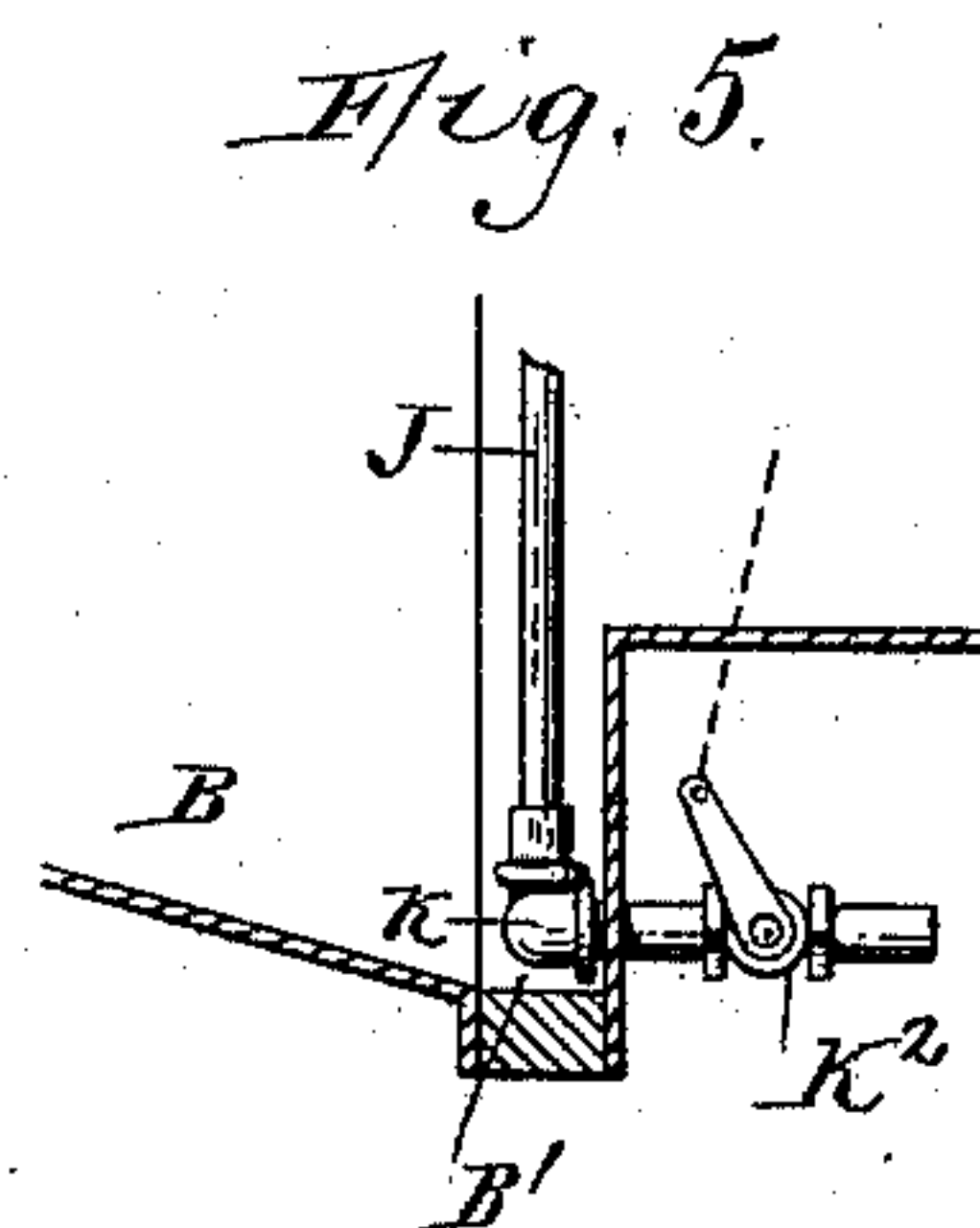
