N. W. Wheeler,

Steam-Boiler Condenser.

No. 56,130. Patented July 3, 1866.

Fig. 1.

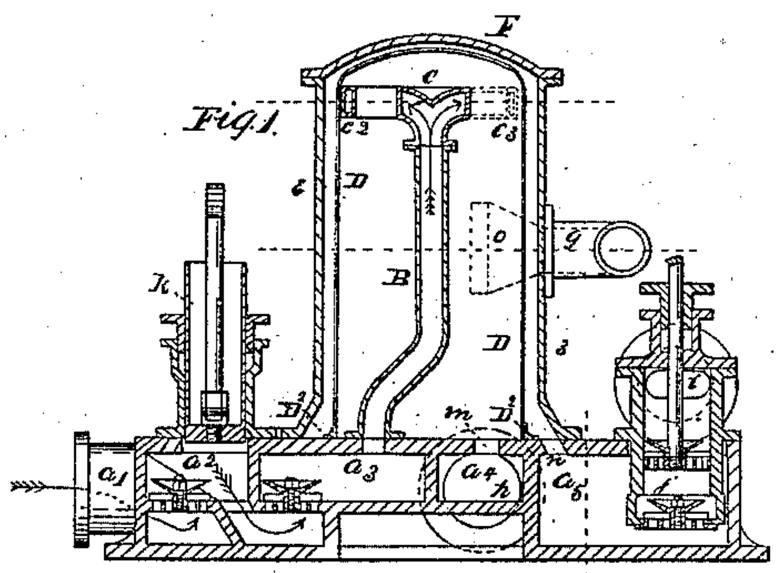


Fig. 2.

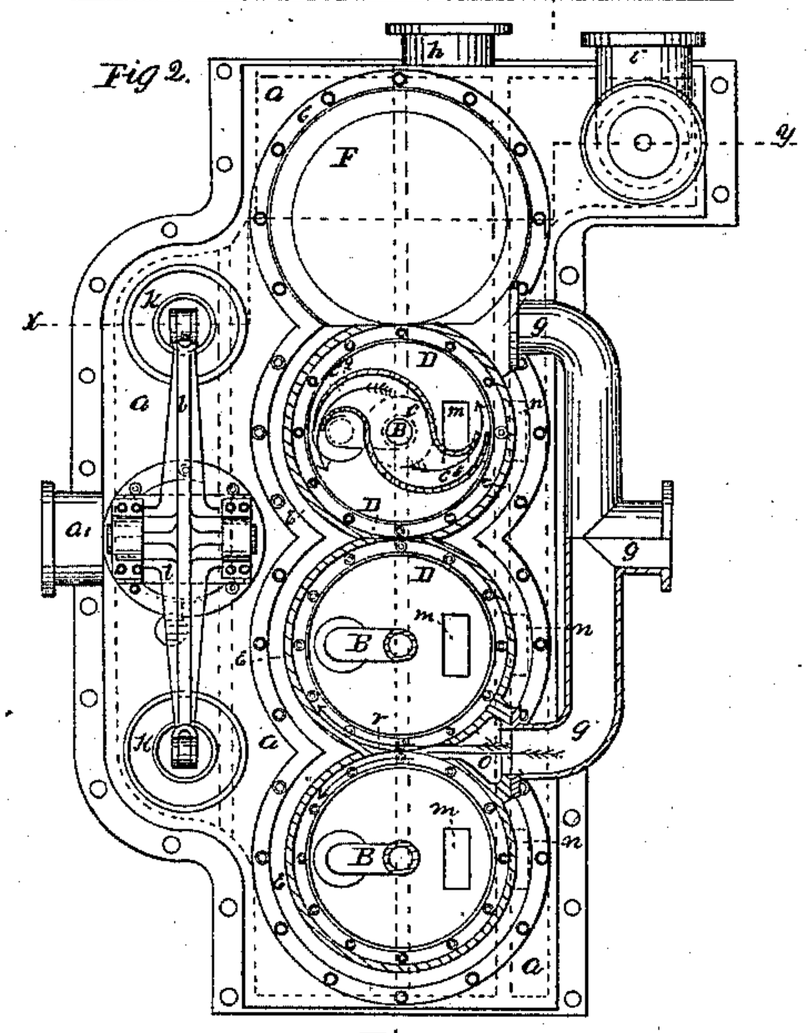
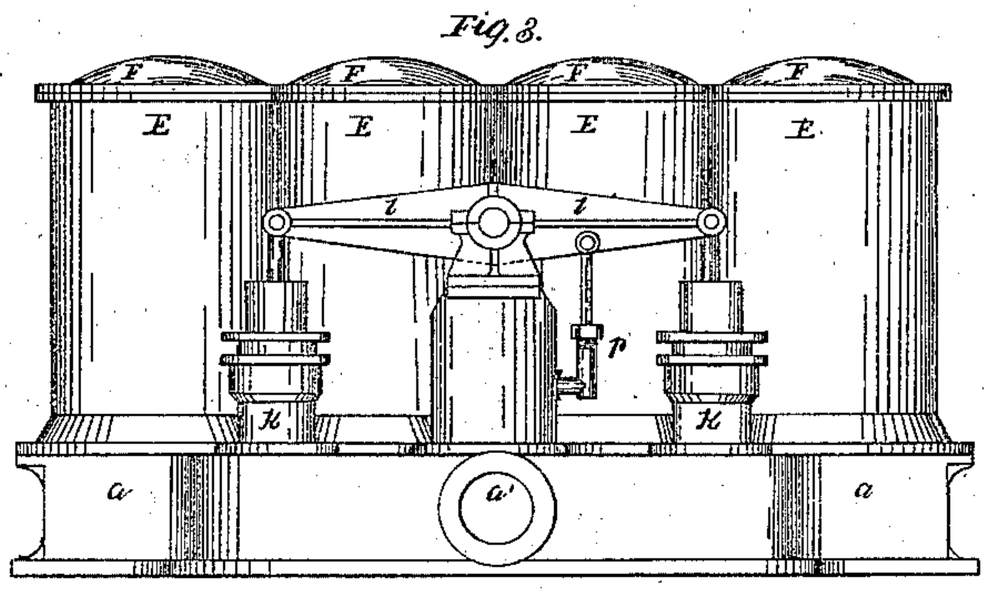


