No. 746,226. PATENTED DEC. 8, 1903.

W. M. WRIGHT.

FEED WATER HEATER.

APPLICATION FILED MAR. 20, 1903.

NO MODEL.

Fig. 1.

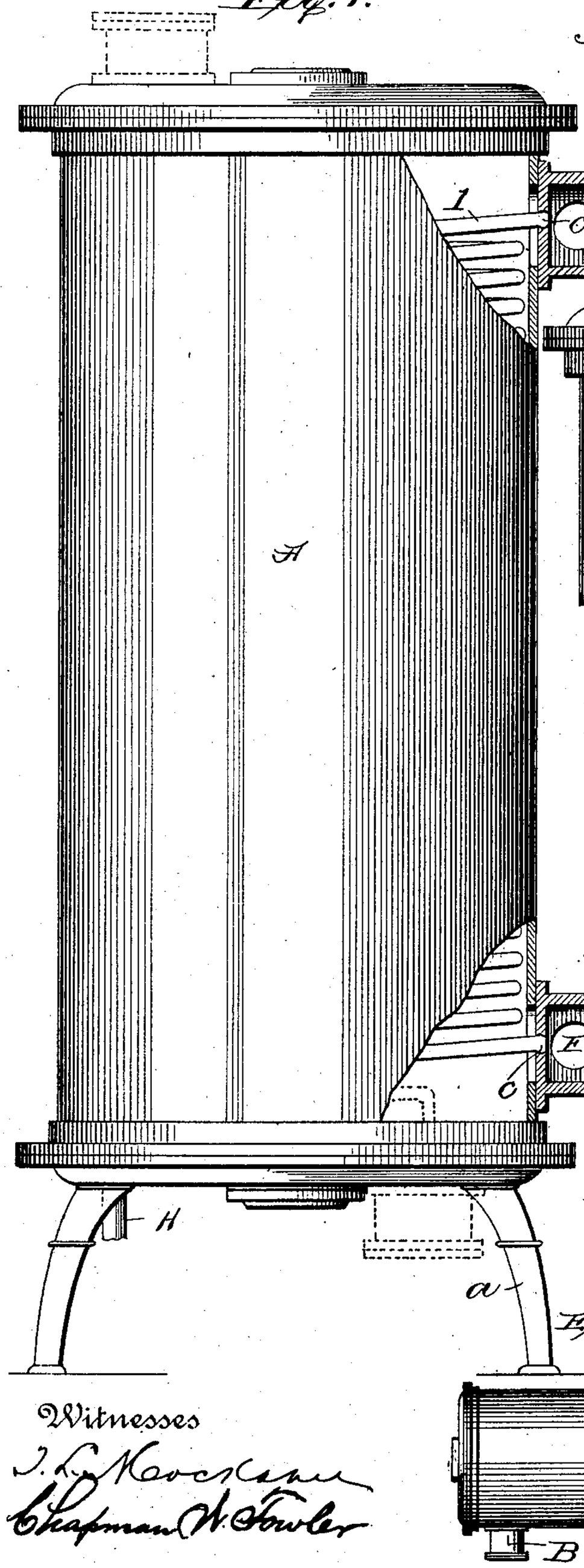


Fig. 6.

