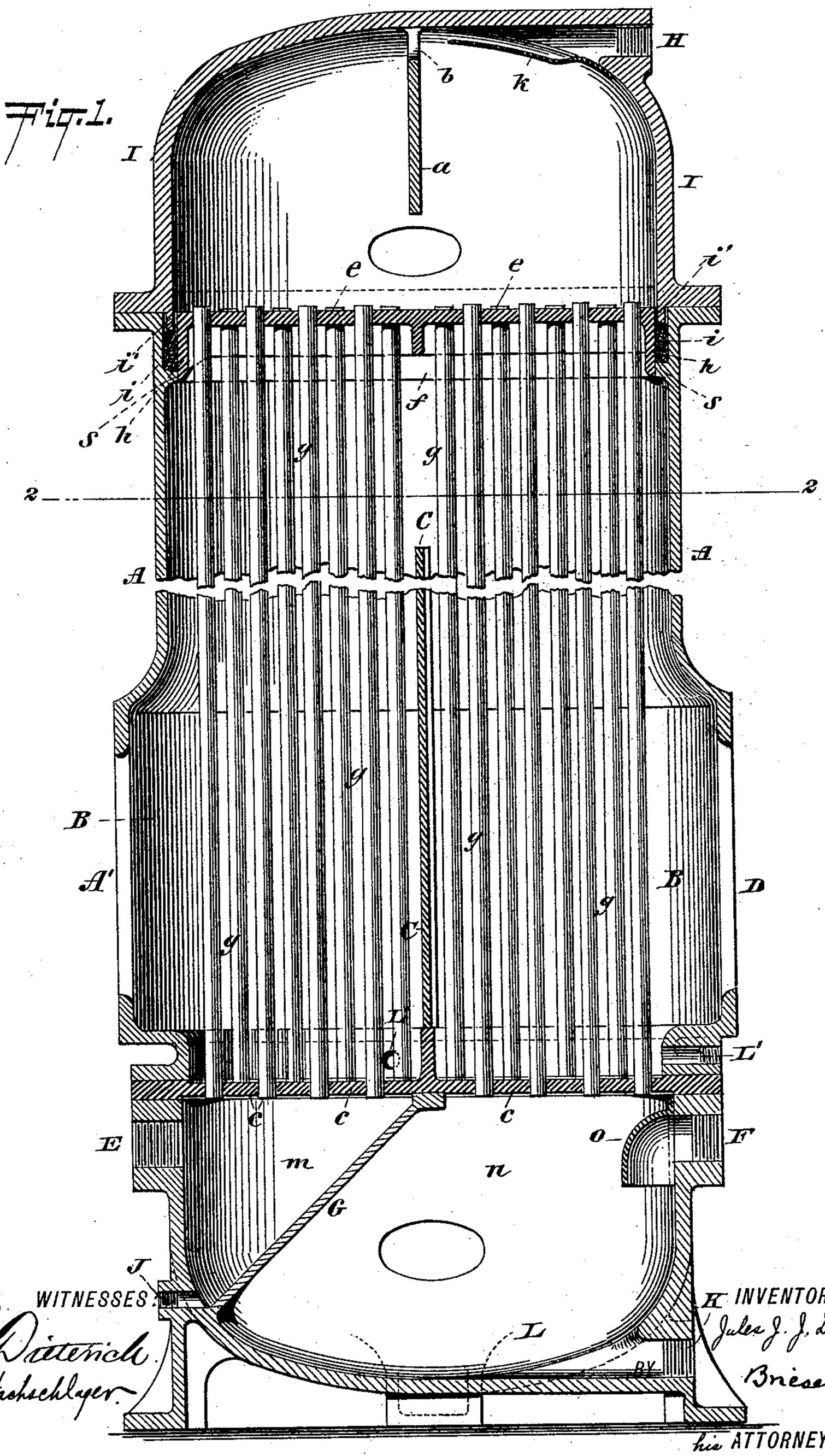
(No Model.) 2 Sheets—Sheet 1.

J. J. J. DE RYCKE.

FEED WATER HEATER AND PURIFIER.

No. 487,724. Patented Dec. 13, 1892.

