

No. 735,715.

PATENTED AUG. 11, 1903.

C. K. CUNNINGHAM.  
FEED WATER HEATER AND PURIFIER.

APPLICATION FILED DEC. 16, 1901.

NO MODEL.

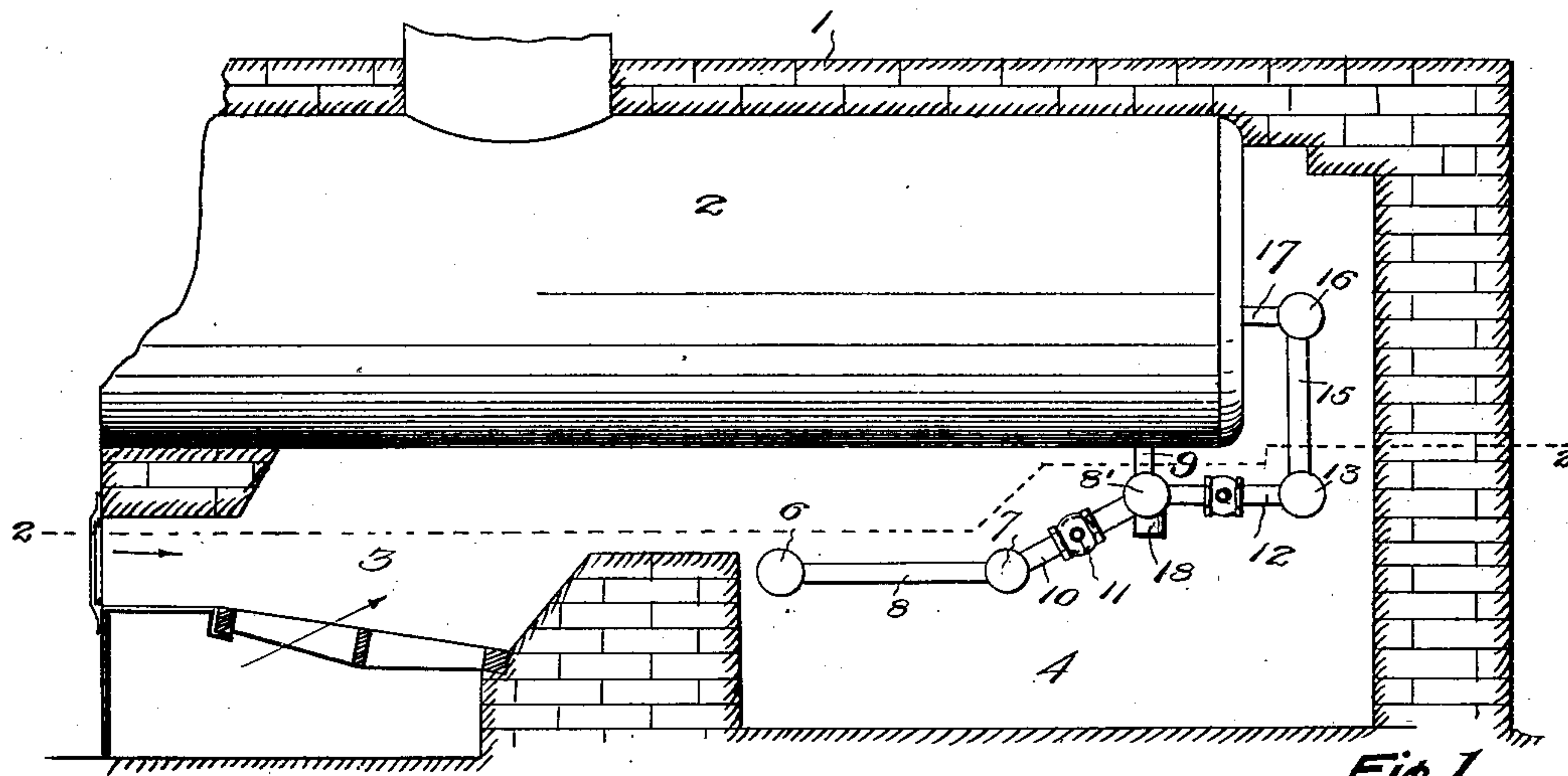


Fig. 1.

