(No Model.) 2 Sheets—Sheet 1.

A. ALSOP & W. BLACKALL.

APPARATUS FOR COOLING AND DRYING AIR.

No. 520,130. Patented May 22, 1894.

FIG. 1

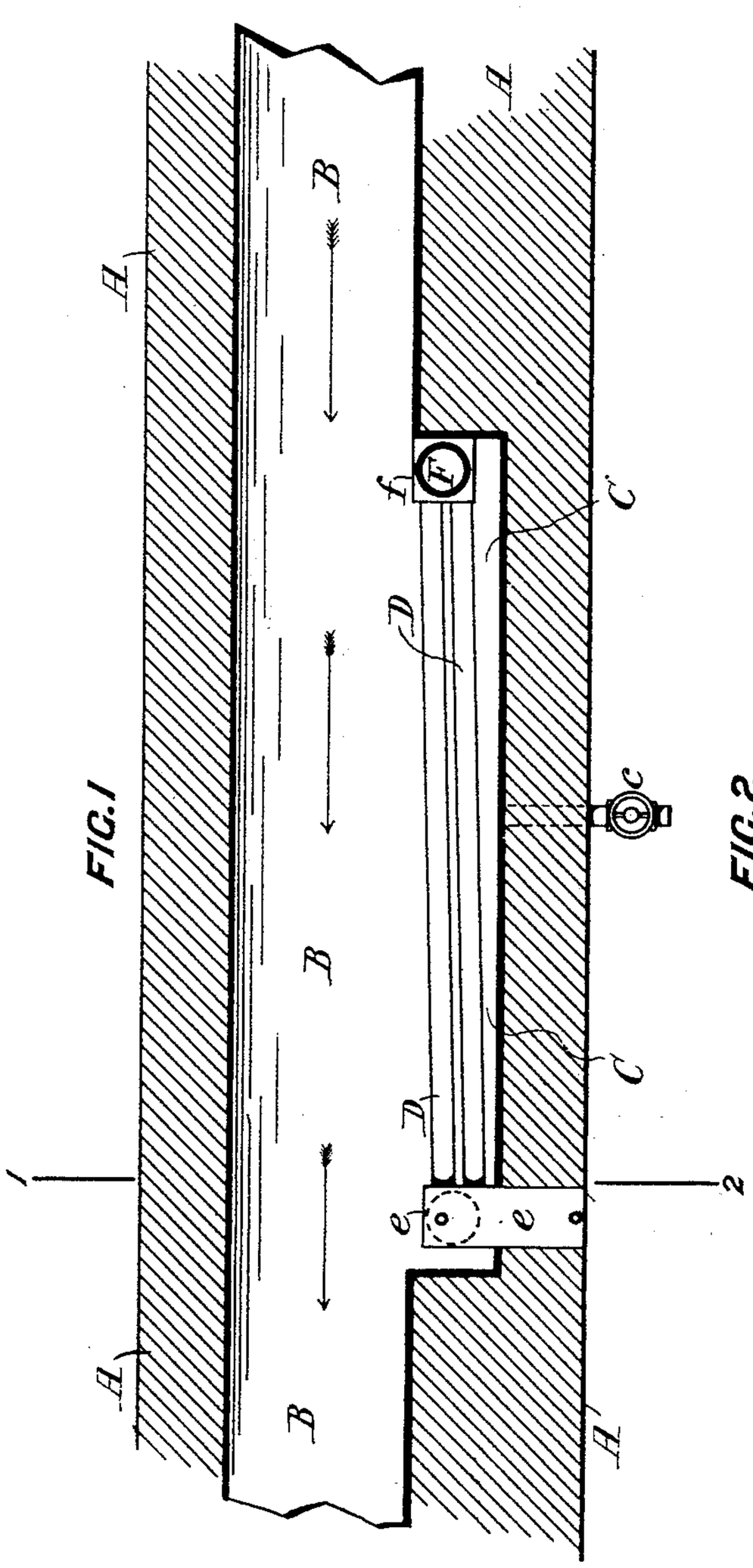
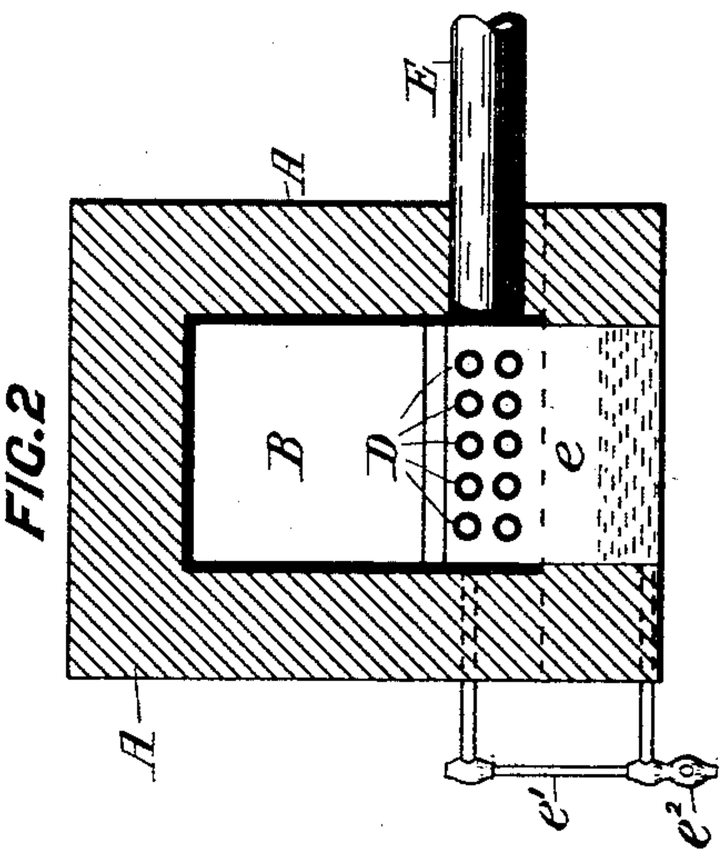


