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No. 839,867. PATENTED JAN. 1, 1907.

H. G. MILLER.

FEED WATER HEATER.

APPLICATION FILED JAN. 18, 1906.

2 SHEETS—SHEET 1.

Fig. 1.

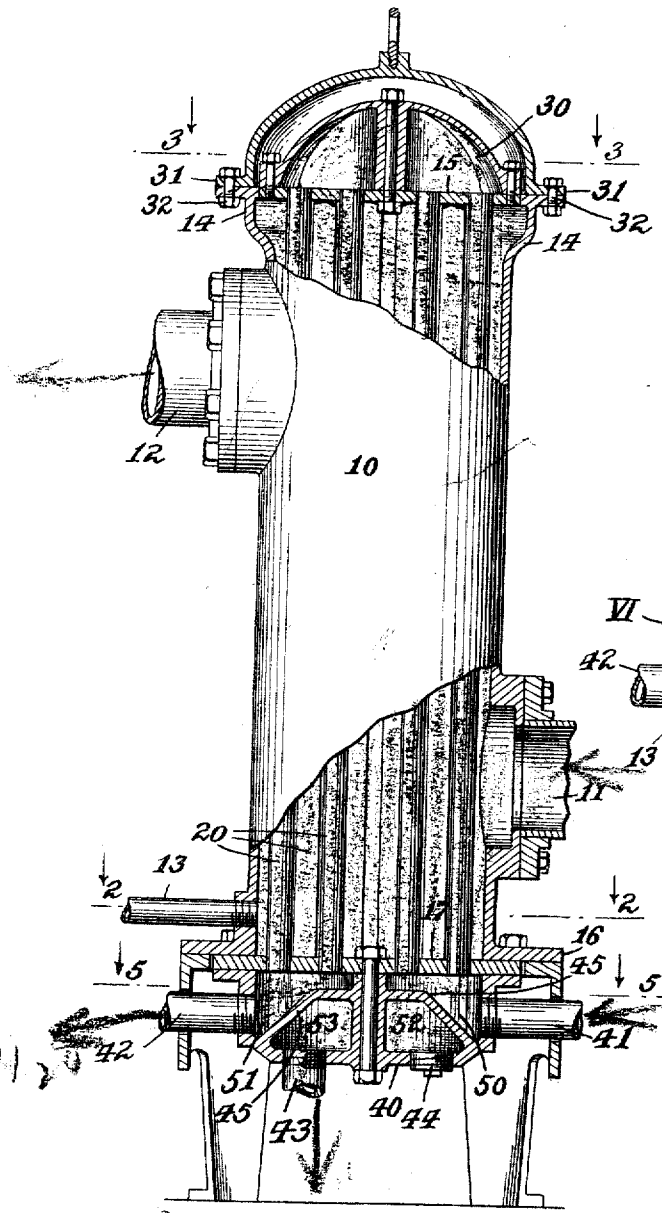
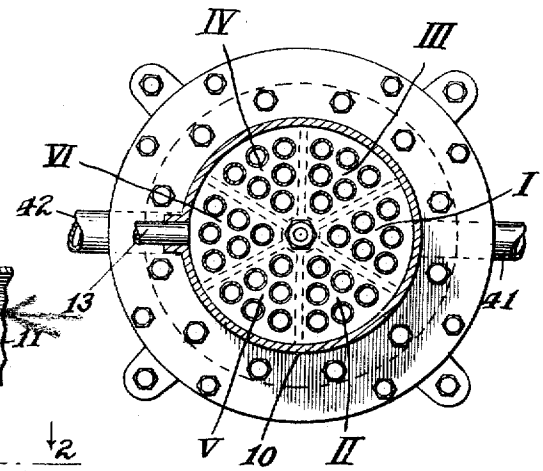


Fig. 2.



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Inventor:
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2 SHEETS—SHEET 2.

Fig. 3.

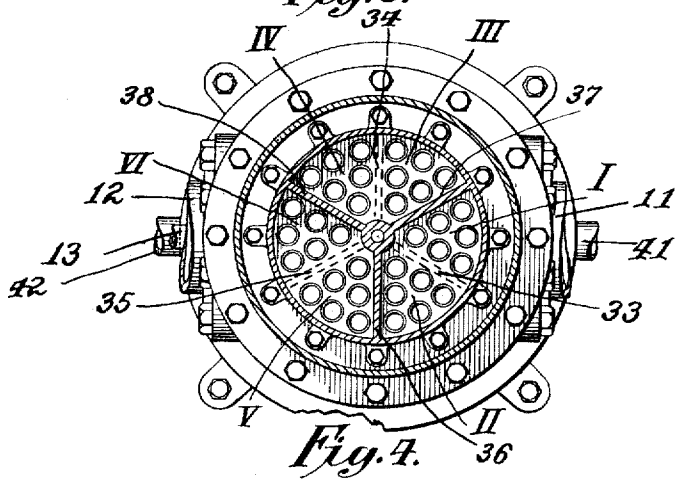


Fig. 4.

