

CHAPTER 5

The Ice Factory

Happy those early days, when I
Shipped ice from Norway, nor did try
Excessively to make the pace,
Or other traders to displace;
Nor scanned in vain my books to see
A credit large in l.s.d.
When on some glorious mountain peak
I now and then could spend a week
Ne'er dreaming man would e'er turn out
Ice half so pure or clear throughout.¹⁶³

These lines are an extract from an English ice merchant's lament, penned in 1907. They record the halcyon days of Norwegian ice imports into Britain when profits were high and competition thin. In most years, importers would visit their suppliers in Norway and take in the glorious summer scenery of lakes and mountains. They were familiar with artificial ice-making machinery, but it seemed an absurd proposition that one day such contraptions would be able to supply ice to a metropolis.

Chemical means of inducing artificial cold had long been known.¹⁶⁴ Dissolving saltpetre in water was one long-tested method. By this means, anything that was immersed in the resulting liquid was cooled to a low temperature. Known as frigorific mixtures, such liquids act by the abstraction of heat. Mechanical or machine methods of producing cold are, by contrast, much more recent in origin. In the eighteenth century, the French chemist Antoine Lavoisier and others had experimented with

¹⁶³ *Cold Storage and Ice Trades Review* X (1907), p. 330.

¹⁶⁴ For a useful history of the various methods of inducing artificial cold, mechanical as well as chemical, see B.H. Springett, *Cold Storage and Ice-Making* (London, 1921); see also *Cold Storage and Ice Trades Review* I (1898), pp. 9–11; see also A.J. Wallis-Taylor, *Refrigeration, Cold Storage and Ice Making* (London, 1902), pp. 415–64.

evaporating liquids within a vacuum as a means of abstracting heat. However, the modern compression systems of refrigeration did not materialize until after Jacob Perkins constructed an ice machine in London in 1834. There then followed a whole succession of technological improvements and refinements that eventually allowed commercial production of artificial ice by the closing decades of the nineteenth century. One critical issue was the liquid to be used in compressors. The first commercial machines used ether, but they quickly became obsolete, to be replaced by ammonia machines. Ammonia has a much higher latent heat and its use enabled major reductions in the size of the compressor needed. Experiments were also made with carbonic acid and sulphur dioxide, but by 1900 ammonia had become far and away the favoured choice.

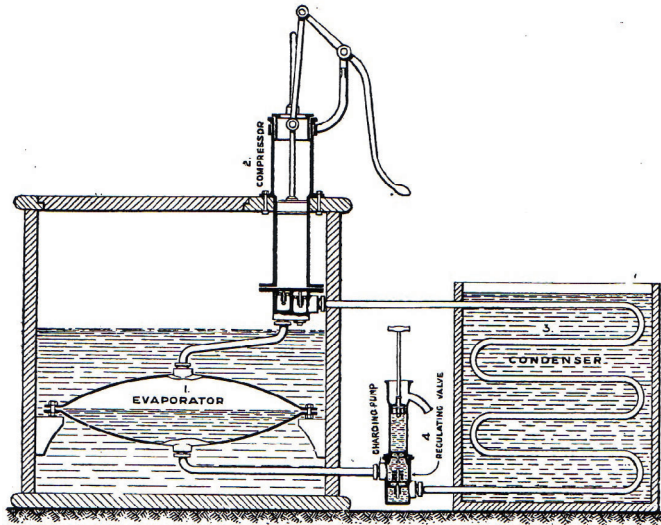


Figure 5.1. The first Perkins ice machine (Bodleian: 193998 e.18 p. 5).

All the early factory-made ice was opaque or cloudy in appearance, as compared with the normally highly transparent natural product. The cloudiness arises because, in stagnant water conditions, bubbles of air adhere to the newly-formed ice and then become imprisoned as ice formation continues.¹⁶⁵ When water is in a gentle state of agitation (as in lakes, for example),

¹⁶⁵ B.H. Springett, *op.cit.*, p. 74.

the bubbles are washed away and the ice remains clear. In natural ice of the best quality, you could place a newspaper beneath an individual ice block two feet thick and still be able to read the small print. Opaque ice was fine for use as crushed ice – that is, for use on board fishing trawlers for packing fish, for filling the ice-boxes of refrigerated railway wagons, or for filling the freezer drums used by confectioners when making ice cream. But it was not acceptable for wider public consumption and use. Thus successful ice factories had to find means of agitating the water during the freezing process in order to obtain the necessary level of translucence to meet a wider market.

In London, the first firm to produce ice by machine means was the Shingleton Ice Company in 1870. It was based in Blackfriars in the City of London and operated an ammonia absorption plant type that was capable of making 9 tons of ice a day.¹⁶⁶ Norwegian block ice then fetched £8 per ton, a price that seriously limited its sale. However, artificial ice was viewed in some quarters as a dangerous chemical product and many potential customers were very reluctant to use it on that account. There was a widespread belief that the ammonia used in its manufacture came into contact with the water from which the ice was formed. In fact, it was to take 30 or 40 years for such prejudice to fade and for factory-made ice to make significant inroads into the natural ice market. The journal, *British Refrigeration and Allied Interests*, in one of its first issues in 1899, commented on the cheerful idiots who still thought that ice was manufactured by dropping some obnoxious chemical into a pail of water and stirring.¹⁶⁷

The Shingleton Ice Company was soon joined by two other ice manufacturers: the General Ice Company with an ether plant at Lambeth, and the British Ice Company at Southwark using another ammonia absorption machine, both locations south of the river.¹⁶⁸ Within a couple of decades or so, London had acquired a total of five ice factories which, according to a reporter for the *Daily Graphic* in 1898, could together put out 200 tons

166 See *Cold Storage and Ice Trades Review* II (1900), p. 154.

167 *British Refrigeration and Allied Interests* I (1899), p. 14.

