HISTORIC BUILDING ENGINEERING SYSTEMS & EQUIPMENT

Heating and Ventilation

Gurney Stove, Tewkesbury Abbey, c.1880

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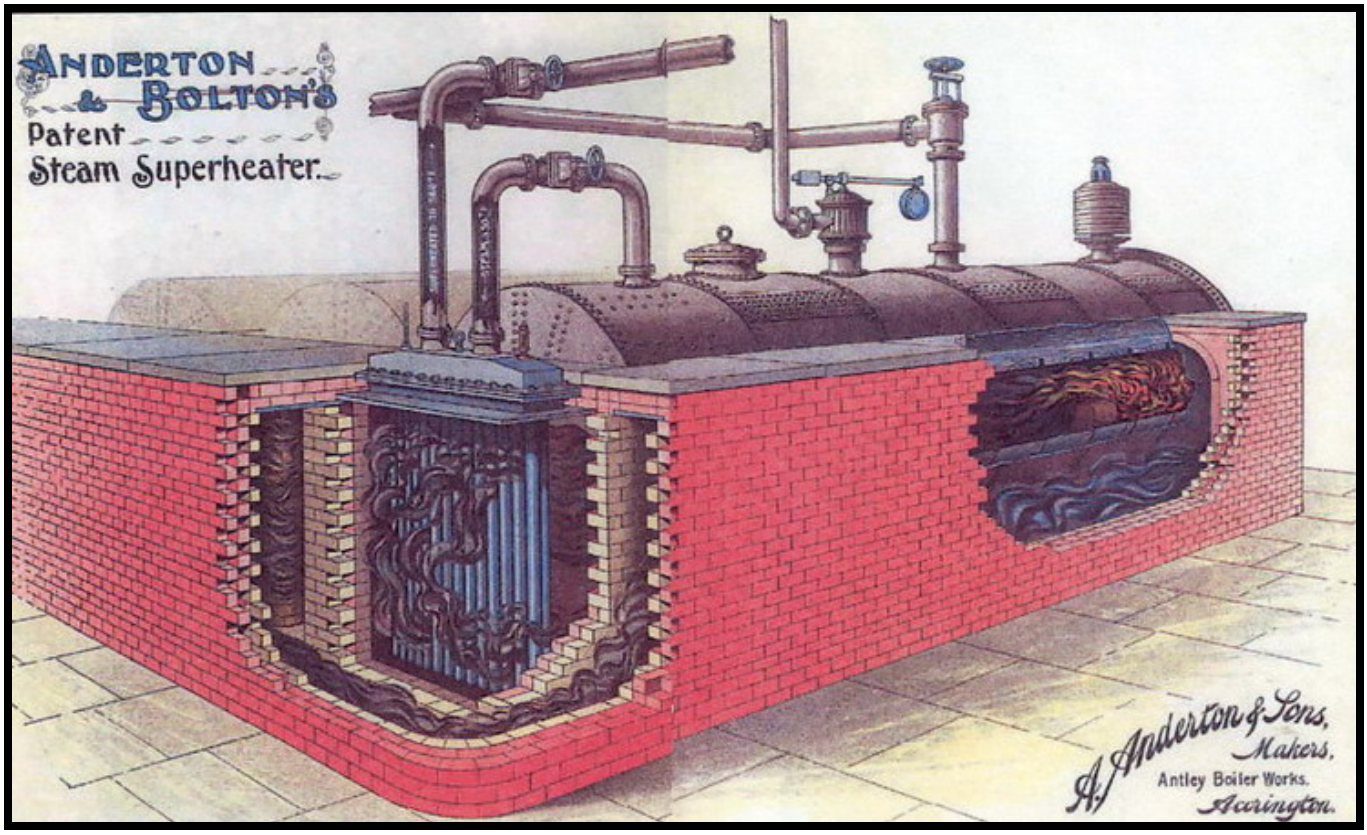
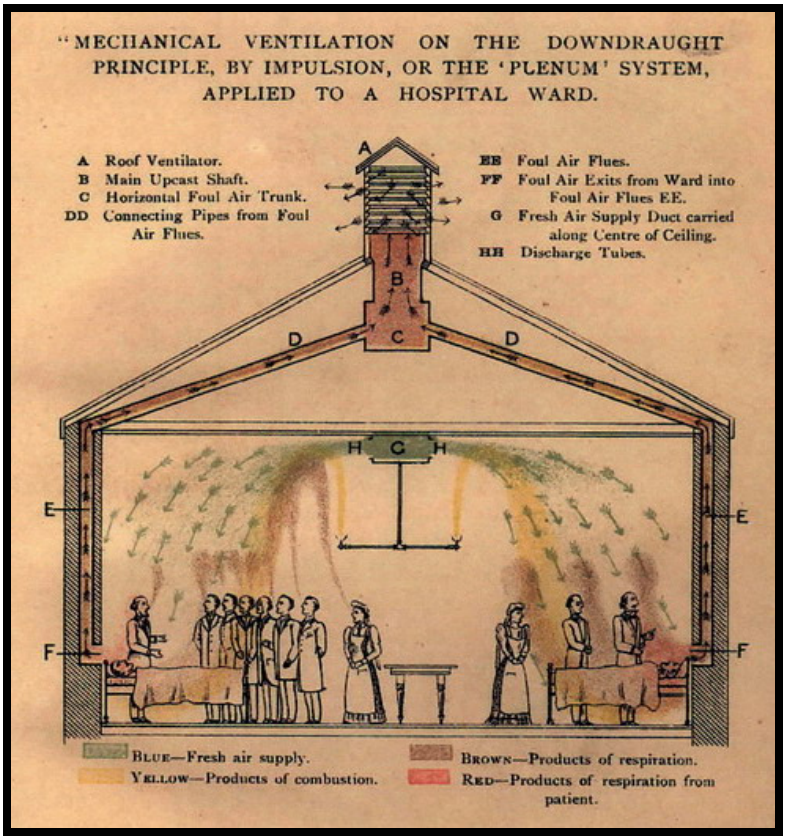


