

(No Model.)

J. A. GRANT.
FEED WATER HEATER.

No. 312,716.

Patented Feb. 24, 1885.

Fig. 1.

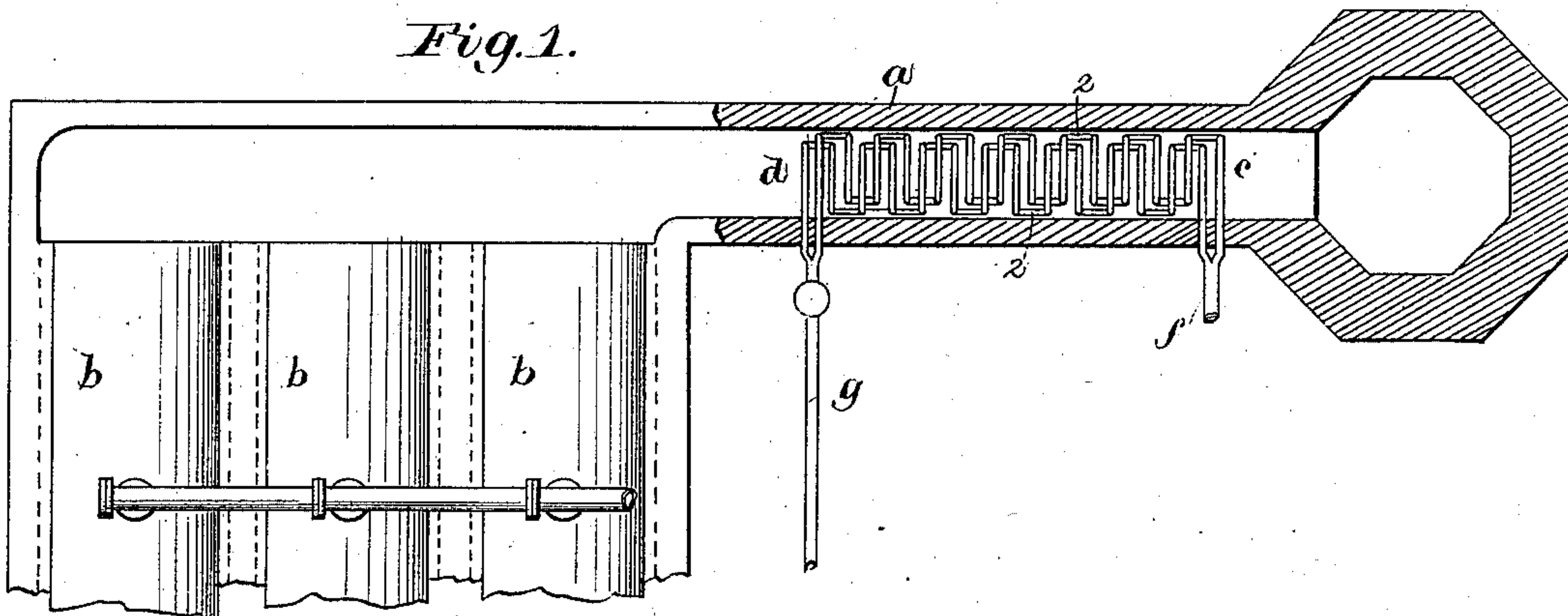


Fig. 2.

