

No. 685,624.

Patented Oct. 29, 1901.

F. J. MANLEY.
FEED WATER HEATER.

(Application filed Dec. 15, 1900.)

(No Model.)

Fig. 1

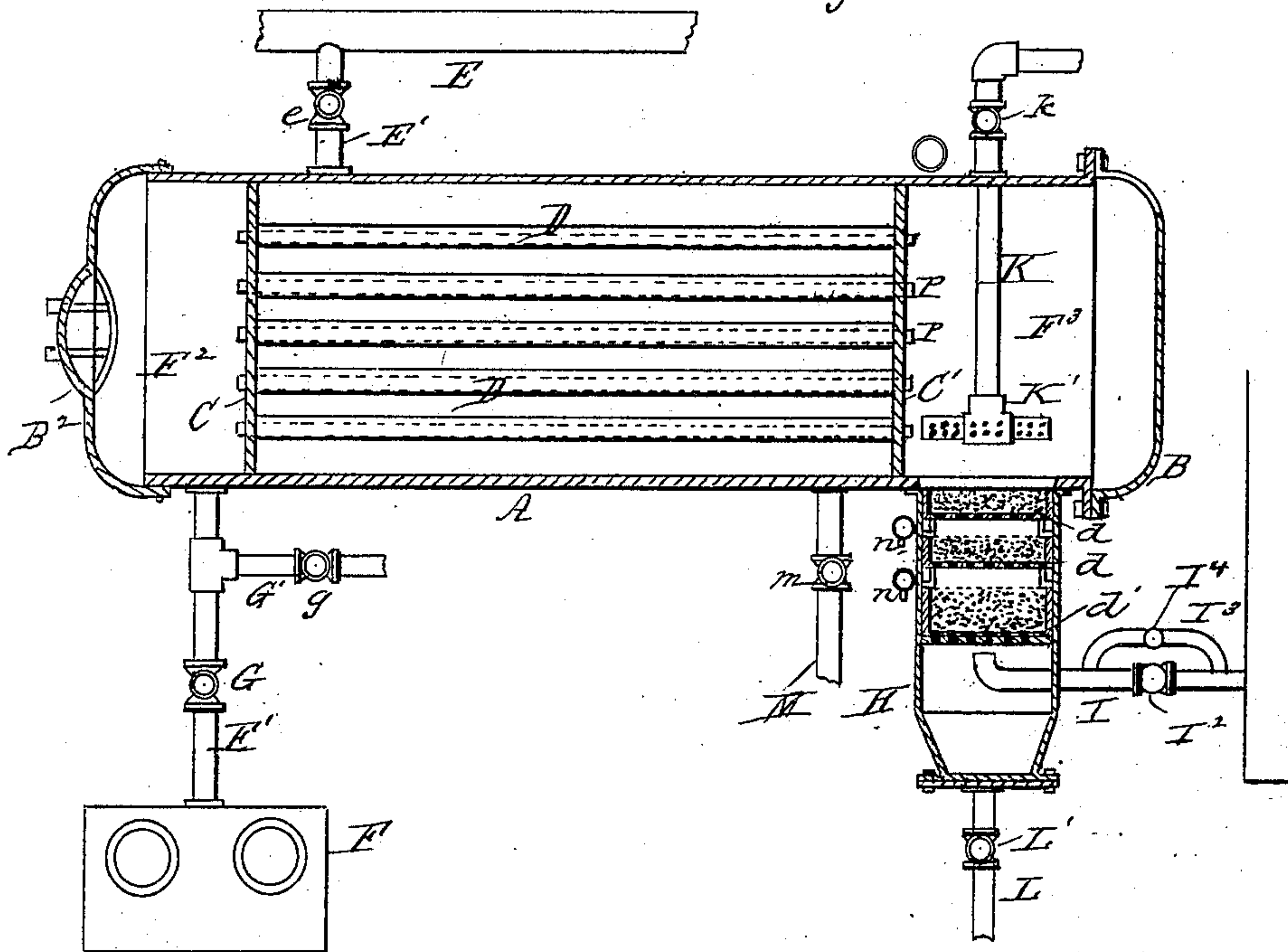


