





# UNITED STATES PATENT OFFICE.

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TRUSTEE, OF SAME PLACE.

## DOWNDRAFT WATER-TUBE BOILER.

SPECIFICATION forming part of Letters Patent No. 671,772, dated April 9, 1901.

Application filed August 31, 1900. Serial No. 28,631. (No model.)

*To all whom it may concern:*

Be it known that I, OREL D. ORVIS, a citizen of the United States of America, residing at the borough of Manhattan, New York, in the  
5 county of New York and State of New York, have invented certain new and useful Improvements in Downdraft Water-Tube Boilers, of which the following is a specification.

My invention has reference to improvements in water-tube boilers, and particularly to that class in which the downdraft or combined downdraft and updraft principle of combustion is employed, and has for its objects, first, to increase the efficiency of such  
15 boilers by presenting an increased available heating-surface, and so thoroughly utilizing the heat units of the products of combustion, and, secondly, to provide a rapidly-steaming boiler or a rapidly-heating hot-water apparatus.  
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With these objects in view my invention consists, essentially, in a water-tube boiler comprising two headers located at opposite ends of the setting, a series of water-tubes  
25 extending from one header to the other, a grate formed between the headers by part of the water-tubes, a fire-box formed by an arch and side walls disposed between the water-tubes and said fire-box extending between  
30 the headers, a charging-opening formed in one of said headers, a drum connected at opposite ends with said headers and provided with an outlet-opening, and a casing inclosing the water-tubes.

35 The nature of my invention will best be understood when described in connection with the accompanying drawings, in which—

Figure 1 represents a front elevation of a boiler and setting embodying my invention,  
40 the front iron doors and frame being removed and said figure being partly in section. Fig. 2 is a side elevation with part broken away and partly in section.

Similar letters and numerals of reference  
45 designate corresponding parts throughout both views of the drawings.

Referring to the drawings, the letters A and B designate two headers located at opposite ends of the setting C, which latter I have  
50 shown in this example to consist simply of two longitudinal parallel walls which support

said headers. The headers A and B are herein shown as substantially rectangular in form, although of course it must be understood that they may be of any other configuration, 55 and one of the same is provided with a charging-opening D for the introduction of fuel to the grate F. The front header A has its interior placed in communication with a drum E, extending lengthwise of the boiler, by fittings 1, attached at or near the top of said header, while the rear header B is connected by pipes and fittings 2 with said drum E, communicating with the bottom of said header. The two headers A and B are connected by 65 horizontal water-tubes 3, placed at proper intervals apart, so that a circulation of water takes place in the direction of arrows 10, as indicated in Fig. 2, from the drum E through the pipe and fittings 2, header B, water-tubes 3, header A, fittings 1, and back to the drum E. Part of the water-tubes—for instance, those indicated by 3\* and arranged in a horizontal tier—are used to form a water-grate F, which is preferably disposed centrally, or substantially so, with respect to the other tubes. 75 A fire-box G is formed above said grate by means of horizontal plates 4, made of suitable refractory material and placed between the two horizontal tiers of water-tubes on opposite sides of the grate F, a series of similar plates 5, arranged between the contiguous vertical rows of water-tubes, and an arch 6, resting on said vertical plates 5 and supported by the same and also by the contiguous tubes. 85 The fire-box thus formed extends from the front to the rear header—that is, throughout the entire length of the water-tubes. The tubes inclosed by or situated within the walls of the fire-box are exposed directly to the action of the flame. 90

Below the fire-box G is located a grate H, adapted to receive the droppings from the grate F, and to which grate H air is supplied from below through a door I (shown in dotted lines in Fig. 1) and located in an iron panel secured to the walls C C. A second door J is located in the panel for the purpose of feeding fuel to the grate H or for raking. 95

The products of combustion from the grate F pass downwardly through said grate and then upwardly and outwardly between the 100



several water-tubes 3, as indicated by arrows 11 in the drawings, and thence upwardly through the uptakes 8, communicating with the opposite sides of the casing and with a chimney or stack 9. The chimney or stack 9 may, however, be considered an uptake leading to a common chimney, as when a battery of boilers is installed.

Water is supplied to the boiler at any suitable point—say at 12—and steam or water is drawn from the drum E—say at 7.

It will be readily understood that the water-tube boiler herein shown can be used as a hot-water heater by keeping all the parts filled with water, or it may be used as a steam-generator by preserving a proper water-level in the drum E, and that in either case an efficient and rapid heating or steaming boiler is produced.

A casing 14, which may be made of suitable refractory material, extends around the headers down to the walls C C for the purpose of inclosing the water-tubes and fire-box and forming a combustion-chamber.

What I claim as new is—

1. A water-tube boiler comprising two headers located at opposite ends of the setting, a series of water-tubes extending from one header to the other, a grate formed between the headers by part of the water-tubes, a fire-box formed by an arch and side walls arranged between the water-tubes, and said fire-box extending between the headers, a charging-opening formed in one of said headers, a drum connected at opposite ends with said headers and provided with an outlet-opening, and a casing inclosing the water-tubes, substantially as described.

2. A water-tube boiler comprising two headers located at opposite ends of the setting, a series of water-tubes extending from one header to the other, a grate formed between the headers by part of the water-tubes, a fire-box formed by an arch and side walls ar-

ranged between the water-tubes, and said fire-box extending between the headers, a charging-opening formed in one of said headers, a drum connected at opposite ends with said headers and provided with an outlet-opening, a casing inclosing the water-tubes, and a grate arranged below the water-grate, substantially as described.

3. A water-tube boiler comprising two headers located at opposite ends of the setting, a series of water-tubes extending from one header to the other, a horizontal grate formed between the headers by part of the water-tubes, a fire-box formed by an arch, side walls arranged between the water-tubes and horizontally-placed plates arranged between horizontal tiers of tubes, and said fire-box extending between the headers, a charging-opening formed in one of said headers, a drum connected with said headers at opposite ends and provided with an outlet-opening, and a casing inclosing the water-tubes, substantially as described.

4. A water-tube boiler comprising two headers located at opposite ends of the setting, a series of water-tubes extending from one header to the other, a grate formed between the headers by part of the water-tubes, a fire-box formed by an arch and side walls arranged within the series of water-tubes and inclosing part of said tubes, a charging-opening formed in one of said headers, a drum connected at opposite ends with said headers and provided with an outlet-opening, and a casing inclosing the water-tubes, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

OREL D. ORVIS.

Witnesses:

EUGENIE P. HENDRICKSON,  
A. FABER DU FAUR, Jr.