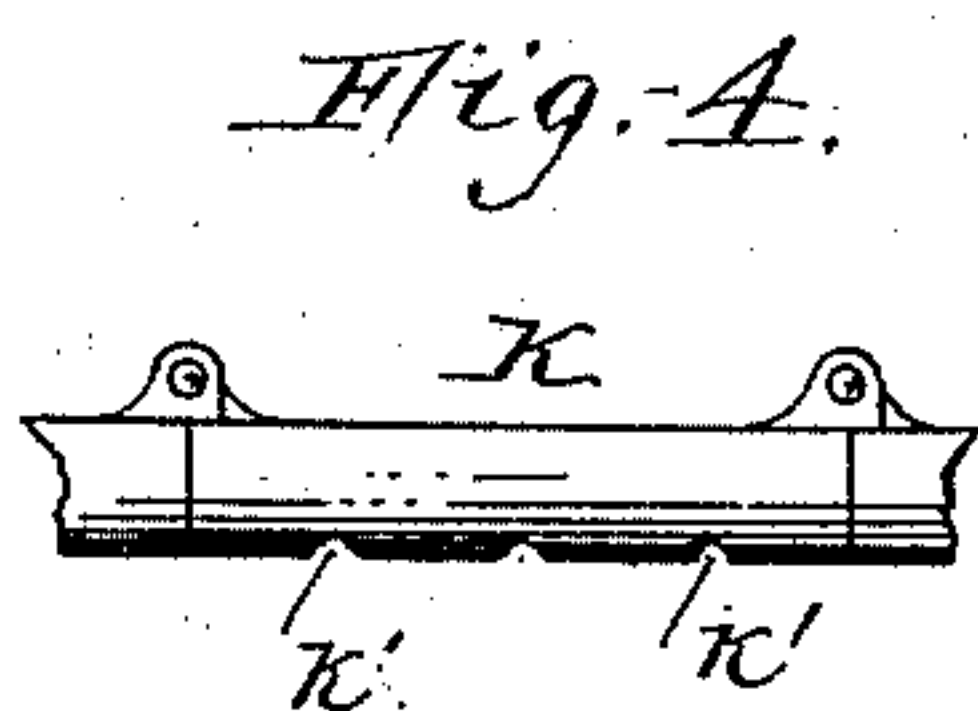
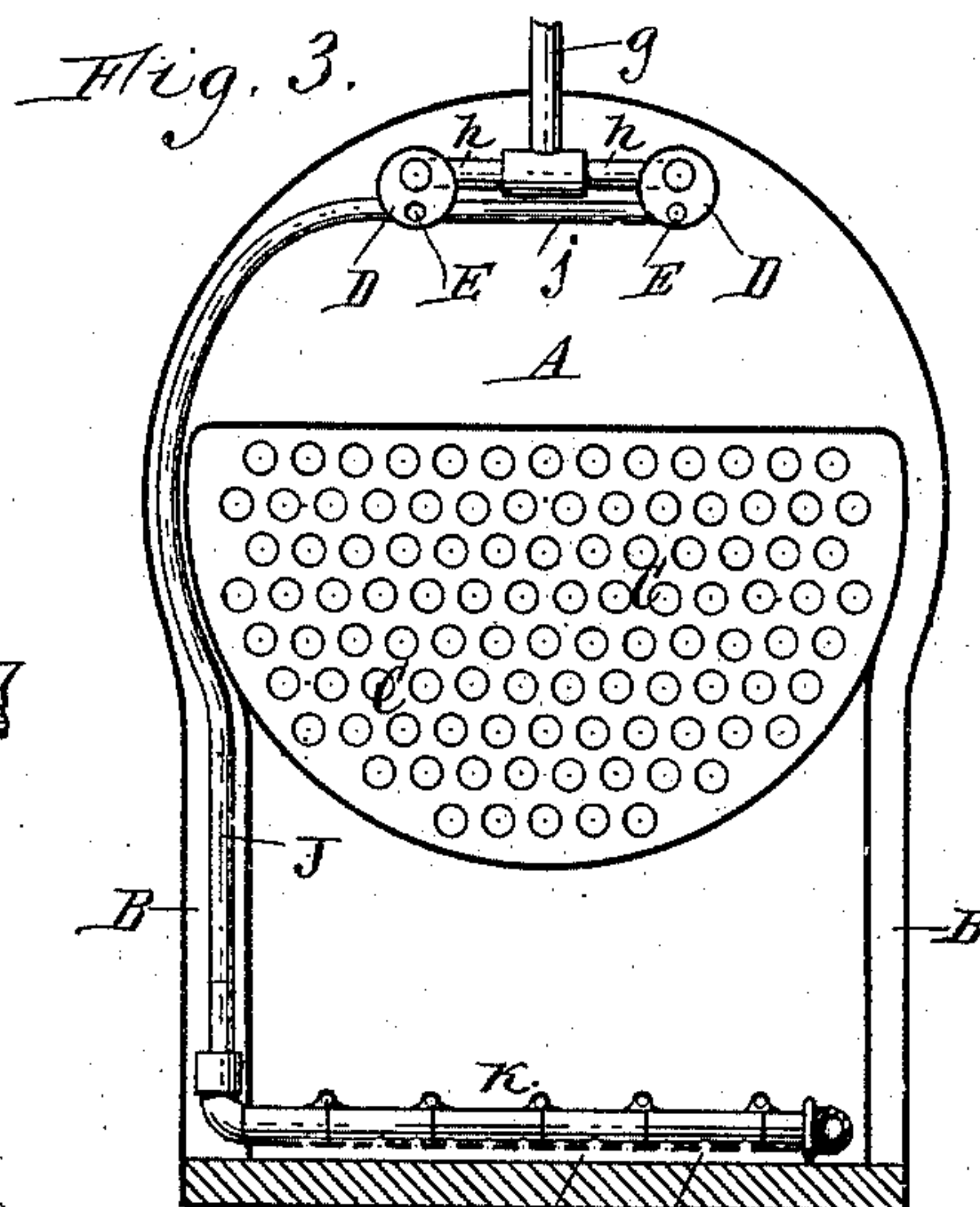
