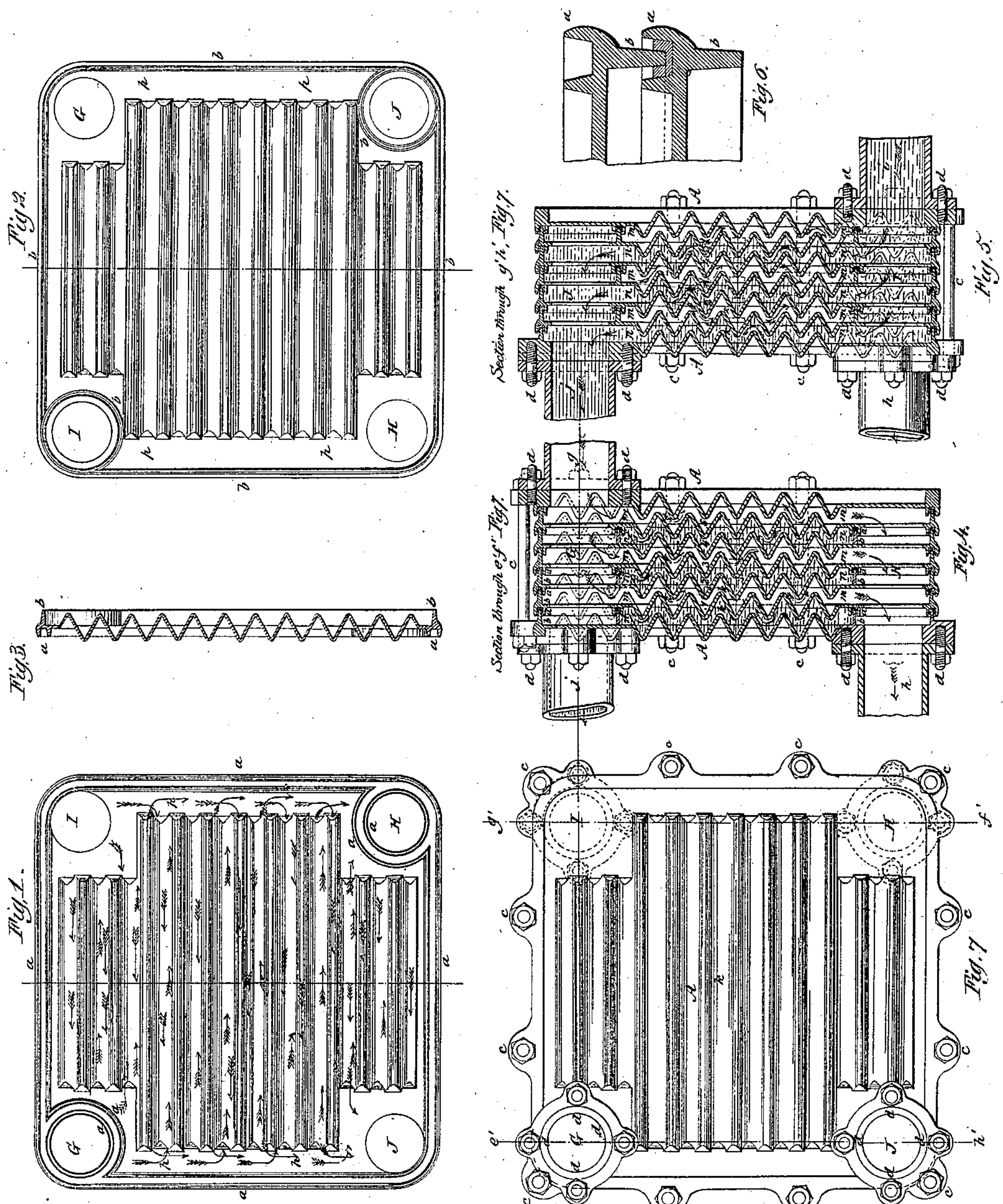
J. Nason,

Steam-Boiler Condenser.

No. 55,149. Patented May 29, 1866.



Witnesses.

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JOSEPH NASON, OF NEW YORK, N. Y.

IMPROVEMENT IN SURFACE-CONDENSERS.

Specification forming part of Letters Patent No. **55,149**, dated May 29, 1866.

To all whom it may concern:

Be it known that I, JOSEPH NASON, of the city and county of New York, in the State of New York, have invented certain new and useful Improvements in the Construction of Surface-Condensers, Heaters, Refrigerators, and the Like Apparatus, in which heat is to be communicated from one fluid to another without admixture of the fluids; and I do hereby declare that the following is a full and exact description thereof.

My invention consists of a series of metal plates, forming, in combination, narrow chambers or cells and suitable channels of communication, through which the fluid to be heated and the fluid or vapor to be cooled or condensed are made to flow through alternate chambers, the hotter fluid or vapor imparting its heat to the colder fluid through thin metal plates, by which the two fluids are separated.

