STATE OF ORIGIN

James Harrison has long been regarded as the grandfather of Australia's refrigeration industry. Although he was the first to create ice via mechanical means, his efforts to ship frozen meat to the UK were met with fierce competition from another pioneer north of the Murray, as Sean McGowan writes.

Thomas Sutcliffe Mort's memorial statue in Sydney.

Laud the achievements of James Harrison too loudly anywhere around the once-cobbled streets of Sydney's Darling Harbour, and you're bound to be frog-marched to Macquarie Place to bow at the effigy of one Thomas Sutcliffe Mort.

"Who?" you might ask – and rightly so (but do it quietly for fear a New South Welshman might be in earshot).

You see, in these parts, Mort is a champion of industry, and of the people.

Indeed, some would argue this notion should be held much more widely. For when he died in 1878, Mort was spoken of as "the greatest benefactor the working classes in this country ever had".

Some epitaph, huh?

These days, the banana-benders bask in the afterglow of their eighth consecutive series win over the Blues (on the back of a team mostly made up of Melburnians and the odd New South Welshman, mind you). In terms of state-of-origin superiority, the rest of us might need to imagine colonial life 150 years ago.

It was a time when industrialisation was transforming the Australian economy and bringing the world closer. And the race to be the first to successfully export frozen meat abroad was on in earnest.

THE GRANDFATHER OF REFRIGERATION

A Scotsman by birth and printer by trade, James Harrison found a country still 64 years short of federation when he emigrated to Sydney as a 21-year old in 1837.

At the time, Australia consisted of the British colony of NSW, the island of Van Diemen's Land (not to be known as Tasmania for another 19 years), and the recently established, far-flung colonies of Western Australia and South Australia. And 800 kilometres south of Sydney, the settlement of Port Phillip was yet to occur.

Having completed his printing apprenticeship in London, Harrison had responded to an advertisement by London-based company Tegg & Co for a compositor to go to its Sydney office. He jumped at the chance.

Following contributions to the first edition of Tegg's short-lived *Literary News*, and a stint with the *Sydney Herald,* Harrison set out for the settlement of the newly named Melbourne. He soon found work as a compositor with the *Port Phillip Patriot* (one of many newspapers established by the city's pioneering founder John Pascoe Fawkner) before ascending to editor.

It was Fawkner who then sent Harrison to Geelong, where he established another of the pioneer's titles, the *Geelong Advertiser,* in 1840.

Harrison would become a respected member of the community. He was an inaugural member of the Geelong Council in 1850, and represented the area in the Victorian Parliament. The bridge over the Barwon River is named in his honour.

A man of many talents and interests, the science of refrigeration had always intrigued Harrison. His interest in the topic grew as, in his role as editor, he recognised the many problems that refrigeration could solve.

This led him to establish an ice works on the banks of the Barwon River at Rocky Point, with blacksmith John Scott. It followed experimentation with a whorl coil sourced from a heating apparatus, and with the ether Harrison used to clean the movable type on printing presses.

The first ice is reported to have been made in 1854 by Harrison's ether-vapour compression refrigeration system that used a compressor to force ether through a condenser, where it cooled and liquefied. The liquefied gas was then circulated through refrigeration coils, and vaporised again, cooling down the surrounding machine.

By the following year, the system was refined such that he submitted his first patent application in Victoria – granted in February 1855 with the title "Refrigerating Machine".

According to Roy Lang's book James Harrison – *Pioneering Genius* – Harrison "named ether or alcohol as refrigerants and gave special directions for the use of ammonia or other gaseous solutions".

"The purposes were 'the manufacture of ice from water, either pure or salt; the preservation of provisions by congelation; the cooling of buildings; and generally for the reduction of temperature wherever required'.

"… this 1855 machine costing over £1,000 had a capacity of 3,050kg of ice per day and was driven by a 3.5 horsepower engine …"

However, Harrison was confronted by the problems of leaking valves, joints and gasket materials.

If he was to achieve his aim of supplying ice more cheaply than the natural ice imported from the US, these problems would need to be resolved. So he set sail for England seeking steam engineering expertise.

It was in London that he patented both the machine and process, and commissioned engineers Siebe & Co to build a new version of his original machine at Rocky Point, at a cost of £1,200.

Harrison demonstrated this 0.5hp model in London in 1856 at a public exhibition, before exhibiting in both

James Harrison

Paris and Vienna the following year. In 1858, he again exhibited in London – this time with a 10hp version – before sailing back to Melbourne with machine in tow.