168 *Cold Storage and Ice Trades Review* II (1900), p. 154.

a day, even if regular production fell well short of that level.¹⁶⁹ The most prominent of the factories was the Linde British Refrigeration Company's ice plant on the Thames river bank at Shadwell, by the dock basin there. Equipped with three Lancashire boilers and two horizontal steam engines of 300 and 150 horse-power respectively, it had been erected in 1887 and was quickly doing a trade in ice with passing vessels, not to mention the adjacent Shadwell fish market. The plant was capable of being in continuous production and yet it could be operated by only four men. From its inception, the owners seemed to have recognized the value of producing ice for different markets. The fish market and the Thames fishing vessels used ice of the lowest quality. The best ice from the factory, known as crystal ice, went to hotels, clubs, restaurateurs and domestic customers.¹⁷⁰

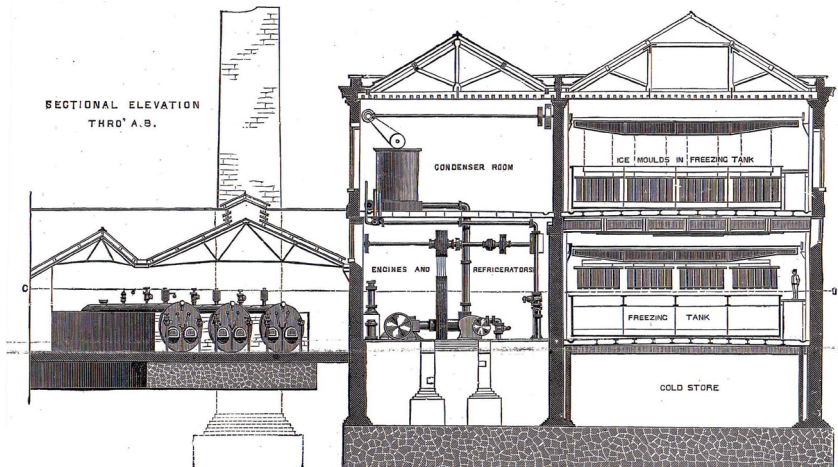


Figure 5.2. The design of the Shadwell ice factory as it existed in 1899 (Bodleian: Per 193998 d.1/II p. 59).

In late June 1900, in the wake of a sudden heatwave in the south of England, the *Daily Mail*, as previously observed, ran a major feature article on Britain's ice supply.¹⁷¹ It included details of a visit by one of the newspaper's reporters to the Shingleton Ice Company's factory that had

169 *Ibid.*, I (1898), p. 66.

170 *Ibid.*, II (1899), pp. 58–60.

171 *Daily Mail*, 20th June 1900.

by then been in operation at Blackfriars in London for 30 years. He saw the huge engine that drove the compressors, along with the condenser room. But the most remarkable spectacle was the huge loft with its many tanks of water in which the artificial ice was made. Ice cold brine, collected in chambers around the tanks, effected the freezing process in about three days. By lifting the hatch-covers off the tanks, you could watch the ice slowly forming. Fern-like crystals and long needles, resembling hoarfrost, began to shoot out from the tank sides and, as time passed, gradually coalesced. Then, towards the end of the freezing process, loops of rope were placed in the centre of each block to allow their removal by travelling crane.

Over the last decade of the nineteenth century, plants making machine ice began springing up in cities, towns and fishing ports all around the country. Many were associated with the erection of cold stores as the technology of refrigeration was steadily consolidated. London in 1887 had but one cold store, but by 1899 there were no fewer than 17.¹⁷² In its January 1900 issue, the *Cold Storage and Ice Trades Review* listed some 22 new companies in Britain that had come into being in 1899 for the purpose of manufacturing ice, often including the provision of cold storage. The tally embraced coastal centres as far flung as Exeter, Swansea, Fleetwood and Dundee, as well as an array of inland towns such as Bath, Coventry, Birmingham and Huddersfield.¹⁷³ The further a town was from a port, the greater were the costs of obtaining natural ice, not least owing to higher transport costs, but also due to higher losses through melting. The city of Manchester ceased to bring in Norwegian ice after 1899 owing to uncompetitive freight rates on the Manchester Ship Canal. Ice manufacture had begun as early as 1874.¹⁷⁴

The economic and social backcloth to this runaway expansion of factory-made ice was the steep rise in urbanisation in Britain in the Victorian age. In 1831, there were just seven urban centres outside London

172 *Cold Storage and Ice Trades Review* II (1899), p. 17.

173 *Ibid.*, p. 151.

174 See R. G. David, 'The Ice Trade and the Northern Economy, 1840–1914', *Northern History* 36 (2000), p. 119.

with populations of 100,000; by 1901 there were near forty.¹⁷⁵ This was far and away ahead of any country of continental Europe and it altered fundamentally the various exigencies of food supply to the nation's inhabitants and, within that, how the life of food could be extended.

Some of the ice-making companies proved wildly successful, while others had a rather short-lived existence. The Shingleton Ice Company's two early competitors in London ceased trading after relatively short periods.¹⁷⁶ In Aberdeen, though, the North Eastern Ice Company was returning a 15 per cent dividend to its shareholders by 1901 and the Aberdeen Ice Manufacturing Company a heady 20 per cent.¹⁷⁷ Between them, these two particular businesses seem to have squeezed out the bulk of the traditional import traffic in Norwegian ice which by 1899 was regarded locally as both unprofitable and unsatisfactory. It was Aberdeen's rapidly growing fishing fleets that were the principal users. And as other leading fishing ports discovered, their interests were best served by making ice on site, then using Norwegian ice as supplementary stock for when demand outstripped available supply. Thus Hull, Grimsby and Lowestoft matched Aberdeen's example.

Grimsby's first ice factory, The Great Northern Ice Company, was launched as early as 1885 and its directors reckoned on an estimated dividend to investors of 15 per cent.¹⁷⁸ At the time, imported Norwegian ice was costing the fishing trade 22/6d per ton. The new company reckoned to manufacture artificial ice for 5/- a ton and to sell it at 15/-. By 1900, construction was in progress at Grimsby on the erection of several more ice plants that, with existing capacity, were expected to be capable of supplying the port with up to 600 tons of ice daily.¹⁷⁹ With over 700 trawlers operating out of the port around that date, this was not an overly optimistic output. One of the new ice plants (the Grimsby Co-operative Ice Co.), located in a triangle of land on the north side of the fish dock, comprised a building 240 feet long, with a 120-foot-high chimney. Each of its

175 F.M.L. Thompson. *The Rise of Respectable Society: A social history of Victorian Britain, 1830–1900* (London, 1988), p. 28.

176 *Cold Storage and Ice Trades Review* II (1900), p. 154.

177 *Ibid.*, V (1902), p. 63.

178 *The Times*, 30th August 1886.

