No. 682,765. Patented Sept. 17, 1901.

J. B. STETSON & W. J. THOMAS.

STEAM BOILER.

(Application filed June 20, 1901.)

(No Model.)

Fig. I

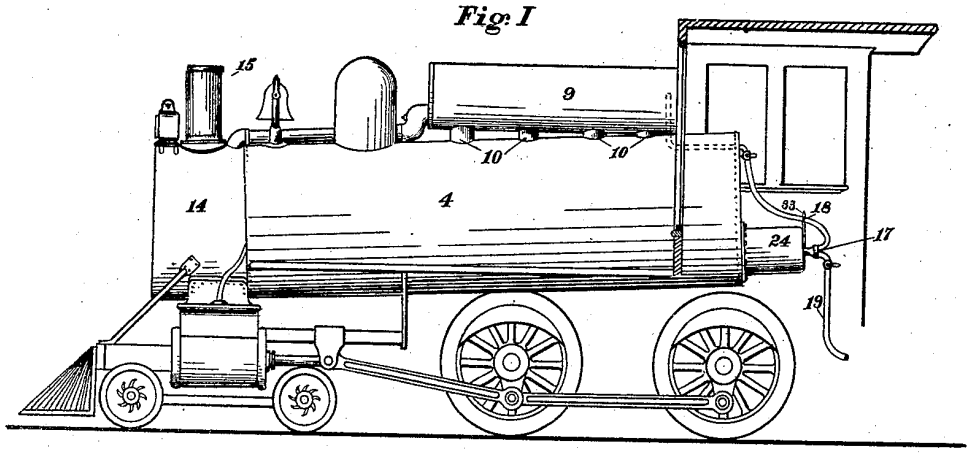


Fig. II

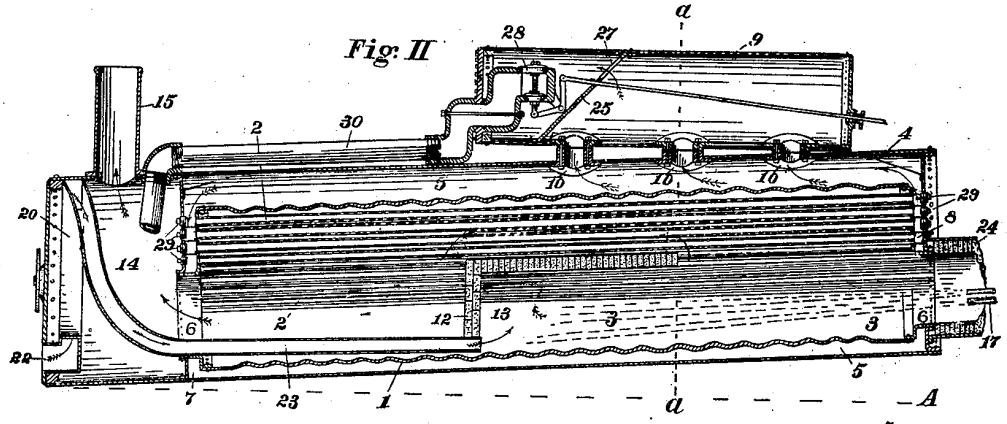


Fig. III

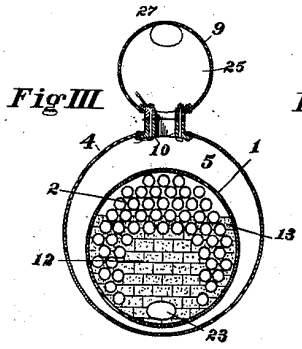


Fig. IV

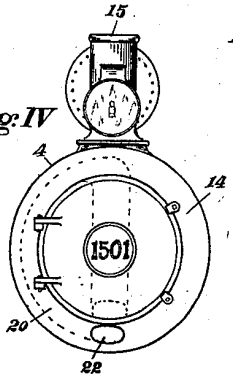


Fig. V

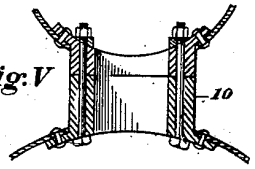
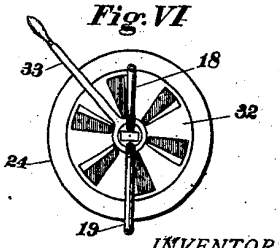


Fig. VI



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UNITED STATES PATENT OFFICE.

JAMES B. STETSON, OF SAN FRANCISCO, AND WILLIAM J. THOMAS, OF SAUSALITO, CALIFORNIA.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 682,765, dated September 17, 1901.

Application filed June 20, 1901. Serial No. 65,302. (No model.)