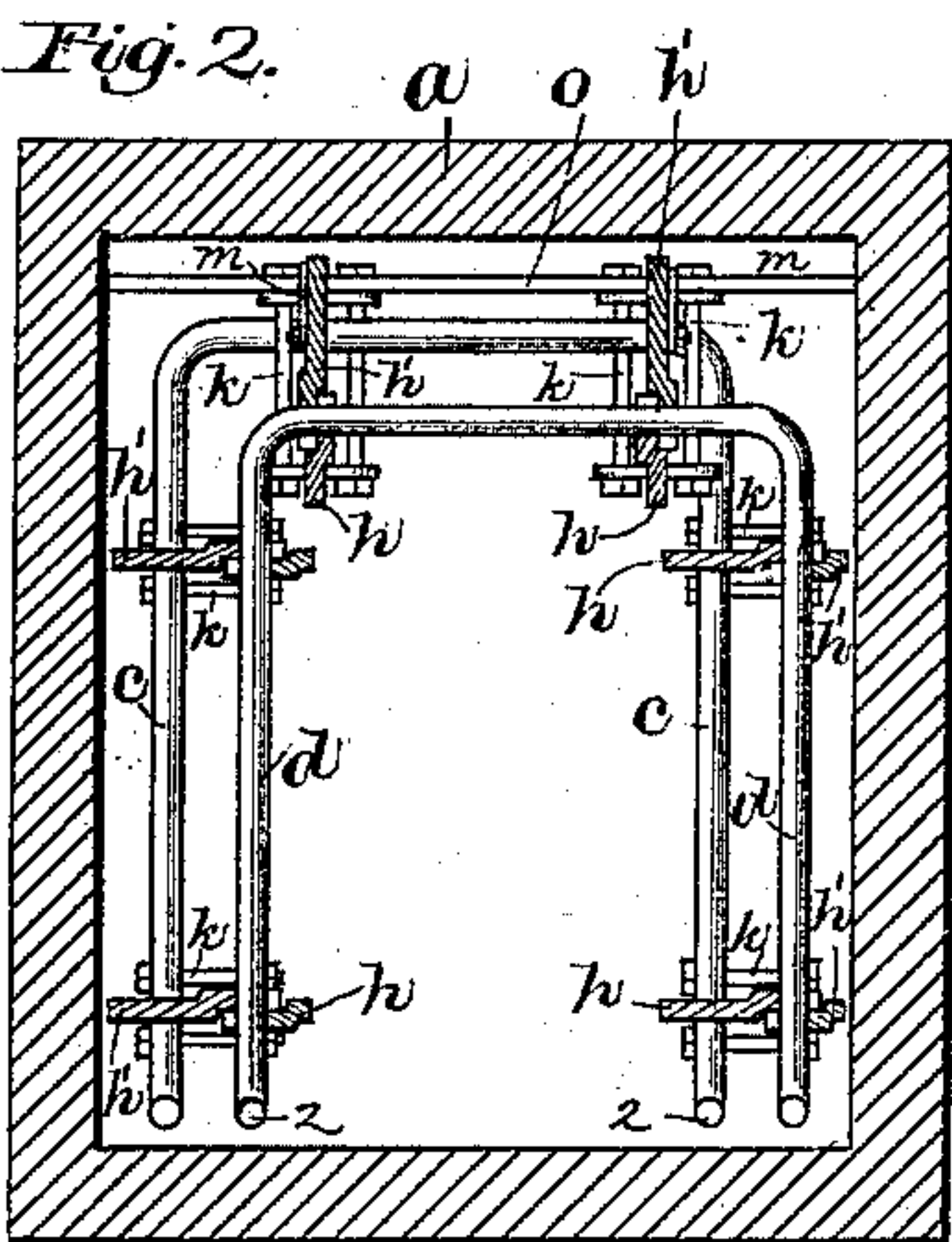


Fig. 3.