179 *Cold Storage and Ice Trades Review* III (1900), p. 235.

ammonia compressors were powered by 300 horse-power triple expansion steam engines and could produce 75 tons of ice each day. The ice made was opaque and came in blocks eight inches thick, weighing about two hundredweight apiece.¹⁸⁰

Grimsby had succeeded in stealing a march over its fishing-port rival, Hull, after the new and highly competitive Manchester, Sheffield and Lincolnshire Railway had constructed a special six-acre Fish Dock there, opened in 1857. Grimsby-landed fish now became one of the new railway company's primary traffics, destined not just for London but for the growing cities of the industrial Midlands and the North. It was not long before the Company's Fish Dock had to be enlarged.¹⁸¹ And Grimsby was later to become England's leading fishing port.



Figure 5.3. The Grimsby Co-operative Ice Company's factory stands to this day, but operations ceased in 1990. The complex is a listed building, and it was once the largest ice factory in the world (Wikipedia - CC BY-SA 2.0).

Although large ice factories were initially the preserve of the major fishing ports, cities were not long in following their example. In London, the newly-formed North Pole Ice Company was, by 1902, operating

¹⁸⁰ *Ibid.*

¹⁸¹ E. Gillett, *A History of Grimsby* (Oxford, 1970), pp. 230–232.

a factory at Blackwall, on the river's north bank, east of Limehouse. It had a capacity of up to 200 tons a day, with further scope for enlargement. Londoners would not fail to have noticed its 150-foot chimney with 'North Pole' emblazoned in large letters stretched from top to bottom, appearing like a new goal for arctic explorers.¹⁸² The ice was made in a chamber in which there were 110 separate tanks, each producing 5-ton ice blocks, 12 inches thick.

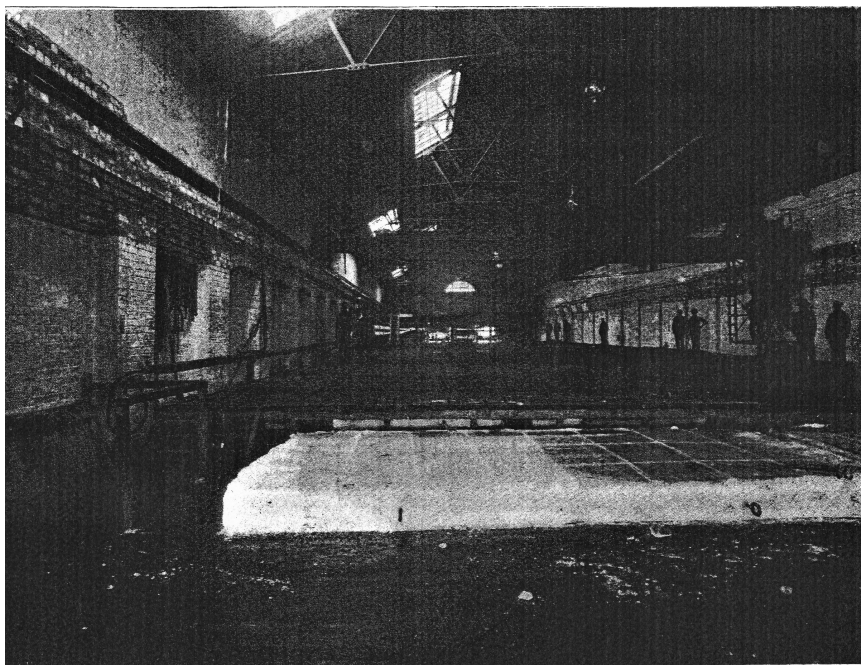


Figure 5.4. The tank room at the North Pole Ice Company's Factory (Bodleian: Per 193998 d.1/ II p. 99).

These were then cut to form two-hundredweight blocks ready for despatch and use. It was claimed that the ice so manufactured was 'free from core', the bugbear of factory-made ice whereby a small mass of opaque ice was left in the centre of each ice block, formed as a result of the withdrawal of the central agitator in the final stage of the freezing cycle. The veracity of this claim was ably demonstrated in the issue of the *Cold Storage and*

¹⁸² *Cold Storage and Ice Trades Review*, IV (1902), p. 314.

Ice Trades Review of April 1905 when two men were pictured standing behind a 5-ton crystal ice block at the company's premises, their images largely unblemished by any imperfections in the ice mass.¹⁸³ By this time, the company had secured a substantial share of the London market and was combining its ice-making with the importing of natural ice from Norway. To ensure continuity of supply, the ice plant was operated 24 hours a day and stopped for a week for cleaning only twice a year.¹⁸⁴ In January 1902, a reporter from the *Cold Storage and Ice Trades Review* had been given a guided tour of the new plant by one of the company's managers. It was equipped with all the latest technology, including super-heated steam boilers, water-softening apparatus and electrically-operated cranes for lifting and moving the huge ice blocks. What most intrigued the magazine's reporter, though, was the method for cutting the 5-ton ice blocks. This was achieved by means of a tube frame laid on top of the ice block in its horizontal position. Steam was passed through the tubes and by this means the frame slowly ate its way through the large block, ultimately producing regularly cut, two-hundredweight blocks.¹⁸⁵

In Glasgow, large-scale ice manufacture was begun in 1902 when William Milne, a prominent local ice merchant, erected a plant with an ice-tank capacity of 180 tons and a projected daily ice output of 60 tons. The premises, in Old Wynd in Glasgow, were housed in an impressive brick building and included cold storage for perishable foodstuffs as well as extensive storage for ice. It was hoped that the latter would help to alleviate, if not remove altogether, the chronic ice shortages that were a regular feature of Scotland's first city in hot summer seasons.¹⁸⁶

In Liverpool, the story of artificial ice manufacture was much the same as in London. In 1880, natural ice realized 40 shillings a ton in the city. By 1905, both natural and artificial ice averaged 15 shillings a ton and there were five companies manufacturing ice with an aggregate daily capacity of up to 200 tons.¹⁸⁷ Among them was the Riverside Cold

183 *Ibid.*, VIII (1905), p. 99.

184 *Ibid.*, pp. 98–100.

185 *Ibid.*, IV (1902), p. 314.

186 *Ibid.*, IV (1901), p. 251.

187 *Ibid.*, VIII (1905), p. 148.

