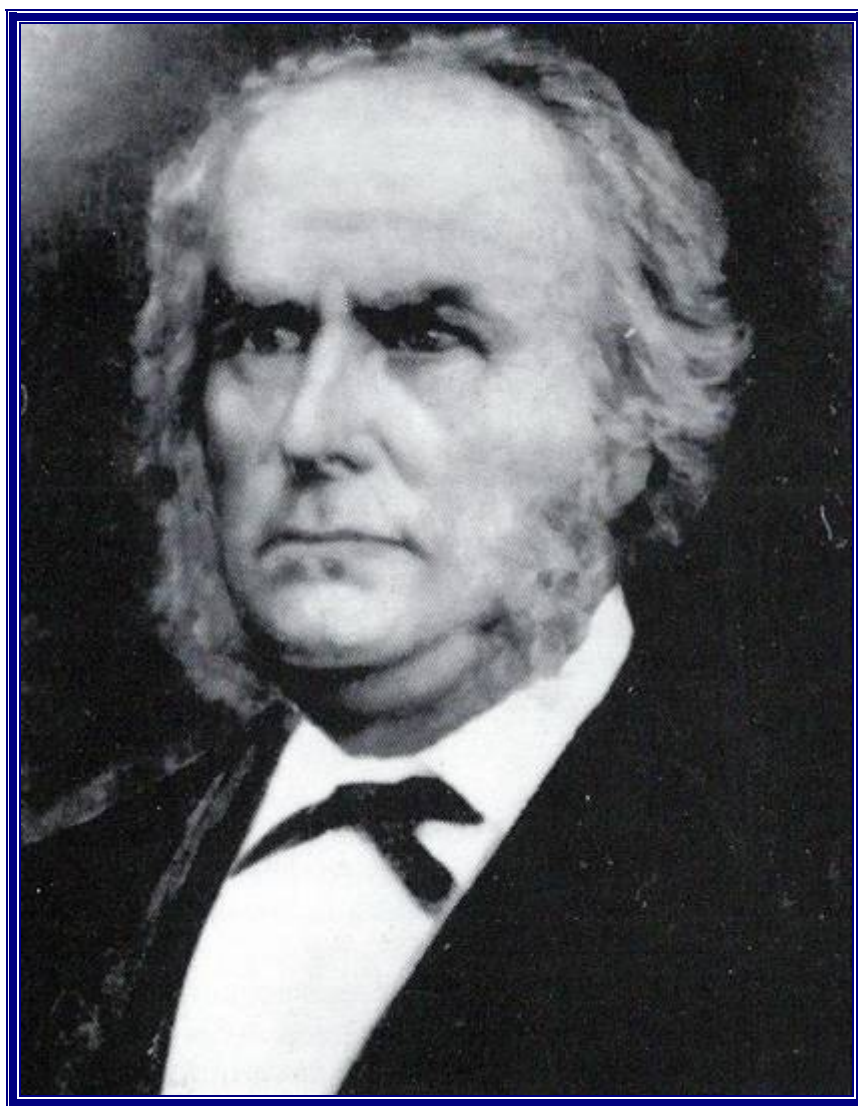


JAMES HARRISON

By EurIng Brian Roberts, CIBSE Heritage Group



James Harrison 1816-1893

James Harrison was born in 1816 in Bonhill, in Dunbartonshire, Scotland, the son of William Harrison, a salmon fisherman, and Margaret McGregor. The family moved to Glasgow where James was apprenticed to a printer. He took evening classes for the sons of artisans and tradesmen at Anderson's University, the subjects including chemistry and mathematics. Harrison later attended the Glasgow Mechanics Institution where he won essay prizes in two successive years. As type-setters were better paid in London he moved into the printing trade there and after a short time was promoted to the position of "clicker" where, still only nineteen years old, he supervised the work and conduct of others. After a year in London, he responded to an advertisement in the *London Times* seeking a compositor to work in Sydney, Australia. Harrison's application was successful and he arrived in what was then the State of Victoria in 1837.

In Sydney, Harrison worked for a number of publications, but in 1839 he sailed to Melbourne, which had been settled only four years earlier and again followed his trade of printing. In 1840, he moved to Geelong where as Editor he helped establish the *Geelong Advertiser*. Over the next ten years or so Harrison became a pillar of the local community. The township grew in importance when in 1848 Geelong became a Free Port.

The story of how Harrison came to take an interest in refrigeration is that he noticed the cooling effect of the evaporation of sulphuric ether while cleaning printer's ink from type. He built and experimented with a closed refrigerating system and after improvement secured Victoria Patent 25 in 1855, followed by British Patents 747 in 1856 and then BP 749. Returning to England he sought assistance from Siebe & Company, an experienced manufacturer of steam engines. Harrison secured another patent, BP 2362, for machines for domestic use, for cooling brewers wort and for cooling houses and hospitals.

A small ice-making machine of ½ horsepower was made by Siebe and demonstrated in London, Paris and Vienna. Other machines went to Australia and one was sold to the brewery of Truman Hanbury & Buxton in London. A 10-hp Harrison-Siebe machine went on trial at 4 Red Lion Square in London, being fully reported in the *Illustrated London News* of 29 May, 1858, where it was viewed by Michael Faraday "who passed favourable comment."

Harrison received a number of offers to purchase his patent but he objected to the imposed conditions. He had protracted negotiations with a prospective purchaser in France but these also came to nothing.

In August 1858, Harrison sailed back to Melbourne where he decided to set up an ice-making plant. It was not the success for which he had hoped. In 1859, he founded the Victoria Ice Works in Melbourne, but a more significant event was when he placed an order with P N Russell & Company of Sydney to manufacture some of his Harrison-Siebe machines, forming a partnership with Russell. The partnership set up the Sydney Ice Company "to bring patent ice to Sydney for the first time."

