

(No Model.)

H. WILSON.  
FEED WATER HEATER.

No. 354,368.

Patented Dec. 14, 1886.

FIG. 1.

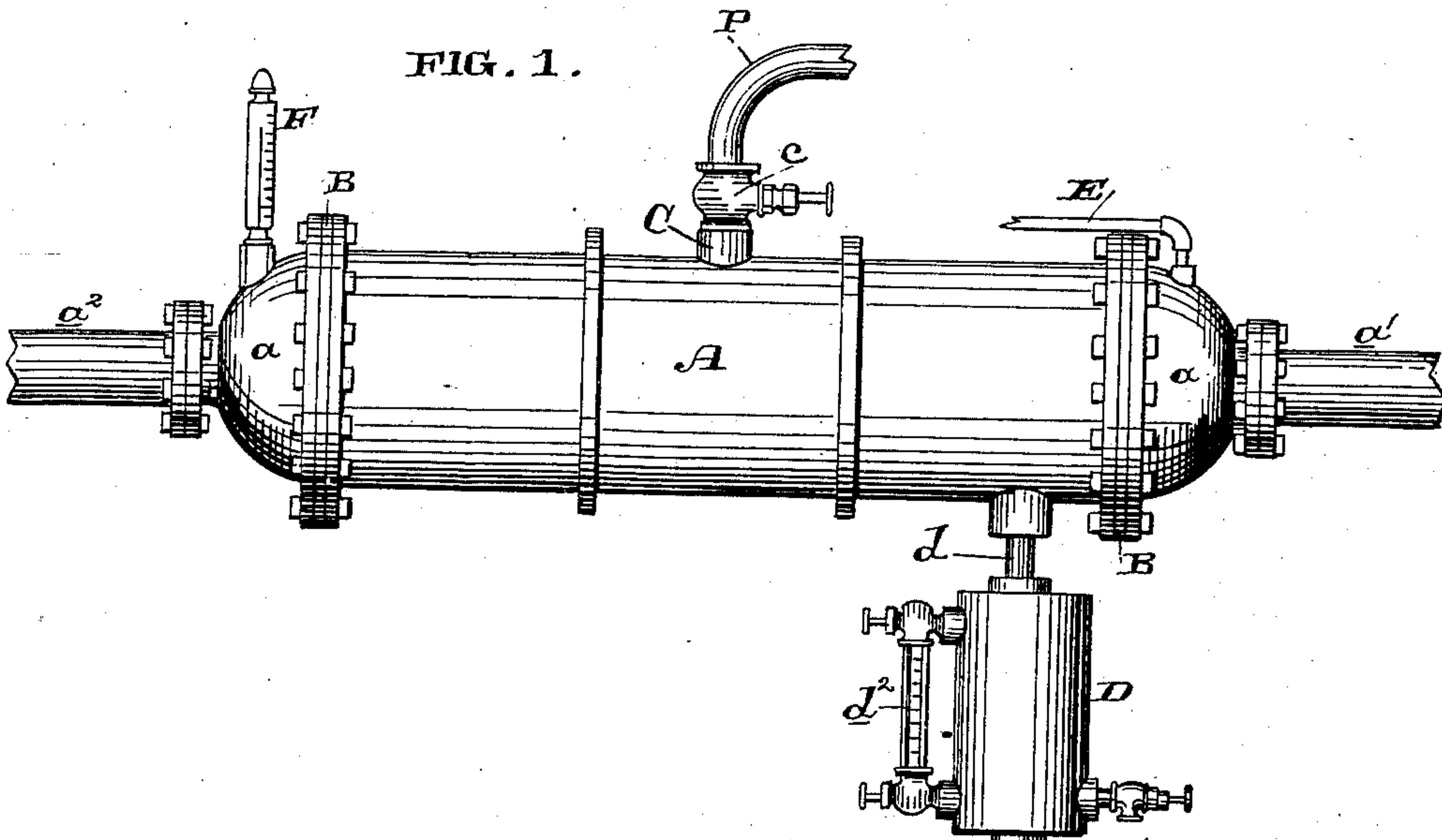


FIG. 2.