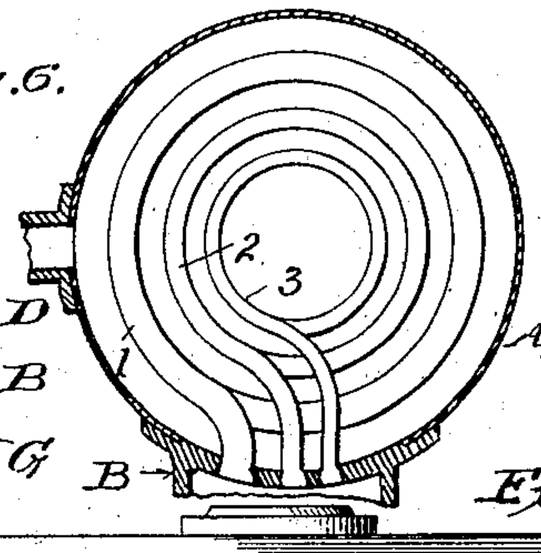


Fig 2

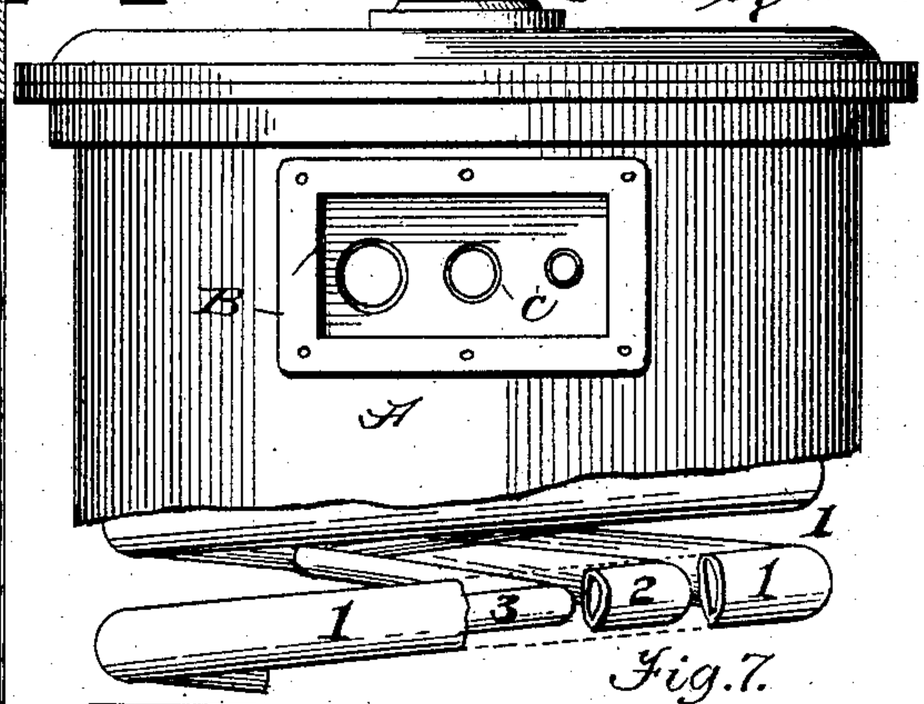


Fig. 7.

Coil	Tube	Transverse area	Surface area	Ratio Surface to Transverse areas
1	2" diam	3.14 Sq. in	13.46 Sq. ft.	4.28
2	1½" "	1.77 " "	7.59 " "	4.29
3	1" "	.78 " "	3.34 " "	4.28

Fig. 3.

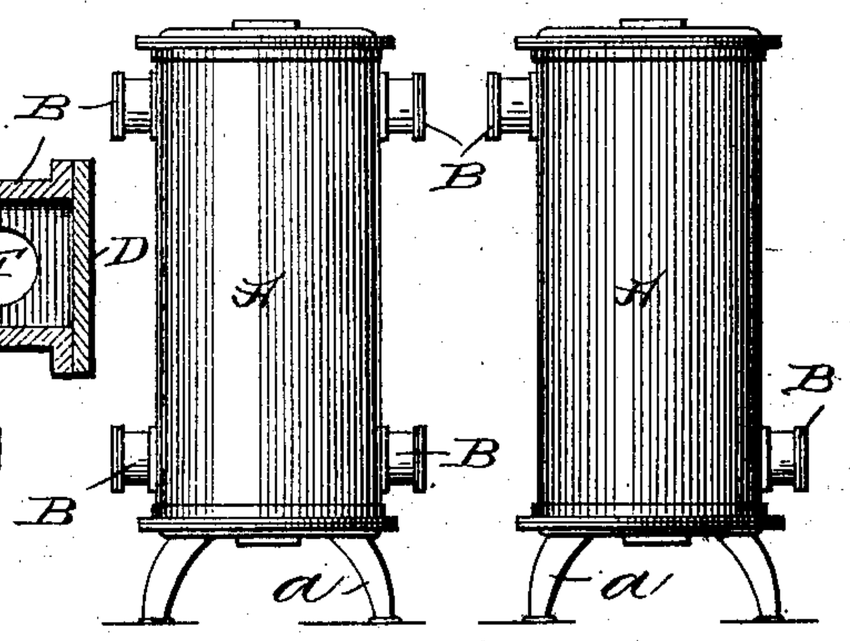
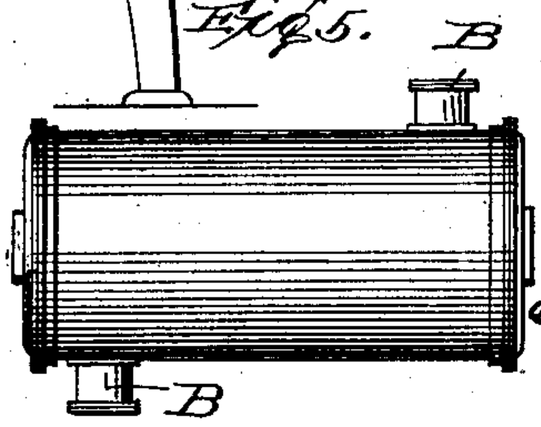


