

R. H. FRASER.  
FEED WATER HEATER.  
APPLICATION FILED MAR. 12, 1903.

NO MODEL.

2 SHEETS—SHEET 1.

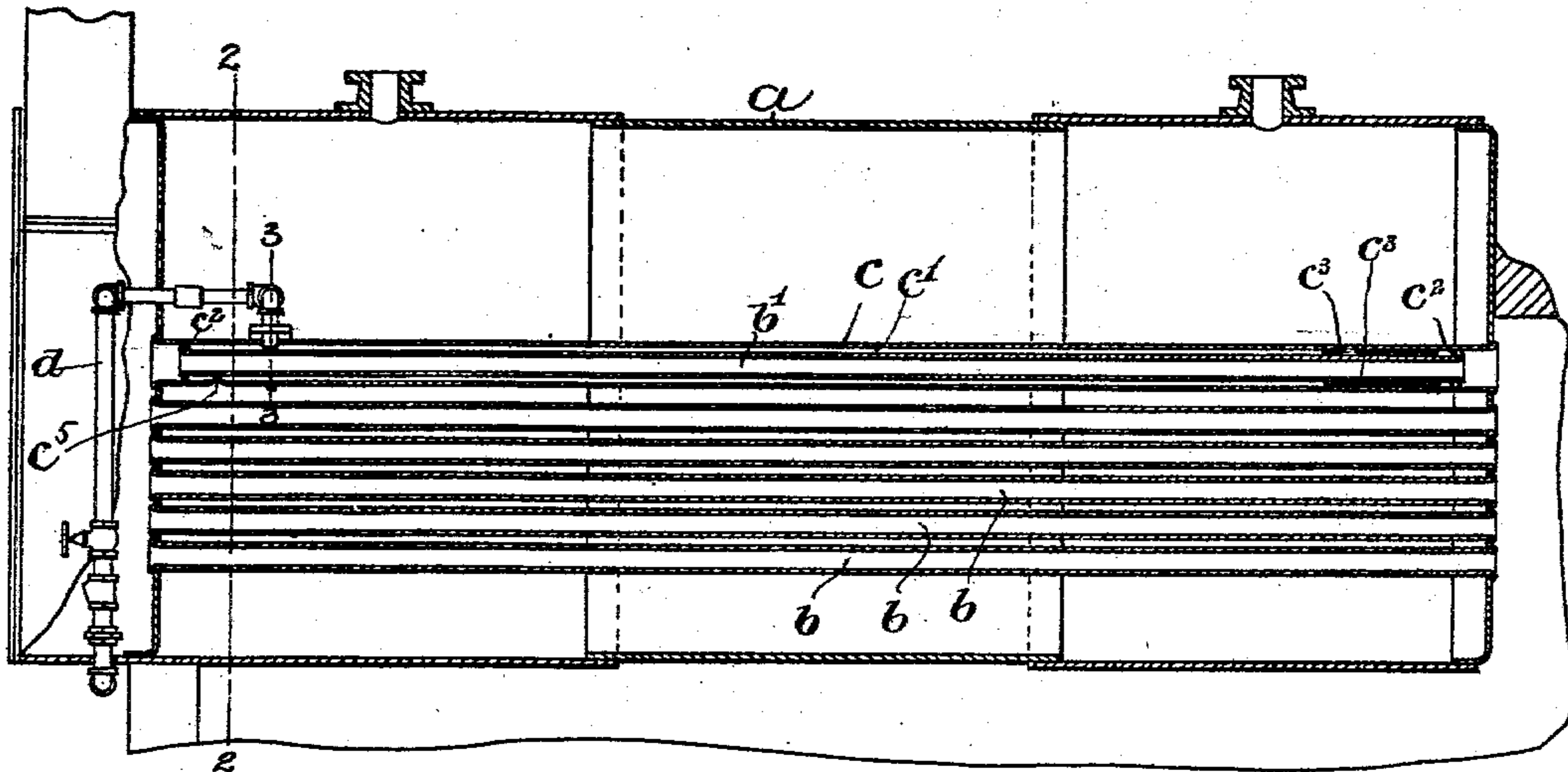


Fig. 1.