Fig. 3.



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UNITED STATES PATENT OFFICE.

NORMAN W. WHEELER, OF BROOKLYN, NEW YORK.

IMPROVED METHOD OF CONDENSATION AND REFRIGERATION.

Specification forming part of Letters Patent No. **56,130,** dated July 3, 1866.

To all whom it may concern:

Be it known that I, NORMAN W. WHEELER, of the city of Brooklyn, county of Kings, and State of New York, have invented a new and useful Method of Condensation and Refrigeration; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, with letters of reference marked thereon, forming a part of this specification, like letters indicating the same parts in the several figures, and in which—

Figure I represents a cross-section on the line *x y;* Fig. II, a sectional plan, and Fig. III an elevation.

My invention relates to what is commonly denominated "surface condensation and refrigeration," or, to describe the process with more precision, the transference of heat contained in any fluid—gas, vapor, or liquid—through intervening solid bodies to other fluids—gas, vapor, or liquid—without admixture of the fluids; and I render such transference of heat very rapid through a given surface of intervening solid by means of a very active and peculiar circulation of the fluids under treatment; and because of the said very rapid transference of heat I am enabled to construct a condensing or refrigerating apparatus which will accomplish a given amount of work with much less surface than has heretofore been necessary, and in such form as to dispense the multiplicity of joints and pieces incident to such apparatus before known.

