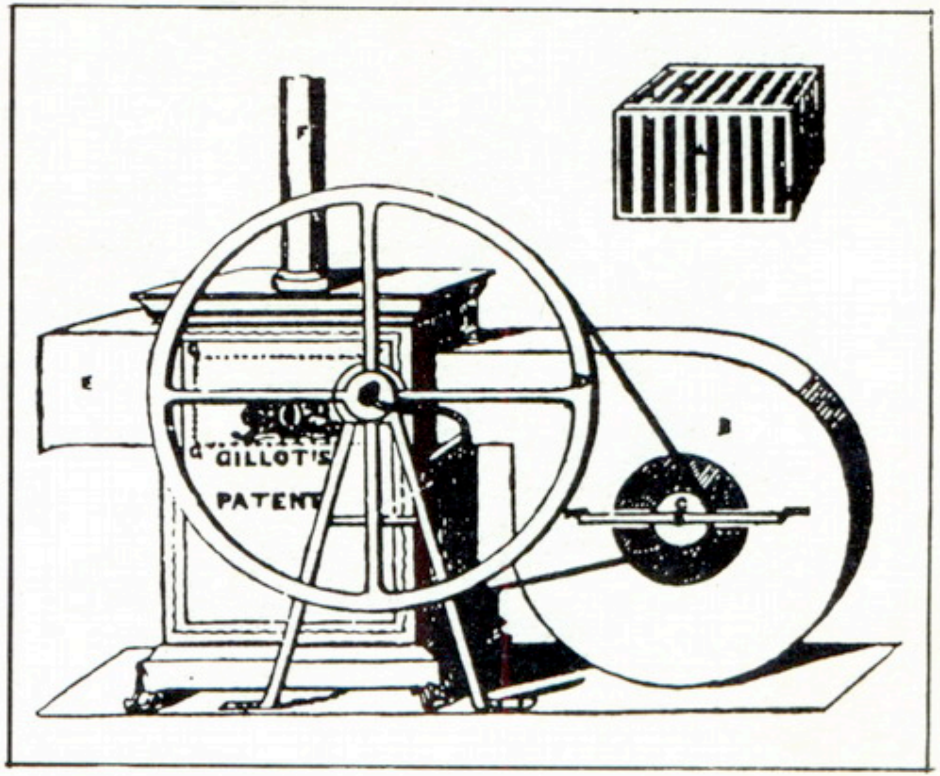
GOLDEN OLDIES

An apparatus for supplying heated and fresh air was set up at Liverpool Street, Finsbury, in 1842. It comprised a stove with a cockle or air jacket, and air was forced through the cockle by a hand-driven fan and delivered through a duct to any part of the building. It was claimed by those who saw this apparatus in action that the purity of the air was "most excellent".

In the following year, an attempt was made to secure mechanical rather than natural (gravity) circulation of warm air. In Germany a two-cylinder blower, driven by a 4 hp steam engine, was used, though it was soon condemned as very expensive and unsafe. In the same year, two factories, in Leeds and Deanston, used windmills to provide the motive power for moving the heated air. The desired room temperature was maintained by regulating the quantity of air and by controlling the steam supply to the air heater. In 1846, Baron von Rothschild used fans to force air through heated tubes (the Molitor type of generator) to the rooms to be warmed; each duct was provided with a control damper.

By 1870, Sturtevant in the USA had introduced a system using a steam coil and a centrifugal fan. The fans were so large that they could only be placed outside the building, or in a basement. The same company offered, in 1906, a ducted warm air system in which the air was heated to 15°C at the main (central) heater for distribution to the spaces to be heated.



Warm-air stove (1842).

