The Civil War, The Ice Trade, And the Rise of the Ice Machine

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Kevin Bair
Introduction

This paper argues the origins of the artificial ice trade was triggered by the Union Naval blockade of the American Civil War (1861-1865), thus causing the slow death of the long-established natural ice trade (1805-1950’s). By the time of the Civil War, southern ports had been accustomed to and dependent on having natural ice for their daily living. This included iced meats, fish and vegetables; and also ice needed for breweries, bars, restaurants, and hospitals. This frozen gold was shipped from men like Frederic Tudor (September 4, 1783 – February 6, 1864) and his successful Tudor Ice business. To substantiate this, a bit of background information on the natural ice trade and early attempts to manufacture ice, is needed before the ramifications of the blockade are discussed.

Fredric Tudor

Fredric Tudor, in 1805, built his business from the ground up. He created the first ice trade shipping company in Boston Massachusetts. His first shipment of 130 tons of ice was in February 1806, to St. Pierre, Martinique. Mr. Tudor was known to be ruthless in his business practices and became known as “The Ice King”. He built a multimillion-dollar industry in an overlooked area; a venture of folly to some. His way of conducting business gained him infamy as America’s first monopolist. By the mid 1850’s competition was a problem for
Tudor, but due to his status as a “First Mover” and his shrewd business practices, he controlled much of it through harsh price reductions to regulate the ice trade, especially in southern cities, such as, Charleston, Savannah, and New Orleans. The vast control of the cold supply line, via monopolies, allowed Tudor to sell ice for as much as $0.25 per pound in Cuba, and as low as, six to eight cents per pound in the southern cities. Tudor would set his price at a penny a pound and leave it there as the competitor’s unsold supply melted away at the docks. His next move was to then raise the price to a lucrative level. This slash the price and hold strategy forced many of his competitors out of business.

According to Alfred D. Chandler, Jr., “First Mover[s]” were leaders in exploiting the cost advantages of scale and scope, but they had a head start in developing capabilities in all functional activities—production, distribution, purchasing, research, finance, and general management.

One of Fredric’s business motives was to establish a Path of Dependency on his ice for merchants and the public. Fredric saw this early and outlined a plan in his personal ice diary. He stated,

It becomes necessary to establish with one of the most conspicuous bar keepers a jar and give him his ice for a year...Thus when people are able to get cool drinks for the same price as warm, the prejudice against cold drinks will be overcome... The object is to make the whole population use cold drinks instead of warm or tepid and it will be affected in the course of three years. A single conspicuous bar keeper having one of the jars and selling steadily his liquors all cold without an increase in price, render it absolutely necessary that the others come to it or lose their customers – they are compelled to do what they could in no other way be induced to undertake.

Figure 2, listing foreign port of calls along with the ice tonnage delivered by Tudor ships in 1852.
We know this strategy worked as Tudor’s business eventually extended throughout the Gulf of Mexico and the Caribbean; the first ice cream ever eaten in Calcutta was fashioned from Tudor’s Massachusetts ice in 1833. By 1847, with his ships in most climates, Tudor helped to expand the consumption of ice year-round, thus building a pathway for an ice addiction-dependency. The Freeman’s Journal in 1849 reported Tudor’s domestic ice trade in 1820 sold 300 tons of ice to New Orleans; in 1851, they received 30,000 tons of ice, and in 1847, the Boston area used more than 50,000 tons, which was shipped in 258 boats. Additionally, it reported, shipments to foreign ports consisted of 95 boats and more than 20,000 tons. Moreover, it stated, shipping ice cost an average of $2.00 per ton in 1847. In Havana that same year, ice sold for 6 ¼ cents per pound with 1,112 tons consumed, New Orleans’ price was set at 3 cents per pound – 28,000 tons, while Boston used 27,000 tons, with an average price of 13.5 cents per hundred pounds. It cost the natural ice owners $54,764 to harvest and transport their product which grossed $72,200, resulting in a net of $18,135. Additionally, in 1817 and 1818, Tudor arranged domestic contracts with Charleston, S.C, and Savannah, GA, and with...
New Orleans, LA in 1820. In 1833, he made his first shipment of ice to Calcutta, then to Bombay, Madras, and other parts of India and China. One of Tudor’s early contracts was in 1807 with the Spanish Government, for sole distribution rights in Cuba. Cuba’s first icehouse was built in Havana.

