The Impact of Refrigeration

Barbara Krasner-Khait discusses the effect refrigeration had on industry and the home.

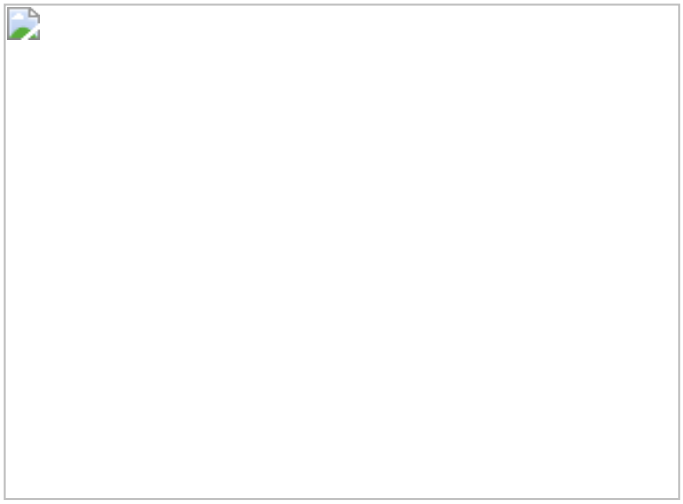
IMAGINE LIFE WITHOUT ice cream, fresh fruit, ice cold beer or frozen entrees. Imagine having to go to the grocer every day to make sure your food was fresh. Imagine no flowers to send to that special someone or medicines or computers.

Over the last 150 years or so, refrigerationoΩ½s great strides offered us ways to preserve and cool food, other substances and ourselves. Refrigeration brought distant production centers and the North American population together. It tore down the barriers of climates and seasons. And while it helped to rev up industrial processes, it became an industry itself.

To look at refrigerationoΩ½s impact on consumers and industry, let us distinguish the refrigeration process from the refrigerator appliance.

Refrigeration is the process of cooling a space or substance below environmental temperature. To accomplish this, the process at first removed heat through evaporation and then later in the 1850s with vapor compression that used air and subsequently ammonia as a coolant. Refrigeration has been around since antiquity. Though its inventor, Maryland farmer Thomas Moore, first introduced the term oΩ½refrigeratoroΩ½ in 1803, the appliance we know today first appeared in the 20th century.

Early Refrigeration



Ice was harvested and stored in China before the first millennium. Hebrews, Greeks, and Romans placed large amounts of snow into storage pits and covered this cooling agent with insulating material. Need a cool drink? Just mix in melting snow or its resulting water. Or bury your container right into the snow. No snow? Do like the ancient Egyptians: fill your earthen

jar with boiled water and stick it on your roof, exposing it to the nightoΩ½s cool air.

Cooling drinks was popular particularly in EuropeoΩ½s southern climates, especially Italy and Spain. It became en vogue by 1600 in France. By this time, instead of cooling water at night, people rotated long-necked bottles in water in which saltpeter was dissolved. This solution, it was discovered, could be used to produce very low temperatures and to make ice. By the end of the 17th century, iced liquors and frozen juices were popular in French society.

For centuries, people preserved and stored their food oΩ½ especially milk and butter oΩ½ in cellars, outdoor window boxes or even underwater in nearby lakes, streams or wells. Or perhaps they stored food in a springhouse, where cool running water from a stream trickled under or between shelved pans and crocks. But even these methods could not prevent rapid spoilage, since pasteurization was not yet known and bacterial infestation was rampant. It was not unusual in colonial days to die of oΩ½summer complaintoΩ½ due to spoiled food during warm weather.

Before 1830, food preservation used time-tested methods: salting, spicing, smoking, pickling and drying. There was little use for refrigeration since the foods it primarily preserved oΩ½ fresh meat, fish, milk, fruits, and vegetables oΩ½ did not play as important a role in the North American diet as they do today. In fact, the diet consisted mainly of bread and salted meats.

Consumer demand for fresh food, especially produce, led to diet reform between 1830 and the Civil War, fueled by the dramatic growth of cities and the improvement in economic status of the general populace. And as cities grew, so did the distance between the consumer and the source of the food.

The Ice Revolution

Ice was first shipped commercially out of Canal Street in New York City, where it was cut, to Charleston, South Carolina in 1799. Unfortunately, there wasnoΩ½t much ice left when the shipment arrived. New Englanders Frederick Tudor and Nathaniel Wyeth saw the potential for the ice business and revolutionized the industry through their efforts in the first half of the 1800s. Tudor, who became known as the oΩ½Ice King,oΩ½ focused on shipping ice to tropical climates. He experimented with insulating materials and built ice houses that

decreased melting losses from 66 percent to less than 8 percent. Wyeth devised a method of quickly and cheaply cutting uniform blocks of ice that transformed the ice industry, making it possible to speed handling techniques in storage, transportation and distribution with less waste.

