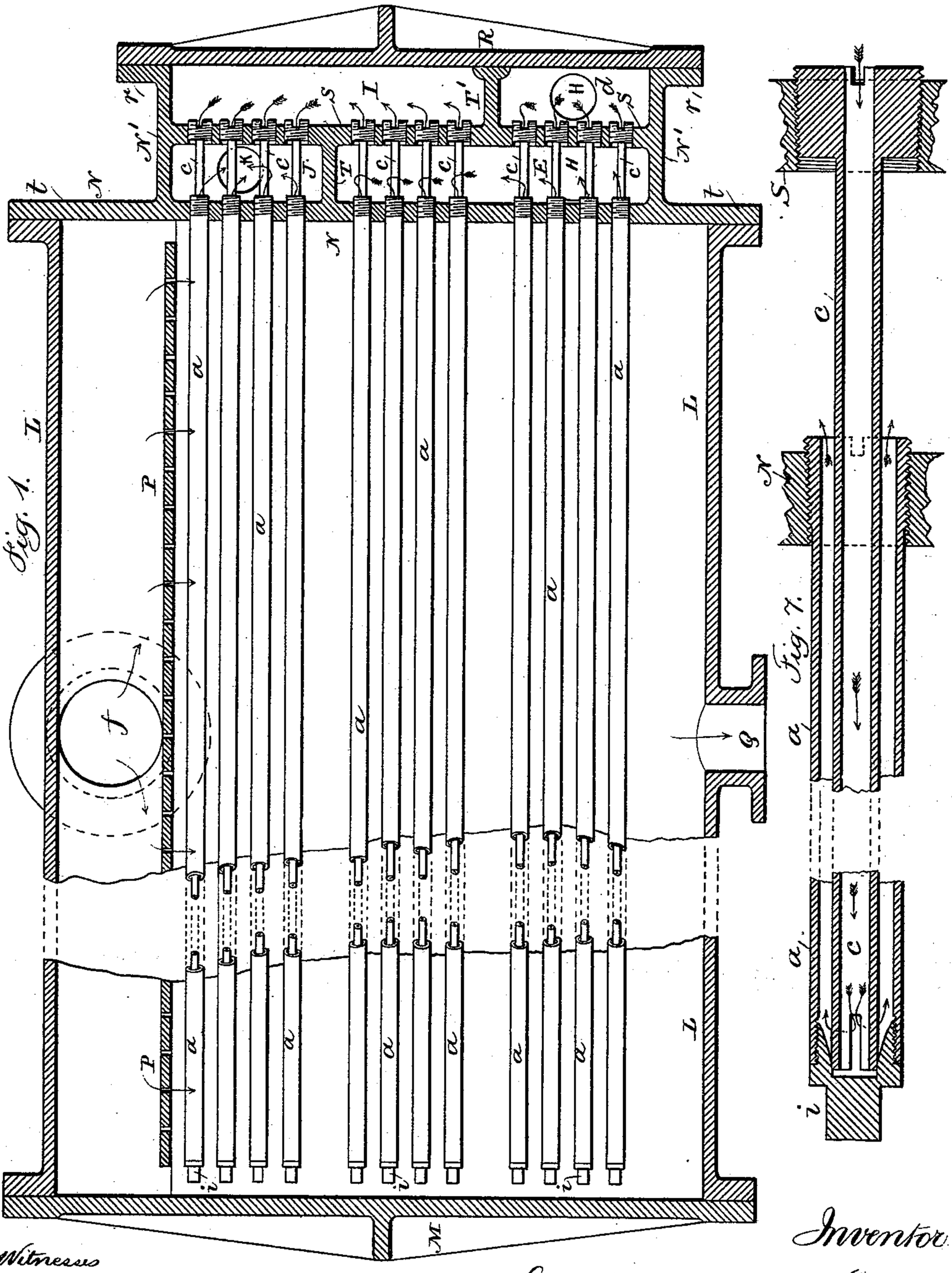
(No Model.)

