(No Model.)

W. L. SHEPARD.

FEED WATER HEATER.

No. 578,904. Patented Mar. 16, 1897.

Fig. 1

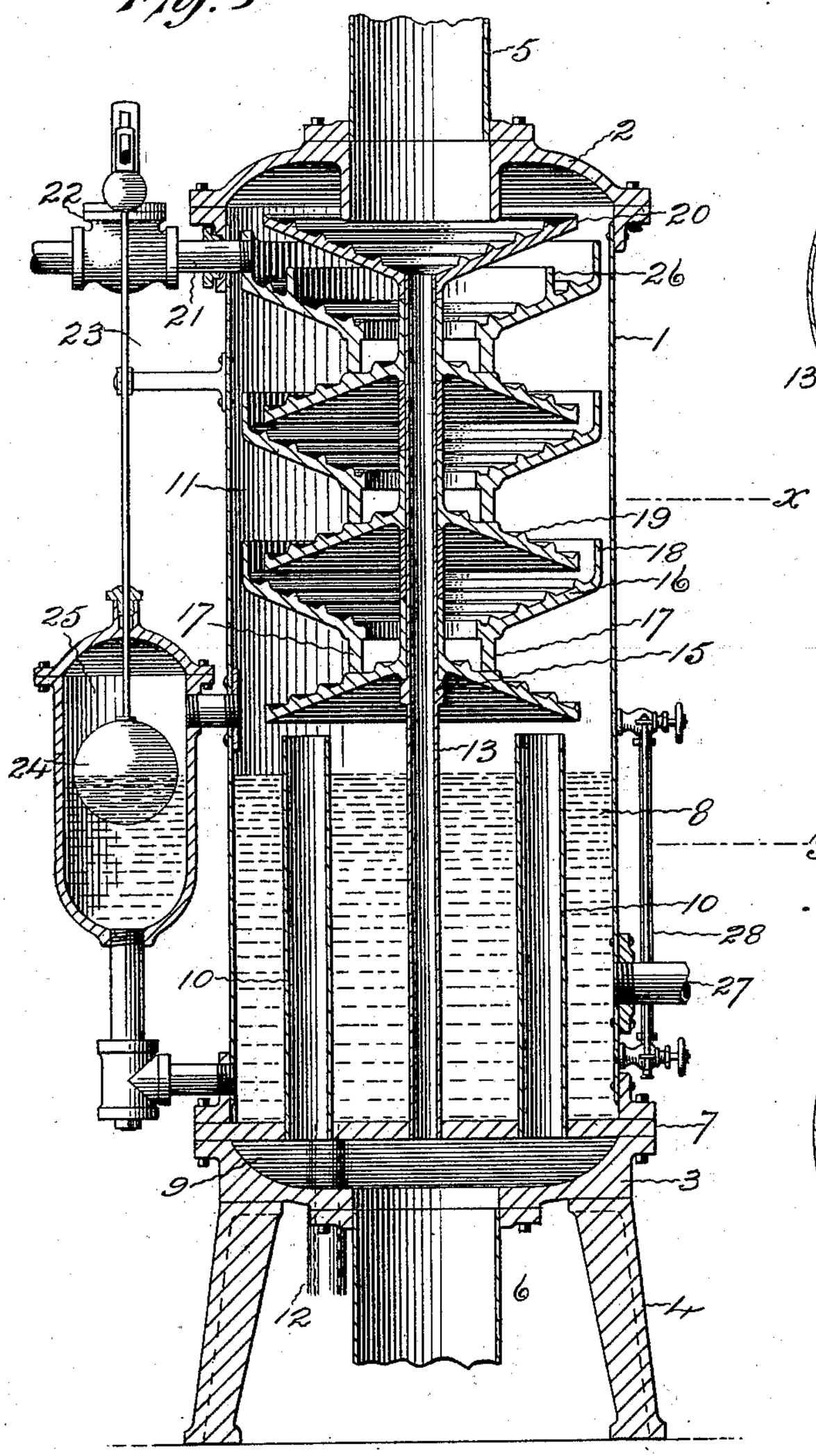


Fig. 2

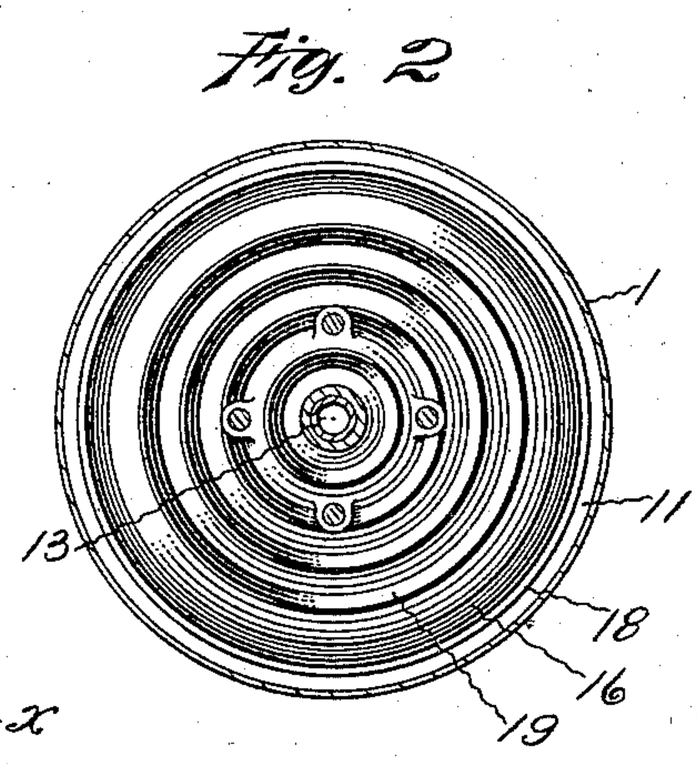
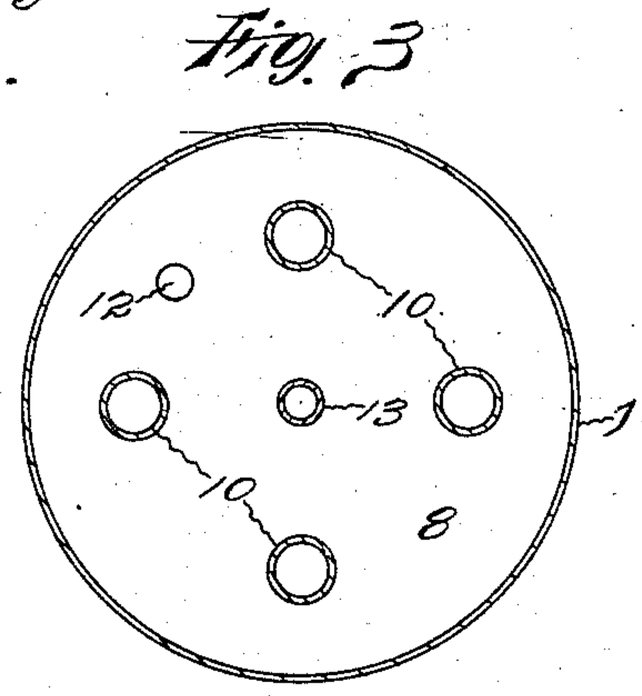


Fig. 3



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UNITED STATES PATENT OFFICE.

WILBUR L. SHEPARD, OF ELMWOOD, CONNECTICUT.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 578,904, dated March 16, 1897.

Application filed June 29, 1896. Serial No. 597,303. (No model.)

To all whom it may concern:

Be it known that I, WILBUR L. SHEPARD, a citizen of the United States, residing at Elmwood, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Feed-Water Heaters, of which the following is a specification.

The invention relates to the class of feed-water heaters known as "open exhaust-heaters," that is, those heaters in which the feed-water for the boiler is heated by direct exposure to exhaust-steam from an engine or pump.

The object of the invention is to provide a heater of this class which is mechanically attractive in appearance, compact in size, and strong in design, and which has all moving parts located outside of the shell in position to be inspected and kept in operative order without necessitating the opening of the shell and all interior parts so placed that they may be easily removed for examination or cleaning, the arrangement of the interior parts being such that the feed-water will be very effectively heated and relieved of a large per cent. of the deleterious impurities by direct and thorough exposure to the action of exhaust-steam that is made to free itself of oil and grease before commingling with the feed-water, which cannot rise out of the comparatively large hot-well sufficiently to flood the heater and set back and injure the engine.

To this end the invention resides in several features of the feed-water heater shown, which has a shell with an inlet and outlet for exhaust-steam, a passage between the steam inlet and outlet for conducting away oil, grease, and the heavier impurities brought in from the engine by the exhaust-steam, an inlet and outlet for the feed-water, removable sediment-disks over which the water is obliged to flow from the water-inlet to the hot-well and be thoroughly and completely exposed to the action of the steam, tubes that conduct the steam through the water in the hot-well and for providing an overflow-passage for the water should the water-valve fail to operate properly, and an automatically-operating valve located outside of the heater-shell for regulating the flow of feed-water, as more particularly hereinafter described, and pointed out in the claims.

Referring to the accompanying drawings, Figure 1 is a central vertical sectional view of a feed-water heater embodying the several features of the invention. Fig. 2 is a horizontal section of the same on plane denoted by the broken line X of Fig. 1, and Fig. 3 is a horizontal section on plane denoted by the broken line Y.

