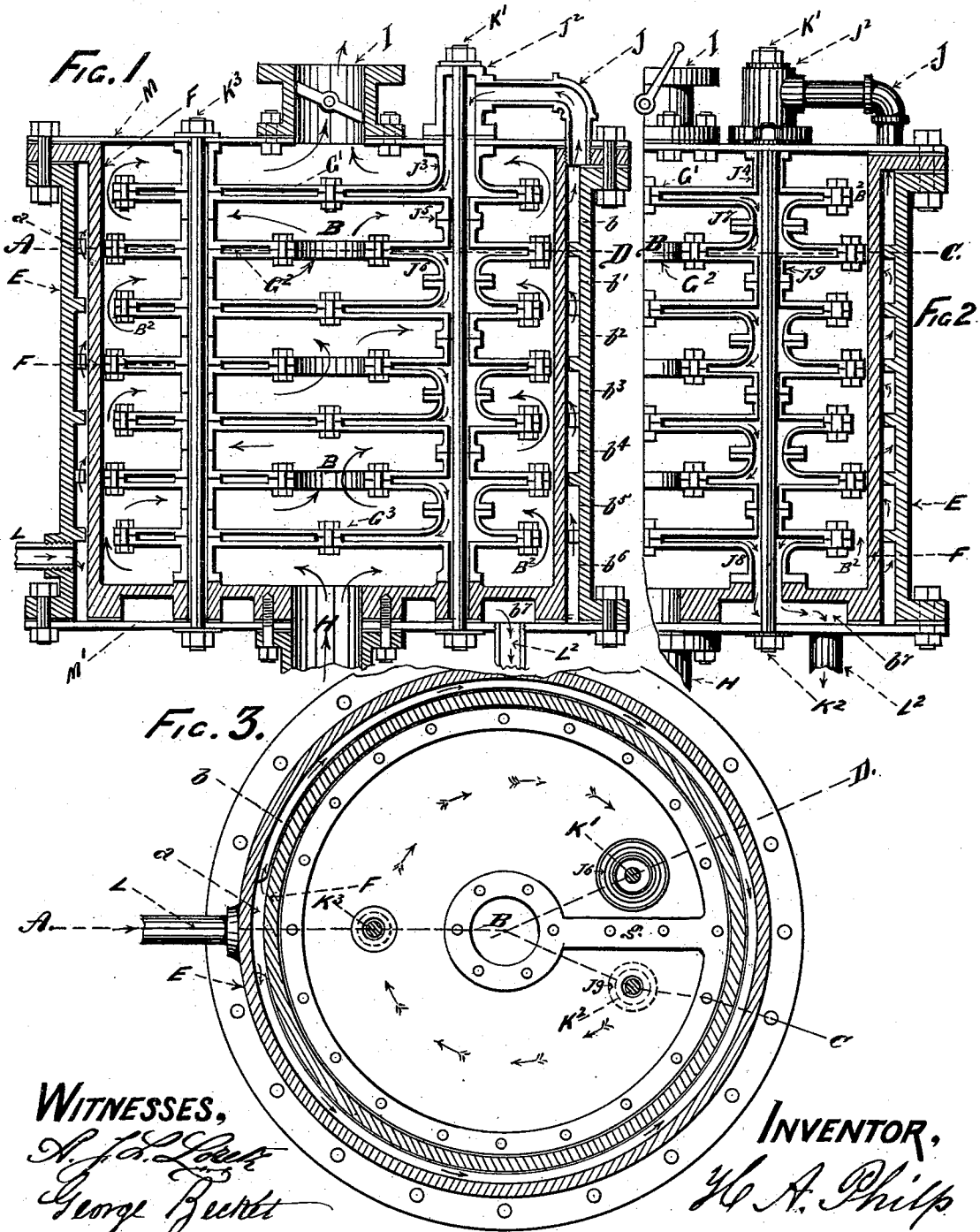


H. A. PHILP.
FEED-WATER HEATER.

No. 178,325.

Patented June 6, 1876.



WITNESSES,
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IMPROVEMENT IN FEED-WATER HEATERS.

Specification forming part of Letters Patent No. **178,325**, dated June 6, 1876; application filed November 20, 1875.

