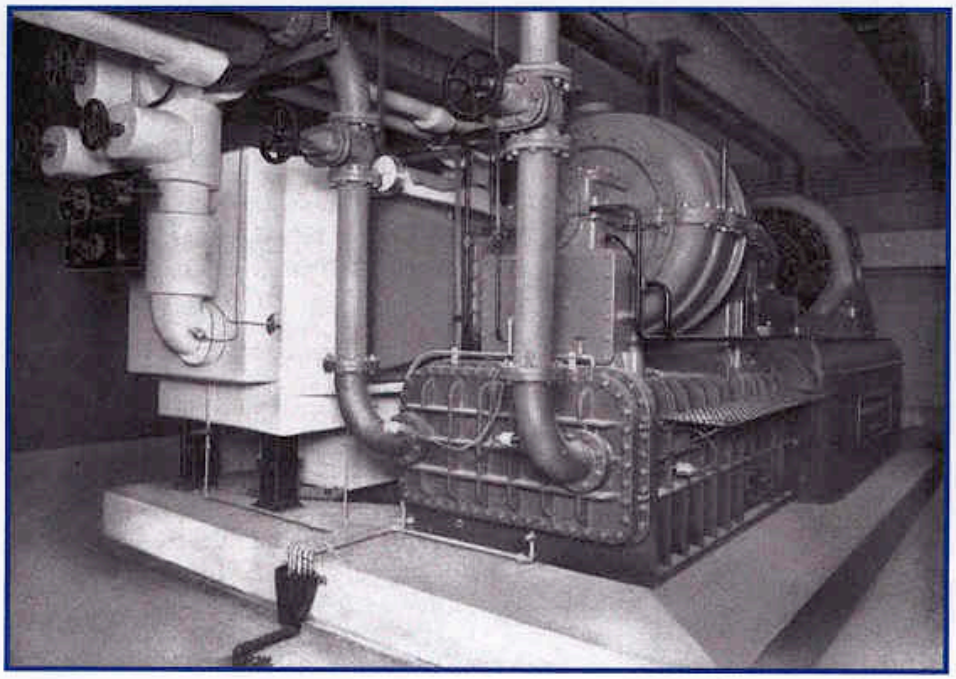
HISTORIC BUILDING ENGINEERING SYSTEMS & EQUIPMENT

Refrigeration & Air Conditioning



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Refrigeration & Air Conditioning

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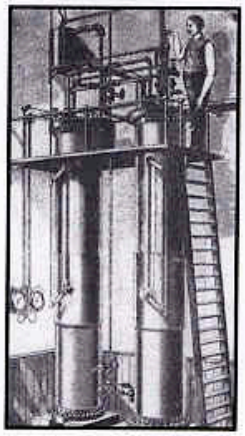

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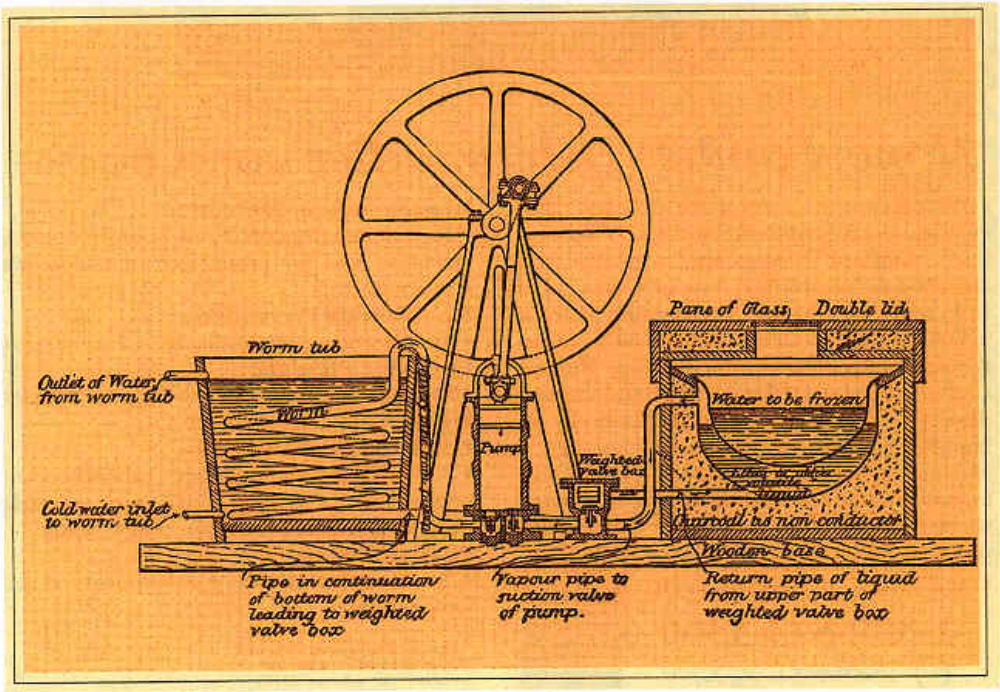