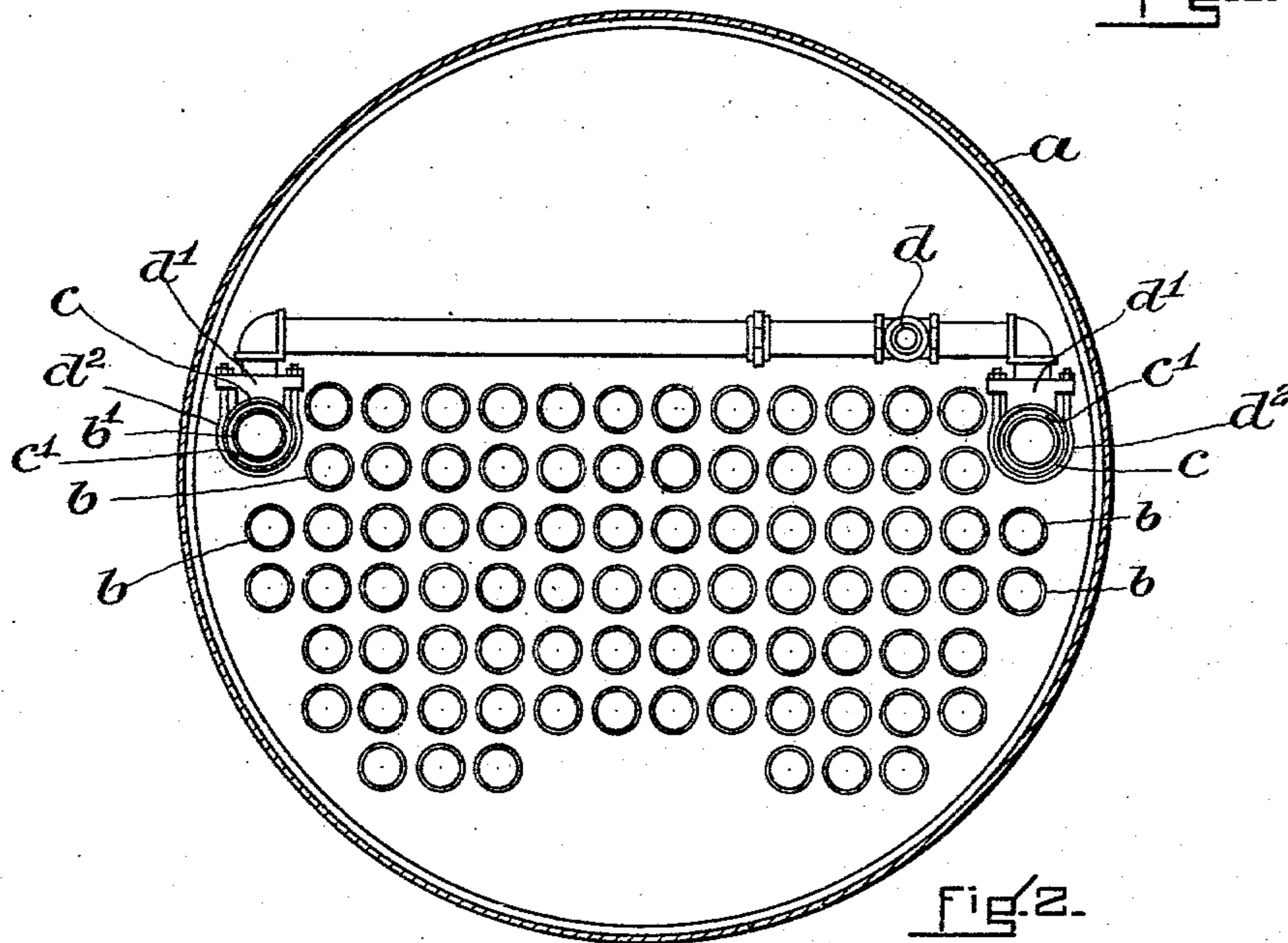


Fig. 2.