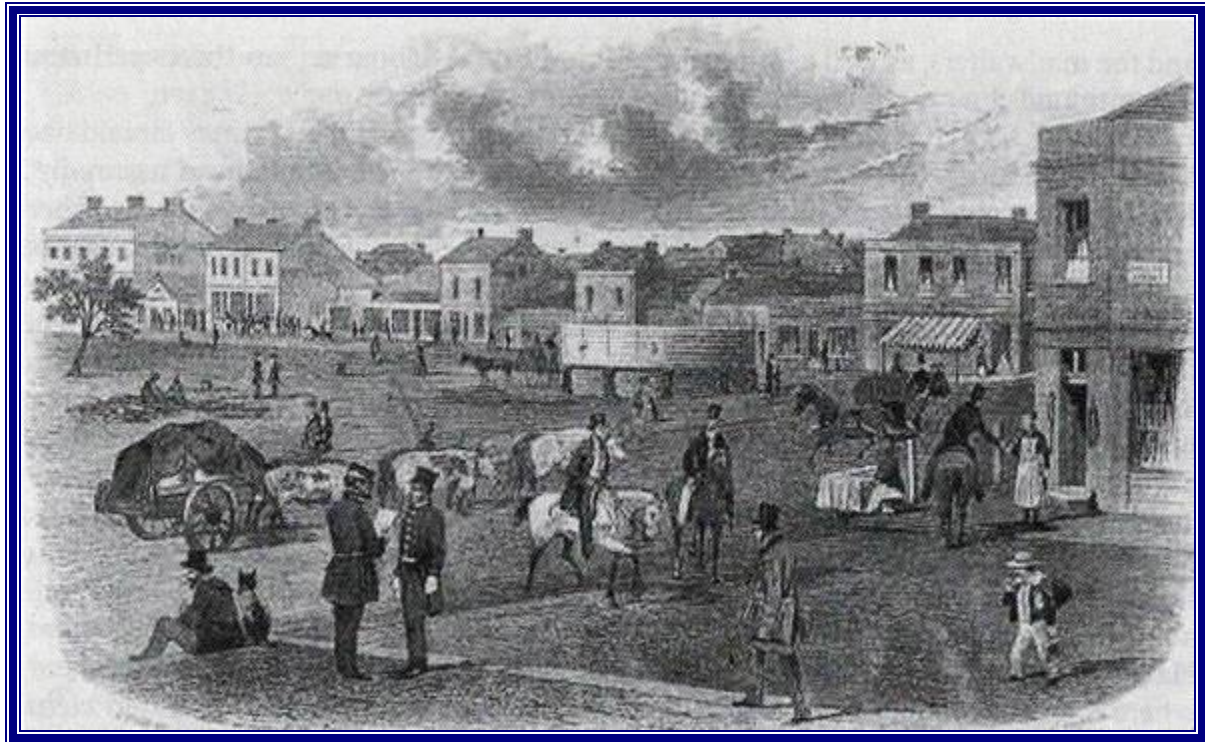
Around 1860, the Glasgow, Thunder & Company installed a Harrison machine in their brewery located in Bendigo (now in New South Wales). In a brochure of 1861, Harrison claimed to have machines in operation in Liverpool, Algiers, Buenos Aires, Chile, Peru and Adelaide, in addition to those in Geelong and Sydney. He also claimed that his machine was "being introduced into Glasgow, Calcutta, Singapore, Bombay, Mauritius and on board the Indian steamers of the Peninsular & Oriental Company." It seems the P&O ice-making plant was actually in Egypt and the steamers were provided with ice when docking there.

How successful his business really was is doubtful. By 1862, Harrison was in serious financial straits and sold his plant, name and franchise to Nicolle Dawson and the Wilkinson Brothers, but their only purpose was to remove Harrison's machine as competition and promote their ammonia refrigerating machine.

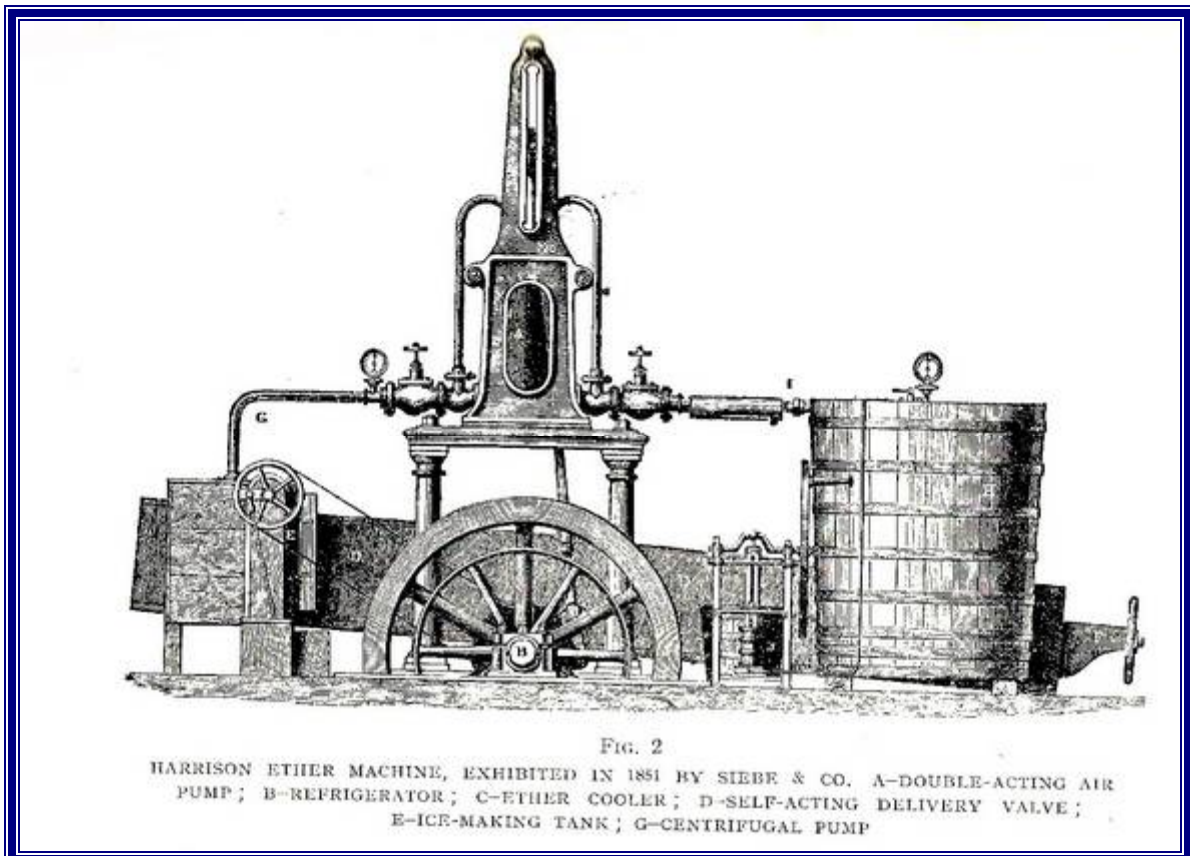
It appears that at the time of Harrison's insolvency Daniel Siebe with H J West, in London, increased their interest in the machine and its future and went on to patent a number of improvements between 1870 and 1874. Harrison himself patented improvements in 1874 and 1878. In 1874, West said "there were fifty to sixty Harrison-Siebe machines manufactured by Siebe-West & Company in use in industry...."