The manner of constructing and joining these plates so as to form, in combination, my apparatus complete is clearly shown in the accompanying drawings, which form a part of this specification, in which—

Figure 1 is a plan of one of the plates; Fig. 2, a plan of the same plate, showing its opposite side; Fig. 3, a tranverse section of the plate; Fig. 4, a transverse section, partly vertical, partly horizontal, of the apparatus complete, showing the alternate spaces for hot and cold fluids and the channels of communication for the hot fluid; Fig. 5, a similar transverse section, showing the alternate spaces and the channels of communication for the cold fluid; Fig. 6, an enlarged sectional view of the tongued and grooved joint and packing; Fig. 7, an exterior view of one end of the apparatus and its opening for the influent and effluent fluids.

Similar letters of reference indicate like parts in all the figures.

The plates which form my apparatus are ordinarily made with four sides, as shown in Figs. 1, 2, 3; but they may also be made circular, or many-sided, or of any other convenient figure, by suitably adapting the channels of communication hereinafter described. They may be advantageously made of cast-iron, which, on account of its economy and durability, is well suited to the purpose.

For my special service, when the fluids are such as to act injuriously upon the iron or the iron upon the fluids, they may be made of brass, tin, or other suitable metal, or they may be made with iron and coated with another metal. In order to give them the requisite degree of stiffness to resist the pressure to which they may be subjected, and also to avoid any liability to fracture or warp in the process of casting, and, furthermore, to increase the superficial surface and to control the direction and distribution of the fluids in the manner hereinafter explained, they are cast with waves or corrugations, as represented, and precisely similar in form each to the other, (except at the apertures G H I J, which will be presently referred to,) so that, being held at a little distance apart, the waves or corrugations are coincident in all the plates, and the spaces between them are of nearly uniform thickness over the whole irregular surface.

In apparatus for surface condensing or cooling four primary and separate channels of communication are necessary, namely: one to receive the steam or the fluid to be cooled, a second to convey away the products of condensation or the fluid which has been cooled, a third to receive the cooling or condensing fluid, and a fourth to convey it away.

The plates which form my apparatus are provided each with four apertures, G H I J, as shown in Figs. 1, 2, 4, and 5, which, by their coincidence with each other, are adapted to form continuations of these channels and to put them into suitable communication with alternate spaces between the plates by a peculiar arrangement of alternate openings between the channels and the spaces, to be presently described.

Each plate has extended along its edge, upon one side, a groove, *a*, and upon the other side a tongue, *b*, as shown in Figs. 1, 2, 3, and 6. These grooves and tongues are also branched and extended around the holes G H I J in the following order: The alternate plates, 1 3 5, &c., as seen in Figs. 4 and 5, have their grooves *a a* branched and extended round the holes G and H and their tongues *b b* branched and extended round the holes I J. The intermediate plates, 2 4 6, &c., on the contrary, have their grooves *a a* branched and extended round the holes I and J and their tongues *b b* branched and extended round the holes G H.

The two outside plates, A A, differ from the rest only in having projecting lugs to receive the compressing-bolts *c c* and flanges to receive short bolts *d d*, which secure the inlet and outlet pipes *g h i j*, as represented. The grooves *a a* along the edges of the plate and round the openings G H I J having been packed with cement, wood, india-rubber, or other suitable material, as indicated in brown color, the plates of the entire series are placed together in their proper order, as represented in Figs. 4 and 5, and drawn together by means of the nutted bolts *c c* with sufficient force to compress the packing and secure the tightness of all the tongued and grooved joints. The following conditions are then secured: First, the spaces *m m* and *n n* between the plates, as shown in Figs. 4 and 5, are circumscribed and inclosed by the grooved packing-joints *a b*, forming a series of narrow chambers, which have no communication exteriorly or with each other, except as hereafter described; second, the alternate spaces *m m*, which are receptacles for the hot fluid or vapor, and which are shown in red color, are open to the inlet and outlet channels G and H, but closed to the inlet and outlet channels I and J by grooved packing-rings, which encircle I and J in the chambers *m m*. In like manner the intermediate chambers *n n*, which are receptacles for the cold fluid, and which are shown in blue color, are open to the inlet and outlet channels I and J, but closed to the inlet and outlet channels G and H by the grooved packing-rings which encircle G and H in the chambers *n n*. The apparatus thus constructed is complete and ready to receive the connecting-pipes *g h i j*.

When employed as a condenser the steam is admitted through the pipe *g* into the channel G, whence, subdividing, it flows into and across the chambers *m m*, when it is condensed by contact with the metal plates on either side, which impart the heat thus derived from the steam to the cooler water, which is at the same time flowing through the intermediate chambers *n n*. The water, air, and vapor resulting from condensation flow directly into the channel H, and thence outward through the pipe *h*. The cold water, on the other hand, is admitted through the pipe *i* to the channel I, whence, subdividing, it flows into and across the chambers *n n*, where, by its contact with the metal plates on either side, it receives the heat imparted by the steam in the contiguous chambers *m m*, thence into the channel J, and outward through the pipe *j*.