In the views, 1 indicates the shell of the heater, which is usually a cylinder of iron or steel of requisite strength with a removable cap 2 and base 3, that has any suitable form of legs 4. Through the cap is an opening that is adapted to be connected with a pipe 5, leading from an engine or any other source of supply of exhaust-steam, and through the base is an opening adapted to be connected with a pipe 6, that leads to any drain or other escape suitable for conducting away that part of the steam that is not condensed in the heater, together with the oil, grease, and other impurities brought from the engine and separated from the steam, and also any excess of feed-water which might overflow into it. Live steam could of course be brought into this heater, but it is more particularly constructed and intended for utilizing exhaust-steam.

A tube-sheet 7 is placed in the interior, so as to divide the hot-well 8 from the lower exhaust-chamber 9, that is above the steam-outlet. Supported by this tube-sheet are a number of tubes 10, that extend upward to a level that is practically the top of the hot-well, so that they provide a free passage for steam or water from the upper exhaust-chamber 11 to the lower exhaust-chamber 9 through the hot-well 8. A pipe 12 is connected with the bottom of the hot-well to provide a mud or cleaning blow-out.

The tube-sheet preferably supports a tube 13, that provides a passage from the upper exhaust-chamber near the mouth of the steam-inlet to the lower exhaust-chamber near the mouth of the steam-outlet, and preferably supported by this tube are a number of sediment-disks. In the form of heater shown these sediment-disks are circular plates of metal somewhat smaller in diameter than the shell, so that their edges stand away from the walls. These plates are arranged so that their upper surfaces decline,

and these declining surfaces are provided with annular ribs or depressions for increasing the extent of the surfaces. The lower disk 14 is shown as having its upper face declining outwardly from a central hub that is perforated and loosely fits upon the central tube 13, a shoulder 15 being formed on the tube to hold the disk at the proper level. The next upper disk 16 has its upper face declining inwardly and is supported by legs 17, that rest upon the disk 14. This disk 16 has, besides the annular ribs or depressions on its upper face, an upwardly-extending flange 18 around its outer edge, and a central perforation is formed through this disk larger in diameter than the tube, so that there is left an opening around the tube for the passage of water from the upper surface of this disk to the disk next below. The next upper disk 19 is similar to the lower disk 14 and is supported by the central tube. The outer edge of this disk lies within the flange 18 around the next lower disk 16. Similar disks may be placed in this manner loosely one upon the other until the shell is provided with the requisite number to give the desired extent of surface that will insure the proper exposure of the feed-water to the action of the steam. The upper disk 20 is preferably made funnel-shaped, rising outward about the mouth of the exhaust-steam inlet and opening downward into the central tube. A pipe 21 leads through the shell to the next to the upper of these disks for the admission of feed-water. A valve 22 is connected with this pipe, preferably on the exterior of this shell, and this valve is connected by a rod 23 with a float 24 in a chamber 25 in a smaller shell located outside of the heater-shell at about the level of the top of the hot-well with which it is connected, so that as the water-level in the hot-well changes the valve is operated by the float to admit or shut off the flow of feed-water. The next to the upper disk with which the water-inlet pipe is connected is shown as having a flange 26, so that the water will pass around the disk and flow down equally on all sides. The water-outlet 27 may be connected with the hot-well at any desired level, and a water-glass 28 may be provided, if desired.

The feed-water enters through the water-inlet and flows down from disk to disk to the hot-well, and as it ripples over the roughened upper surfaces of the disks and trickles from one to the other in a thin sheet it is most thoroughly exposed to the direct action of the steam and to the heat of the plates over which it is flowing. This heats the water to the highest degree possible to be obtained by the use of exhaust-steam, and causes it to part with impurities, such as carbonates of lime and magnesia, which are retained in the depressions of the heated plates. The hot-well in this heater is comparatively deep and provides a proper storage of water for supplying the pump and allows the settling or rising of impurities that escape being collected or picked up on the sediment-disks.

The exhaust-steam enters through the steam-inlet and makes contact with the ribbed or roughened face of the funnel-shaped upper disk. After striking this disk the dry steam changes its course and will rise upward and pass around the edges of the disks and down past the other disks, while the heavier part of the steam and such impurities as cylinder-oil, grease, and small metallic dust particles produced by the wear of the engine parts will flow down the walls of the funnel-shaped upper disk into the central tube and thence escape through the steam-outlet. As this central tube passes through the hot-well heat will radiate from the hot fluid passing through the tube to the water in the well. The dry steam commingles with the thin sheets of water rippling over the roughened disks and trickling from one to the other, and what is not condensed passes out through the tubes that are located in the hot-well, so that the effect of the heat of this steam will not be lost.

