

(No Model.)

F. T. STEVENS.
BOILER.

3 Sheets—Sheet 1.

No. 578,300.

Patented Mar. 2, 1897.

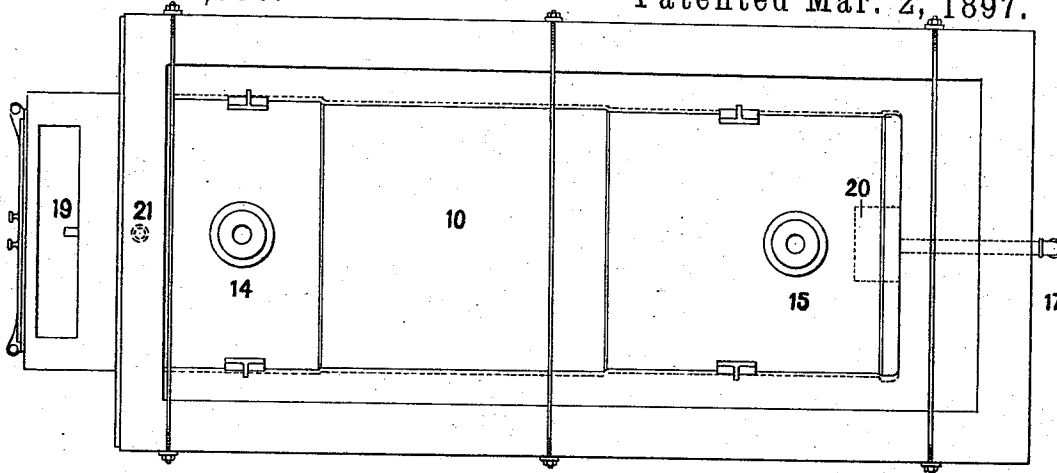


Fig. 1.

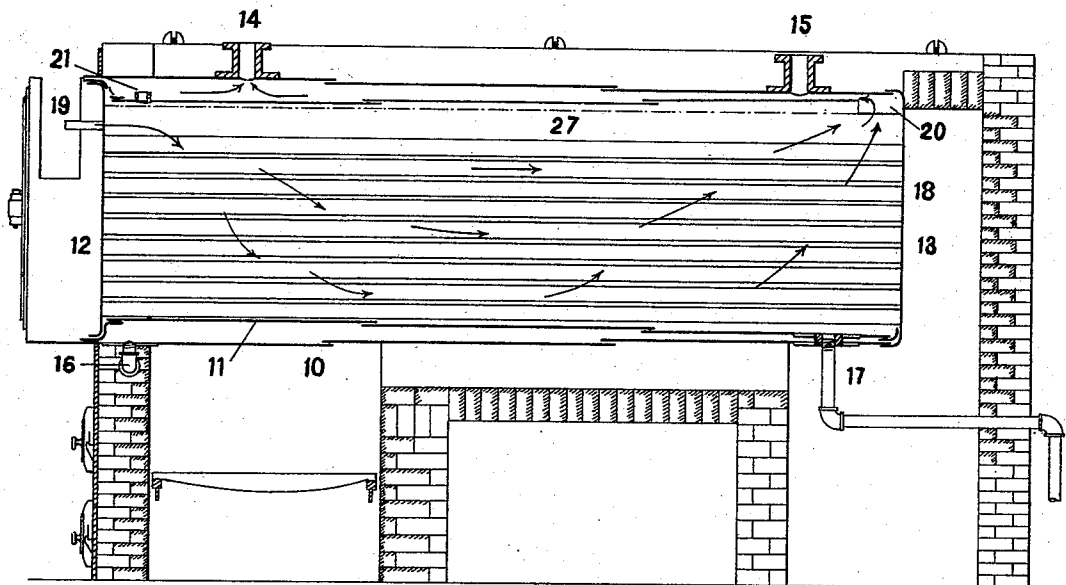


Fig. 2.

