GOLDEN OLDIES 1

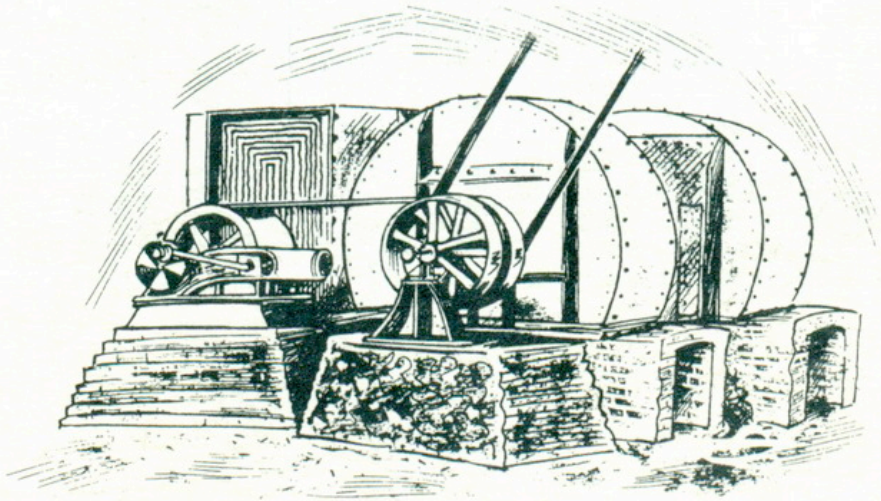
When was the first double duct system installed? Certainly well before the 1950s!

In the United States, even before 1890, there had been numerous instances of cooling air to provide comfort conditions in buildings, generally by the use of ice but sometimes with mechanical refrigeration.

The heating and ventilating of large buildings was well advanced in spite of the fact that electric power was not generally available. Many large fans were driven by means of a steam engine with the exhaust from the engine used for steam heating.

Pictures of early installations show that large air ducts were often constructed of brick with the fan mounted directly above and even with brickwork forming part of the fan scroll.

In the "two fan" layout illustrated, the box-like housing behind the fan is the heater, so only one fan discharged heated air — a dual duct system!



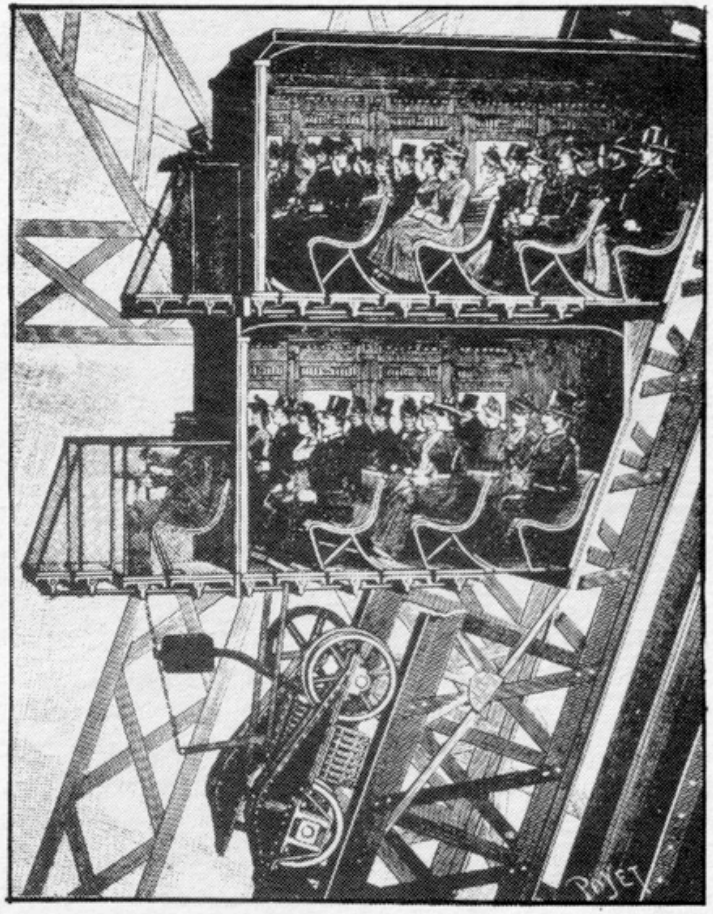
The GOLDEN OLDIES series appeared in "Building Services" (CIBSE Journal) for close to 8 years. It began in September 1984 and finished in March 1992.