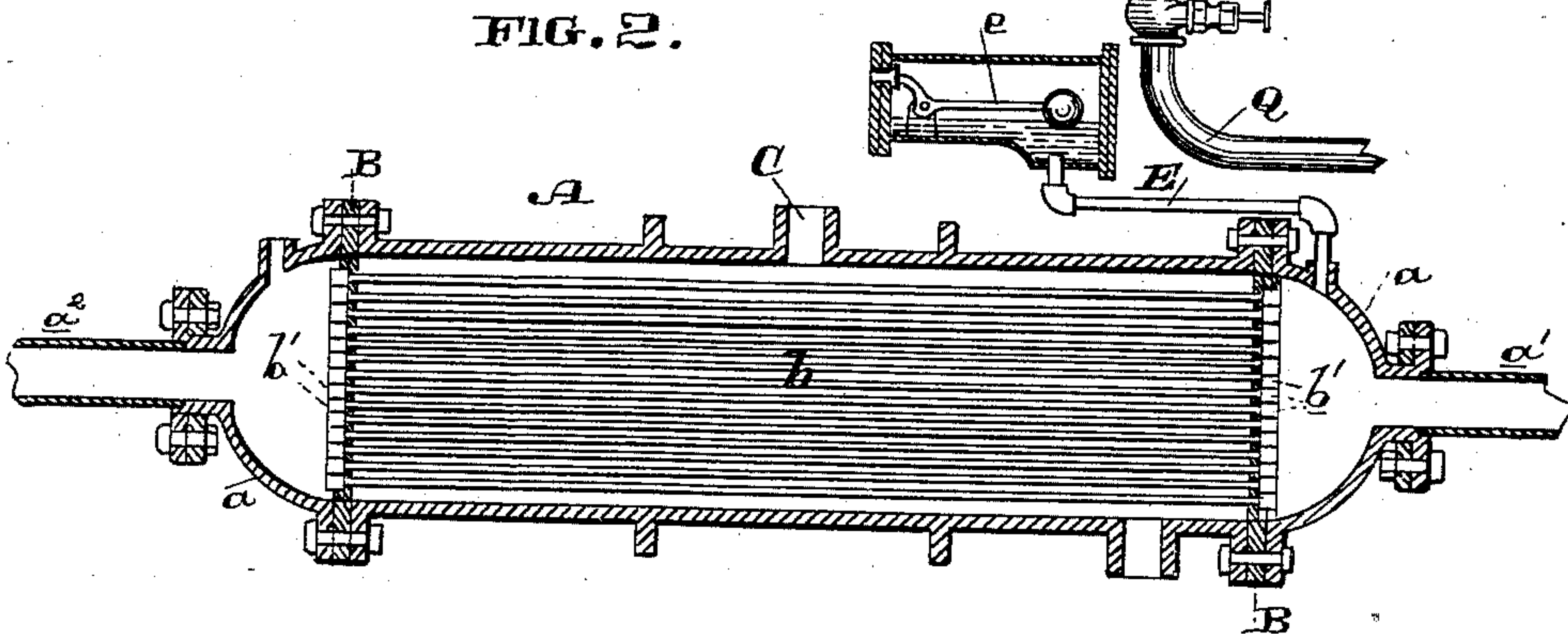
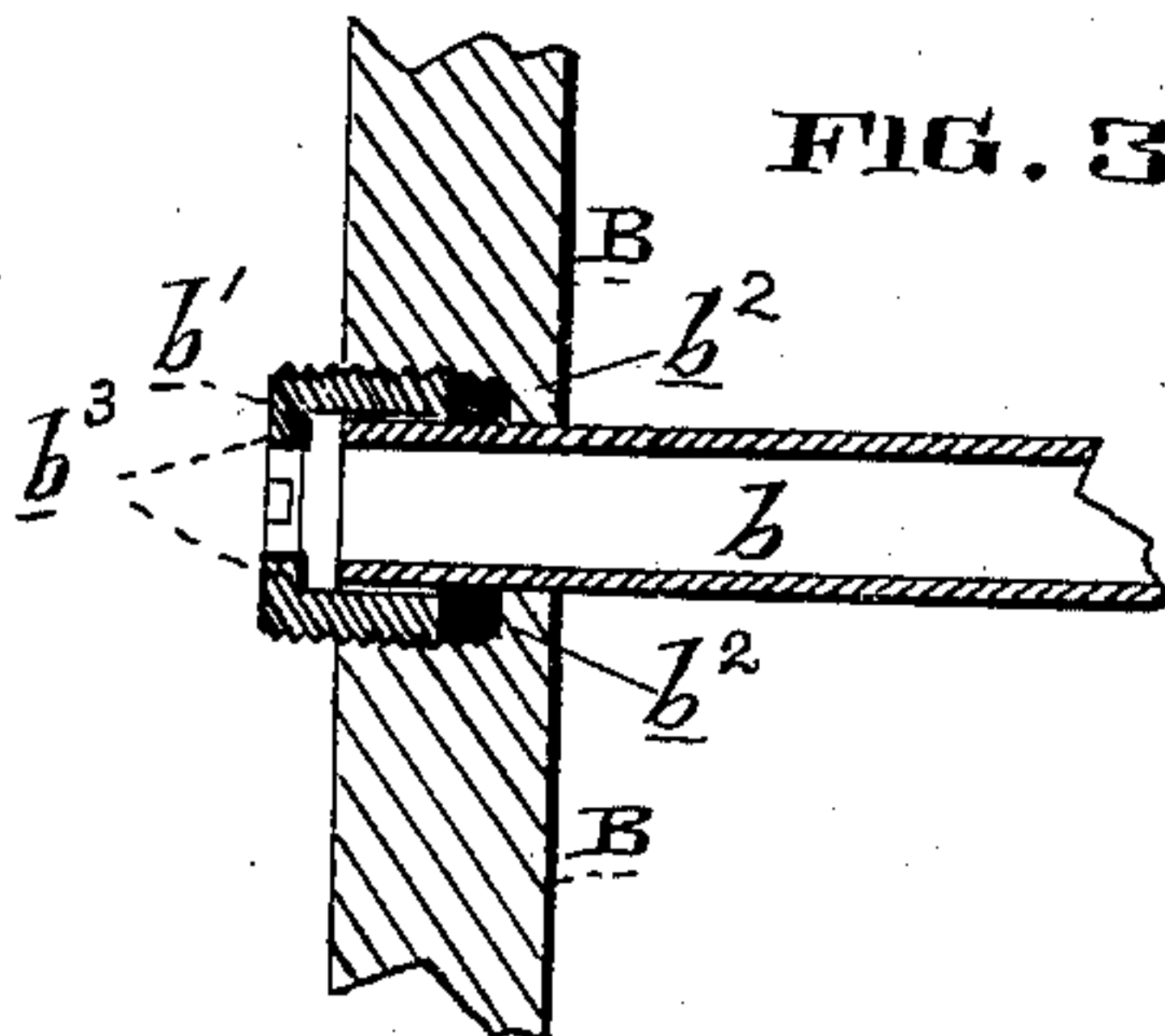