Anderton & Bolton's patent steam superheater, A Anderton & Sons, Accrington, c1900

Heating and Ventilation



Hospital plenum ventilation, Natural and artificial Methods of Ventilation, Robert Boyle & Son Ltd, London, 1899

HISTORIC BUILDING ENGINEERING SYSTEMS & EQUIPMENT

Heating & Ventilation

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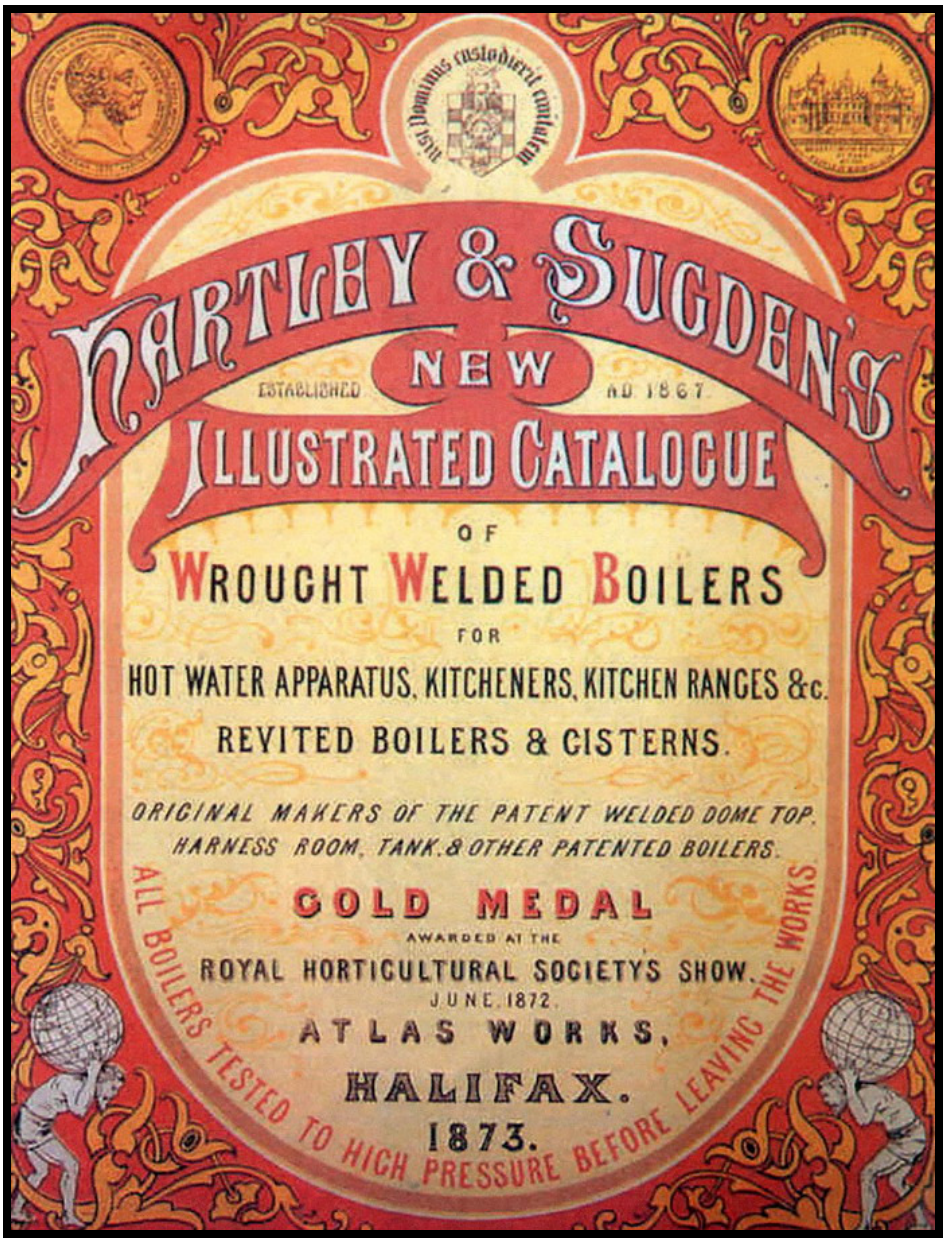