Fig. 2

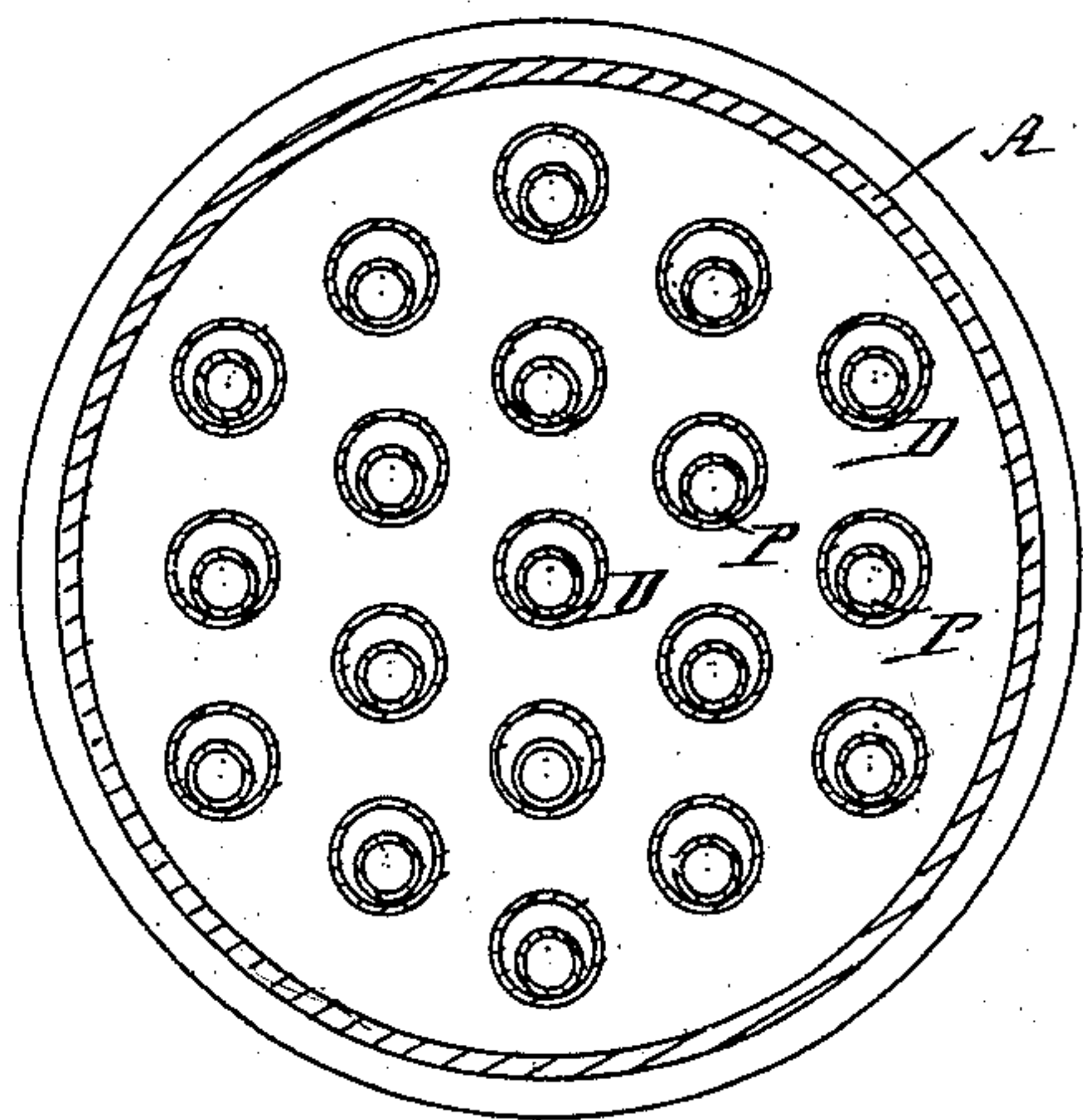
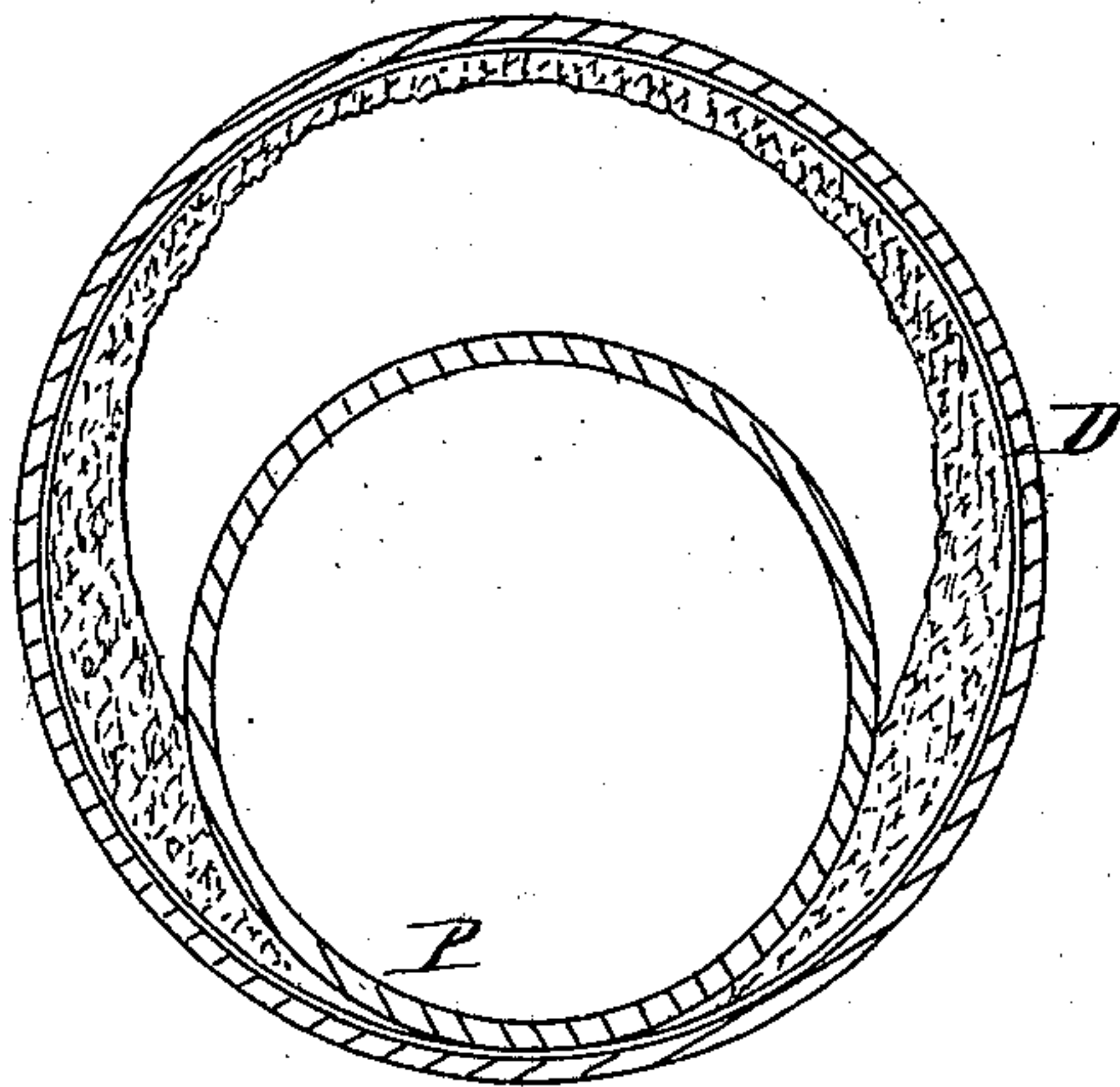