FIG. 3.



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# UNITED STATES PATENT OFFICE.

HARRY WILSON, OF PHILADELPHIA, PENNSYLVANIA.

## FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 354,368, dated December 14, 1886.

Application filed April 3, 1886. Serial No. 197,721. (No model.)

*To all whom it may concern:*

Be it known that I, HARRY WILSON, of Philadelphia, Philadelphia county, State of Pennsylvania, have invented an Improvement in Feed-Water Heaters; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to the class of feed-water heaters for steam-boilers, especially for those upon steamers, where superheated steam is used; and my invention consists, essentially, in a suitable feed-water heater connected directly with the steam-drum of the boiler, whereby it may receive live steam, by which the water is raised to a much higher temperature than could be attained with exhaust-steam.

It consists, particularly, in the cylinder, its heads, tube-sheets, and tubes, its air-pipe and controlling-valves, and its drain and controlling cock and indicator, hereinafter fully described, together with details of construction.

Feed-water heaters have heretofore been supplied with exhaust-steam. This steam does not raise the temperature of the water sufficiently, and its use is frequently inconvenient, and sometimes impossible, as when the engine is stopped.

The main object of my invention is to supply the feed-water heater with live steam, whereby the water is heated more effectively; and to this end I make a heater which can be connected directly with the steam-drum of the boiler, and can be so adjusted and regulated that all the objections to such a source of heat are avoided.

Referring to the accompanying drawings for a more complete explanation of my invention, Figure 1 is an elevation of my feed-water heater. Fig. 2 is a vertical longitudinal section of the main cylinder. Fig. 3 is a detail section showing the means by which the tubes are secured in the tube-sheets.