Figure 6 is of the Tudor wharf Charlestown, Massachusetts.

Figure 3.

Tudor wharves in Charlestown, Massachusetts. Photo Credit: Marc W. Herold

Tudor and his forward-thinking mind changed the world’s desire for ice. In response to this new high demand consumable, the Ice Trade industry was slowly created. To grow beyond a single business, the industry spent millions of dollars in building the proper infrastructure to harvest, ship, and store ice. Along with its growth, it created thousands of supporting jobs and businesses as it became the ice supplier both domestically and internationally. Bahman Zohuri states, *The ice trade revolutionized the U.S. meat, vegetable, and fruit industries, enabled significant growth in the fishing industry, and encouraged the introduction of a range of new drinks and foods.*

The data in Table 1 was prepared by Frederic Tudor in 1857 and demonstrates his company’s slow start in the ice trade. Chart 1 is of the tons shipped.

<table>
<thead>
<tr>
<th>Years</th>
<th>Number of Cargoes</th>
<th>Quantity in Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1806</td>
<td>1</td>
<td>130</td>
</tr>
<tr>
<td>Year ending</td>
<td>Year ending</td>
<td>Year ending</td>
</tr>
<tr>
<td>------------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td>June 30,</td>
<td>June 30,</td>
<td>June 30,</td>
</tr>
<tr>
<td>1848</td>
<td>1849</td>
<td>1850</td>
</tr>
</tbody>
</table>

$75,547     $95,027     $107,018    $106,805    $161,086    $175,056

Table 2 – Ice Exports

Chart 2 – Ice exports

Tudor had to create an entire industry from the ground up. Decisions had to be made on how to minimize loss in the ice supply chain. Better insulated boats and better insulated cold storage designs were needed to conduct business in warmer climates. New ice production tools were invented to speed the harvesting, lifting, and hauling of the ice to and from the ships.

The ice business supplied ice for the wealthy, icehouses, meat packing plants, fish markets, ice packed ships and railroad cars, the brewing industry and many more big and small enterprises.
It supplied ice to anyone who could afford to buy it. Fredrick knew what people wanted, or at least what he wanted them to want. An example of how ice was already incorporated into Southern society can be found in the May 15, 1805, edition of *The Charleston Daily Courier* (Charleston, South Carolina), (Figure 5), where it announced:

**Figure 4, Ice Cream ad, The Charleston Daily Courier (Charleston, South Caroline), 03 15, 1805:**

3.

Another ice advertisement is from the July 4, 1806, *The Charleston Daily Courier* (Charleston, South Carolina), where it announced,

*To be had every day at the Vauxball Garden. ICE, at 7 pence per pound, to be had from 9 o'clock in the morning until into the evening. THIS DAY, ICE CREAMS to be had, of three different qualities – such as Vanilla, Pine-Apple, and Orange-Flower.*

The ad also stated that you needed to make reservations for the ice and to bring a *bit of flannel* to preserve it. Tudor and others like him were ice pushers and the Southerners with their hot and humid climate were especially ice dependent.

**Dr. John Gorrie**

A decade before the Civil War there were several attempts by varied individuals to make artificial ice, but none were deemed practical or successful, that is until 1849, when the *Scientific America Journal, Vol. 5,* reported in a small article an ice making machine created by a Dr. John Gorrie (October 3, 1803-June, 16, 1855) of Apalachicola Florida. In discussing its construction, the article states,

*The materials employed [to construct] are every where very- cheap ones of air and water, ... it must be apparent upon the slightest reflection that ice can be manufactured at a comparatively low cost. ... production of ice, within the tropics, at a less price than it can be imported from nature’s.*
Furthermore, on May 6, 1851, the U.S. Patent Office of New Orleans, Louisiana, issued patent no. 8080 to John Gorrie for his machine designed “to convert water into ice artificially by absorbing its heat of liquefaction with expanding air.” Additionally, the U.S. patent rights were protected for 14 years from date of his patent submission which was August 22, 1850, thus the intellectual rights were protected until 1864. For various reasons outside the scope of this report, he could not obtain financial backing. He died in 1855 without having manufactured a full-scale machine. For this paper’s argument, it is important to know the following details.