Fig. 4.

Fig. 5.



Witnesses

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No. 746,226. Patented December 8, 1903.

UNITED STATES PATENT OFFICE.

WILLIS M. WRIGHT, OF NEW HAVEN, CONNECTICUT.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 746,226, dated December 8, 1903.

Application filed March 20, 1903. Serial No. 148,712. (No model.)

To all whom it may concern:

Be it known that I, WILLIS M. WRIGHT, a citizen of the United States, residing at New Haven, in the county of New Haven and State of Connecticut, have invented new and useful Improvements in Feed-Water Heaters, of which the following is a specification.

My invention relates to certain new and useful improvements in feed-water heaters; and the object of the invention is to so construct the heater that it can be cheaply manufactured and at the same time have a large water-supply from a series of coiled pipes contained in the heater and adapted to contain feed-water, said pipes heated by exhaust-steam or other medium admitted to the heater-casing.

My invention consists of the parts and the construction and combination of parts hereinafter described and claimed.

In the accompanying drawings, forming part of this specification, and in which similar characters of reference indicate like parts throughout the several views, Figure 1 is a side elevation of a feed-water heater embodying my invention and showing part of the casing and one of the headers in section. Fig. 2 is a front elevation showing the header plate or cover removed to expose the ends of the tubes of the several coils of pipe. Figs. 3, 4, and 5 are modifications of Fig. 1. Fig. 6 is a horizontal section showing the different sizes of pipes. Fig. 7 is a table of information relative to the pipes.

In the said drawings, A is the casing of the heater, which may be made of any appropriate material and design. As shown it is of the vertical type, supported on legs or a stand *a* and having end heads A′, to which are connected tubes or passages through which the heating medium—say exhaust-steam—is admitted to and discharged from the casing.

Within the heater-casing are the heating-tubes, herein shown in the form of coils extending substantially throughout the vertical height of the casing and having their terminals connecting with the headers B, as I will presently describe.

While a single coil of pipe may be used for my purpose, especially in the smaller forms of heaters, I prefer to use a plurality of spiral coils 1 2 3, and these may be of iron, brass, copper, or other desired and suitable material. The several coils are preferably of equal length of the same size pipe or of such lengths, if of various sizes of pipe, as to have the ratio of the exterior or interior surface to transverse internal area for the several pipes virtually the same, as shown in Figs. 6 and 7. The principles involved in this construction are as follows: The amount of water, liquid, or gas which will flow through a pipe depends on the area of the pipe and the velocity of flow. The velocity of flow in several tubes united to a common source is not materially different for several sizes of no great variation in diameter and no great length in proportion to their diameters. Thus we see that the quantity flowing through the several tubes is dependent on their diameters, the velocity of flow being practically uniform. Further, the amount of heat taken up by any liquid or gas, either inside or outside of a tube, depends on the amount of surface which separates the heating medium from the medium to be heated, but in decreased amounts as the heating-surface increases. Therefore if a certain size tube has a certain amount of heating-surface a tube of twice the size—that is, internal area—capable of flowing twice the amount of gas or liquid should have twice the amount of heating-surface as the first tube in order that the amount of heat taken up by a unit of the gas or liquid shall be the same in both. For example, suppose a certain-sized tube flowing a certain amount of water in a certain time had ten square feet of heating-surface, the water being heated to 150°, and another tube of the same size, and therefore flowing the same amount of water in the same time, but having twelve square feet of heating-surface heated it, say, to 170°. We should have when the water was mixed in the header a double amount of water at the average resulting temperature, or 160°. Now take two tubes of the same size and having eleven square feet of heating-surface each and we should have a resulting temperature of about 162°. Therefore in the first case a total of twenty-two square feet gave a temperature of 160°, while in the case of equal surfaces (a total of twenty-two square feet) a temperature of 162° was secured—that is, the equal sur-