Natural ice supply became an industry unto itself oΩ½ and a large one at that. More companies entered the business, prices decreased, and refrigeration using ice became more accessible. By 1879 there were 35 commercial ice plants in America, more than 200 a decade later, and 2,000 by 1909. In 1907, 14-15 million tons of ice were consumed, nearly triple the amount in 1880. No pond was safe from scraping for ice production, not even ThoreauoΩ½s Walden Pond, where 1,000 tons of ice were extracted each day in 1847.

But as time went on, ice as a refrigeration agent became a health problem. Says Bern Nagengast, co-author of Heat and Cold: Mastering the Great Indoors (published by the American Society of Heating, Refrigeration and Air-conditioning Engineers), oΩ½Good sources were harder and harder to find. By the 1890s, natural ice became a problem because of pollution and sewage dumping.oΩ½ Signs of a problem were first evident in the brewing industry. Soon the meat-packing and dairy industries followed with their complaints. Refrigeration technology provided the solution: ice mechanically manufactured, giving birth to mechanical refrigeration.

Refrigeration Redefines Brewing And Meat-Packing

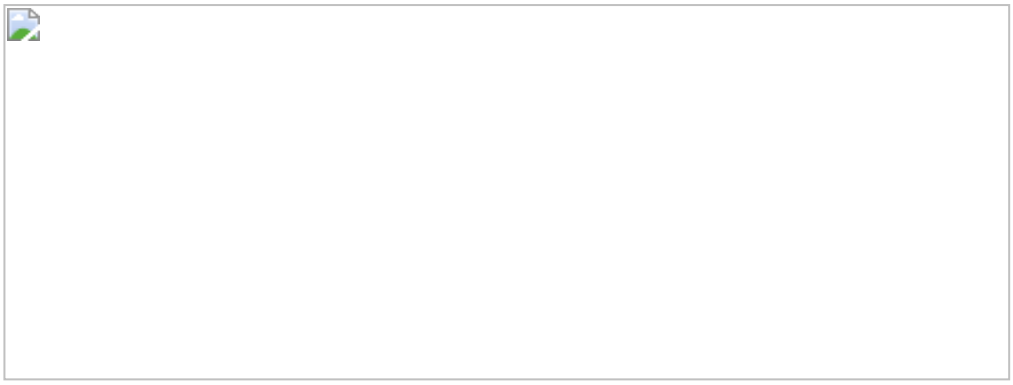
ThereoΩ½s no question that the brewing industry was one of the first to realize the significant benefits that refrigeration offered. German lager beer came to America with the German immigrants in the 1840s, tasting a lot better than American ale. Refrigeration enabled the breweries to make a uniform product all year round. Brewing was the first activity in the northern states to use mechanical refrigeration extensively, beginning with an absorption machine used by S. LiebmannoΩ½s Sons Brewing Company in Brooklyn, New York in 1870. Commercial refrigeration was primarily directed at breweries in the 1870s and by 1891, nearly every brewery was equipped with refrigerating machines.

A decade later, refrigeration was introduced in Chicago to the meat-packing industry. Though meat-packers were slower to adopt refrigeration than the breweries, they ultimately used

refrigeration pervasively. By 1914 the machinery installed in almost all American packing plants was the ammonia compression system, which had a refrigeration capacity of well over 90,000 tons/day.

The five big packers oΩ½ Armour, Swift, Morris, Wilson, and Cudahy oΩ½ owned the expensive equipment extensively, using it in refrigeration cars, branch houses, and other cold storage facilities. This was essential for the distribution of perishable foods on a large scale.

Within the packing plant itself, space for meat chilling and storage was usually cooled by ice in overhead lofts, connected to the area by flues that helped the natural circulation of cold air. With refrigeration, curing became a year-round activity and because animals could be brought to market at any time, not just in winter, meat quality improved.



The Refrigerated Railroad Car

Beginning in the 1840s, refrigerated cars were used to transport milk and butter. By 1860, refrigerated transport was limited to mostly seafood and dairy products. The refrigerated railroad car was patented by J.B. Sutherland of Detroit, Michigan in 1867. He designed an insulated car with ice bunkers in each end. Air came in on the top, passed through the bunkers, and circulated through the car by gravity, controlled by the use of hanging flaps that created differences in air temperature.

The cars helped establish mid-Western cities, especially Chicago and Kansas City, as the slaughter centers of the country and also created regional produce specialization. Consider Georgia peaches, California grapes, peaches, pears, plums, apples and citrus, Washington and Oregon apples, pears, cherries, and raspberries, and of course, Florida citrus. The increasingly widespread distribution of fresh foods expanded

markets and helped to create healthier diets of meat, produce, eggs, butter, milk, cheese and fish.

There were different car designs based upon the type of cargo, whether meat or fruit. The first refrigerated car to carry fresh fruit was built in 1867 by Parker Earle of Illinois, who shipped strawberries on the Illinois Central Railroad. Each chest contained 100 pounds of ice and 200 quarts of strawberries. It wasnoΩ½t until 1949 that a refrigeration system made its way into the trucking industry by way of a roof-mounted cooling device, patented by Fred Jones.

