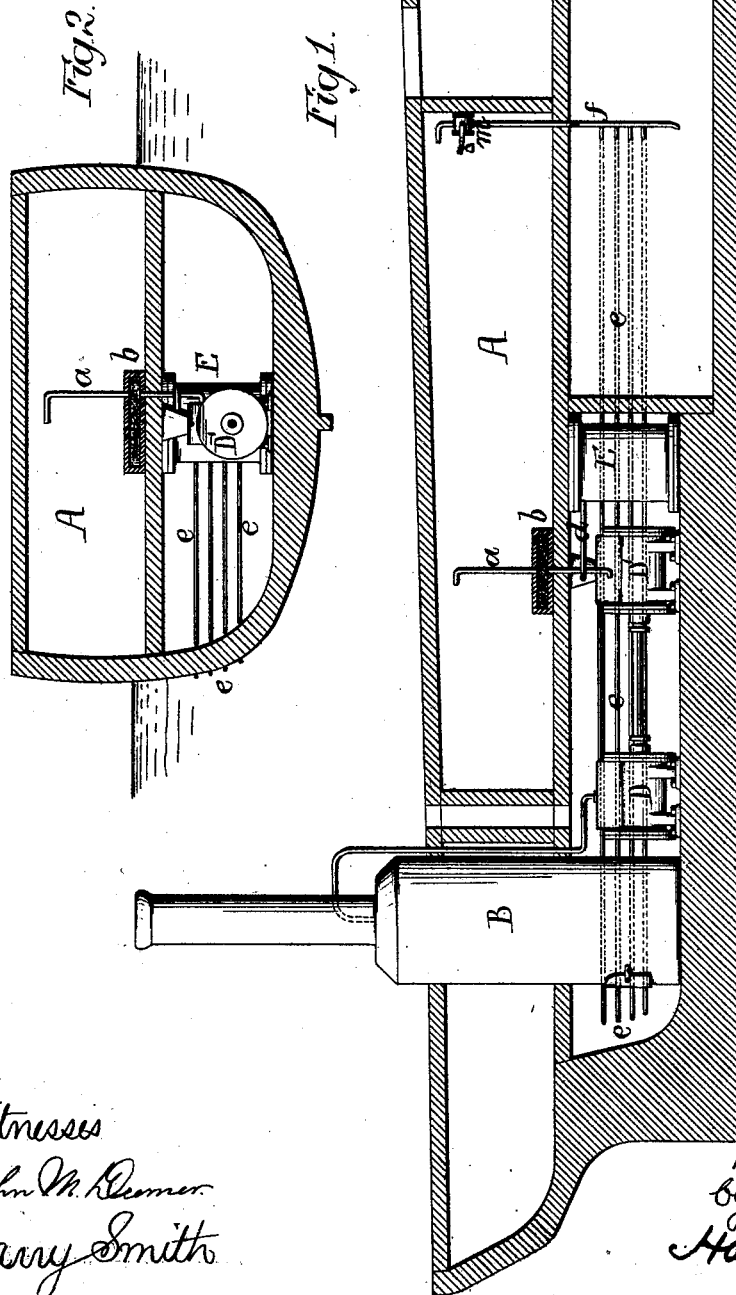


B. F. TEAL.  
Refrigerating Apparatus.

No. 213,954.

Patented April 1, 1879.



Witnesses  
John M. Deemer  
Harry Smith

Inventor  
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# UNITED STATES PATENT OFFICE.

B. FRANK TEAL, OF PHILADELPHIA, PENNSYLVANIA.

## IMPROVEMENT IN REFRIGERATING APPARATUS.

Specification forming part of Letters Patent No. **213,954**, dated April 1, 1879; application filed September 3, 1877.

*To all whom it may concern:*

Be it known that I, B. FRANK TEAL, of Philadelphia, Pennsylvania, have invented a new and useful Improvement in Refrigerating Apparatus, of which the following is a specification:

The object of my invention is to construct simple and economical refrigerating apparatus, in connection with marine vessels, for transporting perishable cargoes; and this object I attain in the manner which I will now proceed to describe, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal section of a vessel with refrigerating apparatus, and Fig. 2 a transverse section of the same.

My invention is founded on the well-known plan, heretofore practiced in ice-making, of first cooling air while under pressure, and then permitting it to escape and expand in a chamber.

In the drawings, A represents the chamber to be cooled; B, a steam-boiler; D, the steam-cylinder; D', the air-compressing cylinder, and E the receiver of the compressed air.

The inlet-pipe *a* of the compressing-cylinder extends up into and terminates in the chamber A, its continuity being interrupted by a chamber, *b*, which contains chloride of calcium, or other equivalent material for absorbing the impurities of the air.

A pipe, *d*, connects the cylinder D' with the receiver E, and from the latter extends a series of pipes, *e*, which are carried rearward to a point at or near the stern of the vessel, where they pass through the hull, and are then carried forward, on the outside of the same and below the water-line, to an extent which the desired cooling-surface and the internal arrangement of the vessel may suggest, the pipes being returned through the hull to the interior of the vessel, where they communicate with a pipe, *f*, the latter extending upward into the chamber A, and being there provided with a weighted valve, *m*.

By the operation of the engine air will be forced into the receiver E and pipes *e* and *f* until it raises the weighted valve, *m*, and escapes into the chamber A. The pressure imparted to the air necessarily increases its temperature; but as the compressed air passes through the pipes immersed in water its tem-

perature must be so far reduced that when allowed to expand in the chamber A it will absorb the moisture from the air contained therein.

By the continued operation of the engine the temperature of the air in the chamber can be maintained at the desired low temperature, for the air which has been introduced into the chamber is withdrawn therefrom and forced through the cooling-pipes prior to its reintroduction into the chamber. In other words, the same air is used over and over again.

I am aware that the cooling of compressed air, in connection with a refrigerating-vessel, by passing it through a chamber or pipes exposed to the water outside the vessel has been described in the patent of *Somes*, February 28, 1865, No. 46,593; but in this case the refrigerating-chamber has a direct communication with the atmosphere, and hence the refrigerating effect must be limited, whereas in my improvement the refrigerating-chamber has no communication with the atmosphere.

I am also aware that air derived from a refrigerating chamber has been compressed and cooled under pressure and expanded in a closed refrigerating-chamber, as in the English patent for ice-making machine No. 2,666 of 1864.

By combining these features in a refrigerating-vessel I am enabled to maintain within the refrigerating-chamber the desired temperature for preserving meat, &c., during long voyages without the aid of ice, thereby saving the cost of the latter and the space usually devoted to the storage of ice in modern refrigerating-vessels.

I claim as my invention—

The combination, in a ship, of the refrigerating-chamber A, closed to the atmosphere, the compressing-cylinder D', deriving the air to be compressed from the said chamber A, and a series of submerged pipes, placed outside the vessel, and forming a communication between the said compressing-cylinder and refrigerating-chamber, all as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

B. FRANK TEAL.

Witnesses:

HARRY A. CRAWFORD,  
HARRY SMITH.