Contributed by the CIBSE Heritage Group

GOLDEN OLDIES

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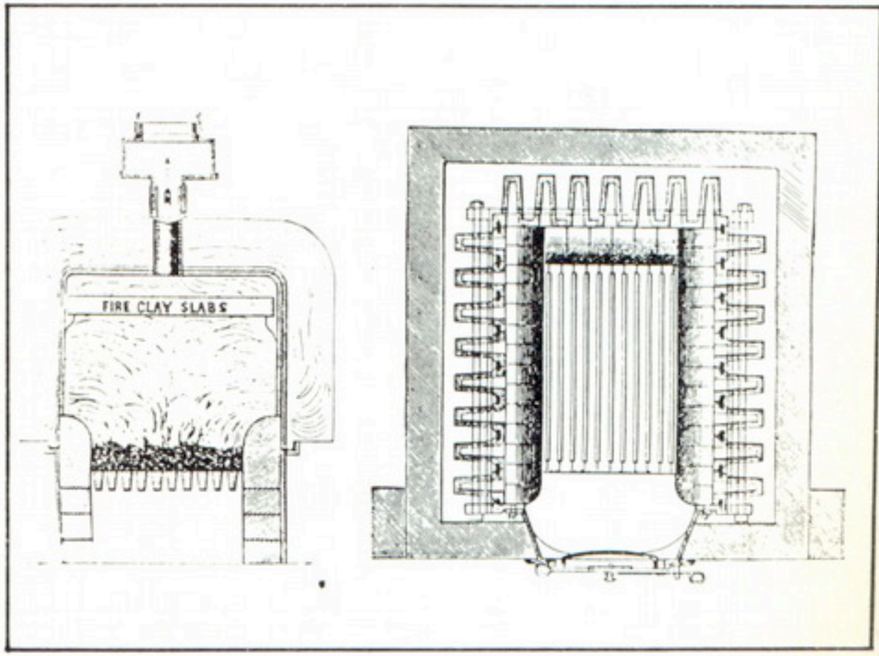
At the beginning of the 18th century, iron-founding had improved sufficiently to permit complicated shapes to be cast, and the "round" cast iron stove came into being. The early Dutch stoves were referred to as "cannon" stoves, from a superficial resemblance to a gun barrel. The fire-pot was never filled to the top with fuel; much of the surface of the stove was heated by radiation from the burning fuel and by contact with the hot gases. It was to this type of stove that Arnott fitted a primitive thermostat (his thermometer stove) to control the primary air supply, in about 1840. These simple stoves were inefficient, since the flue gases were discharged at a high temperature.

During the 18th and 19th centuries, many types of stove were manufactured in Europe. Some had gills or ribs cast in the surface. The "Gurney" stove, which was of this kind, was used at the end of the 19th century to heat St Paul's, Chichester and Ely cathedrals.

The Convoluted stove, due to Constantine, was of this type. It was constructed of ribbed sections bolted together, and enclosed in a brick setting through which air could pass. A noteworthy feature, shown in the drawing, is the arch of fireclay slabs over the combustion chamber — presumably to ensure efficient and complete combustion. These stoves were used to warm the Free Trade Hall in Manchester.



Cross-section, Convoluted stove.

