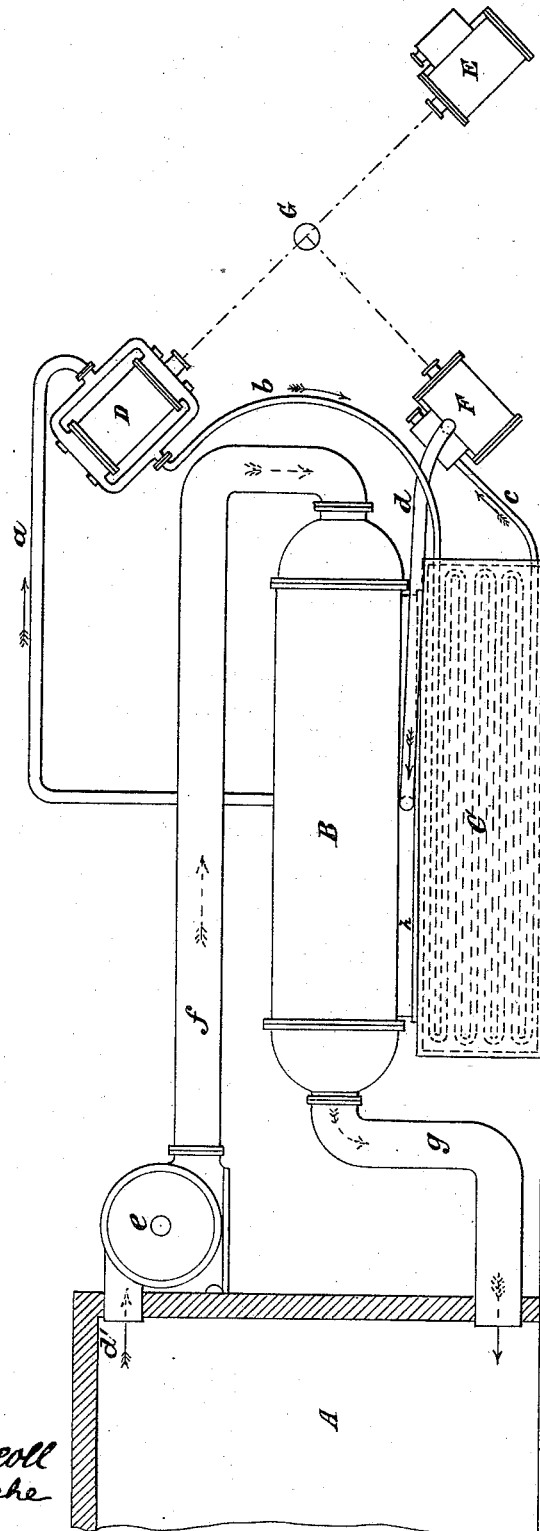


(No Model.)

C. C. PALMER.
REFRIGERATOR.

No. 344,006.

Patented June 22, 1886.



Witnesses
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UNITED STATES PATENT OFFICE.

CASSIUS CLAY PALMER, OF NEW YORK, N. Y.

REFRIGERATOR.

SPECIFICATION forming part of Letters Patent No. 344,006, dated June 22, 1886.

Application filed March 9, 1885. Serial No. 158,253. (No model.)

To all whom it may concern:

Be it known that I, CASSIUS CLAY PALMER, of the city, county, and State of New York, have invented a new and useful Improvement in Refrigerators, of which the following is a specification.

My present invention relates to improvements on the system of refrigeration which is set forth in United States Letters Patent No. 290,794 and No. 290,795, granted to me December 25, 1883, whereby I employ a body of air in lieu of the chloride of ethyl, which is made use of in the system of refrigeration described in said patents.

Chloride of ethyl is objectionable in certain locations—as, for instance, aboard ship—where precautions against fire are supposed to be inconsistent with the use of a fluid of that character. Chloride of ethyl, being a volatile fluid, requires in use more expensive apparatus by reason of the accuracy with which all the parts have to be made and fitted together to prevent its escape, which also would be the case with any other volatile fluid.

In carrying out my present invention the air of the chill-room is caused to flow, preferably by forced circulation, out of the chill-room through a pipe or conduit and in contact with refrigerating-surfaces and back again into the chill-room. The second or refrigerating body of air is compressed and cooled and expanded in a cylinder so arranged that the expansion of a portion of the air assists in the compression of another portion thereof, and thence passes in contact with the opposite sides of the refrigerating-surfaces in contact with which the air of the chill-room is passing, and thence passes back again to the compressing-cylinder, so as to be used over and over again.

In the accompanying drawing I have shown a form of apparatus which is well adapted for carrying out my present invention; but I do not limit myself to the form of any of the parts which are shown in said drawing.

A is the chill-room.

B is the refrigerator, in which the cooling of the air of the chill-room takes place. This refrigerator is preferably constructed as described in the Letters Patent already referred to, but may be modified in any way, so that the air from the chill-room passes in contact with one

side of a conducting-surface on the other side of which the second body of air is passing in contact.

