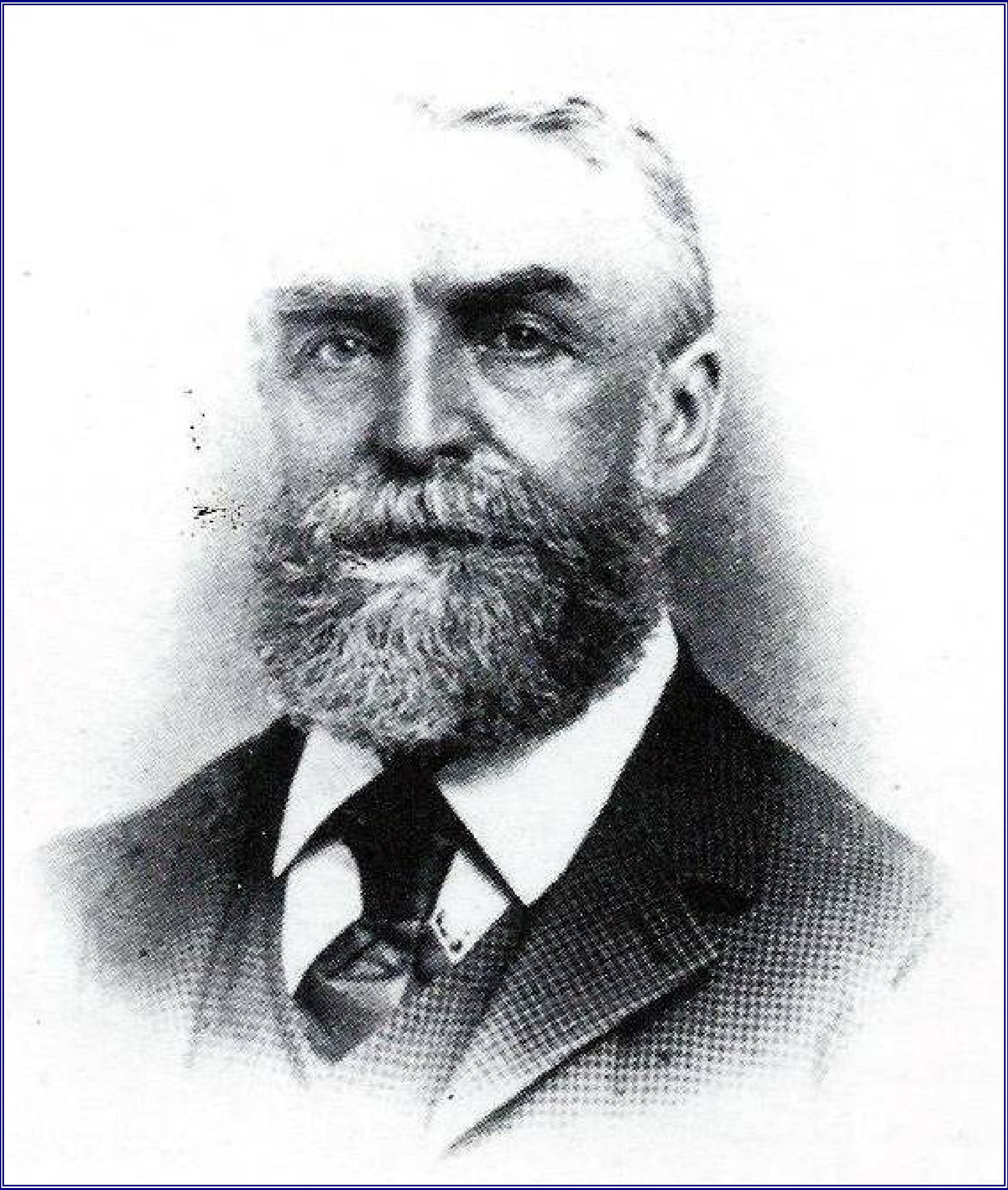
DAVID BOYLE

By EurIng Brian Roberts, CIBSE Heritage Group



David Boyle, 1837-1891

David Boyle was born in Johnston in Scotland on 31 October, 1837. He served an apprenticeship as a clerk in a grocery store, where he became concerned with the price of ice and its scarcity with the consequent loss of perishable products. In 1859, he emigrated to Mobile, Alabama, beginning his refrigeration work in 1865. He later settled in California from 1869 to 1872. Reports and dates on his activities are often contradictory. In 1870, he had bought the rights to the use of petroleum ether refrigerant (chimogene) from Peter Van der Weyde and went to New Orleans, selling most of his assets to purchase a Van der Weyde machine which turned out to be a total failure. Also, around this time, he purchased a Harrison machine from Siebe of London, but it failed to arrive and he had to sue to recover his money since the machine was never shipped.