Though he never made a fortune from his invention, Harrison had the satisfaction and prestige of knowing the Harrison-Siebe refrigerating machine won medals at London's South Kensington International Exhibition in 1862, and at Vienna's International Exhibition of 1873. These machines were also adopted as standard equipment for field hospitals in the British campaigns in Africa. The basic design remained unchanged until 1888.

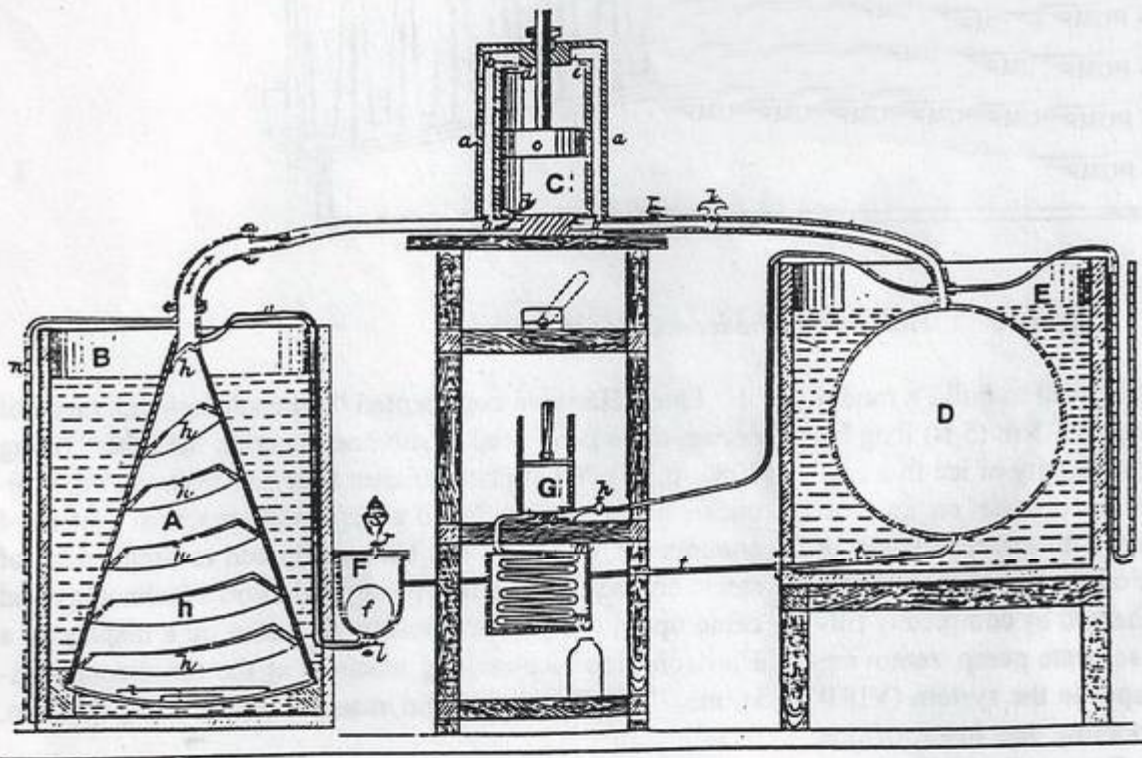
In 1891, while in London, Harrison contracted a form of pleurisy and, after some 19 years in England, took the decision to return to the warmer climes of Australia. Harrison died in Point Henry, Geelong, on 3 September 1893.



