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19TH CENTURY DEVELOPMENT OF REFRIGERATION IN THE AMERICAN MEAT PACKING INDUSTRY

By David I. Smith

The United States, particularly the city of Chicago, proved to be the center of the development of modern refrigeration. The United States led the cutting edge for refrigerator technology as well as natural ice manufacturing by decades in various areas. Certain technologies such as refrigerated railway cars and cold storage facilities proved to be monumental to advancement in the industry. Various works of meat packing giants made revolutionization of refrigerator technology possible. Chicago meat packing titans such as Armour, Hammond, and Swift were key to the development of this transformation. This paper analyzes the development of Chicago's meat packing industry and its role in refrigeration, and the invention of these key technologies. By analyzing the development of refrigerated transport and cold storage facilities it's possible to understand that the local and global success of the meat-packing industry was due to the constant evolution of refrigeration technology spanning decades in the United States from the 19th century to the early 20th century.

There was no other meat-packing industry in the world that was affected more by the development of refrigeration than Chicago. To understand the influence which refrigeration had on the industry it's important to understand not only how the development of refrigeration transformed the industry in Chicago but also how it affected Chicago as well. This is important because the effects of refrigeration completely relied on the development of railroads because of the refrigerator car. The use of the refrigerator car in Chicago shattered old distribution methods throughout the United States and completely transformed the

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industry. Development of refrigeration and transportation in Chicago led the city to become the meat packing center of the world.¹

The effects of railroads were monumental on Chicago's meat packing industry. Before railroad developments around Chicago spanning the years of 1848 to 1861 Chicago was not even the biggest meat-packing industry in Illinois. ² The beginning of the meat packing industry can be traced to Cincinnati in 1818 in which the first slaughterhouse opened.³ As population moved West over time, more slaughter houses began to open in cities such as Louisville and St. Louis.⁴

The problem with Chicago's development was that in the 1830s and early 1840s there were no railroads surrounding the city and there was no adequate transportation linking the north and west.⁵ It was not until the late 1840s that Chicago's industry began to transform. With the creation of the Galena and Chicago railways in 1848, the creation of the Michigan Southern and Northern Indiana railway in 1852, and the creation of the Chicago, Rock Island, and Pacific railway in 1854 the industry exploded.⁶ By 1861 13 rail lines reached Chicago. ⁷ In Illinois alone rail mileage grew from 131 miles in 1850 to 7,851 miles in 1880.⁸ Most of these railways connected to Chicago in some way. Within the first two years of the 1848 Galena and Chicago railway's

¹ Howard Copeland Hill, "The Development of Chicago as a Center of the Meat Packing Industry," *Mississippi Valley Historical Review* 10, no. 3 (1923): 253.

² Hill, 258-260.

³ *Ibid.*, 254.

⁴ *Ibid.*, 257.

⁵ *Ibid.*

⁶ Hill, 258-260.

⁷ *Ibid.*, 260.

⁸ *Ibid.*, 261.

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creation, the pork shipped out of Chicago increased 300 percent.⁹ Because of this Chicago became a hub for rail routes which led to its development as “the leading commercial center.”¹⁰

The primary reason refrigeration played such an enormous impact on this developing industry was because of the invention and use of the refrigerator car by various meat packing giants in Chicago, one of these being Gustavus Swift. Swift went from a boy working under a local butcher to buying his own slaughterhouse in Boston and eventually to his founding of a Chicago packing company named “Swift and Company” in 1871.¹¹ Before the refrigerator car meat-packing almost exclusively relied on drying, smoking, and packing meat in brine or dry salt to preserve the integrity of the meat.¹² Fresh meat was only obtainable through local slaughterhouses.¹³ First attempts on refrigerated transport began in the early 1860s through the Michigan Central railroad.¹⁴ The first “refrigerator car” which transported meat across the country was pioneered by George Henry Hammond, a giant in the Chicago meat packing industry. To call Hammond’s car a “refrigerator car” leads the reader to believe that some form of mechanical refrigeration such as ammonia compression systems were used. On the contrary, these crude railway cars were simply regular cars equipped with bins of ice along the sides of the interior.¹⁵

⁹ Hill, 260.