Boyle designed an ammonia refrigerating compressor which he patented in 1872. (He is credited with being the Father of the Ammonia Compressor, at least in America). About this time, he built his first ammonia compressor of about 3.5 kW refrigerating capacity in New Orleans, this machine being transferred to Jefferson in Texas (probably to the Louisiana Ice Manufacturing Company), where after being completely rebuilt, it was used until 1874 to make ice. Unfortunately, it was later destroyed in a fire.

Boyle arranged for ammonia vapour-compression systems of his design to be made in 1875-1876 in Illinois, notably by Crane Brothers in Chicago. In 1877, a Boyle machine of about 70 kW was in use in the Chicago Brewery of Bemis & McAvoy:

> *It consisted of a twin-cylinder single-acting vertical compressor,*
> *the cylinders were 254 mm bore and 457 mm stroke.*

In 1877 or 1878, he founded the Boyle Ice Machine Company in Chicago and produced about 200 machines in the period up to 1884.

In 1884, the Boyle Ice Machine Company merged with the Empire Refrigerating Company of St Louis to form the Consolidated Ice Machine Company, with headquarters in Chicago and a branch office in St Louis. The architect, Theodore Bergner, designed a new refrigeration machine and boiler house for Boyle ice machines at the Bergner & Engel Brewing Company in Philadelphia. Next, the Anheuser Busch Brewery in St Louis installed three ice machines followed by a similar installation in 1883 for "an elaborate new brewhouse" for Bemis and McAvoy in Chicago.

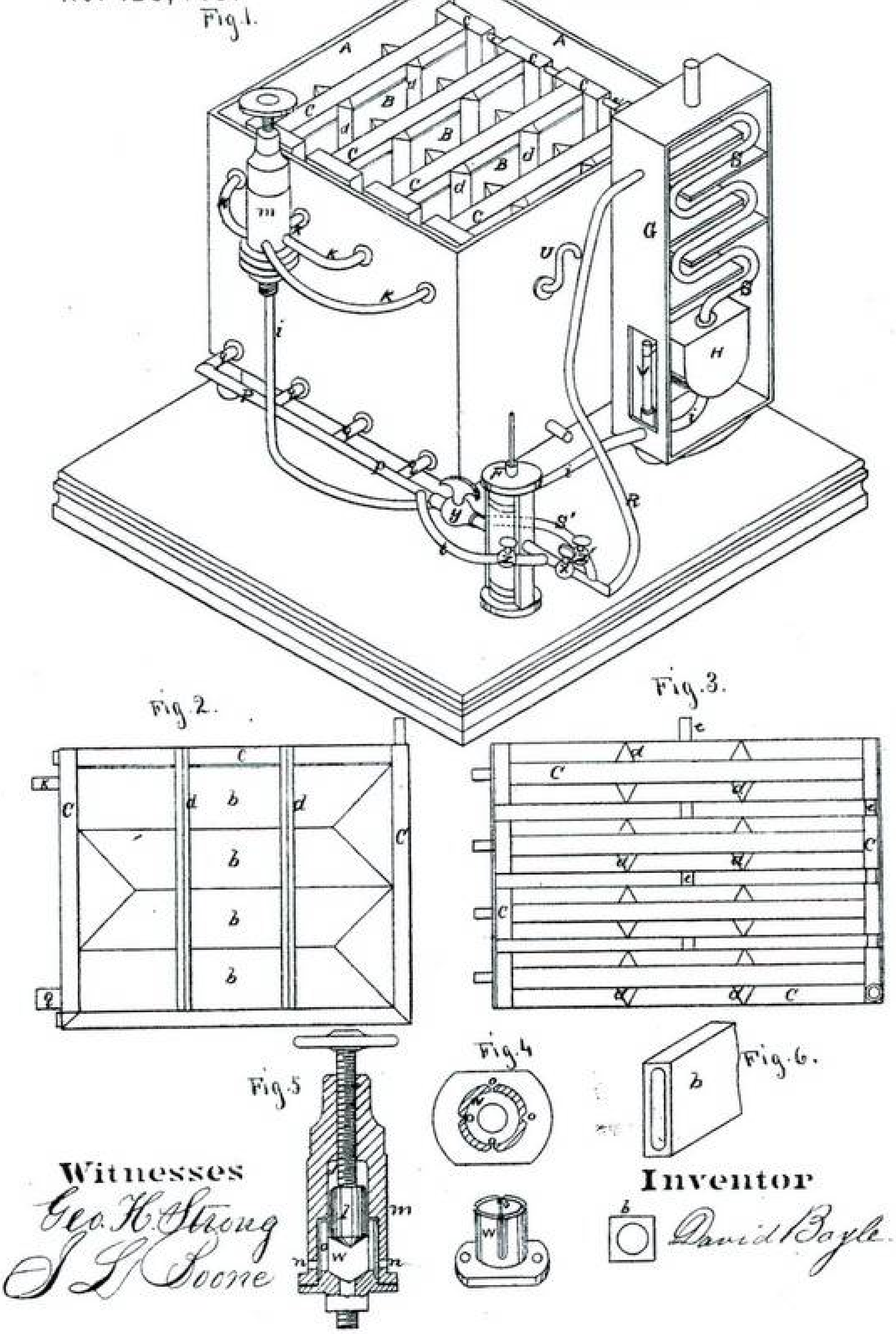
Described as a "genial mechanic," David Boyle died in 1891. His systems were manufactured by his and successor companies until 1905.