To all whom it may concern:

Be it known that we, JAMES B. STETSON, residing at San Francisco, county of San Francisco, and WILLIAM J. THOMAS, residing at Sausalito, county of Marin, State of California, citizens of the United States of America, have invented certain new and useful Improvements in Steam-Boilers; and we hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification.

Our invention relates to an improvement in steam-boilers having internal furnaces and to adapting them for burning liquid fuel, such as mineral oils, and to means of avoiding injurious action of the intense heat produced by such fuel.

Our improvement consists in steam-generating apparatus comprising the following elements: a cylindrical steam-generating chamber provided with water-tubes and a furnace incased within an outer or main shell, the annulus between forming a water space or jacket around the generating-chamber; baffling-walls to direct, diffuse, and determine the range of the flame produced by the induction-nozzle; a superimposed steam-drum, and means to introduce hot air into the gases of combustion; also, other constructive and operative features that are more fully explained in the description to follow, and illustrated in the drawings herewith forming a part of this specification.

Our invention has a number of objects, principally to provide in steam-boilers a general construction of simple nature that will avoid the injurious effects of high temperature and localization of heat that occurs in burning mineral oils or hydrocarbon fuels without flue ends, seams, rivets, or other enlargements of section in the fire-box, combustion-chamber, or any portion of the heating-surface that is exposed to high temperature; also, a simple and inexpensive construction of such boilers that permits replacement or repair of perishable parts and provides a combustion-chamber the length of which can be arranged at will or as the intensity of the flame-jet demands and of such form as to secure an economical and efficient use of liquid fuel, as will be hereinafter more particularly pointed out, and explained by the aid of drawings, in which—

Figure I is a side elevation of a locomotive-engine provided with a boiler constructed according to our invention. Fig. II is a longitudinal central section through the same boiler. Fig. III is a transverse section on the line *a a* in Fig. II. Fig. IV is an elevation of the rear end of the boiler. Fig. V is an enlarged detail in section showing the manner of connecting the steam-drum to the main shell of the boiler. Fig. VI is an enlarged front elevation of a register device for admitting air to the furnace.

Similar numerals of reference are employed to designate like parts throughout the different figures of the drawings.

In burning liquid or hydrocarbon fuels in boilers having internal furnaces it is well known that if in any part of the furnace the thickness of metal interposed between the flame and the water exceeds the normal thickness of the plates, and especially tube ends, there is rapid erosion and destruction of the parts by excessive heat. So marked is this effect that seams, tube ends, or even common rivets set up this eroding action, causing leaks and eventual destruction of the parts. The requirements are therefore that the heating-surface exposed to the flame of the liquid fuel should be of minimum and uniform thickness, free from seams, tube ends, rivets, or joints of any kind that increase the thickness of the section and that the furnace be long enough to permit a diffusion of the heat and prevent its concentration and direct impingement on small areas.

To illustrate an application of our invention in practice, we have chosen a locomotive-engine in which by reason of limited spaces and rapid combustion the temperature is excessive and the requirements are difficult to supply. In this application of our invention it is necessary to illustrate various details that admit of modification and substitution to suit the circumstances of erection, connection, and use; but such details are well understood by those skilled in the art of making and operating steam-boilers and do not form an essential part of or a limitation of

the special and more important features of our invention.

Referring to the drawings, 1 is the generating-boiler, set in an inclined position, provided with water-tubes 2, so disposed as to leave a furnace or combustion chamber 3 eccentric to the shell, which is preferably of a corrugated or sinuous form, as shown in Fig. II. This generating-chamber 1 is connected by the furnace-nipples 6 to an inclosing outer main shell 4, also set in an inclined position, that gives structural stability to the boiler and provides for attachments, as in the case of a locomotive. This outer or main shell 4 also provides an annular water space or jacket 5 around the generating-chamber 1 and water-spaces 7 and 8 at the ends, as seen in Fig. II. On the top of the main shell 4 is mounted a steam-drum 9, set in a level position and preferably connected by internally-flanged nipples 10, as shown in Fig. V.

At some suitable point in the generating-chamber 1 is placed a baffling-wall 12, of refractory material, connecting to a diaphragm 13, also of refractory material, that fits around the water-tubes 2, so the flame and hot gases take the course indicated by the arrows.

At the rear end of the boiler is the usual smoke-box 14 and stack 15 to carry off the products of combustion on their escape from the passage leading from the generating-boiler 1.

The burning-nozzle 17 may be of any of the well-known forms adapted for fluid fuel and is connected to the drum 9 for steam and to a supply-tank for oil by the pipes 18 and 19, having the usual valves or cocks for regulation.