3 Sheets—Sheet 1.

F. M. WHEELER.

SURFACE CONDENSER.

No. 332,468. Patented Dec. 15, 1885.



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(No Model.)

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F. M. WHEELER.

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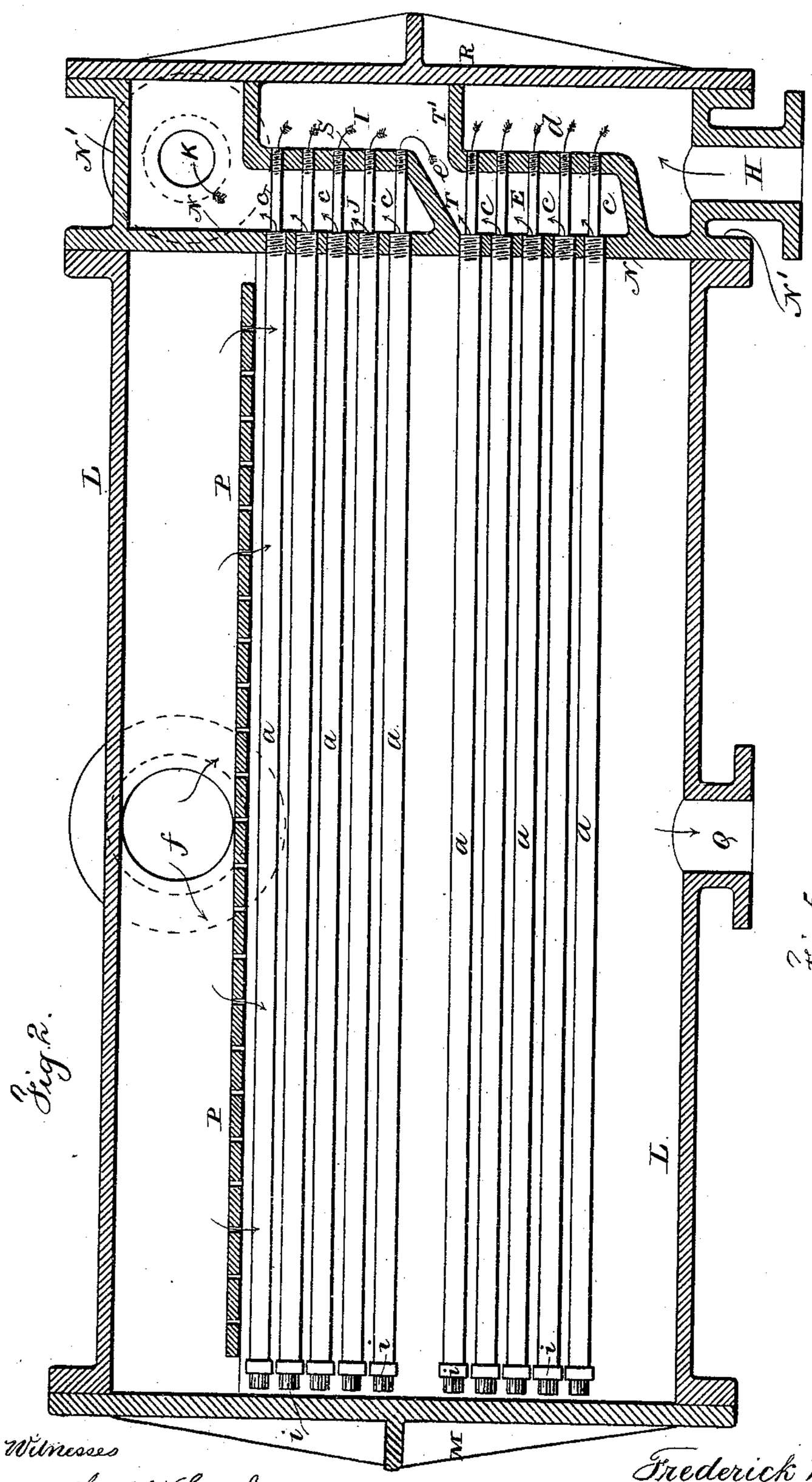

Fig. 2.