To all whom it may concern:

Be it known that I, HENRY A. PHILP, of the city of Brooklyn, in the county of Kings and State of New York, have invented a Feed-Water Heater, of which the following is a specification:

My invention has in view the production of an apparatus for the purpose of heating the feed-water of boilers by the exhaust steam of an engine; and consists in heating the said water by passing it in thin sheets between two metallic plates, a series of which, provided with proper openings and connections for the circulation of the water, are connected together and placed within a cylindrical jacketed chamber, into which the exhaust steam is introduced for the purpose of heating the exterior surface of these plates, in the manner hereinafter described.

The water is first introduced into the jacket of said cylinder before entering the series of plates for the purpose of absorbing what heat is produced by the exhaust steam against the interior surface of said cylinder, thereby utilizing what heat might have been produced and lost by the radiation of the exterior surface of a single cylinder, which arrangement, when complete, will prove both effective in operation and cheap in construction.

Figure 1 is a sectional elevation through Fig. 3 at a point corresponding with the section-line of the latter, A B K¹ D, showing the manner in which the metallic plates are secured together and into the jacketed cylinder; also, in part, the water-connections between said plates, connections J J² between jacket and plates, inlet and outlet pipe L L²; also, the manner in which the exhaust steam enters the lower nozzle H of jacketed cylinder E F, strikes the lower plate of the lower section G³, passing around the circumference B², in between the last-mentioned and next plate, and so on through delivery-nozzle I, provided with a valve.

Fig. 2 is a sectional elevation through Fig. 3, at a point corresponding with the sectional line in the latter, B K² C, showing more particularly the alternate water-connections between the plates, (not shown in Fig. 1;) also showing the connections J³ between the last

plate G³ of the series and the bottom space b⁷, connecting with the delivery-nozzle L².

Fig. 3 is a sectional plan taken through line A D of Fig. 1, and B C of Fig. 2, showing the position of the three bolts K¹ K² K³, which bolt together the series of plates and secure the same within the jacketed cylinder E F; also represents the division-piece g in the plate, for the purpose of reversing and causing the water to move around in the space formed by the two plates, as represented by the arrows from the inlet and outlet nozzles.

The construction and operation of the heater are as follows: The feed-water enters the lower left-hand corner of the jacketed cylinder through the pipe and nozzle L, Fig. 1, passes around the space b⁶ from left to right, from b⁶ to b⁵ by means of an opening in the division-flange, which divides b⁶ and b⁵ into two separate compartments, (the communicating openings being similar to that shown at a, Fig. 3, on the left-hand side;) from thence into the space b⁵ to the left, and up in a like manner into space b⁴, and so on until the water arrives to b, from which it passes into and through the connections J J², and into the first section G¹ by connecting-nozzle J³, Fig. 1; from thence passes in between the two metallic plates, from J³, Fig. 1, to J⁷, Fig. 2, (in an opposite direction to that as represented by the arrows passing from J³ to J⁶, Fig. 3,) from J⁷ into section G², Fig. 2, moving in an opposite direction from the latter, and as represented by the arrows in Fig. 3, which is a plan of that particular section; and from thence to the nozzle communicating with the next section, and so on until arriving to the last section G³, Fig. 1, which delivers through nozzle J⁸, Fig. 2, into the space b⁷, formed by the lower portion of the internal cylinder and bottom plate M', to which the outlet-pipe L² is attached, and from which the hot water heated by the passage of the exhaust steam through the jacketed cylinder, in the manner hereinafter described, passes to the force-pump or boiler direct.

The steam enters the nozzle H at the bottom of the jacketed cylinder E F, Fig. 1, strikes the lower plate of the section G³, passes around its circumference B², at the same time heating the interior portion of cylinder F at

space b^6 , passing in between the last-mentioned section and the next, through the center B of this last, in between this and the next, around the circumference of this last, and so on until the exhaust steam reaches the upper portion of the heater, when then the steam passes off through the nozzle I, provided with a valve, as shown, Fig. 1, to regulate the density of the steam, if so desired.

Having explained the object, construction, and operation of my invention, what I claim is—

A jacketed cylinder, E F, with top and bottom plates M M', provided with inlet steam-

nozzle H and outlet-nozzle I, arranged with a valve, and also provided with inlet and outlet water - nozzles L L', and arranged with compartments $b^1 b^2 b^3$ to b^6 , for the purpose specified, in combination with the plates G¹, G², and G³, arranged with partition - piece g , and connecting - nozzles J³ J⁷ J⁶ J⁸, and connecting-piece J J², when all constructed and arranged for operation as and for the purpose specified.

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Witnesses:

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