D. BOYLE.

Improvement in Ice-Machines.

No. 128,448.

Patented June 25, 1872.



Witnesses

Geo. H. Strong

S. L. Boone

Inventor

David Boyle.

UNITED STATES PATENT OFFICE.

DAVID BOYLE, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO HIMSELF AND JOHN W. PEARSON, OF SAME PLACE.

IMPROVEMENT IN ICE-MACHINES.

Specification forming part of Letters Patent No. 128,448, dated June 25, 1872.

SPECIFICATION.

To all whom it may concern:

Be it known that I, DAVID BOYLE, of the city and county of San Francisco, State of California, have invented a new and useful Improvement in Ice-Machines; and I do hereby declare the following description and accompanying drawing are sufficient to enable any person skilled in the art or science to which it most nearly appertains to make and use my said invention without further invention or experiment.

My improvement relates to various parts of ice-making or freezing machines, particularly to that class in which the vaporization of a volatile fluid is used for producing the required degree of cold.

My improvements are fully described and explained in the following description, in which reference is made to accompanying drawing forming a part of this specification, in which—

Figure 1 is a perspective view. Fig. 2 is an elevation of the refrigerator. Fig. 3 is a plan of the refrigerator. Figs. 4 and 5 are sections of the distributer. Fig. 6 is a section of one of the chambers of the refrigerator.

A represents a tank, inside of which are placed the coils with their freezing surfaces. The tank A, when in use, will be surrounded by some non-conducting substance. B B B B are vertical partitions, which are constructed of the coils above mentioned. These coils are made of tubes *b*, having their outside sectional outline in the form of a parallelogram, while the passage through them is circular, or oblong with circular corners, as shown, Figs. 5 and 6′, thus giving strength to resist fracture from pressure within while offering a smooth plane surface externally for the ice to form on. These tubes are cut to the proper lengths to form the partitions B, and are united together horizontally, having mitered soldered return-joints, so that each partition is formed of a continuous coil extending almost from the bottom to the top of the tank and almost from one side to the other of it. These tubes, when thus united together, form a partition or slab having a smooth even surface upon both sides, upon which the ice is to be frozen. The number and length of these partitions will be varied according to the size of the machine. Entirely surrounding the edge of each of the partitions I place a continuous tube, C, and at intervals along the length of the partitions I connect the bottom and top horizontal tubes by means of the vertical hollow tubes or ribs *d*, upon each side of the partition. These vertical tubes or ribs *d* are made triangular in form, as shown, and they communicate at both ends with the tube C. Short tubes *e* serve to connect the surrounding tubes C of the partitions, so as to give a free circulation around each of them for the purpose hereinafter mentioned. Outside of the tank A is an exhaust and force pump, F, located conveniently with reference to the work it is to perform, and suitably placed with reference to the pump and freezing-tank A is the condensing-tank G. The condensing-coil S is formed of any suitable length or number of tubes to provide sufficient radiating surface. The vessel H, which is attached to the lower end of the condensing-coil S, forms a reservoir to contain the liquid which is to be vaporized for the purpose of producing the cold. A tube, *i*, leads from the bottom of the reservoir H to a distributer at the side of the tank A, and from this distributer as many tubes or pipes K radiate, and are connected to the topmost end of the pipe forming the coils B, as there are coils in the tank A. This distributer or regulating valve consists of a cylinder, *j*, having a solid piston, *l*, with its lower end turned off conical to fit a seat in the bottom of the cylinder over the mouth of the inlet-pipe. The piston is operated the same as in a globe-valve by a screw on the rod and stuffing-box. The diameter of the opening in the lower end of the cylinder *j* is greater than at the upper end, a square shoulder being formed about the middle of the cylinder. A tube or lining, Z, is made to fit in this lower enlarged end and slip up until it rests against the shoulder, and thus give a hole of equal diameter passing entirely through the cylinder. In the present instance this tube is represented as being attached to or a part of the bottom of the cylinder, but the two can be made separate, if desired. Vertical slots *o* are made in the lining Z, commencing at the bottom, and their outer edges are beveled off so as to provide a channel or groove between the lining and tube, to which communication is had through the slots. Holes are made through the cylinder opposite each of these channels to form the exit of the fluid discharged through the slots into the channels, and into these holes the radiating or distributing pipes are secured. When the conical head of the piston is screwed tight against its seat no liquid can enter; but as it is gradually raised each slot will be equally uncovered, and thus each distributing-pipe will inevitably receive the same supply of liquid. P is the main pipe, which leads to the exhaust side of the pump F. This pipe is connected with the lower end of the pipe, forming the coil partitions B, by the short connecting-tubes *q*. Upon the opposite or compression side of the pump is a pipe, R, which leads into the upper end of the condensing-coil S. The pipes P and R are connected by the two pipes *s* and *t*, which pass around upon opposite sides of the pump, and stop-cocks are suitably arranged, so as to reverse the action of the pump by putting the exhaust-port of the pump in communication with the top of the condensing-coil, and the compression outlet of the pump in communication with the freezing-coils B. Secured to the side of the tank A is an overflow-pipe, U, which communicates with the interior of the tank below the surface of the water. This pipe is bent upward and its end then bent forward in the form of a siphon, so that it will keep the water on the inside of the tank standing level with the top of the coils. Connected with the pipe or tube *i* is a glass tube, V, which serves as a liquid-gauge. This tube is, in the present instance, represented as being inside of the condensing-chamber G, but in most cases I shall place it upon the outside and surround it with a large glass tube, which shall form the inlet through which the supply of cooling-water is passed into the condensing-chamber.