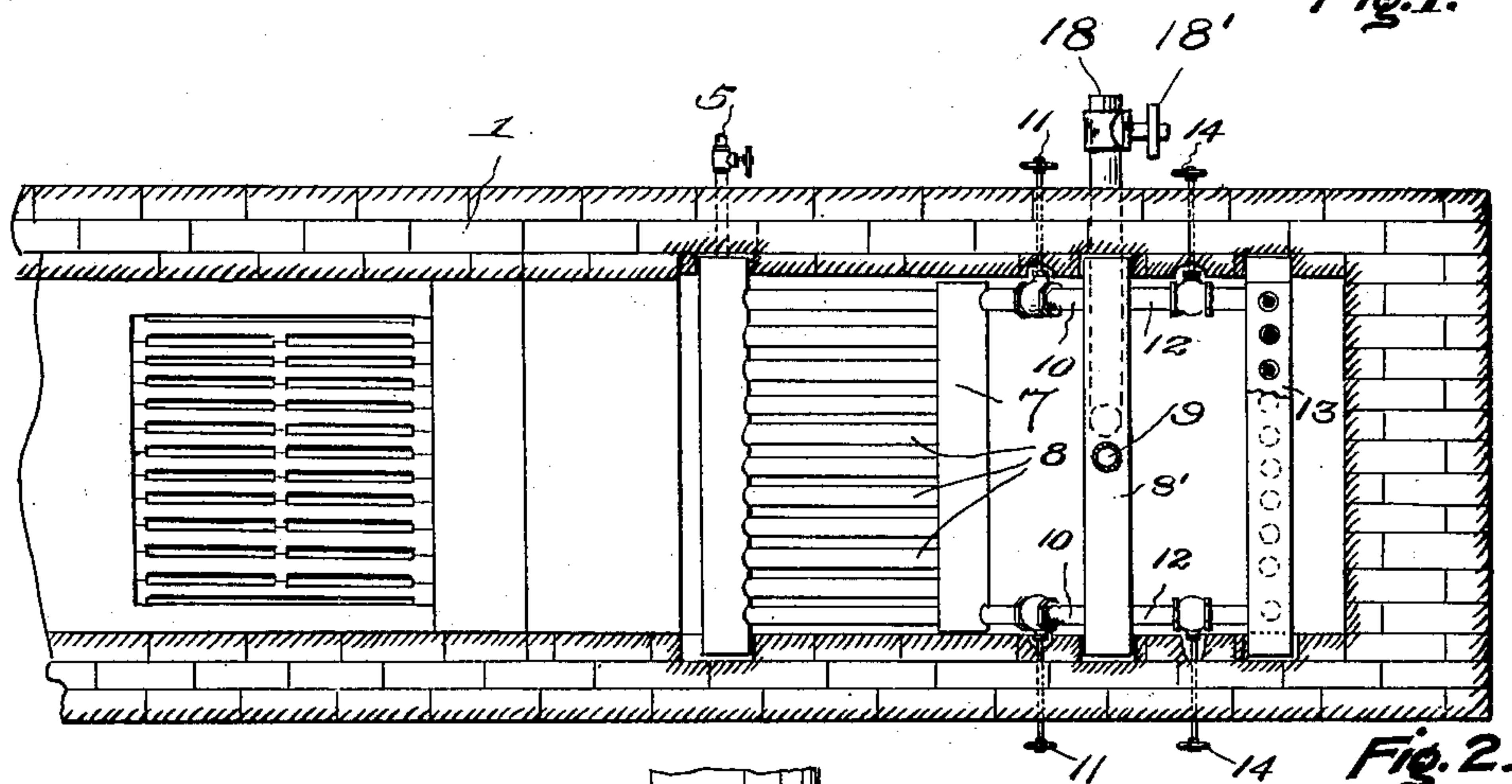
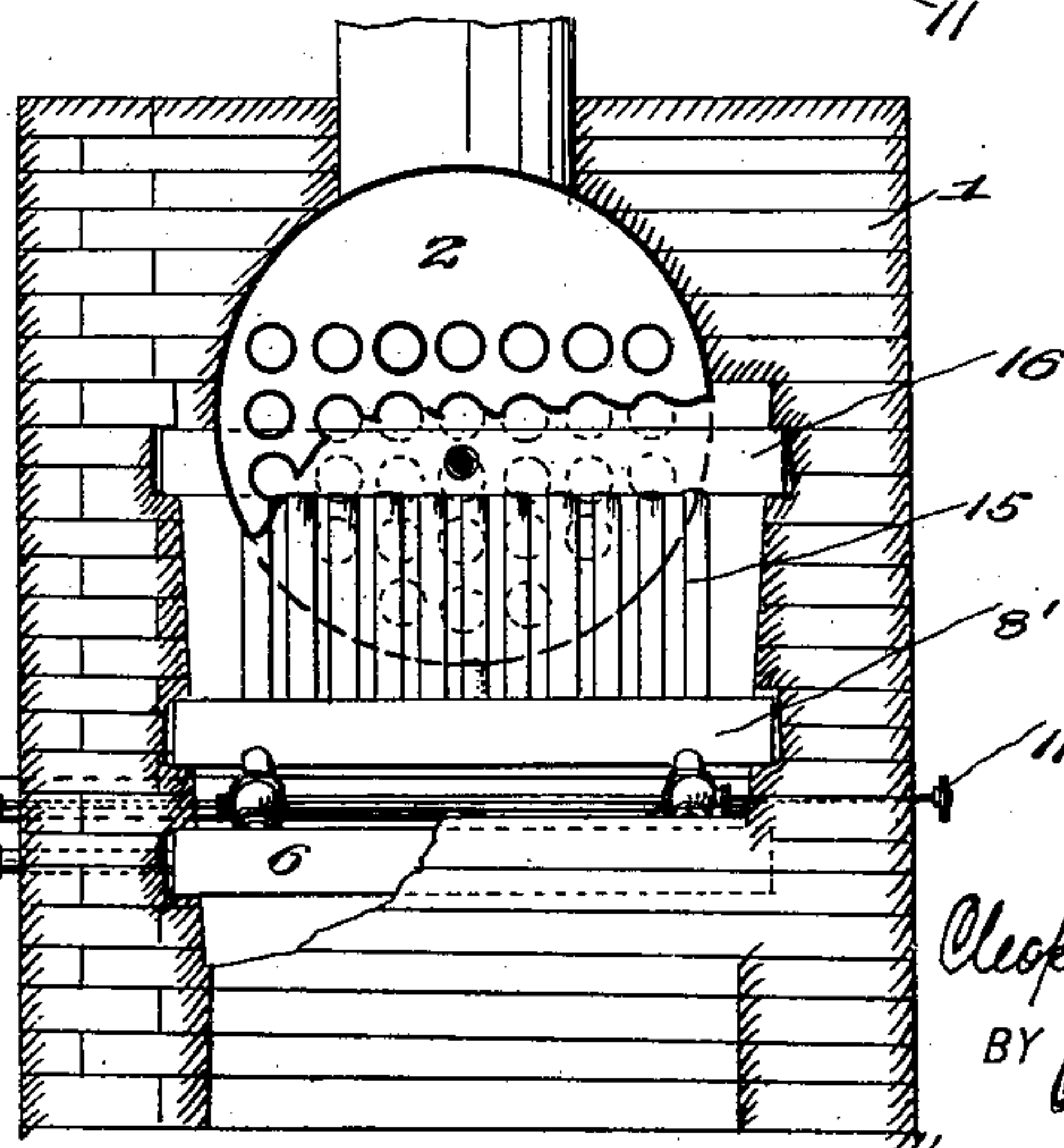