With this construction the exhaust-steam as it is blown into the funnel-shaped disk is made to change the direction of its movement in such manner that a complete separation of the oil, grease, and heavier particles from the dry steam results, the heavier fluid passing down through the central tube without coming in contact with the water, while the lighter dryer steam, which is free from oil and grease, will come in contact with the water. With this form the water has a considerable distance to travel in direct contact with the steam, and as it is exposed in thin rippling and trickling sheets in flowing over the roughnesses and passing to the hot-well the steam very thoroughly commingles with the water and heats it quite hot. This, of course, causes the water to part with a large per cent. of the deleterious impurities. The steam passing through the escape-tubes in the hot-well tends to keep the temperature of the water raised and will keep a constant supply of hot water whether or not the heater is being used and feed-water conducted to the boiler. These tubes are also converted into overflows should the water rise to the top of the hot-well, so that it is impossible for the heater to flood itself and set back on the engine should the feed-valve fail to operate properly, for these tubes have a much greater capacity than the capacity of the water-inlet pipe. The float and valve, which are the only moving parts, are located on the exterior of the shell, where they can be got at for examination or repairs at any time without opening the shell of the heater, and the sediment-disks in the interior can be lifted out for cleaning and removing the sediment which they collect after the cap has been removed. The shell being circular in outline can be made very strong and of suitable capacity without unnecessarily increasing the size.

I claim as my invention—

1. In a feed-water heater, in combination, a shell with a hot-well in the lower part and a steam-chamber in the upper part, said steam-chamber being open to the hot-well, a steam-inlet above the hot-well, a steam-outlet below the hot-well, a water-inlet opening into the steam-chamber, a water-outlet opening from the hot-well, tubes extending from the steam-chamber above through the hot-well below to the steam-outlet, and sediment-disks located in the steam-chamber, substantially as specified.

2. In a feed-water heater, in combination, a shell with a hot-well in the lower part and a steam-chamber in the upper part, said steam-chamber being open to the hot-well, a steam-inlet above the hot-well, a steam-outlet below the hot-well, a water-inlet opening into the steam-chamber, a water-outlet opening from the hot-well, tubes extending from the top of the hot-well through the hot-well to the steam-inlet below, a tube extending from the top of the steam-chamber above through the steam-chamber and hot-well to the steam-outlet below, and sediment-disks located in the steam-chamber, substantially as specified.

3. In a feed-water heater, in combination, a shell with a steam-inlet, steam-outlet, water-inlet and water-outlet and having a hot-well and open steam-chamber, a disk located in the steam-chamber just below the steam-inlet for throwing back the steam as it leaves the inlet, said disk having an opening connected with a tube that extends to the steam-outlet for conveying away the matter separated from the steam, substantially as specified.

4. In a feed-water heater, in combination, a shell with a steam-inlet, steam-outlet, water-inlet and water-outlet and having a hot-well and open steam-chamber, sediment-disks located in the chamber, the upper of said disks being just below the steam-inlet for throwing back the steam as it leaves the steam-inlet, and a tube extending through the several disks and hot-well from the steam-inlet to the steam-outlet, substantially as specified.

5. In a feed-water heater, in combination, a shell with a steam-inlet, steam-outlet, water-inlet and water-outlet and having a hot-well and open steam-chamber, sediment-disks located in the steam-chamber, the upper of said disks being just below the steam-inlet and the others declining inward and outward so that the feed-water is caused to flow inward and downward, then outward and downward alternately from the water-inlet to the hot-well, and a tube extending from an opening in the upper disk through the other disks and hot-well to the steam-outlet, substantially as specified.

6. In a feed-water heater, in combination, a shell with a steam-inlet, steam-outlet, water-inlet and water-outlet and having a hot-well and open steam-chamber, sediment-disks located in the steam-chamber, the upper of said disks being just below the steam-inlet for throwing back the steam as it leaves the inlet and the other of said disks declining inwardly and outwardly alternately so the feed-water is caused to flow inward and outward in passing from the water-inlet to the hot-well, a tube extending from an opening in the upper disk through the other disks and hot-well to the steam-outlet, and tubes extending from the top of the hot-well through the hot-well to the steam-outlet, substantially as specified.

7. In a feed-water heater, in combination, a shell with a hot-well in the lower part, a steam-chamber in the upper part, said steam-chamber being open to the hot-well, a steam-inlet above the hot-well, a steam-outlet below the hot-well, a water-inlet opening into the steam-chamber, a water-outlet opening from the hot-well, sediment-disks located in the steam-chamber, and a passage for steam and overflow-water extending from near the lower of the sediment-disks downward through the hot-well to the steam-outlet below, substantially as specified.

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