

(No Model.)

2 Sheets—Sheet 1.

R. PORTNER & B. E. J. EILS.

Process of and Apparatus for Cooling Air.

No. 229,750.

Patented July 6, 1880.

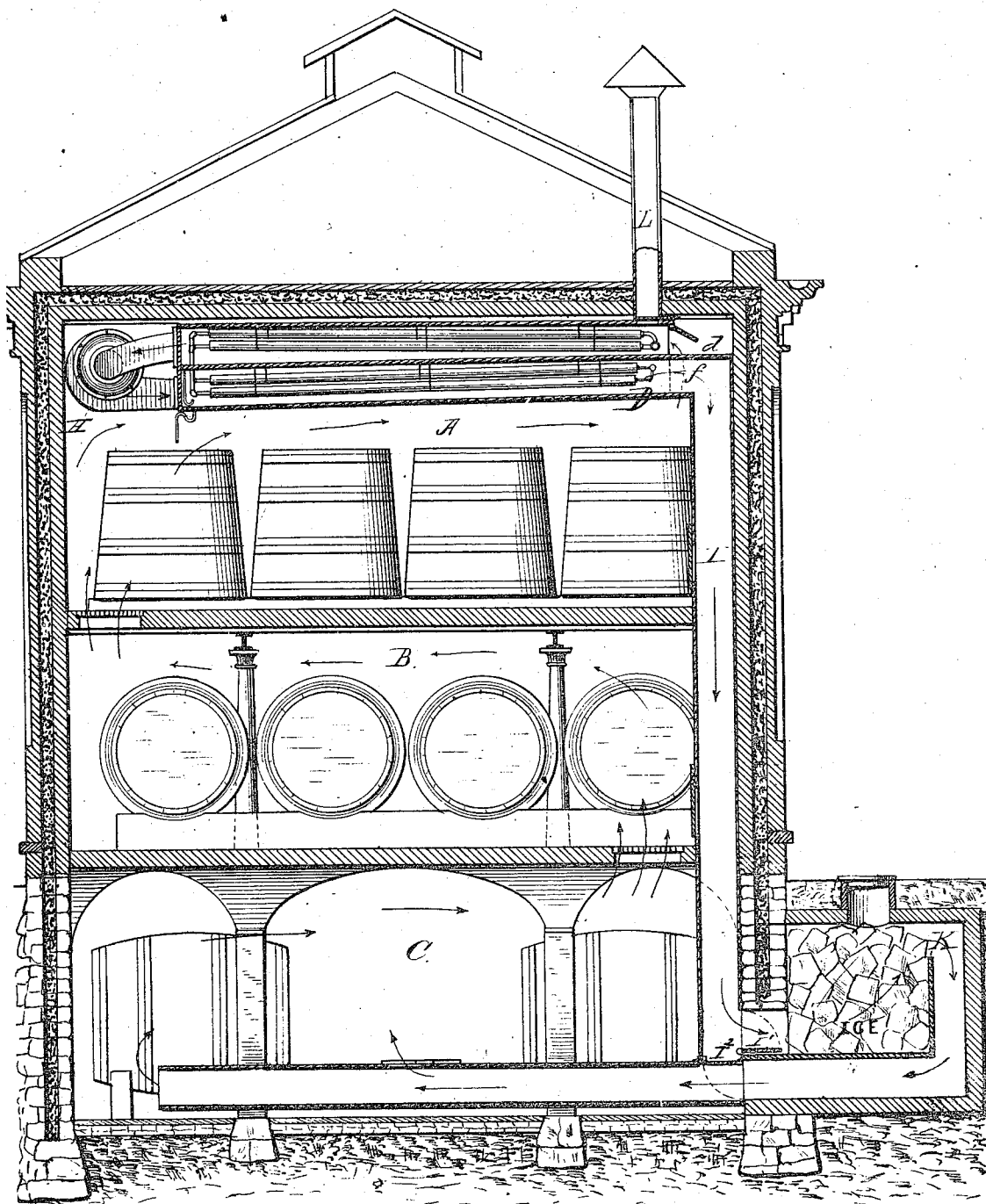


Fig. 1.

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(No Model.)