faces for equal tubes gives the greater results and is therefore the more economical, and the same principle is applicable to several sizes of tubes united to a common inlet and outlet—that is, if it has been determined that a certain heater requires a flow area of twenty square inches and a total of three hundred square feet of surface the ratio of three hundred to twenty (equivalent to fifteen to one) must be the same for all tubes in the heater—that is, if we have a tube of five square inches area it must have a surface of seventy-five square feet, or another of seven square inches must have a surface of one hundred and five square feet, and so on. This makes the quantity of water flowing through each coil or pipe proportional to the area of surface of the pipe. The ends of each of the pipes are fitted to the headers. These headers B are located on and project from the outer sides of the casing, either at the upper and lower portions of the vertical sides of the casing, as in Fig. 1, or on the top and bottom of the casing, as in dotted lines at B′ in Fig. 1, or one may be on a vertical side and the other on the top or bottom or a horizontal side without departing from the spirit and scope of my invention.

In whatever position the headers are placed the adjacent ends or terminals *c* of the tubes or pipes 1 2 3 are brought into the back of the header and there secured either by lock-nuts, flanges, or preferably, as shown, by properly expanding said ends to make tight joints.

It will be understood that the coils, when several are used, are all nested together and the ends are fitted to or come through the back or inner end of the upper and lower headers and are expanded or secured, as before described.

Over the outer faces of the headers are placed cover-plates D, which may be removably secured by bolts or other forms of fastenings, which enable these plates to be removed at pleasure to expose the pipe ends for any purpose—say for examination of the ends or to repair a damaged or defective pipe.

Each header is connected with an appropriate feed-pipe, one of said pipes F admitting water to one header that it might enter the contiguous ends of coiled pipes, and after circulating through said pipes this water may be delivered from the outlet-pipe G, leading from the other header.

When a double-coil heater giving two separate supplies of hot water is used, as when hot water is desired for other purposes than for the boiler, the headers may be located on both sides of the casing, above and below, as shown in Fig. 3, and when using the arrangement of coils first above noted the headers may be on the same vertical side of the casing or one may be on one side and the other on the opposite side, as in Fig. 4.

The heater will also have a drip-pipe H to allow for the discharge of water from condensed steam, and the steam escaping from the outlet-pipe of the casing may be used to heat a building, if desired.

While I have shown the heater as of the vertical type, the salient features thereof, especially the external headers, may be employed in connection with a horizontal heater, as in Fig. 5, without departing from this invention.

In practice the heater may be connected to the exhaust-pipe of the engine and the feed-water pipe will connect with the lower header and the discharge-pipe from the upper header will connect with the boiler; but it is obvious that the feed might enter from the upper portion instead of from below.

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

1. A feed-water heater having a steam inlet and outlet and a plurality of nested coiled pipes, in combination with upper and lower headers on the outside of the casing, said pipes to have each such length and size as to have a virtually constant ratio between the amount of their respective surfaces and their respective transverse areas, the ends of said pipes being fixed in the headers and said headers having removable cover-plates for affording access to the pipe ends.

2. In a feed-water heater having a steam inlet and outlet, a plurality of coiled pipes said pipes to have each such length and size as to have a virtually constant ratio between the amount of their respective surfaces and their respective transverse areas, and headers into which the ends of said pipes are fixed.

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

WILLIS M. WRIGHT.

Witnesses:
EDWARD L. FOX,
LUCIUS BRADLEY.