(No Model.) 2 Sheets—Sheet 1.

A. W. MORRELL.

STEAM BOILER.

No. 559,741. Patented May 5, 1896.

Fig. I.

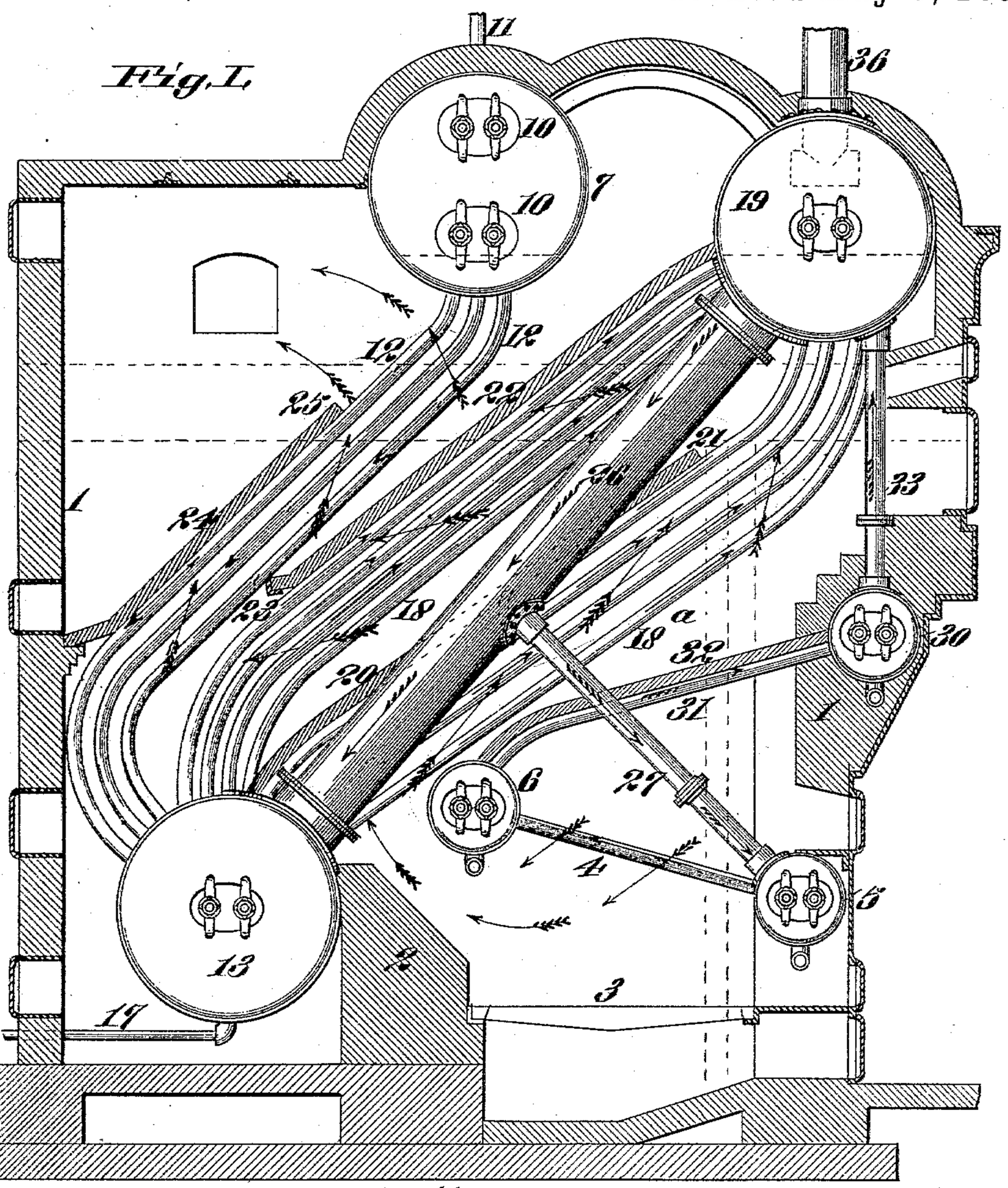


Fig. II.