2 Sheets—Sheet 2.

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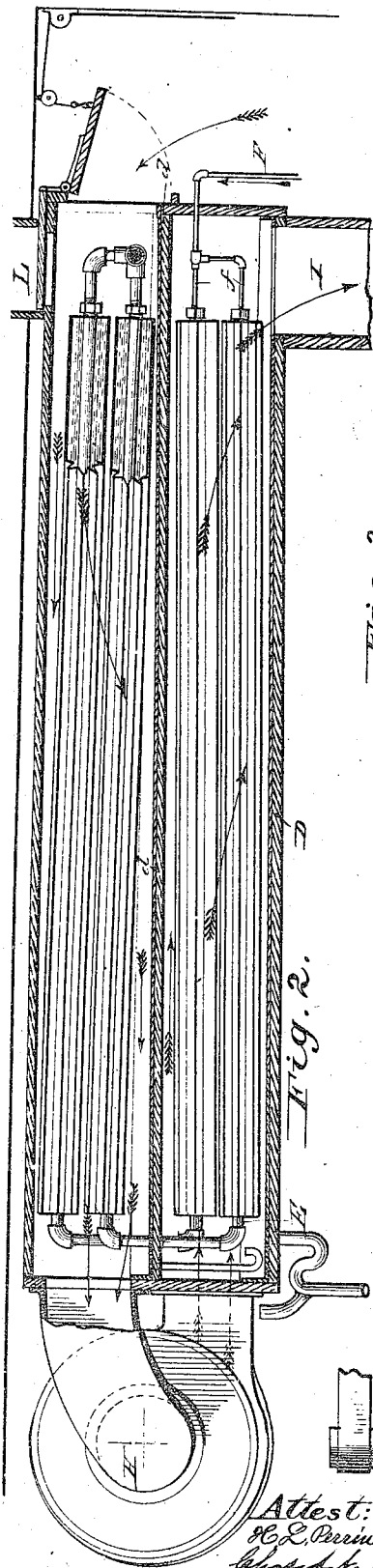


Fig. 2.

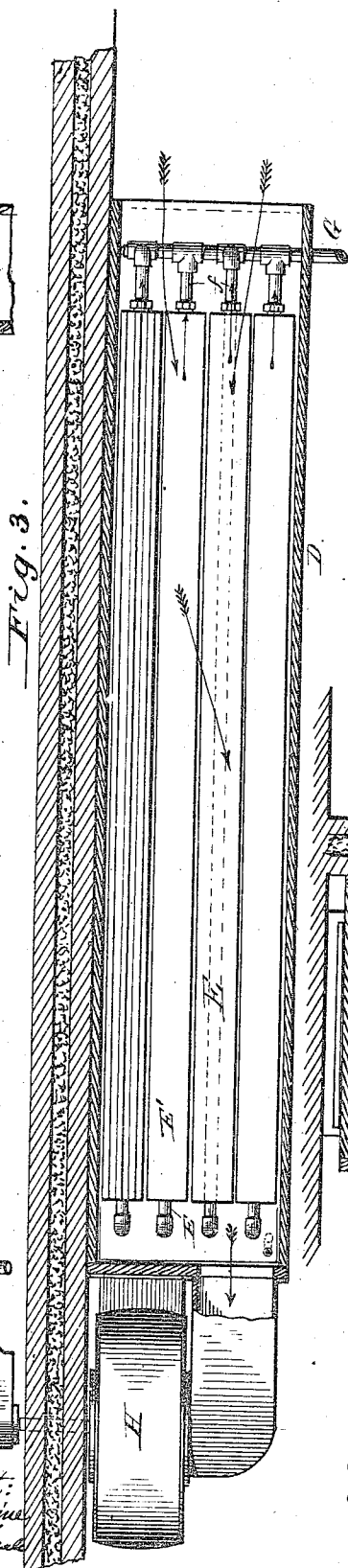


Fig. 3.

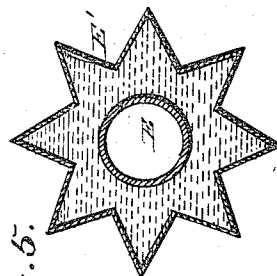
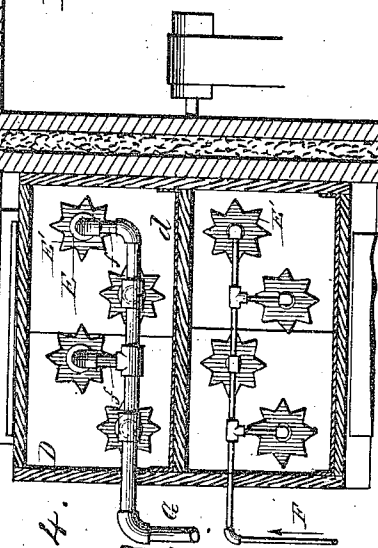


Fig. 5.