GOLDEN OLDIES

2

When Gustave Eiffel built his 300 m tower in Paris in 1889 no one could be found to design and build the special elevators which had to follow the difficult lower curve of the Tower's legs. That was, until Otis Elevator Company accepted the challenge.

"The transportation system incorported various lifting devices to carry the visitor upwards. The Combaluzier lift goes to the first platform. Endless chains, composed of a series of hinged bars, move on guide-pulleys driven by two powerful hydraulic engines. The chains are fastened to the sides of a compartment which can convey 100 persons to the first platform within a minute. The elevators leading to the second platform are capable of holding 50 passengers but travel at double the speed. The compartment is lowered 12 feet for every foot the piston travels. The Edoux elevator carrying the visitors to the top in two stages is a vertical lift moved by the pressure of 700 cubic feet of water stored in a tank at a height of 1000 feet. The water required for the various elevators is carried upwards by steam-operated pumps producing a power equal to 300 hp".



3 GOLDEN OLDIES

In 1886 Bernard Drake set up in business as an electrical engineer. In 1893 the *Pall Mall Gazette* reviewing his installation for Chatsworth House:

"In London the mention of electric lights suggests the blueish icy/cold gleam of arc-lamps in railway stations and streets, or the warm of its still chilly glare of incandescent burners. The installation, moreover, in an old building seems almost necessarily to imply the running of wires along the ceilings and passages, with the pretence at their concealment in unsightly stripes of grooved lathe. As to the electric power, you either have to get it from the mains of one of the monopoly companies, or else you have an engine of your own in the basement, which roars and rattles and gives off a warm smell of oil that recalls a mid-channel steamer.

The electric light at Chatsworth knows none of these drawbacks. To outward appearance no change has been made, save of course in the enormously increased volume of light".

The Chatsworth installation was powered by turbines built into the four hundred foot head of water powering the fountain! In 1898 Duke Drake was due to tell the Royal Institute of British Architects: "The electric light is no longer the light of the future; it is essentially the light of the present, and has come to stay. The redolent oil lamp and guttering candle had been laid aside with the high wheeled bicycle."

Contributed by the CIBS Heritage Group.

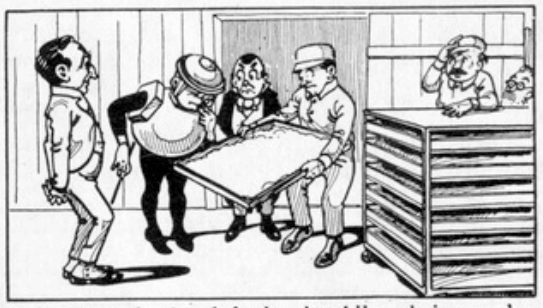
GOLDEN OLDIES

In 1921, the Carrier Engineering Corporation, introduced its monthly magazine *The Weather Vein*.

By way of sales promotion the magazine featured a cartoon strip concerning the "Adventures of the Mechanical Weather Man" (who may have been the source of inspiration for the Tin Man in The Wizard of Oz). The Mechanical Weather Man was to feature in such classics as "The Film Mystery", "The Macaroni Case", "The Piping Incident" and, of course, "The Mystery of the Chemist's Shop".

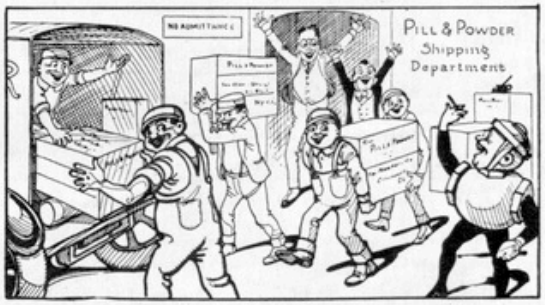
Contributed by the CIBS Heritage Group.

