

No. 669,132.

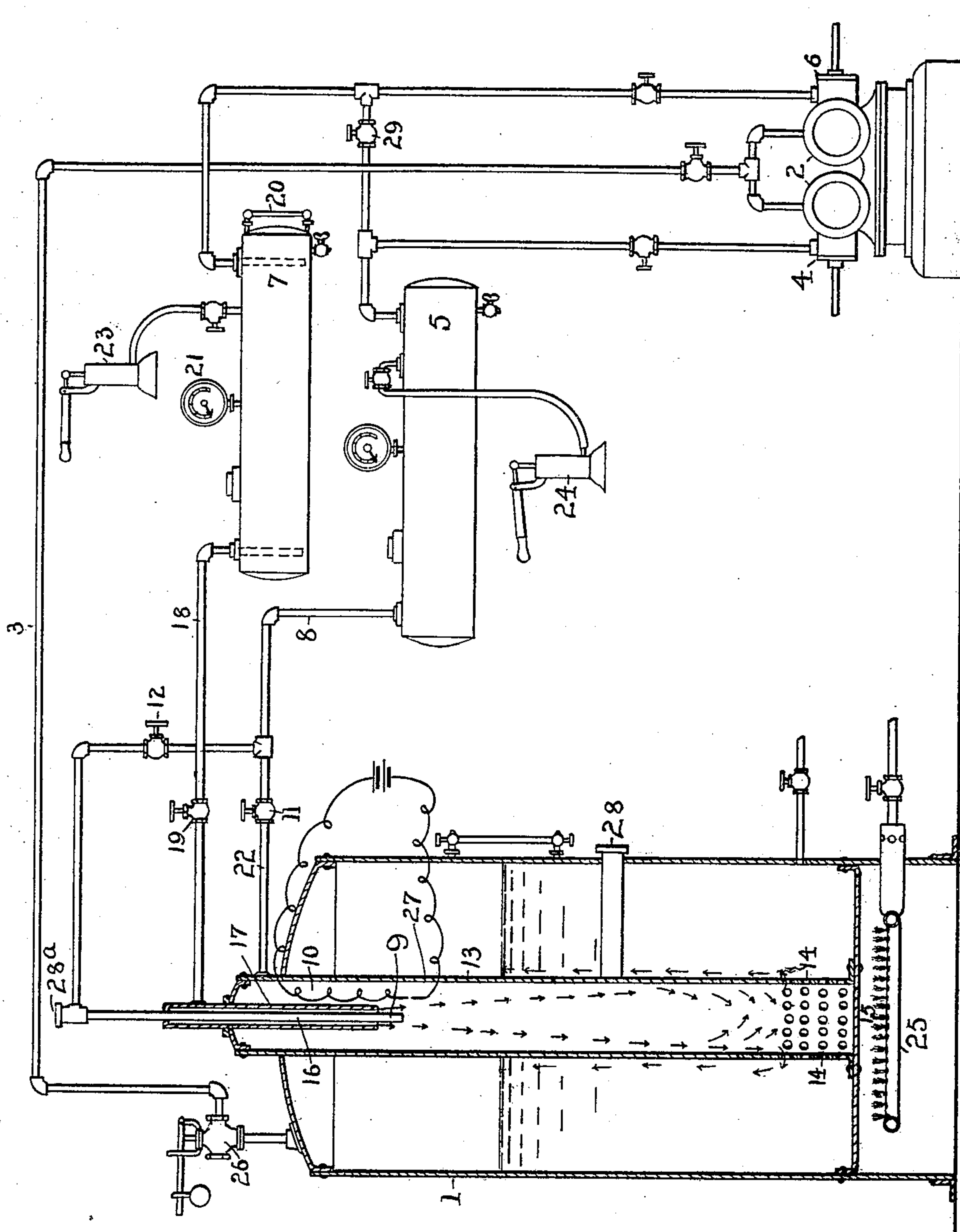
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A. T. WELCH.

STEAM BOILER.

(Application filed Nov. 21, 1899.)

(No Model.)



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# UNITED STATES PATENT OFFICE.

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## STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 669,132, dated March 5, 1901.

Application filed November 21, 1899. Serial No. 737,799. (No model.)