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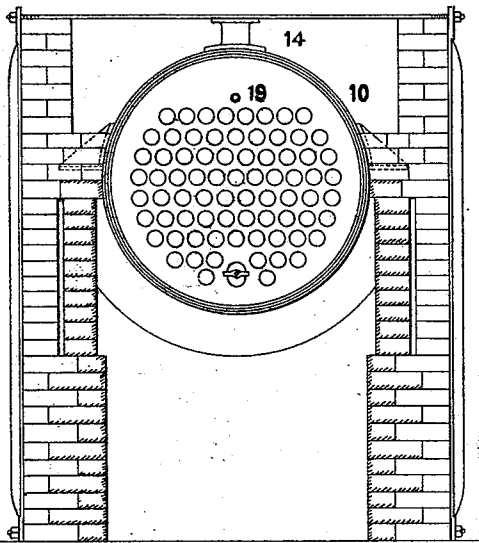


Fig. 4.

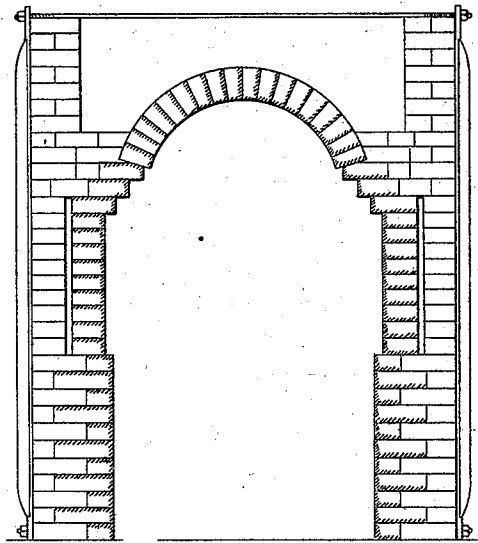


Fig. 5.

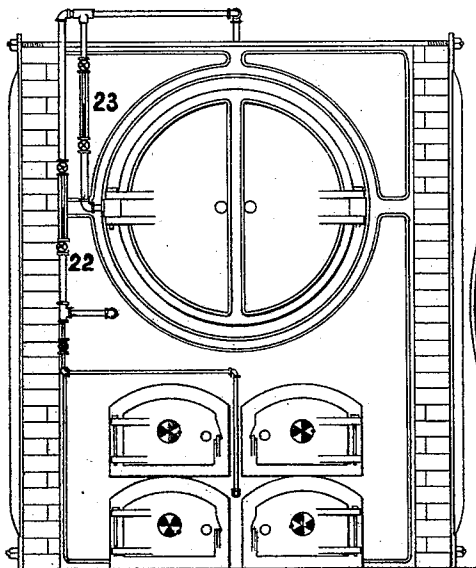


Fig. 6.

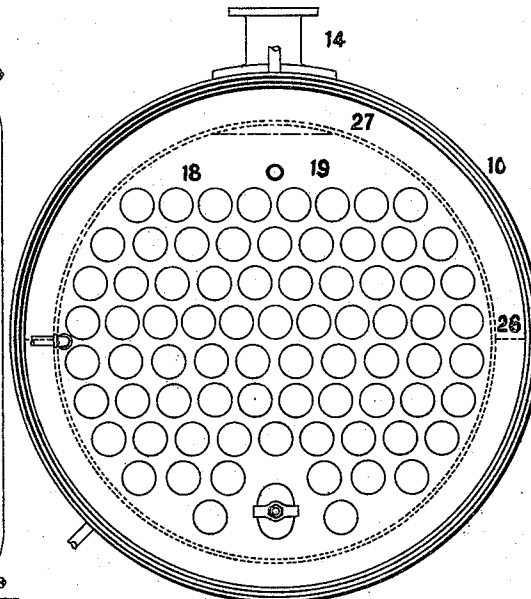


Fig. 7.

