From ice to refrigerators

The need to preserve fish, meat, fruit and vegetables led to the development of thermal insulation for shipping and storing natural ice, which ultimately formed the basis of the thermal insulation for buildings today.

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Worldwide, winter snow and ice have long been collected, stored and used in summer to preserve food and cool drinks. Although New Zealand has natural ice, it is not widely available or easily accessible to most populated regions.

Winter ice chills food

The international trade in winter ice started from lakes near Boston, Massachusetts, in 1804 and, by 1816, created the first opportunity to send chilled food by ship. Apples were successfully carried from Boston to Cuba, and meat shipments across the Atlantic followed. Lacking mechanical refrigeration, the ice was maintained by well insulated ships' holds.

In the Southern Hemisphere, Sydney received the first ice from Boston in 1839, but it wasn't until the ship *Oriental* docked on 19 June 1856 that the first chilled fruit import arrived. The *Oriental* carried 529 tons of ice and 40 half barrels and 20 full barrels of American pippin apples. They were 'packed as gathered from the tree, and stowed in the cargo of ice'. The prices received at auction for this rare cargo were not publicly reported.

Frozen meat trade

The frozen meat trade relied on four main conditions:

- Meat was available.
- There was a market for it.
- Suitable refrigeration technology existed.
- Entrepreneurs were willing to establish a new business.

However, this trade could only begin with the development of suitable insulation to transport natural ice long distances by ship. Natural ice was the first refrigerant for the trade between Canada, America and Europe, but New Zealand and Australian meat exports used manufactured ice. The first exports, using a steam powered refrigeration plant, were from Sydney to London on the SS *Strathleven* in 1879 and from Port Chalmers on the *Dunedin* on 15 February 1882.

Ice and sports fishing

The ability to maintain cool temperatures for a sustained period of time is also valuable for transporting living materials. Although there doesn't seem to have been a direct trade in ice between Boston and New Zealand, American ice played a crucial role in the development of New Zealand sports fishing.

The first attempts to import Atlantic salmon (*Salmo salar*) ova or eggs from Great Britain into Australia were a failure. The ova were either damaged by the ships' movement or hatched in the tropics. Eventually, it was found that packing the ova in soft, clean moss and embedding it deeply in ice enabled them to travel safely.

A shipment of 100,000 Atlantic salmon ova and 3,200 brown trout ova left England in January 1864. After the 12-week journey, many were landed satisfactorily in Hobart. A similar voyage in 1868 delivered Atlantic salmon ova to Dunedin, where they were 'found in excellent condition'.

The Atlantic salmon didn't survive in Australasian waters, but the brown trout did. In 1867, ova from the successful Tasmanian programme were brought to New Zealand rivers. Quinnat or Californian salmon (*Oncorhynchus tshawytscha*) ova first arrived in New Zealand on the steamship *Vasco de Gama* on 5 November 1875, and although much augmented, they form the basis for today's salmon fishing.

Household refrigeration

For businesses and households to preserve food, they required ice or mechanical refrigerators, which were expensive in the 1920s and not readily available until the 1940s. Ice could be shifted around to houses and businesses, but demand exceeded the supply of winter ice that had been transported and stored.

Ice was first manufactured in Victoria in 1859. With the local demand filled, New Zealand must have been seen as an obvious market. The Victoria Ice Company (of Franklyn Street West, Melbourne) advertised themselves in the 1864 *Otago Almanac* as providers of ice, but no other evidence has yet been found of other Australian ice businesses promoting their products in New Zealand. Ice imports, if any, were small, as they don't appear in the statistics from 1859 to 1880. This suggests that ice wasn't available to New Zealand households until manufacturing machinery had been imported.

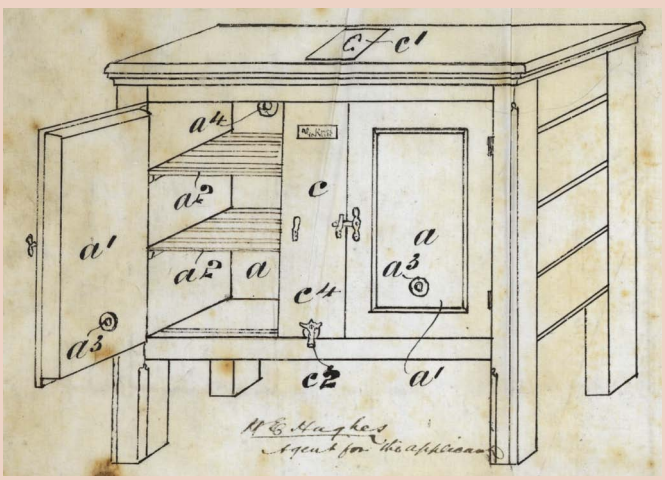

Figure 1: Mr Max Kreissig's 1896 improved ice safe, Patent 8825. c is the compartment where ice was introduced and water drawn off with the tap (c2). (Source: Archives NZ ABPJ Series 7396 Acc W3835 Box 74.)