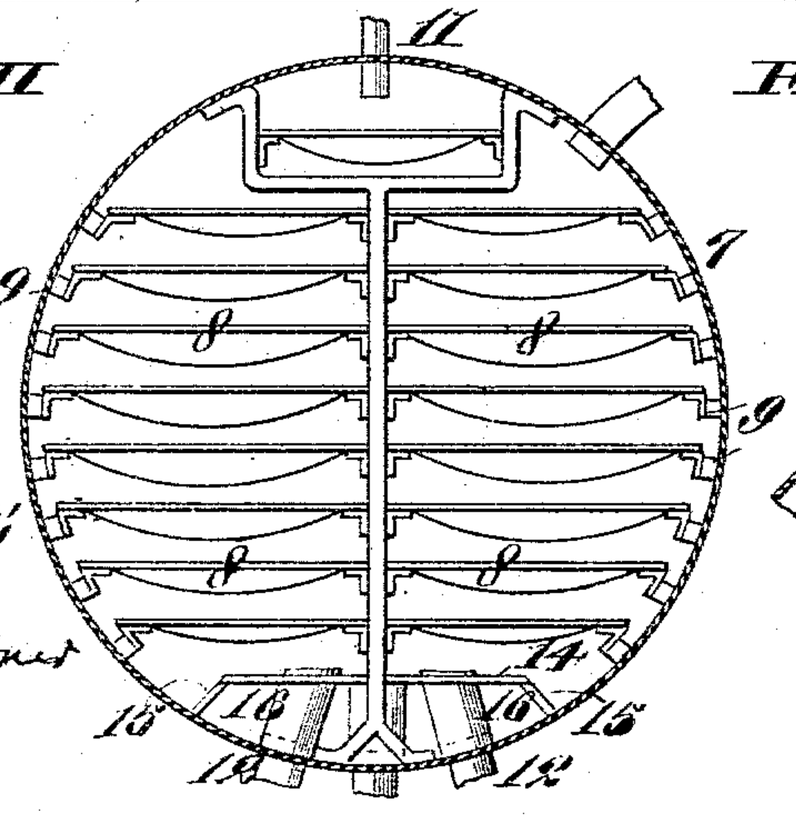
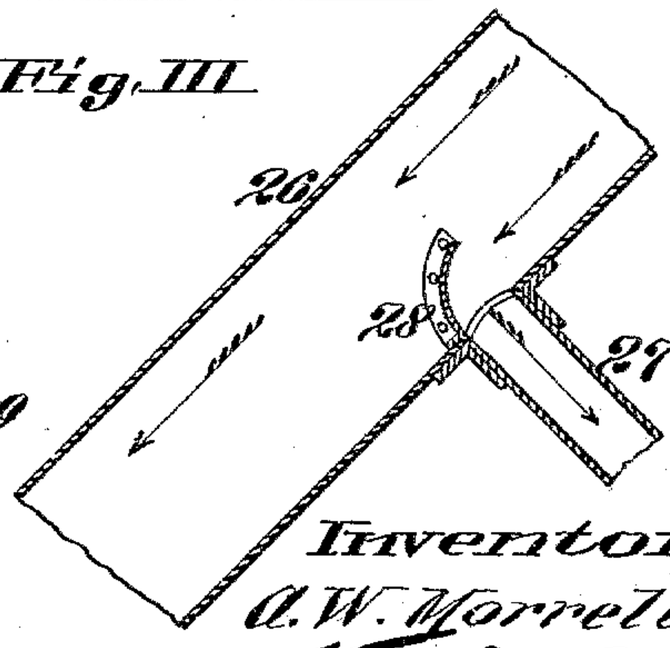


Fig. III.



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Stanley Stone

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(No Model.) 2 Sheets—Sheet 2.

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Fig. IV.