Cover of catalogue of Hartley & Sugden, boilermakers of Halifax, 1873

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Cast iron pipe "In Commemoration of the Queen's Jubilee, 1887," St Mary the Virgin, Emley Castle, Worcs

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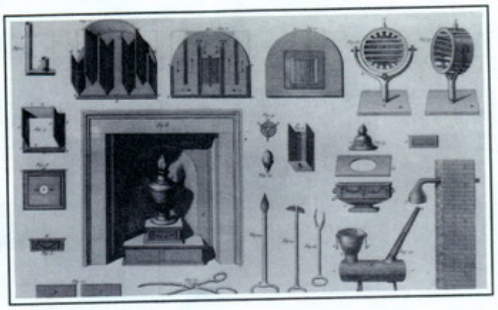
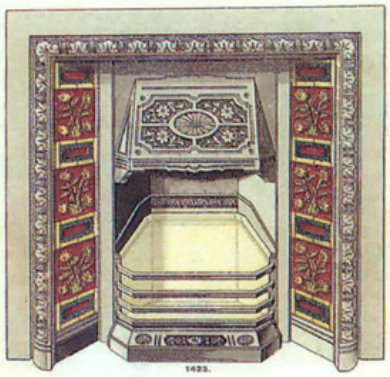


Benjamin Franklin's fancy grates, 1793

M D Wyatt fireplace design for 12 Kensington Garden, London, 1862



Fireplace by Pryke & Palmer, London, 1896

INTRODUCTION

This book provides an illustrated historical outline of the heating and ventilating branch of building engineering services, principally during the 19th century. The aim has been to provide a guide to investigators of heritage buildings to help them recognise the various type of heating and ventilating systems and equipment which may still exist or have been used. It is intended to raise awareness of the importance of historic services, understand what survives, assess its significance and make informed decisions about what to do next. Options range from re-use, retention in-situ, to removal to a safer site or, regrettably in some circumstances, to thoroughly record before destruction.

Investigators faced with this choice 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 heating and ventilation equipment and accessories during the Victorian period was considerble. The number of models or patterns of a particular item, for example radiators, runs into many hundreds. However, it is hoped this publication will aid the recognition and dating of such objects.

Heating and ventilation 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, fuel systems, steam and electrical systems may be hazardous.

Heating & Ventilating Systems and Equipment

The most basic type of heating (other than open fires) is the stove. The first stoves were made of cast-iron, with a door into which a solid fuel, usually coal, could be fed. A low-level ash pit door enabled ash, stones and other residue to be removed. Smaller stoves could be moved and placed in position in one piece, requiring only for a flue pipe, leading to outdoors, to be connected. These stoves were freestanding within the space to be heated. Larger stoves would be assembled in sections. Other stoves were installed in builderswork chambers with a cold air inlet and with the warmed air discharged directly, or through masonry ducts, to the space served. Examples of both types may still be found often in cathedrals and churches. Some are still in use having been converted to oil or gas firing.