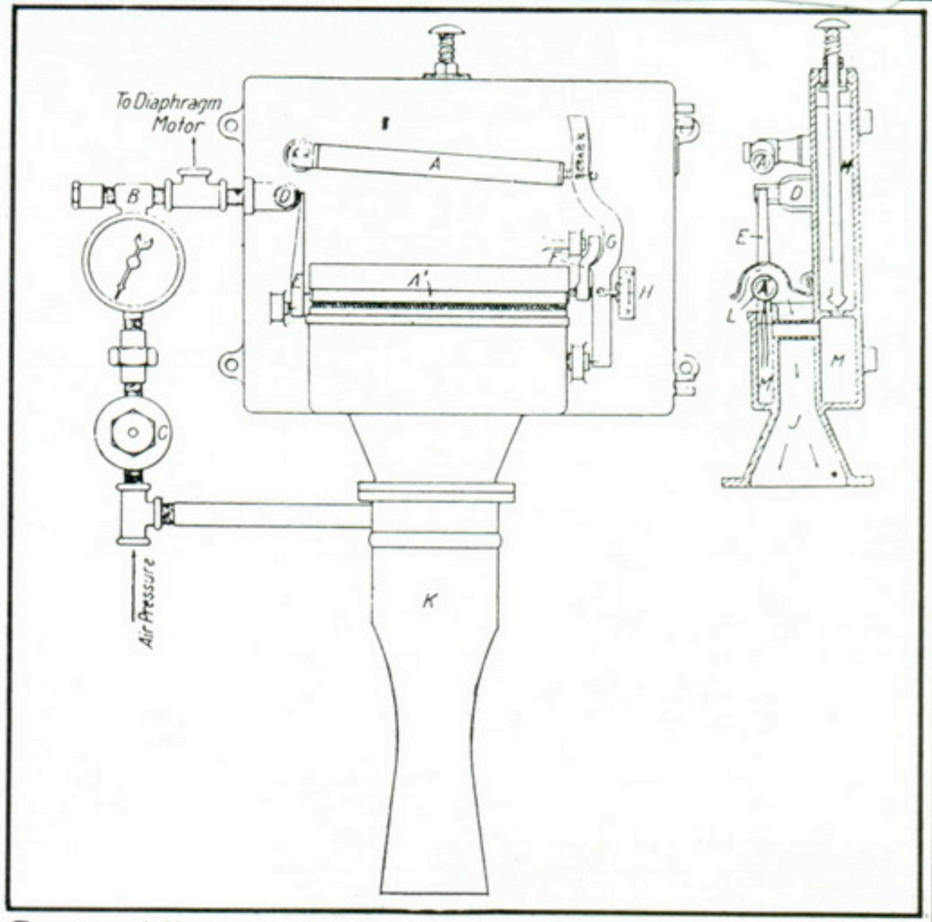
Contributed by the CIBSE Heritage Group.

GOLDEN OLDIES

A development of the dewpoint thermostat of 1911 was the differential thermostat, which employed two expansible members acting conjointly. As air conditioning systems increased in size the fluid differential thermostat was designed to cater for use where several floors were conditioned from one central plant, but where some independent control was required.

Carrier found there were many applications where "the dewpoint system of humidity control cannot be applied to advantage". So he developed the differential hygrostat. This incorporates an expansive dry-bulb member and a wet-bulb member (constructed of hard rubber tube). Carrier recognised that "the difference between the dry and wet bulb temperature for a given per cent of humidity is not constant at different dry-bulb temperature", and made clever use of differential screw threads in the mechanism to compensate for this.

An improved form of hygrostat was operated by the relative pressures of a volatile liquid (sulphur dioxide), subjected to the wet and dry-bulb temperatures in the so-called "vapour pressure hygrostat", acting through suitable diaphragms on a common lever at variable distances from the fulcrum. Carrier went on to apply the same principles in the design and construction of his recording hygrometer.



Carrier differential hygrostat (1911).

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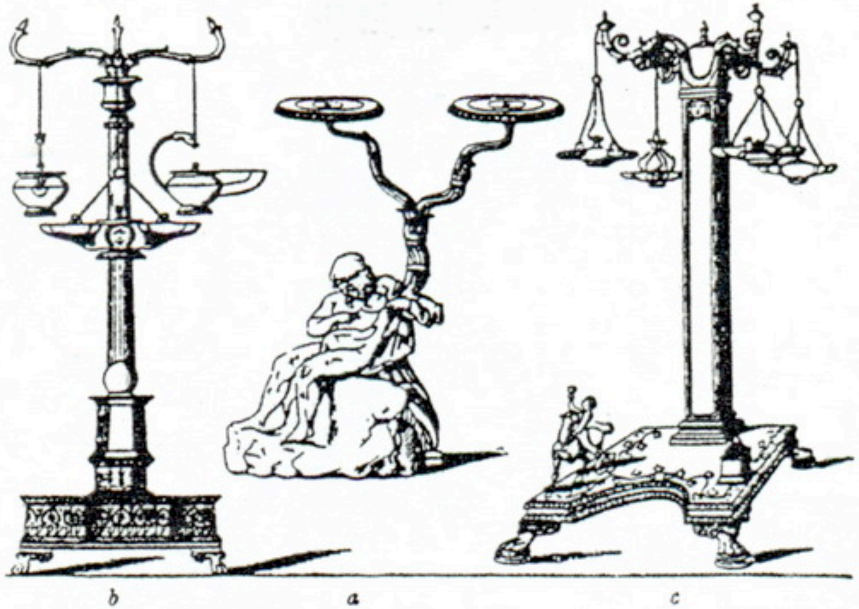
GOLDEN OLDIES

The efforts of the classical lamp makers were directed more towards improvements in lamp appearance by graceful design and artistic decoration than towards technical development. To make brighter lights they increased the number of wicks, but this also increased both the smell and the quantity of smoke.

