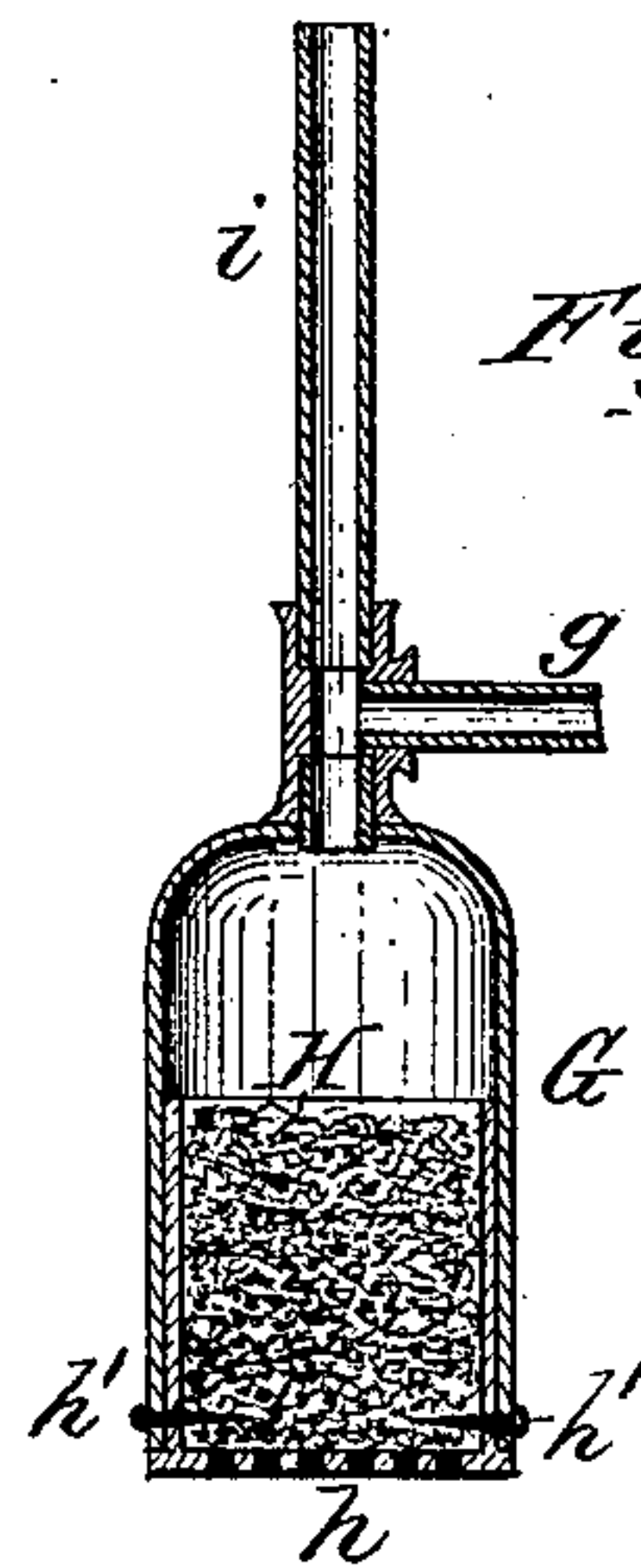