In this specification I propose to confine myself principally to my method as used for the condensation of steam for the purpose of obtaining a vacuum, and also fresh water for steam-boilers, leaving those skilled in the art to plainly and readily infer the other uses to which my method may be put and the forms in which the apparatus may be made; and to illustrate that particular use the drawings have been prepared, in which—

a a^2 a^3 a^4 a^5 indicate a channel-plate, upon which are secured the condensing-cylinders D D, made preferably of thin sheet metal, each with one open and one closed end, the open ends being bolted to the channel-plates at D' D^2, the inclosing-cylinders E E E E, together with proper circulating pump or pumps K K, and air pump or pumps *j*, and within each condensing-cylinder a circulating water-pipe, B B, surmounted with a circulating-head, *c* c^2 e^3.

The circulating and air pumps being connected to and actuated by an engine or other motive power, and the receiving-nozzle *a* being connected by a pipe to a proper body of water, the motion of the circulating-pumps will draw circulating water into the chamber a^2, and force it in the direction of the arms through the chamber a^3 and pipes B B and the circulating-heads *c* c^2 c^3, and out through the sufficiently-contracted nozzles c^2 and c^3, from whence the circulating water will issue with considerable force, and impinge against the inner sides of the condensing-cylinders D D at such an angle as to cause the circulating water to continue its motion around and against the inner sides thereof, thus developing thin sheets of water clinging to the cylinders by centrifugal force, and having a combined rotary and descending movement; and by reason of the centrifugal force developed by the rotative motion of these sheets of circulating water the cooler particles, by reason of their greater gravity, will seek and reach in rapid succession the inner surfaces of the condensing-cylinders, rapidly abstracting heat therefrom if the temperature of the cylinders be greater than that of the circulating water.

If the circulating water be allowed to collect in a body within the condensing-cylinders, so as to fill them or to occupy any considerable space within them, the action of the circulating water will become sluggish and inefficient, a homely illustration of which may be found in the ordinary water-closet bowls, wherein the cleansing-water is introduced with a spiral motion. When the outlet is free the action of the cleansing water is rapid and efficient; but when the outlet becomes clogged the action is sluggish and inefficient.

When the outlets for the escape of the circulating water are at the bottoms of the condensing-cylinders and the water is free to escape by its own gravity, as through the passages *m m*, channel a^4, and nozzle *h*, there will obviously be very little accumulation of water in the lower parts of the condensing-cylinders D D; but if a pipe were connected to the nozzle *h*, with its outlet higher than the condensing-cylinders, then the condensing-cylinders would be filled and the apparatus rendered no

more efficient than others heretofore known, wherein a body of refrigerating water was kept in rotation by mechanical means; but if the temperature of the body of aerated or natural water contained in a condensing-cylinder be considerably increased, there will be set free from it, by continued working, a sufficient volume of gases to fill the condensing-cylinder, and a pressure will exist in said cylinder sufficient to expel the body of water in ordinary cases—as, for instance, on board a steamship—the heavier fluid seeking the lower part of the cylinder and passing out, leaving the gases permanently occupying the greater part of the space contained in the condensing-cylinder, thus restoring the normal action and efficiency of the apparatus. But in most cases it will be advisable to introduce a sufficient quantity of air by mechanical means into the condensing-cylinders, which may be conveniently done by means of a small pump, *p*, actuated by the same power which actuates the other pumps, which pump *p* is so arranged as to discharge a sufficient quantity of air into the ingoing current of circulating water at each stroke. The object may also be accomplished in many instances by simply making a small aperture in the suction pipe or passage of the circulating-pump, so that the requisite air will be forced in by the circulating-pump itself.

When a number of condensing-cylinders are working together it will be well to provide a separate means of supplying air to each of them, or to unite the upper ends of the condensing-cylinders by small pipes, in order that all the air may not pass into one and leave the other condensing-cylinders clogged.

It is obvious that the circulating-pumps might be attached by their suction-inlets to the nozzle *h* and draw the circulating water through the apparatus, instead of forcing it through, as before described; but in that case it would be necessary to provide means of preventing the filling of the condensing-cylinders other than those described. This may be accomplished by means of floats arranged in the lower parts of the condensing-cylinders D D, and so connected with valves in the pipes B B or their continuations that when water accumulates in the cylinders the inflow will be arrested, in whole or in part, and capable of the reverse action.