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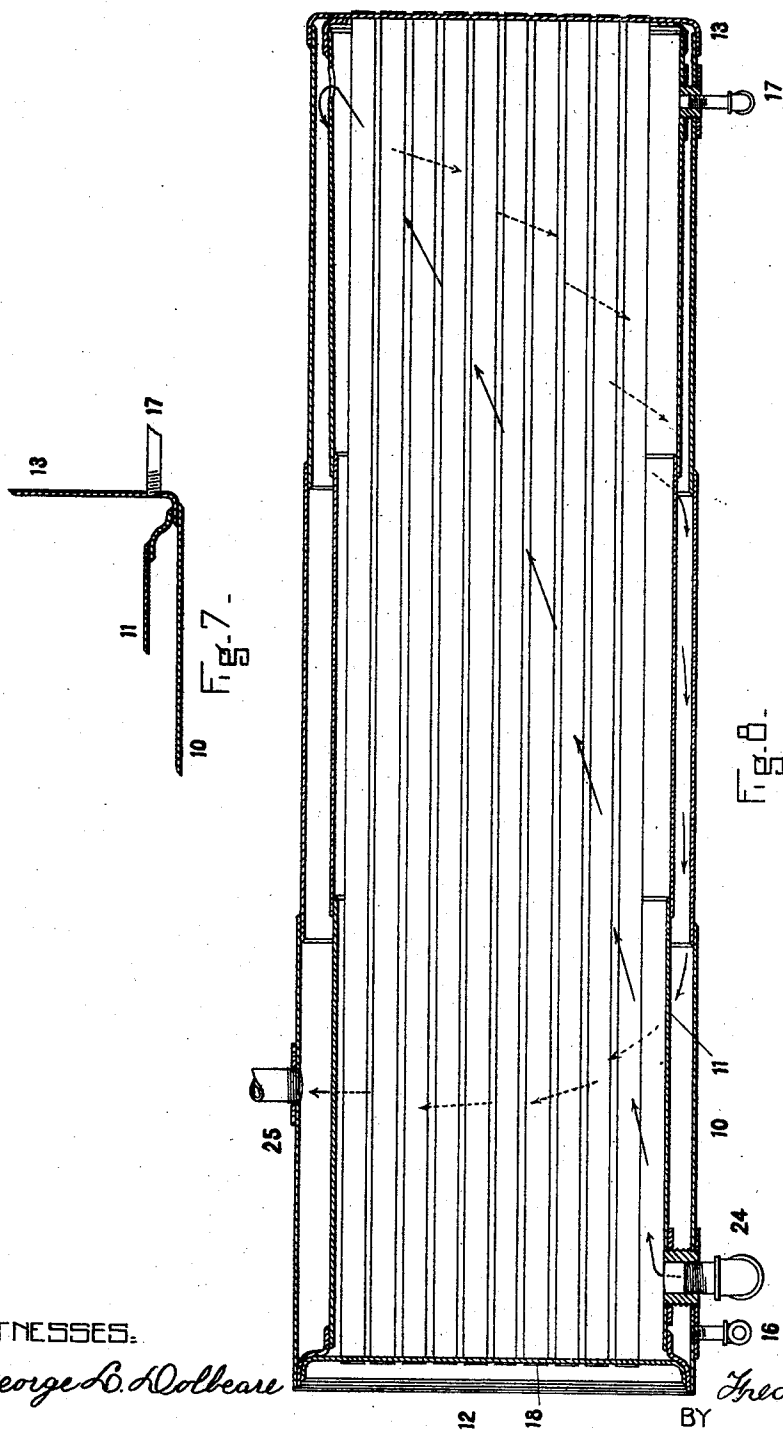
(No Model.)

F. T. STEVENS.
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3 Sheets—Sheet 3.

No. 578,300.

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UNITED STATES PATENT OFFICE.

FRED T. STEVENS, OF BRYANT'S POND, MAINE.

BOILER.

SPECIFICATION forming part of Letters Patent No. 578,300, dated March 2, 1897.

Application filed June 6, 1896. Serial No. 594,612. (No model.)

To all whom it may concern:

Be it known that I, FRED T. STEVENS, a citizen of the United States, residing at Bryant's Pond, in the county of Oxford and State of Maine, have invented certain new and useful Improvements in Boilers, of which the following is a specification.

My invention relates to boilers which are adapted for power and heating purposes; and the boiler is designed as an improvement upon the steam-boiler for which Letters Patent were granted to me August 16, 1892, No. 480,880.

The object of my invention is to produce a boiler that is constructed without the use of braces or stay-bolts and which is adapted to generate dry steam, especially under high pressures, in a most economical manner.

Economy in the production of steam is one of the matters of first consideration and importance in almost every branch of manufacturing industry.