A lamp found in Pompeii had as many as 14 lights, and a shop in Herculaneum had a multi-spouted bronze lamp suspended from the centre of the ceiling. Lamps were also suspended by chains from stands or lamp-holders (candelabrum). Amongst the poorer classes these were made of wood or metal, but the rich "had them executed in the most graceful and elegant forms."

Though the Greek and Roman lamp makers never discovered those principles of combustion which are necessary to produce brighter lights without excessive smoke there is some evidence of attempts at technical improvement. The Greek engineer Hero (ca 200 BC) described a device for automatically adjusting the wick of a saucer-type lamp and there were inventions for supplying oil to the wick either by water pressure or air pressure.



Roman lampholders.

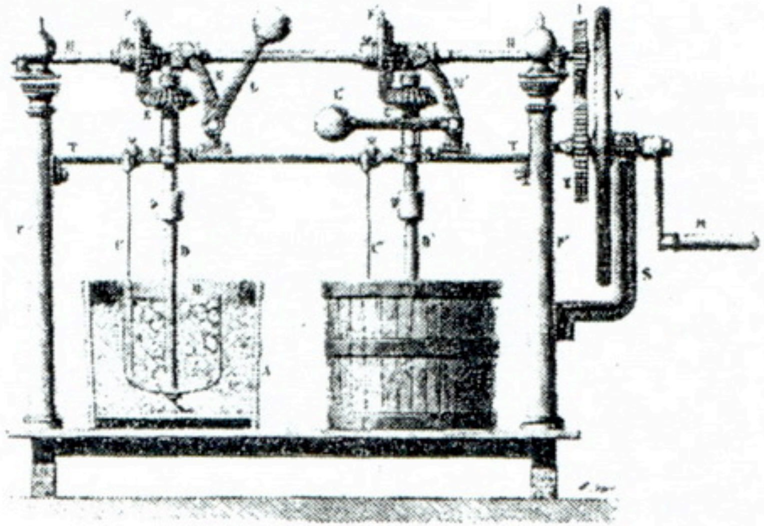
Contributed by the CIBSE Heritage Group.

GOLDEN OLDIES

The original discovery of the cooling of water by the dissolution of a salt in it is unrecorded. That it has been known a long time is evident from a passage in the Indian book *Pancatantrum* of 400 AD, "Water is cooled when it contains salt". The Apulian doctor Zimara, who was Prof at Padua (1525-1532) mentions the cooling by saltpetre in his book *Problemata* which appeared in 1530. The Spanish doctor Blasius Villafrance, who practised in Rome, described the cooling by saltpetre in 1550. He says that this method of cooling water and wine was often used and generally known.

In 1845 Villeneuve demonstrated a freezing machine using a mixture of sodium sulphate and hydrochloric acid. A year later, Goubaud used a mixture of 2·5 kg of salt in 2·5 of water, obtaining 0·5 kg of ice at a cost of 2·5 centimes.

Peclet describes an ice-making machine designed by M Loefz and which was widely used. It employed a freezing mixture of ice and salt; the ice formed on the surface of the freezing cells and was detached by a scraper. It was claimed that with one operator the apparatus would produce 4 to 5 kg of ice in 5 min.



Loefz's ice-making machine.