Jacob Perkins' Refrigerating Machine, British Patent 6662, Granted 1834

INTRODUCTION

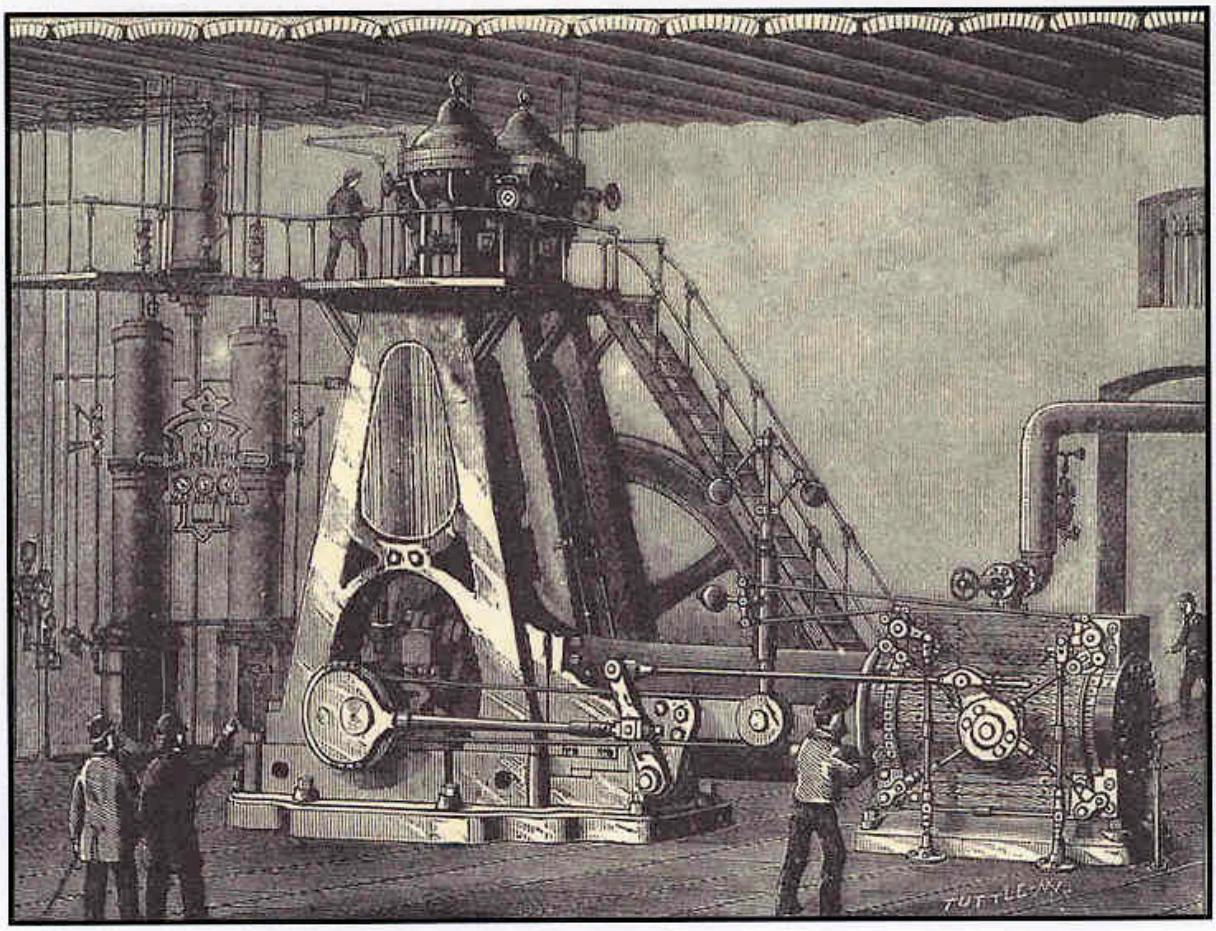
This book provides an illustrated historical outline of the refrigeration and air conditioning branch of building engineering services. The aim has been to provide a guide to investigators of buildings to help them recognise various types of refrigeration and air conditioning systems and equipment, which may still exist or have been used in the past. It is intended to raise awareness of the importance of historic services, identify these, assess their significance and make an informed decision about a course of action. Options range from re-use, retention in-situ, to removal to a safer site or, regrettably in some circumstances, to thoroughly record before destruction. It must be recognised that buildings of little architectural significance may contain engineering services of historical importance.