It is a quite generally acknowledged fact that the practice of feeding a boiler of the usual construction with water of a low temperature compared with the actual temperature in the boiler itself is wrong in principle and disastrous in its results upon the life of the boiler by causing excessive strains on the joints and stays and other troubles well known to practical men. My boiler can be fed with water of low temperature, if desired, without subjecting it to any excessive strains.

Figure 1 is a plan of the boiler. Fig. 2 is a longitudinal central sectional view of Fig. 1. Fig. 3 is a front view of Fig. 1. Fig. 4 is a front view of the boiler with the cast-iron front and grate removed in order to show more clearly the general arrangement of the boiler and setting. Fig. 5 is a cross-sectional view of the setting immediately in the rear of the boiler. Fig. 6 is a view of the front end of the boiler. Fig. 7 illustrates a different mode of securing the inner shell to the back head of the boiler; and Fig. 8 shows the boiler in central longitudinal section, illustrating the construction of the boiler and its connections when it is designed to be used for hot-water heating purposes.

The boiler, as illustrated, is provided with the outer shell 10, inner shell 11, front head

12, and back head 13. The outside appearance of the boiler is substantially the same, except in particulars as hereinafter mentioned, as the ordinary tubular boiler. The front head or tube-sheet 12 serves as the front head of the outer and inner shells, and the back head or tube-sheet 13 serves as the back head for the outer and inner shells. The center of the inner shell is preferably slightly below the center of the outer shell. The outer shell is provided with the usual nozzles 14 and 15, the front nozzle 14 being the steam-nozzle and the nozzle 15 being the safety-valve nozzle.

The plates composing the outer and inner shells by reason of the laps being made as shown in the drawings diverge from the back end to the front end of the boiler. This construction is preferred for the reason that the sediment between the shells will naturally tend to collect near the front of the boiler, where it can readily be blown off through the front blow-off 16, and that the sediment in the inner shell will naturally tend to collect near the back end of the boiler, where it can readily be blown off through the back blow-off 17.

The inner shell is provided with the set of tubes 18, which are designed and set so as to nearly fill the inner shell, a slight or small space being left at the top of the inner shell, only enough to allow sufficient space for the shrinkage of the water, so that when the boiler is cold the upper row of tubes will be covered by water. The inner shell is also provided with the water-feed pipe 19, which is located, as shown, in the front head, the overflow-opening 20, which is made at the top of the inner shell near the back head, and the vent-pipe 21, placed at the top of the inner shell near the front head. This vent-pipe is provided for the purpose of preventing the surging of the water within the inner shell.

The two water-glasses 22 and 23 are provided, water-glass 22 being connected, as shown, so that it will show the level of the water between the shells, and glass 23 being connected, as shown, so that it will show the level of the water within the inner shell.

When the boiler is designed for hot-water heating purposes, as shown by Fig. 8, it is

provided with the cold-water inlet 24 and the hot-water outlet 25.

The operation of the steam-boiler is as follows: The feed-water is forced into the boiler through the feed-water pipe in the front head, and this pipe enters the inner shell directly above the upper row of tubes. It will be observed that the feed-water enters the boiler at its coldest point and at a point where the temperature of the escaping gases is the lowest. The feed-water by reason of its specific gravity (being cold) tends to descend toward the bottom of the inner shell as it is forced the entire length of the inner shell, the path of the circulation being as indicated by the darts shown in Fig. 2. From the inner shell it overflows through the overflow-opening into the rear end of the outer shell, or the space between the shells, where it naturally falls and follows along the bottom of the outer shell toward the hottest portion of the outer shell over the grate, from which point the liberated steam rises and escapes or is forced into and through the steam-nozzle, as indicated by darts. It will be observed that the combined natural and forced circulation of the water is in lines directly opposite or opposed to that taken by the products of combustion from the grate to the smoke-arch. This feature insures great efficiency in the economical production of steam and it permits the feeding of the boiler with water of a low temperature, if desired, without subjecting the boiler to any excessive strains, as the cold water does not come in contact with the hot or hottest portion of the boiler.

