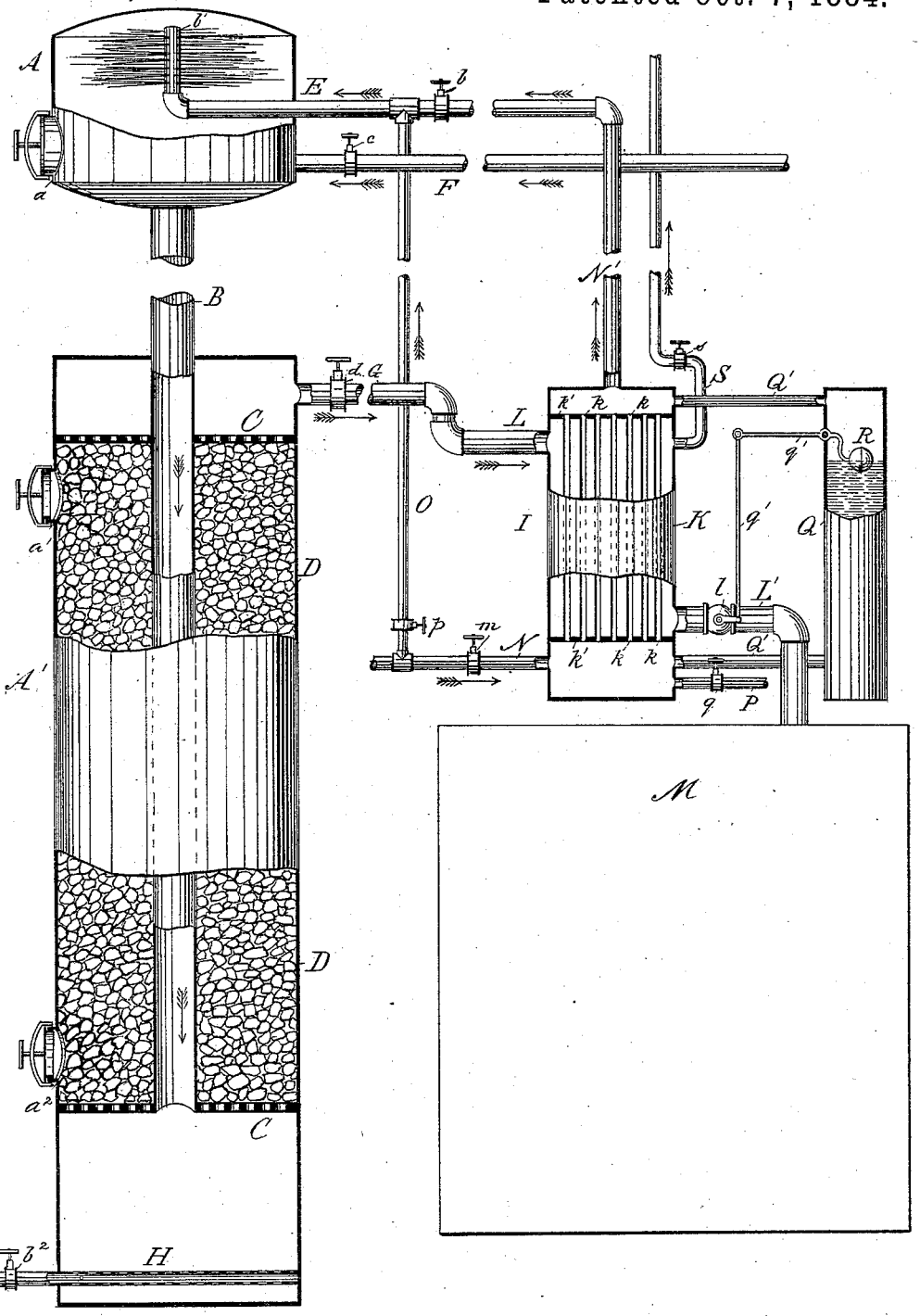
(No Model.)

M. W. HAZELTON.

FEED WATER HEATER AND PURIFIER.

No. 306,155. Patented Oct. 7, 1884.



WITNESSES

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FEED-WATER HEATER AND PURIFIER.

SPECIFICATION forming part of Letters Patent No. 306,155, dated October 7, 1884.

Application filed December 19, 1883. (No model.)

To all whom it may concern:

Be it known that I, MILTON W. HAZELTON, a citizen of the United States of North America, and a resident of Chicago, county of Cook, State of Illinois, have invented a new and useful Improvement in Feed-Water Heaters and Purifiers, of which the following is a specification.

The object of this invention is to provide an improved feed-water heater and purifier especially adapted to be operated with live steam, and most efficient in precipitating and separating from the feed-water all the impurities with which it may be contaminated.

The invention consists of a feed-water heater and purifier constructed for affording hydrostatic pressure to assist in injecting the water into a boiler, and provided with a device for filtering the heated water; and it further consists of an auxiliary attachment that may be used, when desired, for cooling the feed-water issuing from the heater and for raising the temperature of the water on its passage to the heater proper, all of which will be hereinafter fully set forth.

The drawing represents a partly sectional elevation of my improved device.

In the drawing, A A′ represents the two cylindrical shells of the heater and purifier set one above the other, and connected by a perpendicular pipe, B, that extends axially from the bottom of the cylinder A down into and nearly to the bottom of the larger cylinder, A′, through two perforated diaphragms, C C, that are fixed in the latter. The cylinder A is provided with a man-hole, *a*, for affording facilities for cleaning. Said cylinder is designed to be set at a sufficient elevation relatively to the exit-pipe of the heated and purified feed-water to assure the required hydrostatic pressure to supplement the steam-pressure within the heater, for the purpose of forcing the heated feed-water out and into a boiler against the steam-pressure therein; and the pipe B is designed to be of corresponding length.