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GOLDEN OLDIES

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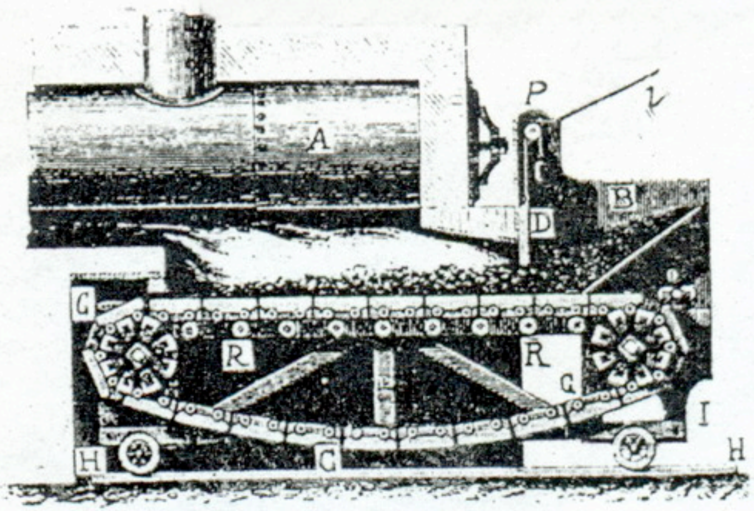
An embryonic stoker was used in Watt's smoke-preventing furnace (British Patent 1485 of 1785). It embodied two-stage firing — the front grate to coke the fuel and the rear grate to consume the residual coke — as an aid to smoke reduction. The principle of the underfeed stoker was invented by Hawkins and Dowson of London in 1816. Brunton (a member of the Watt-Boulton-Murdoch group) made a flat revolving-grate stoker in 1819, and in 1822 he patented a travelling grate with peristaltic motion (BP 4685), which is the basis of almost all modern coking and sprinkler stokers. A sprinkler stoker was invented by Stanley at about the same date.

Bodmer patented a travelling grate with continuous forward motion (BP 6617 of 1834), some years before Juckes' patent chain grate of 1841. This was followed by Taylor's patent 3371 (1868) for a chain grate stoker applied to a shell boiler.



Juckes' chain grate stoker (mid 19th century).

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GOLDEN OLDIES

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David Boyle, a Scotsman who went to America, took out US Patent 128448 in 1872 for a refrigerating machine. In 1873, he built a 3·5 kW ammonia plant which he installed in Jefferson, Texas, and produced the first ice in October of that year. In the spring of 1874, after several improvements, Boyle was able to make clear ice, but his machine was destroyed by fire in the summer. He went to Chicago, where he formed a partnership with W B Bushnell to build ammonia compressors. In 1875 Boyle and Bushnell moved to Chicago and made arrangements for Boyle compressors to be built by the Crane Company. One of these machines was displayed at the 1876 Centennial Exposition in Philadelphia.

While others might disagree, Boyle has a strong claim to be considered the father of ammonia compression refrigeration in America. A Boyle plant in a Chicago brewery had a capacity of 70 kWR (1877). It consisted of a twin-cylinder single-acting vertical compressor, the cylinders being 254 mm bore and 457 mm stroke.

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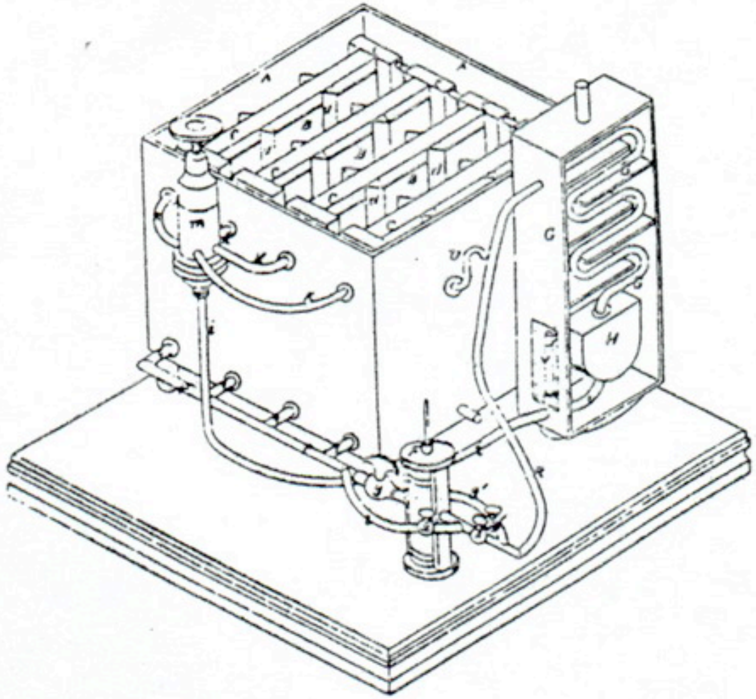

Patent drawing of refrigerating machine developed by David Boyle in 1872 during his stay in California.