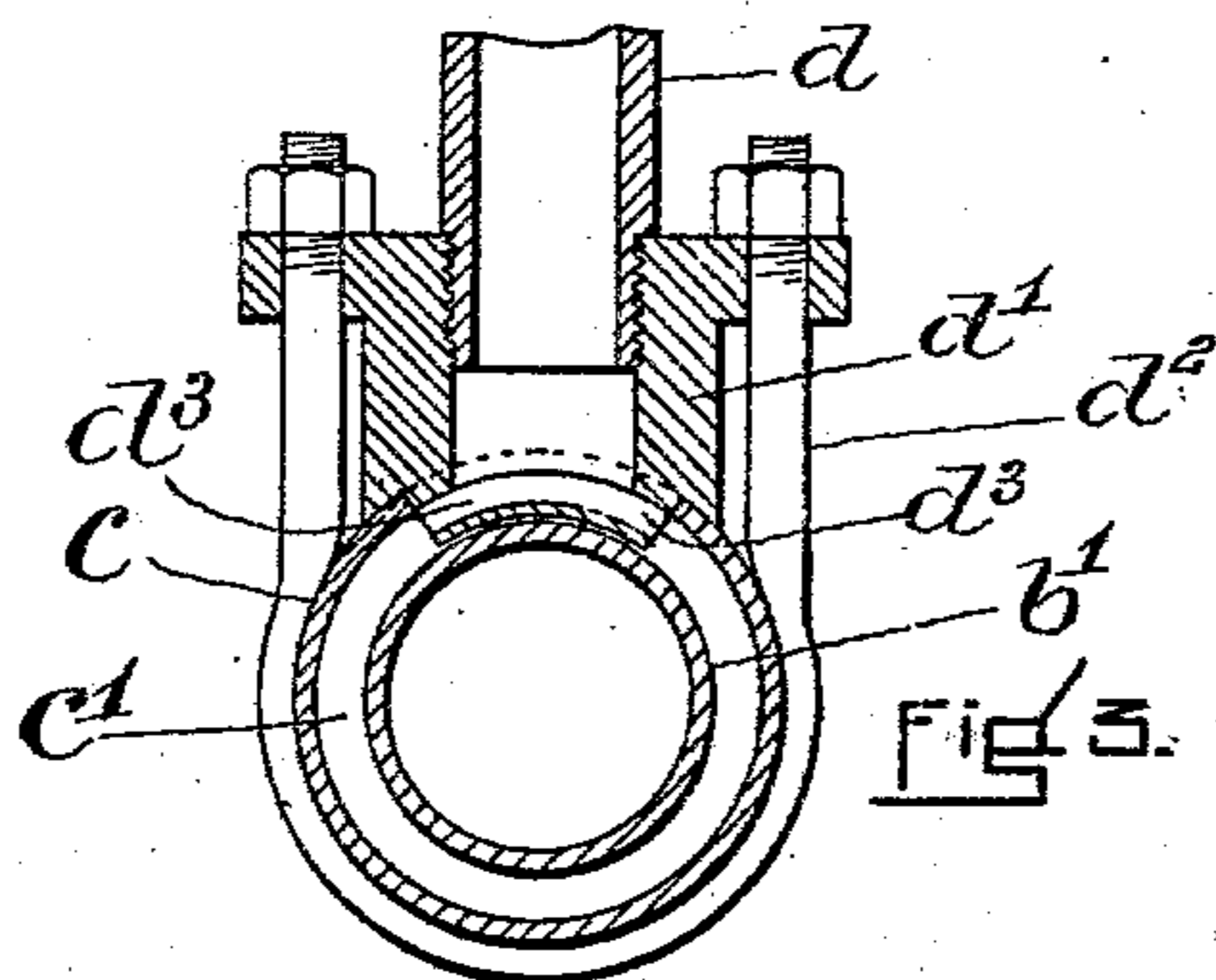


Fig. 3.

WITNESSES.

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No. 740,841.