Fria. 4.

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UNITED STATES PATENT OFFICE.

ROBERT PORTNER, OF ALEXANDRIA, VIRGINIA, AND E. EDWARD J. EILS,
OF WASHINGTON, DISTRICT OF COLUMBIA.

PROCESS OF AND APPARATUS FOR COOLING AIR.

SPECIFICATION forming part of Letters Patent No. 229,750, dated July 8, 1880.

Application filed April 8, 1880. (No model.)

To all whom it may concern:

Be it known that we, ROBERT PORTNER and E. E. J. EILS, citizens of the United States, residing, respectively, at Alexandria, in the county of Alexandria and State of Virginia, and Washington, District of Columbia, have invented certain new and useful Improvements in the Method of Cooling Air and Apparatus therefor; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

The object of this invention is to cool and purify air in buildings by blowing it over metallic refrigerating pipes or tubes and operating in such a way as to condense into water the main portion of the moisture with which the air may be laden, and thus to avoid the injurious accumulation of snow on such refrigerating pipes or tubes, notwithstanding the fact that they are kept, partly at least, at a temperature below the freezing-point by the refrigerant circulating through them.

Another object of our invention is its special application to breweries in such a way as to draw the air from above the tops of the fermenting-tubs in the fermenting-room of such brewery in order to intercept and carry off the carbonic acid and other gases of fermentation for immediate absorption by the water of condensation forming on the refrigerating pipes or tubes, so that the air in the fermenting-room may be kept comparatively pure, which is a matter of prime importance to the attainment of a good fermentation and the production of pure fine beer.

Another object of the invention is to provide for a continuance of refrigeration of the air at times when the artificial refrigerating apparatus may be temporarily inactive for that purpose in consequence of needed repairs or its diversion for other purposes.

Another object of the invention is to provide for drawing air in cold weather from the exterior of the building and forcing it through

the air-passages of the refrigerating apparatus into the building to displace the foul air therein.

To these ends our invention consists of certain devices and combinations set forth in the claims at the close of this specification; also, a new mode of cooling and purifying air stated in the claims, and being made up out of mechanical devices, of which the following are the principal: a cluster of independent refrigerating pipes or tubes arranged to form an extended line, the refrigerant being supplied to them at one end of the line and exhausted from them at the other end; tight metallic jackets, preferably corrugated or star-shaped in cross-section, to obtain a larger surface in a small compass, encircling said refrigerating pipes and filled with a non-congealable liquid; a box for inclosing this extended line of jacketed refrigerating pipes or tubes and conveying the air to be cooled, the relative proportions and arrangements of the box and refrigerating pipes being such that the travel of the air along said pipes shall be substantially coextensive with the travel of the refrigerant, but in a reverse direction; a fan or blower for drawing the air from the proper point or points in the building or room to be cooled, passing it through the aforesaid box in the direction stated, and discharging it finally at a point or points remote from where the air is drawn in by said fan; an ice-box adapted to receive a few tons of ice and connected with the air-flues of the artificial refrigerating apparatus, so that the air therefrom may be passed through said box and cooled by the ice therein, if required; an air-trunk connected with the fan or blower and opening into the atmosphere on the exterior of the building, through which air-trunk fresh air may be drawn into the building in cold weather.

Some specific arrangements of parts recited are also necessary to the embodiment of some features of the invention claimed in some of the claims.

In order that our invention may be clearly understood, we have illustrated in the annexed drawings, and will proceed to describe, a form thereof which, barring a few details, we have

put in practical operation in a brewery, with the understanding that the details of construction and arrangement of parts may be varied to suit different circumstances and different users.

Figure 1 is a cross-section of a three-story building of a brewery with our air cooling and purifying method and apparatus applied thereto. Fig. 2 is a longitudinal sectional elevation of our improved air-cooler. Fig. 3 is a horizontal section of the same. Fig. 4 is a cross-sectional elevation of the same. Fig. 5 is a cross-section of one of the jacketed refrigerating pipes or tubes. Figs. 2, 3, 4, and 5 are drawn on a larger scale than Fig. 1.

The same letters of reference are used in all the figures in the designation of identical parts.