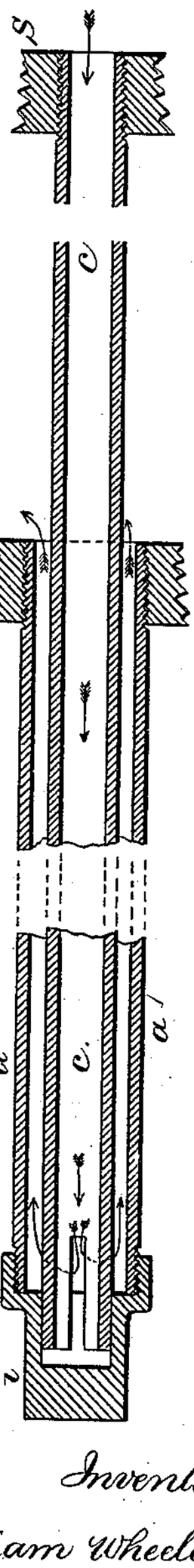

Fig. 5

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Fig. 3.

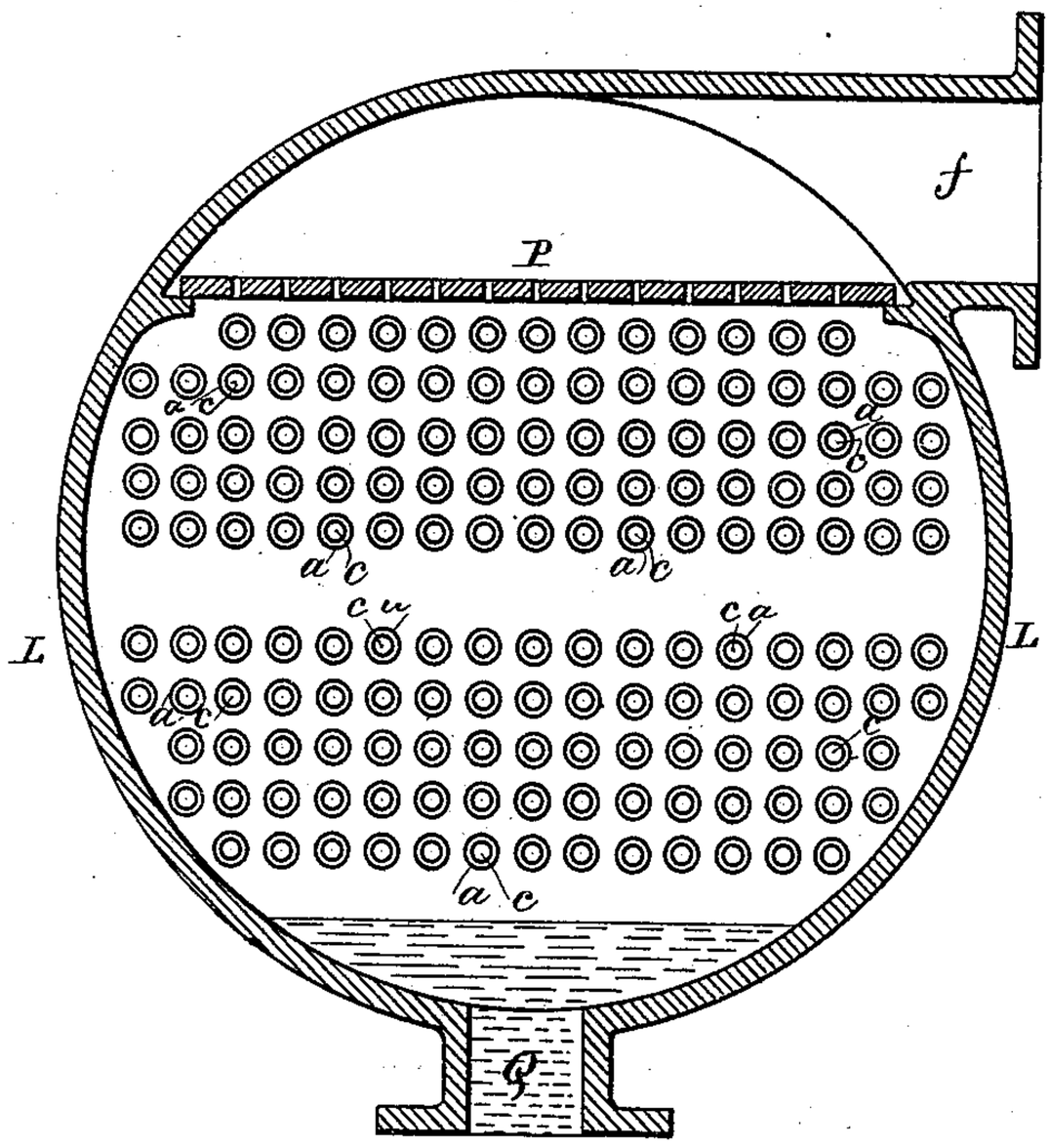


Fig. 6.

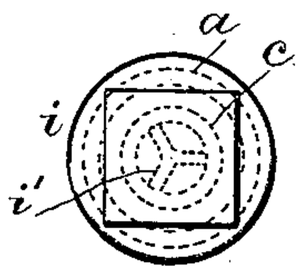
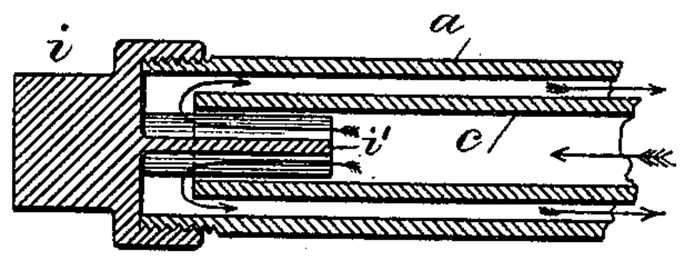


Fig. 4.



Witnesses

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UNITED STATES PATENT OFFICE.

FREDERICK M. WHEELER, OF MONTCLAIR, NEW JERSEY, ASSIGNOR TO THE LIGHTHALL MANUFACTURING COMPANY, OF NEW YORK, N. Y.

SURFACE-CONDENSER.

SPECIFICATION forming part of Letters Patent No. 332,468, dated December 15, 1885.

Application filed April 22, 1885. Serial No. 163,004. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK MERIAM WHEELER, of Montclair, in the county of Essex and State of New Jersey, have invented an Improvement in Surface-Condensers, of which the following is a specification.

Surface-condensers have heretofore been made with ranges of vertical tubes, each larger tube having within it a smaller tube extending from a diaphragm to near the upper end of the larger tube, so as to cause the proper circulation of the condensing-water.

My invention is made for facilitating the insertion of the tubes and their removal for cleaning and repairs and also for economizing the condensing-water, and for preventing the chilling of the water of condensation, so that said water may be returned to the boiler at as high a temperature as possible.

In the drawings, Figure 1 is a vertical section longitudinally of the condensing-tubes with the tubes in elevation. Fig. 2 is a longitudinal section of the condenser with the screw ends and caps slightly different from those shown in Fig. 1. Fig. 3 is a cross-section of the condenser. Figs. 4 and 5 are sections in larger size of the caps and ends of the tubes. Fig. 6 is an end view of the cap and tube, Fig. 4; and Fig. 7 is a section in larger size of the ends of the tubes and cap shown in Fig. 1.