The Market Square, Geelong in 1856-57



The Siebe-Harrison refrigerating machine exhibited in 1851

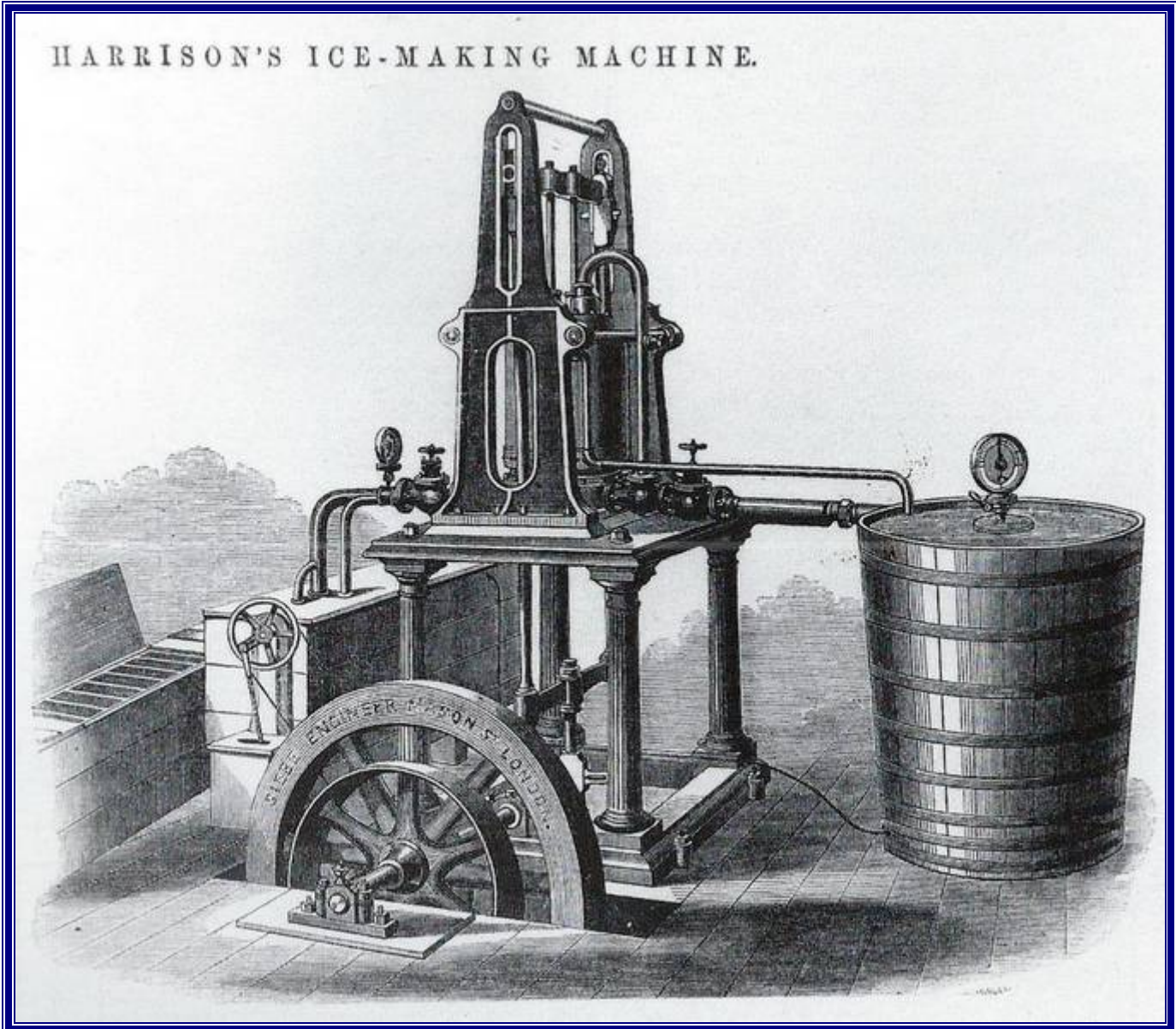


- A - Tinned Copper evaporating vessel
- B - Cistern for containing substance to be cooled
- C - Double action pump
- D - Spherical Copper condensing vessel

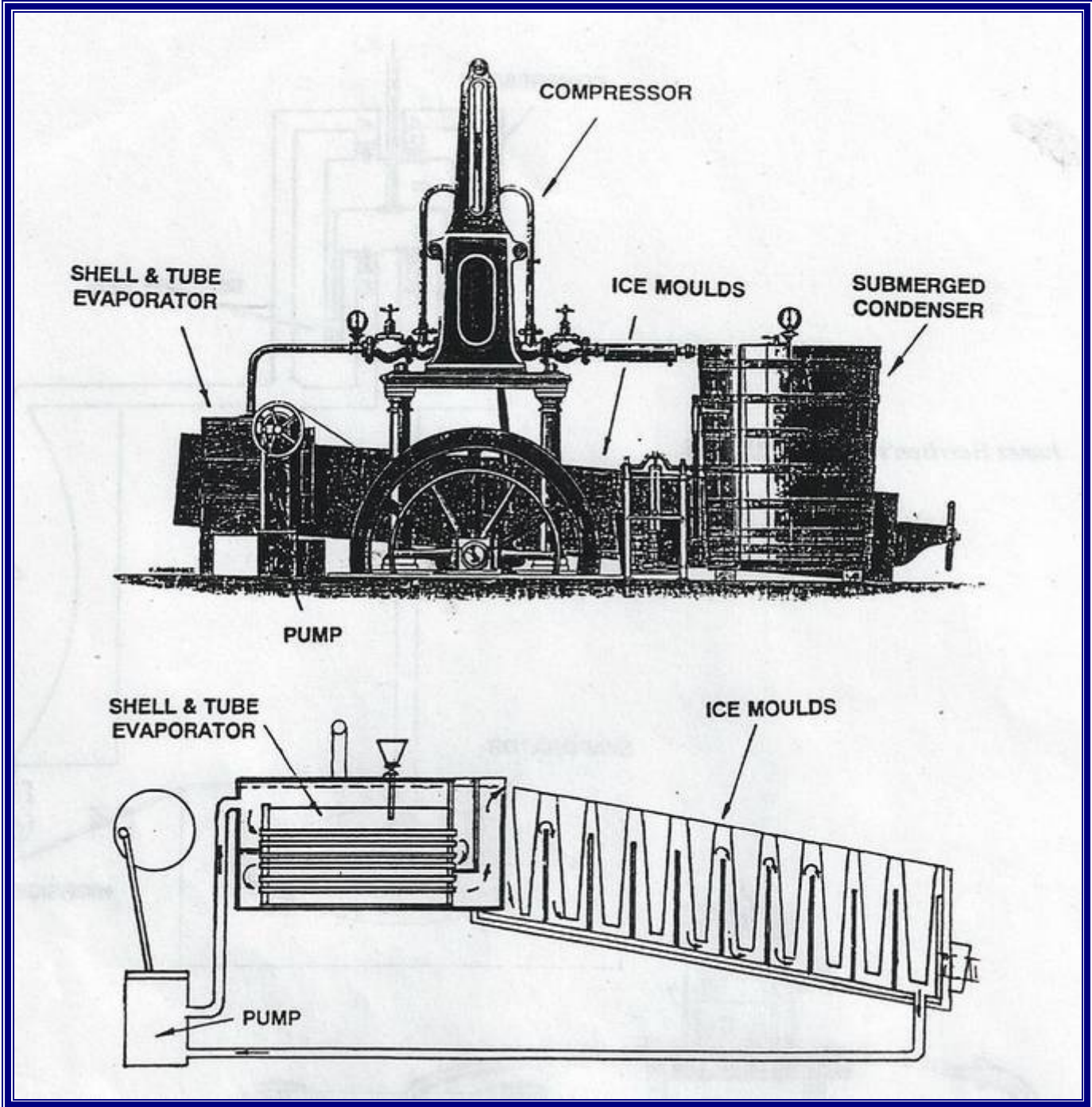
- E - Cistern for cooling water
- F - High side float valve
- G - Single acting pump for creating vacuum at start
- h - Spiral fin with rough edges to allow liquid refrigerant to wet internal surface