Fig. 1.



(No Model.) 2 Sheets—Sheet 2.

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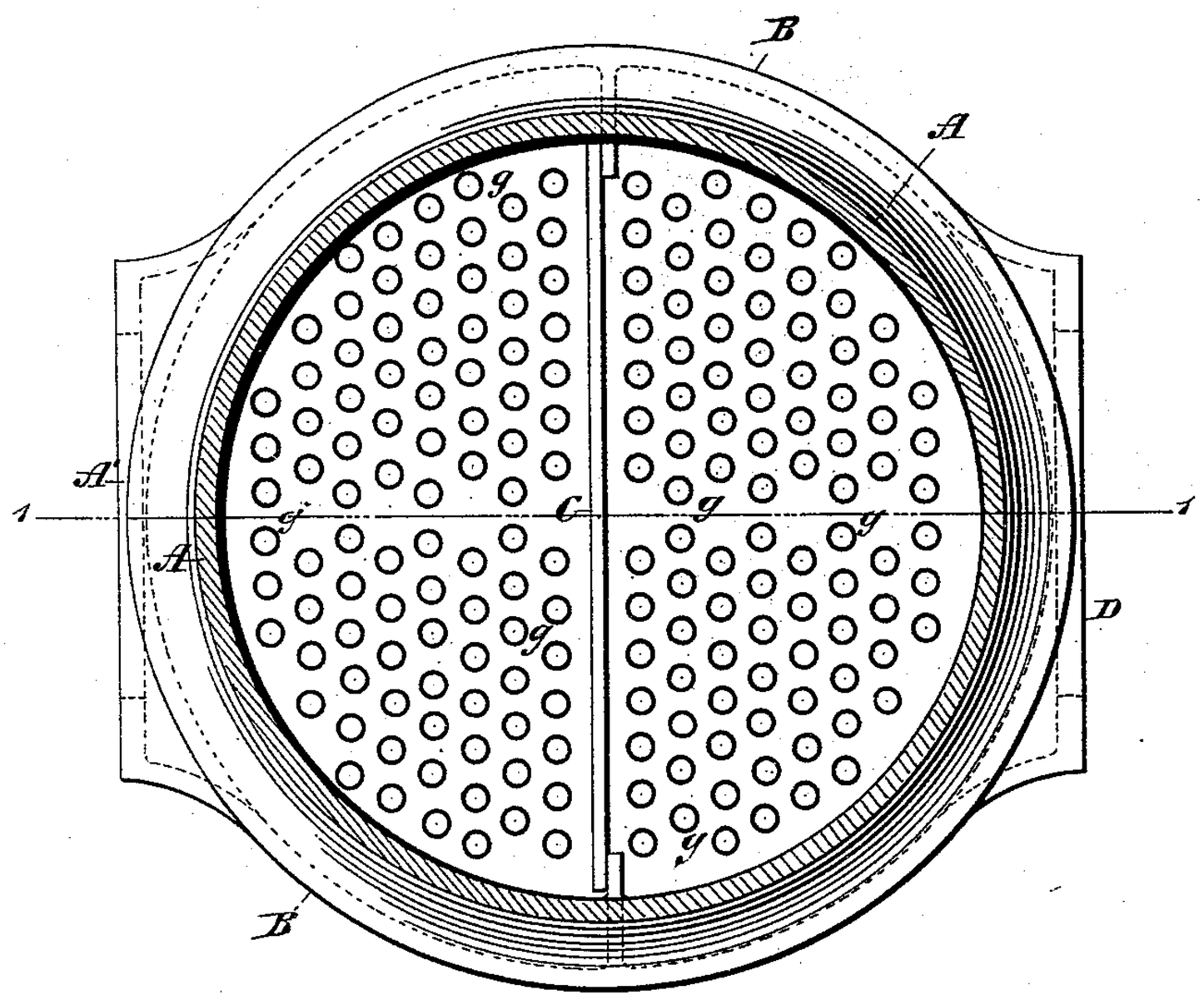
Fig. 2.



WITNESSES:

Gustave Dieterich.

