough quality to be sold as fresh (Fraser, p. 10). *The Evaporator* reported that in May of 1913, in Rochester New York, fresh, cold-storage Baldwin apples were bringing $2.75 to $3.50 per pound, while dried apples realized a mere 5½ cents per pound (Packer, 1913, p. 19).

The value of dried apples depended upon the quality of apples and the evaporation process. Commercial grading of evaporated apples was based primarily on appearance and included three grades: fancy (the highest quality), choice, and prime. Evaporators preferred apple varieties that had firm textures and bleached white—Baldwin and Ben Davis were popular for these reasons (Gould, p. 26). From 1904 to 1909 the average

price of dried apples rose from 4.3 to 6.9 cents per pound (Fraser, p. 9). Pennies per pound for a product that required intense work may not seem like much, but the market for evaporated apples was robust.

The consumer came to favor the white evaporated apples over the brown sun-dried apples of the past (Fraser, p. 10). The demand for evaporated apples was very strong both at home and abroad (Rice, 1891, pp. 19 & 20). Consequently, evaporators became as common as barns in some areas of the eastern United States (Warren, p. 174). The New York Apple Belt that stretched from the Niagara River to Oswego along the southern shores of Lake Ontario produced Seventy-five percent of evaporated apples in the United States (Favor, p. 7). The vastness of the industry is reflected in the fact that Sodus, New York with a population of just 1,000, supported 400 evaporators (Fraser, p. 12).

In Fraser's 1912 article he notes that California was second to New York in dried apple production followed by Michigan, Arkansas, and Illinois. Oregon and Washington in the Pacific Northwest were predicted to become major players as well. Evaporators employed thousands of workers and their productivity fed a growing market for the export of U.S. dried apples (fig 3, data tabulated from Taylor, p. 344; Olmstead, pp. 40 & 41; Rowley, p. 7). Furthermore, because fruit growers operated this industry locally, men, women, and children living in the surrounding communities benefited financially (Rice, p. 19).

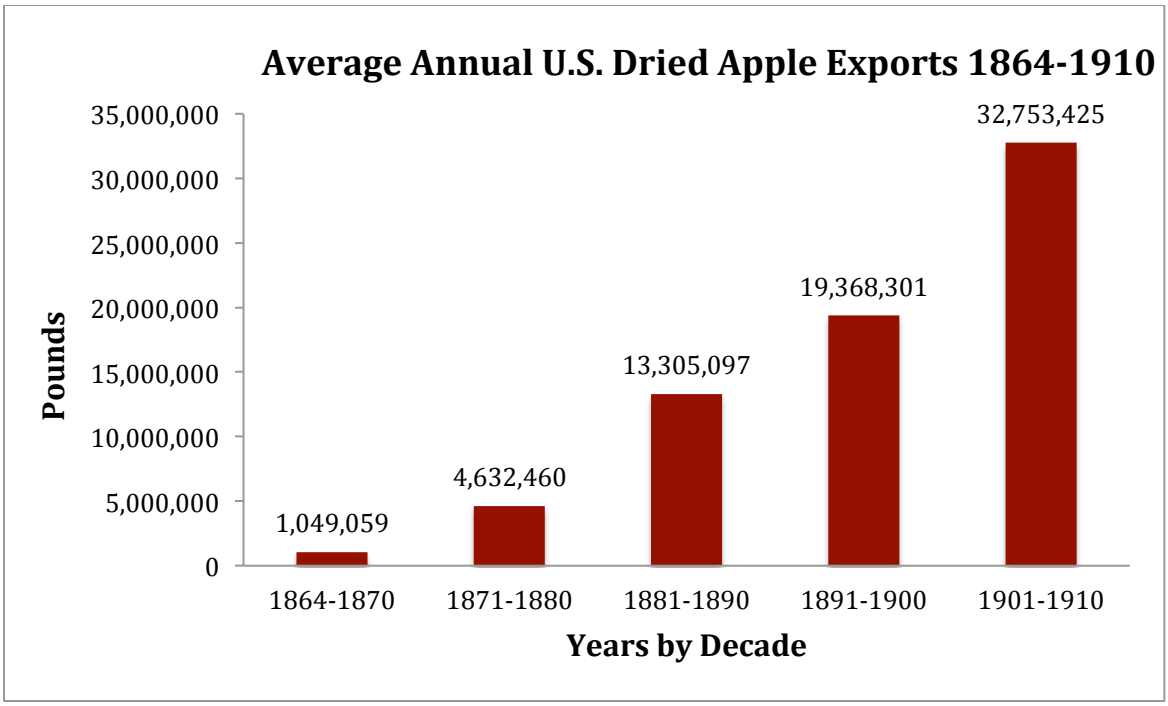

Figure 3: Average Annual U.S. Exports of Dried Apples by Decade, 1866, 1867, and 1868 originally reported in bushels (25 lbs.) (Olmsted, p. 40)

Rice (1891) contemplated the capacity to employ workers and produce dried apples by considering an evaporator that processed 200 bushels of fresh apples per day (pp. 18 & 10). A 200-bushel capacity evaporator would require four parers, eight trimmers, two spreaders, one bleacher, five tenders, one foreman, and two night-workers; 25 hands in all. The product would be around 1,200 pounds of white, dried apples per day, requiring roughly 1,200 pounds of coal and 20 pounds of brimstone.

We can extend Rice's thought experiment and estimate a seasonal capacity for this evaporator to be approximately 72,000 pounds of dried apples in 60 days; as the evaporation of apples was seasonal, work typically lasted 10 weeks. In 1898 E. McAlpine & Son evaporator of Starkey, New York was reported to have processed 10,000 bushels of apples, equivalent to 60,000 pounds of dried apples, employing 15 to 20 people (MacAlpine, 2005) (fig 4).