The upper room, A, of the building illustrated represents a fermenting-room of a brewery, while the lower rooms, B C, respectively represent store-rooms. This is a very common arrangement of a tier of rooms in breweries.

The box D, containing the refrigerating-pipes, is arranged on the wall at one end of the fermenting-room A, and close up against the ceiling thereof, in order to have it occupy a space not otherwise utilized, as well as to put it in a position where it can take in the air to be cooled from above the tops of the fermenting-tubs.

To attain the first object of our invention it is essential to use refrigerating-pipes of very considerable length and so arranged that the travel of the air along them is substantially coextensive with the travel of the refrigerant through them; and we prefer to use straight pipes. In order to obtain and conveniently locate such a long line of refrigerating-pipes, we use in the brewery-building to which we applied our invention, and which is about forty feet wide, a box, D, divided into two chambers by the partition *d* and one return refrigerating-pipes, one length of each pipe being in the upper chamber of the box and the other length thereof in the lower chamber of the box, as clearly shown in the drawings, thus securing an air-travel along the refrigerating-pipes of about seventy-five feet and about a similar travel for the refrigerant.

As a refrigerant, we prefer to use anhydrous ammonia liquefied previous to entering the refrigerating-pipes by the combined effects of mechanical compression and condensation. The ammonia is admitted to one end of the refrigerating-pipes E through branches *f* from the induction-pipe F, and after expanding into gas in its travel through said pipes E is withdrawn from the other end thereof by the exhaust-pipe G and returned to the proper machinery (not shown) for reliquefaction.

A fan-blower, H, is used to draw the air into the upper chamber of box D at the exhaust end of the refrigerating-pipes, and to blow it through the lower chamber of said box

so as to force it therefrom at the induction end of the refrigerating-pipes. At that point the cooled and purified air enters a trunk, I, which, according to the drawings, passes down into the lower room, O, to discharge the air. Openings are formed in the floors to insure a circulation of the air from the lower room through the room above it and back again into the fermenting-room, the manner of circulation being indicated by arrows.

In the afore-mentioned practical application of the invention we passed moderately strong currents of air through the box along the refrigerating-pipes and cooled the passing air constantly to from 8° to 10° Fahrenheit. The greater portion of the moisture in the air was condensed off in the form of water by the refrigerating-pipes, which therefore remained comparatively clear of frost, and what little moisture did freeze on them assumed the condition of ice rather than snow, so as not to materially interfere with the refrigerating action of the pipes on the air. While these effects may be produced by immediate contact of the air with the necessarily rather small ammonia-pipes, provided the ammonia and air are made to travel a sufficient length, we found it impracticable to attain such results by immediate contact in the travel given above. Hence we jacketed the ammonia-pipes by closed sheet-iron jackets E', filled with a suitable non-congealable liquid, and in order to obtain greater surface made these jackets corrugated or star-shaped. The desirable effects stated were the immediate results of such jacketing, which we therefore consider an important feature. The refrigerating-pipes decline in the direction of the travel of the refrigerant, so that the water of condensation may run along them toward the less cold portions of the pipes until it drips off.

The bottom and partition of the box D have also a slight inclination, so as to drain the water of condensation dripping from the pipes to one end, where it may be trapped out, as indicated. The box D may be made of wood and constructed with a series of large doors to provide for ready access to the refrigerating-pipes, and windows may be put at various points, through which the condition of the refrigerating-pipes may be observed. The pipes should be suitably supported by hangers or otherwise.

In order that the refrigeration of the air may continue without interruption at times when the artificial refrigerating apparatus requires repairing, or may be temporarily diverted for other use, we provide a chamber, K, at any point reasonably convenient for connection with the air-trunk I, and adapted to receive a few tons of ice at a time. Gates I' and I'' control the course of the air-currents, so that they may shun said chamber or be compelled to pass through it. When the artificial refrigerating apparatus is not operating on the air this chamber is filled with ice and the air circulated through it by the

fan H. This ice-chamber may also be used as an auxiliary of the artificial refrigerating apparatus in the summer months by passing the air from said apparatus also through this chamber filled with ice. If the air come down from box D at a temperature at or below the freezing-point, it will not, of course, melt the ice in the chamber. The provision of this ice-chamber renders the use of an artificial refrigerating apparatus perfectly safe in breweries, packing-houses, &c., without a reserve of a large amount of ice, stored at great expense, for in case of a temporary breakdown of the artificial refrigerating-machine the ice-chamber can be filled with a few tons of ice (easily obtained at a moment's notice almost anywhere in this country) and the cooling of the air continued by the ice until the machine is put again in operation. Furthermore, being adapted to operate as an aid to the refrigerating-machine in the summer months, it will be possible to get along with less powerful refrigerating-machines where they are combined with such an ice-chamber.

