

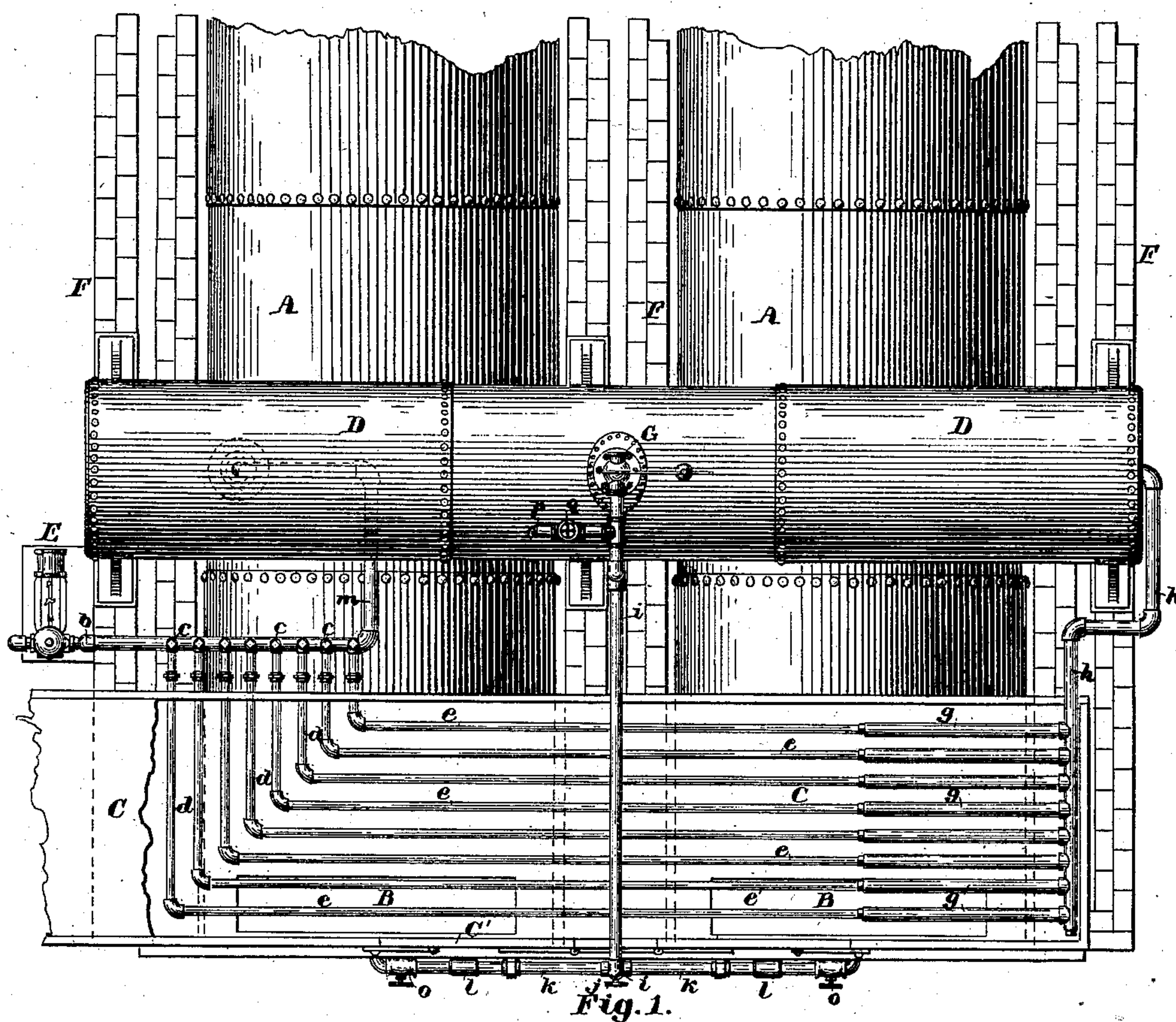
(No Model.)

3 Sheets—Sheet 1.

E. KENDALL.
FEED WATER HEATER.

No. 259,167.

Patented June 6, 1882.



Witnesses:
E. A. Hemmenway
Walter E. Lombard.

Inventor:
Edward Kendall
by N. C. Lombard
Attorney.