FIG. 2



Witnesses:

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Wilson D. Bentley Jr.

Inventors:

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By

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(No Model.) 2 Sheets—Sheet 2.

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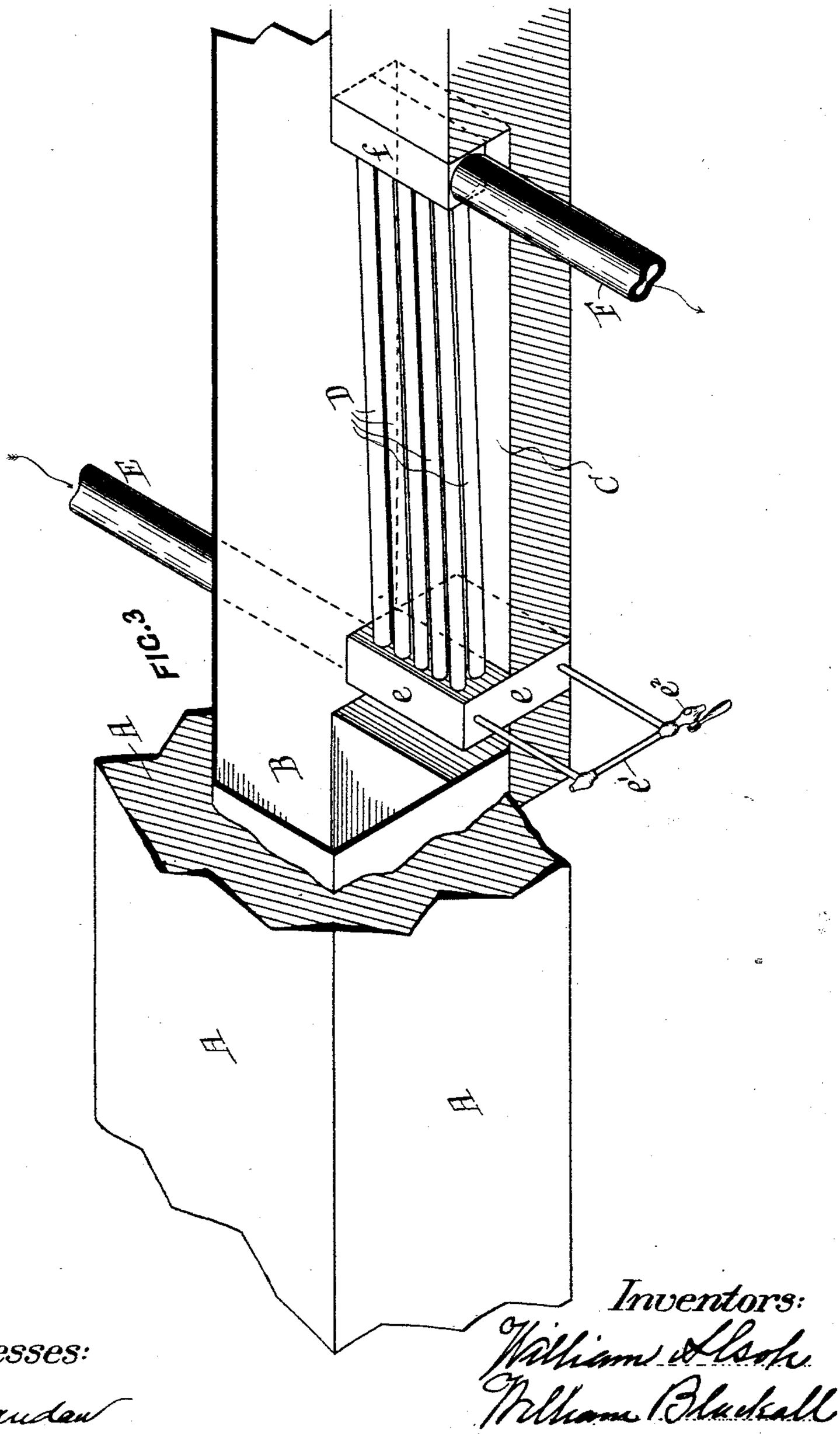