L. M. Waechtlager

INVENTOR:

Jules J. J. DeRycke,

BY Briesen & Knauth

his ATTORNEYS.

UNITED STATES PATENT OFFICE.

JULES JOHN JOSEPH DE RYCKE, OF BROOKLYN, NEW YORK.

FEED-WATER HEATER AND PURIFIER.

SPECIFICATION forming part of Letters Patent No. 487,724, dated December 13, 1892.

Application filed May 13, 1892. Serial No. 432,837. (No model.)

To all whom it may concern:

Be it known that I, JULES JOHN JOSEPH DE RYCKE, a resident of Brooklyn, Kings county, New York, have invented an Improved Feed-Water Heater and Purifier, of which the following is a specification, reference being had to the accompanying drawings, forming part hereof, in which—

Figure 1 is a vertical section of my improved feed-water heater and purifier. Fig. 2 is a horizontal section of the same.

This invention relates to certain improvements in feed-water heaters and purifiers; and it consists in the novel arrangement and disposition of parts hereinafter more fully described.

My apparatus consist of three principal parts—namely, a central vertical shell or drum A, an upper cap I, and a lower cap L. The lower cap L carries and is in part closed at the top by a tube-sheet *c*, in the perforations of which are received the lower ends of vertical tubes *g*, that traverse the central chamber A and that reach into the top cap I. The lower cap L has, moreover, an inner inclined partition G, which divides the space within it into two chambers *m n*. Moreover, the lower cap L has a water-inlet opening E at the side of the chamber *m* and a water-outlet opening F at the side of the chamber *n*. The outlet-opening F is on its inner side partly protected by a hood *o*. At the lower end of the chamber *m* is an opening J for the discharge of sediment from said chamber, and at the lower end of the chamber *n* is a similar outlet K for the discharge of sediment. This being the general construction of the lower cap L, we will next consider the construction of the central chamber A, which rests on the lower cap L and which is closed at the bottom by the tube-plate *c*, while at the top this central chamber A is closed by a tube-plate *e*, that receives the upper ends of the vertical tubes *g* and that helps close the bottom of the upper cap I. This central chamber A, which by preference is of a cylindrical form, has its lower portion B made of greater diameter than its upper portion, and in this lower portion B it has its steam inlet and outlet openings A′ and D, respectively, whereby when the steam is admitted in the chamber A it immediately surrounds the vertical tubes *g* on all sides. Between these two openings A′ and D the shell A contains a vertical partition C, which partition extends all the way down to the lower tube-plate *c* or to a projecting rib thereon, but does not quite extend to the upper tube-plate *e*. Consequently any steam entering through the aperture A′ must pass upwardly on one side of the partition C and can then by passing over the top of said partition reach the other side thereof and then pass downward to and out through the opposite opening D. By having the enlargement B at the lower or steam entrance portion of the shell A or steam-chamber I cause the steam in its ascent to become compacted and to thoroughly embrace the water-pipes that traverse the steam-chamber.

Having now described the general characteristics of the steam-chamber or central portion A, I will next describe the upper cap I. This cap is rested by an outward flange or otherwise upon the upper end of the steam-chamber A, and is of course securely fastened thereto, a small rib *i′* extending from the lower side of the cap I into or against a packing *i*, which is located between a flange *h* or the edge of the upper tube-plate *e* and between an inwardly-projecting rib or ledge *s* of the shell A and the outer wall of said shell, all as clearly shown in Fig. 1. It will be seen that the flange or edge *h* of the tube-plate *e* does not quite reach contact with the inner wall of the cap I, so that some play in a vertical direction is allowed to the plate *e* for the purpose of providing for the elongation or contraction of the pipes *g*. The cap I also contains at or about its center a downwardly-projecting partition *a*, which does not quite reach down to the tube-plate *e*, and which in its upper portion has an aperture or slot *b*. The cap I also has in substantial alignment with this aperture *b* a scum-outlet H, and under the same a guide-plate or deflector *k*, all as shown.