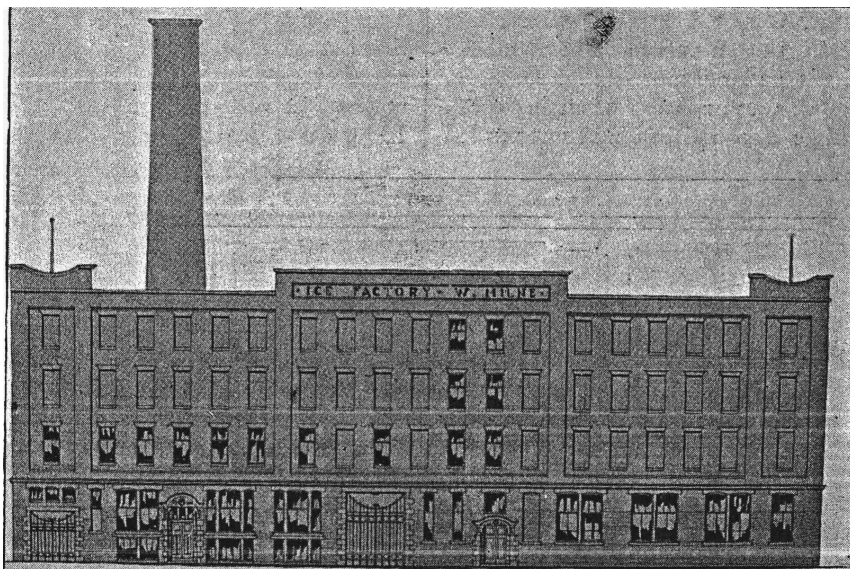


Figure 5.5. The design for William Milne's ice factory in Glasgow (Bodleian: Per 193998 d.1/IV p. 251).

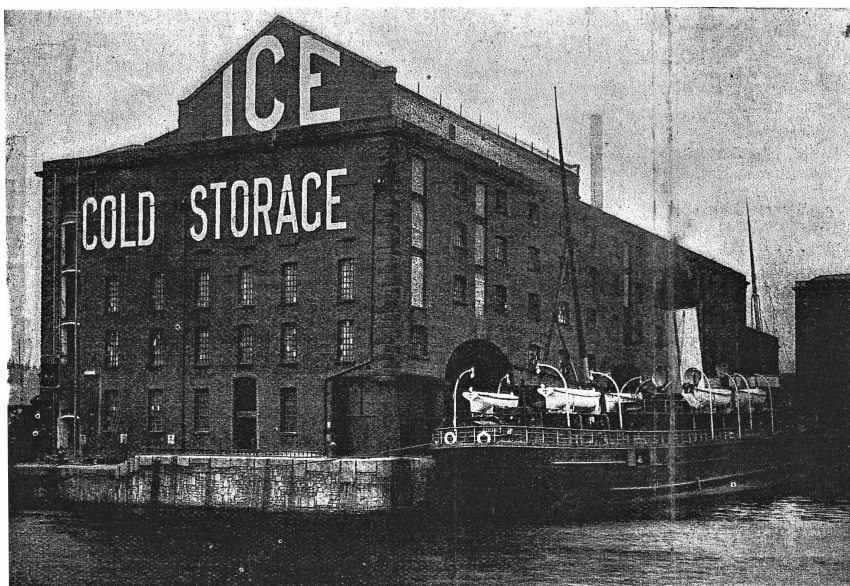


Figure 5.6. The Riverside Cold Storage and Ice Company, Liverpool, 1900 (Bodleian: Per 193998 d.1/II p. v).

Storage and Ice Company, located on a bank of the Mersey in a large four-storey structure, complete with the word 'ice' emblazoned in giant letters on its gable end.

Nevertheless, the city continued to import 12,000 tons of Norwegian block ice a year and some local commentators considered that it was overprovided with ice plants. Except during the three hottest months of the year, there was not the demand to sustain such an ice-making capacity, so it was argued.¹⁸⁸ Even so there were still summer seasons when Liverpool experienced an ice famine, resulting in spiralling prices, especially for natural ice.

Elsewhere, Newcastle-upon-Tyne acquired a large cold store and ice factory in 1904 which was doubled in size inside four years. It was housed in striking five-storey premises on the quayside, a beacon of early-twentieth century factory design.¹⁸⁹ For the manufacturers of ice-making plants, the buoyancy of artificial ice manufacture brought rich rewards. In 1909, The Linde British Refrigeration Company, based in East London, supplied new plants at Paddington, Blackburn, Manchester, Southampton, Bournemouth and Croydon. At Grimsby, it was to install the largest refrigeration machine ever put to work in Britain up to that time, turning out 200 tons of ice a day.¹⁹⁰

Some ice-making companies quickly expanded their initial operations to take in neighbouring towns. The Cardiff Pure Ice Company, for instance, established branch plants at Newport, Barry and Milford Haven, the last two directly alongside the docks. In 1900, the four plants together had a potential output of up to 500 tons of ice a week. And the company was confident enough of its success to take a full-page advertisement in the *Cold Storage and Ice Trades Review* setting out the range of its activities.¹⁹¹ These included substantial cold storage space for cargoes of foreign meat. There was also, significantly, a continuing importation of Norwegian ice, much as in London and in Liverpool.

The ice trade's capacity for occasional boom ensured that there were times when it displayed a propensity to attract capitalist speculators. In June 1901, the *Cold Storage and Ice Trades Review* carried details of the sale at auction of an ice factory at Hanley in the Potteries. It was an entirely new plant and had plainly been commissioned with a quick

188 *Ibid.*

189 *Ibid.*, XI (1908), p. 195.

190 *Ibid.*, XIII (1910), p. 8.

191 *Ibid.*, II (1900), p. x.