The shell of the condenser is to be of any desired size or shape. I prefer to make the same cylindrical, as at L, and to provide at one end a removable head, M. The other head, N, forms a tube-sheet for the reception of the ends of the tubes *a*. The steam to be condensed is introduced at *f*, and there is a deflector or perforated spreader, P, to equalize the steam as it descends to the tubes *a*. The water of condensation is taken away at Q, and the lower range of tubes *a* is at a sufficient distance from the bottom of the condenser L to allow for any accumulation of the water of condensation, so that the same may not be chilled by the condensing-water in the lower range of the tubes *a*.

I prefer to make the condenser ends so as to give access to the tubes without disconnecting the water or steam pipes. With this object in view I prefer to cast the head N with the cylinder N′, and partition or diaphragm S, and with flanges *t* and *r*, the former being bolted to the cylinder of the condenser and the auxiliary head R, and at the sides of this cylinder are two pipes, H and K, the one for the inlet of the cold condensing-water and the other for the escape of the warmer water. Sometimes the water will be admitted at the pipe K and pass out by the pipe H, but usually the water will be made to circulate in the direction indicated by the arrows. In some instances the condensing-pipes will form but one group, and the water entering by the pipe H, between the head R and diaphragm S, will pass directly through all the tubes *c* and return through the tubes *a* into the space between the head N and diaphragm S, and leave by the exit-pipe, or it will be made to circulate in the opposite direction; but I prefer to arrange the condensing-pipes in two or more groups.

In Fig. 1 I have shown three groups, and in Figs. 2 and 3 I have shown two groups.

In Fig. 2 the condensing-water passes in by the pipe H into the chamber *d*, thence through the tubes C in the bottom group of tubes, and back through the tubes *a* into the chamber E, thence by the passage *e*, between the partitions T T′, into the chamber I, and from there through the upper group of tubes, *c*, and back again through the upper tubes, *a*, into the chamber J, and from thence out of the condenser by the delivery-pipe K, or there may be a second passage, *e*, and a third group of pipes, *a c*, if desired.

In Fig. 1 the water is shown as passing in by the pipe H into the chamber *d*, and then going along in the tubes *c*, and returning through the tubes *a* into the chamber E, and from there going into the tubes *a* of the second group of tubes and returning in the tubes *c* into the chamber I above the partition T′, and ascending in that chamber I and entering the third or upper group of tubes, *c*, and returning by the tubes *a* into the chamber J above the partition T, and passing thence to the discharge-pipe K. By this arrangement the

water is economized and caused to act to the best advantage in keeping the condensing-pipes cool.

In two of these groups of pipes the water passes into the open ends of the smaller tubes, *c*, and returns through the inner tubes, *a*. In the third group the water passes into the tubes *a* and leaves at the open ends of the tubes *c*.

The pipes may be arranged, as shown in Fig. 1, one immediately over the other, or they may be staggered or otherwise arranged.

This condenser can be inverted, so that the pipe K will be at the bottom and the pipe H at the top, in which case, if the water enters at K and leaves at H, the directions in which the water moves will be the reverse of the arrows shown in Fig. 1. The tubes *a* are closed at their outer ends, preferably by removable screw-caps *i*, and these tubes, and also the tubes *c*, are free to expand and contract under changes of temperature without injury to themselves or to any of the screws or joints, because such tubes are only fastened at one end. It is, however, important that the tubes *c* be supported centrally within the tubes *a*. With this object in view I construct each cap *i* in one of the forms represented in larger size in the sections, Figs. 4, 5, 6, and 7.

In Figs. 5, 6, and 7 the end of the tube *c* passes into and is supported by the said cap *i*, and the water is free to circulate through openings in the tube *c* near the end, or through channels in the interior of the cap *i*.

In Fig. 4 the channels are shown as in a projection, *i'*, that passes inside the tube *c*. In all instances the condensing-water passes along through the tubes *c* and returns within the tubes *a*, between the inner surfaces of the tube *a* and the exterior surfaces of the tube *c*, or vice versa, the tubes being maintained concentric within the tubes *a*.