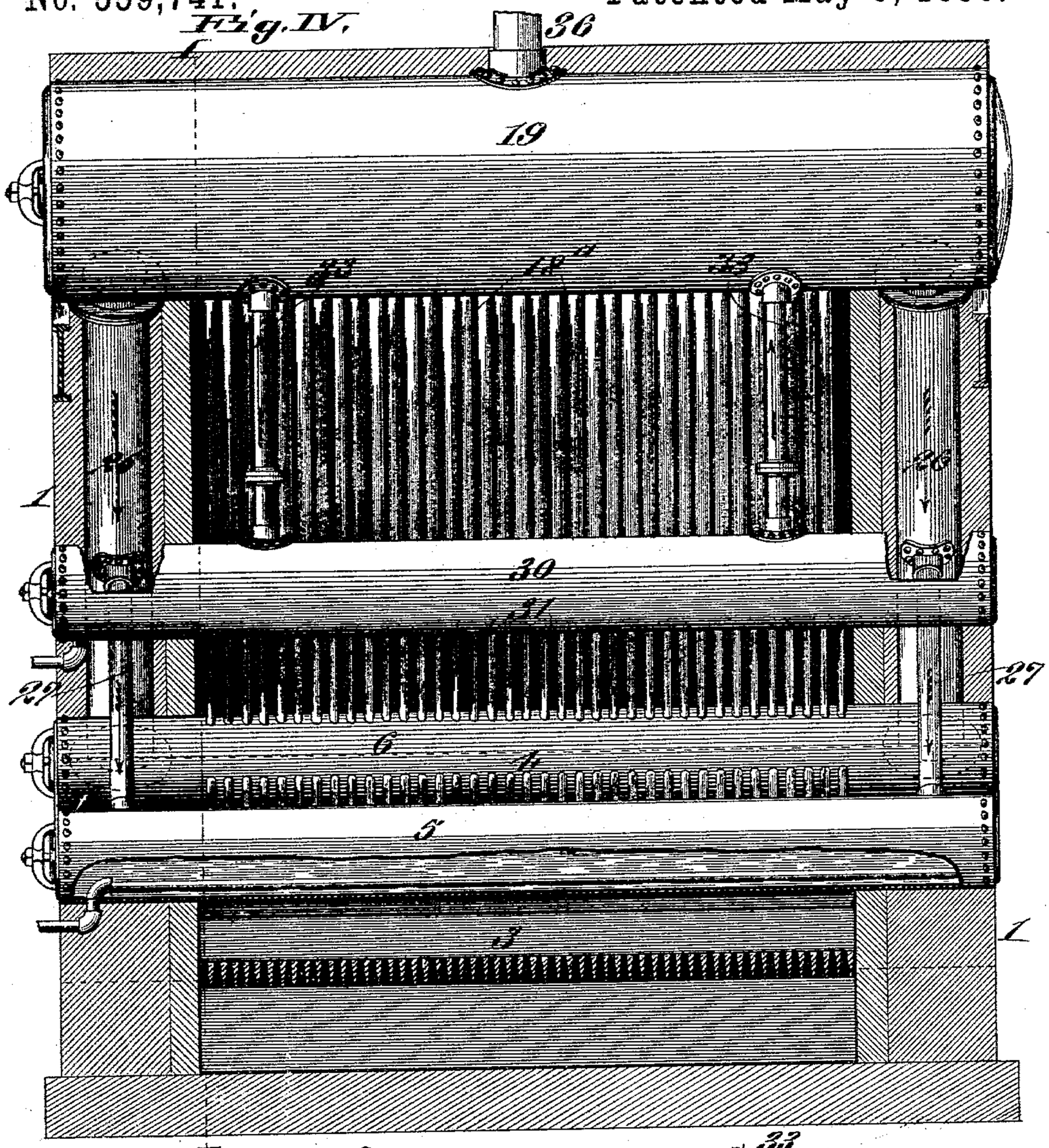
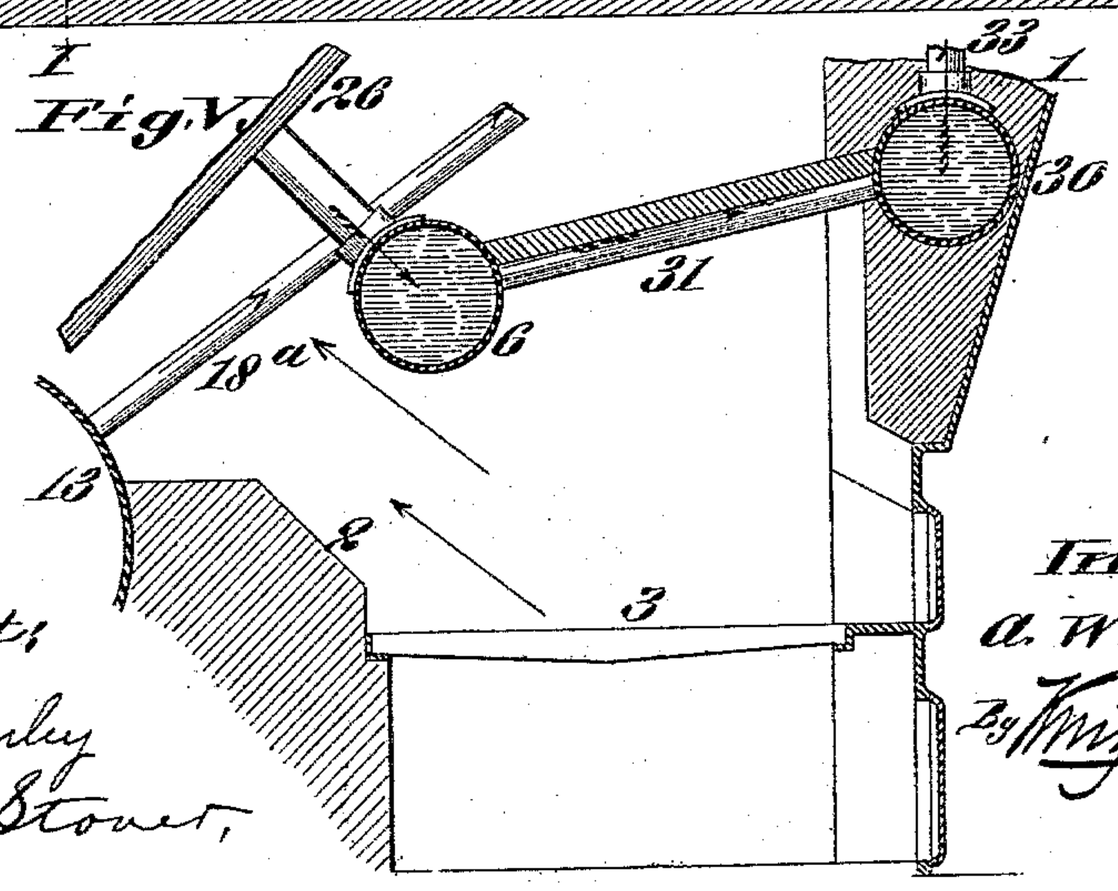