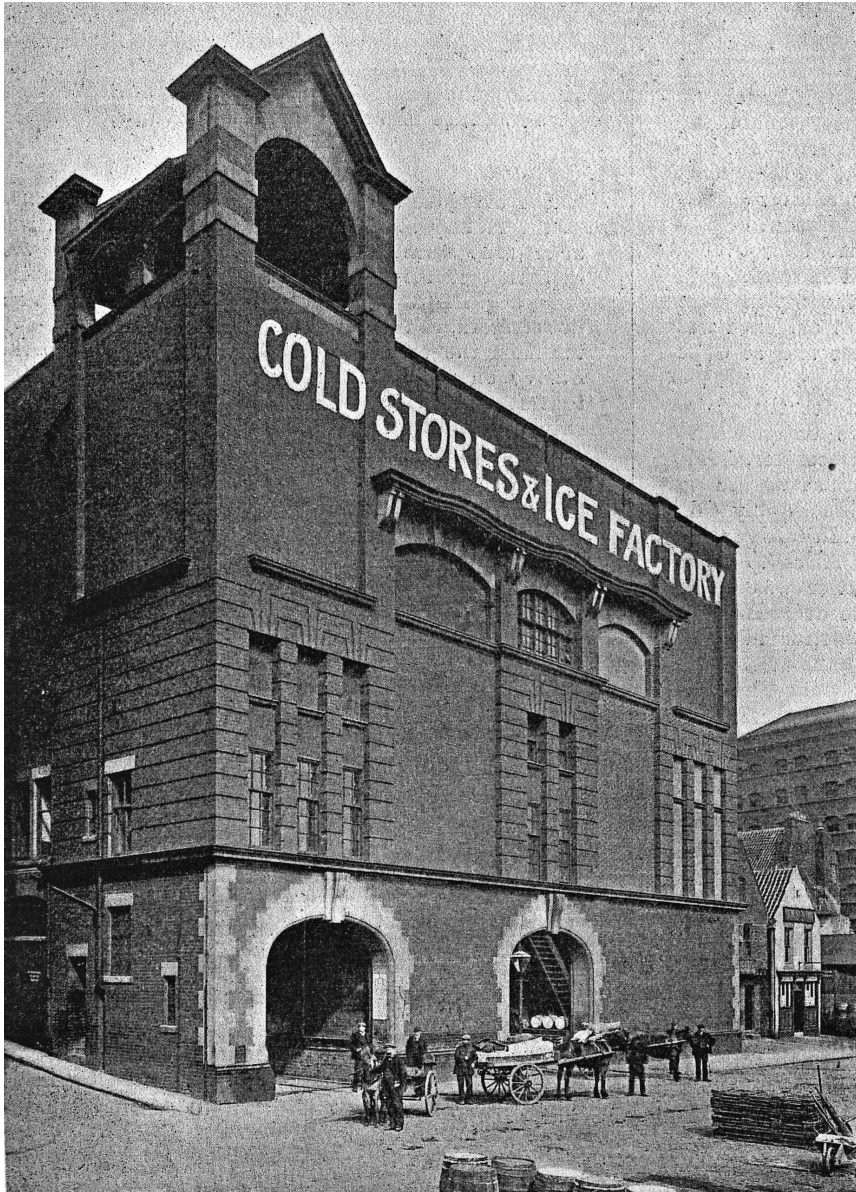


Figure 5.7. Newcastle's cold store and ice factory, 1908 (Bodleian: 193998 d.1/XI p. 195).

profit in mind. The Potteries district then had a population of 300,000 and the auction notice was at pains to emphasize that the plant had no competition.¹⁹² From time to time, the *Cold Storage and Ice Trades Review*

192 *Ibid.*, IV (1901), p. 89.

itself played up the speculative opportunities, as in March 1900 when it observed how the town of Blackburn in Lancashire was ripe for an ice and cold storage capitalist. The borough was made up of some two dozen townships and its butchers were counted in their hundreds.¹⁹³

The impressive financial performance of some earlier ice factories, as already seen in the case of those at Aberdeen, strengthened the belief that ice-making was a potentially lucrative venture. The Fleetwood Ice Company started at the turn of the century with a big dividend and was able to wipe off its purchase money. Within a few years, though, its dividend was only five per cent, well down on the wildly successful Aberdeen enterprises that managed to sustain dividends in double figures.¹⁹⁴ In February 1906, an advertisement regarding the sale of Eastbourne's diminutive 8-ton ice works described it as a 'very good investment for capitalist or syndicate'.¹⁹⁵ Its existing owners had clearly struggled to make a going concern of it, despite there being no competition. The *Cold Storage and Ice Trades Review* made a habit of regularly publishing share lists that included companies' rates of return. Most struggled at around five per cent and a few produced no dividend at all. Thus ice-making was clearly a risky venture. In January 1904, the *Review* editor bemoaned in verse the tense relationship between ice factory promoters and the investing public:

We plan as the experts direct us,
Ice-cold you remain, and unmoved:
With such a convincing prospectus
Our arguments should be approved!
Concessions we have quite abundant,
Firm options in populous towns;
Alas! you declare they're redundant –
And all that we get is your frowns!¹⁹⁶

Within such a speculative investment climate, it comes as no surprise to learn that there were new ice companies that failed not many years after their being established. This was the fate of the Liverpool Cold Storage and Ice Company in 1907. Fuel and engine costs had advanced significantly

193 *Ibid.*, II (1900), p. 175.

194 *Ibid.*, IV (1901), p. 175; V (1902), p. 63.

195 *Ibid.*, IX (1906), p. 63.

196 *Ibid.*, VII (1904), p. 4.

over the year, but the demand for ice had also been much depressed by the cold and wet summer. The directors saw no other course than to go into voluntary liquidation. The company's share capital had been £100,000, so it was no mean venture.¹⁹⁷ Another casualty, this time in 1908, was the Swansea Steam Fishing and Ice Company, its plant snapped up at auction by a local competitor.¹⁹⁸

As the wider public benefits of the availability of artificial ice became clearer, especially the preservation in cold stores of wholesale food perishables, municipal corporations up and down the land began to consider starting up ice-making on their own account, particularly in order to serve city food markets. By 1899, Bolton Corporation, for instance, was manufacturing ice for this purpose and selling surplus to the value of £1400 to the general public.¹⁹⁹ Much the same prevailed at nearby Burnley where, in the year ending March 1908, the corporation sold 1,910 tons of ice, valued at £2,131.²⁰⁰ For pre-existing ice factories, however, such municipal forays, underwritten by local taxation, were viewed with deep suspicion. It was typically claimed that market cold stores could rarely in themselves justify maintaining a dedicated ice plant. In other words, such enterprises could not really be viewed as anything other than unnecessary and unwelcome competition in the face of private capital. When municipal ice-making was in the offing at Blackburn in 1907-8, a local ice manufacturer complained that ratepayers' money would be being used to 'run him off'.²⁰¹ In Wolverhampton, an especially fierce battle had raged in 1900 between supporters of a municipal ice plant and cold store there and a group who opposed it, including many local ratepayers and the companies that already supplied Wolverhampton with ice.²⁰² The latter, however, were located in Birmingham and in Dudley, with the result that the retail price of ice in Wolverhampton was generally half as much again as in those two places. Wolverhampton's butchering trade was, predictably, fully behind the municipal operation; it would obviate

197 *Ibid.*, X (1907), p. 349.