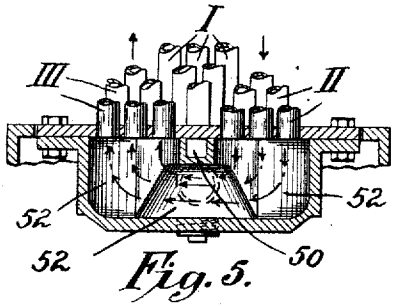
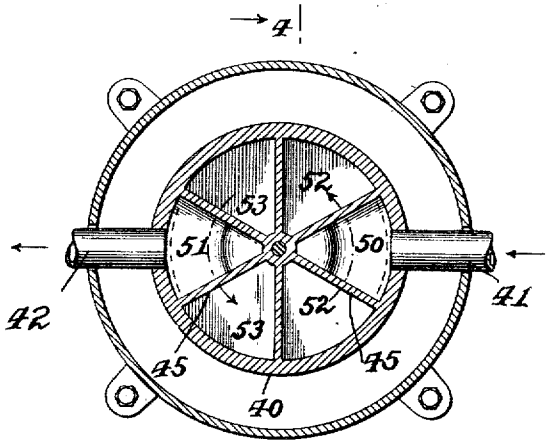


Fig. 5.



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UNITED STATES PATENT OFFICE.

HENRY G. MILLER, OF CLEVELAND, OHIO, ASSIGNOR TO THE LOEW MANUFACTURING COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

FEED-WATER HEATER.

No. 839,867. Specification of Letters Patent. Patented Jan. 1, 1907.

Application filed January 18, 1906. Serial No. 296,646.

To all whom it may concern:

Be it known that I, HENRY G. MILLER, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Feed-Water Heaters, of which the following is a specification.

My invention relates to that class of feed-water heaters in which the heat derived from the exhaust-steam from the engine is used to raise the temperature of the water supplied to the steam-generator; and its novelty consists in the construction and adaptation of the parts, whereby economy of construction, rapidity of action, and efficiency in operation are effectually secured.

One purpose of the invention is to give to the water to be heated a large circulation and at the same time to confine it to a small space. In many devices of this class the water is caused to enter tubes at the bottom and after passing upward in the same general direction the current of steam is discharged at the top. In such construction the water is not long in contact with the heated surfaces of the tubes through which it passes. In other devices the water enters the tubes at the top and falls by gravity through them to the bottom. Such devices are even less efficient than the type first referred to. In yet other forms of heaters the water is circulated in a coil or caused to pass upward and downward, or vice versa. In none of these forms, however, is the water caused to pass many times through the steam-chamber and yet the apparatus as a whole kept small in size.

Another purpose of my invention is to prevent undue expansion of the metal parts of the device due to unequal heating at different points. This is accomplished by carrying the water from one side to the other of the heating-chamber, so as to equalize or balance to some extent the strain due to expansion.

Another purpose of the invention is to mix the water after it has absorbed heat in passing through one series of tubes and before it enters another series, in order that the temperature throughout the mass may be equalized and the simultaneous discharge of bodies of water at different temperatures prevented, and a final purpose is to bring the incoming column of cold water in contact with the surfaces heated by the steam-vapor when the latter is at its highest temperature.

In the drawings, Figure 1 is an elevation and partial section of an apparatus embodying my invention. Fig. 2 is a horizontal section on the plane of the line 2 2 in Fig. 1. Fig. 3 is a horizontal section on the plane of the line 3 3 in Fig. 1 and a plan view of the parts beneath the section plane. Fig. 4 is a vertical section on the plane of the line 4 4 in Fig. 5, and Fig. 5 is a horizontal section on the plane of the line 5 5 in Fig. 1.

In the drawings, 10 is a shell or casing having a valve-controlled steam-inlet conduit 11 near its bottom and a similarly valve-controlled steam-outlet conduit 12 near its top. It has at its bottom also a drip-pipe 13. It is expanded outwardly at 14 at its top and is provided with an upper plate 15, rigidly secured thereto or made integral therewith. It is flanged outwardly at 16 at its bottom and is provided with a lower plate 17, rigidly secured thereto or made integral therewith.

Within the casing 10 there are several series of vertical water-tubes 20 20, arranged in groups. In the particular form of apparatus illustrated in the drawings these tubes are arranged in six groups of six members each, and the several groups are designated on the drawings by the Roman numerals I, II, III, IV, V, and VI, respectively.

It will be readily understood, of course, that each of the tubes is secured at its upper and lower extremity to the plates 15 and 17, respectively, and that all the tubes are open top and bottom.

Above the casing or shell 10 is arranged the upper mixer 30, preferably of hemispherical form, provided with external flanges 31, whereby it can be firmly secured to the casing 10 by means of bolts 32 32. It is divided into three chambers 33, 34, and 35 by means of vertical water-tight radial partitions 36, 37, and 38, the horizontal cross-sectional area of each chamber being greater than the cross-sectional area of the two groups of water-tubes within the casing 10 immediately beneath it and with which it communicates.