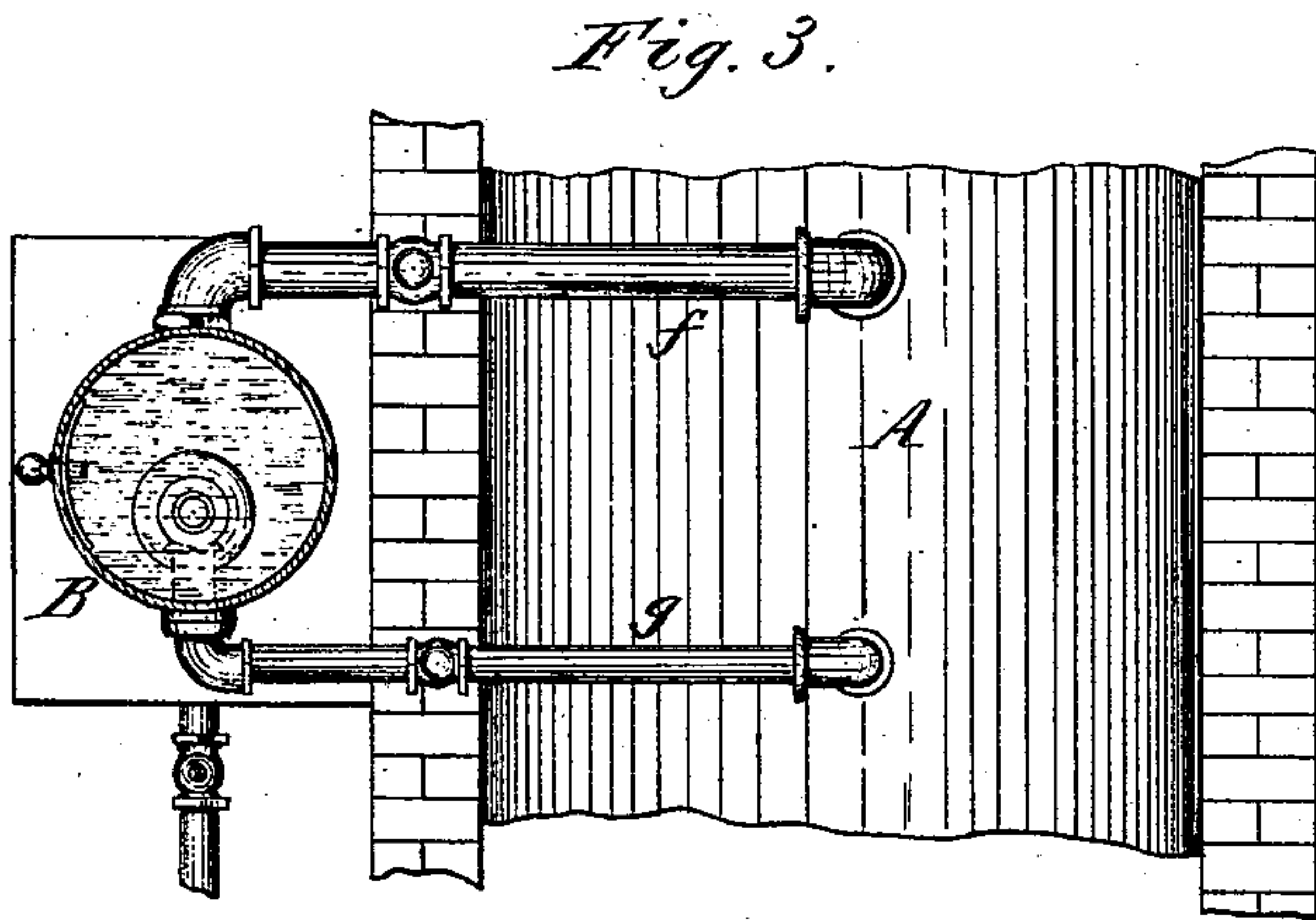
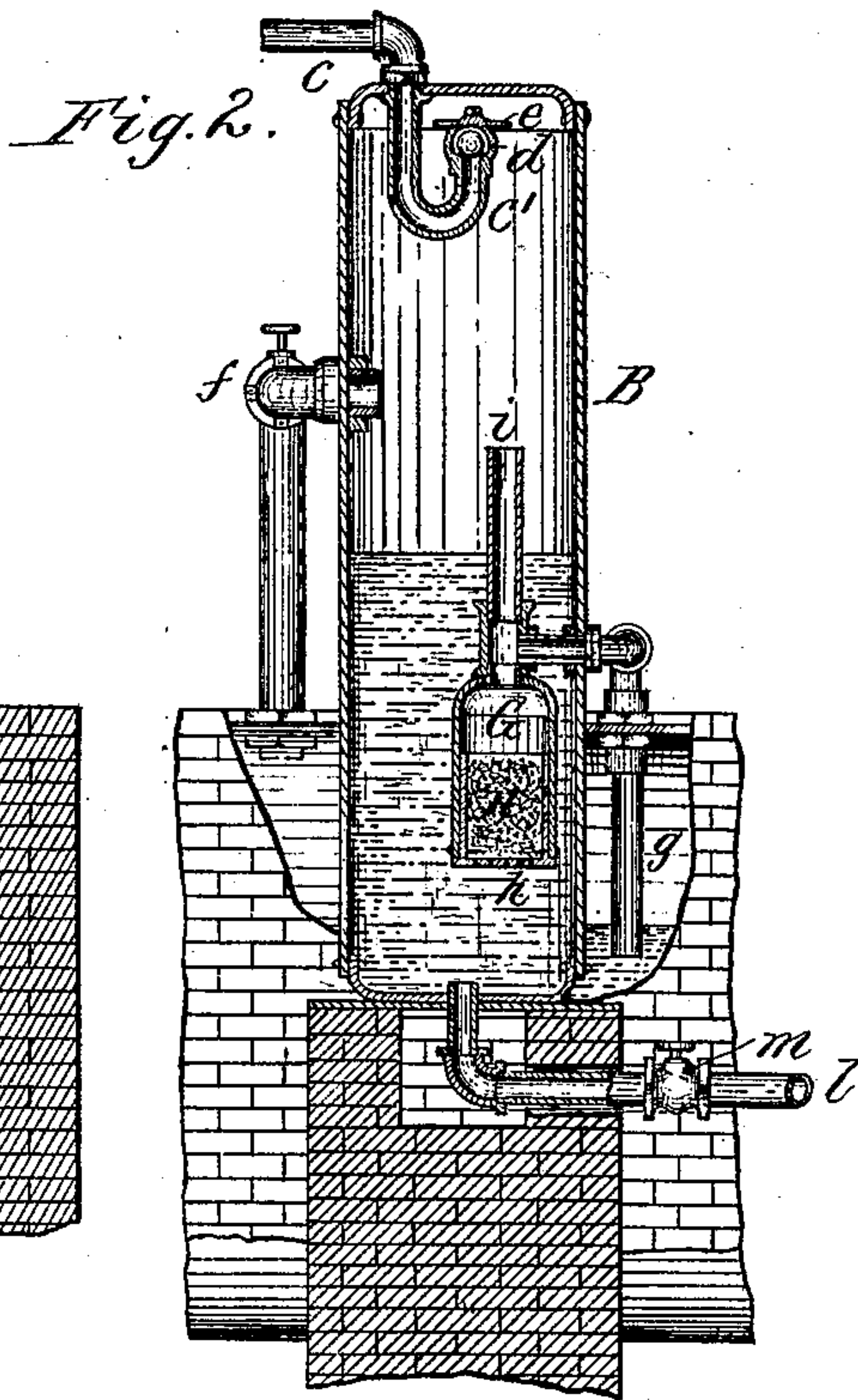