198 *Ibid.*, XI (1908), p. 98.

199 *Ibid.*, IV (1901), p. 125.

200 *Ibid.*, XI (1908), p. 320.

201 *Ibid.*, p. 37.

202 *Ibid.*, III (1900), p. 105.

meat being wasted on warm summer days and save carting costs to and from more distant cold stores. In due course, the town did get its cold store and ice factory (in 1902), the two compressors producing between them 16 tons of ice each day in one-and-a-half-hundredweight blocks.²⁰³ It was a largely hollow victory for the municipal lobby, for so small a scale of output was hardly a threat to ordinary ice factories. But ‘municipalism’ had by then grown into a powerful political movement across the growing industrial wealth of midland and northern towns. It revealed itself as a counter to the free march of capital and profit, gaining most traction in the eyes of the public through its creation of urban parks, art galleries, libraries, museums and swimming baths.²⁰⁴ But at a somewhat more mundane level, the regulated food markets of growing city centres like Wolverhampton (which gained municipal borough status as early as 1848) were equally part of the municipal offering.

Given the increasing scale of artificial ice manufacture by the first decades of the twentieth century and the progressive refinement in the quality of the ice produced, it comes as a surprise to discover how far there remained a preference among many users for natural ice from Norway. However, this preference continued in some measure right up to 1914. The preference for natural over artificial ice reflected a continuing suspicion that the factory product was some kind of chemical concoction. One of the first ways that ice plants attempted to counter this view was to describe themselves as makers of ‘pure ice’. Thus when ice-making began in Leeds in 1899, it was the Yorkshire Pure Ice Company that produced it – up to 50 tons a day from 12 ice tanks. This particular appellation subsequently became widely used, with plants often emblazoning the words ‘Pure Ice’ on their rooftops or on their engine chimneys.²⁰⁵

For users of artificial ice, one of the features that repeatedly attracted comment was its poor lasting quality alongside Norwegian ice. It was reputed by some to endure only half the time of natural block ice. When the London Butchers’ Trade Society in 1901 sought to break the combined monopoly of the city’s ice companies, they were sure that natural not

203 *Ibid.*, V (1902), p. 68.

204 F.M.L. Thompson, *op. cit.*, pp. 324–5.

205 *Cold Storage and Ice Trades Review*, II (1899), p. 30.

machine ice was the best product. Not only could it be obtained in much larger blocks, but it lasted longer.²⁰⁶ The artificial ice producers themselves tended to lend credence to this view because most of them imported Norwegian ice alongside the factory output. They never stated as much, for it would have been counterproductive to sales of manufactured ice. But the scale of their Norwegian imports could not be explained merely as a way of meeting summer peaks in demand. Moreover, the artificial ice producers who also imported Norwegian block ice typically offered both products for the same price, even though the latter was by far the more expensive. They did this largely because so much of their ice sales were on regular contract, and stored natural ice allowed flash surges in demand to be met, something that was beyond the production capacities of ice-making plants.²⁰⁷

Among fishmongers, both wholesale and retail, it was found that artificial ice sometimes failed to preserve their fish stocks in the same condition as did natural ice. Salmon and haddocks, for example, boxed and stored under exactly similar conditions, using natural ice in one case and artificial in another, came out completely differently. The latter emerged yellow about the gills and soft, the former in near perfect condition and capable of commanding a far higher price.²⁰⁸ Much the same applied in the transit of fish to cities and large towns. Towards the close of the nineteenth century, some of the leading British railway companies began constructing special refrigerated vans with double doors, zinc linings and ice tanks as well as tanks for meltwater. They were fitted with passenger carriage wheels and automatic vacuum braking so that they could be worked on fast trains.²⁰⁹ These vans soon helped to boost the nascent 'fish and chip' retail trade that had started to become a food staple of many northern industrial towns, using cheaper fish like cod that had previously been dried, salted or smoked and sold in and around fishing ports.²¹⁰

206 *Ibid.*, IV (1901), p. 246.

207 See R.G. David, 'The Ice Trade and the Northern Economy, 1840–1914', *Northern History* 36 (2000), p. 123.

208 *Cold Storage and Ice Trades Review*, V (1902), p. 74.

209 See, for example, *Ibid.*, I (1898), p. 15.

210 See the discussion in R.G. David, *op. cit.*, p. 124.

The fish for the vans would be packed using natural ice, but the ice used for cooling the vans would usually be factory-produced.

In November 1898, the *Cold Storage and Ice Trades Review* published a report of an American chemist in which were listed a whole sequence of potential contaminants of artificial ice. Metallic substances could find their way into the ice blocks in the freezing process. In summer, ice made from day to day could become contaminated by bacteria and other foreign matter getting into the freezing tanks. The water used for ice-making plants could also become contaminated through leaks in the supply pipes.²¹¹

The famous lasting quality of Norwegian ice derived directly from the average size of its ice blocks, normally 20 to 24 inches in thickness. A block cut in this way presented less melting surface in proportion to its bulk than the average block of artificial ice which, as a general rule, came less than half as thick. To manufacture ice of the same thickness as natural ice would require an extremely lengthy freezing process. In a factory ice-can, the first four inches froze or became congealed inside 24 hours, but the average time taken in freezing the rest of the ice slab increased progressively with each extra inch.²¹² The economics of artificial ice-making permitted the production of ice blocks that were up to 10 or 12 inches thick, but, beyond that, diminishing returns applied. On this basis, in other words, Nature's factory could not be bettered.

Of course, there were factory producers who tried hard to undermine the alleged quality of Norwegian ice, arguing that it was drawn from lakes and fjords that could readily be contaminated by effluents. One correspondent of the *Cold Storage and Ice Trades Review* claimed in 1902 that natural ice, generally, was liable to be contaminated with disease germs and other noxious matter, stating that its use was condemned by most sanitary experts. The only safe ice was that made from water of known purity – that is, from distilled water.²¹³ The medical journal the *Lancet* had earlier tackled the issue in a study in 1901. Testing the Norwegian ice supplied to London shops, they deemed it of excellent quality, pure,

211 *Cold Storage and Ice Trades Review*, I (1898), p. 96.

