D. L. HOLDEN.

Condensers for Ice-Machines.

No. 205,641. Patented July 2, 1878.

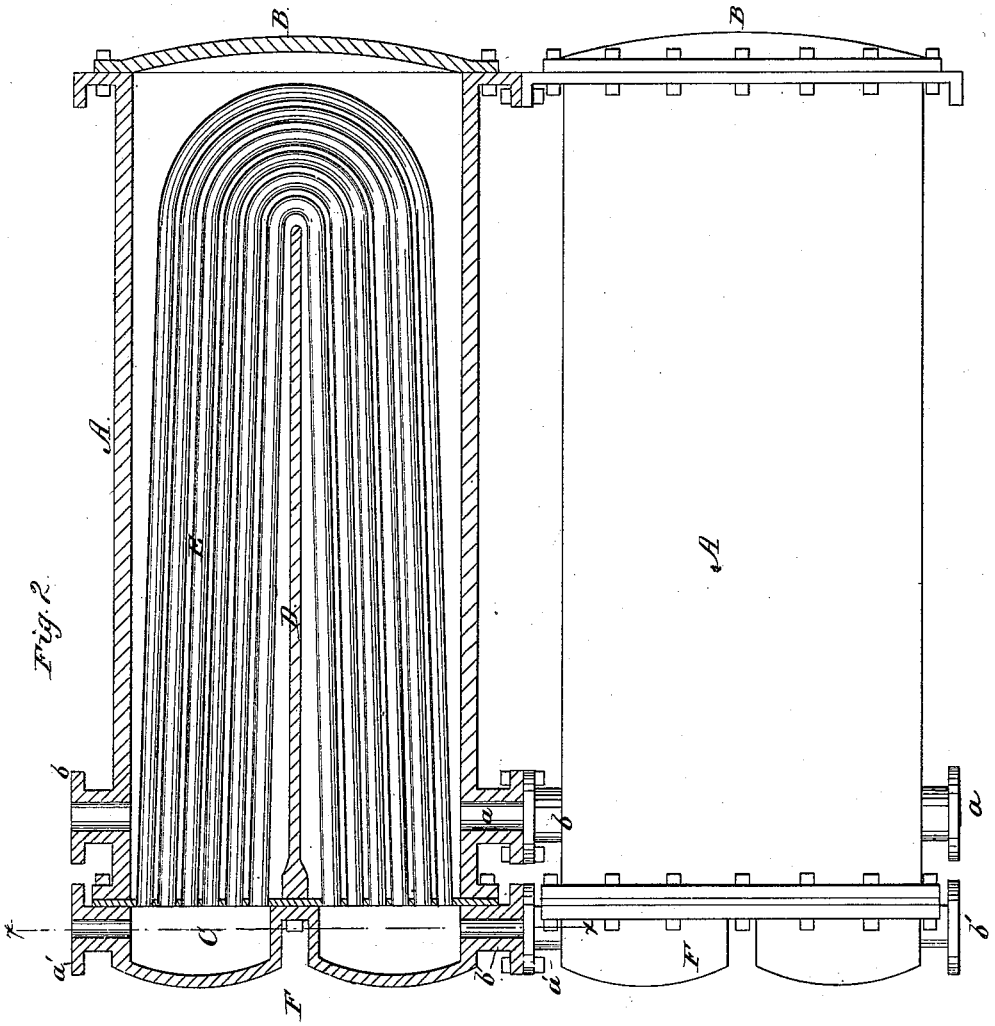

Fig. 2.

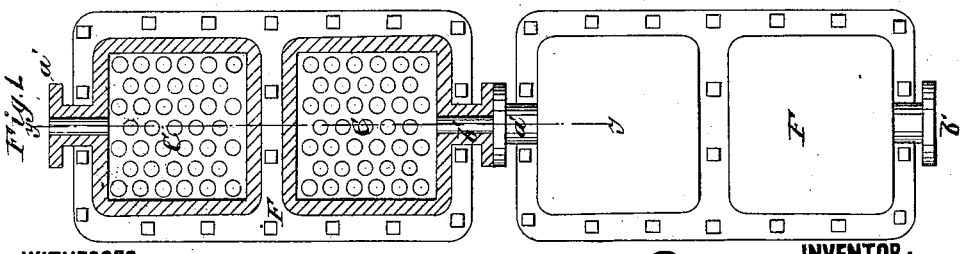

Fig. 1.

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IMPROVEMENT IN CONDENSERS FOR ICE-MACHINES.

Specification forming part of Letters Patent No. **205,641**, dated July 2, 1878; application filed May 8, 1878.

To all whom it may concern:

Be it known that I, DANIEL L. HOLDEN, of the city and county of Philadelphia, and State of Pennsylvania, have invented a new and useful Improvement in Ice-Machines; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing, forming part of this specification, in which—

Figure 1 is an end view of two of my improved condensers, placed one above the other, and the upper one being in section through the line *x x* of Fig. 2. Fig. 2 is a side view of the same, with the upper one in longitudinal section through the line *y y* of Fig. 1.