PATENTED OCT. 6, 1903.

R. H. FRASER.  
FEED WATER HEATER.

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NO MODEL.

2 SHEETS—SHEET 2.

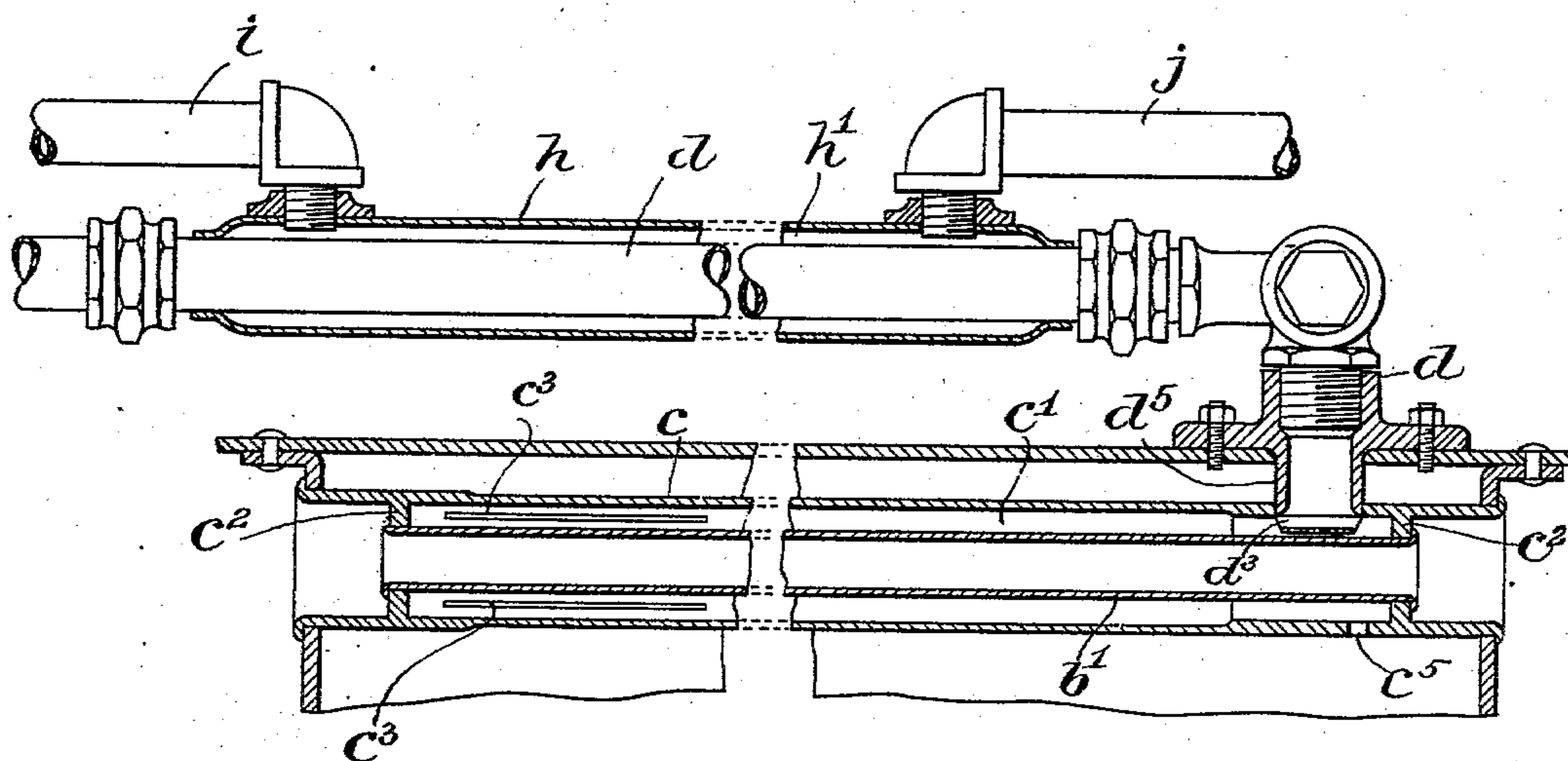


Fig. 5.

