Aug. 31, 1926. 1,597,872

J. B. STANWOOD

STEAM PLANT

Filed Dec. 1, 1921 2 Sheets-Sheet 1

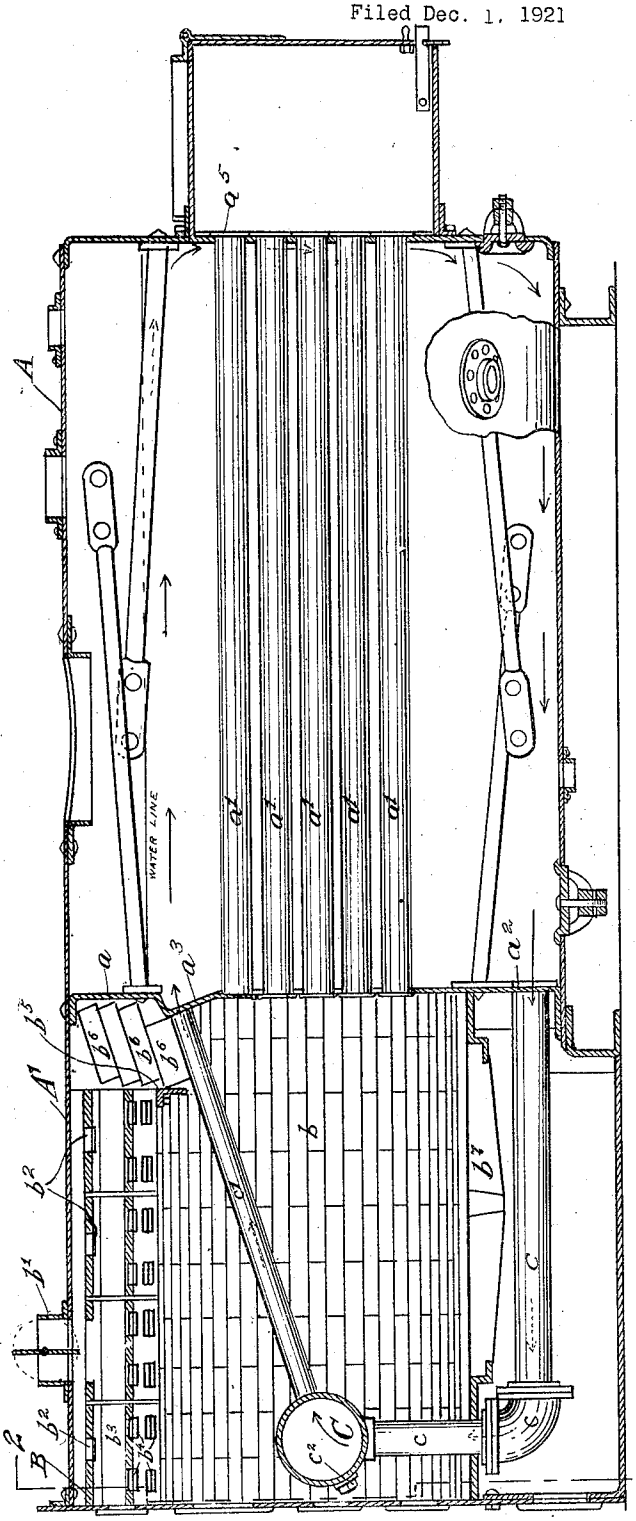

Fig. 1.