My invention relates to an improvement upon that feature of an ice-machine known as the "condenser," which device is employed for condensing the volatilized gas into liquid form by means of cool currents of water, which absorb the heat.

The improvement consists in the peculiar construction and arrangement of U-shaped tubes, located in a case and upon both sides of a longitudinal partition, which tubes open through the end of the case into separate end compartments formed in a removable head, through which end compartments and tubes the volatile gas is forced, and is condensed by a body of water circulating about the partition in the case, and over the outer surface of the tubes in the same.

This device, which is designed primarily for a condenser, may be used to equal advantage and without change for a refrigerator, the liquefied gases in that case being evaporated and exhausted from the pipes, in order to cool the surrounding medium of water instead of imparting its heat to it.

In the drawing, A A represent two of my condensing-chambers, bolted together, the one above the other, and having their outlet and inlet connections arranged in communication. These chambers consist of a horizontal body or shell portion, having a removable end plate, B, a removable end plate, C, an inlet-connection, *a*, and an outlet, *b*.

To the end plate C is attached a longitudinal partition, D, and a series of U-shaped tubes, E, the said tubes being bent around and arranged upon both sides of the partition, and opening upon the outside of said end plate C.

F is a double compartment-head, bolted to the end plate C of the chamber, so that one set of ends of the U-shaped tubes open into one compartment and the other set into the other compartment, the said head being provided with an inlet-connection, *a'*, and an outlet, *b'*.

The operation of the device as thus described is as follows: The gas which is evolved in the refrigerator from the volatile liquid (ammonia, cymogene, gasoline, &c.) must be liquefied, in order to be again utilized for cooling the non-congealable fluid, as described in my previous patent of April 24, 1877—that is to say, it must be divested of its heat. In accomplishing this the said gas is forced through inlet *a'* into the upper end compartment, and passes thence through the upper section of the tubes, and after traversing the bend of the same returns through the lower section of tubes, and then passes into the lower end compartment and out at *b'*. While the gas is passing in one direction through the tubes and end compartments water introduced at the opposite end of the apparatus *a* passes around the partition and tubes, and in absorbing the heat more or less liquefies the gas. Supposing the water enters at *a* at a temperature of 50°, and the gas at *a'* at a temperature of 250°, then, theoretically, the gas would issue in liquid form at *b'* at 50°, and the water at *b* at 250°, thus effecting a transfer of heat from the gas to the water. This result as to the transfer of the heat would not in practice ever be more than approximately reached.

Any number of these chambers may be arranged in connection with each other, and, instead of using them for the purpose of a condenser, their construction is such as to permit them to be equally as well employed for a refrigerator—that is to say, instead of condensing the gas and giving up its superfluous heat to the water, the water or non-congealable fluid may be refrigerated by introducing the volatile liquid at *a'* and exhausting at *b'* by a pump; or the volatile liquid may be exhausted from the space in the case A about the tubes, while the fluid to be cooled circulates through the U-shaped tubes. When the apparatus is

used for a refrigerator, this latter method of working the volatile liquid will be preferred, as there is more room in the case or cylinder for the evaporation and expansion of the volatile liquid than there is in the tubes; and when a series of such cases and tubes are employed, I am better enabled to regulate the levels of the volatile fluid in the several cases or cylinders than I could in the tubes. This adaptability of the device for either of these uses renders it especially desirable for location upon shipboard, where space is an item of importance and compactness of structure is desirable.

With respect to other advantages of the device, its removable head B permits deposits and incrustations to be readily washed off of the pipes, which deposits, by preventing the conduction of heat, interferes with the proper action of the machine. The removable head F also permits the welding, expanding, or sweating of the tubes into the end plate C.

The general arrangement of the tubes, partition, case, and heads, furthermore, secures a very intimate and extensive superficial contact between the gas-pipe and encompassing medium, which increases the useful effect of the apparatus, the partition D serving, as will be seen, to cause the fluid encompassing the tubes to traverse, first, one set of branches of the tubes, and, after turning at the end of the partition, to traverse the other set of branches in returning.

In defining my invention more clearly, I would state the U-shaped tubes E, opening into separate end compartments, have been heretofore used in steam-boilers, and I claim, therefore, only the combination of this feature with the containing-case and separating-partition.

Having thus described my invention, what I claim as new is—

1. The combination, with a containing-case having a longitudinal partition, of a series of U-shaped tubes opening through the end of the case, and a two-compartment removable head placed over the end of said tubes for separately closing in the same, substantially as and for the purpose described.

2. The case A, having removable head B, removable head C, partition D, inlet *a*, and outlet *b*, in combination with the series of U-shaped tubes E and the two-compartment removable head F, having inlet *a'* and outlet *b'*, substantially as and for the purpose described.

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Witnesses:
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