GOLDEN OLDIES

Many of the earliest fans consist of a number of radial blades mounted on one side of a rotating disc. Fans without a casing were typical of designs which were in use prior to 1830.

The first cased fans had circular casings, fitting close to the wheel, with an opening at one point to serve as the outlet. Guibal showed that a casing is essential to achieve full pressure development. A scroll casing, fitted eccentrically, was shown in a drawing in Dr Ure's *Mechanical Dictionary* published in 1844.

A similar arrangement, but using a convolute casing, was illustrated by Reid at about the same time. With this form of casing, the outlet was normally a plain rectangular opening without any further expander.

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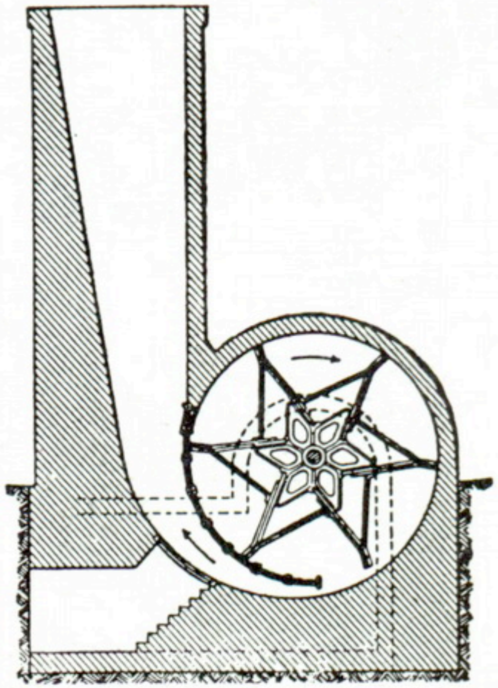
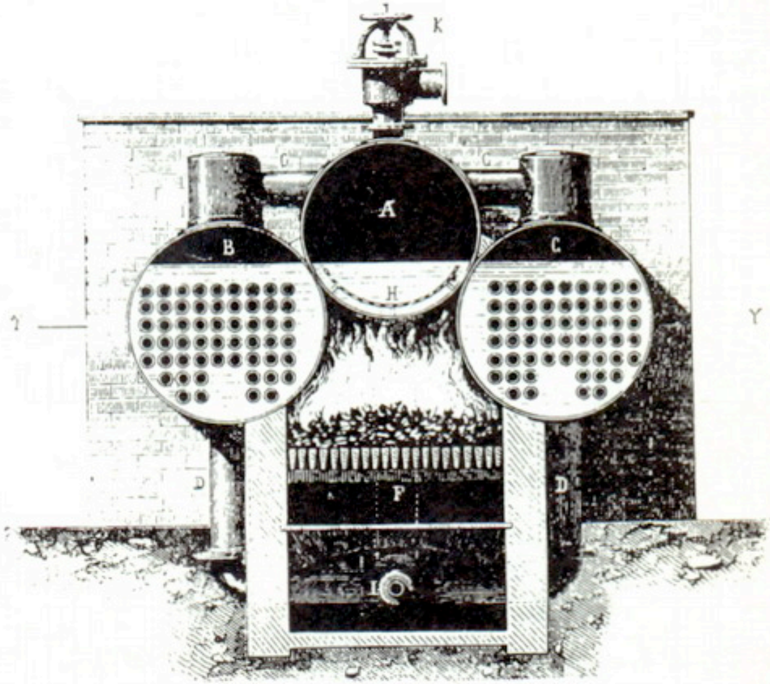


Guibal fan and chimney.