The Messrs. Pill and Powder make chemicals and drugs,
Most everything from Paris Green to bottled little bugs.



And when they've left the dry kilns their powders rare and dear
Become a caked and sorry mass in summer atmosphere.

"Mech" waves his magic wand, then, conditioning the air,
And all their costly chemicals which used to cause despair



Are standardized exactly and made superior,
While everything competitive becomes inferior.

GOLDEN OLDIES

In Babylon bath tubs of stone or clay have been found which date back to the 25th century BC. However, bath tubs were unknown in the ancient Egyptian and Greek civilisations and bathers were sprinkled with water. Bathing then became a well-developed social habit during Roman times in communal leisure centres such as the Baths of Titus and Caracalla in Rome and the baths in Bath.

Roman villas also had their baths and various means of heating the water were used. One method consisted of an urn within which was a pipe to contain a fire. Another, described by Seneca, was a "once-through" heater, made from a spiral copper pipe through which the water flowed, the pipe being heated by the flames of a fire.

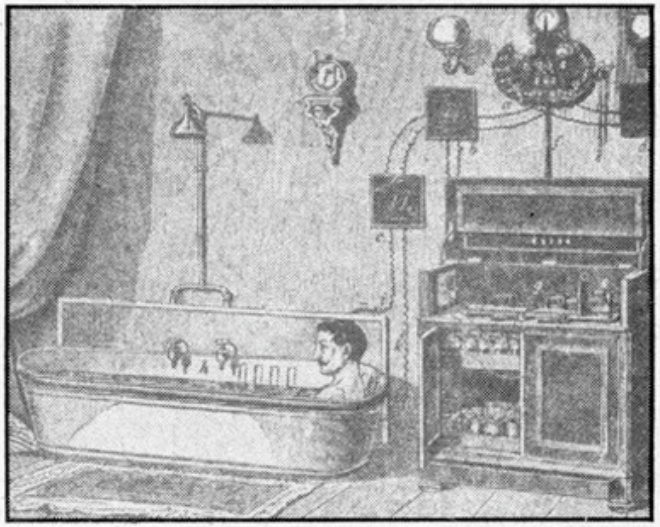
After the decline of Rome the practice of bathing seems to have been largely forgotten in Europe, only to be revived for a time in the Middle Ages. By the reign of Richard II there were 18 bath-houses or "stews" in Southwark alone, owned by the Lord Mayor of London. All made a handsome profit from the immoral business done on the side.

Queen Elizabeth I was considered by her Court to be extremely fastidious in matters of hygiene, taking a bath once a month "whether she needed it or no". By comparison, her godson, the poet Sir John Harington (inventor of the first valve water closet in 1596), was considered eccentric in the extreme, because he had a bath every day!

At the end of the 18th century, bathing was regarded as a luxury, and those who wished to bathe used a tub at home.

When Queen Victoria married there was only one bathroom in Windsor Castle and at this time the portable tub in the kitchen was in common use.

Contributed by The CIBS Heritage Group



From the GEC catalogue of 1886 you could have purchased this electric bath installation, complete with appliances for constant and Faradaire current applications.

6 GOLDEN OLDIES

In his 1859 French patent, Ferdinand Carré described two kinds of aqua-ammonia absorption refrigerating machines: the intermittent type of small capacity, for use in household ice-making machines, and the continuous machine. Carré's machine was built commercially by the firm of Mignon and Rouart in Paris, in a range of sizes to produce from 12 to 200 kg/h of ice. The yield was said to be "10 tons of ice per ton of coal". Manufacture under licence commenced in a number of countries but it was the American Civil War that provided the impetus for its practical development.