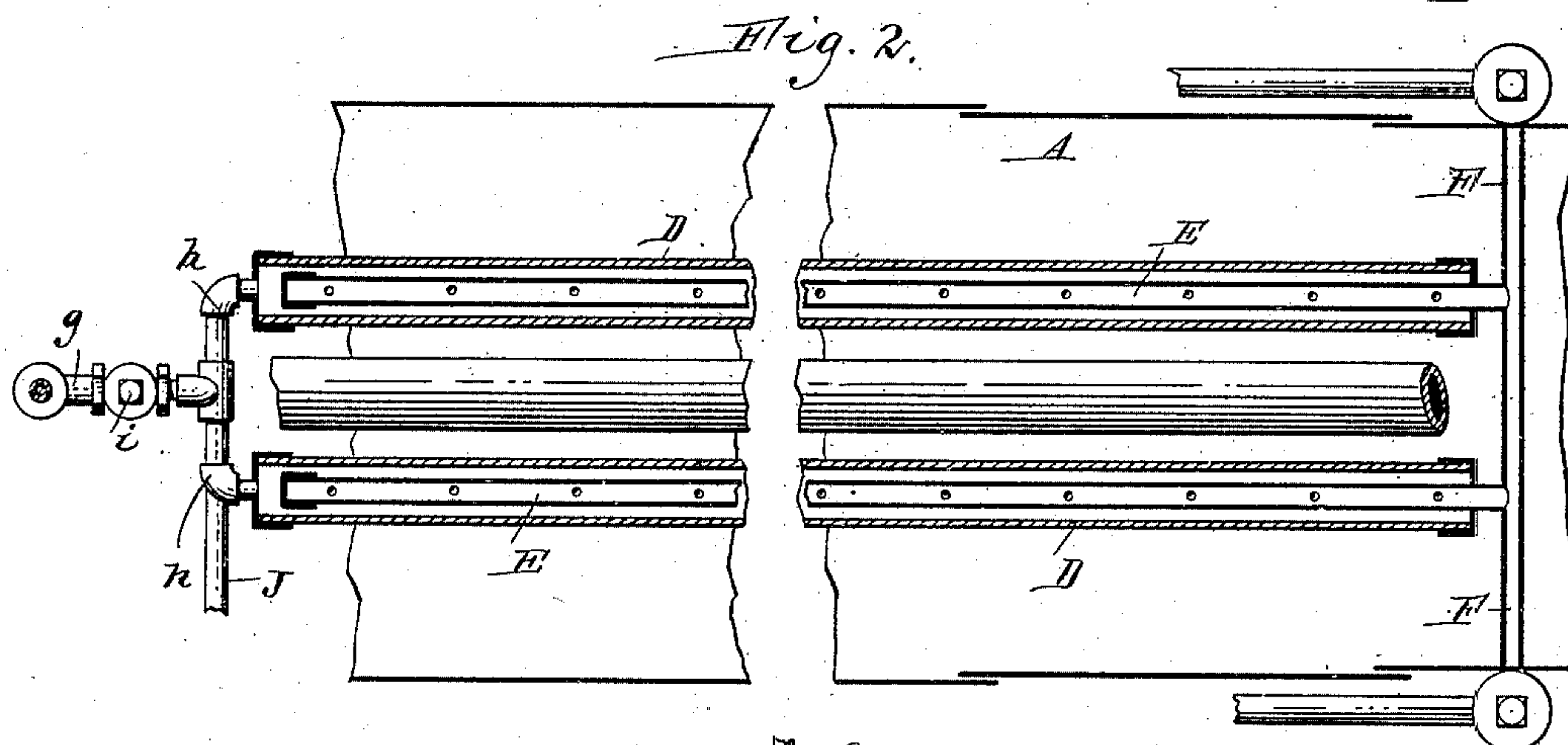
