# A. ORME & W. H. BURK.

## Feed-Water Heater.

No. 163,100. Patented May 11, 1875.

Fig. 1

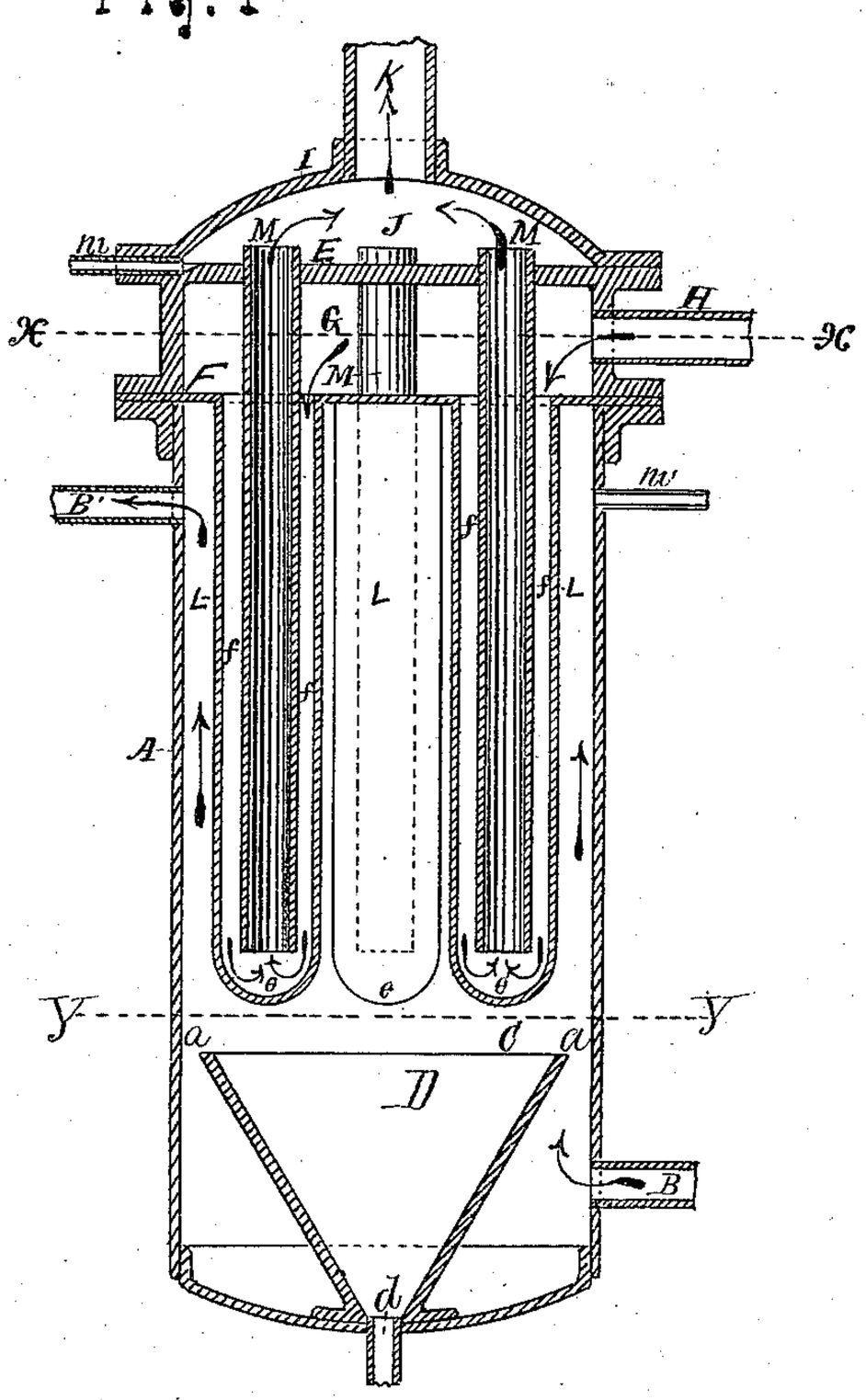



Fig. 2

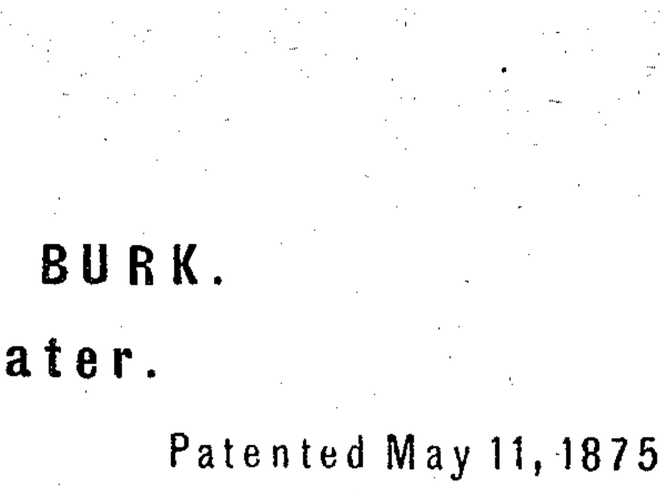
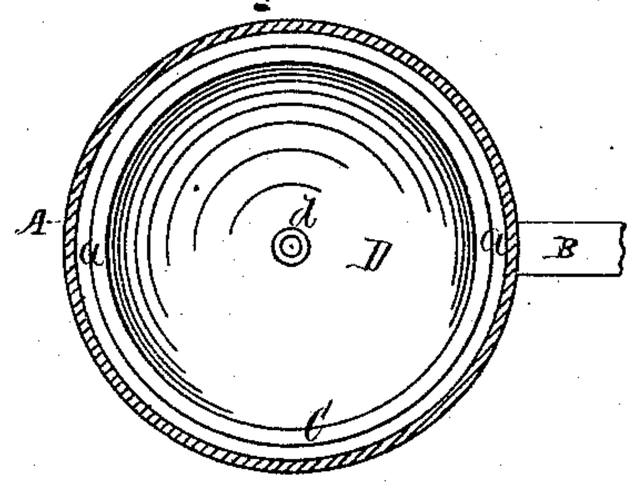



Fig. 3

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# UNITED STATES PATENT OFFICE.

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## IMPROVEMENT IN FEED-WATER HEATERS.

Specification forming part of Letters Patent No. **163,100**, dated May 11, 1875; application filed April 8, 1875.

*To all whom it may concern:*

Be it known that we, ALEXANDER ORME and WILLIAM H. BURK, of Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Feed-Water Heaters; and we do hereby declare the following to be a full, clear, and exact description thereof, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawing, forming part of this specification, in which—

Figure 1 is a vertical central section of a feed-water heater embodying our said invention. Fig. 2 is a sectional plan taken on the line *x x* drawn across Fig. 1, and Fig. 3 is a like plan taken on the line *y y*.

Similar letters of reference indicate like parts in the several figures of the drawing.

Our invention has for its object to provide a feed-water heater used in conjunction with steam-boilers, and arranged to heat the feed-water before it enters the boiler by means of the exhaust steam, and to prevent the sediment in the water from entering the boiler; and to that end it consists in providing the lower extremity of the heater-case with a funnel-shaped diaphragm, adapted to form a dead-water chamber, into which the sediment accumulates, and so arranged as to prevent the water, as it is injected into the heater, from agitating the water in the chamber, whereby the sediment is allowed to settle, and admit of its being drawn off through the lower extremity of the case. It further consists in the combination of the parts employed to conduct the exhaust steam through the water, whereby the latter is heated, as will be more fully understood by the following description:

In the drawing, A represents the outer case of the heater proper, which is made in a cylindrical form, of sheet metal, and of any requisite size to insure the proper heating capacity. B is the induction-pipe, through which the water is injected into the case; and B′ is the eduction-pipe, through which the water passes from the heater into the boiler. C is a funnel-shaped diaphragm, the lower and smaller end of which is permanently attached to the bottom of the case, as shown in Fig. 1. The diameter of the upper end of this diaphragm is slightly less than the diameter of the cavity of the case, forming an annular space, *a*, between its periphery and the inner surface of the case, through which the volume of water ascends. The arrangement of this diaphragm is such as to form a chamber or reservoir, D, which communicates with the discharge-pipe *d* through the bottom of the case. Permanently attached to the upper portion of the case, or made a part of the same, are diaphragms E F, which cover the area of the cavity, forming a chamber, G, into which the exhaust steam from the boilers is conducted through pipe H. Permanently secured to the upper end of the case is a convexed cover, I, so arranged as to form a primary steam-chamber, J, between it and diaphragm E. Attached to this case, and communicating with chamber J, is the exhaust-pipe K, through which the steam escapes from the heater. Permanently attached to diaphragm F, and communicating with chamber G, is a series of depending tubes, L, extending downward to a point near the upper edge of diaphragm C. The lower end of each of these tubes is made tight, and in a spherical form, as shown at *e*, Fig. 1. Permanently attached to diaphragm E, and communicating with chamber J, is a series of open-ended tubes, M, the latter passing downward through diaphragm F into the cavities of tubes L, and extend to a point near the lower end of the same. The gross diameter of each of these tubes is less than the diameter of the cavity in tubes L, forming an annular space, *f*, between the outer side of the former and inner side of the latter, as shown in Figs. 1 and 2. The sectional area of each of these spaces is equal to the sectional area of the cavity in each tube M, the object of which is to allow a free passage of steam through them. *m* is an escape-pipe, which communicates with chamber J, through which the accumulation of water from the exhaust steam escapes from said chamber. *m′* is an escape-pipe, which communicates with the interior of the case, and is provided with a safety-valve, (not shown,) through which the water passes from the heater when the pressure exceeds the limit allowed.

The operation of our invention is as follows: The water to be heated is injected into case A

through pipe B, filling the former, while at the same time the exhaust steam is admitted into chamber G through pipe H, and by its impact it is forced downward through space *f* of tubes L, thence upward through tubes M into chamber J, and exhausts therefrom through pipe K, producing a continuous current of steam through the tubes, and by the radiation of heat therefrom the water in the upper portion of the heater is properly heated, while that in the lower portion remains comparatively cool; and as the column of water enters the case through pipe B it ascends through space *a*, forcing an equal amount of heated water out of the heater into the boiler through pipe B′; and by means of diaphragm C, the central column of water in the heater, as well as that in chamber D of the diaphragm, is prevented from being agitated by the force of the injected volume through pipe B, thus allowing the sediment to settle, when it may be drawn off through discharge-pipe *d*. By arranging the heating-tubes in the upper portion of the heater only, so that the steam is admitted and discharged at the top, and extending them downward to a point slightly below the center of the case, only the upper portion of the column of water is heated by direct radiation from the pipes, thus preventing a descending current, which would have a tendency to agitate the water, and thus keep the sediment continually in motion, and prevent it from settling into chamber D as it is liberated by the action of the heat; and by causing the injected volume of water to come in contact with the outer surface of the diaphragm, the latter, as well as the column of water within it, is kept comparatively cool, which prevents the sediment from adhering to the walls of the diaphragm; consequently, as the water is free from agitation, a greater amount of sediment is deposited within chamber D before the water enters the boiler than with the heaters now in use.

Having thus described our invention, we claim—

1. The chambers J G and depending tubes L and M, attached at their upper ends to the diaphragms E and F, all acting in conjunction to admit and discharge the steam at the upper end of the heater, whereby only the upper portion of the column of water is heated by direct radiation of heat, as specified.

2. The diaphragm C, located at the base of the heater, and arranged to form the annular space *a*, through which the volume of water ascends, as specified.

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