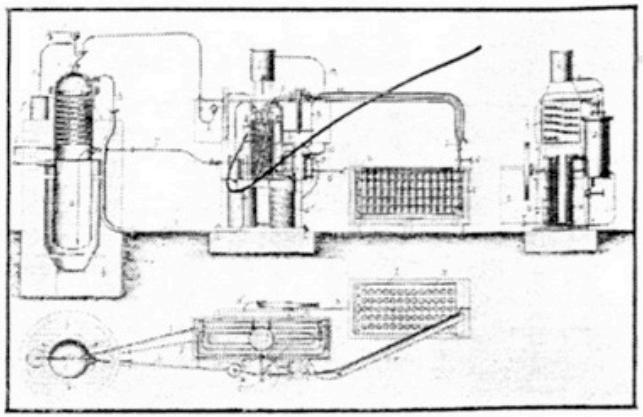
When war was declared between the Union and the Confederacy (1861), shipments of ice out of Boston came to a halt. Only Dr Gorrie's hospital in Florida with a cold-air refrigerating machine could artifically produce ice for the South.

The first Carré machine on the American continent was set up at Matamoros in Mexico, where it operated for a short time before being moved to Texas. Four Carré machines were smuggled through the blockade in 1863 but apparently the fuel-fired generators caused considerable operating difficulties.

Daniel Holden of Kentucky, who had served as a major in the Confederate Army, purchased a Carré unit in 1865 (when the war ended) and put it to work in San Antonio making commercial ice. He too experienced problems with the generator and found that San Antonio water produced an off-colour ice. Holden's first idea was to install steam coils in the generator to heat the aqua-ammonia; his second modification was to produce the ice from distilled water.

So quickly did these changes bring about public acceptance of machine-made ice and place the Carré machines on a sound commercial footing that Bujas and Girardey were to publicly announce that Holden's work was "the development that made possible the introduction of Carré machines as large units."

Contributed by the CIBS Heritage Group



Carré's continuous absorption refrigerating machine of 1859.

GOLDEN OLDIES

At the end of the 19th century a number of pipeline refrigerating installations were carried out. This was the start of district cooling.

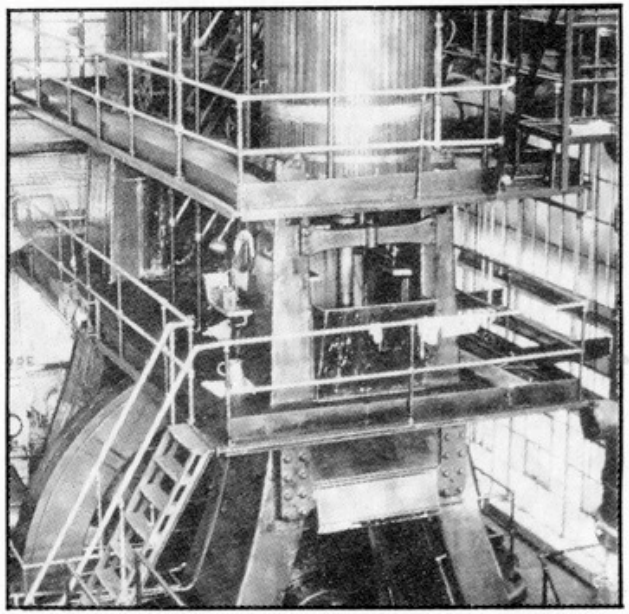
In 1890 a large district cooling system using direct expansion of ammonia proved successful in St Louis, Missouri. It employed some 13 km of piping and the farthest point from the central plant was 4 km. In the same year, a brine distribution system serving some 40 000 m^3 of space was organised around a large cold store in Quincy Market, Boston. By 1908, Quincy Market had expanded sixfold and was provided with some 7000 kW of cooling capacity.

Also in 1908 a large brine distribution system served part of lower Manhattan in New York, later being expanded to serve some 75 000 m^3 of buildings. In Baltimore, Los Angeles and Atlantic City direct expansion systems using ammonia were preferred. By 1916, some 20 towns in the USA had direct cooling systems.