*To all whom it may concern:*

Be it known that I, ABRAHAM T. WELCH, a citizen of the United States of America, and a resident of the city of Baltimore, State of Maryland, have invented certain new and useful Improvements in Boilers for Generating Steam, of which the following is a specification.

My invention relates to a boiler for the generating of steam, and has for its object the utilizing of all the heating capacity of the fuel consumed in the generation of steam and at the same time the recovery and utilization of all of the products of combustion which are mixed with the steam and which aid in creating a gaseous pressure suitable for driving an engine.

Heretofore in the consumption of fuel and the generation of steam where the products of combustion are allowed to escape into the atmosphere there are two great sources of loss. One lies in the necessity for conducting the heat produced by the fire through some form of conducting medium, as the walls of a boiler, and this indirect application of heat to the water is a considerable source of loss. In all such boilers where the heating-flame is caused to blow upon the exterior of a vessel containing water a large part of the heat produced at the instant of combustion is lost in the flues.

I have improved the old method and apparatus by forcing a flame produced from gas and air under pressure into my boiler and into direct contact with the water, thus causing all the heat of the flame to be converted into work in the evaporation of water. The constant cooling of the flame will cause a part of the unconsumed gas, as well as the carbon dioxid, to enter the steam-space of the boiler together with the steam and being hot and most of it expansive it will be almost as efficient for motor purposes as steam itself.

Referring to the drawing, which is a diagrammatic view of an apparatus embodying my invention, the boiler being shown in vertical section, 1 is a boiler.

2 is a double engine and pair of air-pumps connected to the boiler by steam-pipe 3.

4 is one of the air-pumps, connected to an

air-reservoir 5. 6 is the other air-pump, connected to a gas or oil reservoir 7. The reservoir 5 is intended to contain air under pressure. It is connected at its far end by the pipe 8 with the air-pipe of the burner 9. It is provided with a connection direct to the fire-chamber 10 and has a stop-cock 11 in that connection and a stop-cock 12 in the connection to the burner.

In the center of the boiler is a cylinder of small diameter extending from the bottom to the top of the boiler and protruding through the top. It is perforated near the bottom with the series of holes 14 14, by which water and gas can pass backward and forward from the boiler to the cylinder, and vice versa. These openings should be of greater area than the total capacity of the gas-inlets, so that there will always be some water in the bottom of the fire-chamber 13.

16 is an oil-burner located in the top of the cylinder and consisting of an interior air-pipe 9 and an exterior oil or gas pipe 17. The oil or gas pipe 17 is connected with the oil or gas tank 7 by means of pipe 18, provided with a stop-cock 19. The oil or gas tank 7 is provided with an oil-gage 20 and pressure-gage 21. When the valve 19 is set at a desired opening and a requisite pressure of air is maintained on the top of the oil in the oil-cylinder 7, a desired quantity of oil in the form of spray and gas produced from the oil is forced through the oil-pipe 17 into the combustion chamber or cylinder 13. At the same time air is forced from the air-reservoir 5 through the air-pipe 9 and, if desired, also through the air-pipe 22 into that portion of the combustion-chamber marked 10 outside of the burner, so as to supply the requisite quantity of air for the complete combustion of the oil. I may use oil or gasoline, producing sprayed oil or vapor-gas, or I may use a fixed gas.

23 is a hand-pump connected to the oil-cylinder 7, and 24 is a hand-pump connected to the air-cylinder 5, which may be used to create pressure enough in the tanks 5 and 7 to start the apparatus. If the hand-pumps are used, the burner 25 will be unnecessary. If the burner is used, the hand-pumps will be



unnecessary. The pipes connecting the air-pumps 4 and 6 with the tanks 5 and 7 may be closed with stop-cocks and a communicating pipe opened between the tanks by stop-cock 29, so as to balance the pressure in the two tanks.