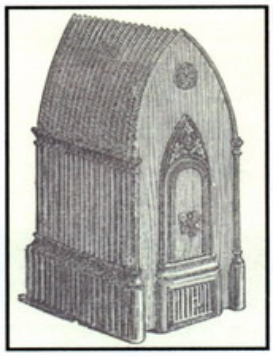
A heating system requires a form of heat producing apparatus (usually a boiler), a means of distributing the heat (pipes or ducts) and heat emitters in the space serves. Types of heating system include steam, low-pressure hot water and high or medium pressure hot water. The earliest steam boilers, c.1700, were developed to drive steam engines and it was about a century before they were used for heating. Hot water heating boilers were manufactured in quantity from around 1860 onwards. The first room heaters were pipe-coils, often housed in decorative cases. Radiators were introduced in the 1880s.

Early ventilation was by natural means. By the 1840s, fire and then heat-assisted systems were in use, the latter using steam or hot water coils to create an updraught, often aided by the heat from gas lighting. Fans for mechanical ventilation were introduced about 1850, being driven by gas or steam engines. Fans driven by electric motors were used from the early 20th century.

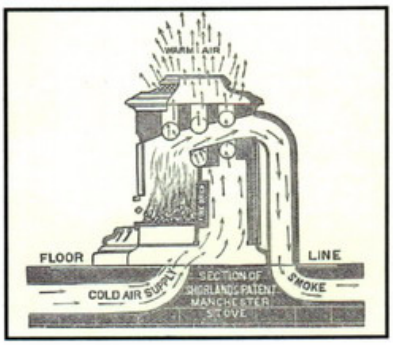
Stove, formerly in the Royal Institution, probably by Count Rumford –metal casing surmounted by bust of Faraday [Royal Institution]

The Comforts of a Rumford Stove, 1800

Buzaglo stove, Knole Orangery, Kent, 1774



Gill stove, 1881



Shorland Manchester stove, 1907

Heating Stoves

Masonry stoves of brick, earthenware and porcelain have been used for over one thousand years in northern Europe, particularly in Scandinavia, Russia and Switzerland. Closed metal stoves were devised in Germany in the 15th century and improved over the next two hundred years, spreading across continental Europe. But Britain preferred its open fires.

In England, around 1609, the first metal stoves were imported from Holland to heat the orange houses of the nobility (It is said that the word "stove" is of Dutch origin and the first English heated greenhouses were in fact called stoves.)

In the 1790s, Count Rumford devised a metal stove, while William Strutt with Charles Sylvester installed his Cockle (or Belper) stove at Derby Infirmary. This cockle stove consisted of a circular iron pot with a rounded dome. Fuel was consumed on a grate at the bottom of the furnace, coal or coke being added through a charging door at the side. Air for combustion was supplied through a duct to a chamber below the grate.

A forced warm-air furnace was patented by Benford Deacon in 1812, using a fan powered by a descending weight, and used at the Old Bailey. In the latter part of the 19th century, ventilating and other improved grates (the distinction between grates and stoves is not always clear) were due to Sir Douglas Galton, George Jennings *(London* grate), T Elsey (*Lloyd's* patent ventilating grate), D O Boyd (*Hygiastic* grate) and the firm of Shorland (*Manchester* grate).

COMYN CHING & CO., CASTLE STREET, LONDON, W.C.

DR. ARNOTT'S

ORIGINAL SLOW COMBUSTION FUEL STOVES

WITH

Cook's Patent Regulator or Compound Bars.

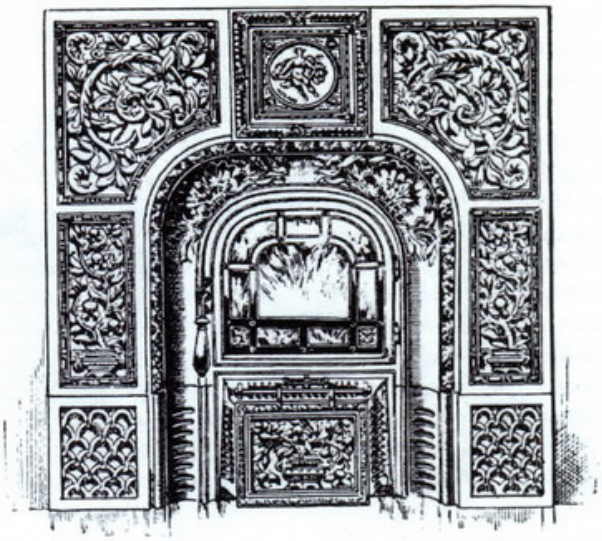
Cook's Patent Regulator.