Large industrial organisations also make use of direct cooling plant. Starting in 1891 the Eastman Kodak Company at Rochester, NY, had by 1967, installed 99 MW of refrigeration plant. During the period 1908 to 1934 alone, Kodak installed nearly 32 MW. The Kodak system served some 140 manufacturing buildings, spread over 5·3 km^2 of land, which housed a workforce of 20 000 people. From 1900 to 1934 the Rubber Coal & Ice Corp of New York City installed 47 MW of cooling, while in Chicago, over a similar period, Armour & Co put in some 32 MW.

By comparison, the 1970s refrigerating installation for the World Trade Center, New York employs seven 7000-tr water chillers to give a total cooling capacity of 172 MW.

Contributed by the CIBS Heritage Group.



Early two-cylinder, single-stage, double-acting ammonia compressor (1700 kW cooling) driven by a double expansion Corliss engine (Kodak Park, NY).

8 GOLDEN OLDIES

The earliest use of flat solar collector plates for heating water is not known but it is recorded that in the USA: "Early settlers had heated water in the sunlight for many years. A tank usually painted black, was put in the sun and by late afternoon the water in it was hot enough for washing."

In 1891, C M Kemp of Baltimore patented the Climax water heater; four 30 litre tanks arranged side by side in a glass-covered box, mounted on the slant with one tank above another. By 1900 some 1600 Climax heaters were in operation throughout the southern states.

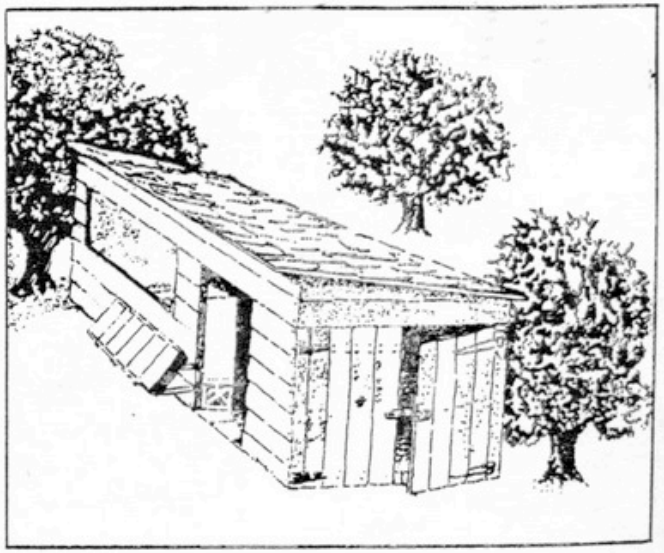
In 1898, Frank Walker of Los Angeles designed "an improved heater, with better water flow and back-up provision" and in 1905, Charles Maskell introduced an "Improved Climax".

The galvanised-iron or cast-iron water tanks in these early solar heaters had themselves to warm up before transferring heat to the stored water. William J Bailey of Monrovia, California tackled these problems around 1909. He ran the water through copper pipes soldered to a copper sheet, both painted black. Secondly, because the water was stored in the same tanks in which it was heated, it cooled off at night and had to warm again the next day. Bailey removed the storage from the heater and kept the hot water in an insulated tank.

The final step came when the disastrously cold winter of 1912-13 froze solar heaters. This forced Bailey in to using a non-freezing solution in the solar panel which then passed through a coil in the tank.

It has been estimated that about 25 000 solar water heaters were in use in California during the 1920s and 1930s. In 1923, Bailey licensed the use of his patent to an entrepreneur in Florida. By 1941 at least 60 000 were in use there.

Contributed by the CIBSE Heritage Group



Bailey's solar heater of 1908

GOLDEN OLDIES

Christianity came to Kent in AD 597 when its ruler, Ethelbert, was converted by missionaries from Rome and helped establish the first Cathedral of Canterbury. Twice ravaged by fire, and twice rebuilt, the Cathedral and its Benedictine monastery had assumed much of their present form by 1160 when the water works were carried out by Prior Wibert.

Water was taken from springs outside the city, some 1¼ km from the monastery, to a circular conduit house, from whence it was conveyed, through a perforated screen and several settling tanks, by pipes to the city. Within the monastery, the water was taken underground to various offices and lavatories. Waste water went to a fish-pond and on to the "Prior's water-tub," where it was "joined by the waste from the bathhouse and the rainwater from the roofs, to provide a hearty cleansing flow through the main drain running under the 'reredorter' latrines." The original plans of the system still exist.