James Harrison's Patent No. 74 of 1856

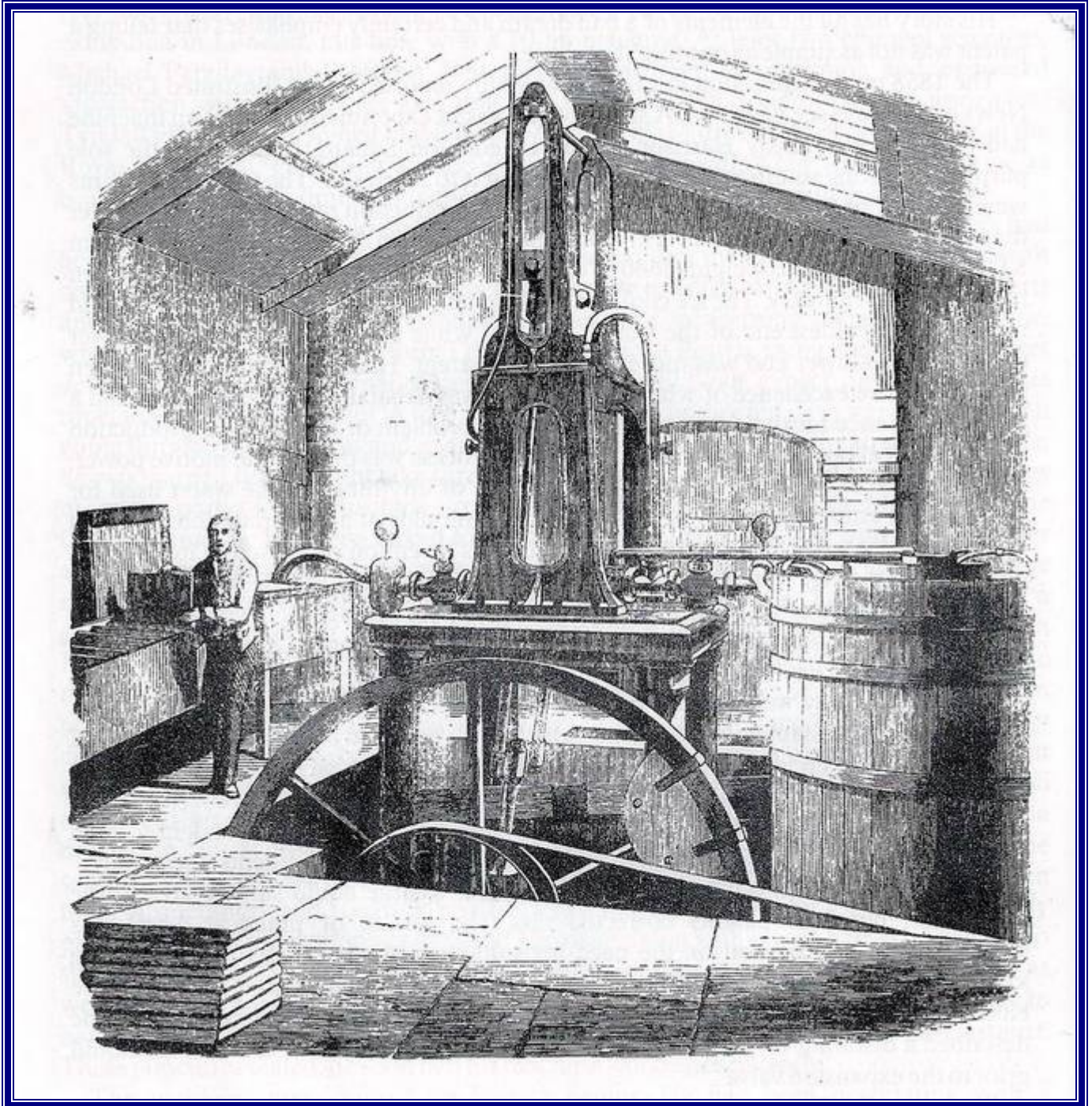
HARRISON'S ICE-MAKING MACHINE.