Investigators faced with these choices may include the owner or occupier, architect, builder, services consultant or contractor, local government officers (especially conservation officers), and English Heritage inspectors, none of who may have the necessary expertise to evaluate a particular item. The number of firms engaged in the manufacture and installation of refrigeration and air conditioning equipment and accessories in the UK before World War II is fairly limited and the survival rate is low. It is hoped this publication will aid in their the recognition and dating.

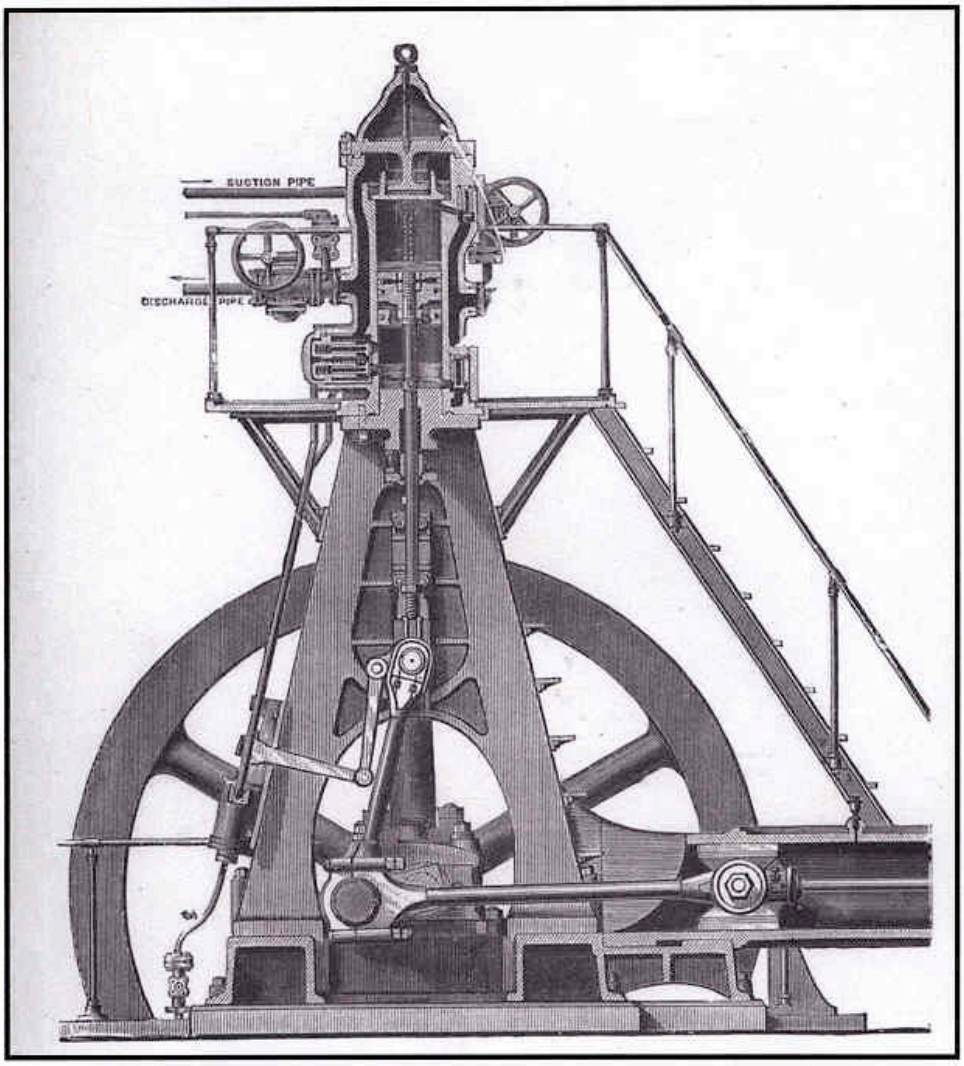
Refrigeration and air conditioning equipment should only be operated, opened up, or dismantled by competent engineers familiar with Health & Safety procedures and having appropriate tools and equipment. Rotating equipment, high-pressure pipelines, toxic refrigerants, steam and electrical systems may be hazardous.