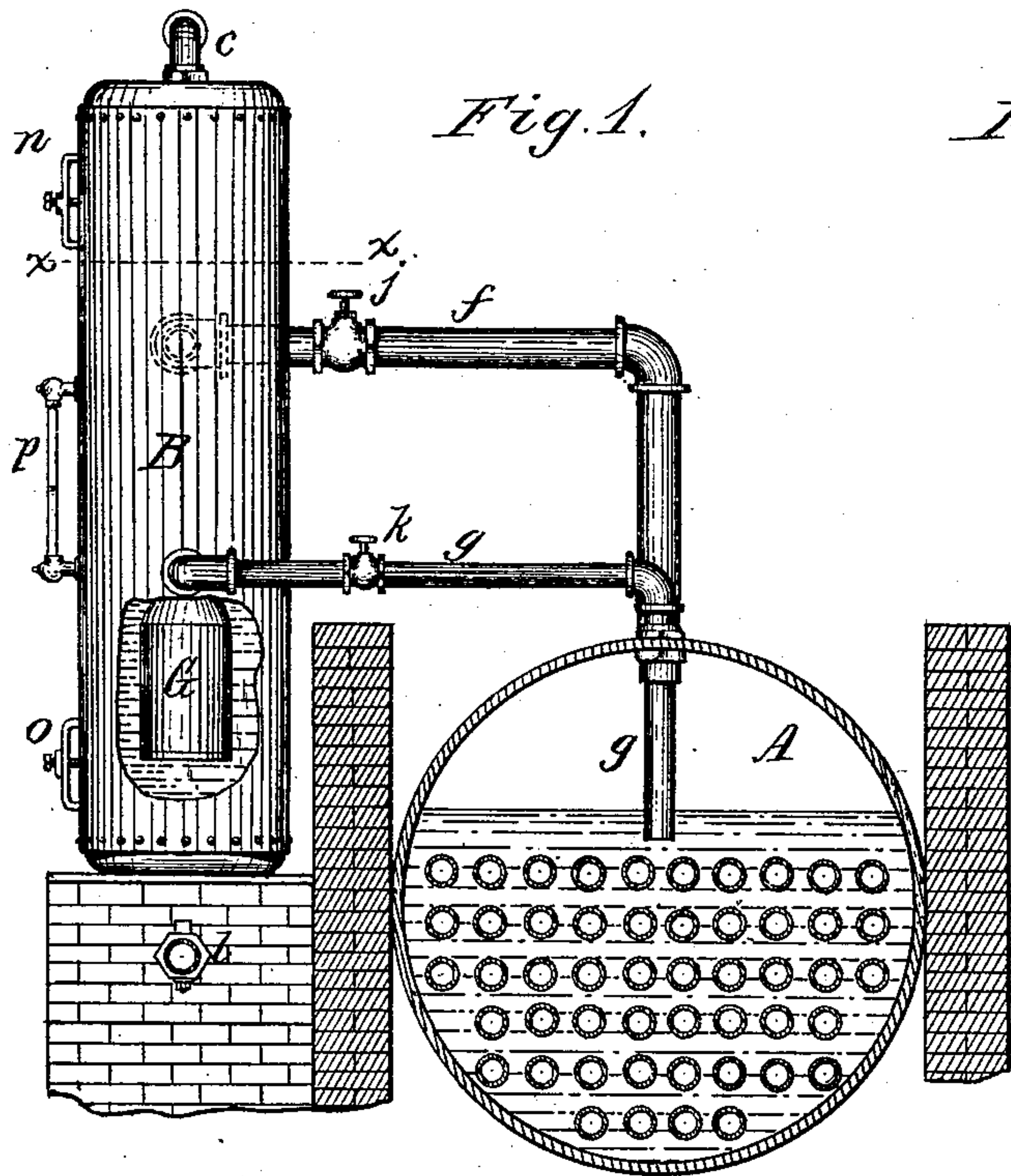