When heat is to be transferred from one fluid to another fluid—as, for example, in the process of cooling the injection-water of steam-engines, or of cooling liquors in breweries, distilleries, and other manufactories—the same order is to be observed in the flow of the cold and the hot fluids. The fluid to be cooled, flowing inward through the channel G, thence through and across the chambers *m m*, and outward through the channel H, will impart its excess of heat to the cooler fluid in the contiguous chambers *n n*, which cooler fluid, flowing inward through the channel I, thence through and across the chambers *n n*, and outward through the channel J, will receive and carry away the excess of heat thus derived from the warmer fluid.

The most complete abstraction or transference of heat will be made when the two fluids—the hot and the cold—are made to flow as nearly as possible in opposite directions. This condition is secured approximately by the method which I have indicated of arranging the channels G H I J and their connecting-pipes, while the proper direction of the interior currents and their equal distribution over the whole surface of the plates are further secured by a modification in the shape of the plates, which will be readily understood by referring to Figs. 1 and 3, where it will be seen that the corrugations already referred to do not extend longitudinally quite across the plates, but terminate so as to leave a narrow margin of plain or flat surface, indicated by the letters *p p*.

The distance between the plates being about twice as great where they are flat as where they are corrugated, the chambers *m m* and *n n* will be correspondingly enlarged or widened along the two sides *p p*, and the larger spaces thus gained are intended to serve as lateral ducts or feeders to the narrow corrugated spaces, so that the fluids, instead of flowing diagonally in a nearly direct line across the plates from G to H and from I to J, may tend to flow, mainly, first along the larger spaces *p p*, thence across the corrugated spaces, and, lastly, along the opposite spaces *p p*, the fluid in the chambers *m m* flowing from left to right and the fluid in the chambers *n n* flowing from right to left, as indicated by red and blue arrows in Fig. 1.

I have shown such a disposition of the inlet and outlet pipes *g h i j* as will insure the most equal distribution of the fluids through all parts of the apparatus; but this arrangement of pipes is optional, since they may be made to communicate with their appropriate channels through either of the end plates, A A, by providing suitable flanged openings at the influent and effluent ends of the channels and closing their opposite ends. In certain cases it may be found convenient or necessary to bring all the pipes to the same end of the apparatus; but any departure from the arrangement here shown will result in a less equal distribution of the fluids and a corresponding loss of efficiency.

It is obvious that a series of plates like that shown in Figs. 4 and 5 may be extended indefinitely, or until the apparatus becomes so large that the channels G H I J are no longer adequate to convey the fluids in sufficient quantity, and that with plates and channels of appropriate size a condenser of any required capacity may be constructed by applying together the requisite number of plates arranged to alternate in the manner described. This mode of construction, besides its great simplicity, is attended with peculiar advantages.

The apparatus, instead of being transported in bulk, may be carried in separate pieces and put together in the place where it is to be used. It may also be taken apart with the same facility with which it is put together for the removal of incrustation or for repair.

In case the apparatus is to be employed for any purpose where one fluid is to be subjected to a much greater pressure than the other, the several plates may have as many intermediate points of support as may be needed to prevent bending or fracture. These may be provided by casting upon the plates projecting bases, as indicated at *k* in Figs. 4, 5, and 7, which coincide and touch, or nearly touch, each other, and so transmit the strain to the outside plates, A A, which are made strong enough to resist it. But I consider it preferable to omit these bearings whenever it is practicable, and to make the corrugations deep enough to give to the plates the required degree of strength or stiffness.

When the pressure in the two fluids is very light, or where it is nearly equal in each, plates 1 2 3, &c., (see Figs. 4 and 5,) may be made of very light material, as sheet copper or brass, of considerable area. In such cases I propose to use a sash or border of cast-iron or other metal to go between the plates at their edges and keep them in position. The thickness of the sash, which may be one or two inches, will determine the thickness of the chambers *m m* *n n*. The packing-joints between the sashes and the plates along the edges and around the openings G H I J may be either plain or tongued and grooved, and the packing material the same as before indicated. In other respects the construction is essentially the same as that already described.

Having now fully described my invention, I desire to say that I do not claim as new the use of flat chambers or vessels for heating, cooling, or condensing, as I believe such chambers or vessels have been before used both singly and in combination; but

What I claim as new, and desire to secure by Letters Patent, is as follows:

The within-described construction and arrangement of the plates 1 2 3, &c., and the coinciding holes G H, &c., whereby one of the fluids is allowed to flow freely through the holes into and through alternate spaces *m m*, &c., between the plates, and is prevented from communicating with the intermediate spaces *n n*, &c., while the other fluid is allowed to flow through said intermediate spaces, substantially in the manner and for the purpose herein set forth.

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Witnesses:
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