The steam to be condensed flows through the pipes *g g* and through elongated or otherwise-formed openings, in the direction of the arrows, into the spaces between the inclosing-cylinders E E E E and the condensing-cylinders D D, preferably in such a way as to impinge against the inner sides of the inclosing-cylinders, as at *r*, and continue its motion in a rotary manner, developing centrifugal force against the sides of the inclosing-cylinders, thus throwing the particles of grease and condensed water against the inclosing-cylinders and away from the condensing-surface, in whole or in part obviating a great defect occurring in tubular condensers—viz., the greasing of the condensing-surface, which prevents the intimate contact of the steam.

In the example before us the four inclosing-cylinders E E E E are represented as cast in one with their circumferences tangenting each other, thus leaving a free communication throughout the series, and with the inlet-openings so placed that each incoming current of steam is split into two parts, as seen by the arrows at *r*, care being taken that the steam-current does not impinge directly upon the condensing-cylinders D D, for reasons hereinbefore stated. This arrangement is not necessary, but convenient; but care should always be taken that the steam shall not impinge upon the condensing-cylinders before it has impinged upon the inner surfaces of the inclosing-cylinders E E E E, to prevent, as far as possible, the fouling of the condensing-surface.

The condensed water or refrigerated fluid falls through the openings *n n n n* into the chamber a^5, and is removed by the air-pump *j* through the nozzle *i* in the usual way, and the vacuum, if any, exists in the annular spaces between the cylinders D D and E E E E and such inclosed spaces as are connected therewith, thus making the pressure upon the condensing-cylinders internal—that is to say, from within outward—rendering them stronger than if exposed to collapsing stress.

It may be well in this connection to recapitulate what is obvious from that which is hereinbefore stated—viz., that by reason of the extreme and peculiar activity of the circulating water and of the steam or other fluid to be cooled a given amount of condensing-surface is, by this invention, made equal in efficiency to a much greater amount of surface disposed as and used under the conditions in vogue heretofore, and that a few condensing-cylinders of moderate size and easy fabrication may take the place of a multitude of tubes and the corresponding number of joints and packing devices, each cylinder with its one easily-made joint being equal to many tubes with their necessary joints, all of which are liable and addicted to leakage; and it is expected that, inasmuch as the quantity of electrical action bears a relation to the magnitude of the metallic surfaces exposed to chemical action, the destructive effects of such electrical action upon boilers and engines, necessarily endured heretofore, will be materially diminished wherever this invention, with its comparatively small amount of condensing-surface, is practiced.

It has become the favorite practice with many engineers to condense steam from an engine by means of the ordinary jet-condenser, but to draw the condensing water from a fund of fresh water, which water is cooled by passing over refrigerating-surfaces while circulating water traverses the opposite side, which cooled or decalorated water is returned to the fund, and so on continually. This operation can be readily performed by my method, even

without changing in any important particular the apparatus, by simply directing the flow through the pipes *g g*, so that it will follow the course and be subjected to the same influences as hereinbefore described for steam, and this is true for all other fluids susceptible of the like treatment.

I do not intend to limit myself to the specific contrivances described in this specification, it being evident that these may be greatly varied without a departure from the principle of my invention.

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

1. In an apparatus for surface condensation or refrigeration, producing the desired result by directing the refrigerating-fluids into the refrigerating-vessels in such a way that they shall form thin sheets or strata on the inner surfaces thereof, which cling to such surfaces under the influence of centrifugal forces when such vessels are prevented from filling with liquid, substantially as above described.

2. In an apparatus for surface condensation or refrigeration, facilitating the object sought by directing the substances to be condensed or cooled into inclosed spaces surrounding the refrigerating-vessels in such a way that they will not impinge primarily against the principal refrigerating-surfaces, but against other inclosing-surfaces under the influence of centrifugal force, substantially as and for the purpose above set forth.

3. In an apparatus for surface condensation or refrigeration, the mode herein described of preventing the refrigerating-liquid from accumulating in the interior of the refrigerating-vessel—to wit, by means of injecting air into such vessels by mechanical means, substantially in the manner above described.

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