In case of introducing air at the rear of the combustion-chamber, which is advisable in most cases, especially for locomotive-engines, we provide for heating the air in the smoke-box 14 by means of a conduit 20, as shown in Fig. II and indicated by dotted lines in Fig. IV. This conduit 20 is supplied with air at 22 and connects with a pipe 23, that passes through the baffling-wall 12 into the combustion-chamber 3, where air mingles with the hot gases, causing more perfect combustion, increasing the temperature accordingly.

In the case of locomotives, where the heating-surface is limited and the combustion is so intense as to endanger even plates of single thickness, we prolong the front furnace-nipple 6 by a projecting extension 24, that when thickly lined with refractory material, as shown in Fig. II, causes but little loss of heat and lengthens the furnace or combustion chamber 3. This extension 24 can be made tapering, expanding inward or parallel, as shown, and may be of any length required to protect the combustion-chambers 3, but, as explained, is not required except in case of continuous forced combustion and only for locomotive-boilers. The rotary valve or register 32, operated by a handle 33, is applied on the end of the extension 24 or on the end of the furnace-nipple when the extension 24 is not employed and is adjusted to admit the required amount of air to the combustion-chamber 3.

Steam rises from the water-spaces 5, 7, and 8 and passes through nipples 10 into the steam-drum 9, which has a diagonal diaphragm 25, with an aperture 27 at the top, which prevents water from reaching the throttle-valve 27 by priming or entrainment.

The inclined position of the boiler (indicated by the line A) is to cause circulation through the water-tubes 2, and the plugs 29 are to give access to the water-tubes 2.

While we have shown our improvements adapted for a locomotive, the section in Fig. II, omitting the throttle-valve 28 and the steam-pipe 30, sufficiently indicates the construction for stationary or marine purposes.

Having thus explained the nature and objects of our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a steam-boiler for liquid fuel, in combination, a steam-generating chamber of cylindrical form, water-tubes therein disposed to leave a central combustion-space, an outer shell completely surrounding said chamber with a suitable interval, into which said water-tubes open at their ends, front and rear nipple-openings to said steam-generating chamber, connecting it with said outer shell, and means for introducing liquid fuel through said front nipple-opening, substantially as specified.

2. In a steam-boiler for liquid fuel, in combination, a steam-generating chamber of cylindrical form, water-tubes therein disposed to leave a central combustion-space, an outer shell completely surrounding said chamber with a suitable interval, into which said water-tubes open at their ends, front and rear nipple-openings to said steam-generating chamber, connecting it with said outer shell, means for introducing liquid fuel and steam to said steam-generating chamber through said front nipple-opening, and a steam-drum over said outer shell, communicating with the water-space therein, substantially as specified.

3. In a steam-boiler for liquid fuel, in combination, a steam-generating chamber, water-tubes therein disposed to leave a central combustion-space, an outer shell completely surrounding said chamber with a suitable interval, into which said water-tubes open at their ends, front and rear nipple-openings to said steam-generating chamber, connecting it with said outer shell, means for introducing liquid fuel to said steam-generating chamber through said front nipple-opening, a refractory bridge-wall across the combustion-chamber at a suitable point toward the rear, and a refractory baffling-plate or barrier fitted around the water-tubes extending forward from the top of the bridge-wall, to deflect the combustion-current, substantially as specified.

4. In a steam-boiler for liquid fuel, in com-

bination, a steam-generating chamber of cylindrical form, placed in an inclined position, water-tubes therein disposed to leave a central combustion-space, an outer shell completely surrounding said chamber with a suitable interval, into which said water-tubes open at their ends, front and rear nipple-openings to said steam-generating chamber, connecting it with said outer shell, means for introducing liquid fuel and steam to said steam-generating chamber through said front nipple-opening, and a register-valve at the entrance of said front nipple-opening for the regulated admission of air therethrough, substantially as specified.

5. In a steam-boiler for liquid fuel, in combination, a steam-generating chamber of cylindrical form, placed in an inclined position, water-tubes therein disposed to leave a central combustion-space, an outer shell completely surrounding said chamber with a suitable interval, into which said water-tubes open at their ends, front and rear nipple-openings to said steam-generating chamber, connecting it with said outer shell, means for introducing liquid fuel through said front nipple-opening, a smoke box and stack in communication with said rear nipple-opening, a refractory bridge-wall across the combustion-chamber at a suitable point toward the rear, a refractory baffling-plate or barrier fitted around the water-tubes, extending forward from the top of the bridge-wall, to deflect the combustion-current, an air-conduit 20 in the smoke-box, and an air-pipe 23 leading from said air-conduit into the combustion-chamber through the bridge-wall, substantially as specified.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

JAMES B. STETSON.
WM. J. THOMAS.

Witnesses:
P. P. J. LANDER,
ELMER WICKES.