According to world renown botanist Dr. Alvin Wentworth Chapman (September 28, 1809 – April 6, 1899), and the 23rd Justice on the Supreme Court, Justice George Raney (October 11, 1845-January 8, 1911), and Mr. John Sharon, all residents of Apalachicola, confirmed, on July 14, 1850, during a Bastille Day celebration at the Mansion house, owned by Mr. Sharon, Gorrie demonstrated the ice machine to Monsieur Rosan, a cotton broker and the French Consul for the Port of Apalachicola. The men independently stated Rosan was delighted and took great interest in the apparatus and worked alongside Gorrie for some time in perfecting the machine.

Furthermore, it was reported, Rosan left for France within two years after seeing how Gorrie’s machine made ice and, at some point, Rosan had communications with Mr. Ferdinand Carré.

Moreover, in 1858 Carré developed his own mechanical ice making machine very similar to Gorrie’s, but with significant improvements, such as using liquid ammonia, instead of water, as his active agent. His machine successfully made blocks of ice and he was awarded a French patent for his invention in 1864 and it became the world standard for the next decade.

Naturally, the year the patent was awarded coincides with the year Gorrie’s patented expired.

**The Civil War and Ice Contracts**

To further explore the important role ice played in the Civil War and to the south this paper looks to The Medical and Surgical History of the War of the Rebellion. (1861-65) Vol. I, Part III. This section describes how the federal government established contracts for ice to be supplied to Union soldiers and hospitals, especially in the South. It states,

*The per diem allowance for each patient in hospital south of the latitude of Washington, D. C., was fixed at one pound: north of that latitude at half a pound. The ice procured in this manner during the years 1862, 1863, 1864 and 1865 amounted in the aggregate to 48,661 tons. The vast quantities*
purchased from the hospital funds by the general, post and regimental hospitals throughout the country are not included in this statement. [18]

Although, 48,661 tons seems to be a small amount, the last sentence is the important one, “The vast quantities purchased from the hospitals ...are not included in this statement.” The amount then is much greater than the 48,661 quoted. The blockade may have ended the general ice shipping trade, yet the federal government quickly set itself up in the ice commodity business seeking bids from ice merchants to supply the needs of the Union Army. Richard Cummings states,

Northern speculators, operating from Maine, have profited highly by supplying ice to Union Army headquarters in southern field of action, where the medical corps and a sanitary commission distributed the commodity to troops in the interest of health and morale. [19]

The 1864, Report on the Ice Contracts, by The Joint Committee's Conduct of the War, provides detailed information on the ice trade during the war. It specifies one of the contract recipients was the Boston ice company Addison Gauge & Co. Its president, Addison Gauge, gave testimony to the committee on his company’s ice deliveries under his government contract. He states his business had been operating for 25 years and could harvest 75,000 tons a year. Under the contract starting in May 1862, he supplied the ice needs of the hospitals in Charleston, Savannah, Mobile and New Orleans at .15 cents per pound. [20] According to the report, each city had an official Union ice agent who worked with the United States Medical Department coordinating shipments. [21]

The report has several tables with ice delivery bids for Union hospitals along with information on how to deliver the ice to the hospital once it reaches the designated port. Figure 17 is an 1864 bid sheet for ice delivered per ton. You can see the price per ton increases as the port gets farther away from its source of origination.
Of note, the research into the ice contracts did not reveal the Tudor Ice Company as one of the contract bidders. In fact, the Tudor name was not located in the reports that were studied at all. This could be the result of Fredric Tudor’s death in February of 1864. The company survived until 1887 when it closed and was sold to Addison Gauge. By 1882, Tudor’s once profitable foreign ice trade ended due to losing lucrative customers like tropical Calcutta, who in 1878, obtained their own artificial ice machine and then soon after another.