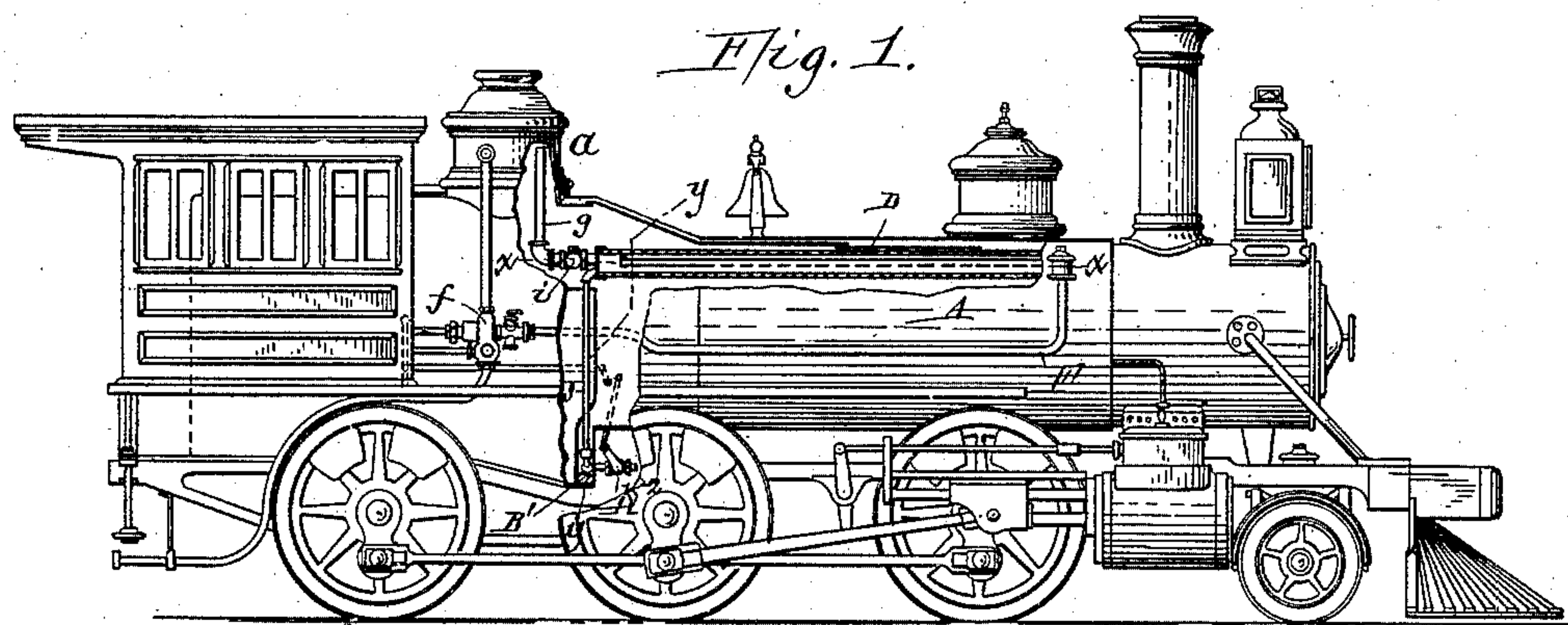


