

No. 788,114.

PATENTED APR. 25, 1905.

H. E. MOFFAT.

FEED WATER HEATER AND PURIFIER.

APPLICATION FILED MAY 22, 1903. RENEWED FEB. 20, 1905.

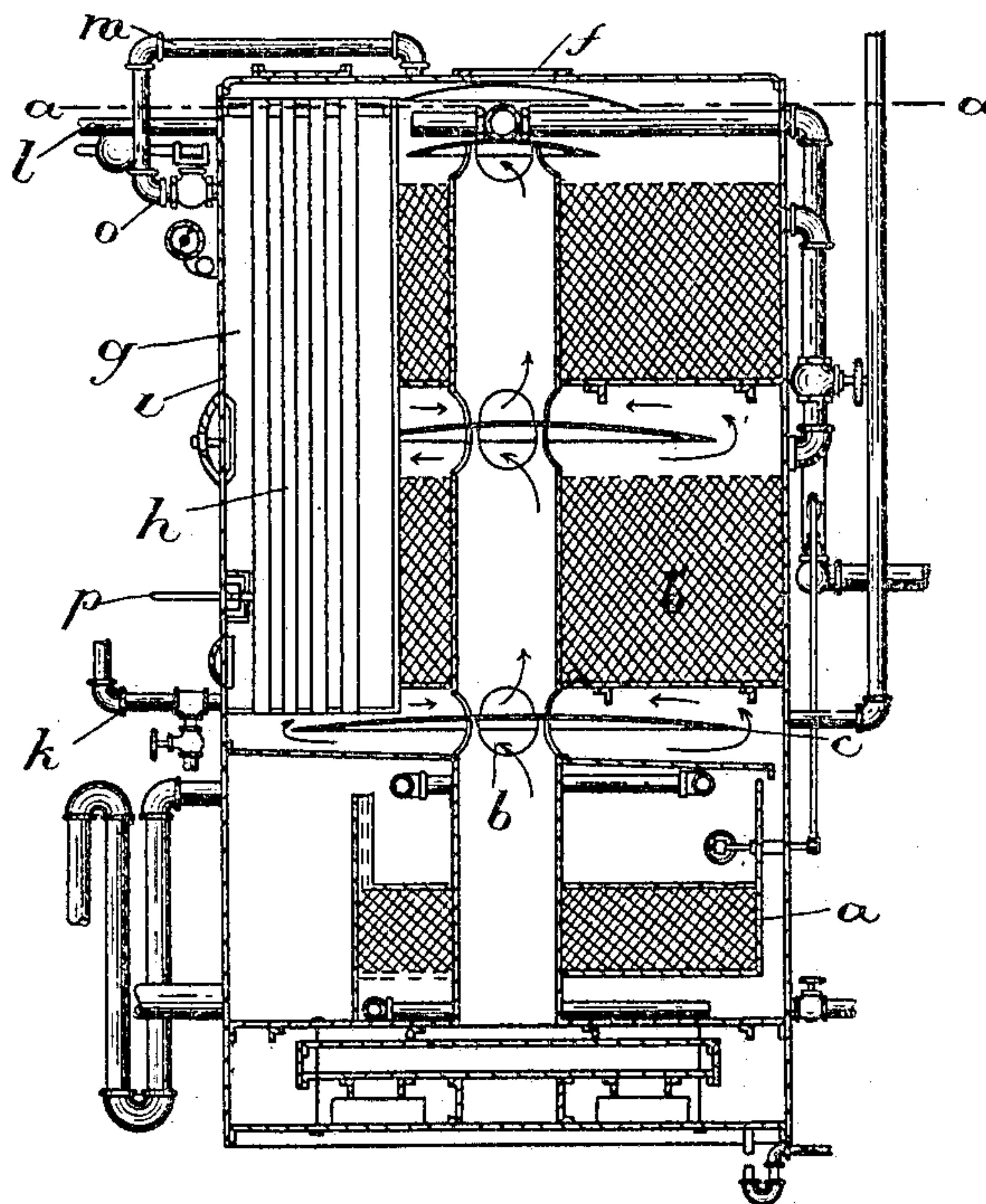


Fig. 1.