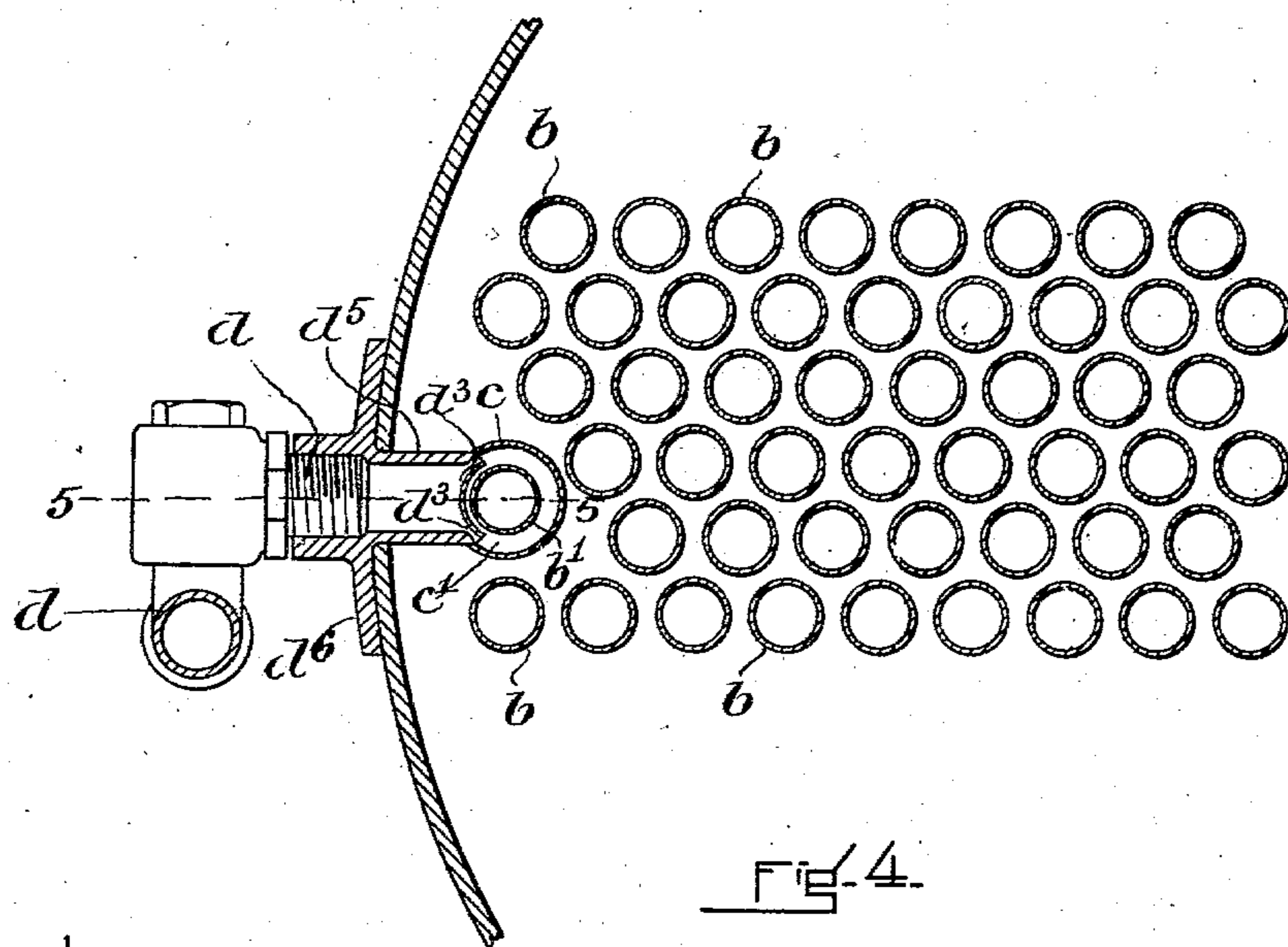


Fig. 4.