Chemical alternatives

Freezing powders based on chemical mixtures such as nitrate of ammonia and carbonate of soda, which absorbed heat when added to water, could be used to generate cold. These were being used in Sydney as early as 1848.

In New Zealand, they don't seem to have been widely advertised, even before the availability of machine-made ice. Two Wellington examples have been found after the availability of machine-made ice – on 7 March 1880, Laery & Campbell auctioned '4 American ice machines, with freezing salts', and on 31 July 1884 JH Bethune sold by auction '1 Ash's patent double stoneware freezing machine and 2 casks freezing powder'.

Ice manufacturing in main centres

News items and advertisements suggest that, by the late 1870s, ice was being manufactured in the main centres.

AUCKLAND

In 1871, Mr George Gledhill made ice in his lemonade and aerated water manufactory at the corner of Albert and Wellesley Streets. He used a Siebe Brothers machine, which would have been based on the patent of James Harrison of Geelong and used ether as the refrigerant. By 1872, demand for ice had significantly increased, and an Auckland Ice Company was proposed.

WELLINGTON

Mr Edward Hibberd's Wellington Ice Works opened in Courtenay Place in 1877. Initially, it made use of the town water supply to drive the machinery, rather than use a costly coal-fired steam engine. Some members of the city council found this unacceptable, particularly in times of low water, and the council stopped water supply in January 1880.

By April 1880, the creation of the Wellington Ice Company was under way. In 1881, the Wellington Biscuit and Confectionery Company advertised that ice could be obtained from its factory in Farish Street, and by 1888, 'cheap and pure and transparent ice' was available from the ice works in Tinakori Road.

CHRISTCHURCH, NELSON

From 1878, Messrs Lindeman and Fogel sold ice from their New Zealand Ice Works factory at the corner of Tuam and Montreal Streets.

G Mercer at the Auckland O & S (Oyster and Salon) rooms, located on the 'Wrong side, Bridge-st', sold fresh fish and ice to Nelson customers in 1888.

Provinces not so well served

In the provinces, regular supplies of ice were somewhat slower in arriving. By 1881, sufficient ice was publicly available for the Government Railways 'Freight Rates' to include a specific listing for 'Ice, packed', which, although it was carried 'At owner's risk', was under the same goods class as corrugated iron.

The 1886 Census of Manufacturing recorded the production of 5 tons of ice a year from the six 'Aerated Waters and Cordial Manufactories' in Hawke's Bay, although not specifying whether this was from all or only one of them.

By January 1890, the Poverty Bay Herald was reporting that, in 'Auckland, Napier and other places every home has its ice chest, and the frozen article is supplied each morning at 1d per lb'. But although Messrs Nelson Brothers had a plant to 'freeze the mutton', it had insufficient capacity to supply Gisborne householders. The Gisborne City Butchery of J Clark & Co. was advertising the availability of 'a constant supply of ice' by December 1893.

Figure 2: Leonard early 1900s 'cleanable' refrigerator with 'shelves of solid galvanised iron'. The ice chamber is at the top to supply 'cold dry air' to the food stored below. (Photo courtesy of Fisher & Paykel.)

For Christmas 1891, Mr WS Dustin, caterer of Wanganui, had arranged 'a full and constant supply of ice from Wellington' to provide ice creams and ice puddings. However, it took till 1895 for Mr C Tate of the Taranaki Hotel, New Plymouth, to receive 'from Auckland a constant supply of ice' so that 'all drinks supplied at his hotel may be had cool during the hot weather'.

Kreissig's secret

On 5 September 1896, Mr Max Kreissig of Wellington patented his 'improved ice safe' (Patent 8825). His ice chest, awarded medals at the 1897 Auckland and Wellington Exhibitions, reduced 'ice consumption by one third' and gave 'several degrees lower temperature'. It was also 'better constructed and more durable' than its competitors, and by November 1902, there were over 300 in use in Wellington.

Kreissig's secret, apart from a solid construction, was that he left 'a space between the boarding for the introduction of charcoal, fur, pumice, sawdust, or other well-known non-conductor of heat'.

The thermal insulation knowledge gained from shipping and storing natural ice was crucial to the development of the manufacture and storage of machine-made ice and formed the basis for the development of thermal insulation for buildings.

The history of thermal insulation was covered in Build *117 (April/May 2010 pages 90–91) and Build 118 (June/July 2010 pages 94–95).*