It has been claimed that good sanitation due to the excellent water supply discouraged rats and helped the monks escape the worst effects of the Black Death.

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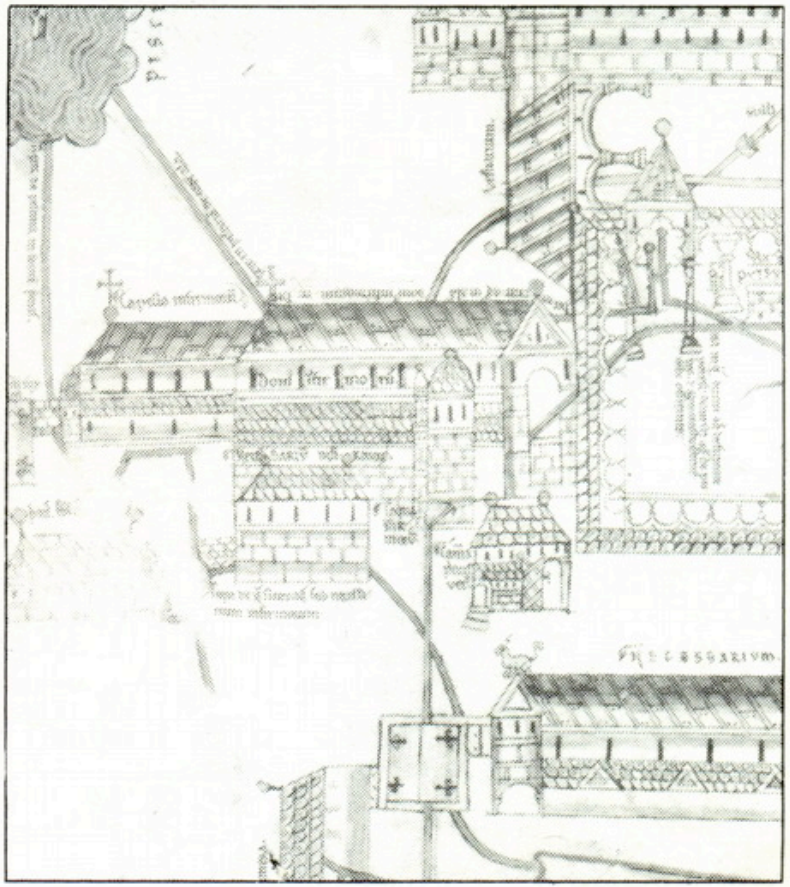

10 GOLDEN OLDIES

Early room coolers used ice but around 1925 small units were developed in the USA for cooling offices and individual rooms in the home. Some 70 years earlier, C Piazzo Smith had studied the question of cooling the living rooms of buildings in the tropics by means of cold-air refrigerating machines.

Schultz's patented design of 1926 included a water cooled condenser and a receiver but no means of disposing of condensate.

By the 1930s units were mainly free standing console types with belt driven compressors and water cooled condensers. Many used methyl chloride or sulphur dioxide as a refrigerant. The majority were too big, too heavy and far too costly to gain widespread acceptance.

However, welded hermetic compressors were introduced in 1931 and one of the options available included reverse-cycle heating. In 1931 Earl Babcock proposed mounting the air conditioning unit in a window, with the bulk of it outside the room. He got his patent in 1946 and by 1950 this type practically squeezed out the console models.