Safety First

Despite the inherent advantages, refrigeration had its problems. Refrigerants like sulfur dioxide and methylchloride were causing people to die. Ammonia had an equally serious toxic effect if it leaked. Frigidaire discovered a new class of synthetic refrigerants called halocarbons or CFCs (chlorofluorocarbons) in 1928. Then part of General Motors, the company sewed up all the patents. It released CFCs in 1930. And despite its original intent to keep its patents proprietary, this was too big an invention to keep to itself, not to mention it didnoΩ½t have its own manufacturing facility. The entire industry was allowed to use the patents and refrigeration technology switched to these new oΩ½safeoΩ½ agents like Freon (which have since been banned for harming the ozone layer).

Without the discovery of CFCs, says Nagengast, oΩ½Refrigeration wouldnoΩ½t have been pervasive.oΩ½

RefrigerationoΩ½s Cooling Makes Businesses Hot

Though ice, brewing, and meat-packing industries were refrigerationoΩ½s major beneficiaries, many other industries found refrigeration a boon to their business.

In metalworking, for instance, mechanically produced cold was used to help temper cutlery and tools. Iron production got a boost, as refrigeration removed moisture from the air delivered to blast furnaces, increasing production. Textile mills used refrigeration in mercerizing, bleaching, and dyeing. Oil refineries found it essential as did the manufacturers of paper, drugs, soap, glue, shoe polish, perfume, celluloid, and photographic materials.

Fur and woolen goods storage could beat the moths by using refrigerated warehouses. Refrigeration also helped nurseries

and florists, especially to meet seasonal needs since cut flowers could last longer. And there was a morbid application oΩ½ preserving human bodies in the morgue.

Sugar mills, confectioneries, chocolate factories, bakeries, yeast manufacturers, tea companies oΩ½ all found refrigeration helped their business.

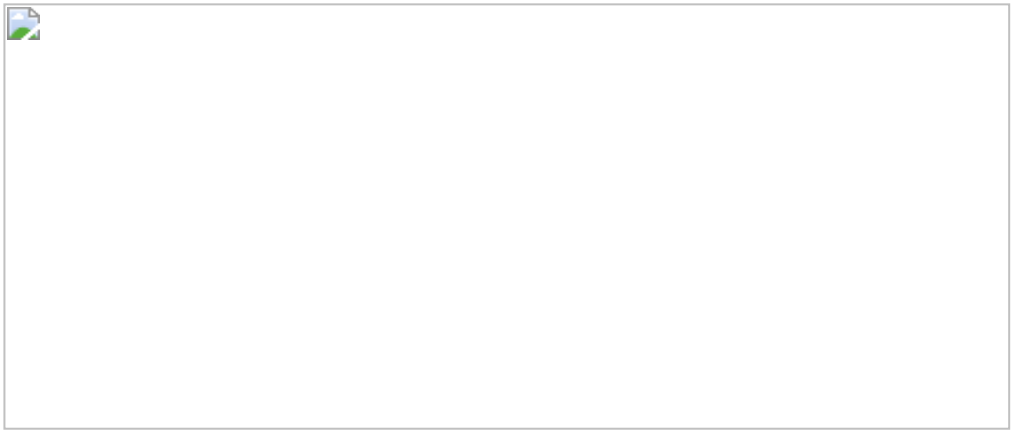
Hospitality businesses including hotels, restaurants, saloons, and soda fountains, proved to be big markets for ice. And there was a defense application. In WWI, refrigeration in munitions factories provided the required strict control of temperatures and humidity. Allied fighting ships held carbon-dioxide machines to keep ammunition well below temperatures at which high explosives became unstable.

The Household Refrigerator

Refrigeration in the home lagged behind industrial applications. But by 1884, one writer noted that refrigerators were as common as stoves or sewing machines in all but the poorest tenements. The use of ice in the home was growing to keep food longer and to cool drinks.

The ice wagon was a familiar site on urban streets. It became an American institution, delivering ice as needed when consumers posted the oΩ½Ice TodayoΩ½ sign in their windows. Iceboxes were typically made of wood, lined with tin or zinc and insulated with sawdust or seaweed. Water pans had to be emptied daily.

According to Nagengast, the household refrigerator is one of the greatest unsung inventions. Engineering technology perfected it, made it reliable, and inexpensive enough for widespread ownership. He says, oΩ½The household refrigerator changed the way people ate and socially affected the household. They were no longer dependent on ice delivery and they didnoΩ½t have to make provisions for it like leaving a key or leaving the door open.oΩ½ Ice wagons became a thing of the past. By the 1920s, the household refrigerator was an essential piece of kitchen furniture. In 1921, 5,000 mechanical refrigerators were manufactured in the US. Ten years later that number grew past one million and just six years later, nearly six million. Mass production of modern refrigerators began in earnest after WWII. By 1950, more than 80 percent of American farms and more than 90 percent of urban homes had one.



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return to contents