

No. 616,431.

Patented Dec. 20, 1898.

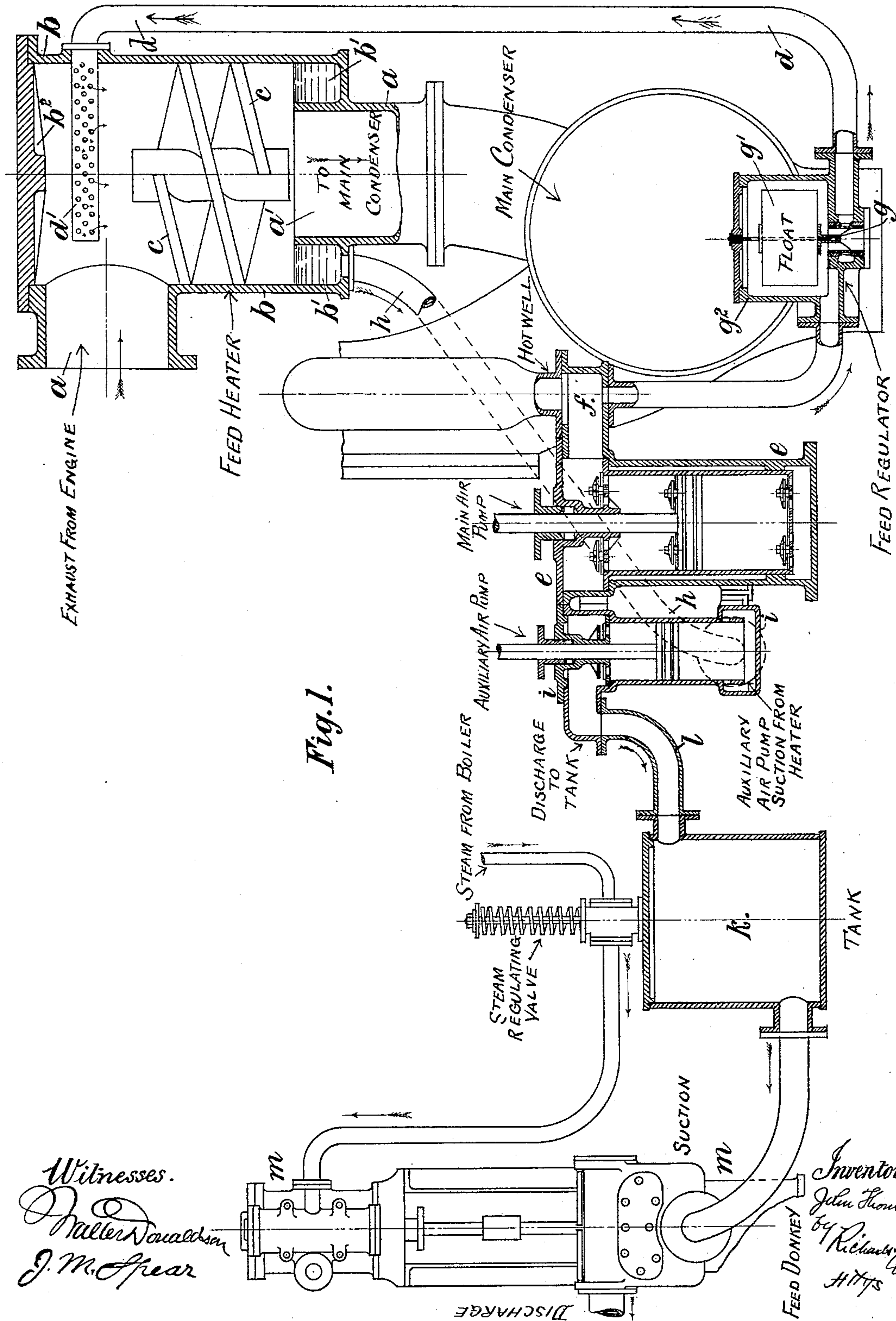
J. THOM.

BOILER FEED WATER HEATING APPARATUS.

(Application filed Apr. 23, 1898.)

(No Model.)