(No Model.)

E. J. HALL.
Feed Water Heater.

No. 243,249.

Patented June 21, 1881.



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UNITED STATES PATENT OFFICE.

EDWARD J. HALL, OF BUFFALO, NEW YORK.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 243,249, dated June 21, 1881.

Application filed January 17, 1881. (No model.)

To all whom it may concern:

Be it known that I, EDWARD J. HALL, of the city of Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Feed-Water Heaters, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to a feed-water heater whereby the feed-water is thoroughly freed from its impurities before it enters the steam-boiler, thereby preventing the formation of scale in the same.

My invention consists, principally, in combining with a steam-boiler a feed-water heater which has connections with both the steam-space and the water-space of the boiler, and which is furnished with a spray-valve at the mouth of its feed-pipe, whereby the feed-water is caused to pass through the steam-space in the heater in fine drops, which are rapidly heated to the boiling-point, and whereby the impurities contained in the water are separated therefrom in a form in which they can be readily discharged from the heater; also, of the particular construction and arrangement of the parts whereby the separation of the impurities from the water is effected and the proper flow of the feed-water from the heater to the boiler is insured, as will be hereinafter fully set forth.

In the accompanying drawings, Figure 1 is an elevation of my improved feed-water heater. Fig. 2 is a vertical section thereof at right angles to Fig. 1. Fig. 3 is a horizontal section in line *x x*, Fig. 1. Fig. 4 is an enlarged sectional elevation of the filtering apparatus.

Like letters of reference refer to like parts in the several figures.

A represents a steam-boiler of any ordinary and well-known construction.

B represents the cylindrical shell of the feed-water heater, arranged near the steam-boiler in a convenient position.

c is the pipe through which the feed-water is introduced into the shell B from the pump or other feeding apparatus. The pipe *c* enters the shell B at its top, and is provided in the upper portion of the shell B with an upturned end, *c'*, which terminates in a valve-seat, upon which rests a ball-valve, *d*.

e is a spreading-disk, secured above the valve

d in such a position that the stream of water issuing from the pipe *c'* in an upward direction strikes against the under side of the disk *e*, and is thereby broken and deflected downward in a circular spray.

f represents the steam-pipe which connects the steam-space of the boiler with the upper portion of the shell B of the heater, whereby the same steam-pressure is maintained in both.

g represents the pipe through which the feed-water is conducted from the heater B to the boiler. The pipe *g* is provided within the heater B with a downwardly-extending enlargement, G, whereby the water is taken from a point sufficiently below the surface to prevent the scum and other impurities which accumulate on the surface to enter the feed-pipe. The great area of this depending portion of the feed-pipe, compared with the size of the feed-pipe proper, causes the velocity of the ascending current of water to be reduced, thereby permitting any impurities which may be suspended in the water to settle and drop out of the current before the water enters the pipe *g*.