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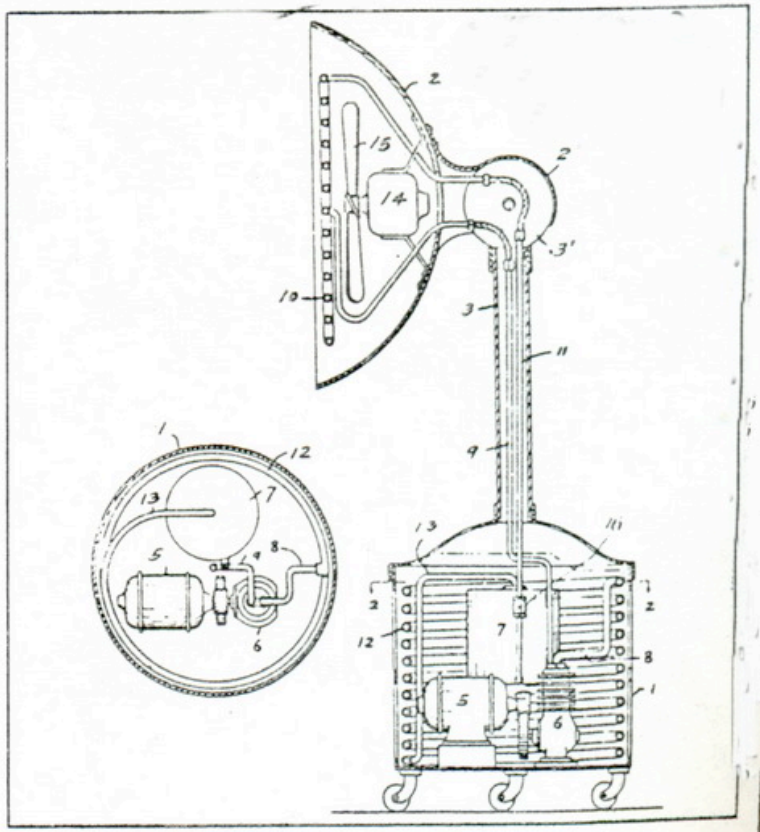

Schultz's 1926 room air conditioner.

GOLDEN OLDIES

The mechanical fan, or "fanner" as it was originally called, was invented in 1734 by Dr Desaguliers, specifically for ventilating purposes.

"The wheel was enclosed in a concentric case, which had a 'blowing pipe' on the upper part and a suction pipe that communicated by a funnel with the central opening in the wheel which was turned by a handle attached to the axis. The fanner was adjusted to revolve as closely to its concentric casing as possible.

"By the revolution of the wheel, the air entering through the central opening into the spaces formed by the radiating partitions was thrown by centrifugal motion towards the circumference where it was confined by the concentric casing and carried round until it arrived at the opening of the blowing pipe into which it was impelled by each radiating partition in continuous revolution."

One of Dr Desugaliers' fanners was installed in the House of Commons in 1736 where it remained in use until 1817.

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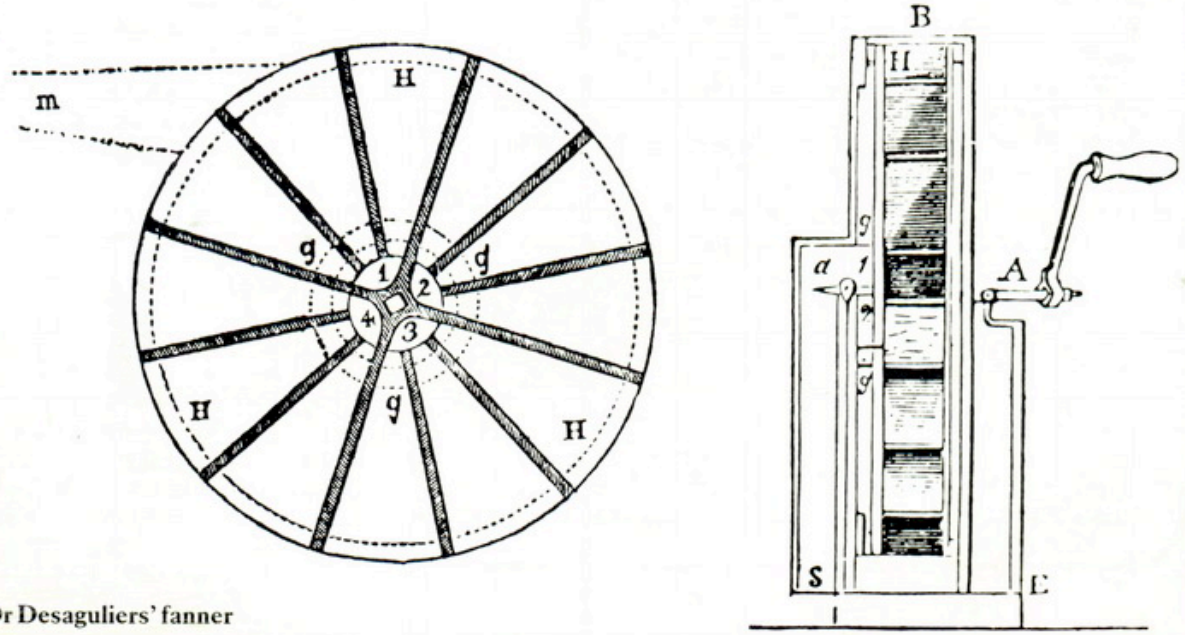