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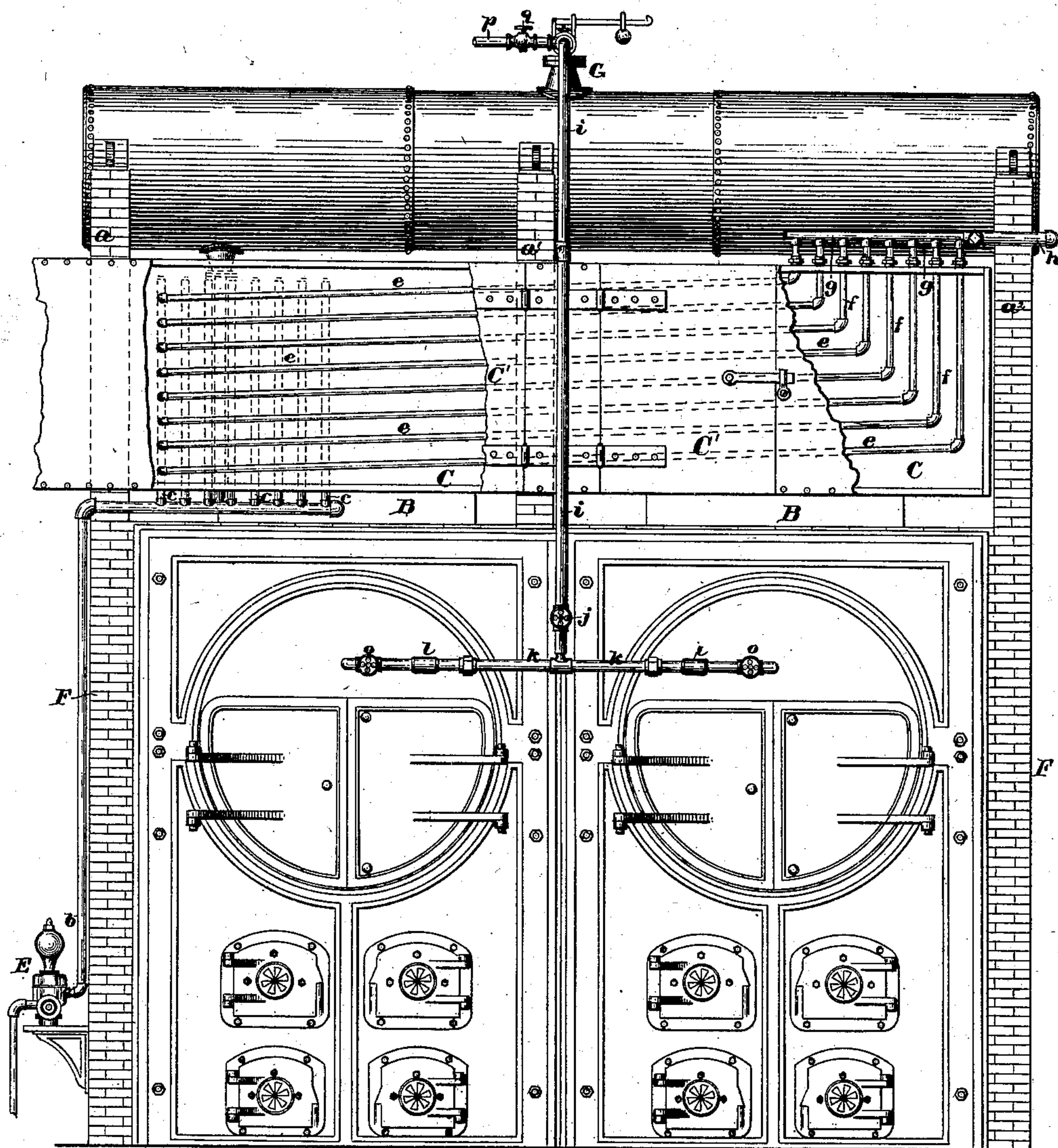


Fig. 2.

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(No Model.)