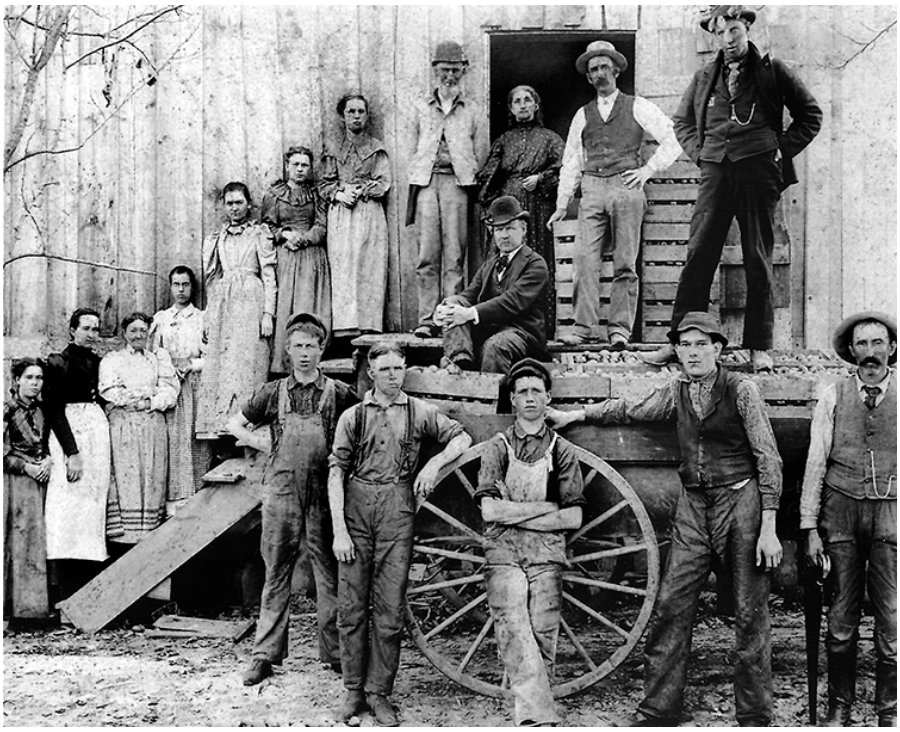

Figure 4: E. McAlpine & Son Evaporator, Starkey, New York 1905, photo courtesy of Rich MacAlpine.

Although lucrative, the evaporator was faced with many challenges such as financing, fires, weather, competition, and laws enacted by government agencies designed to ensure quality and protect the consumer. New York required that evaporated apples contain no more than 27 percent water—the only state to have such a law at that time (Fraser, p. 11). Evaporated apples from other states often retained 30 to 40 percent of their water content, making them less expensive to produce, but more prone to spoilage. Apples typically contain 85 percent water by weight and the ideal dried apple was thought to retain only 20-22 percent (Fraser, p. 11). Case (1895) warned that those who brought evaporated apples of poor quality to market placed the entire apple evaporated industry in jeopardy (pp. 704-808). Germany required imported apples to have not been dried on zinc or galvanized screens as the apple acids caused some of the zinc to be taken up by the apple (Rice, pp. 20 & 21). Evaporators constructed of wood were fire hazards (Billinge, 1914, p. 15).

Entries from the McAlpine family diaries indicate that their evaporators were lost to fire on at least three occasions. Each year Ezra McAlpine leveraged his farm to secure bank loans that were paid in full by the end of the apple-drying season. In 1917, a hard October frost damaged apples stored on the lawn so extensively that the local bank took over the farm when the loan could not be paid (MacAlpine).

Market for Evaporator Appliances

The perfection of the commercial evaporator in the 1870s and its subsequent proliferation triggered innovation and economic opportunities for the manufacture and sales of apple processing equipment. Evaporator appliances included: paring tables, paring machines, bleachers, sulfur stoves, slicing machines, heating apparatuses, fuel, crates, trays, racks, paring knives, etc. (Gould, pp. 18-25). Companies such as Boutell, Coons, Goodell, Evans, Hurley, Hunt, Trescott, J. W. Hallauer & Sons, and Fruit Machinery, to name a few, ran full-page lavishly illustrated ads in *The Evaporator* and other periodicals. Many companies also published testimonials from satisfied customers.

Conclusion

Transformation of the domestic fruit drying industry from one that met local needs to one that met regional and even global needs occurred in a brief amount of time—less than half a century. Perfection of the American commercial evaporator that employed factory-like mechanisms to dry apples on an industrial scale catalyzed this transformation. The ability to process large amounts of surplus fruit as well as transform low-grade fruit into a valued product made American evaporators an economic force both locally and abroad. The commercial evaporator spurred innovation and economic opportunities in both Canada and the U.S. for the design and sales of equipment needed to operate industrial-sized apple drying facilities. An appetite for

American evaporated apples abroad created a lucrative U.S. dried apple export. Since construction and operations of evaporators were within the means of farmers, this commercial enterprise remained a homegrown phenomenon that lasted for decades, employing men, women, and children living in local communities.

Endnote

The following information was used to calculate dried apple production from 200 bushels. A bushel of fresh apples was considered to be around 50 pounds. After paring and coring a bushel, one was left with 35 pounds of fresh apples. When dried, the 35 pounds yielded an average of 6 pounds of dried apples (Fraser, p. 11). America's transportation infrastructure of roads, canals, and railways grew at a phenomenal rate during the 19th century and was a key factor in providing farmers access to regional and even global markets—a key factor not explored in this work.

Acknowledgments

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