**Southern Hardship, Entrepreneurship, and The Rise of The Ice Machine**

By 1863, hardships placed on the south by the naval blockade of 1861, was reported on by Jabez Larmor Monroe Curry, who remarked,

> ...medicines, luxuries, and even necessaries were shut out by the blockade,... For coffee a substitute was found in toasted corn and wheat and potatoes; for tea, in sassafras; sorghum supplied sugar and molasses, and earthen floors of smokehouses, saturated by the drip ping of bacon, were dug up and boiled for necessary salt and “Foreign students of Confederate history are strongly of the opinion that the blockade was the most fatal of all the causes... which conspired for our defeat.”

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**Figure, Ice bids, Joint Committee in the Conduct of War, Report on the Ice Contracts. p.75**
“Sick soldiers in Augusta [Ga] were perishing for the want of ice. In Columbia [Ga.] it [ice] was sold only for the sick and on a physician's certificate.”

The hard life being lived in the south caused Mr. Bujac of New Orleans to contact France to acquire two small Carré ice machines. He was successful and via a blockade runner, the ice machines were smuggled into the South and delivered unassembled in Augusta, Ga... Once completed each machine produced 500 pounds of ice daily. Additionally, Bujac along with his business partner Mr. Girarde soon purchased three additional Carré machines along with their patent rights. These machines were the start of many to follow. They were used to reverse engineer the ice producing process, improve it, and copy it repeatedly.

When compared to the amount of natural ice harvested in the north, these early machines did not seem viable, as they could not produce the volume of ice the south needed. Yet, as each community, each brewery, hotel, etc., eventually purchased their own small machine, the strains of depending on the northern ice suppliers eventually diminished and then slowly disappeared.

The list below is a timetable indicating the growth of artificial ice machines in the south. The list was compiled from the 1915 *Ice and Refrigeration Illustrated*, Vol. 49 (4).

- **Fall 1865**, Mepes, Holden, Montgomery & Co., secured one of three Carré machines imported from France and transported to San Antonio, Texas.
- **1868** the Louisiana Ice Manufacturing Co. erected six 10-ton Carré absorption ice making machines, built at Gretna; La., opposite New Orleans, by Sylvester Berinett, from plans provided by M. Carré.
- **January 5, 1869**, George Merz, a renowned brewer of New Orleans, imported a small machine from the works of the inventor to produce cold dry air and of making ale and lager beer without ice.
- **1869**, John M. Beath, constructed an ice plant at Los Angeles.
- **1870**, John M. Beath, constructed an ice plant at San Francisco.
- **1871**, John M. Beath, constructed an ice plant at Portland, Ore.
- **1872**, Mr. Beath constructed an ice plant in Chattanooga. Tenn.
- 1874, Beath organized in the North American Ice Company.
- 1874, Beath constructed an ice plant in and erected plant in Galveston.
- 1874, Beath constructed an ice plant in New Orleans.
- 1875, Beath constructed an ice plant in Atlanta.
- In 1878, Mr. Charles J. Ball installed an ice making machine in Sherman, Texas, and it was a modified Carré machine, which produced five tons of ice a day which consumed 1 ton of coal.

The list demonstrates the artificial ice business was gaining momentum in the south. Yet, it had not fully replaced natural ice.

Figure 18 is from the September 12, 1872, newspaper, The New Orleans Republican. Its transmission was complaining about an ice monopoly, alleging ice prices had doubled within a few days as the supply of natural ice was running out. This type of public message only fueled the desire for the cities and other establishments to acquire their own artificial ice machines.

Ice monopolies and trusts became a big problem, especially between 1898 and 1902, when 236 consolidations occurred with a total capital of $6.1 billion. These groups controlled 40 percent of the manufacturing capital. This paper will not discuss this issue, but it must be known that part of this network was run by Charles W. Morse. Morse bought several failing natural ice companies during the natural ice shortage caused by the warm winter of 1880. After the purchase, he consolidated them along with his own artificial ice companies into the American Ice Company. Morse and his companies became known as an Ice Trust. Ice was not his only interest as he owned several banks and was involved with the powerful and corrupt political organization known as Tammany Hall.