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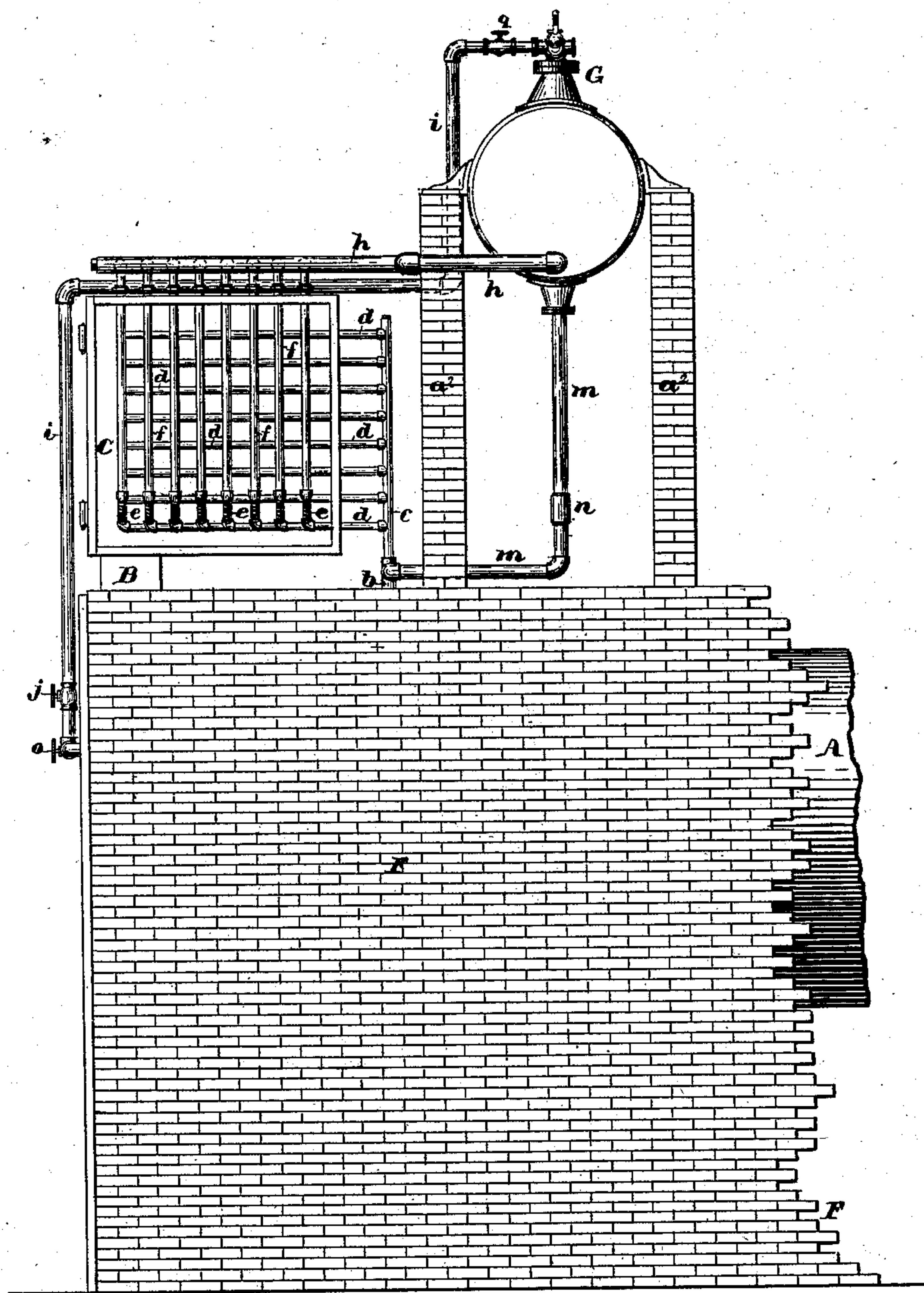


Fig. 3.

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UNITED STATES PATENT OFFICE.

EDWARD KENDALL, OF CAMBRIDGEPORT, MASSACHUSETTS.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 259,167, dated June 6, 1882.

Application filed July 30, 1881. (No model.)

To all whom it may concern:

Be it known that I, EDWARD KENDALL, of Cambridgeport, in the county of Middlesex and State of Massachusetts, have invented certain
5 new and useful Improvements in Feed-Water Heaters, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to an attachment to
10 steam-boilers for heating water to be used for feeding the boilers, and for other purposes, by utilizing the waste heat which ordinarily escapes to the chimney; and it consists, first, of a smoke-flue, preferably rectangular in cross-
15 section, arranged above or outside of the boiler or boilers, and connected by suitable flues with the smoke-chamber or uptake of the boiler or boilers, through which the hot gases pass after having traversed all of the flues or passages of
20 the boiler or boilers, and also communicating at one end with the chimney, in combination with a series of pipes or tubes arranged within said flue in a position to be acted upon by the hot gases in their passage to the chimney, a
25 pump communicating by a suitable pipe with said series of tubes and adapted to force water into and through them, and a pipe or pipes leading from said series of pipes or tubes to the interior of the boiler or boilers, as will be de-
30 scribed.