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# UNITED STATES PATENT OFFICE.

ROBERT H. FRASER, OF BOSTON, MASSACHUSETTS.

## FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 740,841, dated October 6, 1903.

Application filed March 12, 1903. Serial No. 147,361. (No model.)

*To all whom it may concern:*

Be it known that I, ROBERT H. FRASER, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Feed-Water Heaters for Tubular Boilers, of which the following is a specification.

This invention relates to tubular boilers or those having horizontally-arranged fire-tubes extending through the water-spaces of the boiler and adapted to conduct products of combustion, the said tubes being surrounded by the water in the boiler.

My invention has for its object to utilize one or more of said fire-tubes as the inner surface of an annular conduit for feed-water, so that the feed-water before entering the water-space of the boiler will have its temperature raised by the products of combustion passing through the said fire tube or tubes.

The invention also has for its object to provide in connection with the above an auxiliary feed-water-heating means which shall utilize exhaust-steam, this feature being especially intended for locomotive-boilers and adapted to utilize the exhaust-steam from the air-pump of the locomotive.

The invention consists in the improvements which I will now proceed to describe and claim.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a longitudinal section of a stationary boiler provided with my improved feed-water heater. Fig. 2 represents a section on line 2 2 of Fig. 1. Fig. 3 represents a section on line 3 3 of Fig. 1. Fig. 4 represents a view corresponding to a portion of Fig. 2, showing my invention applied to a locomotive-boiler. Fig. 5 represents a section on line 4 4 of Fig. 3, various parts being broken away.

The same letters of reference indicate the same parts in all the figures.

Referring first to Figs. 1, 2, and 3, *a* represents the shell of a steam-boiler, and *b b* represent the usual fire-tubes, the ends of which are engaged, as usual, with the tube-sheets at the ends of the boiler.

On carrying out my invention I attach to the boiler, in the place usually occupied by one of the fire-tubes *b*, an enlarged tube *c*, which is engaged at its ends with the tube-sheets in

the same manner as the fire-tubes *b b* and is of sufficient diameter to surround one of the fire-tubes and form in connection therewith an annular feed-water conduit *c'*, the outer wall of said conduit being the tube *c*. The inner wall of the conduit *c'* is formed by a fire-tube *b'*, which is made like the fire-tubes *b b*, excepting that it is somewhat shorter, and is engaged at its ends with annular plugs or inwardly-projecting flanges *c<sup>2</sup> c<sup>2</sup>*, welded to the inner surface of the enlarged tube *c* near the ends thereof, the ends of the inclosed fire-tube *c'* being preferably expanded into union with the plugs *c<sup>2</sup> c<sup>2</sup>* in the same manner that the fire-tubes *b b* are expanded into union with the usual tube-sheets.

*d* represents a feed-pipe which communicates at one end with one of the end portions of the annular conduit *c'*, said pipe conducting feed-water from any suitable source of supply to the said conduit *c'*. The connection between the feed-pipe and the conduit *c'*, as shown in Figs. 1 and 2, comprises a nipple secured by a yoke *d<sup>2</sup>* to the enlarged tube *c*, said nipple having a coupling member to which the terminal member of the feed-pipe *d* is secured. One end of the nipple projects into the enlarged tube *c* and is provided with outlets *d<sup>3</sup> d<sup>3</sup>*, Fig. 3, which discharge the feed-water into the annular conduit *c'*. The opposite end portion of the conduit *c'* communicates with the water-space of the boiler preferably through elongated slots *c<sup>3</sup>*, formed in the elongated tube *c*, there being preferably four of said slots arranged at equal distances apart and each extending lengthwise of the tube, each of these slots constituting an outlet.

It will be seen that the construction above described provides a feed-water heater located within the boiler and conducting the feed-water for a considerable distance between two heated surfaces, one of which is heated by the water in the boiler and the other by the products of combustion passing through the boiler. The said feed-water heater is extremely compact, taking up no room outside the boiler, and is extremely efficient in operation.