The operation of my freezing-machine is as follows: The tank A is filled with water so as to entirely submerge the coils, the overflow-pipe causing it to stand upon a level with the top of the coils and below the upper horizontal portion of the surrounding tubes C. The distributing-valve is then opened to allow a flow of volatile liquid into the freezing-coils B. The pump F is then started to exhaust the vapor or gas formed in the coils B and to compress it into liquid form again in the condensing-coil S. This operation goes on continuously until the heat extracted by the vaporization of the volatile fluid from the water in which the coils B are immersed has formed on their sides slabs of ice of a sufficient thickness. To detach the ice from the coils, cocks Y and Z′ are closed and X and Z are opened. By this means the action of the pump is reversed, and it exhausts warm vapor from the condenser S and compresses it into the coils B B B B, which compression liberates heat and thaws the ice off their surfaces. The tubes C are then filled with water, which detaches the ice from them, allowing it to be removed from the tank.

By this means I construct a simple and effective freezing-machine, in which the work of making ice can be accomplished with little trouble, my improvements being of great value in enabling the work to be done successfully.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The tubes *b*, having their outside sectional outline in the form of a parallelogram, while the passage through them is made with circular corners, for the purpose specified.

2. The tube C, entirely surrounding the coils or partitions B, substantially as and for the purpose above described.

3. The triangular dividing-ribs *d*, for the purpose specified.

4. The dividing-ribs *d*, arranged to communicate with the surrounding tube C both above and below the partitions, substantially as and for the purpose above described.

5. In combination with the condensing-coil, the glass-tube or liquid-gauge V, when placed so as to be continually surrounded by water, substantially as and for the purpose above described.

6. The perforated cylinder *j*, with its piston *l*, in combination with the bottom *m* and slotted tube *n*, substantially as and for the purpose above described.

7. In combination with the freezing-tank A, the overflow-pipe U, substantially as and for the purpose above described.

8. An ice-making or freezing machine, consisting of the tank A, partitions B with their surrounding tubes C, overflow-pipe U, distributer *j*, connecting-pipes P R, and reversing-pipes *s t* with their cocks, pump F, and condensing-chamber G, all constructed and arranged to operate substantially as and for the purpose above described.

In witness whereof I have hereunto set my hand and seal.

DAVID BOYLE. [L. S.]

Witnesses:
J. L. BOONE,
GEO. H. STRONG.

D. BOYLE.

Ice-Machine.

No. 163,142.

Patented May 11, 1875.

Fig 1.

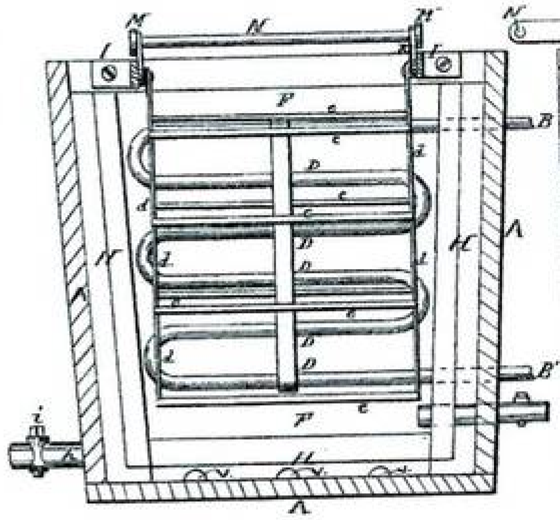


Fig 2.

