June 4, 1940. E. H. TAYLOR 2,203,370

POWER BOILER

Filed June 25, 1938 2 Sheets-Sheet 1

FIG. I.

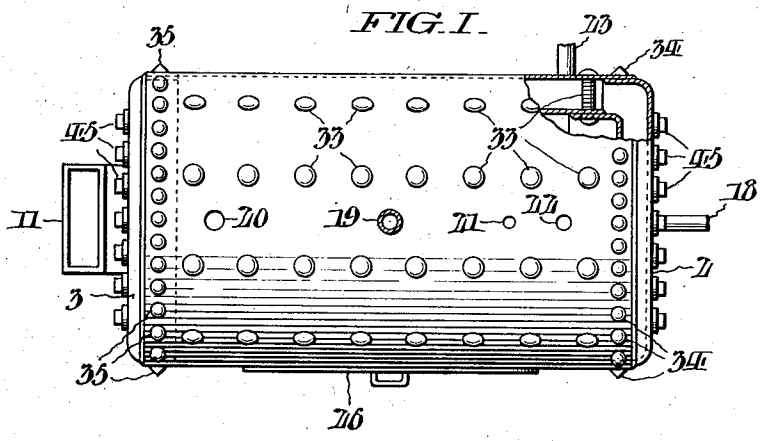
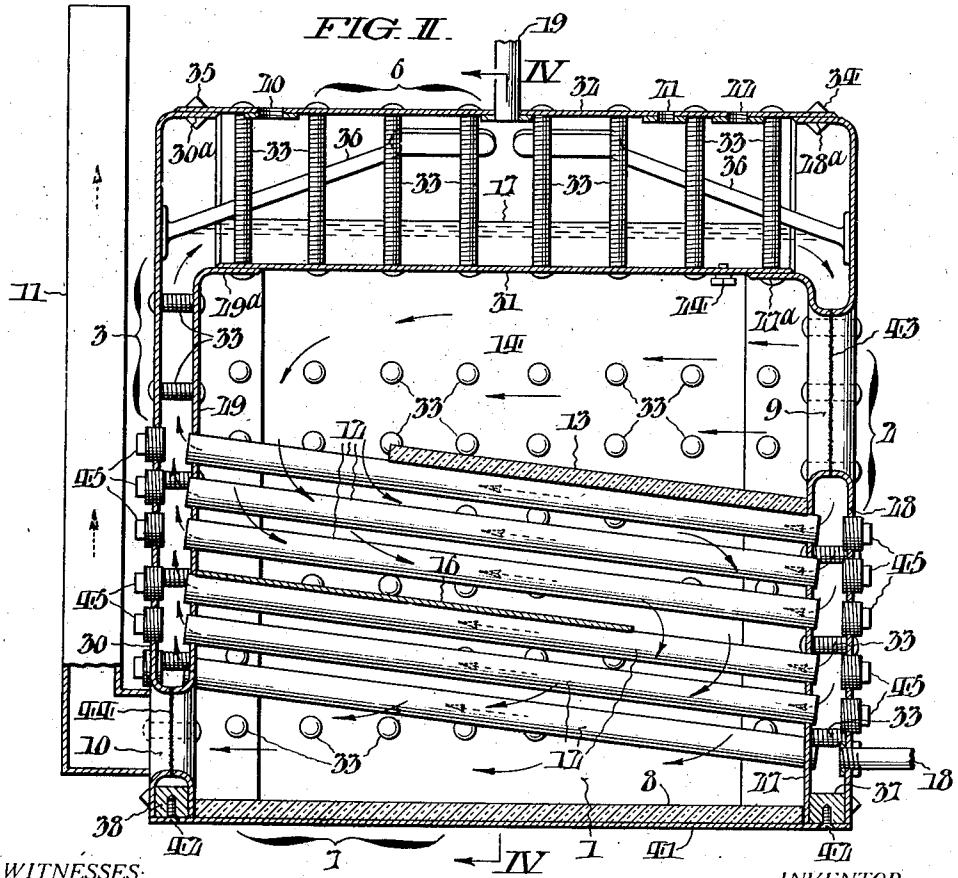


FIG. II.



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FIG. III.