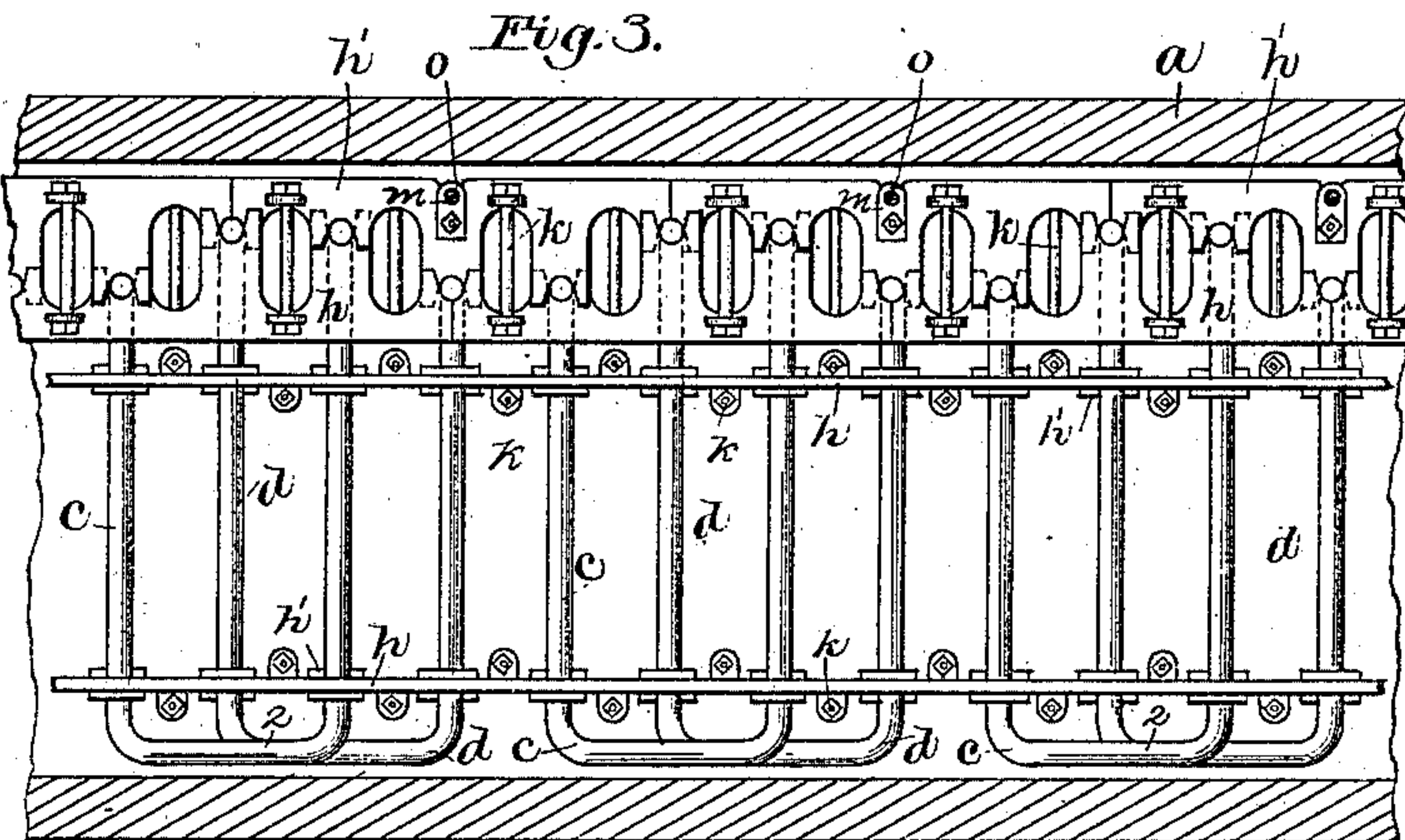


Fig. 4.