Fig. V.



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UNITED STATES PATENT OFFICE.

ALBERT W. MORRELL, OF ST. LOUIS, MISSOURI, ASSIGNOR OF ONE-HALF TO JOHN O'BRIEN, OF SAME PLACE.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 559,741, dated May 5, 1896.

Application filed May 13, 1895. Serial No. 549,096. (No model.)

To all whom it may concern:

Be it known that I, ALBERT W. MORRELL, of the city of St. Louis, in the State of Missouri, have invented a certain new and useful Improvement in Steam-Boilers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to certain improvements in boilers for generating steam, my object being to construct such a device as will produce a maximum amount of steam to a given amount of fuel.

My invention consists in features of novelty hereinafter fully described, and pointed out in the claims.

Figure I is a vertical section of the furnace-walls, taken on line I I, Fig. IV, the parts within the furnace being shown in elevation. Fig. II is an enlarged transverse section of the feed-water heater and purifier. Fig. III is an enlarged detail vertical section of one of the large descending pipes of the boiler. Fig. IV is a front elevation, the furnace-setting being shown in section. Fig. V is a detail sectional view showing my improvement applied to an updraft-furnace.

Referring to the drawings, 1 represents the walls of the furnace; 2, the bridge-wall; 3, the lower grate-bars, and 4 the water-tube grate-bars of a downdraft-furnace, these water-tubes communicating at one end with a manifold 5 and at the other end with a manifold 6. These parts are of ordinary construction.