¹⁰ Mary Yeager Kujovich, “The Refrigerator Car and the Growth of the American Dressed Beef Industry,” *The Business History Review* 44, no. 4 (1970): 465.

¹¹ Hill, 264.

¹² *Ibid.*, 271.

¹³ *Ibid.*

¹⁴ *Ibid.*

¹⁵ Armour, 20.

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Regular rail cars were filled with ice bins on both sides “capable of holding from two to three thousand pounds of ice.”¹⁶ Because of this method being in its early stages, this method could only preserve the meat for a few days. ¹⁷ Hammond’s method succeeded in delivering dressed meet from Detroit to Boston in his “Davis Pattern refrigerator car.”¹⁸ Dressed meat would be “suspended from the rafters and ceiling.”¹⁹ The result was that meat were “set swinging like pendulums.”²⁰ To remedy this, evolution of the refrigerator car resulted in more well-managed suspension and placement of dressed beef. Natural ice was placed in an “ice bin” or “bunker” at one end of the car.²¹ The problem with this method was that the meat “became discolored and spoiled quickly.”²² Though ice was present in the car with the meat, it was not capable of keeping the meat cold enough not to spoil. Swift later expanded this idea and create a refrigerator car which completely transformed the meat packing industry and revolutionized refrigerated transport.

Swift achieved this by hiring an inventor named Andrew Chase who received a patent for the project.²³ Swift’s car had more of an emphasis on ventilation and succeeded in using less ice than any other car at the time.²⁴ In his design, air filtered into the car through the bunker, chilling it so that “it drops down, circulating through the car.”²⁵

¹⁶ Hill, 271.

¹⁷ Ibid.

¹⁸ Ibid.

¹⁹ Armour, 20.

²⁰ Ibid.

²¹ Armour, 21.

²² Hill, 271.

²³ Jonathan Rees. *Refrigeration Nation: A History of Ice, Appliances, and Enterprise in America*. (Baltimore: Johns Hopkins University Press, 2016), 90.

²⁴ Rees, 90.

²⁵ Armour, 21.

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Eventually, as it became closer to its original temperature, it rose up and filtered out of the car through a ventilator.²⁶ This resulted in a continuous process where air constantly circulated throughout the car and meat was fixed securely to allow efficient and complete refrigeration.²⁷

Refrigerator cars “enabled dressed beef to be slaughtered in Chicago and shipped to the East at a lower cost than livestock.”²⁸ Before this, livestock had to be transported to the East then slaughtered and packed because meat would spoil and perish during the journey without refrigeration. While in prairies cattle could graze and be managed at a low cost, in manufacturing plants they were expensive to continuously feed and maintain.²⁹ There were multiple reasons why livestock shipping was inefficient compared to the dressed beef transition. The most glaring reason was the amount of space cattle took up. Only 60% of the cow was edible and the cattle had to be fed and watered along the journey to the east.³⁰ Ogden Armour, son of the meat packing titan of Armour & Co., states that “a steer weighing one thousand pounds would dress five hundred and fifty pounds.”³¹ More than half of the cow was wasted, making the private car line expensive for meat packers.³² Dressed beef weighed less, took up less space, required no facilities along the way and as a result of this transition, butchering could be centralized in Chicago.³³

This transition to refrigerated railway cars caused eastern livestock shippers to lower meat costs as well as force railroads to lower

²⁶ Ibid.

²⁷ Hill, 273.

²⁸ Kujovich, 460.

²⁹ Armour, 17.

³⁰ Kujovich, 460.

³¹ Armour, 17.

³² Ibid.

³³ Kujovich, 460.