Having now described the construction of my apparatus, I will briefly state how it operates. Steam enters at the aperture A′ and escapes at D. On entering it is at once forced into a more compacted condition by the fact that it has to pass from the wider entrance chamber B into the narrower upper portion of the shell A. In passing upward it embraces the pipes

g, that are on one side of the partition C, and in then, having reached the top of the partition, passing downward it embraces the pipes *g*, that are on the opposite side of the partition C. Thus the steam is forced by reason of the partition and also by reason of the contraction of the upper part of the steam-chamber to thoroughly reach every particle of surface of every pipe that traverses the steam-chamber and to give off, therefore, as much of its heat as practicable to the water that passes through said pipes, and at the same time, the steam also being in contact with the tube-plates *c e* heats the same and assists in heating whatever water is contained in the two caps. Any products of condensation of the steam can be discharged through small outlet-openings L′, provided for that purpose in the lower portion of the steam-shell. The water enters the chamber *m* in the lower cap L through the opening E, and is by the inclined partition G forced to ascend in one set of pipes *g*. It then reaches the cap I and descends through the other set of pipes *g* into the chamber *n*, passing out finally through the pipe F. Thus the water is required to flow twice through the steam-chamber A, and is thoroughly exposed to the heat of the steam that passes through that steam-chamber or that is contained therein. The partition *a* in the cap I serves to keep the water in said cap quiet and causes it, therefore, to allow the scum to ascend to the top, whence such scum may flow off through the aperture H, the hole *b* in the partition *a* permitting the scum to reach said outlet from every part of the top of the cap I, the deflector *k* assisting in guiding the scum properly to the outlet-opening H. Any sediment contained in the water will be received in the lower parts of the chambers *m* and *n*, respectively, and can be drawn off through the pipes J and K, the hood *o* preventing any of such sediment going off through the water-outlet pipe F. Any expansion and contraction of the pipes *g* is provided for by the movable tube-sheet *e*, to which the pipes are ridgidly secured, in manner already specified.

Although in this specification I have described one cap L as being the lower the other cap I as being the upper cap, and the intermediate steam-chamber A as being vertically interposed between said two caps, it is perfectly clear that, nevertheless, my apparatus can be used, with slight modifications which will be apparent to every mechanic, in a horizontal or in an inclined position, and I therefore wish it understood that whenever terms herein are used that refer to an upright position they are intended to apply to any equivalent other position of the apparatus. I also desire it to be understood that the enlargement B may be at the upper end of the steam-chamber instead of the lower end, in which case the partition C wlil not quite reach to the lower tube-sheet.

Having now described my invention, what I claim is—

1. In a feed-water heater, the steam-chamber A, partially divided by partition C, combined with water-pipes traversing the same, enlarged steam-entrance portion B, and steam inlet and outlet openings in said enlarged portion, arranged diametrically opposite each other in said enlarged portion, whereby the steam can readily circulate around said water-pipes, substantially as and for the purpose herein shown and described.

2. The cap I, having scum-outlet H, deflector *k*, partition *a*, and aperture *b* in said partition, combined with the tube-sheet *e*, tubes *g*, steam-chamber A, tube-sheet *c*, and cap L, substantially as and for the purpose specified.

3. The combination of the steam-chamber A, having enlarged portion B of greater diameter than the body thereof, water-circulating pipes *g*, inclined partition G for forcing the water through said circulating-pipes, tube-sheet *e*, adapted to reciprocate within said steam-chamber, inner steam-deflecting partition C, cap I, partition *a*, provided with opening *b* therein, scum-outlet H, and scum-deflector *k*, all arranged substantially as described, and for the purposes set forth.

4. In a feed-water heater, the combination, with the steam-chamber A, tube-sheet *c*, tubes *g*, open at both ends, and cap I, of cap L, having water-inlet E, and plate G, dividing the chamber of cap L into two separate portions inclined toward the opening E, and adapted to force the liquid entering at E into the tubes *g*, substantially as described.

5. In a feed-water heater, the combination, with the steam-chamber, water-pipes traversing the same, and tube-plates, of cap L, water inlet and outlet openings, inclined partition G within said cap, and hood *o* over the water-outlet, substantially as described, and for the purposes set forth.

JULES JOHN JOSEPH DE RYCKE.

Witnesses:
HENRY M. TURK,
E. L. SHERMAN.