25 is a gas-burner located underneath the boiler in a position to heat a small quantity of water in the boiler to such an extent as may be necessary to generate steam enough to start the engines and pumps, after which the burner 25 may be shut off, and the flame produced by the burner 16 will so heat the water as to maintain a sufficient pressure in the boiler. It will be noticed that the air and oil or gas pressure in the combustion-chamber and steam-pressure in the boiler must balance one another, or nearly so. The steam generated is proportional to the temperature of the fire, and the pressure is equal to the steam generated less the radiation. The temperature of the fire is due to the pressure of air and gas in the tanks 5 and 7, and this pressure is automatically controlled by pressure-regulating valves connected to the air-pumps 4 and 6. The pressure in the combustion-chamber is always a little greater than the pressure in the boiler, because although the pressures have a tendency to balance one another the radiation of the boiler will constantly reduce the pressure in the boiler somewhat.

26 is a safety-valve on the boiler, which will only be called into play when the pumps through some accident create an abnormal pressure in the tanks.

In starting up the apparatus before sufficient steam is gotten up in the boiler to operate the pumps the hand-pumps 23 and 24 may be operated to produce a desired pressure in the cylinders 5 and 7.

27 is a sparker introduced into the combustion-chamber for the purpose of lighting the burner. When the burner has been lighted and a sufficient pressure has been obtained upon the tanks 5 and 7 and a sufficient pressure also obtained in the boiler, the pumps will run steadily and maintain the pressure in 5 and 7, blowing the air and oil from the burner 16 into the combustion-chamber 13. It is desirable to control the location of the flame so as to focus the highest temperature below the level of the water, not to burn the wall of the combustion-chamber. The pressures will be so regulated that some water may remain in the bottom of the combustion-chamber 13, when it will be highly heated by the direct action of the flame and forced through the apertures 14 14 up into the boiler, when its place will be filled by other water flowing in through the bottom row of holes 14, and when the pressure of gas in the combustion-chamber is greater than the pressure of steam in the boiler, which is generally the case when steam is being drawn from the boiler, the

tail of the flame will travel through the upper row of apertures 14 14 into the water and come into direct contact with it, generating steam not only by conduction through the walls of the combustion-chamber, but by the direct contact of the flame with the water by which all of the heat units of the flame will be absorbed by the water and utilized in the work of generating steam. Thus all the products of combustion, as well as the total heat units of the flame, will be available for the purpose of creating and maintaining pressure in the boiler.

28 is a sight-tube extending from the combustion-chamber 13 to the exterior of the boiler, so that the color of the flame and its condition may be observed. This sight-tube may be located at 28<sup>a</sup> on the upper end of the air-pipe.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a boiler for generating steam, the combination of a water-containing vessel with means for producing flame located above the normal level of the water in said vessel and adapted to cause the flame to impinge directly upon the water contained in the vessel.

2. In a boiler for generating steam, the combination of a water-containing vessel, and a burner producing flame within the vessel, the burner being so located as to produce the flame above the normal level of the water in said vessel and cause it to impinge upon or through the water, whereby the produced steam and the unconsumed products of combustion are both collected together, for the purpose of producing a gas-pressure.

3. In a boiler for generating steam, the combination of a water-containing vessel, having a stationary combustion-chamber located within the boiler, and connected therewith for the admission of water, a burner within the upper part of the combustion-chamber, and means for producing a steady air and gas pressure within the combustion-chamber, to counterbalance the steam-pressure of the boiler.

4. In a boiler for generating steam, the combination of a water-containing vessel, having a combustion-chamber permanently located therein, and having water-passages between the boiler and combustion-chamber, a burner in the upper part of the combustion-chamber, adapted to produce flame, and cause it to impinge upon the water in the lower part of the combustion-chamber, or through the connecting passage-ways in the boiler, and devices for producing a steady air and gas pressure in the combustion-chamber, to counterbalance the steam-pressure in the boiler.

5. In a boiler for generating steam, the combination of a water-containing vessel, a combustion-chamber permanently located within the water-containing vessel, and having wa-



ter passage-ways between the combustion-  
chamber, and water - containing vessel, a  
burner located in the upper part of the com-  
bustion-chamber, and arranged to cause its  
5 flame to impinge upon the water in the com-  
bustion-chamber or through the passage-ways  
upon the water in the water-containing ves-  
sel, means for supplying oil under pressure  
to the burner, and means for supplying air

under pressure to the burner, as, and for the 10  
purpose specified.

Signed by me at Baltimore, Maryland, this  
20th day of November, 1899.

ABRAHAM T. WELCH.

Witnesses:

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