Fig. 3



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FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 685,624, dated October 29, 1901.

Application filed December 15, 1900. Serial No. 40,002. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK J. MANLEY, a citizen of the United States, residing at Allegheny, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Feed-Water Heaters for Steam-Boilers; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

My invention has relation to feed-water heaters for steam-boilers, and particularly to that class of heaters designed and adapted to increase the temperature of the feed-water taken from the open heater using exhaust-steam from the engine by pumping or forcing it into the boiler through a series of horizontal tubes arranged in a suitable casing and surrounded by live steam from the boiler. In heaters of this class the water when raised to a higher temperature than that imparted to it in the open heater by the exhaust-steam will deposit the magnesia and other scale-forming minerals contained therein, and these instead of being deposited in the boiler will be deposited inside the water-tubes of the heater, which therefore require to be frequently relieved of the incrustation, which by lessening the conductivity of the walls of the tubes impair their efficiency. This scale when deposited in the tubes of a heater is very difficult to dislodge, as it forms a continuous circle within the tube thicker at the bottom than at the top and of great density and tenacity, so that its removal is attended with great labor and loss of time. I have found that if the formation of this scale within the heater-tubes in the form of a continuous circle or arch at the point of greatest density or thickness is prevented by interposing a suitable removable barrier and cooling and contracting the tubes while this barrier or removable keystone is in place the disintegration and dislodgment of the scale from its position become easy and the cleaning of the tubes a work requiring comparatively little time and labor.

In carrying my invention into effect I find

that by the insertion in each water-conveying tube of the heater of a supplementary tube of considerably less diameter, arranged so as to rest on the bottom of the water-tube, the continuity of the scale will be broken and that after the heater has been in use the flooding of the tubes with cold water will cause a contraction of their walls and such displacement of their inner tubes as will effectually disrupt the scale formation and lead to its easy and rapid disintegration and dislodgment.

My invention accordingly consists in the combination, with the main water-tubes of a feed-water heater heated by live steam, of loose removable supplementary tubes arranged therein and adapted to prevent the formation in said main tubes of unbroken circles of scale and to loosen and disrupt the solid scale deposit when the tubes are contracted by cooling.

In the accompanying drawings, which represent a feed-water heater embodying my invention, Figure 1 is a central longitudinal sectional view of the heater. Fig. 2 is a vertical transverse section of the same. Fig. 3 is a transverse sectional view, enlarged, of one of the water-tubes with the inner supplementary tube in position.

The body of the heater consists of a cylindrical shell or casing A, having at one end removable head or cap B, flanged, and having at the other or front end an opening closed by a removable cap B² and bolted to the body. At some distance from each end of the casing a partition is fitted in place and secured to the wall of the casing. These partitions C and C', respectively, are pierced for the insertion and support of the main water-tubes D, of which any desired number is employed, the tubes being expanded and flanged at their ends, so as to be water and steam tight at the joints.

E designates the live-steam pipe leading from the boiler, and E' a branch leading therefrom to the casing A and communicating with the space between the partitions C C', so that the live steam will surround and heat the tubes D and raise the temperature of the water passing through said tubes to the required degree. The branch pipe E' is provided with a suitable valve e.

F designates the pump, from which leads the pipe F' to the space F² at the front end of the heater forward of the partition C. G is a valve on said pipe, and G' a branch leading
 5 from the pipe F' above the valve G to the open air and having a valve g.

H designates a vessel attached to the heater near its rear end and opening at its upper end into the space F³ between the partition C' and
 10 the rear end of the casing A. This vessel, with its contents, is intended and adapted to constitute a water-purifier or oil-separator and for this purpose contains a series of seive-like pans *d d d'*, filled with gravel, in which
 15 the water passing from the tubes D of the heater is filtered or purified, so as to separate from it the oil taken up by the water from the exhaust-steam in the open heater and such scale-forming or other minerals as may
 20 not have been deposited in the tubes of the heater. The vessel H communicates near its lower end with the boiler by means of a pipe I, the end of which is bent upwardly in the vessel H. This pipe is provided with a check-
 25 valve I², past which the water from the heater is forced into the boiler, but which closes against back pressure of water from the boiler. A by-pass pipe I³ is connected with the pipe I and communicates therewith on opposite
 30 sides of the check-valve I². The pipe I³ is provided with a valve I⁴, which may be opened or closed as it is required to use the by-pass for the admission of water from the boiler to the vessel H and water-space of the heater to
 35 "blow off" the same when clogging or accumulation of solid matter takes place.

K designates a pipe entering the space F³ at the rear end of the heater above the vessel H and provided at its lower end with a T
 40 connection K', the horizontal portion of which is perforated. This pipe extends above and outside the heater and is opened to the air at its end, but provided with a valve *k* to close it when not in actual service. A drip and
 45 blow-off pipe L, provided with a valve L', leads from the bottom of the vessel H. Another pipe M, provided with a valve *m*, leads downward from the steam-space of the casing A near the vessel H. This pipe is used
 50 to draw off from the steam-space the water of condensation.

