(No Model.)

W. L. CHURCH.

ICE MAKING APPARATUS.

No. 529,347. Patented Nov. 13, 1894.

FIG. 1.

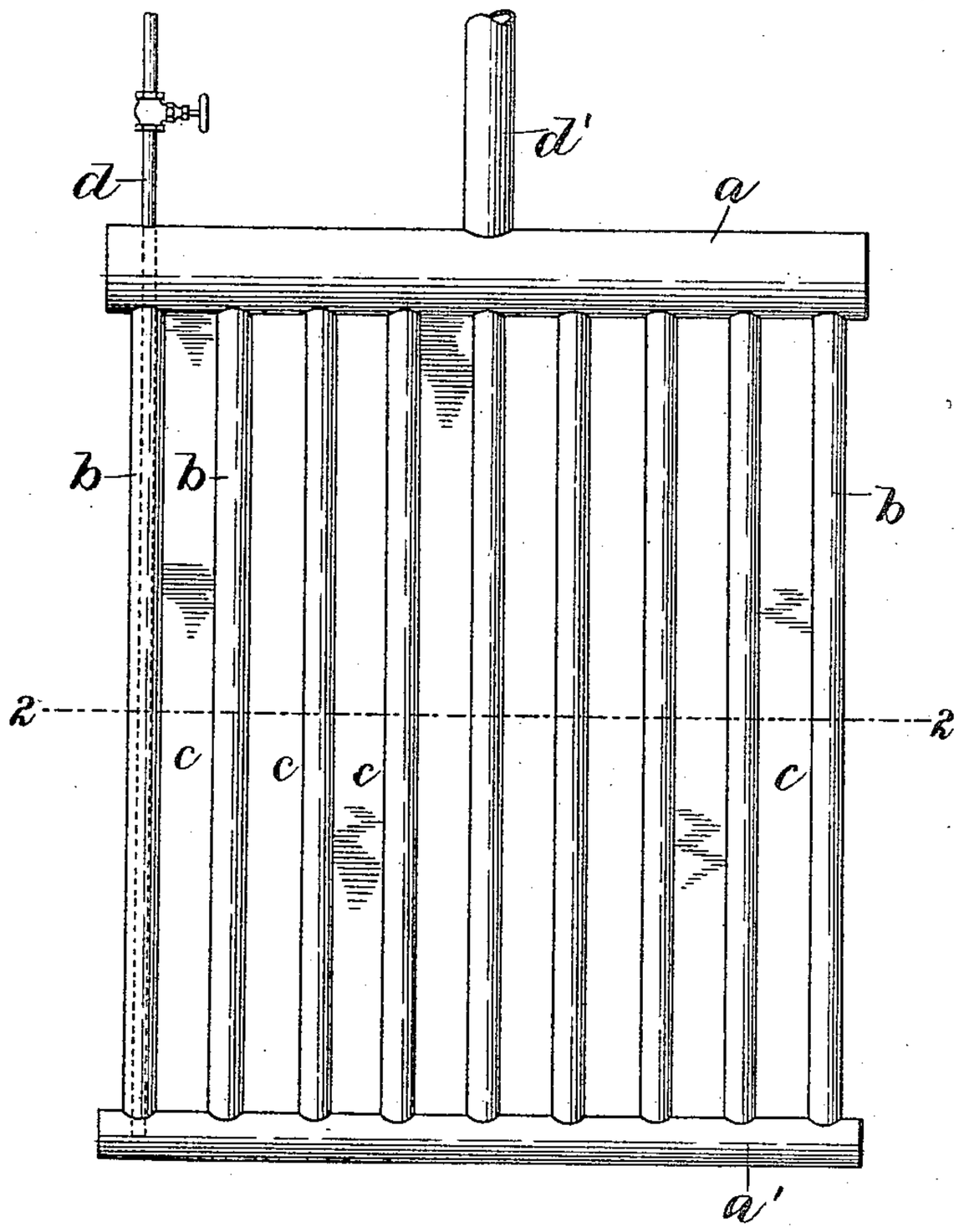


FIG. 2.

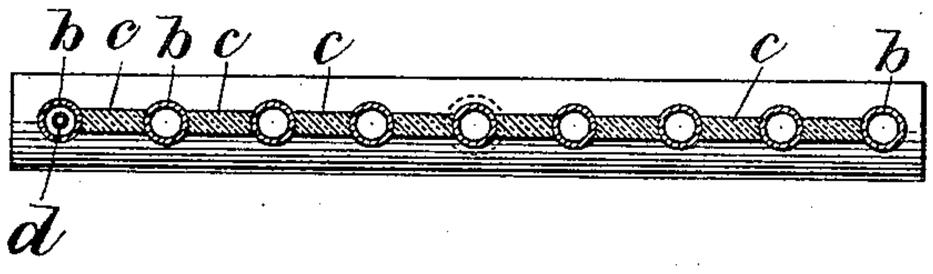


FIG. 3.