3 Sheets—Sheet 1.



Witnesses.
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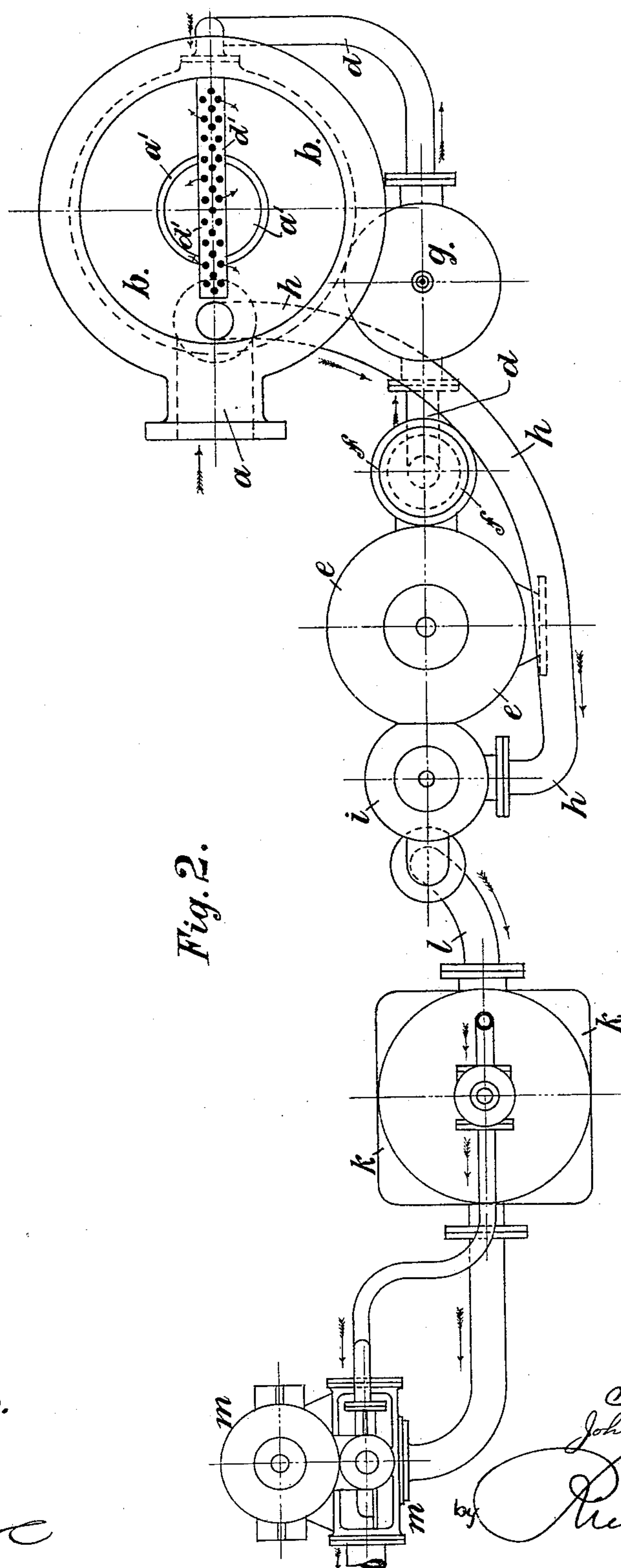


Fig. 2.