FIG. 3

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UNITED STATES PATENT OFFICE.

WILLIAM ALSOP AND WILLIAM BLACKALL, OF NEWCASTLE, NEW SOUTH WALES.

APPARATUS FOR COOLING AND DRYING AIR.

SPECIFICATION forming part of Letters Patent No. 520,130, dated May 22, 1894.

Application filed June 23, 1892. Serial No. 437,707. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM ALSOP, engineer, and WILLIAM BLACKALL, chemist, subjects of the Queen of Great Britain and Ireland, and residents of Newcastle, in the Colony of New South Wales, have invented certain improvements in the mode of more effectually cooling and drying the compressed air in refrigerating apparatus and in the means or apparatus whereby the same may be effected, of which the following is a specification.

This invention is specially applicable to that class of refrigerating machines, in which a suitable gas, such as atmospheric air, is first compressed, thus causing a development of heat, the heat is then abstracted from the compressed gas, which is then allowed to expand, with a consequent lowering of temperature.

A great source of trouble in this class of machine or apparatus is the snow that is formed, owing to the humidity that is ever present in the air that is first compressed and then expanded. This invention is for the express purpose of abstracting from the air before it is expanded, the heat and moisture that is present with it in a greater measure than the ordinary coolers are capable of doing. This will have the effect of lowering the temperature of the air before it is expanded, and a greater degree of cold will be the result.

In carrying our invention into effect, we cause the compressed air, after it has been cooled in the ordinary coolers, to pass through a pipe or pipes, a passage or passages, so placed that the expanded air from the expansion cylinder, as it passes to the refrigerating chamber shall act, play or impinge upon the exposed surfaces of such pipes, tubes or passages. These pipes, tubes or passages are fixed in such a position that any snow or ice that is formed in the expanded air, shall be deposited upon or around them. This deposit of snow or ice will absorb a large proportion of the heat that is contained in the compressed air that is within the tubes or passages, and will thereby be melted into water, which will be drained off in any suitable manner. The compressed air as it passes through the aforesaid tubes or passages, will part with so much of its heat in the liquefaction of the snow or ice that is deposited on or around the tubes or passages (as before mentioned) that it will be considerably reduced in temperature (generally below 40° Fahrenheit) and will insure a great condensation of the moisture that is present with the compressed air in the tubes or passages. The compressed air tubes or passages, are provided with a suitable drain pipe or trap for drawing off the condensed moisture.

As a means of effecting the desired object, one example or specimen of suitable apparatus is shown in the accompanying drawings, in which—

Figure 1 is a longitudinal vertical section of the expanded air passage, leading from the expansion cylinder to the refrigerating chamber, and showing the compressed air tubes or passages in elevation. Fig. 2 is a cross section of the same, taken on the line 1—2 of Fig. 1. Fig. 3 is an isometrical view of Fig. 1, on a slightly larger scale, and with the side partly broken away to show the disposition and arrangement of the several parts.