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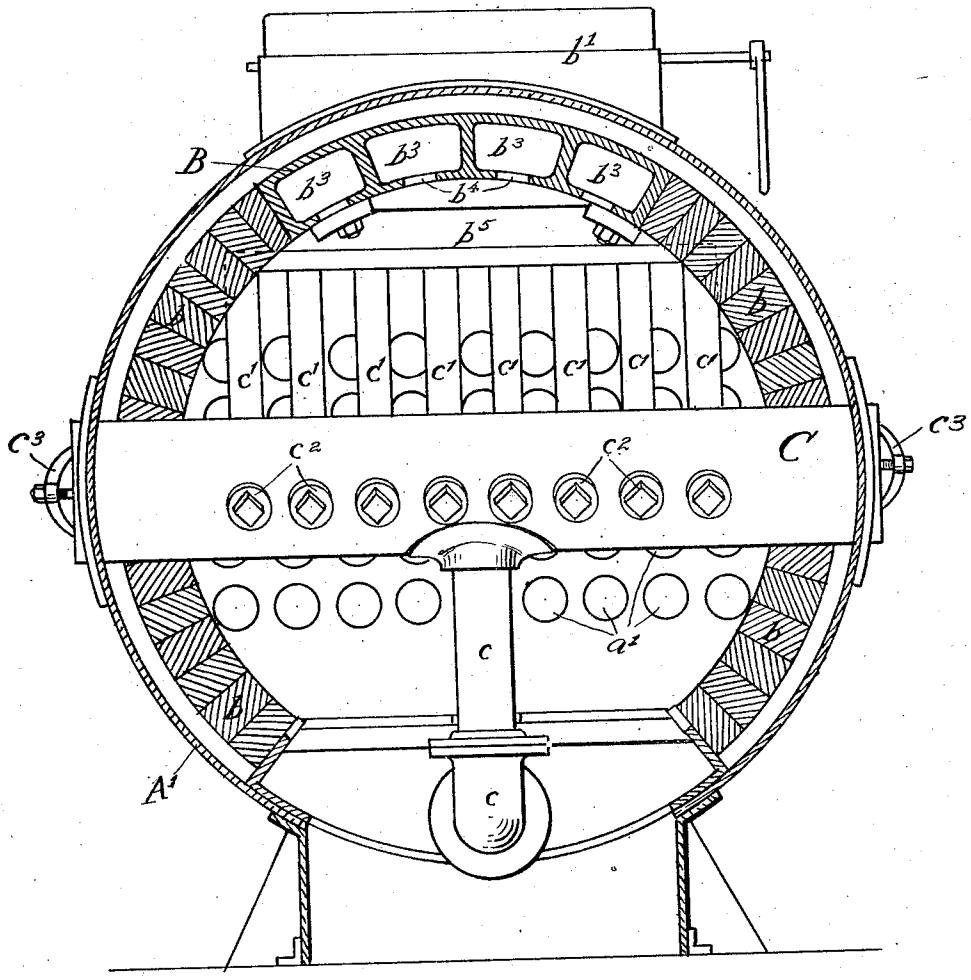

Fig. 2.

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UNITED STATES PATENT OFFICE.

JAMES B. STANWOOD, OF CINCINNATI, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE STANWOOD CORPORATION, OF CINCINNATI, OHIO, A CORPORATION OF OHIO.

STEAM PLANT.

Application filed December 1, 1921. Serial No. 519,176.

My invention relates to improvements in steam plants comprising a steam boiler and furnace of the "down-draft" type.

Some of the objects of the invention are to provide such a combination of elements as will ensure a steam plant that is cheap, simple and durable; and that is economical to operate because of the very complete combustion of the fuel and efficient means for conducting the generated heat to the water in the boiler.

Another object of my invention is to provide positive means for quickly inducing and maintaining circulation of water thru the boiler and the forward connections thereof in the furnace, giving low stack temperatures with one pass of the gases through the tubes, and resulting in increased economy and efficiency.

Another object of my invention is to provide a steam plant of maximum efficiency which requires a greatly reduced vertical space. When used for heating only, or both for heating and power, as in office or power buildings, a saving of from 2 to 4 feet may be made in the height of the sub-basement where the steam plant is installed.

In the particular embodiment of my invention selected for illustration, which is the best form known to me:—

Figure 1, is a vertical axial-section thru the steam plant, and

Fig. 2, is a cross-section on the line 2—2 of Fig. 1 as tho the apparatus was there shown in full.

Referring now to the drawings, A is the shell of a cylindrical, horizontal fire tube boiler extended forwardly beyond the front head a to form a fire box casing A^1.

The boiler has a back head a^5 and fire tubes a^1 and is of the usual type except in two particulars. Toward the bottom of the front head or tube sheet a are one or more openings a^2 for water outlet connections c; and toward the top the front head is protruded or otherwise shaped to form a shoulder a^3 whose front surface is at right angles to inlet connections c^1 hereinafter more fully described. There is the usual steam space above the tubes a^1 and a generous water space below these tubes, as shown in Fig. 1. This ample space below the fire tubes a^1 secures two distinct advantages, first, a spacious chamber is provided at the lowest point of the boiler in which mud, scale and other precipitates can settle, so that the shell is not exposed to heat and the shell plates cannot be bagged nor the seams cracked; and second, it gives a wide lane of low frictional resistance for the complete secondary circulation of the water on its way back from the back head a^5 to the front head a.

The furnace is lined with fire brick b or other refractory material, except at the top where an arch key member B preferably made of cast iron in sections is used. Cast iron may be used because the heat is not great at the top of this furnace. This arch key member has longitudinal air chambers b^3, to which air from without the furnace is admitted thru the damper b^1 and passages b^2. From these chambers b^3 the air passes into the furnace thru the openings b^4.

Thru one or more pipes c fitted into one or more outlet openings a^2 of the boiler, water flows into the manifold C; and water flows from the manifold back into the boiler at the shoulder a^3 thru a plurality of water-tubes c^1 which form grate-bars upon which the burning fuel lies. I prefer that the tubes c^1 should be sloping, to facilitate circulation as shown.