Reverting to the principal features of my invention—to wit, the supplementary loose removable tubes within the main tubes of the
 55 heater, such supplementary tubes are shown at P. These are wrought-iron tubes of considerably less diameter than the main tubes D and are simply laid eccentrically therein, so as to rest loosely on the bottoms of tubes
 60 D. The supplementary tubes P are preferably a little longer than the main tubes, so as to project slightly from the ends of the main tubes for convenience in handling and removing.

65 When the heater is in actual use, the valves on pipes K L M G' are closed and the valves on pipes F' E' opened, water being then

forced into the heater by the pump, which preferably takes its supply from the open heater, wherein it has been primarily heated
 70 by the exhaust-steam from the engine, passes through the tubes D and supplementary tubes P, and takes up additional heat to near the boiler temperature from the live steam admitted around the pipes D from the boiler. 75
 This increased heat causes the liberation of the scale-forming matter from the water, and all or nearly all such matter is deposited in the tubes D, the deposit being greatest at the bottom of the tubes and gradually diminish- 80
 ing in depth to the top of the tubes. Scale is also deposited on the exterior exposed surface of the supplementary tubes P, but obviously is not deposited at the lower middle part of the tubes D D, upon which the sup- 85
 plementary tubes P rest. The circle of scale which would otherwise form is therefore interrupted or broken at its deepest or densest part and its resistance weakened. When
 90 upon removing the cap B² it is observed that so much scale has been deposited that its removal becomes necessary, the valves on the steam-inlet and pump pipes are closed. Cold water is now let into the heater while the
 95 heater-tubes are still hot, and the result is a contraction of the tubes and of the mass of incrustation therein. This contraction lifts the supplementary tubes P from their seats and causes such a break in the mass of in- 100
 crustation that it disintegrates and loosens from the tubes, so that when the inner tubes are removed the further crushing and displacement of the scale becomes easy, and the tubes can therefore be cleaned with but little 105
 labor or loss of time. As the supplementary tubes will also require the removal of scale from their inner and outer surfaces, it is intended that one or more sets of inner tubes should be kept in reserve, so that a clean set
 110 may be inserted in the heater while the incrustated set are being cleaned, thus obviating any long interruption in the use of the heater. The adherence of scale to the tubes D D may be considerably lessened by wiping their inner surfaces previous to use with a mixture 115
 of cylinder-oil and plumbago, which will thus form a thin film, preventing actual contact of the scale with the metal. When it is desired to blow off the heater and purifier by
 120 water from the boiler, the valves *e* and G are closed and the valves *g k L'* opened. Water from the boiler is then admitted to the vessel H by opening the valve in the by-pass pipe I³, and the accumulations of oil and sediment are blown out through the pipes K, 125
 L, and G'. The oil which accumulates in the purifier above the gravel-pans is from time to time drawn off through the cocks *n n* at the side of the vessel H.

Having described my invention, what I 130
 claim, and desire to secure by Letters Patent, is—

1. A feed-water heater comprising the casing A, with vertical partitions C C' and hav-

ing water-spaces between said partitions and the ends of the casing; water-tubes attached to and extending between said partitions and communicating with said water-spaces, loose, 5 removable supplementary tubes arranged eccentrically within and resting on the bottoms of said water-tubes; a live-steam-supply pipe leading from the boiler to the casing and communicating with the space around the 10 water-tubes; a water-supply pipe leading from a pump to the water-space of the casing A and a pipe provided with a check-valve leading from the water-space of the casing to the boiler, substantially as set forth.

15 2. The combination with the feed-water heater comprising a closed casing having horizontal water-tubes, water-spaces with which

said tubes communicate and means of access to the interior of the casing from one or both ends, of means for forcing water from an 20 open heater through said tubes to the boiler, means for admitting said water from the boiler into said casing and around said tubes and loose, removable supplementary tubes located eccentrically within and resting upon 25 the bottoms of the water-tubes as and for the purpose set forth.

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

FREDERICK J. MANLEY.

Witnesses:

THOS. A. CONNOLLY,
JOHN GRAEBING, Jr.