GOLDEN OLDIES

In the 19th century, as metal-working techniques improved, the multi-tubular boiler (either fire-tube or water-tube) became possible. It gave a greatly increased heating surface, and because of the higher gas or water velocities, there was also a greater rate of heat transfer. The construction of the water-tube boiler also permitted higher pressures to be used. The tubes imposed some restriction on water flow within the boiler, and gravity circulation was insufficient to prevent local boiling. Forced circulation became necessary. (This was less of a problem in hot-water boilers, since the external circuit ensured a circulation with the boiler.)

Seguin (French patent of 1827) invented a vertical multi-tubular fire-tube boiler, and used fan draught to overcome the resistance of the fire-tubes. The Holcroft and Hoyle boiler (British Patent of 1854) comprised an upper cylinder and two lower cylinders containing fire-tubes. The use of fire-tube boilers was then increasing, particularly in England. Cater's patent tubular boiler had a furnace beneath the shell, and the gases passed along a bottom external flue, and then through two passes of fire-tubes within the shell.



Holcroft and Hoyle's steam boiler (1854).

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GOLDEN OLDIES

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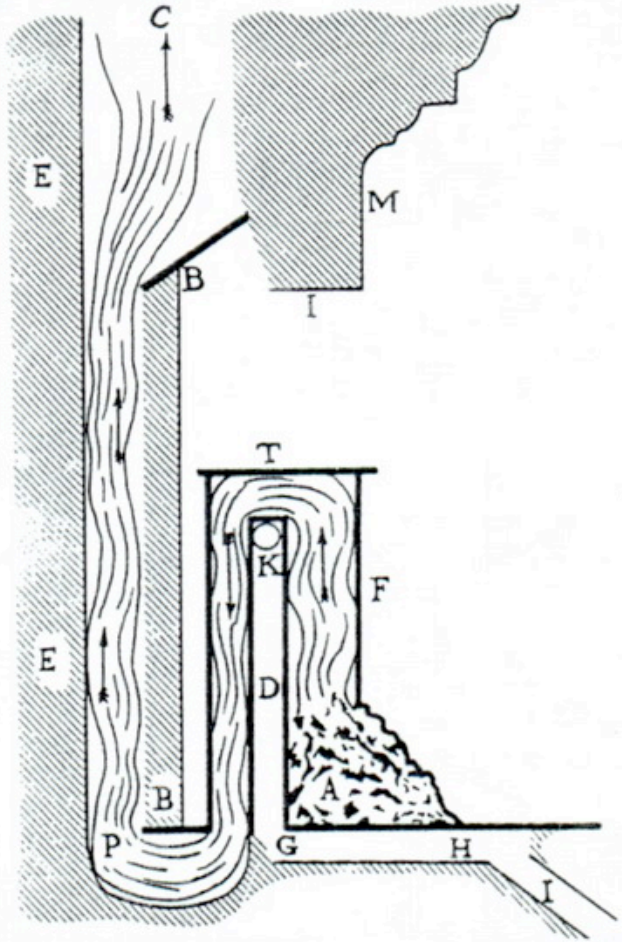
Between 1740 and 1750, Benjamin Franklin turned his attention to the problems of the open fire. In 1745, he published a description of his Pennsylvania fireplace. Designed for burning wood, it was a six-plate closeable stove, set in an ordinary fireplace recess. Fresh air was admitted both to supply air for combustion, at the front of the hearth, and for room warming by means of an air-heating box in the stove. The flue gases were made to pass upwards and downwards over the air-box on their way to the chimney. A register plate at the front of the fire was used to control the rate of burning and to close the fire at night. The top of the stove was available for simple cooking. He also designed a down-draught fire, and was the first to advocate that chimneys should be built on inside walls.



Pennsylvania fireplace.