Rather than return it to Geelong, Harrison set up the machine in Melbourne, where he began producing slabs and blocks of ice of various weight. In 1859, he founded the Victoria Ice Works in Franklin Street, and the following year, ordered another machine for the establishment of the Sydney Ice Company, in partnership with P.N. Russell.

But financial difficulty would strike Harrison – his investment in the machinery had not delivered a significant return. He was soon forced to sell the plant, name and franchise in NSW to a consortium that included French engineer Eugene Nicolle, who was determined to suppress it in favour of his own ammonia gas liquefaction system.

Not long after, Harrison was declared insolvent, and was forced to sell the *Geelong Advertiser* he had acquired from Fawkner. Although machines of his design continued to be exhibited and sold across the globe, including at a brewery in Bendigo, it would appear any financial windfall owing to Harrison was not forthcoming.

RACE AROUND THE WORLD

Harrison returned to journalism, his work including a stint with *The Age* in Melbourne. He continued to publicly lament the problems faced by local pastoralists unable to ship meat to the UK due to the tyranny of distance.

Un-refrigerated meat was being successfully shipped across the North Atlantic from the US. However, it was widely thought that the journey across the equator from the southern hemisphere would require the meat to be frozen solid, and remain that way for the three-month passage.

More mutton and beef was produced than could be consumed by the local population. The idea of shipping surplus fresh meat (rather than the tinned variety) overseas came to fascinate the nation's leaders, as it did in other countries.

The first to achieve such a feat could rightly expect to make a fortune. The race was on, both in Australia and around the globe, to make a successful shipment.

According to Lang, in 1867 the Sydney Chamber of Commerce turned to successful entrepreneur Thomas Sutcliffe Mort, who had a new-found interest in Nicolle's refrigeration inventions.

But in Melbourne, Harrison was keeping an eye on developments. In 1872 he exhibited "Fresh meat frozen and packed as if for voyage, so that the refrigerating process may be continued for any required period" at the Victoria Exhibition.

Harrison dispensed with the idea of a refrigeration machine onboard due to fire concerns. Rather, he experimented with keeping the cargo in a frozen state during the three-month voyage by studying melting rates and the design of an insulated, onboard container.

Unlike the ice houses being used by American ships trading with the West Indies, Harrison's plan was to pre-freeze carcasses to a suitable temperature. He would then place them in the container with sufficient ice provided to hold the freezing conditions for the duration of the voyage.

He had shown it was possible to maintain meat in frozen condition for the period required for shipping. He was ultimately awarded a gold medal for his successful experiments at the exhibition.

This led to a number of pastoralists financing a trial shipment of 20 tonnes of meat to London to test the effectiveness of Harrison's idea.

He quickly assembled and installed two tanks within the hull of the Norfolk, each capable of holding 10 tonnes of meat. These were insulated with tanning bark, and two pumps were used to circulate a brine solution throughout the ice supply.

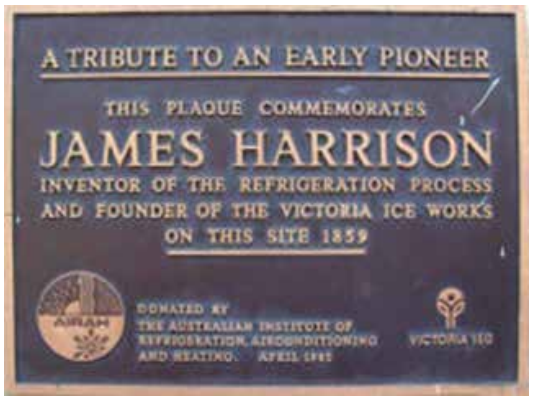
On July 22, 1873, the ship set sail for London, arriving three months later on October 22. The following day, *The Argus* newspaper reported:

"Mr Harrison's meat experiment has completely failed, through the defective construction of the tanks placed on board the Norfolk. The failure was anticipated shortly after leaving Melbourne, and the meat had to be thrown overboard off Cape Horn."

It was later reported that the hurried preparations had ultimately brought Harrison's scheme undone. Once at sea, it was found that a leak had caused ice to deteriorate quickly, leading to the meat being off-loaded on just the 34th day of the voyage.

Dejected, Harrison remained in London. However, he was not dissuaded for long, lodging a patent application later the same year titled "Preservation of Food: Improvements in the Preservation of Food and in the Construction and Refrigeration of Enclosed Chambers to be used for this and other purposes".