In 1900, after his ice monopoly was secured, Morse doubled the price of ice and through his political connections, he achieved total control of New York city’s shipping docks, thus he could dictate the flow of all commodities which used the docks, including ice. This action prompted public outcry and inspired several New York breweries to install their own artificial ice machine.
As already mentioned, in 1880, an unprecedented weather phenomena occurred, a very warm winter in the north, which caused the natural ice harvest to be significantly reduced. An area known as “the New York zone” was hit particularly hard. Its 1880 harvest dropped from 2,371,000 tons in 1879, to 800,000 tons. This shortfall of ice prompted Norwegian ice to be imported into the United States to help make up the difference. Additionally, in 1890, the natural ice crop suffered another warm winter. This time, the harvest completely failed south of the 430 deg north latitude. [32]

The failure of natural ice to constantly deliver demonstrated the need for further investment into the artificial ice business. The 1880 Census reported there were 35 artificial ice plants in the country with an invested capital of $1,251,200, at a cost of $158,112.00 for manufacturing materials. By 1890, there were 220 artificial ice plants in the country, with an invested capital of $9,840,468, with a cost of manufacturing material of $940,690. [33] By 1900, there were 775 ice producing companies, with an invested capital of $38,019,507, and a cost of production materials at $18,780,978. [34]
In 1885, to help stabilize the constant shortage of ice in Savannah George, the Gorrie Ice Company opened its doors (figure 7), and by 1896, the company opened a second ice factory.

Figure 7

The Gorrie factory could produce 26,000 – 30,000 pounds of ice a day, roughly 15 tons. The company was started by Captain Samuel J. Whiteside (March 10, 1831- April 17, 1902), who in 1851 was a riverboat captain and owned a shipping company with his brother George. Their trade was between Apalachicola and Columbus, Georgia. His brother, Captain George H. Whiteside (October 4th, 1855 – October 10, 1919), who was a Confederate soldier during the war, started the Apalachicola Ice and Canning Company in Apalachicola Florida in 1885. It lasted until 1925. In 1899, Captain Whiteside also helped organize the Central Ice Company, erecting plants in Mobile, Savannah, New Orleans, Birmingham, AL, Charleston, SC, and Brunswick, GA. Furthermore, during the war he was a Confederate soldier. When the war broke, Whiteside was part of the Columbus Iron Works brigade. Columbus Iron Works made arms for the Confederacy. While at the Iron Works, Samuel helped the company copy, build, and improve upon several early ice machines. It should be noted, Samuel was a close friend of Dr. Gorrie’s from 1851-1855.
In the 1890’s, Florida had a staggering fourfold increase in ice plants. Additionally, in 1892, The Southern Ice Exchange was born, and according to the premier episode of the ice trade journal, Ice and Refrigeration Illustrated, July, 1891,

*The Southern Ice Exchange is...and association of Southern ice manufactures and dealers who have banded together for mutual protection and advantage. One of the founding committed member was Captain Whiteside.*

Statistics demonstrate since 1891, the volume of machine ice being produced had a discouraging effect on the retail natural ice industry throughout the country. By 1899, the natural ice business yielded roughly 13,000,000 tons, while the machined made ice bore 8,000,000 tons. This indicates the artificial ice industry was closing in on the natural ice monopoly.

Chart 3

Graph 3 demonstrates the cost of artificial ice was decreasing as production processes improved, thus artificial ice for the first time, since its introduction, sold for $2.13 a ton which was closing in on the 1847 natural ice price of $2.00 per ton. It took 60 years (1845 -1905) and much diligence of artificial ice machine experimenting, modifying, and refining, to finally arrive at this price point.

By 1905, the southern states generated 36.4 percent of all the artificial ice in the United States. The northern states yielded 57.3 percent and the Rocky Mountain states and associated territories produced 6.3 percent. In the same year, 43 percent of the North’s refrigerating machines were utilized to make ice, while in the South it was 75 percent. Moreover, only 27 percent of the refrigeration plants in the northern and western states made ice.