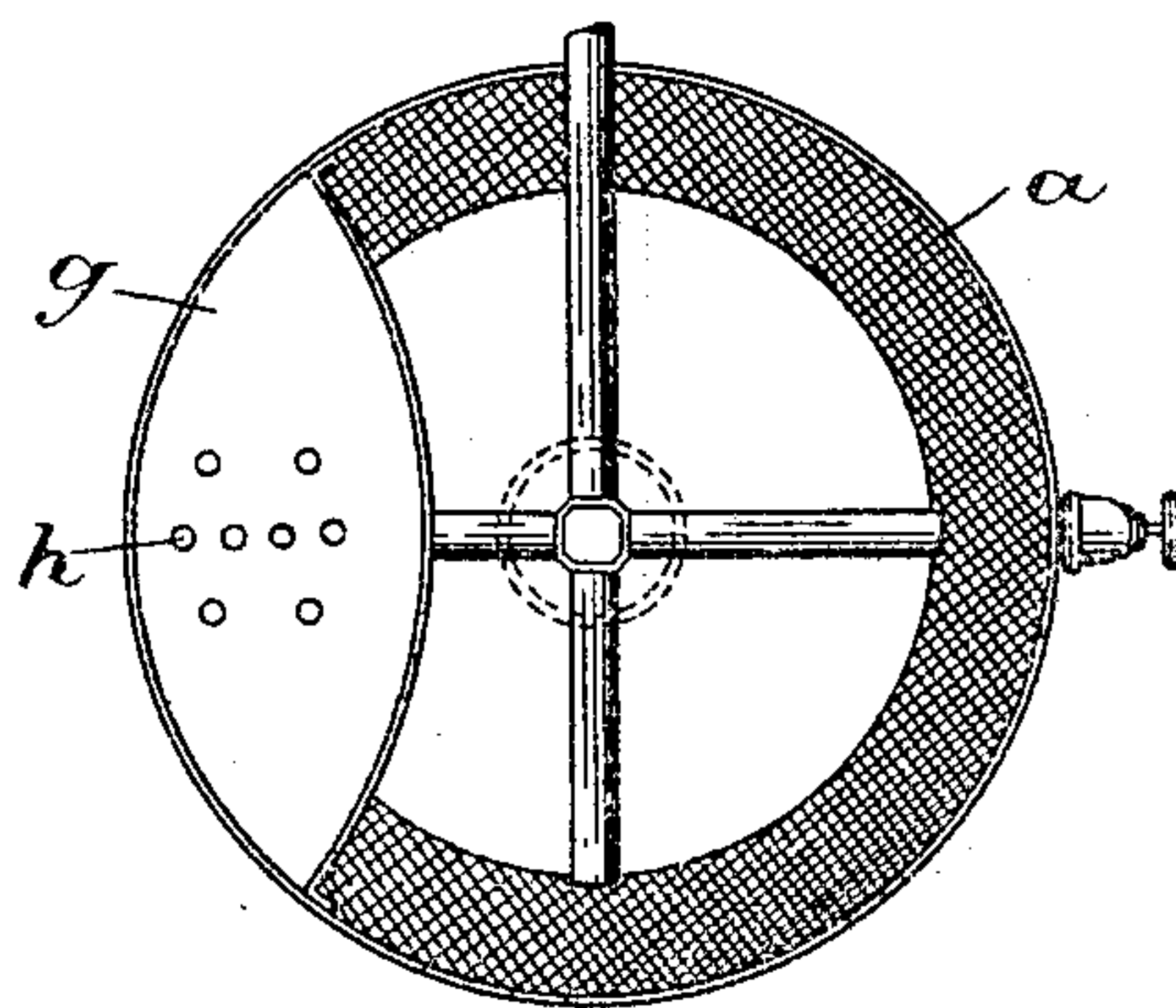


Fig. 2.

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UNITED STATES PATENT OFFICE.

HENRY ESSON MOFFAT, OF WOODSTOCK, CANADA.

FEED-WATER HEATER AND PURIFIER.

SPECIFICATION forming part of Letters Patent No. 788,114, dated April 25, 1905.

Application filed May 22, 1903. Renewed February 20, 1905. Serial No. 246,591.

To all whom it may concern:

Be it known that I, HENRY ESSON MOFFAT, of the city of Woodstock, in the county of Oxford and Province of Ontario, Canada, have invented certain new and useful Improvements in Water-Heating and Steam-Condensing Attachments for Feed-Water Heaters; and I hereby declare that the following is a full, clear, and exact description of the same.