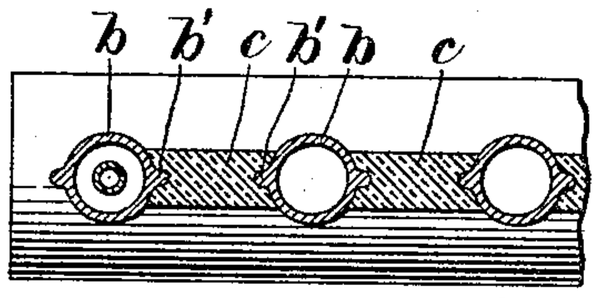
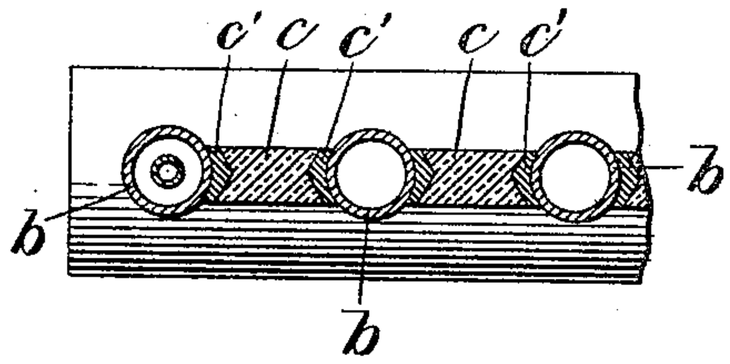


FIG. 4.



WITNESSES:

Arthur H. Abell.

Herbert A. Hall.

INVENTOR:

Wm. Lee Church

by Wright Brown Quinby & Otts.

Attys.

UNITED STATES PATENT OFFICE.

WILLIAM LEE CHURCH, OF NEWTON, MASSACHUSETTS, ASSIGNOR TO THE WESTINGHOUSE, CHURCH, KERR & COMPANY, OF JERSEY CITY, NEW JERSEY, AND NEW YORK, N. Y.

ICE-MAKING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 529,347, dated November 13, 1894.

Application filed January 30, 1894. Serial No. 498,430. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM LEE CHURCH, of Newton, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Ice-Making Apparatus, of which the following is a specification.

This invention relates to the support or structure on which ice is formed in the operation known as plate freezing, in which operation a vertical casing adapted to receive a refrigerant is immersed in the water to be frozen, and presents surfaces on which two cakes of ice may be formed simultaneously.

The invention has for its object mainly to provide a freezing plate of simple and strong construction, free from liability to leakage of brine or other agent contained in the plate, and presenting considerable areas of ice-shaping surface made of a material which is non-adhesive to ice, so that the cakes of ice may cleave from the plate with the minimum loss of time.

The invention consists mainly in a freezing plate comprising two headers constituting opposite ends of the plate, a series of tubes rigidly attached at their ends to said headers, and filling pieces between said tubes composed of a material or mixture of low conductivity, to which ice does not adhere, said filling pieces presenting ice limiting surfaces which are non-adhesive to ice, between the generating surfaces of the tubes.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a side elevation of a tubular freezing plate constructed in accordance with my invention. Fig. 2 represents a section on line 2—2 of Fig. 1. Figs. 3 and 4 represent sectional views similar to Fig. 2, showing certain variations in the construction.

The same letters of reference indicate the same parts in all the figures.

In carrying out my invention, I make a tubular freezing plate by assembling two tubular headers, *a a'*, and a series of tubes *b*, connecting said headers, the tubes being substantially parallel with each other and substantially at right angles with the headers. The ends of the tubes are rigidly secured to the headers so that the said tubes and headers constitute a rigid frame which is self-supporting, or in other words has sufficient stiffness and rigidity in all portions to prevent independent swaying or springing of any of the parts or members of the said frame. An inlet pipe *d* is provided for the admission of a volatile liquid such as anhydrous ammonia into the header *a*, and a pipe *d'* is provided for the removal of gas from the header *a*.

I prefer to arrange the headers *a a'* vertically, the header *a* constituting the top and the header *a'* the bottom end of the tubular freezing plate. Under this arrangement the lower header *a'* becomes a liquid-equalizing device receiving the liquid and holding it so that it acts uniformly through all the connecting tubes *b*, said liquid expanding into gas which rises in said tubes and accumulates in the gas receiving header *a*, from whence it is drawn through the pipe *d'* by a suitable compressor.