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prices for livestock shipping to combat this new industry. This was possible because railroads had massive investments in the eastern livestock shipping industry.³⁴ These tight relations between eastern livestock shippers and the railroads branching out of Chicago made it difficult for Swift to use his refrigerator car in the beginning. In a newspaper article published in 1881, the *Chicago Tribune* stated that in regard to refrigerator cars that “it encountered great opposition at first from the butchers in the East, who believed that their business would suffer greatly from the competition.”³⁵ The butchers were greatly aided by railroad managers “who were interested in stockyards and cattle-rings, who thought the new industry, if successful, would diminish the shipments of livestock and thus curtail the profits they derived from the cattle business.”³⁶

Railroads refused to build these cars for Swift because of their heavy investments in the eastern livestock shipping industry so Swift was forced to go to the Detroit Michigan Car Company to build ten prototype refrigerator cars.³⁷ Swift used the Grand Trunk railroad system to put his cars to use because it was the only railroad system that didn’t have ties to the eastern industry.³⁸ Early on, only the biggest packers in Chicago could make this transition to refrigerator cars.³⁹ The high costs of the cars required heavy investments as they were more expensive than regular railroad cars.⁴⁰ Substantial increases in monopoly over the industry resulted from this transition for the big packers of Chicago while smaller packers were overtaken. Eventually the success of the

³⁴ Kujovich, 463-464.

³⁵ “Refrigerator Cars and the Dressed Beef Trade to the East,” *The Chicago Tribune* (Chicago, IL), May 9, 1881.

³⁶ *Ibid.*, 5.

³⁷ Kujovich, 466.

³⁸ *Ibid.*, 481.

³⁹ Rees, 95.

⁴⁰ *Ibid.*

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refrigerator car revolutionized the industry and forced eastern livestock shippers to either form alliances with western dressed beef shippers or disappear completely.⁴¹

The centralization of the butchering in Chicago and the monumental impact of refrigerated transport resulted in an environment ripe for business. Chicago dominated the meat packing industry at the turn of the 20th century. By 1900, Chicago employed “25,000 of the country’s 68,000 packinghouse employees.”⁴² In 1902 the total value of products produced by the meat packing industries of America totaled \$785,500,000 with one-third of that being from Chicago’s industry alone.⁴³ In 1906, Packingtown, the famous location of the meatpacking factories of Chicago, employed 30,000 men and slaughtered 10,000 animals each day to meet the demands of 30 to 40 million consumers in America and abroad.⁴⁴ In this year the meat products and by products exceeded “the sum of 600,000 annually.”⁴⁵

While refrigerated transport was impacting the meat packing industry, development in cold storage technology and use in the late 19th century and early 20th century was revolutionizing the industry as well. As stated earlier, in the 1800s there was a major transformation of the economy due to the shift from localized merchants practicing meat trade to regional manufacturers. Quincy, Illinois became a hub for distributions and local entrepreneurs began setting aside large warehouses to collect

⁴¹ Kujovich, 482.

⁴² “Meatpacking.”

⁴³ “The Chicago Packing Industry,” *Chicago Tribune* (Chicago, IL), Jul. 4, 1902, 12.

⁴⁴ Paula Young Lee, *Meat Modernity, and the Rise of the Slaughterhouse*, (New Hampshire, Durham: University of New Hampshire Press, 2008), 34.

⁴⁵ J. A. Spoor, “Chicago’s Greatest Financial and Industrial Success,” *Chicago Tribune* (Chicago, IL), Feb. 7, 1909.

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pork and other animals.⁴⁶ These early warehouses such as those in Texas used a variety of forms to store meat which evolved over time such as “pickling meats” which involved placing meat in barrels of salt water and sealing it.⁴⁷ The next method warehouses used was drying meats in order to preserve them over long periods of time.⁴⁸ Other warehouses began opening throughout the west and with these warehouses came refrigeration development and the entrance of cold storage facilities known early on as ice houses. Walsh states in “From Pork Merchant to Meat Packer: The Midwestern Meat Industry in the Mid Nineteenth Century” that “while the size of packing plants had gradually increased in midcentury thanks to improvements in transportation and greater availability of capital, the sudden upsurge in their growth was due to the technology of ‘ice’ packing.”⁴⁹

While natural ice dominated refrigerated transport, mechanical refrigeration shined in the cold-storage realm. With natural ice, the preservation of meat was unstable and unreliable. Meat could only be shipped for short distances and there was not a high chance that it would be in good condition when it arrived. Many factors contributed to this such as the amount of ice, meat, the temperature, and humidity. These were factors which did not have regulations in the late 19th century.⁵⁰ The transition to ammonia compression systems seemed to be the correct route for manufacturers because it could maintain a precise temperature which natural ice could not. By

⁴⁶ Walsh and Schmitz, 128.