Beneath the casing 10 is arranged a casting 40, comprising a valve-controlled water-inlet conduit 41, a water-outlet conduit 42, a blow-off pipe 43, and a hand-hole 44. It is divided by suitable partitions 45 45 into a number of compartments or chambers—viz, a water-inlet chamber 50, communicating

with the water-inlet conduit 41 and group I of the water-tubes; a water-outlet chamber 51, communicating with the water-outlet conduit 42 and with group VI of the water-tubes; a mixing-chamber 52, which communicates with groups II and III of the water-tubes, and another mixing-chamber 53, which communicates with groups IV and V of said tubes. The chambers 52 and 53 are lower mixing-chambers having functions analogous to those of the upper mixing-chambers 33, 34, and 35, and their horizontal cross-sectional area is greater than that of the combined cross-sectional area of the tubes with which they communicate. It is largely this difference in area which insures the thorough mixing of the water in passing from one group of tubes to the other.

The mode of operation of the device will readily be understood. The valve of the steam-inlet conduit 11 being opened, the entire space within the casing 10 is soon filled with steam, and the valve of the steam-outlet conduit 12 being opened a current of steam through the casing is established. As the entering steam strikes the cool walls of the apparatus some of it is condensed and falls as water to the bottom of the apparatus, whence it can be drawn off through the drip-pipe 13, as occasion requires. The steam is led away for whatever future use may be convenient. The water-inlet conduit 41 is then opened, letting the comparatively cold water into the chamber 50. Thence it passes upward, forced by the pressure of the oncoming liquid into the water-tubes 20 20, constituting the group I. Reaching the top of these pipes it passes into the mixing-chamber 33, whence it falls through the group of water-tubes of the group II by gravity until it reaches the lower mixing-chamber 52. It then crosses over through this chamber and up into the tubes of group III into the upper mixing-chamber 34. Thence it falls through the group of tubes IV to the lower mixing-chamber 53, whence it enters the group of tubes V and, at their top, passes into the upper mixing-chamber 35, and finally passes down through the group of tubes VI to the water-outlet chamber 51 and the outlet-conduit 42.

It will readily be understood that in crossing from group I to group II and from group III to group IV in the upper mixing-chambers and from groups II to III and IV to V in the lower mixing-chambers the temperature of the water passing into the tubes of any one group becomes well equalized; also, that in crossing from one side to the other of the casing in these mixing-chambers no sudden heating of the parts, causing undue expansion, is apt to occur, and the strains due to expansion are balanced or compensated for. If the groups of these tubes were numbered in successive order, as the numerals on the face of a clock, it will be seen that the water passes through the first, second, sixth, fifth, third, and fourth groups in succession, thus passing from one side of the apparatus to the other while at different degrees of temperature.

The curvature or slope of the walls of the upper mixing-chambers facilitate the mixing of the columns of water coming from the several tubes, because when the column of water impinges against such a wall it changes its direction, and when the directions of the different columns are thus changed a general interchange of particles takes place.

What I claim as new is—

1. An apparatus of the kind described, comprising a casing, means for admitting steam into the space within, water-tubes arranged in groups of tubes about the center of the casing, means for admitting water into one of said groups, means for conducting water from groups of said series respectively to the groups on the opposite sides of said casing, and means for discharging the water from the group on the opposite side of the casing from the group into which it enters.

2. An apparatus of the kind described, comprising a casing and means for admitting the steam to the space within the same, water-tubes arranged in successive groups of segmental form about the center of the casing, and means for causing water to flow consecutively through the tubes of the first, second, sixth, fifth, third and fourth groups of the series.

3. An apparatus of the kind described, comprising a casing and means for admitting steam to the space within the same, water-tubes arranged in successive groups of segmental form about the center of the casing and means for causing water to flow consecutively through the tubes of the first, second, sixth, fifth, third and fourth groups of the series, comprising water-mixing chambers arranged intermediate the successive groups and alternately at the top and bottom of the casing.

4. An apparatus of the kind described, comprising a casing forming a steam-chamber, water-tubes within said casing arranged in groups of segmental form about the center of the casing, a water-inlet chamber communicating with the lower ends of the tubes of the first groups, a water-mixing chamber communicating with the upper ends of the tubes of groups one and two, a water-mixing chamber communicating with the lower ends of group two and group three on the opposite side of the casing, and water-mixing chambers communicating successively with the upper and lower ends of the succeeding groups.

5. An apparatus of the kind described, comprising a casing forming a steam-chamber, water-tubes within said casing arranged in groups of segmental form about the center

of the casing, a water-inlet chamber communicating with the lower ends of the tubes of the first group, a water-mixing chamber communicating with the upper ends of the tubes of groups one and two, a water-mixing chamber communicating with the lower ends of group two and group three on the opposite side of the casing, a water-mixing chamber communicating with the upper ends of said group three and group four adjacent thereto, a water-mixing chamber communicating with the lower ends of group four and group five on the opposite side of the casing, a water-mixing chamber communicating with the upper ends of said group five and group six adjacent thereto, and a water-outlet chamber communicating with the lower ends of said group six.

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

HENRY G. MILLER.

Witnesses:

WILLIAM R. BAIRD,

EMIL O. SAELTZER.