The air-shaft L opens into the atmosphere, and is connected with the fan H through the box D in this instance. It is provided in order that in cold weather fresh air may be drawn from the exterior of the building and blown into it to displace the contaminated air in it, which may be let out through the doors and windows. During the warmer seasons this air-shaft must be tightly closed and made non-conducting where it joins the box D.

By drawing the air from above the tops of the fermenting-tubs in a fermenting-room of a brewery, we draw off continually the carbonic-acid and other gases and fungi of fermentation always hovering above the fermenting wort in the tubs, retarding and debasing the fermentation. These impurities so drawn off are absorbed, if not all, in greater part at least, by the water of condensation formed on the refrigerating-pipes, for, in practice, we find that the air in the building cooled by our apparatus is kept remarkably pure. In consequence a better fermentation resulted, and the quality of the beer was correspondingly improved.

It will be understood by those familiar with the subject of artificial refrigeration that the refrigerating-pipes are coldest at the end where the refrigerant is first introduced, and that their temperature gradually increases toward the end where the refrigerant is exhausted. We took advantage of this fact and forced the air along the pipes in a direction opposite to the flow of the refrigerant to attain the first object of our invention, making the travel of the air and refrigerant sufficiently extended so that the greater portion of the moisture in the air might be condensed as water on the warmer ends of the refrigerating-pipes.

Instead of jacketed refrigerating-pipes operating as described, the air may be cooled by refrigerating-pipes through which a continu-

ous flow of a non-congealable liquid is maintained by a pump from a reservoir wherein said non-congealable liquid is cooled by direct contact with a coil or coils of ammonia or other refrigerating-pipes, the non-congealable liquid being caused to flow through the pipes in a direction opposite to the travel of the air, as before; but we prefer the construction first described, for it is both simple and effective in operation.

In some cases we propose to pass the air along the refrigerating-pipes in a spiral or zig-zag direction, so that the travel of the air would considerably exceed the travel of the refrigerant. Such modification we consider as a variation of our invention and as covered by our claims.

We are aware that it is common to cool liquids by passing them along cooling or refrigerating pipes in a direction opposite to the flow of the refrigerant, the travel of the liquid to be cooled being substantially co-extensive with the travel of the refrigerant; but the cooling of liquids does not involve injurious accumulation of frost on the refrigerating-pipes, which is, on the other hand, a very serious difficulty met with in the cooling of air by refrigerating-pipes. Hence our described method of cooling air is not analogous to the cooling of liquids in the same way, because by preventing injurious accumulation of frost on the refrigerating-pipes it produces a new result, and one of great importance to a continuous effective cooling of air.

We are also aware that it is common to cool air by blowing it through an ice chamber or box; but so far as we know we are the first to combine refrigerating-pipes for the artificial cooling of air with an ice-box for also cooling the air by the natural cold of the ice therein.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. In cooling currents of air by refrigerating pipes or tubes, the method of preventing injurious accumulation of frost on the said pipes, which method consists of forcing the air through a suitable box along the refrigerating-pipes in a direction opposite to the flow of the refrigerant through said pipes, the travel of the air being substantially co-extensive with the travel of the refrigerant, substantially as before set forth.

2. The combination, substantially as before set forth, of the air-box, the refrigerating-pipes therein, extending singly from the outlet to the inlet of the box, and being thus substantially of equal length therewith, and the fan or blower forcing the air along the said pipes in a direction opposite to the flow of the refrigerant.

3. The combination, substantially as before set forth, of the air-box, the jacketed refrigerating-pipes therein, and the fan or blower.

4. The combination, substantially as before set forth, of the air-box placed under the ceiling of a fermenting-room, the jacketed refrig-

erating-pipes in said air-box, and the fan or blower drawing the air from above the tops of the fermenting-tubs.

5 5. The combination, substantially as before set forth, of the fan or blower, the refrigerating-pipes of the artificial refrigerating apparatus, the air-flue, and the ice-chamber.

In testimony whereof we affix our signatures in presence of two witnesses.

ROBERT PORTNER.

B. E. J. EILS.

Witnesses:

CHAS. A. NEALE,

EMIL SCHANDER.