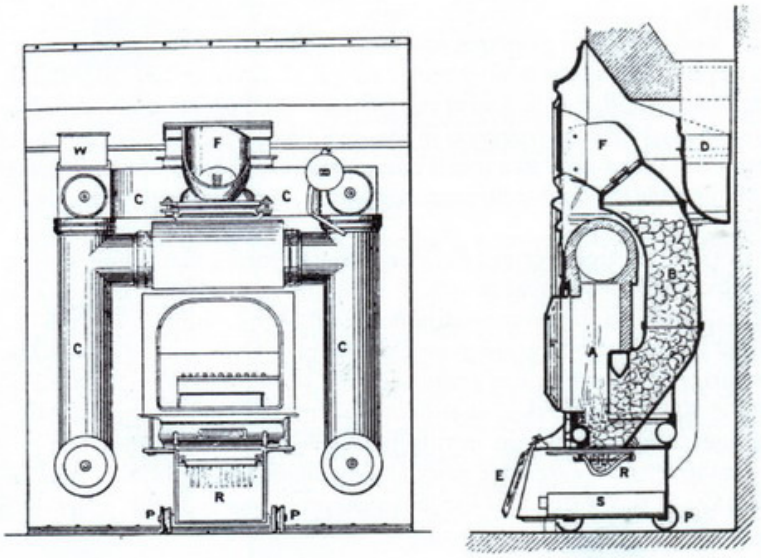
Many years since, this principle was perfected at our Works under the direct superintendence of Dr. ARNOTT, and though many new plans for economically and effectually heating apartments, churches, &c., have since been introduced, the continued and steady sale of these, prove, that they still compete successfully, with the many newer methods.

With these Stoves you reduce the supply of air to the smallest that can be, to support combustion; thus reducing to the minimum the amount of heat lost to use by escaping through the flue.

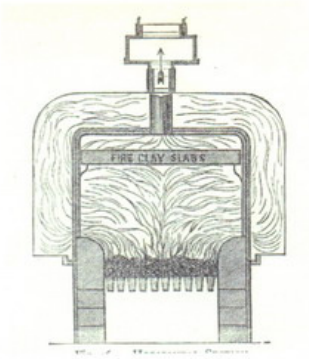
By Cook's Patent Compound Bar, you actually make your fire regulate itself, for as it begins to burn too fiercely, the Compound Bar becoming heated curves gradually and thus shuts off the supply of air.

Dr Neil Arnott's Slow Combustion Fuel Stove marketed by Comyn Ching, London, probably c.1880

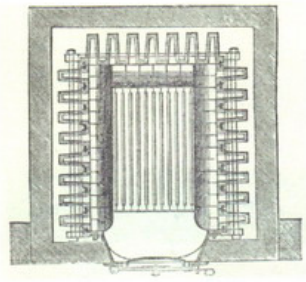




Helios smoke-consuming grate, really a portable stove on wheels, designed by a Mr Heim and sold by John Grundy of Islington, c.1890