Fig. 2.

Fig. 3.

WITNESSES:  
Edwin G. Lane  
a Schmitt Jr.



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Cleophas K. Cunningham  
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# UNITED STATES PATENT OFFICE.

CLEOPHUS K. CUNNINGHAM, OF ALGONQUIN, OHIO, ASSIGNOR OF ONE-HALF TO WILLIAM LOOFBOURROW, OF CARROLLTON, OHIO.

## FEED-WATER HEATER AND PURIFIER.

SPECIFICATION forming part of Letters Patent No. 735,715, dated August 11, 1903.

Application filed December 16, 1901. Serial No. 86,095. (No model.)

*To all whom it may concern:*

Be it known that I, CLEOPHUS K. CUNNINGHAM, a citizen of the United States, residing at Algonquin, in the county of Carroll and State of Ohio, have invented new and useful Improvements in Feed-Water Heaters and Purifiers, of which the following is a specification.

This invention relates to feed-water heaters.

The object of the invention is to provide a feed-water heater which shall be simple of construction, durable and efficient in use, and inexpensive of production, and which is adapted to utilize the waste heat underneath the boiler to heat the feed-water; and a further object of the invention is to assist in raising the temperature of the feed-water to the desired degree by commingling therewith steam and hot water from the boiler prior to the introduction of the feed-water into the boiler and to also make provision for the convenient blow-off of all sediment and foreign matter.

With these and other objects in view, which will readily appear as the nature of the invention is better understood, the same consists in certain novel features of construction and combination and arrangement of parts which will be hereinafter fully described, defined in the appended claims, and illustrated in the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section through a boiler-setting, showing the application of the invention to a boiler. Fig. 2 is a horizontal section of the same on the line 2-2 of Fig. 1. Fig. 3 is a transverse section through the boiler-setting looking toward the rear of the boiler, which is partially broken away to show the construction.

Referring now more particularly to the drawings, the numeral 1 represents the boiler-setting; 2, the boiler; 3, the furnace, and 4 the smoke passage or chamber in rear of the furnace and beneath the boiler. Extending into the passage 4 through one side of the boiler-setting is a feed-water pipe 5, which connects with a header 6, which in turn is connected with a similar header 7 by a series of horizontal transverse tubes 8, through which the water passes from one header to

the other. These parts are located in the passage 4 beneath the boiler, so as to be enveloped by the heat and flames passing rearwardly from the furnace 3, so that the water circulating through said tubes will be heated on its passage to the boiler.