Early Days

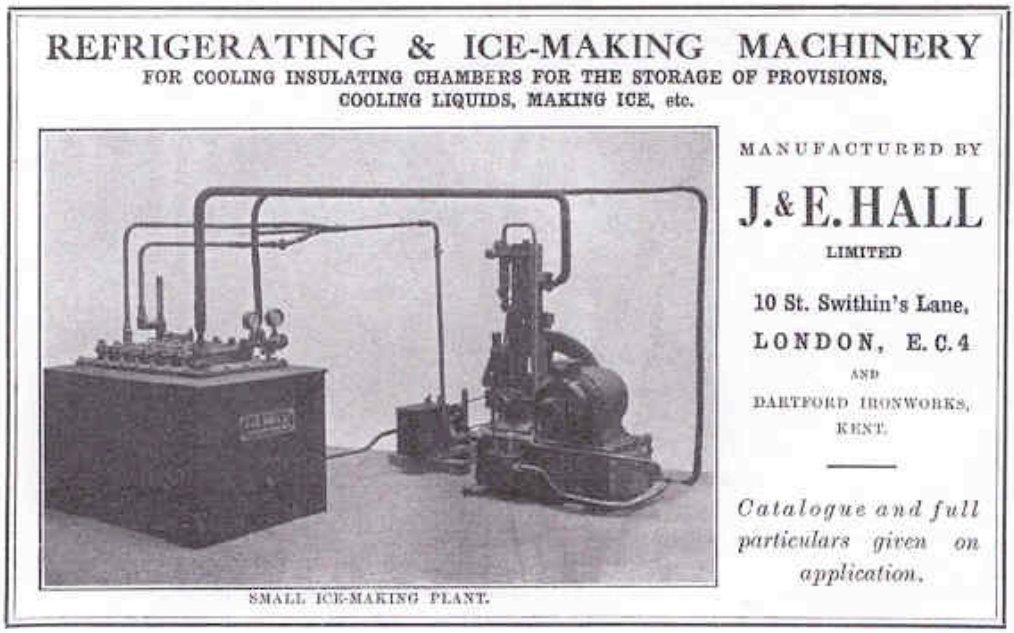
The first refrigerating systems were developed in the 1840s and 50s, but did not find much practical use until nearly 40 years later. By Edwardian times, over half the machines in use were employed in breweries. Other significant users included cold stores (meat and provisions), ice-making, ships' holds (again for meat), dairies and chemical processes. Of use in air conditioning there was virtually none until the 1920s and this was limited. After World War II, air conditioning in the UK found use in manufacturing, as in the textile and confectionery industries. Comfort air conditioning only became widespread with the boom in office block and hotel building in the 1960s and 70s.



Steam engine driven ammonia reciprocating compressor (220 TR), De La Vergne, c.1900



Vertical centre section of a double-acting De La Vergne ammonia compressor, fitted with Louis Block's patent arrangement of valves, 1896. The machine is steam engine driven. Note the massive flywheel.



Advertisement for J & E Hall refrigerating machinery 1921

AN INTRODUCTION TO REFRIGERATION

Refrigeration has been defined as the artificial production of cold. It can also be considered as a means of transferring unwanted heat elsewhere. It may be used for product storage or manufacture, in many industrial applications, or in air conditioning systems.

Machine types

There are four basic types of refrigerating machine:

- Mechanical compression
- Cold air
- Absorption
- Steam jet

Mechanical compression machines are of three principal types: reciprocating, centrifugal and screw.

Historical summary
The development of the various methods and machines was truly international:

1834 Compression (Jacob Perkins, an American living in London)
1844 Cold air (John Gorrie, an American doctor)
1859 Absorption (Ferdinand Carré, a French inventor)
1909 Steam jet (Maurice Leblanc, French engineer)
1922 Centrifugal (Dr Willis Carrier, American engineer)
1934 Screw (Professor Lysholm of Sweden)

Refrigerating capacity
Until metrication the standard unit used in the rating of refrigerating machines was the *ton of refrigeration* (TR). This is derived from the melting of 1 US ton (2000 lb) of ice over a 24 hour period and equates to a heat removal rate of 12000 Btu/hour (3.516 kW).

Refrigerants
A refrigerant is a substance that absorbs heat through expansion or vaporisation. Desirable refrigerants possess chemical, physical and thermodynamic properties that make them suitable for efficient use in refrigerating systems. Early refrigerants were natural substances and included air, water, carbon dioxide and ammonia. In 1930 new refrigerants (the fluorinated hydrocarbon series) were introduced. All refrigerants are commonly identified by a system of numbering, e.g. R-11, R-12, and R-22.

Motive Power
Steam engines were used to drive early compression and cold air machines. By the 1920s electric motor drives had virtually supplanted steam engines in refrigerating work. Steam turbines were used to drive centrifugal machines in some circumstances and may still be employed. Absorption and steam-jet units operated on live steam: the former can also be operated on medium-pressure hot water at a temperature of around 120 degC.

Estimating Refrigerating Plant Output
Where the compressor cooling output is unknown an approximate estimate may be made from the nameplate rating of the electric motor. In air conditioning work, a reciprocating compressor rule-of-thumb is 1 hp/TR. For screw and centrifugal machines it will be slightly less, typically 0.8-0.9 hp/TR (1 hp = 0.746 kW). Power requirements generally increase in industrial applications.