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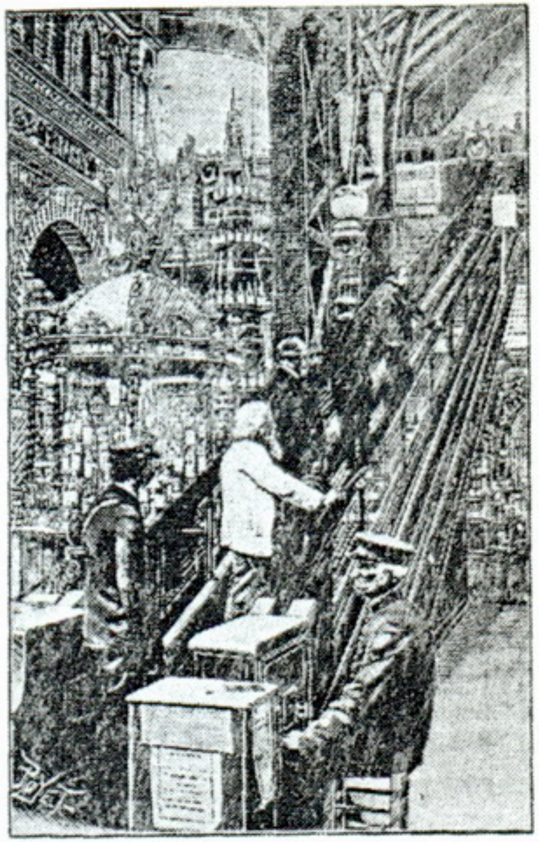
GOLDEN OLDIES

The escalator was the subject of patents by Reno (1891) and Seeberger around the turn of the century.

In 1889, the Frenchman Amiot designed a device "to do away with the fatigue of climbing stairs". Known as a stair climber it consisted of two metal rails, one placed above the other, and a platform with wheels capable of moving up and down this track under motive power obtained from an electric motor or other suitable machinery to which it was connected by a chain or cable.

A rolling staircase was demonstrated at the Paris World Exhibition of 1900, but it was not successfully marketed until 1921 and then by Otis who had earlier pioneered the practical lift or elevator.



Rolling staircase at the Paris World Exhibition (1900).

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GOLDEN OLDIES

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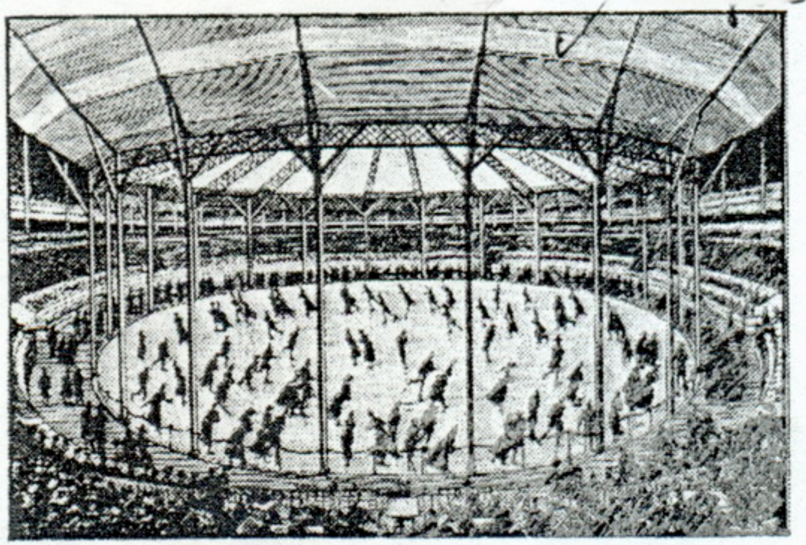
The following report appeared in the French Press in 1890:

"What is often denied to us by nature - a winter bringing ice for skating - will be provided by art, or rather science, for in the near future La Gran Plaza de Toros in the Rue Pergolese in Paris will be transformed into an ice palace where a circular skating-rink more than 2000 square metres in area will provide continuous facilities for ice-sport.

How is this artificial skating-rink installed and kept up despite the sometimes high temperatures which prevail outdoors? By evaporating liquid ammonia and using the cold thus generated for making ice...(with) a network of fourteen iron pipes, each some 1200 metres long and having an inside diameter of 35 mm and a total length of 17 kilometres. Ammonia is piped through this system and the gas thus released is compressed and liquefied again by enormous pumps driven by three steam engines delivering a total of 120 horsepower."



The artificial skating-rink in Paris (1890).

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