⁴⁷ T. J., Cauley. “Early Meat Packing Plants in Texas.” *Southwestern Political & Social Science Quarterly* 9, no. 4 (1929): 465.

⁴⁸ Cauley, 465.

⁴⁹ Margaret Walsh, and Mark Schmitz. “From Pork Merchant to Meat Packer: The Midwestern Meat Industry in the Mid Nineteenth Century,” *Agricultural History* 56, no. 1 (1982): 135.

⁵⁰ Rees, 76-77.

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1914 mechanical refrigeration was the standard for meat packers.⁵¹

Before ammonia compression systems, Chicago meat packers used ice to pack pork during the summer, but it was unreliable due to the lack of control ice had over the temperature though it proved to be successful enough for this process to expand to beef as well.⁵² Ammonia compression systems expanded cold storage and proved to be the most reliable way to preserve meat.⁵³ Ammonia could not simply be used on the meat as it was toxic and would taint the beef and pork so packers would instead chill brine, a mix of salt and water, and circulate it throughout the cold storage warehouses to preserve the meat.⁵⁴ In 1881 the first facilities for ammonia compression meat storage arrived in Boston. These large buildings which could reach to 14 stories high contained many levels of meat storage. With these massive facilities came great risks though as explosions were always a possibility during ammonia leaks and therefore insurance was very costly.⁵⁵

These facilities were put in place “to promote their dressed beef in eastern cities.”⁵⁶ Meat packing companies “built branch sales offices and cold storage warehouses” to bridge the gap between the east and west.⁵⁷ Regarding Armour, the meat packing company had what were called “branch houses,” which were cold storage facilities which kept meat refrigerated for packers as well as local butchers. This allowed local butchers to have a reliable way to maintain their meat and produce a

⁵¹ Rees, 109.

⁵² Rees, 102.

⁵³ Ibid.

⁵⁴ Ibid.

⁵⁵ Rees, 102-103.

⁵⁶ Carroll Louise Wade, “Meatpacking,” *Encyclopedia of Chicago*, Accessed Dec. 9, 2018, <http://www.encyclopedia.chicagohistory.org/pages/804.html>.

⁵⁷ “Meatpacking.”

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yearlong inventory for consumers. These branches numbered about 300 hundred in the United States.⁵⁸ Smoke houses had a direct relationship with these cold storage facilities. Smoke meats would be sent and stored continuously throughout the year.⁵⁹

The fear of food shortages during wartime resulted in the need of cold storage to continually supply US soldiers with food as well as European allies.⁶⁰ Creation of the US Food administration had the largest impact regarding public trust of cold storage through various laws and regulations. In January 1908 the New York Tribune reported “the despised and suspicioned cold storage facilities are now our best friend.”⁶¹ The most common laws were labeling laws which between 1911 and 1915 were laws that required cold storage facilities to put labels on food displaying the age of the food that the consumer was buying.⁶² By 1916, at least 1000 cold storage houses existed in the US as opposed to 620 in 1904.⁶³ Rees states that “By 1952, America had 135 square meters of cold storage space for every thousand people in the country.”⁶⁴

In conclusion, cold storage facilities revolutionized the industry through efficient year-round storage for packaged meat as well as year-round meat for consumers. The invention of the refrigerator car revolutionized the industry by providing efficient and reliable transport for chilled, packaged meat and removed the old system of transporting livestock, saving immeasurable amounts of money. Development of railroads around Chicago led to the creation and use of the refrigerator car while developments in mechanical refrigeration in the form of ammonia compression led to the creation of efficient cold storage facilities. While Swift manipulated air flow to create manageable cold,

⁵⁸ Armour, 53-56.

⁵⁹ Armour, 56.

⁶⁰ Rees, 109.

⁶¹ *Ibid.*, 110.

⁶² *Ibid.*, 111.

⁶³ Rees, 111.

⁶⁴ *Ibid.*, 113.

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cold storage facilities, using mechanical refrigeration, managed cold with precision. While many other developments in refrigeration led up the creation of refrigerated transport and cold storage facilities such as the evolution of the natural ice industry, these two technologies prove that development in refrigeration was key in the revolutionization of the American meat packing industry.