As previously mentioned, breweries used a vast amount of ice and in the 1880-1910 era had been victims of the ice monopolies. To combat the ice monopolies and trusts, and to ensure a constant supply of ice, enterprising men like brewer Jacob Ruppert had invested heavily in the refrigeration business. He built three manufacturing facilities. By 1900, his New York City plant had the largest single ice producing capacity in the world at 965 tons per day. His Baltimore plant produced 600 tons, while the Philadelphia facility delivered 400 tons. The
Anheuser-Busch Brewing Company in St. Louis had a daily ice-making volume of 1,190 tons of ice, making the company the largest single manufacturer of ice in the world.

In 1905, North America’s total artificial ice-making potential was 75,590 tons per day, or roughly 15 million tons annually. In the same year, there were 9,039 ice-making and refrigerating machines in the U.S. The North American combined volume was 354,000 tons daily, or equivalent to 37,170,000 tons for the year.\[43\]

Figure 8 is a map from the 1905 Census of Manufacturers, which indicates how many artificial ice plants there were in each state. This is an amazing amount of artificial ice when in 1864, merely 41 years earlier, the country only had two smuggled ice machines.

![Map 1.—Zones of Natural and Manufactured Ice: 1905.](image)

By 1905, there were 4,640 patents issued on various refrigerating devices\[44\]. Moreover, by 1915, there were around 30,000 refrigerating machines in the United States, signifying an investment of approximately $350,000,000, and directly influencing products valued at over $3 billion.\[45\]
As the artificial ice trade was taking over the ice business the last major holdout to convert was the railroads. In 1906, G. Harold Powell, of the United States Department of Agriculture, remarked regarding railcar refrigeration,

*Refrigeration by means of ice has its limits; it has served us well, but modern science has provided a better substitute in the production of low temperatures by mechanical means.*

He explained how natural ice had been replaced in large packing houses, large hotels, provision dealers, and that this new mechanical refrigeration can also be found cooling perishable goods on ocean-going freighters. Furthermore, he stated this new technology is feasible to be used on freight trains. Moreover, he asserts, this new method of refrigeration has proven

*beyond doubt that a lower temperature can be produced in the same time and maintained while the car is in transit than can be produced by the ice refrigerator car under similar conditions.*

Furthermore, he suggests mechanical refrigeration has “superseded” any ice used to refrigerate railcars, as the contents arrive to their destination in better condition.

Additionally, Powel relates,

*The refrigeration provided is infinitely more advantageous to the shipper, insomuch that all products would be delivered in ... more marketable condition ... this mechanical refrigerator car...the cost of operation is so much reduced that it results in a substantial saving all around.*

In the following years and decades, electric power generating plants and cost-effective Tesla 3 phase motors allowed for better and less expensive industrial mechanical refrigeration. In addition, as the country slowly converted homes to electricity, there was a transition away from natural ice boxes, to electric refrigerators. By the late 1950’s, the natural ice business was reduced to fond memories.

**Conclusion**

In summary, the data in this report indicates the Union Blockade during the America Civil War, in conjunction with its ice contracts for the union soldiers serving in the south, prompted some southern citizens, like Mr. Bujac of New Orleans, to seek alternative methods to obtain the
desired frozen gold. His yearning for ice resulted in him procuring two small Carré, ice machines smuggled into the South from France. This successful ice liberation from the Northerners prompted an artificial ice revolution, moving many away from the natural ice trade.

Furthermore, the ice shortage in 1880 and 1890, coupled with supply issues due to ice monopolies and trusts, caused many dependent natural ice users, including brewers, to embrace artificial ice for the first time. This new experience of ice independence prompted men like the Whiteside brothers to invest in and develop their own ice manufacturing businesses. As a result of this increase in supply, by 1905, a ton of artificial ice was comparable to the 1847 price of $2.00 per ton, thus making artificial ice more affordable to the masses.

Lastly, the artificial ice manufacturers realized they needed to optimize their businesses in scale and scope in order to produce the large consistent volumes needed to surpass the natural ice business. This was finally achieved in 1906 when the railroads decided to embrace the new refrigeration technology of the self-contained refrigeration car, thus ending the railroads’ dependence on natural ice.

It took 60 years after the advent of Dr. John Gorrie’s ice making machine for the artificial ice business to generate the necessary volume needed to topple the longstanding natural ice dynasty, thus becoming the ice trades new Ice King.

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