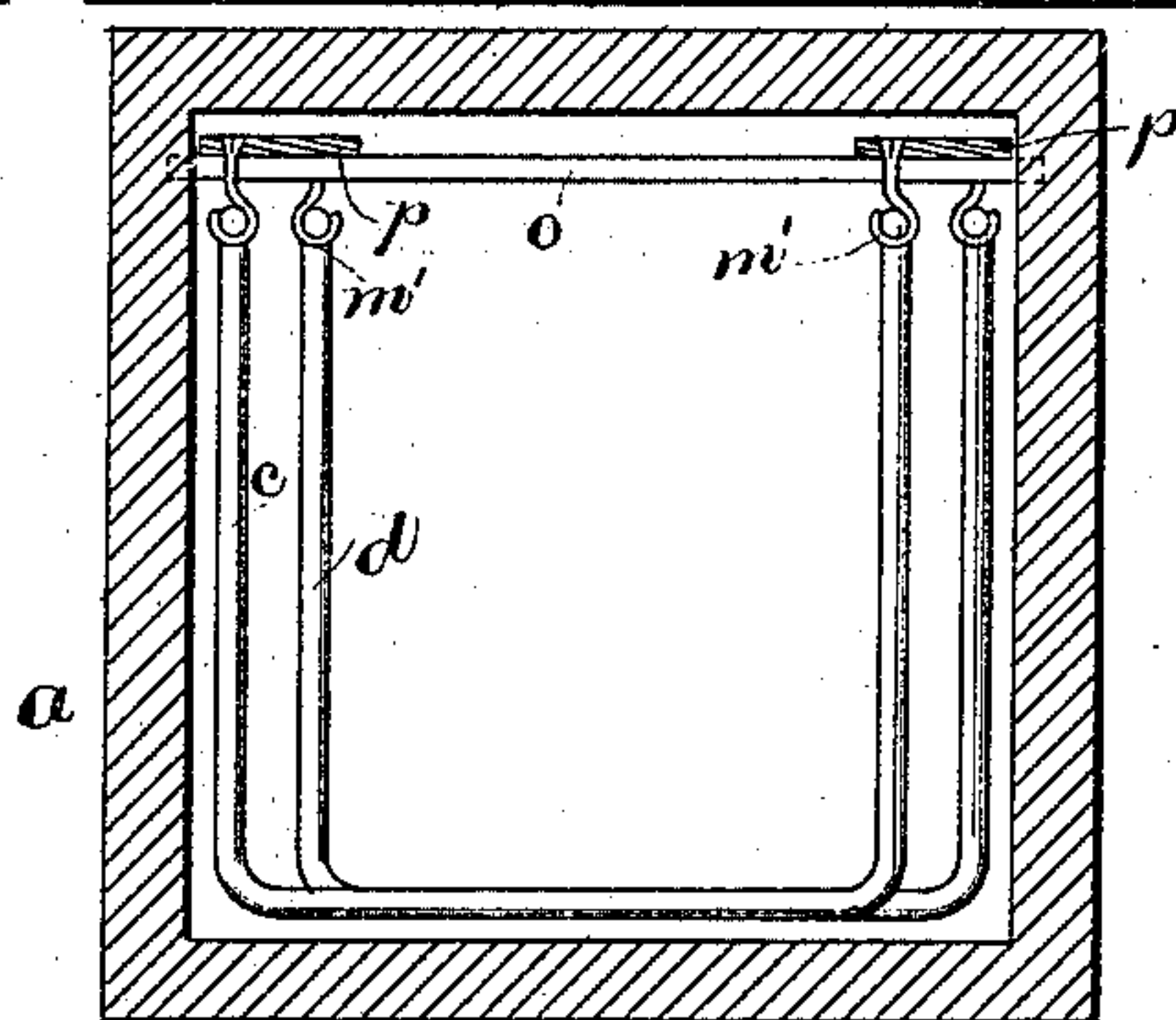
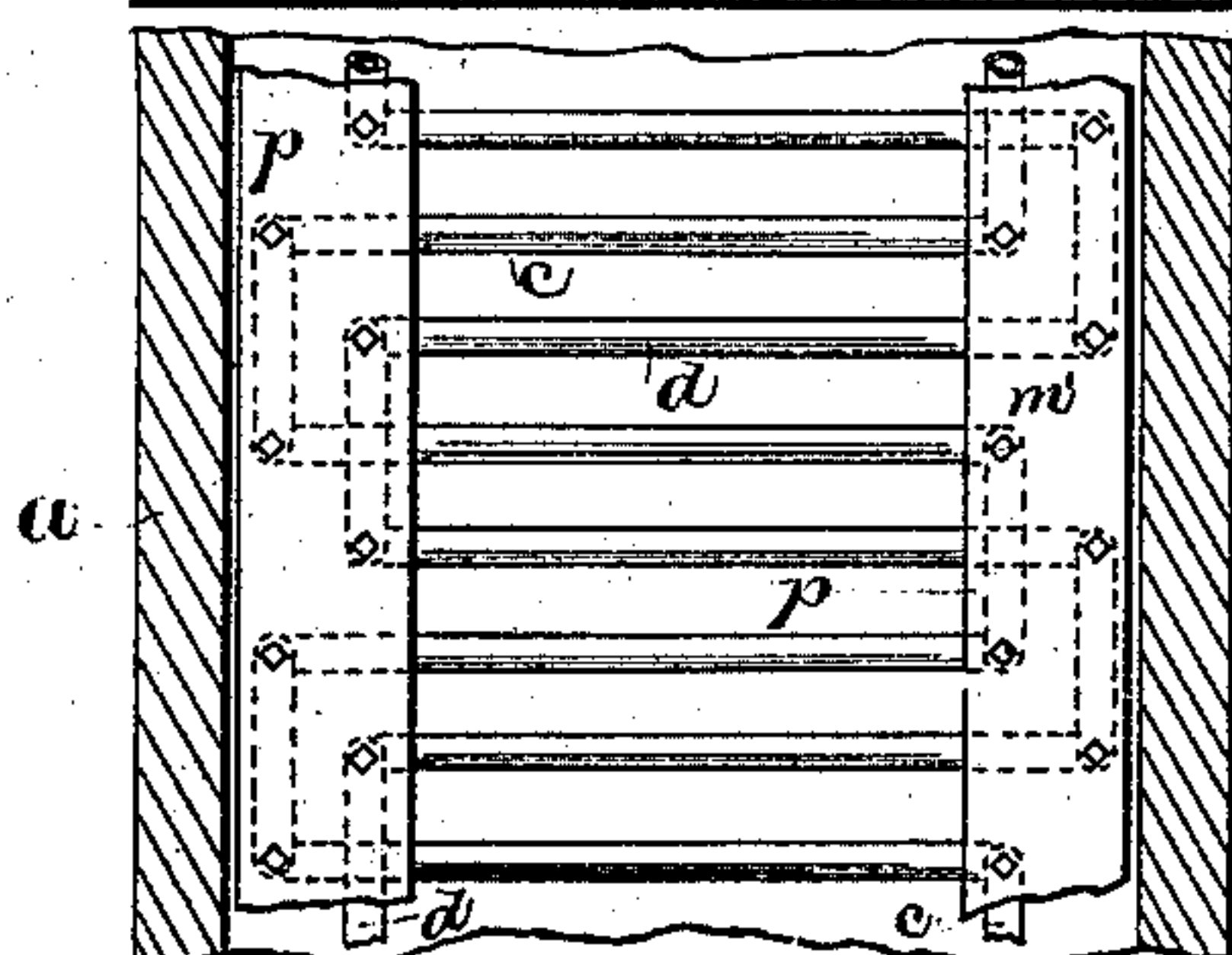