C designates a condenser or cooler, in which the air which is compressed is cooled by passing through a coil of pipe immersed, preferably, in a cooling-liquid.

D is an air-compressing cylinder of any ordinary construction.

E is a steam-cylinder of any ordinary construction.

F is a cylinder of any ordinary construction, in which the air is expanded.

The cylinders D, E, and F are so arranged and their pistons are so connected that the expansive force of the steam in E is assisted by the expansive force of the air in F in compressing the body of air in D. In the drawing the nature of this connection, as indicated, is by having the piston of each cylinder connected with the same shaft at G.

a is a pipe by which the air, after being expanded and used in the refrigerator B, is drawn into the compressing-cylinder D.

b is a pipe through which the air, after being compressed in the cylinder D, is forced into the cooling-coil of the condenser or cooler C.

c is a pipe by which the air, after being cooled in the condenser and while still compressed, is conducted into the expanding-cylinder F, where it is partially expanded.

d is a pipe through which the partially-expanded and cooled air is conducted from the expanding-cylinder F to the refrigerator, where it preferably passes outside of the tubes through which the air of the chill room is circulating.

Below the refrigerator may be arranged an oblong box, *h*, into which the air may pass before entering the refrigerator B. This box may communicate with the refrigerator by perforations. Its object is to cause the entering cold air to be equally distributed from one end of the refrigerator to the other, and also to catch any snow which may have been formed from possible moisture in the air when first used.

d' is the opening through which the air is drawn from the chill-room, and which may be connected with a perforated or branched pipe to draw the air from different parts of the room,

e is a fan-blower for producing a forced current of air from the chill-room.

f is a pipe connecting the outlet of the fan-blower with the refrigerator B, so as to allow the fan to force the air from the chill-room into the refrigerator B, in which it passes through the interior of the tubes around the outside of which the other or refrigerating body of air is passing, as already described.

g is a pipe connecting the refrigerator with the chill-room, preferably near its bottom, and which may or may not, as desired, be connected with a perforated or branched pipe for distributing the cold air within the chill-room.

In the operation of the apparatus the air is drawn from preferably the top of the chill-room and forced through the pipe *f*, and thence through the refrigerator B, and thence through the pipe *g* back into the chill-room,

preferably near the bottom, passing in its course in contact with the cooling-surfaces within the refrigerator B. These cooling-surfaces are made cold by the other or refrigerating body of air, which is used over

and over again, and which, starting at the cylinder D, is compressed and passes through the pipe *b* into and through the condenser or cooler, and thence to the expansion cylinder, where it is partially expanded, and

thence through the pipe *d* into the refrigerator B, where it circulates, so as to render intensely cold the cooling-surfaces in contact with which the air from the chill-room is passing. From the refrigerator B the air

passes through the pipe *a* back into the compression-cylinder, when the same operation is repeated.

I am aware that systems of refrigeration have been in use in which a single body of air is used for the purposes of refrigeration—that is to say, the air is drawn from the chill-room into the compression-cylinder, where it is compressed, and whence it is driven through the condenser, and, after being expanded, is driven back into the chill-room. These systems of refrigeration are open to very serious

objections by reason of the fact that the same air which is used in the chill-room is conducted through the expanding apparatus, whereby the moisture received from the chill-room is deposited through other parts of the apparatus in the form of snow, and forms a

serious drawback in practice. Various complicated arrangements have been devised for overcoming this difficulty; but they are expensive and their success is limited. In my previous patents, already referred to, the air of the chill-room is shown as being circulated in contact with surfaces made cold by the use of a volatile fluid; but, as before stated, the use of a volatile fluid of any kind is attended with very serious inconveniences, which in certain locations may make its use entirely impracticable.

My present invention combines all the advantages of the systems which have been before in use employing compressed air, with the additional advantage of having the body of air which is compressed always confined in such a manner that it cannot become charged with moisture or other impurities from contact with the outside atmosphere, or with any foreign substance. By my arrangement the air of the chill-room, especially when used over and over again, can be rendered perfectly dry and pure, the impurities being left on the surface of the tubes within the refrigerator, whence they can be removed, if necessary, as described in my said former patent; but I do not limit myself to the use of the air in the chill-room over and over again, since with less economy, but with good results, it may be taken from without the chill-room and thence discharged into the outside atmosphere.

I claim—

1. The process of cooling the air of a chill-room, consisting of forcing the air of the chill-room in contact with surfaces made cold by contact with a second body of confined air, which is repeatedly compressed, cooled, and expanded, substantially as described.

2. The refrigerator B, containing two air-passages separated by metallic divisions, the chill-room, the air-compressing cylinder D, the condenser or cooler C, the expanding-cylinder F, the pipe *g*, connecting one of the passages in the refrigerator with the chill-room, the pipe *d*, connecting the other passage in the refrigerator with the cylinder F, and the pipes *a* and *b*, all combined substantially as described.

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