The enlargement G may be provided with a filter, H, which consists of a cylinder which is fitted within the enlargement G, and which is provided with a perforated bottom, *h*, the margin of which rests against the lower end of the enlargement G. The filter H is secured in the enlargement G by pins or bolts *h'*, which can be readily withdrawn when it is desired to remove the filter. The filter is filled with gravel or any other suitable material which permits the water to percolate through it and arrests the light impurities.

i is a vent-pipe, which rises from the inner end of the pipe *g* and extends above the water-level in the heater B. The vent-pipe *i* establishes a communication between the pipe *g* and the steam-space in the heater B, and prevents the pipe *g* from acting as a siphon. The pipe *g* enters the boiler A, preferably at the top, and extends downward in the boiler to a point below the water-line. The pipes *f* and *g* are respectively provided with valves *j* *k*, whereby the flow of steam or water through the same may be stopped, when desired.

l represents a blow-off pipe connected with the bottom of the heater B, and provided with a suitable valve, *m*.

n represents a man-hole arranged in the up-

per portion of the shell B for the purpose of giving access to the spray mechanism, and *o* is a man-hole arranged in the lower portion of the shell B for permitting the removal of the filter.

p is a water-gage applied to the heater B.

The feed-water descends through the steam-space of the heater B in a fine spray, whereby the drops of water are almost instantaneously heated to the boiling-point, and the impurities contained in the water are separated therefrom in a granular form. The granules descend through the water and accumulate on the bottom of the heater, and are expelled therefrom from time to time by blowing them off through the pipe *l*. The water-level in the heater is kept at a suitable height above the point where the pipe *g* leaves the shell B, so as to produce the proper flow of water from the heater into the boiler, in accordance with the quantity of water which is evaporated in the boiler. The enlargement G reduces the force of the upward current of water to such an extent that it is unable to lift the heavy granules of impurities which settle to the bottom; but when feed-water is employed which contains light impurities the filter H is employed to intercept and collect such light impurities which still remain suspended in the water.

The filter is readily cleaned by closing the valve *j* in the steam-pipe *f* and opening the valve *m* in the blow-off pipe *l*, when the boiler-pressure, acting upon the contents of the heater B, will force a current of water downward through the filter, whereby the impurities which have collected in the filter are loosened and expelled.

When it becomes necessary to renew the filtering material the filter H is readily disconnected from the enlargement G and withdrawn through the man-hole *o*. The filter is also cleaned every time the blow-off cock *m* is opened by reason of the steam in the upper portion of the heater forcing the water down through the vent-pipe *i* and the filter.

By my improved apparatus the feed-water is completely freed from the impurities which can be separated therefrom by boiling and filtering before the feed-water enters the boiler, and the formation of scale and the accumulation of muddy deposits in the boiler are thereby entirely prevented.

I am aware that a spray-valve has been applied to the mouth of the feed-water pipe in the steam-space of a boiler, and that a feed-water heater connected by pipes with the steam-space and water-space of a boiler is not new, and I do not claim such devices separately; but

I claim as my invention—

1. The combination, with a steam-boiler, of a feed-water heater, B, connected with the steam-space of the boiler by a pipe, *f*, and with the water-space thereof by a pipe, *g*, and a feed-water pipe, *e*, terminating in the upper portion of the heater, and provided at its mouth with a spray-valve, *d*, all arranged substantially as and for the purpose set forth.

2. The combination, with a steam-boiler, of a feed-water heater, B, connected with the steam-space of the boiler by a pipe, *f*, and with the water-space thereof by a pipe, *g*, provided within the heater, with a downward extension or inlet, G, whereby the scum is prevented from entering the pipe *g*, and a feed-water pipe terminating in the upper portion of the heater, and provided at its mouth with a spray device, *d*, substantially as set forth.

3. The combination, with a steam-boiler, of a feed-water heater, B, connected with the steam-space of the boiler by a pipe, *f*, and with the water-space thereof by a pipe, *g*, having in the heater an enlarged depending inlet, G, provided with a filter, H, substantially as set forth.

4. The combination, with a steam-boiler, of a feed-water heater, B, connected with the steam-space of the boiler by a pipe, *f*, and with the water-space thereof by a pipe, *g*, opening below the water-line in the heater, and provided with a vent-pipe, *i*, extending above the water-line, substantially as set forth.

5. The combination, with a steam-boiler, of a feed-water heater, B, connected with the steam-space of the boiler by a pipe, *f*, and with the water-space of the boiler by a pipe, *g*, provided with a vent-pipe, *i*, and a blow-off, *l*, *m*, connected with the lower portion of the heater B, substantially as set forth.

EDWARD J. HALL.

Witnesses:

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