He would return to the Geelong area some years later, but his days of refrigeration experimentation were effectively over and he died in 1893. In reporting his death, an article in *The Age* on September 3, 1893, confirmed Harrison's standing:



"It is striking proof of his insight that he was the first to see the enormous source of wealth that lies still undeveloped in the export of meat from the Australian pastures. The very industry which Mr Russell tells us has pulled New Zealand out of the shoals into calm waters was receiving Mr Harrison's strenuous advocacy thirty years ago."

MORT'S ATTEMPT

Meanwhile, the race continued among other entrepreneurs, with Thomas Sutcliffe Mort leading the way from Sydney.

A Lancashire-born man, Mort had emigrated to Australia around the same time as Harrison, and founded the successful wool-broking firm, Mort and Co., in Sydney, as well as Australia's first dry-dock in Balmain in 1855.

Around the same time, he began acquiring pastoral land at Moruya on the NSW south coast, eventually owning 38,000 acres in the district. Here he oversaw the production of butter and cheese.

It was these interests that led Mort to investigate various methods of refrigeration, and eventually to his introduction to Nicolle, the French engineer.

Financing Nicolle's developmental work, Mort soon established the world's first freezing works at Darling Harbour in 1861 – later to become known as the NSW Fresh Food and Ice Company.

The pair also had their eye on the export of frozen meat, and obtained a patent for a cold-air machine in 1868. After further testing, they reverted back to the ammonia absorption system they had already been operating.

But at the same time, similar attempts were being made around the world.

Chilled beef was by now being successfully shipped from the US to the UK. Queen Victoria is said to have proclaimed this to be "very good". But this route avoided

Timeline

1837	Harrison and Mort emigrate to Australia (separately and unknown to each other)
1854	Harrison's Rocky Point ice works produces its first ice
1855	Harrison submits his first patent in Victoria – "Refrigerating Machine"
1861	Mort establishes the world's first freezing works
1868	Mort and Nicolle submit their patent for a cold-air machine
1873	Harrison makes his first and only attempt at shipping frozen meat to England
1877	Mort attempts to ship frozen meat aboard the Northam
1879	McIllwraith successfully ships frozen meat and butter from Melbourne to London.

the equator, and didn't represent the same challenges as those faced from the southern hemisphere.

Elsewhere, Frenchman Charles Tellier attempted to take a cargo of frozen meat from Rouen to Buenos Aires and back again in 1868, using onboard ammonia compression. Though not completely unsuccessful, the venture was deemed as having failed due to the amount of cargo found to be unsatisfactory on arrival.

Back in Australia, Mort's determination to export frozen meat overseas became all the greater following his development of a large abattoir in Lithgow, designed to slaughter and freeze sheep and cattle from western NSW.

At an inaugural lunch in late 1875, Mort had frozen meat served to his 300 distinguished guests to prove the viability of his export venture. It was here that he is reported as talking of the inevitability that France and England would look to Australia for their supply of food.

In what now read as prophetic words, Mort said: "I feel, as I have always felt, that there is no work on the world's carpet greater than this in which I have been engaged. Yes, gentlemen, I now say that the time has arrived at all events, is not far distant when the various portions of the earth will each give forth their products for the use of each and of all; that the over-abundance of one country will make up for the deficiency of another; the superabundance of the year of plenty serving for the scant harvest of its successor; for cold arrests all change."

In 1877, at the same time as a ship fitted with an ammonia machine and cargo of frozen meat sailed from Buenos Aires to Marseilles, Mort and Nicolle attempted the same.

Frustratingly, however, a mechanical breakdown of their machine (caused by the flexing of the ship in harbour) ultimately saw the Northam leave Sydney with the pair's failed machinery onboard – but without its precious cargo.

It's not known if Mort realised just how close he had come, for the ship from Buenos Aires struck trouble during its journey, arriving some four months late but with its frozen cargo still intact.

Whatever the case, it was a bitter blow to Mort, and he died the following year with his dream unfulfilled.

Just two years later, Andrew McIllwraith laid claim as the first to successfully send frozen meat from Australia to London, using an English Bell and Coleman air compression/expansion refrigeration machine aboard the S.S. Strathleven.

The race had been won, and the world had changed forever. ▲

James Harrison Medal

In commemoration of James Harrison, whose work in refrigeration in Australia, and worldwide, made him one of the great pioneers of the industry, AIRAH awards the James Harrison medal. It is the most prestigious award presented by AIRAH and although nominations are sought each year, it is only awarded if a suitable nominee is found. It has been awarded to 25 recipients in the past 40 years.

All previous winners are listed at www.airah.org.au/AIRAHAwards

Sources:

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