(No Model.)

V. H. McCONNELL.
FEED WATER HEATER AND PURIFIER.


No. 445,933.

Patented Feb. 3, 1891.



Jacob Nispenblatt
Theo. L. Popp.

Witnesses.



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UNITED STATES PATENT OFFICE.

VIRGIL H. McCONNELL, OF BUFFALO, NEW YORK.

FEED-WATER HEATER AND PURIFIER.

SPECIFICATION forming part of Letters Patent No. 445,933, dated February 3, 1891.

Application filed September 12, 1890. Serial No. 364,755. (No model.)

To all whom it may concern:

Be it known that I, VIRGIL H. McCONNELL, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, 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 and purifiers in which the water is heated to a high temperature before it enters the boiler, so as to liberate the lime and other impurities from the water and facilitate the precipitation of such impurities.

In order to avoid the deposit of sediment upon the boiler-flues and the formation of scale resulting from such deposits, it is necessary to introduce the heated feed-water into the boiler below the flues, so that any sediment remaining in the feed-water will not rise above the flues, but will settle in the bottom of the boiler, where it may be readily blown off from time to time to prevent incrustations from forming at this point.

The object of my invention is to provide an efficient purifying and blow-off apparatus of simple construction, whereby the impurities are confined in the bottom of the boiler, and which is especially applicable to locomotive-boilers, although the same is also adapted for other boilers.

In the accompanying drawings, Figure 1 is a sectional side elevation of a locomotive provided with my improved feed-water heater and purifier. Fig. 2 is a horizontal section in line *x x*, Fig. 1, on an enlarged scale. Fig. 3 is a vertical transverse section in line *y y*, Fig. 1, on an enlarged scale. Fig. 4 is an enlarged view of a portion of the sectional delivery and blow-off pipe. Fig. 5 is a fragmentary sectional elevation of the mud-ring, showing the blow-off pipe on an enlarged scale.

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

A represents the boiler of the locomotive; *a*, the steam-dome; B, the water-legs on opposite sides of the combustion-chamber; B', the mud-ring, and C the flues.

D D represent water heaters or chambers, preferably arranged longitudinally within the upper portion of the boiler in the steam-space. Each of these heaters consists of a drum or cylinder closed at its ends.

E E represent spray-pipes arranged in the heating-chambers D D, and F is the feed-water-supply pipe connected with the spray-pipes E E, and which is provided with the usual pumps or injectors *f*. The spray-pipes E extend nearly from end to end of the heating-chambers, and are provided with numerous perforations through which the feed-water is delivered into the heaters in jets or fine streams.

g is a steam-supply pipe terminating with its open upper end in the steam-space of the boiler, preferably in the dome, where the steam is hottest, and *h h* are branch pipes connecting the rear ends of the heating-chambers D with the supply-pipe *g*. In the steam-supply pipe *g* is arranged a check-valve *i*, which allows the steam to enter the heating-chambers, but prevents the water in these chambers from passing into the boiler through the steam-supply pipe. The feed-water entering the heating-chambers in a finely-divided state is thoroughly mixed with the steam in the chamber, and in passing through the same is intensely heated, whereby the lime and other impurities contained in the water are set free and precipitated.

J represents a delivery-pipe whereby the heated and partially-purified feed-water is conducted from the heaters D into the lower portion of the boiler, preferably to the water-legs or mud-ring, as shown. This delivery-pipe is connected with the heaters D D by a branch pipe *j*, and extends through one of the water-legs, and is provided with a horizontal branch *k*, which is arranged transversely in the front portion of the water-legs, and is provided within the latter with slots or perforations *k'*, through which the heated water enters the water-legs. The perforated delivery-pipe is preferably arranged at the foot of the forwardly-sloping mud-ring B', so that any sediment which settles in the water-legs will drain toward the perforated pipe and gather around the same, as represented in Fig. 5. The perforated branch of the delivery-pipe is preferably flexible and composed of a number of jointed sections, which are provided at their adjacent ends on one side with ears, through which pass pivot-pins, as shown in Fig. 4. This construction permits the pipe to be introduced into the water-leg

from the top of the boiler and to be pushed under the inner wall of the water-leg and across the bottom thereof.