Constantine Convoluted stove, Manchester, 1881Horizontal section

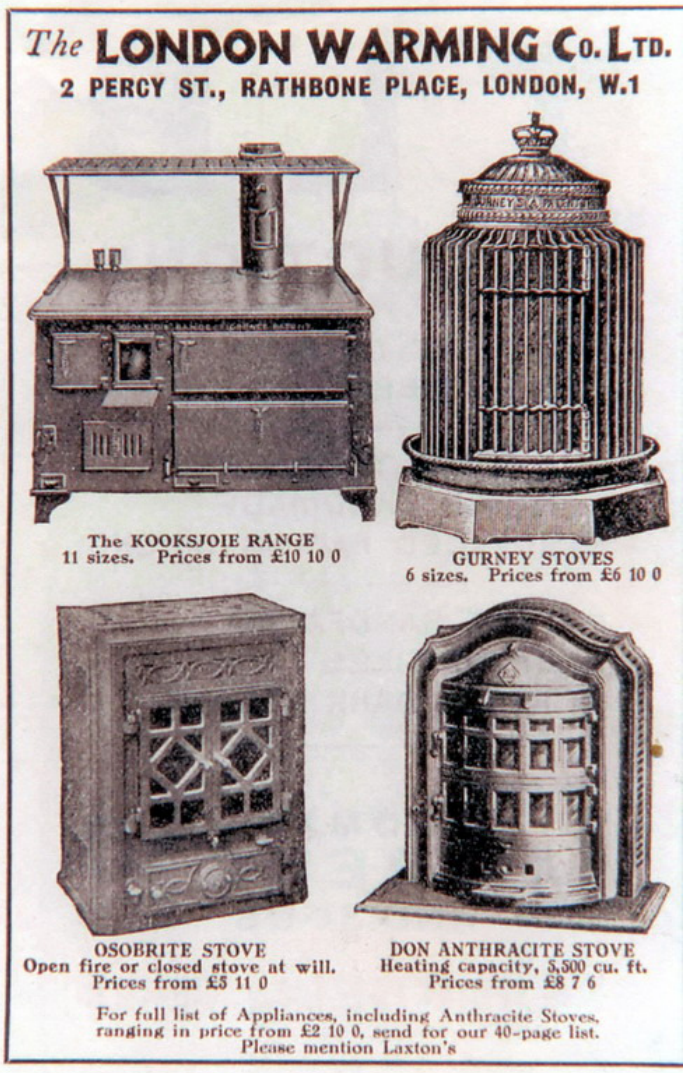


Constantine stove Cross-section

In 1818, the Marquis de Chabannes introduced his *Calorifere* stove (air warming furnace) from France. Just before this, in 1816, the firm of G & J Haden set up in business in Trowbridge to erect the steam engines of Boulton & Watt in the West Country. Within a few years Haden was manufacturing heating stoves for churches and the country houses of the gentry. Between 1824 and 1914 they manufactured and installed nearly 7000 stoves. Atkins & Marriot introduced their *Thermo-regulated* stove in 1825, followed by the *Thermometer* stove of Dr Neil Arnott (Physician Extraordinary to Queen Victoria) in 1834. The 1830s also saw the development of the famous *Tortoise* stove by Charles Portway who went on to manufacture some 17,000.

Use of the warm air stove grew considerably from the middle of the 19th century with the tremendous wave of Victorian church building and the construction of many and varied institutions –prisons, hospitals, schools, workhouses and asylums. Around this time Dr Goldsworthy Gurney brought out the large stove which bears his name. It was later sold by the London Warming and Ventilating Company who in 1897 claimed it had been used to warm 22 cathedrals and over 10,000 churches, schools and other buildings. They were also agents for the *Choubersky*, *Salamandre* and similar continuous burning stoves, which only needed refuelling once a day. Other stoves of the later Victorian period included Saxon Snell's *Thermhydric*, Mr George's *Calorigen*, Dr Bond's Euthermic, The *Manchester* stove of Shorland and *the Convoluted* stove of Joseph Constantine. Another notable heating apparatus manufacturer was John Grundy of London and Tydesley Ironworks, Manchester (the first President of the Institution of Heating & Ventilating Engineers in 1898) whose products included the *Helios* and *Sirius* smoke consuming grates and the *Hestia* warming and ventilating stove. But the increasing use of hot water heating systems and the introduction of the radiator soon caused a marked decline in the use of warm air stoves.

Tortoise slow burning stove designed by Charles Portway, the first being hand-built by him in 1830 to heat his ironmongery store in Halstead, Essex. Sold over 17,000 stoves, many for use in churches, by 1880. Used tortoise as his emblem with the motto "Slow but Sure."