The water-level 26 between the shells is maintained in the usual manner by forcing into the boiler the feed-water which overflows from the inner shell. The water-level 27 in the inner shell is always, when the boiler is in active operation, on the same level as the bottom or lower side of the overflow-opening.

By reason of maintaining a high water-level in the inner shell I am enabled to almost entirely fill the inner shell with tubes, thereby greatly increasing the heating-surface as compared with the ordinary boiler. For instance, a forty-eight-inch tubular boiler of the common type with tubes sixteen feet long contains about seven hundred and twenty-four square feet of heating-surface and has a capacity, as usually rated, of about forty-eight-horse power, while a boiler of my improved construction with tubes sixteen feet long contains about ten hundred and seventy-two square feet of heating-surface and has a capacity, as usually rated, of about seventy-one-horse power. It will thus be seen that in this instance my boiler will have a heating-surface or horse-power capacity about fifty per cent. greater than the ordinary boiler. I am therefore able to sell my boiler at a less rate per square foot of heating-surface than an ordinary boiler can be sold. The inner shell being nearly filled with tubes makes unnecessary the use of braces, and my boiler

can be made to carry very high pressures, no braces or stay-bolts, which are always a cause of more or less trouble, being used.

It is believed, and it has been proved by careful expert tests, that my improved boiler generates very dry steam even when the temperature of the escaping gases is quite low, the reason for this being that no cold water is mingled with the hot water over the grate-surface at the point where the greater portion of the steam is liberated, and also that the inner shell seems to act as a separator, separating the water from the steam, collecting the water on the upper surface of the inner shell, the separated and collected water being returned to the water-line between the shells.

When the boiler is designed for hot-water heating purposes, as shown in Fig. 8, the cold water enters the boiler through the cold-water inlet or feed pipe and leaves the boiler through the hot-water outlet pipe or nozzle, the path of the circulation being shown by means of darts. It will be seen that an almost perfect circulation of the water is maintained, thereby assuring the highest economical efficiency in hot-water heating.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a boiler, an inner shell constructed as shown whereby it can be substantially filled with tubes which are, in operation, always covered by the feed-water, and an outer shell inclosing the inner shell, the front and back heads serving for both inner and outer shells, said inner shell having an overflow-opening located near its back end at its top and a vent-pipe near its front end at its top, substantially as and for the purposes set forth.

2. In a boiler, the inner and outer shells composed of plates, diverging from the back head; the front head 12; and the back head 13; said inner shell being provided with the overflow-opening 20 and the back blow-off 17, and said outer shell being provided with the front blow-off 16, substantially as described.

3. In a boiler, the inner and outer shells composed of plates, diverging from the back head; the front head 12; and the back head 13; said inner shell being provided with the overflow-opening 20, the vent-pipe 21, and the back blow-off 17, and said outer shell being provided with the front blow-off 16, substantially as described.

4. A boiler comprising the inner shell 11 eccentrically placed within the outer shell 10, said inner shell having the overflow-opening 20 located as shown so that the inner shell may be nearly filled with tubes and thereby permitting the maintaining of two different water-levels, the water-level of the space between said shells being near the horizontal center line of the boiler, and the water-level of the inner shell being near its top, the feed-water entering the inner shell and overflowing therefrom into the space between the shells, substantially as described.

5. A boiler comprising the inner shell placed

eccentrically within the outer shell, said inner shell having the set of tubes 18, and being provided with the overflow-opening so placed as to permit the maintaining of two
5 separate water-levels within the boiler, and being also provided with the vent-pipe 21 by means of which the surging of the water within the inner shell is prevented, the feed-water entering the inner shell and overflowing therefrom into the space between the
10 shells, substantially as described.

6. A boiler provided with an inner and an outer shell, said inner shell being provided with the feed-pipe located near the front head
15 and the overflow-opening located at the top

of the inner shell near the back head, and said outer shell provided with the nozzle located near the front head, by means of which, in operation, the combined natural and forced circulation is in lines directly opposed to that
20 taken by the products of combustion from the grate to the smoke-arch, substantially as and for the purposes set forth.

In testimony whereof I have signed my name to this specification in the presence of
25 two subscribing witnesses.

FRED T. STEVENS.

Witnesses:

ARTHUR C. RICKER,
ALBERT C. BOLSTER.