The horizontal portion of the delivery-pipe extends through the shell of the boiler, and is provided on the outer side of the boiler with a blow-off cock or valve K² for discharging impurities which accumulate in the heaters D and the water-legs or the bottom of the boiler. The blow-off cock is operated from the cab by a hand-lever and connecting-rod, as shown, or in any other suitable manner. The water entering the heating-chambers comes in intimate contact with the steam, whereby its temperature is raised to a sufficient degree to release and precipitate the earthy impurities. A part of these impurities settle in the heating-chambers, while the residue is carried with the feed-water to the mud-ring or the bottom of the water-legs, where it is precipitated, while the purified water mingles with the water in the boiler.

The horizontal branch of the delivery-pipe J may be provided with a single exit-opening; but it is preferably perforated, because by this construction the feed-water is caused to enter the boiler in numerous small streams which do not agitate or disturb the sediment collected about the pipe.

By delivering the feed-water into the lower portion of the boiler the sediment remains in the bottom of the boiler and does not rise and diffuse itself and coat the flues and the shell of the boiler, as is the case when the feed-water is discharged at or near the water-level.

When it is desired to blow off the accumulated impurities, the blow-off cock is opened. The steam-pressure upon the water in the heaters D forces the water and sediment from said chambers through the delivery-pipe and the blow-off cock, thoroughly cleaning the heaters. The passage of the water through the horizontal branch pipe k of the delivery-pipe creates a suction through the perforations of said pipe, whereby the sediment lodging in the water-legs around the pipe is caused to enter the pipe and is expelled through the blow-off cock. After cleaning the boiler the blow-off cock is again closed.

It will be observed that in my improved apparatus the feed-water-delivery pipe also serves as a discharge-pipe for blowing off the sediment, thus rendering the apparatus very simple in construction. By the use of my apparatus the feed water is purified and delivered into the boiler in such a manner that no sediment reaches the flues, and such impurities as enter the boiler settle in a place from which they may be readily and thoroughly discharged.

In blowing off it is not necessary to shut off the supply of water to the heaters D, and the pumps or injectors may be kept in constant operation without requiring any extra care on the part of the engineer.

Two heaters are shown in the drawings; but it is obvious that a single heater may be employed, if desired.

I claim as my invention—

1. The combination, with a steam-boiler, of a closed feed-water heater, a steam-supply pipe connected with said heater, a spray device arranged in said heater and connected with the feed-water pipe, whereby the feed-water is delivered into the heater in fine streams, a feed-water-delivery pipe extending from said heater to the lower portion of the boiler with its lower end terminating outside of the boiler and provided near its lower end with a discharge-opening, whereby the feed-water is delivered into the lower portion of the boiler, and a blow-off valve closing the other end of said delivery-pipe outside of the boiler, substantially as set forth.

2. The combination, with a steam-boiler, of a feed-water heater arranged in the boiler and communicating with the steam-space of the boiler, whereby the water in said heater is heated by the steam entering the same, a spray device arranged in said heater, whereby the feed-water is delivered into the heater in a finely-divided state, and a delivery-pipe connected with said water-heater and terminating in the lower portion of the boiler, substantially as set forth.

3. The combination, with a steam-boiler, of a feed-water heater arranged in the boiler and communicating with the steam-space of the boiler, whereby the water in said heater is heated by the steam entering the same, a spray device arranged in said heater, whereby the feed-water is delivered into the heater in a finely-divided state, a feed-water-delivery pipe connected with said heater, extending through the lower portion of the boiler and provided within the boiler with a discharge-orifice for the feed-water, and a blow-off valve arranged in said delivery-pipe beyond said discharge-orifice and on the outside of the boiler, substantially as set forth.

4. The combination, with a boiler having a water-leg provided with a sloping bottom, of a water-heater arranged in the steam-space of the boiler and communicating with the steam-space, a spray-pipe arranged in the heater, whereby the feed-water is delivered into the heater in fine streams, a delivery-pipe connected with said water-heater and provided with a perforated horizontal branch arranged in the water-leg at the foot of its inclined bottom and extending through the shell of the boiler, and a blow-off valve arranged in said branch outside of the boiler, substantially as set forth.

Witness my hand this 4th day of September, 1890.

VIRGIL H. McCONNELL.

Witnesses:

JNO. J. BONNER,
FRED. C. GEYER.