Fig. 5.



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UNITED STATES PATENT OFFICE.

JOSEPH A. GRANT, OF EVERETT, ASSIGNOR TO THE JARVIS ENGINEERING COMPANY, OF BOSTON, MASSACHUSETTS.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 312,716, dated February 24, 1885.

Application filed May 26, 1884 (No model.)

To all whom it may concern:

Be it known that I, JOSEPH A. GRANT, of Everett, county of Middlesex, State of Massachusetts, have invented an Improvement in Feed-Water Heaters, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention relates to a feed-water heater or apparatus, sometimes called a "fuel-economizer," for utilizing the waste heat from the gases passing through the flue of a furnace for heating water or other material which may be used as the feed for the boilers or steam-generators that are heated by the said furnace, or for other purposes.

The feed-water heater consists, essentially, of continuous seamless pipes bent and supported in the flue, as hereinafter described, the said pipes occupying the space adjacent to the walls of the flue, and thus leaving the main passage unobstructed, so that it is readily accessible for the purposes of cleaning or repairs, and the flow of the gases is not materially impeded. The pipes are arranged to afford the maximum exposure to the heated gases, and when two or more pipes are employed each will have the same exposure and relation to the flow of gases about them and of the liquid through them. The feed-water heater is shown in this instance as composed of two pipes united in common inlet and outlet pipes at the points where the said piping passes through from the exterior to the interior of the flue, and the reverse. Each of the said pipes within the flue is bent into a series of U-shaped loops passing around three sides of the flue, one leg or portion of the U of one pipe being nearer to one wall of the flue than the other, and the nearer legs of the two pipes being on opposite sides of the flue, so that the branches of the two pipes have a staggered arrangement along the adjacent walls of the flue. The liquid moving continuously through one of the pipes will first pass through the branch that is nearer to the wall, and then through the branch that is farther from the wall and more exposed to the gases flowing through the flue, and the said liquid will thus extract the largest possible amount of heat from the said gases. The

pipes are supported and held in the proper position with relation to one another by means of holding pieces or bars bolted together from the opposite sides of the said pipes, the said bars with the pipes forming a substantially rigid frame, which is supported in any suitable way from the walls of the flues.