In Figs. 1 and 7 the tubes *a* are thickened at the ends that are screwed into the tube-sheet N, preferably sufficiently to allow of their removal by a suitable tool applied at these ends of the tubes, to unscrew the same and withdraw them through the tube-sheet N and diaphragm S. In this case the caps *i* should be screwed within the tubes *a*, as seen in Fig. 7, so as not to project outside of the tubes *a;* but where the tubes *a* are sufficiently strong to withstand the torsion, the head M may be removed and the unscrewing tool applied to grasp these ends of the pipes either before or after the caps *i* are removed. In Figs. 3, 4, and 5 this latter mode of removing the tubes will be employed. The thickening of the ends of the tubes *a* where they enter the sheet N is rendered necessary, because said tubes are of comparatively thin metal, and not sufficiently thick for a screw-thread to be cut therein. This thickening may be made by sweating or otherwise securing to the ends of the tubes a screw backing or thimble.

When the tubes *a* are removable through the diaphragm S, after removing the head R, Figs. 1 and 7, the ends of the tubes *c* must be provided with bushings with screws upon the outside to fit the holes in the diaphragm S, because such holes must be larger than the screws of the tubes *a* in order to give the necessary room for inserting or withdrawing the tubes *a*.

If desired, the tubes *a* and *c* may be secured into the sheet N and diaphragm S, respectively, by expanding the ends of said tubes within the openings provided for them in N and 5; or said tube may be secured in place in any desired manner.

The recesses in the caps *i*, Figs. 4 and 5, into which the ends of the tubes *c* pass, are preferably longer than the screw-threads upon the ends of the tubes *a*, in order that the caps may be passed upon the ends of the tube *c* before being screwed upon the ends of the tubes *a*, and the recesses in the caps *i* are sufficiently deep to allow for expansion or contraction without binding upon the ends of the tubes *c*.

I have spoken of this condenser as adapted to steam. It is to be understood that the same may be used for any condensing or cooking purposes.

I do not claim a condenser in which the tubes are placed vertical and the feed-water circulates through the inner tube of each pair of tubes and between the same and the outer tube, as these have been used. Neither do I claim a feed-water heater that is horizontal and the steam passes in through the pipes and the water to be heated surrounds such pipes. In my improvement the steam is distributed around the pipes that contain the water, and these pipes are horizontal. The water of condensation does not accumulate around the water-tubes, and hence does not become unduly chilled, and the water is so directed through the tubes successively that the largest volume of steam is condensed by the smallest volume of water.

I claim as my invention—

1. The horizontal case L, having an inlet-pipe for the steam at the top and an outlet-pipe for the water of condensation at the bottom, in combination with the perforated distributer P, the tube-sheet N, the horizontal tubes *a*, screwed into such sheet N and opening through the same, the movable caps that close the other ends of such tubes *a*, the tubes *c* within the tubes *a* and open at each end, and the tube-sheet S, into which such tubes *c* are screwed, and the heads and the pipes for supplying water to circulate between the heads and tube-sheets and through the tubes *a c*, substantially as set forth.

2. The combination, with the horizontal condenser-case and the tube-sheets N S, of the tubes *a*, with the ends thicker than the body, and having screw-threads thereon screwed into the sheet N, the tubes *c*, having attached to them screw-ferrules at their ends that are larger in diameter than the pipes *a* and screwed

into the tube-sheet S in line with the tubes *a*, so that such tubes *a* can be removed through the openings in the sheet S after the tubes *c* have been removed, the removable caps *i* to the tubes *a*, and the supply and discharge pipes H K, substantially as specified.

3. The combination, with a horizontal condenser-case, of two or more groups of pipes, the respective tube-sheets N S, into which the respective pipes *a c* are screwed, the inlet and outlet pipes H K, and the partitions between the respective groups of pipes to direct the circulating water, substantially as specified.

Signed by me this 27th day of March, A. D. 1885.

FREDK. M. WHEELER.

Witnesses:
GEO. T. PINCKNEY,
WILLIAM G. MOTT.