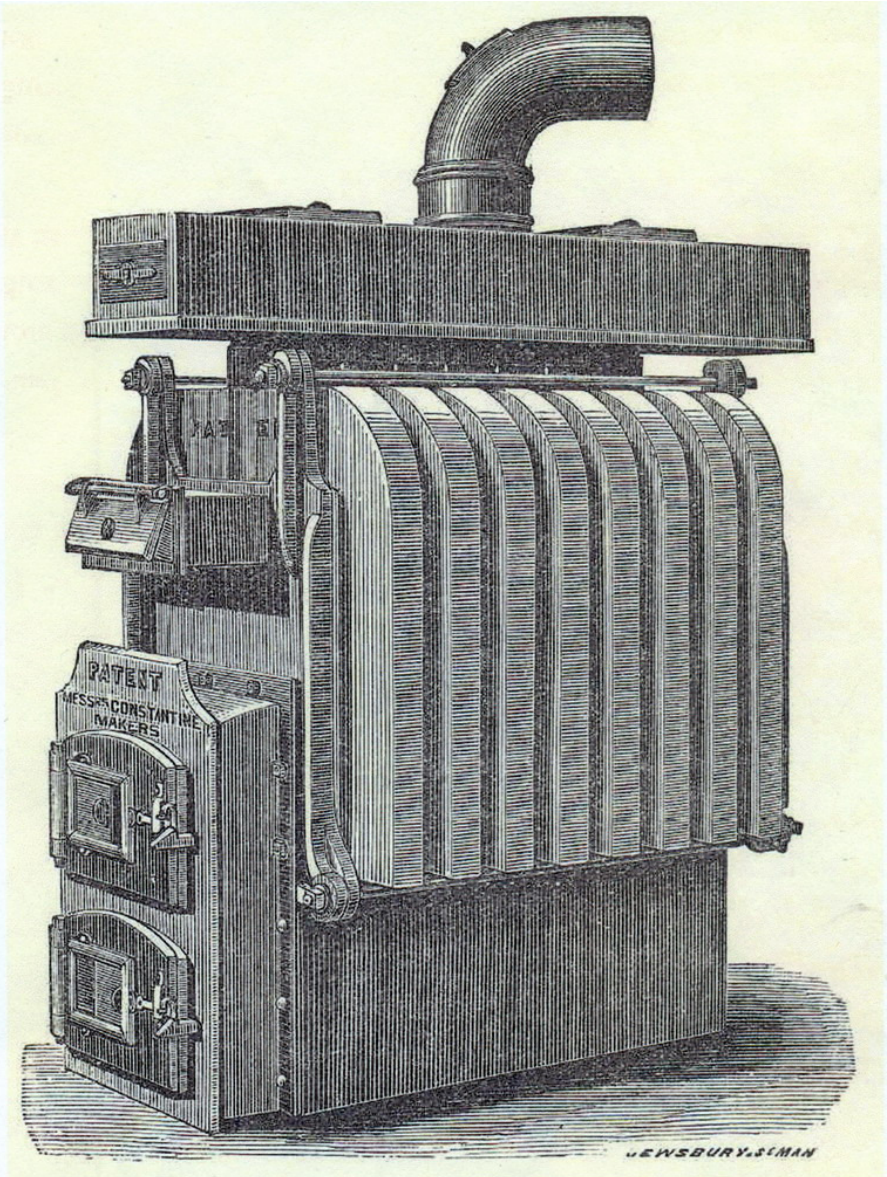
Victorian stoves, including the Gurney stove [top right) invented by Sir Goldsworthy Gurney and installed in many churches and cathedrals

Haden stove, now used as a post box, near Bristol

Musgrave Ulster stove, Belfast & London, 1891

Stove at Edmondthorpe Church, Leicestershire

Grundy stove c.1883, St Paul, Deptford, London, converted to oil firing



The first Convoluted stove made by Joseph Constantine, Manchester, 1881. The stove illustrated has 8 convolutes (sections). These stoves were made in 8 sizes with from 5 to 12 convolutes. There were 8 sizes of convolute weighing from 0.5 to 3.5 cwt each. [about 18 cwt = 1 tonne]

Gurney stove, Tewkesbury Abbey, 1875

Musgrave stove, St Leonard, Rodney Stoke, c1879

G & J Haden stove front

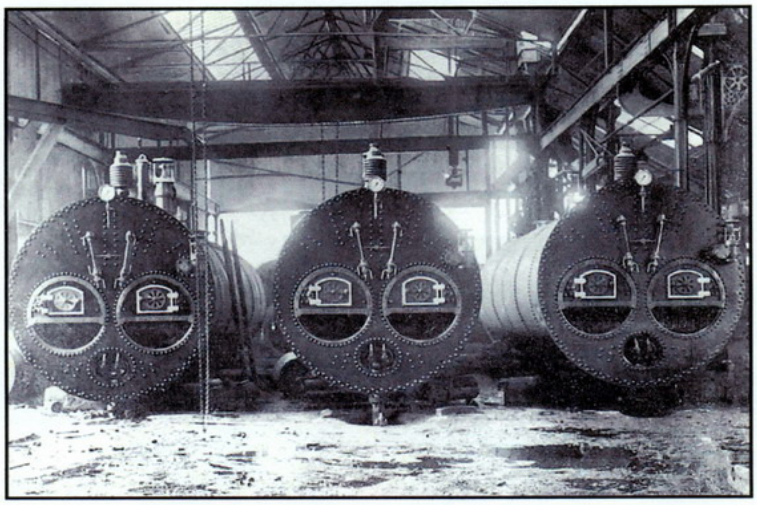
Falkirk Iron Gill stove, All Saints, Woodford, c.1845