212 *Ibid.*, VIII (1905), p. 8.

213 *Ibid.* V (1902), p. 74.

sparkling and clear. The ice-water approached very nearly to the composition of distilled water or water from a mountain stream. The one concern expressed was the way Norwegian ice could become contaminated if allowed to melt in a leaden vessel, a function of the legendary softness of the water from which the ice was formed.²¹⁴ In 1902, a Glasgow water analyst compared a sample of ice taken from Baardsrud Lake, south of Kristiania, with one from Loch Katrine. It had only the slightest traces of organic matter compared with five grains per gallon for Katrine water and it was almost entirely free from lime and magnesia – in other words very soft compared with Katrine water.²¹⁵

Contamination, though, was not a charge from which factory-made ice could necessarily claim immunity, as we have previously seen. In 1903, Bermondsey Borough Council invited its Medical Officer of Health to inquire into the purity of ice from a public health point of view.²¹⁶ The officer observed that factory ice was made with water derived from three sources: distilled water; water supplied by metropolitan water companies; and well water. The last-named source was very certainly liable to contamination by bacteria via leakage from sewers. Moreover, contrary to some popular perceptions, freezing merely inhibited the growth of disease pathogens; it did not kill them. There were few ice-making plants that used distilled water. One London plant that did was the Shingleton Ice Company, and in the provinces there was an ice plant in Devon, the Brixham Pure Ice Company, that used it, although not, presumably, for use in fish packing.²¹⁷ In by far the majority of ice-making plants, water was drawn from municipal supplies – that is, from mains drinking water. Its quality, then, met the standards that public health officials deemed appropriate for general public consumption. Even so, many ice-plant managers were soon seeking independent testing of the water they used to make ice. It became a vital part of their selling apparatus. London's large North Pole Ice Company drew its supplies from the Kent Water Company. When the ice it manufactured was melted in laboratory tests,

²¹⁴ *Ibid.*, IV (1901), p. 136.

²¹⁵ *Ibid.*

²¹⁶ A summary appeared in *Cold Storage and Ice Trades Review* VI (1903), pp. 233–4.

²¹⁷ *Cold Storage and Ice Trades Review* XI (1906), p. 269.

it resembled distilled water more closely in composition than almost any other.²¹⁸ In Hull, local ice plants drew supplies from the chalk basins of the Yorkshire Wolds. Its purity was beyond reproach. All the ice-makers did was correct for the water's legendary hardness.²¹⁹ Occasionally, municipal supplies could fail for quite other reasons. In 1903, for instance, a London ice factory had to destroy 200 tons of its ice stocks. The public water supply in this case had become discoloured when the Thames was in flood and the brown silt had coagulated in the freezing process, making the ice-blocks streaked and unsightly.²²⁰

Ice merchants who dealt largely or exclusively in imported Norwegian ice repeatedly dwelt upon the softness of the lake or fjord water from which it was made. It was claimed to form a preventive and curative in cases of kidney, liver and kindred disease. As for pureness, at Southampton in 1905 Thomas Mowat Ltd. sought the Borough Medical Officer's opinion on samples of its stocks of Norwegian block ice. He found that it contained only one forty-fourth part of the average solid matter contained in water taken from Southampton's own Corporation Water Works.²²¹ In the war of words and of scientific evidence, then, it was six of one and half a dozen of the other. Natural ice importers and artificial ice-makers engaged in a constant struggle to influence consumers in the type of ice that they chose. All kinds of stratagems were used to try to curry favour. One particular argument that did sometimes strike home against natural ice was the way ice-carrying ships could be used for other purposes on their return passages across the North Sea. Where coal or coke was a back-cargo, no amount of hosing down or washing out of holds could remove all residues. And the regular sight of filthy collier brigs on the Thames could hardly have been a more evocative reminder of this. The counter to this argument was the way, by the early 1900s, some ice-carrying was done in new wooden-hulled steamships specially built for the trade. The likelihood was that these returned in

218 *Ibid.*, p. 268.

219 *Ibid.*, p. 269.

220 *Ibid.*, VIII (1905), p. 8.

221 *Ibid.*, XI (1906), p. 269.

ballast, particularly when they were making weekly voyages in the vital summer export season.

At various times, the operators of ice factories lobbied Parliament to get a duty placed on imported ice.²²² There had been such a levy in the past, amounting to 20 per cent of the value of the cargo, but it had been repealed in 1845 under the momentum of free trade.²²³ With a duty re-imposed, the hope was that Norwegian imports would be stopped in their tracks and a splendid impetus given to the home ice industry. Some parliamentarians backed the idea, but, fortunately for those involved in the Norway trade, no such policy was taken up in peacetime.

The nadir in the war of words between natural and artificial ice came in a High Court action for slander in 1910.²²⁴ It was between the two giants of the London ice trade: The North Pole Ice Company, and United Carlo Gatti, Stevenson, and Slaters Ltd. The plaintiffs, the North Pole Ice Company, alleged slander on the part of the United Company in respect of natural ice supplied to a leading London hotel. The basis of the slander was that a representative of the United company had claimed the ice to be artificial, not natural. The jury found for the plaintiffs and the judge awarded damages of £200. The story had an even more bizarre twist in that, in the course of evidence, it came out that the two firms competed with each other in the supply of ice to the hotel in question. The plaintiffs supplied ice for one half of the week, the defendants for the other. It might have been a script for a music-hall comedy act.

An entirely different feature of artificial ice manufacture that sometimes placed limits on its expansion was the environmental nuisance to which it could give rise. It was not just the familiar problem of smoke and soot from the plant's steam engines, but the periodic leakages of ammonia gas which, allegedly, gave food a nasty taste. Some witnesses also complained of perpetual dampness, arising, it seems, from the ice stores. The difficulties were potentially most acute in the case of ice factories located in central urban areas, particularly those associated with municipal markets. In 1904, the environmental problems created by a

²²² *Ibid.*, VII (1904), p. 46.

²²³ This was part of the same campaign that shortly led to the repeal of the Corn Laws in 1846.

²²⁴ *Cold Storage and Ice Trades Review*, XIII (1910), p. 331.