My invention further consists in the combination, with a steam-boiler, of a smoke pipe or flue located outside of the boiler and provided with one or more doors in its front side through
35 which access may be had to its interior for cleaning, a cluster or series of pipes located in said flue and communicating at each end with a single pipe, a pump connected to one of said single pipes, a reservoir-tank connected to the other of said single pipes, and a suitable pipe lead-
40 ing from said reservoir to the interior of the boiler or other receptacle where the heated water may be required for use.

My invention further consists in the combination, with a steam-boiler, of a smoke-flue lo-
45 cated outside of the boiler and connected by suitable passages with the uptake of the boiler and leading to the chimney a cluster or series of tubes arranged within said flue in positions
50 to be acted upon by the hot gases in their passage to the chimney, a water tank or reservoir

located above said smoke-flue, a pump connect-
ed with and adapted to force water through
said cluster or series of pipes, a pipe connect-
ing said cluster or series of tubes with said res- 55
ervoir, and a pipe leading from said reservoir to the interior of the boiler or other receptacle where the heated water is required for use, and provided with suitable valves for controlling
60 the passage of the water.

It further consists in the combination of a steam-boiler, a water tank or reservoir located outside of the boiler, a smoke-flue leading from the uptake of the boiler to the chimney, a series of pipes located within said flue in posi- 65
tions to be acted upon by the hot gases in their passage to the chimney, a pump connected with and adapted to force water through said series of pipes, a pipe connecting each end of said series of pipes with said reservoir, and a check- 70
valve in one of said connecting-pipes arranged to open outward or away from said reservoir, as will be more fully described.

Figure 1 of the drawings is a plan of a por-
tion of a pair of boilers with my improved wa- 75
ter-heating apparatus applied thereto. Fig. 2 is a front elevation of the same with portions of the front plate of the heater-flue removed to show the heater-pipes; and Fig. 3 is a partial
80 side elevation of the same with the end plate of the heater-flue removed to show the heater-
pipes contained therein.

A A are two boilers, which may be of any well-known construction, and provided with
85 the usual combustion-chamber and ash-pit and with the smoke-flues B B, which ordinarily would extend to and enter the chimney; but with my improvements attached the flues B B are made short and open into the horizontal rectangular flue C, which has one end closed 90
and connects at its other end with the chimney-flue, and is provided with one or more doors, C', as a means of access to its interior for cleaning the pipes.

D is a cylindrical tank or reservoir, made of 95
boiler-iron, and supported upon the brick piers a , a' , and a'' at some distance above the boilers, and entirely above the top of the flue C, as shown, though both reservoir and flue may be placed at the side of the boiler, if desired. 100

E is a steam-pump, the discharge-pipe b of which extends upward and is turned into a

horizontal position above the brick setting F of the boilers, and there connects with a series of vertical pipes, *c c c*, each of which connects with a series of horizontal pipes, *d d d*, which pass through the rear wall of the flue C, and the several series of said pipes *d* extend a greater or less distance into said flue transversely thereof, and are connected by suitable quarter-turns to other series of pipes, *e e e*, which are arranged longitudinally of the flue C, but somewhat inclined, as shown in Fig. 2, and are in turn connected by quarter-turns to the series of vertical pipes *f f f*, which pass through the upper plate of the flue C, and are in turn connected to the series of horizontal pipes *g g g*, each having one end closed and connected at its other end with the single horizontal pipe *h*, leading to and communicating with the interior of the reservoir D, as shown in Fig. 1. By this arrangement of the heater-pipes provision is made for unequal expansion, the spring of the pipes preventing injury to the joints. The reservoir D is provided with a safety-valve, G, and the discharge-pipe *i*, which extends downward in front of the boilers, where it is provided with a globe-valve, *j*, and connects with the horizontal branch pipes *k k*, each of which is provided with a check-valve, *l*, arranged to prevent the passage of water from the boiler, and a globe-valve, *o*, by means of which the supply of feed-water may be shut off from the boiler with which said pipe connects. The reservoir D is also provided with a second discharge-pipe, *m*, which leads from the bottom of said reservoir to and connects with the pipe *b*, as shown in Figs. 1 and 3, said pipe being provided with a check-valve, *n*, so arranged as to prevent the passage of water into the reservoir through the pipe *m* when the pump is in operation, and to permit the free passage of water from the reservoir when the pump is not in operation.