In Letters Patent of the United States No. 541,751, issued to me on the 11th of June, 1895, I have shown and described a feed-water heater in which the boiler feed-water is introduced at the top and percolates through a series of filters to the pure-water chamber at the bottom of the apparatus, from which it is drawn off for boiler-feeding purposes, the impurities being removed from the water and retained in the filters and settling-chamber, and the boiler feed-water heated by the circulation through it of the exhaust-steam from the engines, pumps, or auxiliaries, which is discharged into the apparatus through a suitable inlet. It has been established, however, by the use of an apparatus of this character, that under certain conditions a large portion of the thermal units or calories are wasted by the inability of the boiler feed-water to absorb them as the steam passes from the steam-inlet to the steam-outlet; and it is the object of the present invention to provide this and other feed-water heaters with a water-heating attachment for domestic, manufacturing, and heat radiating or distributing purposes which can be heated by the absorption of the excess of heat units or calories of the steam ordinarily wasted. To attain this object, the water-heating attachment is placed within or attached to the shell of the feed-water heater and has steam tubes or passages in circulation with the steam-inlet of the feed-water heater, so that a portion of the exhaust-steam discharged into the feed-water heater will circulate through its steam tubes or passages and enable its contents to absorb the whole or a part of its thermal units or calories as it circulates through the steam tubes or passages to an exhaust-outlet, which when possible is connected with the interior of the feed-water heater at a point beyond the entrance of the

steam to the steam tubes or passages. When the water-heating attachment is located within the shell of the feed-water heater, its inner surface is exposed to and acted upon by and absorbs from the steam a portion of its thermal units or calories as it circulates through the feed-water heater to assist the steam circulating through the steam tubes or passages in heating the contents of the water-heating attachment.

As the feed-water heater described in the above patent is heated by the exhaust-steam from the engines, pumps, or auxiliaries, it will be understood that the number of wasted thermal units or calories will vary according to the horse-power consumed or transmitted, and that when the consumed horse-power represents more than the full absorbing capacity of the apparatus the waste of the thermal units will be in excess of the waste when the consumption is less than the full absorbing capacity of the apparatus, and that when the exhaust-steam admitted to the feed-water heater is in excess of what is required to heat the water for boiler-feeding purposes the surplus exhaust-steam can be employed to heat the water within the water-heating attachment; but when the exhaust-steam admitted to the feed-water heater is not in excess of what is required for heating the boiler feed-water it is necessary to provide the water-heating attachment with a connection through which live steam can be introduced directly into the water within it, and the introduction of which is also necessary to raise to and maintain the water within the water-heating attachment at the required temperature when the exhaust-steam has been cut off from the feed-water heater.

To maintain a water circulation within the water-heating attachment, it is fitted with the usual flow and supply pipes and also with a discharge-pipe connected with the water-space of the water-heating appliance and when possible with the feed-water heater, and this discharge-pipe is preferably fitted with a safety-valve regulated to open at any predetermined pressure within the water-heating attachment. The condensation from the steam passing through the steam tubes or passages of the

water-heating attachment drains into the feed-water heater and combines with the boiler feed-water passing through the apparatus to the pure-water chamber.

5 By means of this water-heating attachment I am able to not only heat a body of water for domestic, manufacturing, or heat radiating or distributing purposes, but I can also condense the exhaust-steam for boiler-feeding
10 purposes, thereby saving a large volume of water and corresponding amount of steam and fuel.

For a full understanding of the invention reference is to be had to the following description and to the accompanying drawings,
15 in which—

Figure 1 is a vertical sectional view of a feed-water heater and purifier with the water-heating and steam-condensing attachment.
20 Fig. 2 is a horizontal section on the lines *a a* of Fig. 1.

Like letters of reference refer to like parts throughout the specification and drawings.