Figure 1 is a horizontal section of a portion of a furnace with a flue and stack containing a feed-water heater embodying this invention; Figs. 2 and 3, transverse and longitudinal sections, respectively, of the flue and feed-water heater therein, and Figs. 4 and 5 vertical and horizontal sections of a modification to be described.

The feed-water heater is shown as employed in the flue *a* of a furnace for generating steam in a series of boilers, *b*. (See Fig. 1.) The said feed-water heater consists in this instance of two pipes, *c d*, which may be used to convey the feed-water to the boiler, or to supply hot water for any purpose, the said pipes forming two branches from a common feed-pipe, *f*, and preferably uniting in a common delivery-pipe, *g*, leading to the boiler or other place where the hot water or other material heated in its passage through the said pipes is to be used. The said pipes *c d* each consist of a seamless drawn tube, preferably of copper or brass, bent, as shown in this instance, into a series of U-shaped loops passing transversely about three sides of the flue, as shown in Fig. 2, the successive loops being connected together by short bends extending longitudinally of the flue, as shown at 2, Figs. 1 and 3. The U-shaped loops (see Fig. 2) of each pipe are somewhat narrower than the interior of the flue, and are set nearer one side of the flue than the other, the pipe *d*, for instance, being nearer the right-hand wall and the pipe *c* nearer the left-hand wall when looking in one direction, as seen in Fig. 2. The different loops of one pipe are located about midway between those of the other pipe, and consequently the vertical portions of the two pipes have a staggered arrangement along the adjacent side of the flue. When the flue is sufficiently high, the different loops of each pipe may rise to different heights, as shown in Figs. 2 and 3, thus giving a staggered arrangement along the upper wall

of the flue. The average height of the two pipes will be the same. The pipes *c d* are supported and held in proper position with relation to one another by braces *h h'*, consisting of rigid bars having sockets arranged to receive a branch of each of the said pipes alternately, the sockets of the bar *h* corresponding with those of bar *h'*, so that when the two are fastened together, as by the bolts *k*, they embrace the said pipes, fixing them tightly in place with relation to one another. The socket portions of the bar *h h'* are offset, as shown, so that they overlap one another and wedge tightly upon the pipes, and the same bars may be used for pipes of different size, so that one set of patterns will answer for economizers of different capacity. The bars *h h'* may be made in sections of any desired length, and will be so arranged that the joints of one will be covered by unjointed portions of the other, as shown in Fig. 3. The braces *h h'*, that engage the horizontal portions or branches of the pipes which are adjacent to the upper wall of the flue, are shown as attached to lugs or ears *m*, suspended on cross-bars *o*, that are fixed in the walls of the flue.

In the modification shown in Figs. 4 and 5 the horizontal portions of the U-shaped branches are adjacent to the lower wall or bottom of the flue, instead of the top, and the longitudinal portions of the pipes connecting the different U-shaped loops are supported by hooks *m'*, themselves depending from plates *p*, resting on cross-bars *o* in the flue.

The economizer, constructed as herein described, is easily made and affords but little obstruction to the flue, although the exposure

to the heated gas is very great, and by using seamless drawn tubing the danger of leaky joints is avoided.

The different pipes are of the same length and have substantially the same position with relation to the flue, so that the liquid circulates equally and is heated equally in each.

I claim—

1. The combination of a furnace and flue leading therefrom with a feed-water heater comprising two pipes, each having a series of U-shaped loops passing transversely around the walls of the flue, the side portions of the loops being nearer one side wall of the flue than the other, and the loops of one pipe being nearer to one wall, and those of the other pipe nearer the opposite wall, substantially as and for the purpose described.

2. In a feed-water heater, the combination, with the pipes bent into a series of loops, of the bracing-bars *h h'*, provided with corresponding recesses to engage and hold the said pipes between them, substantially as described.

3. In a feed-water heater, the combination, with a series of pipes, each bent into a series of loops, of the bracing-bars *h h'*, having sockets for embracing the said pipes, the socket portions being offset, substantially as and for the purpose described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOSEPH A. GRANT.

Witnesses:

JOS. P. LIVERMORE,
W. H. SIGSTON.