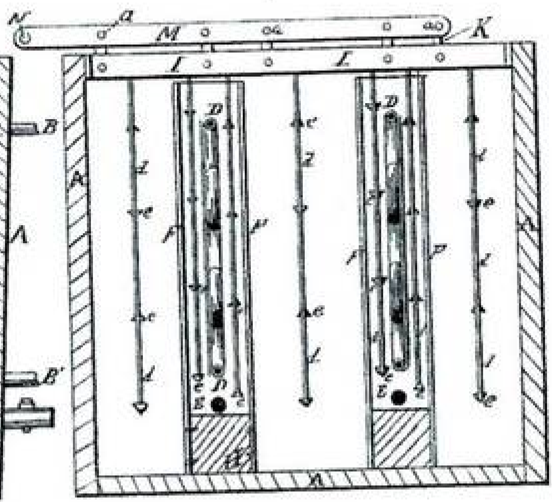
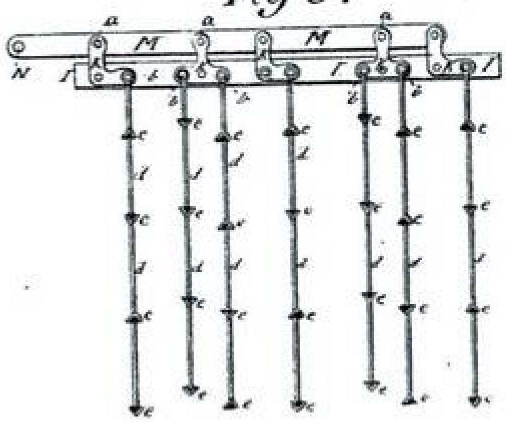


Fig 3.



Witnesses:

J. P. Theodore Lang
Chas. C. Gill

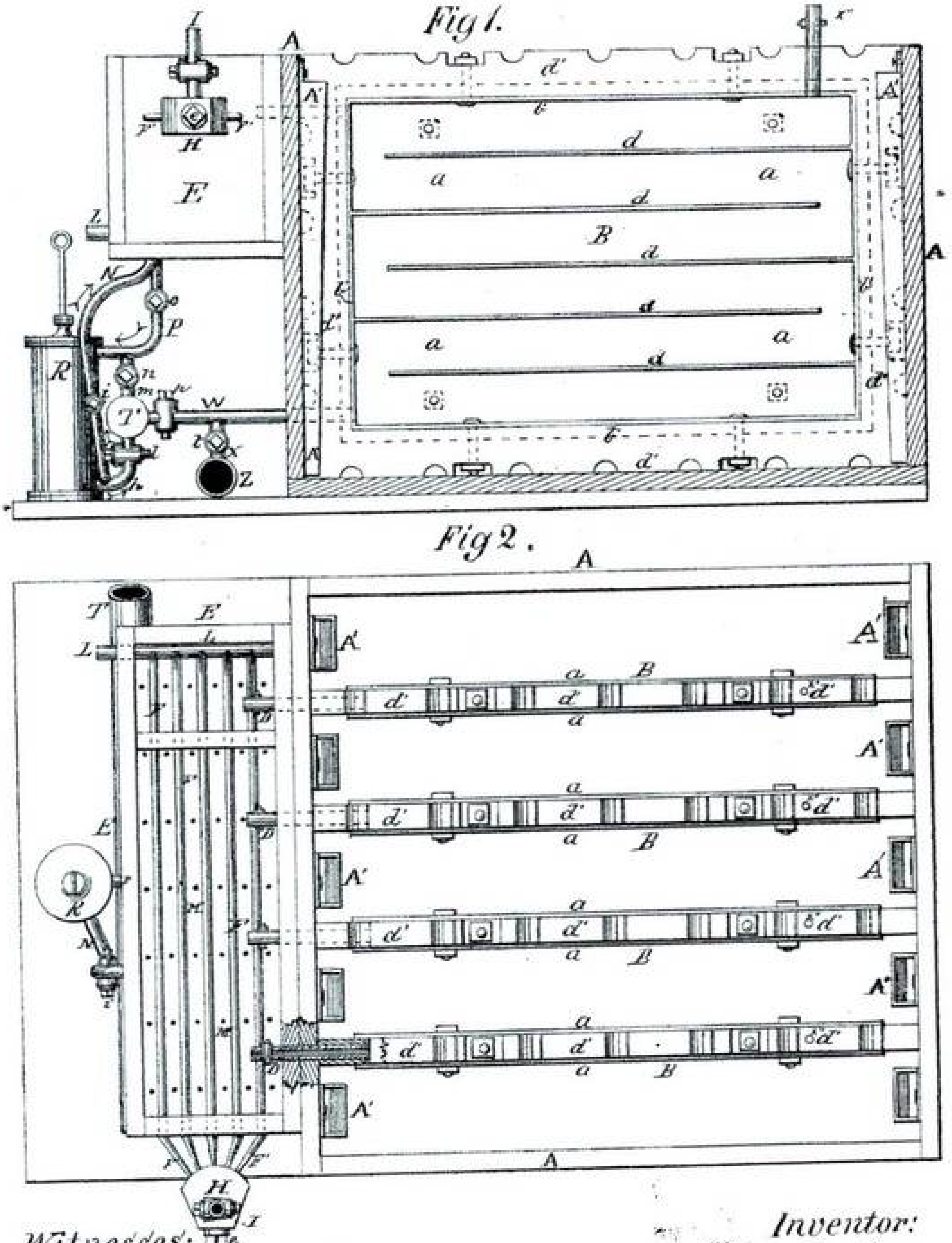
Inventor:

David Boyle
by his Attys.
Cox & Cox

2 Sheets--Sheet 1.

D. BOYLE.
Ice-Machine.

No. 163,143. Patented May 11, 1875.