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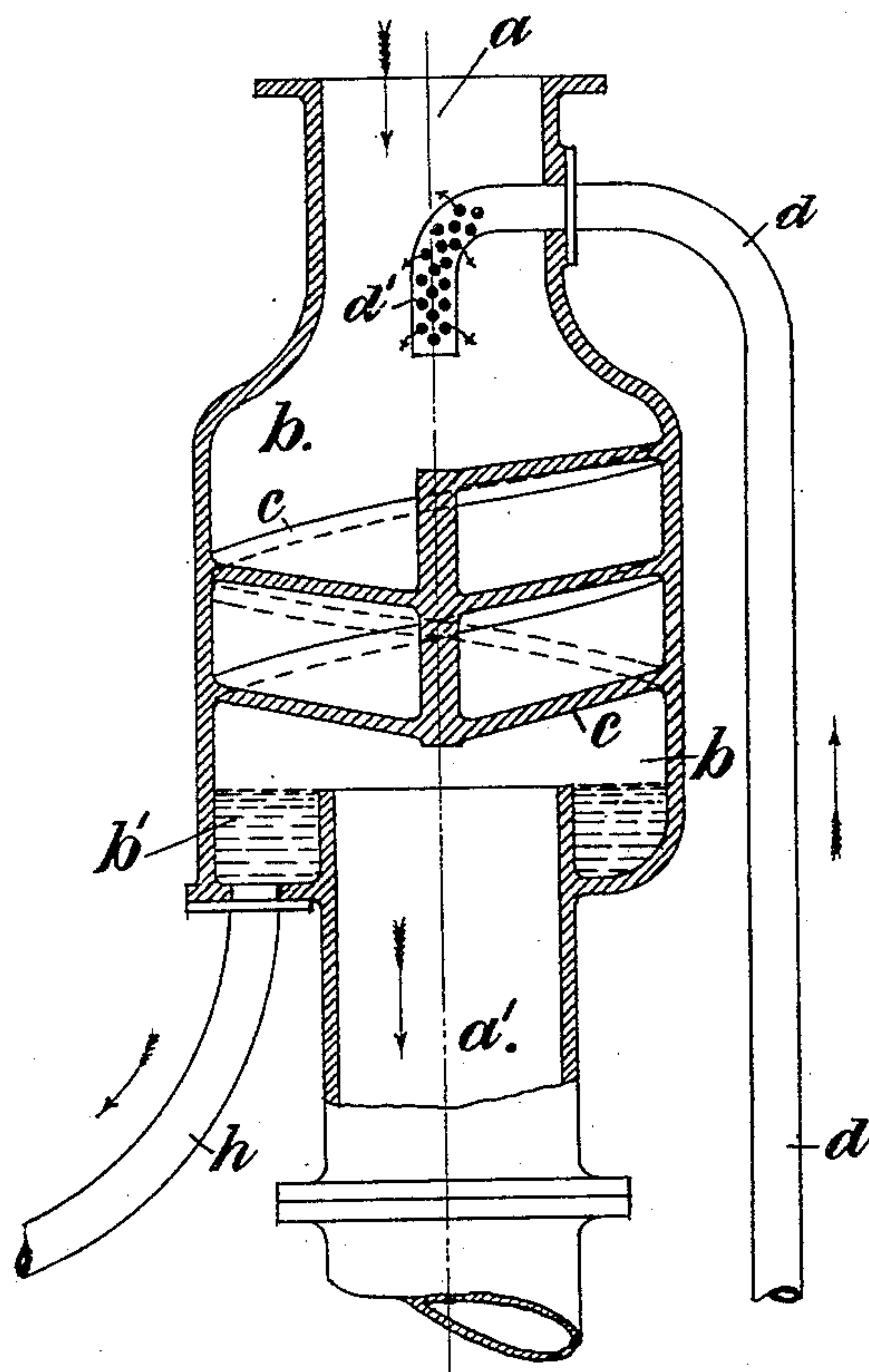
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3 Sheets—Sheet 3.

Fig. 3.



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UNITED STATES PATENT OFFICE.

JOHN THOM, OF GLASGOW, SCOTLAND.

BOILER FEED-WATER-HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 616,431, dated December 20, 1898.

Application filed April 23, 1898. Serial No. 678,630. (No model.)

To all whom it may concern:

Be it known that I, JOHN THOM, consulting engineer, residing at Glasgow, in the county of Lanark, Scotland, have invented an Improvement in Boiler Feed-Water-Heating Apparatus, of which the following is a specification.

This invention has reference to the heating of the feed-water supplied to steam-generators used in connection with and for driving steam-engines and wherein the exhaust-steam from the engines is employed in the heating of this feed-water.

According to this invention the feed-water is heated by discharging it, say in suitable spray form, in among the steam in the exhaust-steam pipe (or chamber) of the engine, within which is provided a means or device so arranged that the water so discharged into the pipe is collected at a lower point, from which point it is drawn off by the auxiliary air-pump or feed-pump and delivered to the steam-generator, while the uncondensed steam passes away through a pipe past the point at which the water is collected to a condenser for condensing it. The water resulting from this condensation of steam in the condenser is drawn up by the vacuum from the hot-well on the main air-pump discharge to the point in the exhaust-steam pipe at which the water is discharged into it. Thus in this case the feed-water at the temperature at which it is withdrawn from the main condenser hot-well or air-pump discharge is further heated by being introduced into the steam-exhaust pipe at a point above the condenser where it is hotter, and consequently receives additional heat. The supply of water from the hot-well or air-pump discharge is regulated, say, by a regulating-valve or the like controlled by a float, and is drawn up to the heating part, as described.

The drawings hereto annexed illustrate the invention.

Figure 1 is a front sectional elevation showing the various parts used in connection with a condensing steam-engine, and Fig. 2 a plan of same with parts omitted.