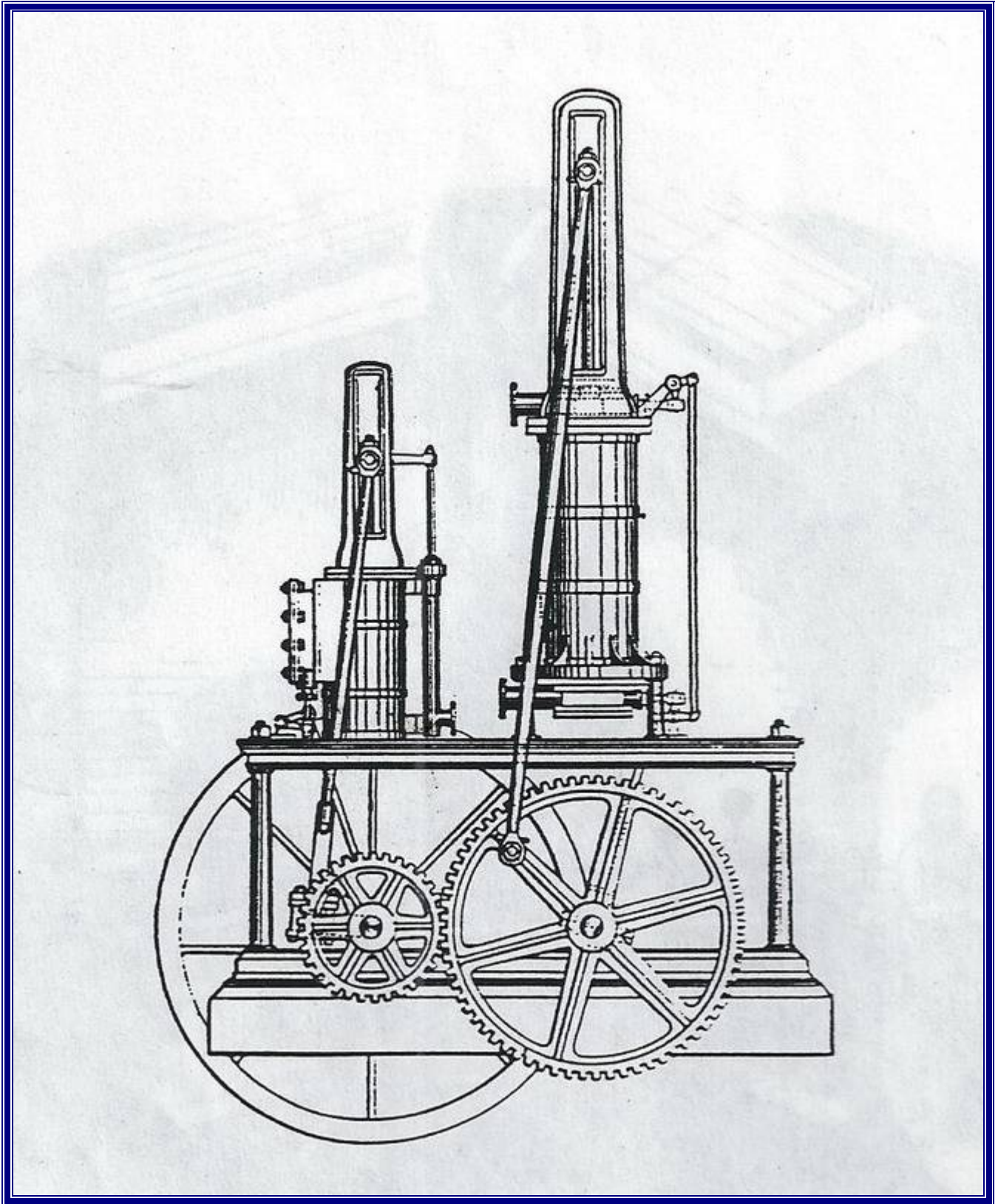
Harrison-Siebe machine based on BP No. 2363 1857