Witnesses:

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David Boyle

by his attys

Cox & Cox

D. BOYLE.

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Fig 1.

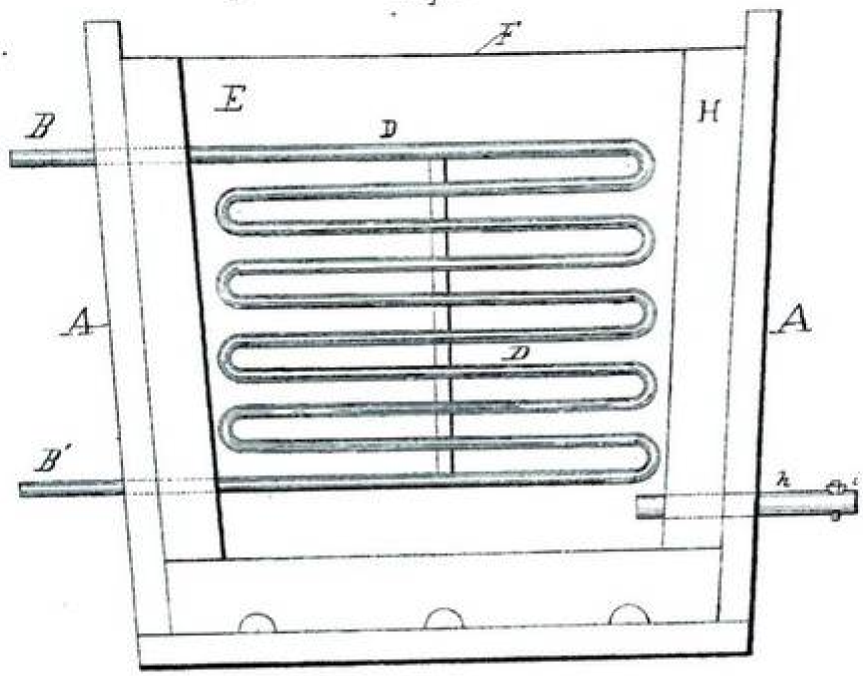
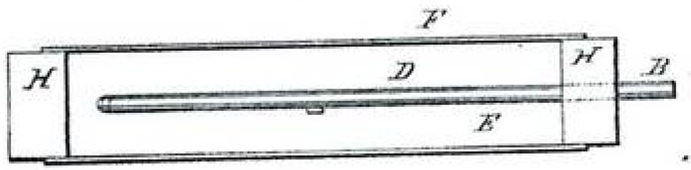


Fig. 2.



WITNESSES.
Chas. H. Fisher
Chas. C. Gill

INVENTOR.
David Boyle
by his Attys.
Cox & Cox

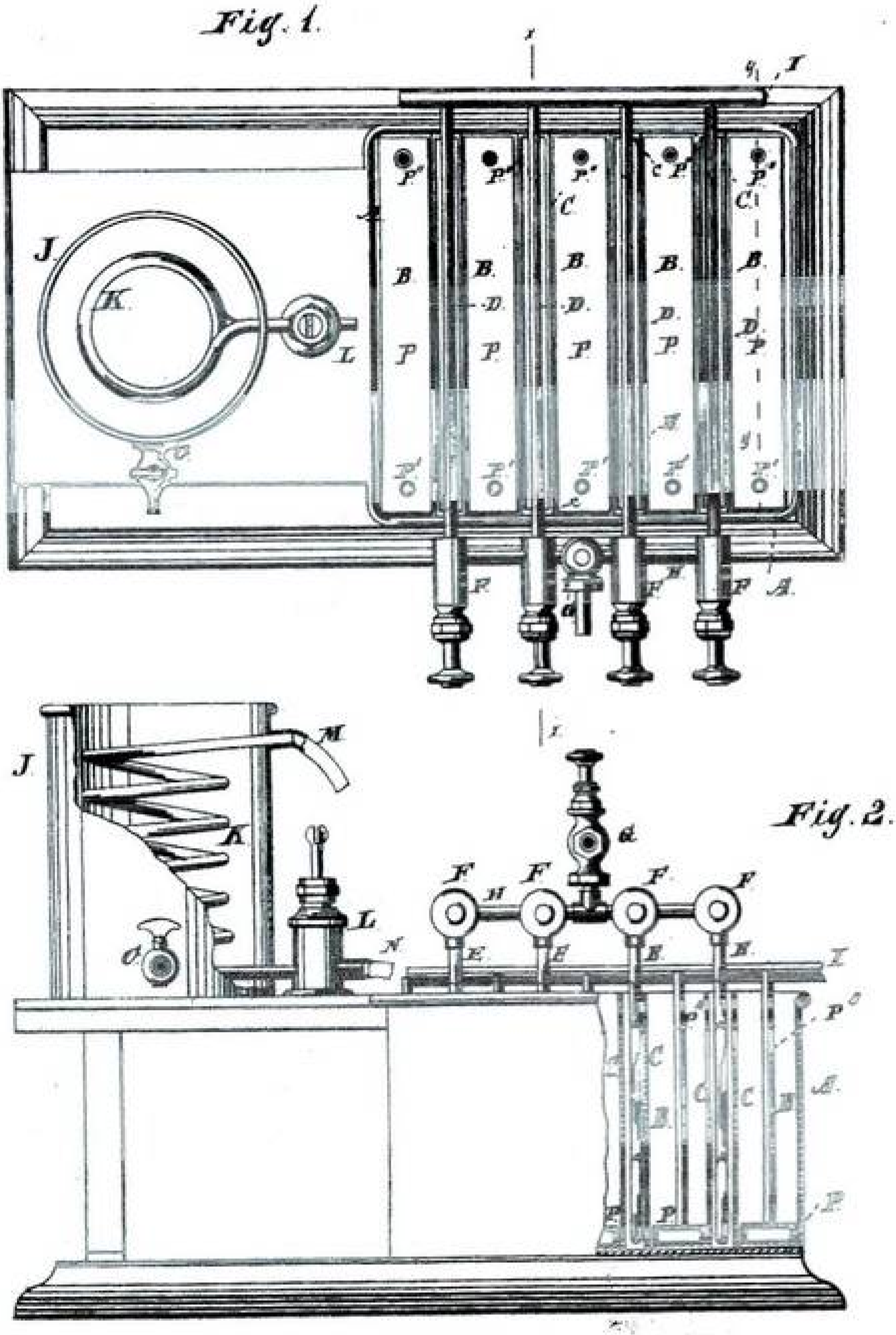
2 Sheets—Sheet 1.