The space between the diaphragms C C is designed to be filled with coke or other suitable material, as shown at D, for the filtration of the feed-water before it passes out of the heater, and the man-holes $a' a^2$ in the cylinder A′ respectively afford facilities for introducing fresh coke or other filtering material and for removing spent or unserviceable filtering material. The water-supply pipe E, provided with valve *b*, is entered into a side of the cylinder A and turned vertically upward in the axis thereof. It is closed at the upper end, and is provided with numerous lateral perforations, *b′*, through which the water is ejected in fine streams or jets under the pressure of the feeding-pump or other device. (Not shown.) The steam-pipe F, provided with valve *c*, leading from the steam-drum of the boiler, (not shown,) enters the side of the cylinder A, so as to deliver steam upon the spray or jets of water, and so as to keep the cylinder A constantly filled with steam. With a boiler-pressure of from sixty to sixty-five pounds, the temperature of the steam will range from 294° to 300° Fahrenheit, and at such temperature will enter the heater and make contact with the entering water, which latter will be thereby raised to nearly the same temperature—say to 290° Fahrenheit, or higher.

As the mineral salts—such as the sulphates and carbonates of lime, magnesia, sodium, alumina, and iron, that singly or in combination are usually present in water—may be precipitated therefrom at temperatures varying from 265° to 290° Fahrenheit, and not at lower temperatures, it is evident that the heating of the feed-water to such temperatures by the use of live steam, as by my method, will better accomplish the purpose of preventing scale in boilers than does the application of exhaust-steam, as is commonly practiced. The feed-water then entering my heater and purifier is by the injected live steam raised to a temperature sufficient to precipitate the contained impurities; but these impurities would remain suspended in the water, and, entering a boiler, would form scale there were it not for the filter placed within the heater. In this case the heated feed-water passes down through the pipe B into the bottom of the cylinder A′, where a portion of the impurities subsides and may be blown off through the pipe H, provided with cock b^2, and thence up through the filter C C D, by which the remaining suspended impurities are removed

and retained, and then out through the outlet-pipe G, provided with valve *d*, to the boiler (not shown) or other receptacle.

When the heater and purifier is designed to be applied to a boiler, no auxiliary devices are required excepting a common pump or injector applied in the usual manner for forcing the supply-water into the heater; but when the heater and purifier is designed to be used for purifying water and delivering it at a lower temperature for use in tanneries, dye-houses, sugar-factories, &c., I combine with it the auxiliary apparatus consisting of the cooler I, which itself consists of a closed iron cylinder, K, containing a number of tubes, *k*, held in position by ordinary tube-sheets, *k'*. When this cooling apparatus I is used for this purpose, the water-egress pipe G from the heater will be connected with a pipe, L, that conducts the water into the space in which are the tubes *k* between the tube-sheets *k'*, and from thence the water escapes through a pipe, L', provided with valve *l*, to a tank, M, or other suitable receptacle. The feed-water forced into the heater at the same time from the pump or injector (not shown) through a pipe, N, provided with valve *m*, into the bottom of the cylinder K, below the lower tube-sheet, and passing up through the tubes *k* into the space above the upper tube-sheet, flows through the pipe N', connected with the top of the cylinder K, into the pipe E, the pipes E N' being connected for this purpose. Thus it is obvious that the feed-water entering the heater will have its temperature raised in passing through the cylinder K by heat abstracted from the water coming from the heater, and that the purified water from the heater will be cooled in passing through the cylinder K by parting with a portion of its heat to the entering feed-water, and it is evident, too, that in this exchange of temperatures there can be little or no ultimate loss of heat from the water.

A pipe, O, provided with valve *p*, may connect the pipes E N, the respective valves of the latter pipes being placed beyond or outward from such connections, as shown, that they may be closed to cut off communication with the cooler, then the feed-water entering the pipe N from pump or injector will pass up the pipe O into pipe E, and thence into heater, avoiding the cooler.

When, as in some instances, it may be desirable to make use of exhaust-steam for partially heating the feed-water, the pipe L' will be dispensed with and the connection be broken between the pipes G and L, and then the exhaust-steam will be entered into the cylinder K through pipe L to raise the temperature of the water that will pass into the cylinder K through pipe N and out of said cylinder into the heater through pipes N' E, and the blow-off pipe P, provided with cock *q*, will be used for blowing off the sediment deposited from the water in the said cylinder K, and the uncondensed exhaust-steam will escape through pipe S, provided with valve *s*, that connects with the space about the tubes *k*.

In order to automatically regulate the flow of water from the cylinder K when the latter is used for cooling purposes, a cylinder, Q, is connected therewith at top and bottom by pipes Q' Q', and a ball-float, R, resting on the surface of the water contained in the cylinder Q, is connected by jointed rods *q' q'* with the valve *l* of the pipe L', so that the opening and closing of the said valve will be automatically regulated by the variations in the water-level in the cylinders K Q.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

A feed-water heater and purifier constructed substantially as herein shown and described, consisting of two cylinders set one above the other, and connected with a vertical pipe, the upper cylinder having the water and steam supply pipes connected with it, and being set at a sufficient elevation relatively to the lower cylinder to afford hydrostatic pressure to assist in injecting water into a boiler, and the lower cylinder being provided with a filtering device and having the water-egress pipe connected with it, all arranged and operating as set forth.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 10th day of December, 1883.

MILTON W. HAZELTON.

Witnesses:
JACOB J. STORER,
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