In Figs. 4 and 5 I show my improved feed-water heater as applied to a locomotive-boiler, *a* being the shell, and *b b* the fire-tubes, of a

locomotive-boiler. The enlarged tube *c*, forming the outer wall of the annular feed-water conduit *c'*, is located near one side of the boiler-shell and is provided with plugs *c<sup>2</sup> c<sup>3</sup>*, with which the ends of the inclosed fire-tube *b'* are united in the manner described in connection with Figs. 1 and 2. The ends of the enlarged tube *c* are also united to the tube-sheets of the boiler in the same manner that the fire-tubes *b b*, above described, are united. In this case the feed-pipe *d*, which is connected with the discharge end of an injector, is connected with the conduit *c'* by a nipple *d<sup>5</sup>*, which extends through the boiler-shell and has a flange *d<sup>6</sup>* affixed to the exterior of the shell. The inner end of the nipple projects into the annular conduit *c'* and has outlets *d<sup>3</sup> d<sup>3</sup>* arranged like the corresponding outlets shown in Fig. 3. The outer end of the nipple *d<sup>5</sup>* is internally screw-threaded, and therefore constitutes a coupling member which receives the terminal portion of the feed-pipe *d*. The enlarged tube *c* is provided with outlet-slots *c<sup>3</sup>* like those described in connection with Fig. 1. In this embodiment of my invention I have provided an auxiliary feed-water heater adapted to utilize exhaust-steam from the air-pump or other part of the locomotive to heat the feed-water before it enters the conduit *c'*. To this end I locate upon the feed-pipe *d* a surrounding tube or jacket *h*, which forms the outer wall of an annular steam space or conduit *h'*, the inner wall of which is the feed-pipe *d*. *i* represents a pipe which conducts exhaust-steam from the air-pump to one end portion of the conduit *h'*, and *j* represents a pipe which conducts the exhaust-steam from the opposite end portion of the conduit *h'* to the stack of the locomotive or to any other suitable point.

In Figs. 1 and 5 I show at *c<sup>5</sup>* an opening in the enlarged tube *c*, said opening connecting the annular feed-water conduit *c'* with the water-space of the boiler and providing for the admission of water from the boiler to said water-space to prevent the formation of an air-space therein in case the supply of feed-water ceases.

I claim—

1. A boiler provided with a plurality of fire-

tubes, an enlarged tube surrounding one of the fire-tubes and forming with the latter an annular feed-water conduit located within the boiler, and a feed-pipe communicating with one end portion of said conduit, the opposite end portion of the conduit communicating with the water-space of the boiler.

2. A boiler provided with tube-sheets and fire-tubes engaged therewith, an enlarged tube engaged at its ends with the tube-sheets and provided internally with annular plugs or flanges near its ends, a fire-tube located within said enlarged tube and engaged at its ends with said plugs, said enlarged tube and the fire-tubes therein forming the walls of an annular feed-water conduit located within the boiler and surrounding the said fire-tube, and a feed-pipe communicating with one end portion of said conduit, the other end portion of the conduit communicating with the water-space of the boiler.

3. A boiler provided with a plurality of fire-tubes, an enlarged tube surrounding one of the fire-tubes and forming with the latter an annular feed-water conduit located within the boiler, a nipple secured to and extending through the boiler-shell, the inner end of said nipple entering the said conduit, while its outer end is provided with a coupling member, and a feed-pipe engaged with said coupling member, the said enlarged tube being provided with one or more outlets communicating with the water-space of the boiler.

4. A boiler provided with a plurality of fire-tubes, an enlarged tube surrounding one of the fire-tubes and forming with the latter an annular feed-water conduit located within the boiler, a feed-pipe located outside the boiler, a connection between said feed-pipe and the said conduit, the conduit having one or more outlets communicating with the water-space of the boiler, and means for preliminarily heating the water in said feed-pipe.

In testimony whereof I have affixed my signature in presence of two witnesses.

ROBERT H. FRASER.

Witnesses:

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E. BATCHELDER.