The operation of my improved heater is as follows: A fire having been started under the boilers A A, one or both, and steam having been raised, the pump E is set in operation to fill the pipes *b, c, d, e, f, g*, and *h* and the reservoir D with water, when, if there is sufficient water in the boiler, the pump will be stopped until such time as it becomes necessary to supply the boiler with more water. In the meantime the water in the pipes *d, e*, and *f* becomes heated, and by virtue of the natural tendency of hot water to rise to the surface it passes through the pipes *g* and *h* into the reservoir D and to the upper part of said reservoir, the colder water in the lower part of the reservoir descending through the pipe *m* and valve *n* to take the place of the warmer water which has risen into the reservoir from the pipes contained in the flue C, which latter pipes are continuously exposed to the action of the hot gases escaping through the flues B B and C to the chimney. If, now, it is desired to supply the boilers with a quantity of water, the pump E is again set in operation, the effect of

which is to force cold water up the pipe *b*, the pressure of which will close the valve *n* and cause a discharge of an equal amount of hot water from the reservoir D through the pipes *i* and *k* into the boilers A, the globe-valves *j* and *o o* being open to permit such movement of the water.

If for any reason one of the boilers is not in use, the globe-valve *o* upon that boiler should be closed, so that the feed-water would be discharged only into the boiler where it was needed.

In order that the hot water may be made available for other uses, I provide the branch pipe *p*, provided with the globe-valve *q*, said pipe *p* leading to the place where it is desired to deliver the heated water, and when it is desired to use the water for such other uses it is only necessary to close the valve *j* and open the valve *q* before starting the pump.

By the use of my invention the boilers may be supplied with water raised to a temperature at or near the boiling-point, and at the same time a large amount of hot water may be supplied for other purposes without extra cost other than the power required to pump it.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The smoke-flue C, connected with a boiler and chimney, in combination with a series of water-pipes arranged within said flue in positions to be acted upon by the hot gases in their passage to the chimney, a pump connected by its discharge-pipe with said series of pipes and adapted to force water through them, and a pipe or pipes leading from said series of heating-pipes to the interior of the boiler or other receptacle, substantially as described.

2. In combination with a steam-boiler, the smoke-flue C, connected with the boiler by a suitable passage, B, and provided with one or more doors, C', a series of tubes located in said flue C and communicating with a single tube at each end located outside of said flue, a pump connected to one of said single tubes, a reservoir connected to the other of said single tubes, and a pipe leading from said reservoir to the interior of the boiler or other receptacle, substantially as described.

3. In combination with a steam-boiler, the reservoir D, the flue C, connected by a suitable passage with the boiler, a series of tubes arranged within the flue C in positions to be acted upon by the hot gases, a pump connected with and adapted to force water through said series of tubes, a pipe connecting said series of tubes with said reservoir, the pipes *i* and *k*, check-valve *l*, and globe valve or gate *o*, all arranged and adapted to operate substantially as described.

4. In combination with a steam-boiler, the flue C, connected with the boiler, a series of tubes located in said flue in positions to be acted upon by the hot gases in their passage to the chimney, a reservoir located at a higher

level than the flue C, a pump connected with and adapted to force water through said series of heater-pipes, the pipes *h* and *m*, each connecting one end of said series of heater-pipes with said reservoir, and the check-valve *n*, all arranged and adapted to operate substantially as described, for the purposes specified.

5. The combination of the boiler A, flues B and C, the reservoir D, pump E, pipes *b*, *c*, *d*, *e*, *f*, *g*, *h*, *i*, *k*, and *m*, check-valves *l* and *n*, and globe valves or gates *j* and *o*, all arranged and adapted to operate substantially as and for the purposes described.

6. The combination of the boiler A, flues B and C, the reservoir D, pump E, pipes *b*, *c*, *d*, *e*, *f*, *g*, *h*, *i*, *k*, *m*, and *p*, the check-valves *l* and *n*, and the globe valves or gates *j* and *q*, all arranged and adapted to operate substantially as and for the purposes described.

7. In a feed-water heater, the combination of the flue C, a series of small tubes composed of parts *d*, *e*, and *f*, connected together by quarter-bends of elbow-pipes at right angles to each

other, and suitable pipes connecting said heater-pipes with a source of water-supply and with a receptacle to receive the heated water, substantially as and for the purposes described.

8. In a feed-water heater, the combination of a smoke-flue, a cluster or series of small tubes, each provided with one or more right-angled bends and arranged within said flue in positions to be acted upon by the hot gases in their passage to the chimney, a single supply-pipe of larger capacity connected with and adapted to supply water to each of the tubes in said cluster or series of small tubes, and a single discharge-pipe connected with and adapted to receive the water from each of said small tubes, substantially as described.

Executed at Boston, Massachusetts, this 28th day of July, A. D. 1881.

EDWARD KENDALL.

Witnesses:

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