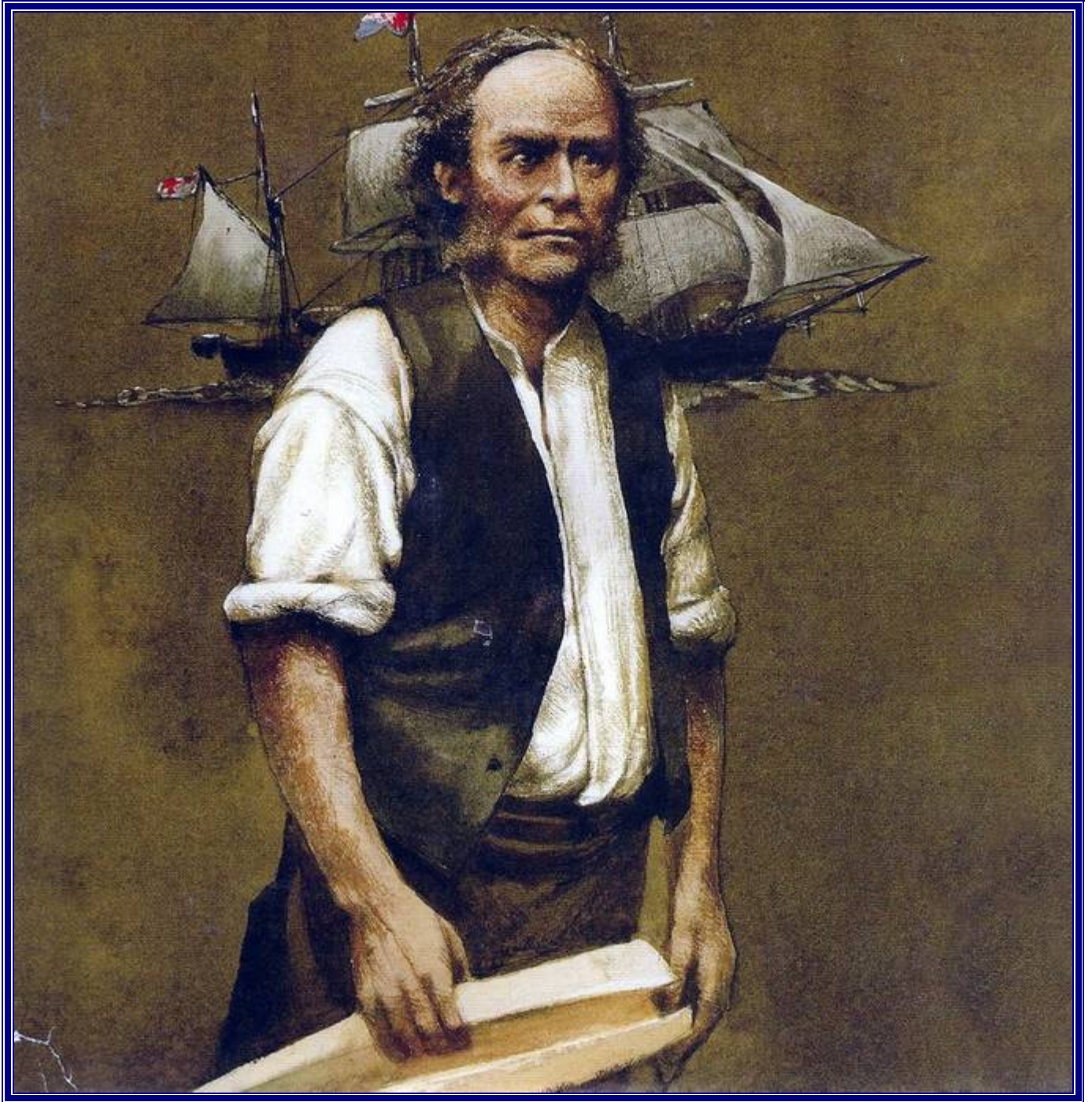
The Harrison-Siebe ice-making machine



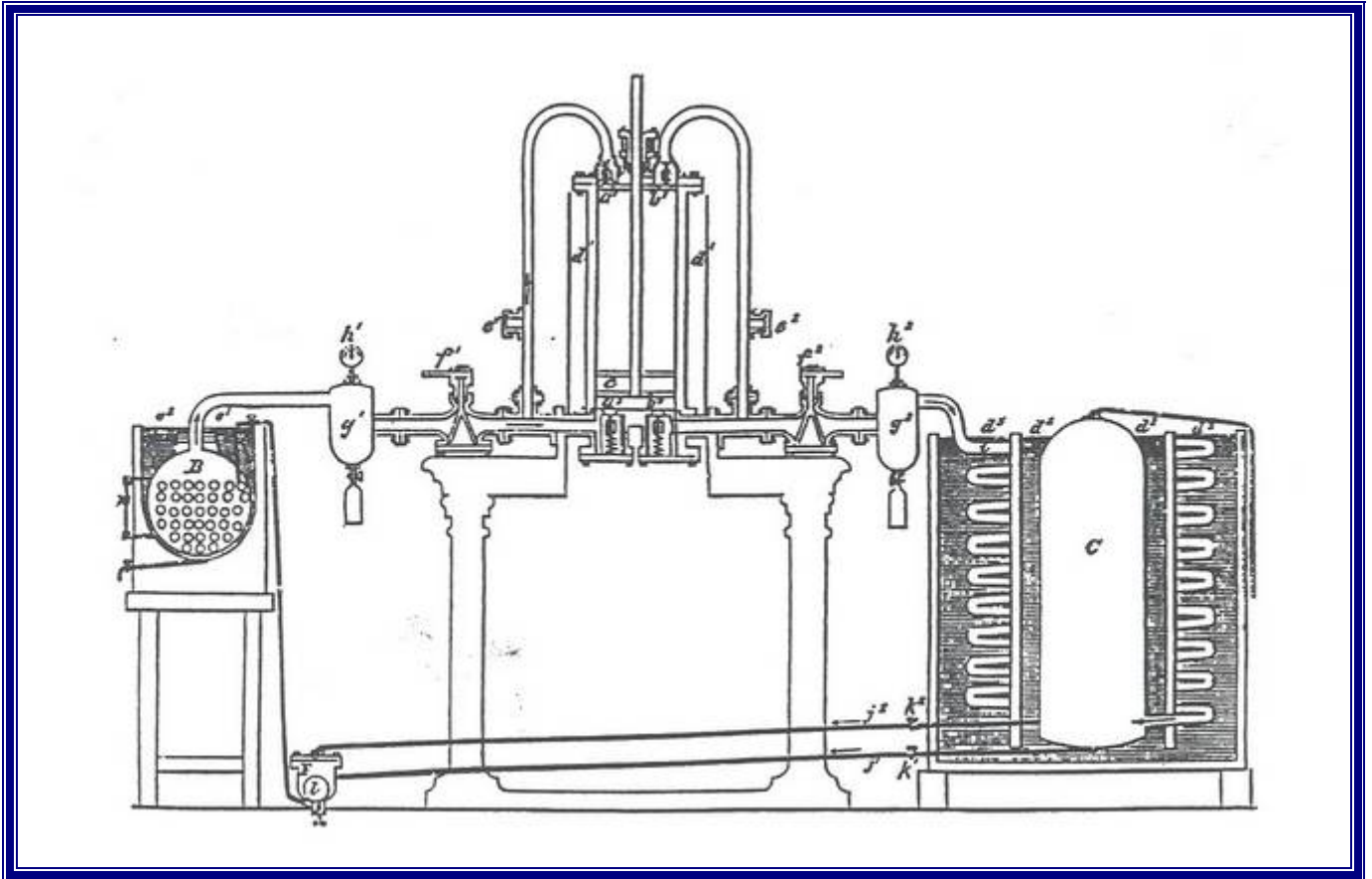
The 10-hp Harrison-Siebe machine on Public Exhibition at 4 Red Lion Square, London
Illustrated London News 29 May 1858