A bar b^5, preferably angular, placed horizontally across the furnace above the water-tube grate-bars c^1 forms a support for refractory baffle bricks or tiles b^6, which together form a transverse wall across the furnace improving the combustion by facilitating a more complete mixing of the gases evolved from the burning fuel. Lower secondary grate-bars b^7 are of any usual construction.

The manifold is provided with a plug c^2 opposite the end of each water-tube grate-bar c^1 to facilitate calking, cleaning, and removal.

The manifold is provided on its ends with hand-hole plates c^3 to facilitate cleaning out the interior. The manifold extends thru the lining bricks b and shell A^1 to sustain the weight of the manifold, at the same time allowing for such movement as is necessary for expansion and contraction.

An important feature of my invention is

the furnace, which instead of being built in is substantially entirely in front of the boiler construction. By locating it up in front of the boiler shell three beneficial results are obtained; first, it eliminates the usual steel firebox which forms an integral part of most boilers, thus avoiding crown-sheets, mud-legs and stay-bolts; second, this location relative to the boiler shell enables the overall vertical height of the boiler as well as the height of the water line in the boiler to be very low, a most desirable feature in many heating plants particularly where head room is restricted; third, it enables the delivery ends of the water-tubes c^1 to be placed just above the fire-tubes a^1 and also very near to the water line where the ejected water from them induces the secondary current.

The operation is as follows: The burning fuel rests upon the water-tube grate-bars c^1, and fresh air enters the furnace chamber from above thru damper b^1, passages b^2, chambers b^3, and openings b^4, passes down thru the bed of fuel and between the grate-bars c^1, heating them and the water in them to a high temperature. The hot gases then pass on into the interior of the furnace between the bars c^1 and grate-bars b^7 and then thru fire tubes a^1 continuing the work of combustion.

Induced by the heat, the water in the tubes c^1 rises, entering the upper part of the boiler, and water from the lower part of the boiler enters the pipe c and passes thru the manifold C to the water-tube grate-bars c^1. This movement of the water causes the water in the boiler to flow backward at the water line over the fire tubes to the back head a^5 of the boiler, then downward and then forward along the bottom of the boiler towards the front head a at the opening a^2 completing the circuit.

Obviously many changes could be made in the apparatus without departing from the spirit of my invention, and all forms of such an apparatus that may fall within the scope of my claims are within the scope of my invention.

I claim as my invention and desire to secure by Letters Patent of the United States:

1. In a steam plant, the combination of a down draft furnace, a horizontal fire tube boiler the water space of which is substantially all back of the furnace and the fire tubes of which communicate at their front ends directly with the furnace, a water outlet extending from the lower part of the boiler through the furnace, a water tube grate in the furnace which opens into the upper part of the boiler, and means for distributing the water from said outlet to the tubes of said grate.

2. In a steam plant, the combination of a down draft furnace, a horizontal fire tube boiler the water space of which is substantially all back of the furnace, and the fire tubes of which communicate at their front ends directly with the furnace, a water outlet extending from the lower part of the boiler into the furnace, and a primary grate in the furnace comprising pipes connected with to receive water from said water outlet which primary grate pipes are substantially straight and enter the boiler near the upper part thereof.

3. In a steam plant, the combination of a down draft furnace, a horizontal fire tube boiler the fire tubes of which communicate at their front ends directly with the furnace, a water outlet extending from the lower part of the tube sheet of the boiler into the furnace substantially in line with the bottom of the boiler, and a primary grate in the furnace comprising pipes connected with to receive water from said water outlet, which primary grate pipes enter the front tube sheet of the boiler above the fire tubes and near the water line.

4. In a steam plant, the combination of a down draft furnace, a horizontal fire tube boiler the fire tubes of which communicate at their front ends directly with the furnace, a water outlet extending from the lower part of the tube sheet of the boiler into the furnace substantially in line with the bottom of the boiler, and a primary grate in the furnace comprising pipes connected with to receive water from said water outlet, which primary grate pipes are substantially straight and enter the boiler near the normal water line thereof.

5. In a steam plant, the combination of a down draft furnace, a horizontal fire tube boiler the fire tubes of which communicate at their front ends directly with the furnace, a water outlet extending from the lower part of the boiler into the furnace substantially in line with the bottom of the boiler, a manifold in the furnace to which the water outlet is connected, and water tubes constituting the primary grate of the furnace which extend from said manifold to and through the tube sheet of the boiler.

6. In a steam plant, the combination of a down draft furnace, a horizontal fire tube boiler the fire tubes of which communicate at their front ends directly with the furnace, a water outlet extending from the lower part of the boiler into the furnace substantially in line with the bottom of the boiler, a manifold in the furnace to which the water outlet is connected, and water tubes constituting the primary grate of the furnace which extend from said manifold in an upwardly inclined direction to and through the tube sheet of the boiler.