Located above the header 7 is a third header 8', which is located a short distance below the boiler at a point just in advance of the rear end thereof and is connected with the boiler through a vertical induction-tube 9 and with the header 7 by two inclined conducting pipes or tubes 10, which are provided with valves having exteriorly-projecting operating devices 11 for opening and closing them to control the flow of water through the tubes.

From the header 8 extend two horizontal pipes or tubes 12, which are connected at their rear ends to a header 13 and are provided with valves having exteriorly-projecting operating devices 14 for cutting off and letting on the flow of water therethrough and to effect the blow-off of sediment and other foreign matter contained therein, as herein-after described.

Extending upwardly from the header 13 are a number or series of tubes 15, which are connected at their upper ends to a header 16, connected with the interior of the boiler by a short horizontal pipe 17, which enters the boiler below the water-line.

The tubes 8, 9, and 10 and the connecting-headers 6, 7, and 8' form the conductors for conveying the feed-water to the boiler, while the tubes 12, 15, and 17 and the connecting-headers 13 and 16 form a return-circuit for the flow of hot water from the boiler to the header 8' to commingle with the feed-water prior to its introduction into the boiler.

The header 8' has connected thereto a blow-off pipe 18, which extends to the exterior through the wall or setting of the furnace and is provided with a valve 18'.

The pipes and headers of the feed-water heater may be supported in any preferred manner. In the present instance I have shown them supported by connecting the headers 6, 8', 13, and 16 with the side walls of the boiler-setting by having the ends of said headers seated in suitable recesses therein.

In operation the feed-water passes from the



pipe 5 into the header 6, thence through the tubes 8 to the header 7, from the header 7 through the tubes or pipes 10 to the header 8, and thence through the induction-pipes 9 into the boiler. As the water flows through these pipes and headers it is heated by the flames and heated products of combustion passing through the chamber 4. As the feed-water flows into the boiler through the induction-pipe 9 it is met by a counter-current of hot water, which passes from the boiler down to the pipes 17, 15, and 12 and headers 16 and 13 and into the header 8', where this counter-current of hot water admixes or commingles with the feed-water before it passes into the boiler, and thereby assists in raising the temperature of the feed-water to the desired degree and at the same time promotes the circulation of the water within the boiler to constantly maintain a predetermined temperature. If desired, the pipe 17 may enter the boiler above the water-line, in which case steam from the boiler will be supplied to commingle with the feed-water entering the boiler through pipe 9, or said pipe 17 may be branched to enter the boiler both above and below the water-line, thus allowing both steam and hot water to pass through the return-flow pipes and enter the boiler with the feed-water through inlet-port 9.

Should it be desired to blow out the pipes and headers of the feed-water-supplying connections, this may be readily effected by closing the valves in pipes 12 and opening the valve in pipe 18, whereupon the water-pressure will blow the dirt or accumulation of foreign substances out through the pipe 18. The pipes and headers of the return connection for supplying the counter-current of steam may also be blown out whenever desired by closing the valves in pipes 10 and opening the valve 18', whereupon the sediment or accumulation of foreign matter therein will be forced out through the pipe 18 by the pressure of the hot water from the boiler.

From the foregoing description, taken in connection with the accompanying drawings, the construction, operation, and advantages of my improved feed-water heater will, it is

thought, be readily apparent without requiring an extended explanation.

Various changes in the form, proportion, and the minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of this invention, and I therefore reserve to myself the right to make such changes as clearly fall within the scope thereof.

Having thus described the invention, what is claimed, and desired to be secured by Letters Patent, is—

1. In a feed-water heater, the combination with a boiler, of a header, an induction-pipe connected thereto and entering the boiler, feed-water pipes arranged beneath the boiler and connecting with the header, return-flow pipes for conveying heated fluid from the boiler to the header to commingle with the feed-water prior to the introduction of the latter into the boiler, a blow-off pipe also connected to the header, and cut-off valves in said feed-water and return-flow pipes, substantially as described.

2. In a feed-water heater, the combination with a boiler; of a feed-water pipe, a pair of headers one of which connects with the said feed-water pipe, a horizontal series of conducting-tubes connecting said headers, a third header provided with an induction-pipe extending into the boiler, pipes connecting the other header of the first-named pair with the third header and provided with valves, return-flow pipes connecting between the boiler and said third header for introducing a counter-current of heated fluid to commingle with the feed-water prior to its introduction into the boiler, a blow-off pipe connected with the third header, and valves in the return-flow pipes, substantially as and for the purpose set forth.

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

CLEOPHUS K. CUNNINGHAM.

Witnesses:

CHAS. R. MILLER,  
WM. G. GEIER.