The exhaust-steam from the engines, pumps,
25 or auxiliaries is admitted to the interior of the feed-water heater *a* through a steam-inlet *b* and is caused to circulate through the boiler feed-water as it descends through the filters *b'*, interposed between the steam and feed-
30 water inlets by a diaphragm or distributor *c* to enable the boiler feed-water to absorb the whole or a portion of its thermal units or calories as it circulates from the steam-inlet *b* to the feed-water inlet *f*. Under ordinary con-
35 ditions the boiler feed-water fails to absorb from the steam all of the thermal units or calories, and to utilize these unabsorbed thermal units or calories I provide the feed-water heater with a water-heating and steam-con-
40 densing attachment *g*, having its steam tubes or passages *h* in circulation with the steam-inlet of the feed-water heater. This water-heating and steam-condensing attachment *g* may be attached to the outer surface of the
45 feed-water-heater shell *i*; but I prefer to place it within the upper part of the shell, as by doing so I am able to relieve it of atmospheric influence and obtain the greatest number of thermal units or calories with the least ex-
50 penditure of steam or fuel. The steam tubes or passages *h* extend through the water-heating and steam-condensing attachment *g* and are connected at their upper ends with the interior of the feed-water heater at a point be-
55 yond the inlet to the steam tubes or passages.

In the use of the apparatus the exhaust-steam enters the feed-water heater through the steam-inlet *b*, and a portion of it during its circulation to the feed-water inlet *f* passes
60 into and through the steam tubes or passages *h*, and during its circulation through the steam tubes or passages its thermal units or calories are absorbed by the water-heating and steam-condensing attachment *g*, the condensation

from the tubes draining into the feed-water heater and mixing with the boiler feed-water.

To maintain a circulation and supply of water within the water-heating and steam-condensing attachment *g*, it is fitted with a valve-controlled supply-pipe *k* and a valve-controlled
70 flow-pipe *l*, and to relieve any excess pressure within the water-heating and steam-condensing attachment it is fitted with a discharge-pipe *m*, having a safety-valve *o*, capable of
75 being regulated to open at any predetermined pressure.

As it often happens that the supply of exhaust-steam is cut off from the feed-water heater, it is necessary to fit the water-heating and steam-condensing attachment with a con-
80 nection *p* for the admission of live steam directly into the water within it for the purpose of maintaining the water at the desired temperature when the supply of exhaust-steam has been cut off from the feed-water heater or
85 when such supply is not sufficient for more than the ordinary requirements of that part of the apparatus. When it is not necessary to raise the contents of the water-heating and steam-condensing attachment to a higher de-
90 gree of heat, the steam tubes or passages can be dispensed with and the water-heating and steam-condensing attachment can be heated by the circulation of steam against its inner surface.

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

1. The combination of a feed-water heater having steam and feed-water inlets respectively, and a filtering means interposed between the steam and feed-water inlets; with a tubular water-heating appliance having both ends of its tubes in circulation with the steam and water space of the feed-water heater between
105 the steam and feed-water inlets.

2. The combination of a feed-water heater having steam and feed-water inlets respectively, and a filtering means interposed between the steam and feed-water inlets with a tubular water-heating appliance having both ends of its tubes in circulation with the steam and water space of the feed-water heater between the steam and feed-water inlets, and flow and return pipes for the tubular water-heating ap-
115 pliance.

3. The combination of a feed-water heater having steam and feed-water inlets respectively and a filtering means interposed between the steam and feed-water inlets; with a tubular water-heating appliance having both ends of its tubes in circulation with the steam and water space of the feed-water heater between the steam and feed-water inlets, and a live-steam-feed pipe for the tubular water-heating
120 appliance.

4. The combination of a feed-water heater having steam and feed-water inlets respec-

tively, and a filtering means interposed between the steam and feed-water inlets; with a tubular water-heating appliance having both ends of its tubes in circulation with the steam and water space of the feed-water heater between the steam and feed-water inlets, flow and return pipes for the tubular water-heating appliance, a live-steam-feed pipe for the tubular water-heating appliance, and a safety-valve-controlled discharge-pipe.

5. The combination of a feed-water heater having steam and feed-water inlets respectively, and a tubular water-heating appliance having both ends of its tubes in circulation with the steam and water space of the feed-water heater between the steam and feed-water inlets.

6. The combination of a feed-water heater having steam and feed-water inlets respectively, a tubular water-heating appliance having both ends of its tubes in circulation with

the steam and water space of the feed-water heater between the steam and feed-water inlets, and flow and return pipes to maintain a circulation for the water within the tubular water-heating appliance independent of the circulation of the water within the feed-water heater.

7. The combination of a feed-water heater having steam and feed-water inlets respectively, and a tubular water-heating appliance having both ends of its tubes in circulation with the steam and water space of the feed-water heater between the steam and feed-water inlets and clear of the path of the water descending from the feed-water inlet but in the path of the steam ascending from the steam-inlet.

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Witnesses:

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