1860 model made by P N Russell & Company, Sydney
It shows the steam cylinder (right) with the drive to the compression cylinder (left)
The expansion device and the freezing tanks (evaporator) are omitted



Portrait of James Harrison {from dust jacket of W R (Roy) Lang's biography}



Harrison's Australian Patent NSW No. 36 of 1860 (similar to BP 2360)

References

Cold Storage and Ice-Making, Bernard H Springett, Sir Isaac Pitman, London, 1921

A History of Refrigeration, Roger Thevenot, International Institute of Refrigeration, Paris, 1979

Times of Challenge –The Cold Makers in Australia, Geoffrey C Luscombe, ASHRAE Transactions, CH-95-17-2, 1995

Heat & Cold, Mastering the Great Indoors, Barry Donaldson & Bernard Nagengast, ASHRAE, 1994

Engineer Extraordinaire (James Harrison), AIRAH Journal, Vol. 51, No. 7, July 1997

James Harrison –Pioneering Genius, W R (Roy) Lang, IMAG Digital Media, Melbourne, 2003

Appendix: Examples of Harrison's Patents (Title pages)

A.D. 1856 N° 747.

Refrigerators.

LETTERS PATENT to James Harrison, of Geelong, in the Colony of Victoria, Gentleman, Member of the Legislative Council of Victoria, for the Invention of "PRODUCING COLD BY THE EVAPORATION OF VOLATILE LIQUIDS IN VACUO, THE CONDENSATION OF THEIR VAPOURS BY PRESSURE, AND THE CONTINUED RE-EVAPORATION AND RE-CONDENSATION OF THE SAME MATERIALS."

Scaled the 23rd September 1856, and dated the 28th March 1856.

PROVISIONAL SPECIFICATION left by the said James Harrison at the Office of the Commissioners of Patents, with his Petition, on the 28th March 1856.

I, JAMES HARRISON, of Geelong, in the Colony of Victoria, Gentleman, Member of the Legislative Council of Victoria, do hereby declare the nature of the Invention for "PRODUCING COLD BY THE EVAPORATION OF VOLATILE LIQUIDS IN VACUO, THE CONDENSATION OF THEIR VAPOURS BY PRESSURE, AND THE CONTINUED RE-EVAPORATION AND RE-CONDENSATION OF THE SAME MATERIALS," to be as follows:—

10 To employ an air-tight apparatus of three vessels connected by tubes a vacuum is to be established throughout the apparatus, the air being expelled by the vapour of ether, alcohol, liquid ammonia, or other volatile liquid. The

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A.D. 1873, 19th NOVEMBER. N° 3760.  
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Preservation of Food.

LETTERS PATENT to James Harrison, of 52, Mornington Road, in the County of Middlesex, for the Invention of "IMPROVEMENTS IN THE PRESERVATION OF FOOD, AND IN THE CONSTRUCTION AND REFRIGERATION OF ENCLOSED CHAMBERS TO BE USED FOR THIS AND OTHER PURPOSES."

Sealed the 20th March 1874, and dated the 19th November 1873.

PROVISIONAL SPECIFICATION left by the said James Harrison at the Office of the Commissioners of Patents, with his Petition, on the 19th November 1873.

I, JAMES HARRISON, of 52, Mornington Road, in the County of Middlesex, do hereby declare the nature of the said Invention for "IMPROVEMENTS IN THE PRESERVATION OF FOOD, AND IN THE CONSTRUCTION AND REFRIGERATION OF ENCLOSED CHAMBERS TO BE USED FOR THIS AND OTHER PURPOSES," to be as follows:—

This Invention relates mainly to improvements in apparatus and processes for economically applying ice and freezing mixtures to the preservation of perishable animal and vegetable substances, and to the cooling of enclosed spaces in which they are kept, handled, or carried.

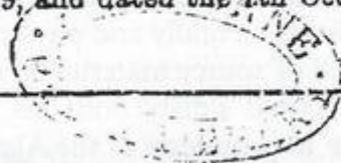


A.D. 1878, 7th OCTOBER. N° 3935.

Refrigerating by Evaporation and Rarefaction.

LETTERS PATENT to James Harrison, of No. 58, Gowrie Road, in the Parish of Battersea, in the County of Surrey, Gentleman, for the Invention of "IMPROVEMENTS IN THE MODE OF AND APPARATUS FOR REFRIGERATING BY EVAPORATION AND RAREFACTION."

Scaled the 25th March 1879, and dated the 7th October 1878.



PROVISIONAL SPECIFICATION left by the said James Harrison at the Office of the Commissioners of Patents on the 7th October 1878.

JAMES HARRISON, of No. 58, Gowrie Road, in the Parish of Battersea, in the County Surrey, Gentleman. "IMPROVEMENTS IN THE MODE OF AND APPARATUS FOR REFRIGERATING BY EVAPORATION AND RAREFACTION."

The improvements relate to a process and apparatus for cooling and congealing liquids by their own evaporation in vacuo, whereby the vapours are withdrawn from the partial vacuum wherein they are formed, and condensed in another partial vacuum with or without the aid of absorbents, and expelled by pressure, the improvements being also applicable to the condensation and liquefaction of the vapours of volatile liquids when employed to cool or congeal other fluids, as well as to the compression, rarefaction, and cooling of air and other gases. The improvements also relate to the vessels and surfaces in and upon which the ice or other solid is formed, or other refrigerating effect produced, and to the modes of applying cold and its carriers.