Referring to the drawings, *a* represents the pipe or conduit by which the exhaust-steam is conducted from the engine to the main condenser for creating and maintaining vacuum

in the low-pressure cylinder or cylinders, and *b* a chamber thereon having within a spiral diaphragm or web *c*.

a' is an extension of the pipe *a*, which stands above the level of the bottom of the chamber *b*, and the annular space *b'* around which constitutes a receiving vessel for water which falls from the spiral diaphragm *c*.

d is a pipe by which the water from the main condenser and which is to be heated and fed to the steam-generator supplying the engines with steam is conducted from the hot-well of the condenser air-pump to the exhaust-pipe *a*, above the diaphragm *c*, *d'* being a distributing-rose on the end of *d*, by which the water is sprayed into the exhaust-steam in the cylinder *b* coming from the engine.

e is the main air-pump for withdrawing air and condensed water from the condenser and admitting it to the chamber *b*, *f* being the hot-well of this pump, to which the water-supply pipe *d* is connected, and *g* is a valve on the pipe *d* for regulating the supply of water from the hot-well to the chamber *b*, *g'* being a float carrying the valve *g* and contained within the casing *g²*, by which the valve *g* is operated, said float and valve being adapted to be raised by water in the case *g²* when there is a certain quantity of water in it and the valve *g* opened and to fall, and the valve *g* closed when the water in *g²* falls below a certain point. By this means the action of the air-pump *e* is not interfered with and the float prevents air being drawn into the condenser from the hot-well.

h is a pipe connected with the bottom of the chamber *b'* for drawing off the water from this chamber, and *i* is a second air-pump, to the inlet of which the pipe *h* is connected and by which the water and air from the chamber *b'* is drawn off.

k is a tank into which the water from the pump *i* is discharged, *l* being the discharge pipe connecting the pump *i* with the tank.

m is a donkey-pump for drawing off the hot water from the tank *k* and for feeding the steam-generator with the hot water.

In action the condensed water from the main engine-condenser is pumped by the air-pump *e* into the hot-well and drawn through the pipe *d* and into the heater *b* above the spiral diaphragm *c*, it being sprayed into the

steam coming from the engine by the pipe *a* by the perforated spraying-rose *d'*. The effect is that the fine jet or spray of water is heated by the exhaust-steam (some of which is also condensed by the water, which is of a lower temperature) and the steam and water pass down through the spiral space between the spiral diaphragm *c*, and the water separates from the steam and is delivered into the annular receiving part *b'* in the bottom *b* from the lower edge of the diaphragm, which is so arranged that no water falls into the pipe *a* below it, while the steam passes on freely into the upwardly-projecting part *a'* of the pipe *a* and away to the main condenser.

From the bottom chamber *b'* of the vessel *b* the heated water is drawn off by the secondary air-pump *i* and is forced by it into the hot-water tank *k*, from which it is drawn off by the pump *m* and delivered in its heated state to the steam-generator of the main engine. Thus by this means the hot water from the engine-condenser and hot-well *f* has its temperature raised very considerably by the exhaust-steam from the engine on its way to the condenser, and, further, the degree of vacuum in the condenser is enhanced, thus attaining a twofold advantage and augmentation of efficiency of the engines and boilers.

As regards the construction of the chamber *b* and parts connected with it, in Fig. 1, the steam is led in at the side by the pipe *a* and the diaphragm device *c* is a separate part—*i. e.*, is not an integral part of the chamber *b'*—while the top of the chamber is closed at the top by a detachable cover *b²*. Thus by removing this cover the diaphragm device *c* can be removed if and when desired. In the modification in Fig. 3 the chamber *b* and diaphragm device *c* are in one and the supply-steam pipe *a* is arranged directly above the device *c*.

In some cases the exhaust-steam from the auxiliary engines used in connection with the main engines, and as exist in the case of ships' propelling-engines, may be introduced into the chamber *b* and the heat of such steam employed to assist the raising of the temperature of the water to be heated and delivered by the pipe *d*, or it may receive the additional heat by passing the exhaust-steam from these engines through a pipe on the engine near where the water-spray is arranged, or in a separate pipe, vessel, or device, or it may receive the additional heat by passing the exhaust-steam from these engines through a pipe to the part or vessel where the feed-water is collected at the main feed-pump.

What is claimed in respect of the herein-described invention is—

1. In combination with the chamber *b*, the exhaust-steam pipe *a*, the inlet-pipe *d* for the water, both of said pipes being located at or near the top of the chamber *b*, the steam and water separating device in said chamber and the pipe *a'* and pipe *h* for the steam and water respectively leading from the lower part of the said chamber *b*, substantially as described.

2. In a feed-water-heating apparatus, the combination of the chamber *b*, engine steam-exhaust pipe *a* to which the chamber *b* is connected; the spiral diaphragm steam and water separating device *c* in *b*; the water-supply pipe *d*; water-collecting chamber *b'* in the bottom of *b*, around the inwardly-projecting part *a'* of the steam-pipe *a*; and the draw-off pipe *h*; substantially as set forth.

In witness whereof I have hereunto set my hand in presence of two witnesses.

JOHN THOM.

Witnesses:

ALEXANDER LOCKHART DICK,
ANTHONY BARTON.