7 represents a feed-water purifier, consisting of a drum within which are a number of removable pans 8, supported on ledges 9, so that they can be readily removed through the manholes 10 of the drum for the purpose of cleaning them.

11 is the supply-pipe, and water entering therethrough is discharged into the upper pan of the series and runs from one pan to another until it is discharged into the lower part of the drum, from where it passes through descending tubes 12 into a lower water-drum 13, preferably located behind the bridge-wall of the furnace, as shown in Fig. I. Located in the lower part of the drum of the feed-water purifier is a perforated plate 14, supported on legs 15. (See Fig. II.) The object of this perforated plate is to support nipples or short sections of pipe 16, placed over the upper ends of the tubes 12, for the purpose of keeping dirt and sediment from entering the tubes 12 while the boiler is in use, and there is thus formed a settling-chamber in the lower part of the drum of the feed-water purifier to collect the sediment, and when it is desired to clean this drum the perforated plate and the nipple 16 may be withdrawn through the manholes and the sediment washed out through the pipes 12 into the drum 13, from where it is blown out or removed through a clean-out pipe 17. By using the perforated plate and the short sections of pipe 16 a sediment-chamber is formed (the perforated plate supporting the tubes or nipples) without extending the tubes 12 a distance into the drum, when it would be impossible to connect them to the drum by flaring their inner ends.

The water circulates from the drum 13 upwardly through the tubes 18 and 18ª, arranged within the combustion-chamber of the furnace and communicating at their upper ends with a steam-drum 19. There is a series of tubes 18 and a series of tubes 18ª, the two series being separated by a fire-clay tiling or other wall 20, which is preferably supported by the inner tubes of the series 18ª and which extends from the drum 13 in an inward direction to a point 21 a short distance beneath the drum 19. The heat and products of combustion pass from the fire-box up in front of the wall or projection 20, as indicated by the full arrows, Fig. I, coming in contact with and heating the pipes 18ª. Reaching the top of the wall 20, the heat and products of combustion pass downwardly around the tubes 18, this course being induced by a fire-clay tiling or other suitable wall or projection 22, extending from the drum 19 downwardly to a point 23 a short distance above the drum 13. The wall 22 is preferably supported on the inner tubes of the series 18. Rounding the lower end of the wall 22, the heat and products of combustion pass upward around the tubes 12, this course being induced by a fire-clay tiling or other suitable wall 24, resting upon the inner tubes of the series 12, this

wall extending from the back wall of the furnace to a point 25 a short distance beneath the drum of the feed-water purifier. The water entering the drum 19 passes in a downward direction through large tubes 26, forming a communication between the drums 13 and 19 and located in the side walls of the furnace, as shown in Fig. IV, so as to be out of contact with the heat and products of combustion, so that they will be cooler than the tubes 18 and 18ª, thereby causing the water to descend within them while it rises through the outer tubes 18 and 18ª, and thus a complete and perfect circulation of water through the tubes is maintained.

27 represents tubes forming a communication between the tubes 26 and the manifold 5, these tubes preferably joining with the tubes 26 at a point about midway of the length of the latter. A portion of the water descending through the tubes 26 enters and passes through the tubes 27 into the manifold 5, and for the purpose of increasing the circulation through the tubes 27 I arrange deflectors 28 within the tubes 26, (see Fig. III,) which curve inwardly and upwardly from the lower line of the tubes 27 and extend, preferably, about half-way across the interior of the tubes 26.

30 represents a manifold located in the front wall of the furnace above the fire-door and which communicates with the inner manifold 6 of the tubular grate-bars by means of tubes 31, extending over the fire-box, and covered by a fire-clay tiling or other suitable wall or protection 32.

33 represents tubes forming a communication between the manifold 30 and the steam-drum 19. (See Figs. I and IV.) The water passing down through the tubes 27 into the manifold 5 passes through the tubes 4, through the tubes 31, through the manifold 30, and through the pipes 33. The tubes 27 are located in the side walls of the furnace, as shown in Fig. IV, so that they, like the tubes 26, are cooler than the tubes 4, 31, and 33, so that a downward circulation is maintained through them and an upward circulation through the tubes 4, 31, and 33.