Leicester ice factory came before the local county court.²²⁵ The Midland Ice Company was subsequently required to make modifications to its plant and operations or face assessment for damages. A similar case at Hanley in the Potteries involved the excessive vibration from the plant of the Stoke-on-Trent Pure Ice Company.²²⁶ Here an injunction was granted, suspended for two months to allow time for remedial action.

In the final analysis, of course, artificial ice production could work only as long as the economics of the enterprise were viable. In March 1907, at a meeting of the Cold Storage and Ice Trades Association, a Grimsby plant manager treated delegates to a show of lantern slides in which the difficulties of running a large ice-making plant were made disarmingly plain.²²⁷ Aside from the capital costs of plant and machinery, and the costs of maintenance and labour, the price of coal was critical to viability. It was here that natural ice really had no peer. Apart from the rental costs involved in securing access to lakes, ice from Norway cost nothing to produce. The costs were all in labour, storage, shipping and insurance. The annual reports of ice factories in Britain repeatedly comment on the problems posed to their operations by the fluctuating price of coal and of the continued efforts that engineers were making to try to raise the efficiency of energy use. In the year 1900, the Croydon Ice Company had spent £500 more on coal than it had anticipated, representing almost a third of its entire annual profit.²²⁸ In Lowestoft in 1909, the directors of the once successful East Anglian Ice Company commented on the implications of Parliament's Eight Hours Bill for the increased price of coal and, in consequence, the plant's production costs.²²⁹ Within the trade, it was generally reckoned that it required one ton of coal to make 20 tons of ice. A shilling a ton on the coal price could make the difference between profit and loss. So it was hardly surprising that there were proprietors who started looking for alternative sources of heat like town gas.

225 *Ibid.*, VII (1904), p. 87.

226 *Ibid.*, XIII (1910), p. 15.

227 *Ibid.*, X (1907), p. 125.

228 *Ibid.*, III (1901), p. 433.

229 *Ibid.*, XIII (1910), p. 15.

In an effort to cut their specific labour costs, many ice factories naturally sought to mechanize further the range of their operations. For example, in 1908 the Burnley ice factory installed an electrical ice cutter to saw its standard five-hundredweight ice blocks into the hundred weight sizes that it sold to customers. Previously it had taken three men half a working day to saw seven tons of ice with hand cross-cut saws. With the ice cutter, one man could saw the same quantity in 30 minutes. The machine also used circular saws which gave a more even cut to the ice blocks and better satisfaction to customers.²³⁰

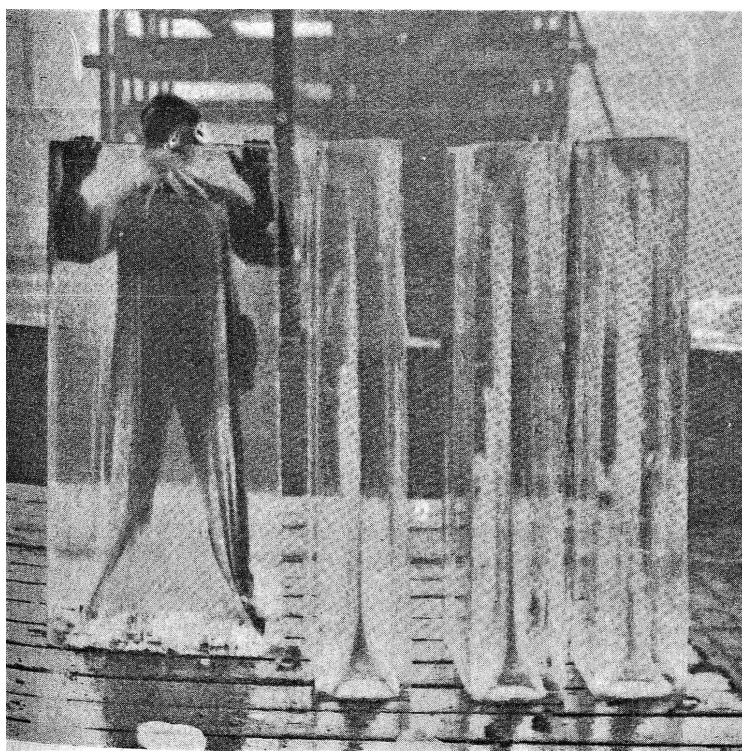


Figure 5.8. Giant, translucent ice blocks from Bradford's ice factory, 1923 (Bodleian: Per 193998 d.1/XXVI p. 171).

Ultimately, it is not easy to measure the scale of actual ice consumption in Britain and the relative contributions accounted for by natural and by artificial ice. The tonnages of ice imported and the productions of ice

²³⁰ *Ibid.*, XI (1908), p. 122.

factories are no guides in themselves, especially when long-term storage of ice is contemplated as part of the calculation. The 1907 Census of Ice Factories had put total ice manufacture in Britain at 597,000 tons, 250,000 tons ahead of imports from Norway.²³¹ However, in early 1915, the *Cold Storage and Produce Review* gauged London's annual pre-war ice consumption at around 300,000 tons, of which only slightly over a third comprised artificial ice.²³² There were then three principal companies producing artificial ice, with an aggregate potential output of around 365 tons a day. In other words, as far as potential consumption of artificial ice went, London appears to have had more than sufficient productive capacity. In 1910, though, at the time of the High Court case between the North Pole Ice Company and the United Company, these two principal firms were, between them, actually producing only 30,000 tons of artificial ice each year, a surprisingly low figure, even allowing for expansion of productive capacity in the intervening five years up to 1915. At the time of the court hearing, moreover, the United Company stated that it imported 120,000 tons of natural ice a year, twelve times its artificial output. Thus, for one leading firm of London ice merchants, factory ice appears to have made only limited inroads into its business, even by the time that imports of Norwegian ice were well and truly in decline. This almost certainly had something to do with its customer base in which hotels, clubs, restaurants and the houses of the upper classes featured prominently. Chefs also used natural ice for all kinds of fancy work, in that they cut table decorations from it. Artificial ice was quite unsuitable for this purpose: the ice was brittle and would not sculpt properly. Once more, then, one registers the remarkable subtleties there were in the distinctions between the artificial product and the natural material which one wit referred to as from 'Norroway across the foam'.²³³

231 *Ibid.*, XIII (1910), p. 309.

232 *Ibid.*, XVIII (1915), p. 48.

233 *Ibid.*, IX (1906), p. 261.