Dr Desaguliers' fanner

GOLDEN OLDIES

Early refrigerant condensers were basically of two types — the simple coil and the shell-and-tube. Coils were usually of wrought iron, but copper was sometimes used because of fear of leakage from the joints. Cast iron pipes, with fins and turbulators, were used by Lebrun in 1888. The earliest condensers were of the submerged type (ie a coil through which the refrigerant passed and which was immersed in water) and afterwards cooled by sprayed water. The "atmospheric" condenser was developed by Louis Block of De la Vergne in the USA in 1882; similar units were made in Britain by Sterne in 1885.

Pictet seems to have been the first, in 1892, to use a shell-and-tube condenser. He arranged the shell vertically, since it was then easier to keep clean. It was satisfactory for SO2, but the large number of joints rendered it unsuitable for the higher pressures associated with ammonia. For this latter refrigerant, coils continued to be used until the techniques for constructing shell-and-tube condensers had been improved in the 1920s.

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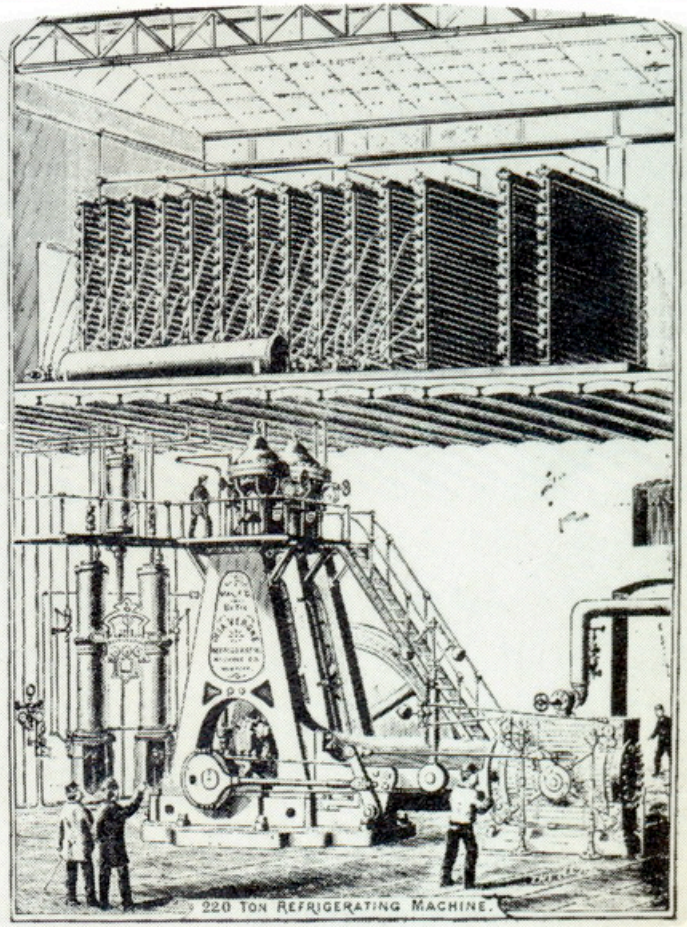

Right: **A 220 ton De la Vergne refrigerating machine with atmospheric condenser of 1890.**