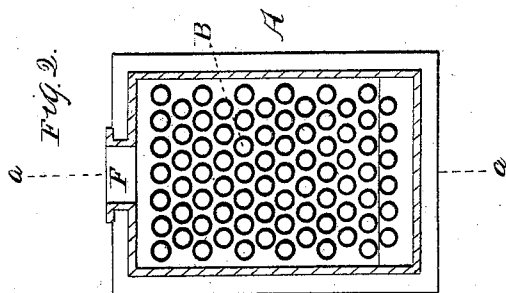
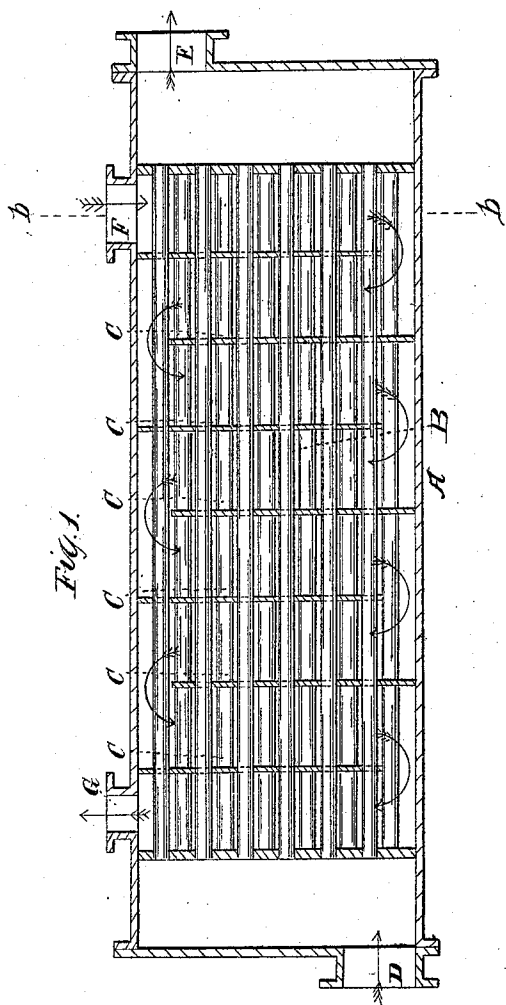


W. A. Lighthall,
Steam-Boiler Condenser.

N^o 46,368.

Patented Feb. 14, 1865.



Witnesses.
Francis S. Son.
Joseph Bishop.

Inventor.
Wm. A. Lighthall.

UNITED STATES PATENT OFFICE.

WILLIAM A. LIDTHALL, OF NEW YORK, N. Y.

IMPROVEMENT IN CONDENSERS OR REFRIGERATORS.

Specification forming part of Letters Patent No. **46,368**, dated February 14, 1865.

To all whom it may concern:

Be it known that I, WILLIAM A. LIDTHALL, of the city, county, and State of New York, have invented a certain new and useful improvement in refrigerators for cooling the injection-water of marine engines in order that the same may be reused in the condenser of the engine; and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, in which—

Figure 1 is a longitudinal section taken through the line *a a*, Fig. 2; and Fig. 2 is a transverse section taken through the line *b b*, Fig. 1.

My invention is a modification of the improvement patented to me by Letters Patent of the United States bearing date of February 26, 1861, (to which reference is hereby made;) and consists in the use and employment of one of the sections of the duplicate apparatus therein shown, the injection-water to be cooled and the cooling-water to cool down and refrigerate the injection-water being employed and used in the same manner as is therein shown in the second section of the refrigerator, its purpose being effected by the use of a greater number of division-plates than would be used in one section of the duplicate apparatus to cause the injection-water to travel an increased distance over, around, and past the exterior of the tubes of the apparatus for the more perfect accomplishment of that end, and to make it approach in its operation the action of the duplicate apparatus at less expense for the apparatus and to occupy less space where these two conditions would prevent the use of the other apparatus.

The case *A* is constructed and the tubes *B* inserted and located the same as is set forth in the Letters Patent above named. The division-plates *C* are also arranged in the same manner as those shown in the duplicate apparatus, but are increased in number, so that the changes of the direction of the injection-water to be cooled shall be more frequent, and the cooling action of the tubes therefore the more efficient. The supply of cooling-water is taken in through the nozzle *D*, and, after passing through the tubes *B*, is taken off through the nozzle *E*, the supply

being furnished either by a pump or by the use of the chutes or hoods patented to me by Letters Patent of the United States bearing date March 5, 1861. The supply of injection-water from the "hot-well" of the engine to be cooled is taken in at the nozzle *F*, and, after passing across, around, and among the tubes, (on the exterior thereof,) by and between and over and under the division-plates *C*, is taken off through the nozzle *G*, to be returned to the condenser of the engine to be reused in the condensation of the steam exhausted into the condenser from the cylinder of the engine.

It will be observed that the currents of cooling-water and injection-water pass through the apparatus in contrary directions, so that the injection-water is subjected to the first (and coolest) action of the cooling-water as it leaves the apparatus to go to the condenser.

I am aware that a combination of tubes and water-nozzles for the reception and delivery of cooling and injection water similar to that described above has heretofore been employed and used; but in every case it has proved in practice to be inoperative, for the reason that the water to be cooled has been passed through the tubes, while the cooling-water has been passed around and over them—in other words, its action has been the exact reversal of the one herein described. This inoperative condition arises from the fact that the cooling-water, which can be supplied in any desired quantity, has been made to travel and pass over the longest route of movement, while the water to be cooled, which is fixed and definite in quantity, has been passed over the shortest, the consequence being that the cooling-water (impeded in its flow by its travel among the tubes and by and around the division-plates) could not be got through the apparatus in sufficient quantity to abstract from the heated injection-water the requisite amount of caloric to reduce its temperature sufficiently to make it effective, the injection-water being only impeded in its flow by the friction due to its passage through the tubes, and therefore passing off so freely and rapidly as to be too much heated when it left the apparatus to be effective.

This improvement is intended to be applied to all the uses and purposes of the one set forth in the Letters Patent before named.

What I claim as my invention, and desire to secure by Letters Patent, is—

The combination of the case A, tubes B, and division-plates C with the nozzles D and E, for the reception and delivery of the cooling-water, and the nozzles F and G, for the reception and delivery of the injection-water, when the said nozzles are arranged in relation to

each other and to the case, tubes, and division-plates, as and for the purpose herein set forth.

WM. A. LIGHTHALL.

Witnesses:

FRANCIS S. LOW
JOSEPH BISHOP.