In Fig. V, I have shown my invention applied to an ordinary updraft-furnace wherein the manifold 5 and the tubes 4 are omitted and the tubes 27 communicate direct with the inner manifold 6, the arrangement otherwise being the same as in the other construction.

A boiler thus constructed has a high capacity for generating steam compared with the fuel consumed, as a large heating-surface is presented and a perfect circulation is maintained.

36 represents the steam-pipe leading from the boiler.

I claim as my invention—

1. In a steam-boiler, the combination of a feed-water purifier, a lower drum, tubes located within the combustion-chamber of the furnace and forming a communication between said purifier and said drum, an upper drum, tubes located within the combustion-chamber and forming communications between said upper and lower drums, and large descending tubes located in the walls of the furnace and forming communications between said upper and lower drums; substantially as set forth.

2. In a steam-boiler, the combination of a feed-water purifier, a lower drum, descending water-tubes located within the combustion-chamber of the furnace and forming communications between said purifier and drum, an upper drum, ascending water-tubes located within the combustion-chamber of the furnace and forming communications between said drums, and large descending tubes located in the walls of the furnace and forming communications between said drums, said ascending tubes being arranged in two series separated by a wall or projection extending from the lower drum nearly to the upper drum, substantially as and for the purpose set forth.

3. In a steam-boiler, the combination of a feed-water purifier, a lower drum, descending water-tubes located within the combustion-chamber of the furnace and forming communications between said purifier and drum, an upper drum, ascending water-tubes arranged in two series within the combustion-chamber of the furnace and forming communications between said drums, large descending tubes located in the walls of the furnace and forming communications between said drums, and walls or projections arranged within the combustion-chamber, one of said walls being located between said series of ascending tubes and extending from the lower drum nearly to the upper drum, another of said walls being arranged back of said ascending tubes and extending from the upper drum down to a point a short distance above the lower drum, and another of said walls being arranged back of said descending tubes that connect the purifier with the lower drum, and extending from the back wall of the furnace to a point a short distance beneath said purifier, substantially as and for the purpose set forth.

4. In a steam-boiler, the combination of a feed-water heater, a lower drum, descending tubes forming a communication between said feed-water heater and drum, a perforated plate located within the drum of the feed-water heater, and short tubes or nipples arranged within the drum of the feed-water heater over the open ends of the tubes and supported by said perforated plate; substantially as set forth.

5. In a steam-boiler, the combination of a lower drum, an upper drum, ascending tubes located within the combustion-chamber of the furnace and forming communications between said drums, large descending tubes located within the walls of the furnace and forming communications between said drums, a manifold located within the combustion-

chamber of the furnace, tubes located in the walls of the furnace and forming communications between said large descending tubes and said manifold, and ascending tubes forming communications between said manifold and said upper drum, substantially as set forth.

6. In a steam-boiler, the combination of an upper drum, a lower drum, ascending tubes arranged within the combustion-chamber of the furnace and forming communications between said drums, large descending water-tubes arranged within the walls of the furnace and forming communications between said drums, a manifold located within the combustion-chamber of the furnace, descending tubes forming communications between said manifold and said large descending tubes, ascending water-tubes forming communications between said manifold and said upper drum, and deflectors 28 arranged within said large descending tubes at the junction of said descending tubes and the manifold, substantially as and for the purpose set forth.

7. In a steam-boiler, the combination of a lower drum, an upper drum, ascending water-tubes located within the combustion-chamber of the furnace and forming communications between said drums, large descending tubes located in the walls of the furnace and forming communications between said drums, a front manifold, descending water-tubes forming communications between said manifold and said large descending water-tubes, and which are located in the walls of the furnace, an inner manifold, water-tubes located within the combustion-chamber of the furnace and which form communications between said manifolds, an upper manifold located in the front wall of the furnace, tubes located in the combustion-chamber of the furnace and forming communications between said inner manifold and said upper manifold, a wall located over said tubes, and tubes forming communications between said upper manifold and said upper drum, substantially as and for the purpose set forth.

ALBERT W. MORRELL.

In presence of—
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STANLEY STONER.