G & J Haden stove, Erdigg, 1826

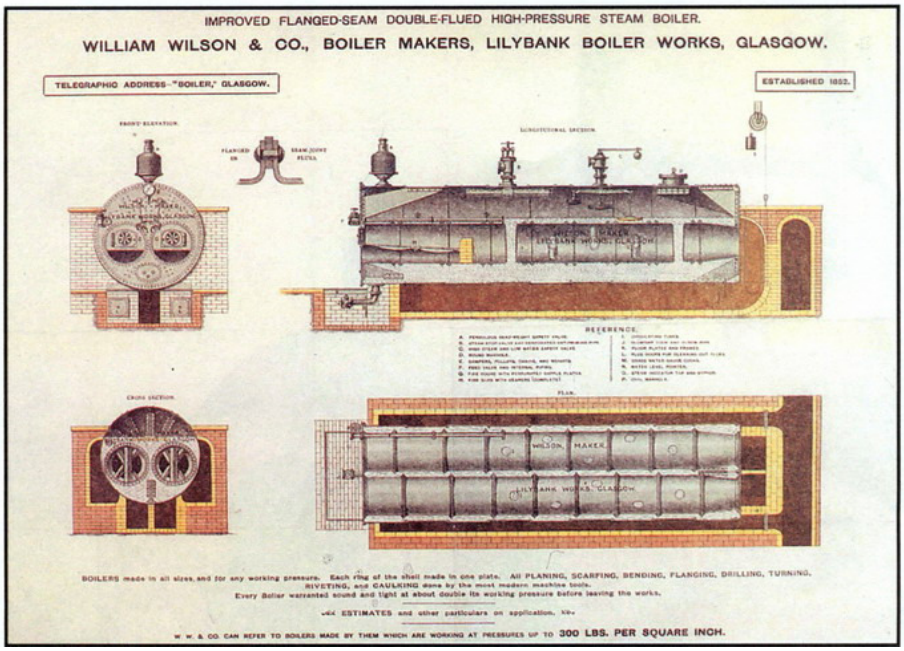
Stove door at Edmondthorpe Church

Grundy stove at St Paul, Deptford, believed c.1883

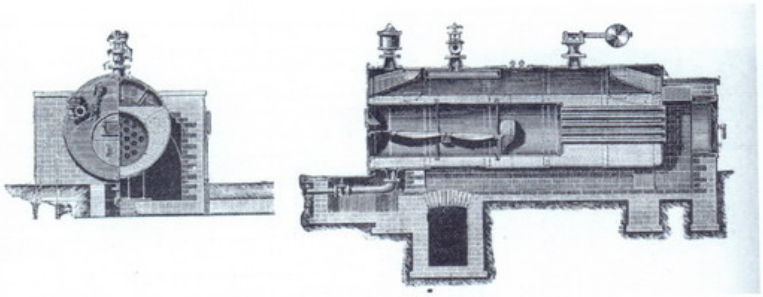
Paragon stove at Erdigg



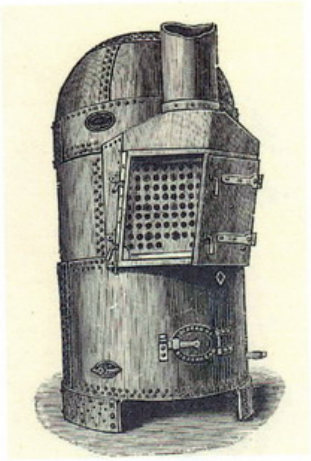
John Thompson Lancashire steam boilers, 1895



William Wilson, Lancashire style high-pressure steam boiler, Glasgow, c.1900



Cornish steam boiler with smoke tubes, Marshall & Co, 1898



Vertical steam boiler with horizontal smoke tubes, Cochran, 1898

Steam Boilers

The first steam boiler proper was a spherical type described by the Marquis of Worcester in 1663. Other early examples include that of Savery (1698) and Newcomen & Cauley (1705). By 1725 the Wagon and Haystack types of boiler were in common use. James Watt used a steam boiler to operate his engine in 1769. None of these was used for heating. The first steam heating was for factories, from about 1799. A number of engineers produced designs for steam boilers including Count Rumford (1798), Richard Trevithick (1800 & 1804) and Thomas Tredgold (c.1824). Perhaps the most important early boiler was the Cornish type, with its single internal furnace, said to have been developed by Oliver Evans of Philadelphia, but given its name in recognition of the help received from Trevithick. A patent by Pearce (1853) was the forerunner of the Economic boiler. The even more famous Lancashire boiler was developed in Manchester by Sir William Fairbain (1855), who increased the length and diameter of the Cornish boiler and introduced two furnace tubes. However, while steam was widely used for power and process work, particularly in the textile industry, factories, breweries and the like, it was not widely adopted for heating and tended to be used only where generated primarily for other purposes.

Notable British steam boiler manufacturers from the Victorian era include Babcock & Wilcox, Cochran, Clarke Chapman, William Fairbairn, Fraser & Fraser, Galloway, Marshall, Musgrave, Paxman, John Thompson and Yates & Thom. Some still exist.