D. BOYLE.

Ice and Refrigerating Machine.

No. 242,107. Patented May 31, 1881.

Fig. 1.



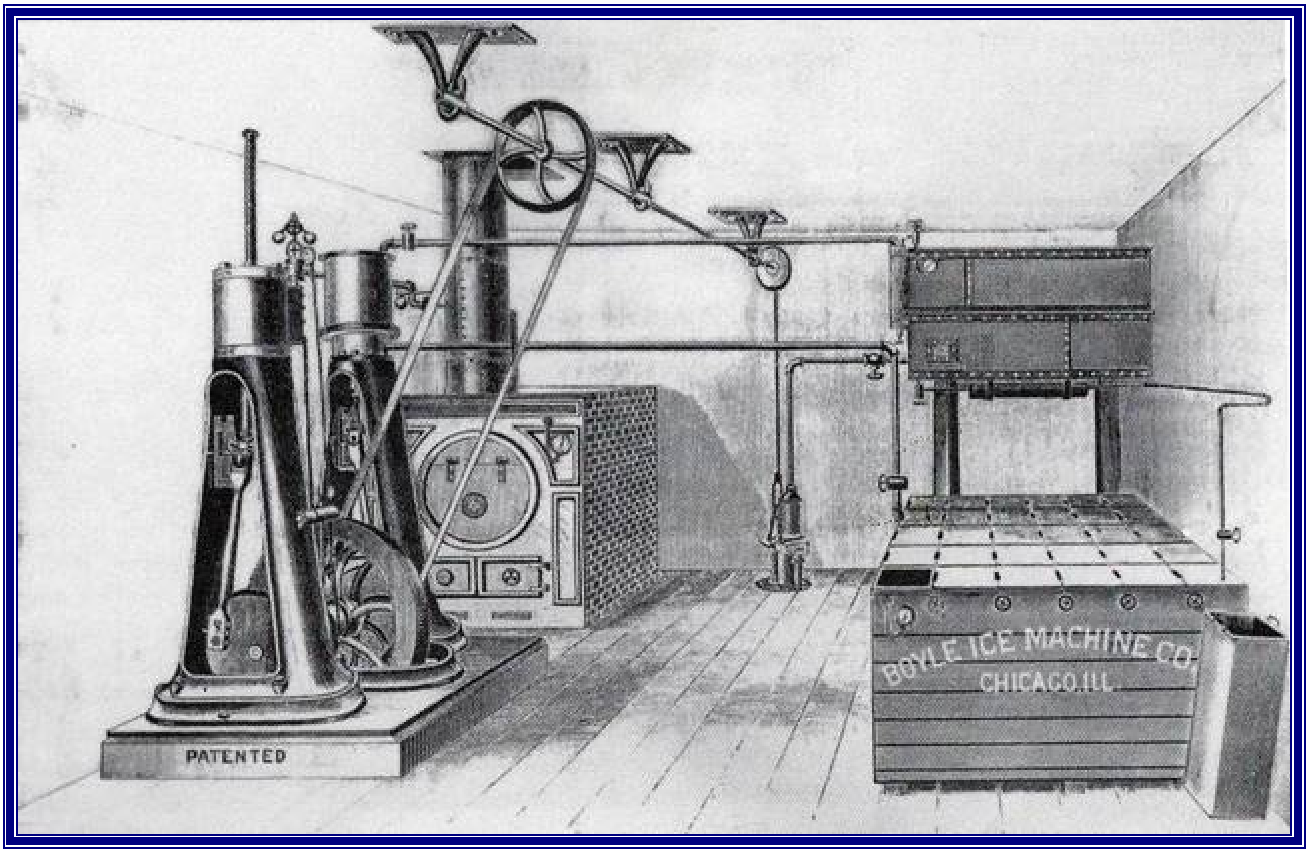
Witnesses:

H. F. Brunt.

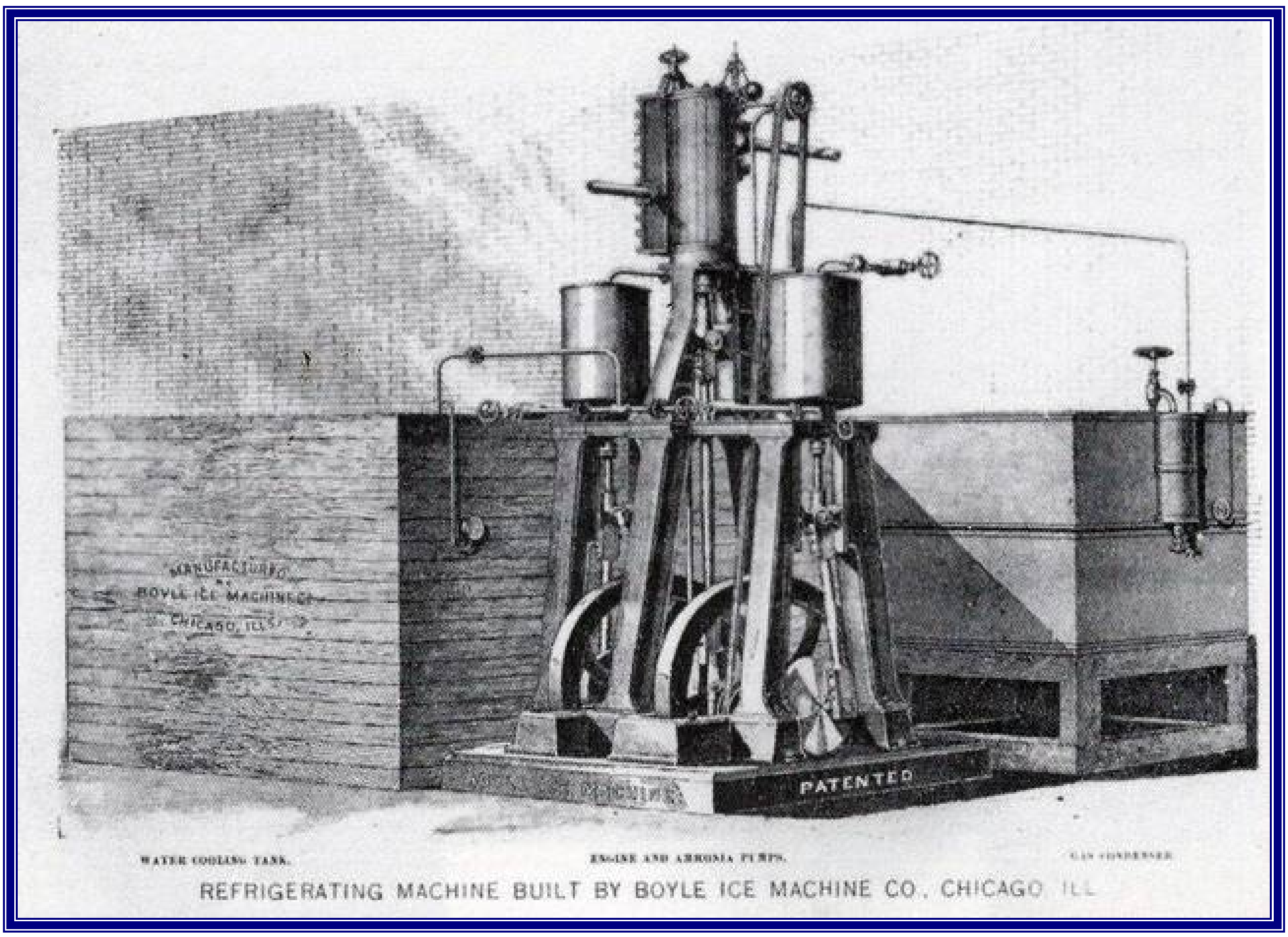
A. W. Bond.

Inventor:

David Boyle



Boyle ice-making plant of 1879, now using the *ice-can* system in favour of his earlier *plate-ice* plants



A Boyle machine for breweries, from a catalogue of about 1881

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