A is the main cylinder, having bolted to it heads  $a$ , with which communicate the inlet-pipe  $a'$  and the discharge pipe or outlet  $a''$ . Within the cylinder, at each end, and bolted between the flanges of the heads and the ends of the cylinder, are brass tube-sheets B, into which are let the longitudinal tubes  $b$ . These tubes are secured in the sheets in the manner

shown in Fig. 3. They pass through an aperture in the sheet and receive an encircling screw-gland,  $b'$ , between the inner end of which and the tube-sheet is a packing,  $b^2$ . The outer end of the screw-gland is provided with an inwardly-extending flange,  $b^3$ , which prevents the tubes from creeping longitudinally. On the body of the cylinder is the port C, on which is secured a valved coupling,  $c$ , with which the connection P from the steam-drum of the boiler (not here shown) is made, whereby live steam is admitted directly to the cylinder.

Connected by a short pipe,  $d$ , with the lower portion of the cylinder is the drain-cylinder D, provided with a suitable valved outlet,  $d'$ , and also with a gage-glass,  $d^2$ , on its side for indicating the amount of drain-water within the cylinder. The drain-cylinder is connected by pipe Q with the condenser or hot-well.

E is an air-relieving pipe from either head of the cylinder, preferably the inlet-head. An automatic float-actuated valve,  $e$ , controls the air-pipe.

F is a thermometer on the discharge-head of said cylinder.

The heater is intended to be situated between the feed-pumps and the boiler. Consequently, the pressure of steam and water being equal, there is no unequal strain, whereby leaks might be caused.

The operation of the heater is as follows: The condensed water derived from the exhaust-steam is forced by suitable pumps (not shown) into the inlet  $a'$ , where, finding space in the inlet-head, it spreads out and passes in streams through the tubes within the cylinder. Live steam is taken directly from the steam-drum of the boiler and introduced through the valved port C into the cylinder, in which it completely surrounds the tubes, and thereby raises the degree of temperature of the feed-water as it passes through said tubes, so that when it comes out at the discharge-head its temperature is sufficiently high to admit it at once to the boilers. The condensation of the steam within the cylinder passes out into the drain-cylinder D, and the amount, as before stated, is indicated in the gage-glass  $d^2$ , so that a certain depth of water may be kept in the drain-cylinder to prevent the live steam from blowing directly through the main



cylinder into the condenser or hot-well. The  
valved outlet of the drain-cylinder is kept par-  
tially open, and is regulated according to the  
condensation, so that a sufficient quantity of  
5 water may be kept in the cylinder. There is  
always more or less air taken in by the pumps,  
and which accompanies the water into the cyl-  
inder; but instead of entering the tubes this  
air passes out directly from the entrance-head  
10 into pipe E and blows off through valve *e*,  
which closes again as the water rises. In this  
way the accumulation of air in the heater is  
avoided. The heater may be placed in either  
a vertical or a horizontal position, as may be  
15 required. By increasing the temperature of  
the feed-water, which results from the use of  
live steam, undue expansion in the boilers is  
prevented and the consequent leaks in the  
seams and rivets are avoided. The steam be-  
20 ing generated in the boiler at a temperature  
corresponding to the pressure, it passes through  
a suitable superheater, acquiring a much  
greater degree of heat, and the heat thus ob-  
tained is given to the feed-water, the temper-  
25 ature of which is increased in a much greater  
proportion than could otherwise be obtained,  
and consequently, less heat being required to  
generate steam, there is a saving of fuel.

Having thus described my invention, what I  
30 claim as new, and desire to secure by Letters  
Patent, is—

1. In combination with a feed-water heater,

the air-relieving pipe connected with the head  
of the heater and controlled by an automatic  
valve, substantially as herein described. 35

2. In a feed-water heater, the cylinder A,  
having heads *a*, with which the inlet and out-  
let pipes communicate, the tube-sheets B, and  
tubes *b* in combination with the air-relieving  
pipe E from the head *a*, and the valve con- 40  
trolling said pipe, substantially as herein de-  
scribed.

3. In a feed-water heater the cylinder A,  
supplied with live steam from the boiler, and  
the tubes *b* in the cylinder, in combination 45  
with the drain-cylinder D, connected with the  
cylinder A, and the valved outlet *d'* from said  
drain-cylinder, substantially as herein de-  
scribed.

4. A feed-water heater comprising the cyl- 50  
inder A, having heads *a*, tube-sheets B, and  
tubes *b*, said cylinder being supplied with live  
steam from the boiler, the air-relieving pipe  
E, and the drain-cylinder D, having valved  
outlet *d'*, and a gage-glass, *d''*, all arranged and 55  
adapted to operate substantially as herein de-  
scribed.

In witness whereof I have hereunto set my  
hand.

HARRY WILSON.

Witnesses:

S. H. NOURSE,  
H. C. LEE.