7. In a steam plant, the combination of a down draft furnace, a horizontal fire tube boiler the fire tubes of which communicate at their front ends directly with the furnace,

a water outlet extending from the lower part of the boiler into the furnace substantially in line with the bottom of the boiler, a manifold in the furnace to which the water outlet is connected, and water tubes constituting the primary grate of the furnace which extend from said manifold in an upwardly inclined direction to and through the tube sheet of the boiler above the fire tubes and below the normal water line of the boiler.

8. In a steam plant, the combination of a down draft furnace, a horizontal fire tube boiler the fire tubes of which communicate at their front ends directly with the furnace, and a water circulating system consisting only of the following elements, to-wit: a water outlet from the lower part of the boiler substantially in line with the bottom of the boiler, a manifold with which the water outlet is connected, and a single series of substantially parallel water pipes constituting the primary grate of the furnace extending from said manifold directly to the upper part of the boiler.

9. In a steam plant, the combination of a horizontal fire-tube boiler the fire tubes of which communicate at their front ends directly with the furnace, a furnace located substantially entirely in front of said boiler, water tubes in the furnace directly entering the front head of the boiler below and near its water line and suitable connections from said boiler to connect a lower front part thereof, with said water tubes; so that a primary current of water through said water tubes developed by heat in the furnace induces a secondary current of water above said fire-tubes from front to rear and below said fire-tubes from rear to front in the mass of water in the boiler, this secondary current forming a complete circuit through said boiler, water-tubes and connections.

10. In a steam plant, the combination of a horizontal fire-tube boiler the fire tubes of which communicate at their front ends directly with the furnace, a furnace located substantially entirely in front of said boiler, water tubes in the furnace directly entering the front head of the boiler below and near its water line and suitable connections from a lower part of the front head of said boiler to connect with said water tubes; so that a primary current of water through said water tubes developed by heat in the furnace induces a secondary current of water above said fire-tubes from front to rear and below said fire-tubes from rear to front in the mass of water in the boiler, this secondary current forming a complete circuit through said boiler, water tubes and connections.

11. In a steam plant, the combination of a down draft furnace, a horizontal fire tube boiler the water space of which is substantially all back of the furnace and the fire tubes of which communicate at their front ends directly with the furnace, a water outlet extending into the furnace from the lower part of the boiler, and a primary water tube grate in the furnace comprising substantially straight pipes connected with said water outlet and extending to and through the tube sheet near the normal water line of the boiler.

12. In a steam plant, the combination of a down draft furnace, a horizontal fire tube boiler the water space of which is substantially all back of the furnace and the fire tubes of which communicate at their front ends directly with the furnace, a water outlet extending into the furnace from the lower part of the boiler, and a primary water tube grate in the furnace comprising substantially straight pipes which are connected with the water outlet and extend in a diagonally upward direction to the tube sheet of the boiler near the normal water line of the boiler.

13. In a steam plant, the combination of a down draft furnace, a horizontal fire tube boiler the water space of which is substantially all back of the furnace and the fire tubes of which communicate at their front ends directly with the furnace, a water outlet extending into the furnace from the lower part of the boiler, a primary water tube grate in the furnace comprising substantially straight pipes which are connected with the water outlet and extend in a diagonally upward direction to the tube sheet of the boiler near the normal water line of the boiler, and a secondary grate, without water ducts, arranged between the primary grate and said water outlet.

14. In combination with a furnace and a horizontal fire tube boiler the fire tubes of which communicate at their front ends directly with the furnace, the water space of which is substantially all back of the furnace, water tubes located within the furnace and connected directly into the front tube sheet of the boiler below the normal water level thereof and above the fire tubes so as to project streams of heated water into the end of the boiler in such a direction as to cause water near the top of the boiler to flow substantially horizontally backwardly therein and means disposed substantially in line with the bottom of the boiler for withdrawing water from the lower part of the boiler and causing the same to pass into said water tubes.

15. In combination with a furnace and a horizontal fire tube boiler the fire tubes of which communicate at their front ends directly with the furnace and the water space of which is substantially all back of the furnace, water tubes located in the furnace extending to and thru the front tube sheet

of the boiler and so arranged as to project substantially horizontal streams of heated water into the end of the boiler near the normal water level of the boiler and in a direction to cause the water to flow over the fire tubes lengthwise of the boiler and means substantially in line with the bottom of the boiler for withdrawing water from a lower part of the boiler and causing same to pass into said water tubes.

In testimony whereof I have hereunto set my hand.

JAMES B. STANWOOD.