I prefer to arrange the liquid-pipe *d* in the manner shown in Fig. 1, the said pipe passing through the header *a* and extending downwardly through one of the tubes *b* into the header *a'*. By this arrangement the pipe *d* is kept out of contact with the water in the tank containing the freezing plate, there being no joint between the said pipe and the freezing plate which is exposed to contact with the water, so that there is no liability of undetected leakage of the liquid into the sweet water from the joint where the pipe *d* enters the freezing plate. Moreover, if the pipe *d* were exposed outside the plate ice would form on and lock around it, thus preventing the freezing of the plate from the cake. It will be seen that a freezing plate thus constructed is adapted to be made gas and liquid-tight at a comparatively small expense, and presents large areas of cooling surface to the water in which it is immersed. The structural strength of the plate is so great that no external clamps are required to hold the central portion of the tubes *b*. Hence the plate presents freezing sur-

faces which are not interrupted by projections, such as would be caused by external clamps.

c c represent filling pieces or blocks which are interposed between the tubes *b* as a means for limiting the inward extension of the ice between the tubes, thus preventing the locking of the ice around the tubes. Said filling pieces are interlocked at their edges with the tubes, so that they are not liable to drop out laterally. The interlocking may be effected in any suitable way, such as by forming the blocks with recesses at their edges, formed as shown in Fig. 2, to fit the natural curvature of the cross-section of the tubes *b*, or as shown in Fig. 2, to fit ribs *b'* on said tubes, or as shown in Fig. 4, with recesses to receive fillings *c'* which may be introduced in a melted condition into the spaces between the edges of the pieces *c* of the tubes, said fillings being hardened in place and making the construction continuous.

It will be seen that the strength afforded by the described construction of the tubular plate enables said plate to support the additional weight of the fillings without external fastening devices.

I prefer to make the filling pieces *c* of a material, composition, or mixture of low conductivity on which ice is frozen and to which ice does not adhere, a suitable material for this purpose being paraffine, which may be melted into blocks of the form shown. Since, however, paraffine alone would not possess sufficient strength to withstand long continued usage, I prefer to construct the filling pieces of a mixture of a fibrous material, such as felt, and paraffine, said ingredients being suitably commingled and molded by pressure into the desired shape, the pressure compressing the material and rendering it sufficiently dense and durable.

The filling pieces, while limiting the extension of the ice and giving shape to the portions of the ice that are formed between the exposed portions of the tubes *b*, do not adhere to the ice, so that the cakes formed upon the plate may be cleaved from the plate with the minimum expenditure of time, the only time necessary being that required to slightly warm the tubes *b* and thus enable the ice to cleave therefrom.

I am aware that it has been proposed to insert filling pieces between the parallel members of a coil composed of a series of loops all arranged in one plane; and the filling pieces have hitherto been of metal of equal conductivity with the pipes, so that the ice not only forms upon the filling pieces but adheres strongly to them, requiring to be liberated by heat. The filling pieces used by me are the precise converse, being of a non-conducting material, from which the ice cleaves naturally without the use of heat.

Any material other than paraffine, such as resin, asphalt, &c., having equivalent non-conducting properties, and non-adhesive to ice comes equally within the scope of my invention.

I claim—

1. A freezing plate comprising two headers constituting opposite ends of the plate, a series of tubes rigidly attached at their ends to said headers, and filling pieces between said tubes composed of a material or mixture of low conductivity, to which ice does not adhere, said filling pieces presenting ice limiting surfaces which are non-adhesive to ice, between the generating surfaces of the tubes.

2. A freezing plate comprising two headers constituting opposite ends of the plate, a series of tubes rigidly attached at their ends to said headers, and filling pieces between said tubes composed of a fibrous material treated with a non-conducting substance which is non-adhesive to ice, such as paraffine, compressed and molded into blocks.

3. A freezing plate comprising a substantially horizontal liquid equalizing header constituting the lower end of the plate, a substantially horizontal gas receiving header constituting the upper end of the plate, a series of substantially vertical tubes attached at their ends to said headers, a liquid supply pipe entering the gas receiving header at the upper edge of the plate, and passing through one of said tubes to the equalizing header at the lower portion of the plate, and a gas outlet pipe communicating with the gas receiving header.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 20th day of January, A. D. 1894.

WM. LEE CHURCH.

Witnesses:
W. W. CHURCHILL,
W. M. WHEILDON.