The part of the expanded air passage, that is shown in the drawings, and containing the compressed air passages, practically takes the place of the ordinary snow box.

A, is the non-conducting or packing material, that surrounds the expanded air passage B. A recess or well C is preferably formed in the floor of the expanded air passage B, to receive the compressed air pipes or tubes D.

E, is the compressed air pipe leading from the compressor through the ordinary cooler, and debouching into a small chamber *e*, one side of which forms a tube plate for the reception of the ends of the pipes D, the other ends of which terminate in a tube plate that forms one of the sides of a second small chamber *f*, from which a pipe F leads to the expanding cylinder. The chamber *e*, is placed at a lower elevation than the chamber *f*, and the tubes D are inclined upward from the chamber *e*, to the chamber *f*. This is for the purpose of allowing the water of condensation, within the pipes D, to drain into the chamber *e*, which is made deeper than *f*, to allow room for its reception. The chamber *e*, is preferably fitted with a water gage glass *e'*,

and drain cock e^2. The well or recess C, is also provided with a drain cock *c*, whereby any water that may be in the well, may be drawn off. The compressed air after it leaves the ordinary cooler will pass through the pipe E, into the chamber *e*, through the tubes D, into the chamber *f*, and from thence, through the pipe F, to the expansion cylinder. After leaving the expansion cylinder, the cold expanded air will pass along the passage B, in the direction of the arrows and the snow will be deposited in the well or recess C, on or around the tubes D. The compressed air as it passes through the tubes D will give up a large percentage of its heat, which heat will be absorbed or utilized in melting the snow around the tubes, thereby causing a great lowering of the temperature of the compressed air within the tubes and a consequent condensation of much of the moisture that is present with the compressed air; the result being that the compressed air will be delivered to the expansion cylinder, in a comparatively dry and cool condition. By thus utilizing the chilling effect of the produced snow, a greatly increased degree of cold in the expanded air is obtained, owing to the low temperature and dryness of the air before expansion. After the machine or apparatus has been at work for some time, and the several parts have become thoroughly cooled down to their work, it will be found that very little snow will be produced.

It is preferable to employ a number of small tubes D rather than one large pipe or passage but the aggregate sectional area of the small tubes should be about equal to the sectional area of the pipe E.

It is obvious that our improved mode of cooling and drying the compressed air in refrigerating apparatus by means of the cold expanded air assisted by any ice or snow that may be present with it, acting upon the compressed air passage, may be carried into effect by numerous modifications of the apparatus shown in the drawings.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is—

1. In a refrigerating apparatus, the compressed air pipe leading from the compressor, a tube plate chamber to which said pipe is connected, a pipe or pipes running from said tube plate chamber to another tube plate chamber, one of said chambers being provided with a waste pipe or drain cock and a pipe connected to this latter tube plate chamber and conveying the air to the expansion cylinder, and an expanded air passage, substantially as described.

2. In a refrigerating apparatus, the combination with the expanded air passage formed with a well or recess therein a compressed air pipe or pipes located in said well and connected at each end with suitable tube plate chambers, said chambers being situated in different planes and one of them being provided with a waste pipe or drain cock, a compressed air pipe leading from the compressor to one of said chambers and another pipe leading from the other of said chambers to the expansion cylinder, substantially as described.

3. The combination of the expanded air passage B, formed with a well or recess therein, the tube plate chamber *e* located in one end of said well and the tube plate chamber *f* located in the other end of said well, one of said chambers being smaller than the other and in a lower plane, the compressed air pipe or pipes D running from one of said chambers to the other, together with the pipe E leading from the compressor to the lower tube plate chamber *e* and the pipe F leading from the upper tube plate chamber *f* to the expansion cylinder, substantially as described.

4. The combination of the expanded air passage B, the well C provided therein, the tube plate chamber *e* located in one end of said well and provided with a waste pipe or drain cock e^2 and gage *e'*, the pipe E connected to said chamber *e*, the tube plate chamber *f* located in the other end of said well, the pipe F connected to said chamber, compressed air pipe or pipes D communicating with both chambers *e* and *f* and the drain cock *c*, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

WILLIAM ALSOP.
WILLIAM BLACKALL.

Witnesses:
H. A. HAWKINS,
RICHARD BLACKALL.