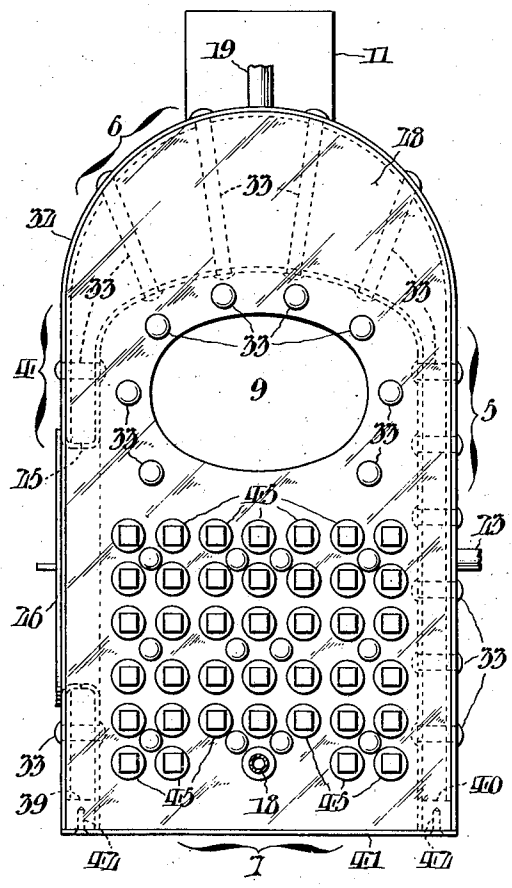
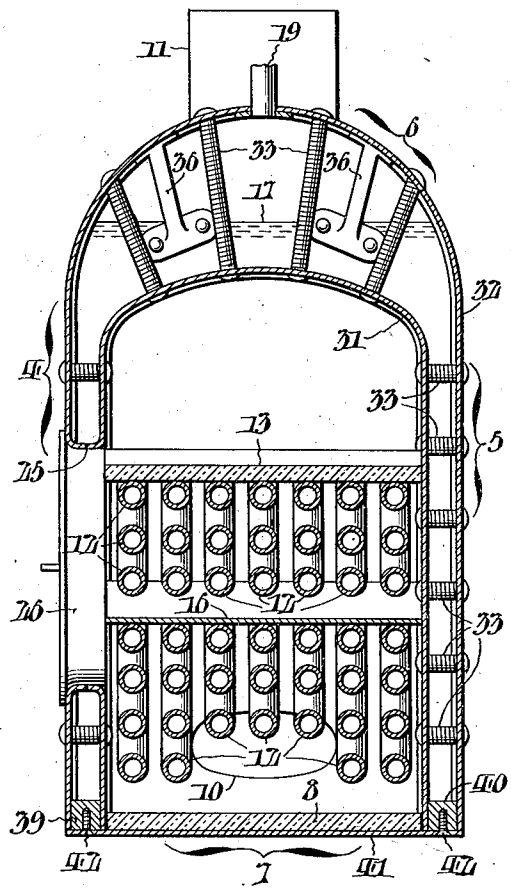


FIG. IV.



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UNITED STATES PATENT OFFICE

2,203,370

POWER BOILER

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Application June 25, 1938, Serial No. 215,788

2 Claims. (Cl. 122—140)

This invention relates to boilers for generating high pressure steam, of a type intended for use more particularly in power plants.

In connection with boilers of the kind referred to, I aim to secure a greater output of dry steam per square foot of heating surface than was possible heretofore without the use of special or additional super-heating means; to attain a maximum yield of dry steam with a minimum consumption of fuel; and to reduce the flue gas temperature to a minimum degree consistent with good draft conditions.

These objectives I realize as hereinafter more fully disclosed in a boiler wherein a continuous water jacket extends over the top and down opposite side walls of its combustion chamber; wherein a multiplicity of water tubes inclined somewhat in respect to the horizontal, extend longitudinally of the combustion chamber beneath a diaphragm which sets apart a fire box in the upper portion of said chamber and connects the hollows of opposite walls so that a "ring" circuit is established for the water; wherein the gases of combustion emanating from the fire box are caused to follow a devious course, with changed direction of flow between and along the water pipes, enroute to a flue outlet in one of the walls at a level below said pipes.

A further aim of my invention is to attain the above advantages in a boiler which lends itself to manufacture from a small number of interfitting components fashioned from sheet metal secured one to another in such manner as to form a strong, rigid hollow steam power unit capable of withstanding high internal pressures.

Other objects and advantages of my invention will appear from the detailed description of the attached drawings, whereof Fig. I is a view, partly in plan and partly in horizontal section, of a power boiler conveniently embodying the present improvements.

Fig. II is a central longitudinal sectional view of the boiler drawn to a larger scale.

Fig. III shows the front or firing end of the boiler; and

Fig. IV is a tranverse sectional view of the structure taken as indicated by the arrows IV—IV in Fig. II.

As herein shown, my improved power boiler has a combustion chamber 1 with jacketed front and rear end walls 2, 3, jacketed side walls 4, 5 and a transversely-arched jacketed roof 6, the hollows of which are all directly communicative, the bottom or floor 7 of said box paved or lined with heavy refractory material 8. The boiler is adapted to be fired through a door opening 9 in its front end wall 2 near the top of the fire box 1; while the products of combustion leave by way of an opening 10 in the rear end wall 3 near the bottom and are exhausted through a connecting flue or chimney 11. Extending longitudinally of the lower part of the combustion chamber 1 and connecting the hollows of the end walls 2 and 3 are water tubes 12 which slope downwardly somewhat toward the front end of the boiler. A transverse diaphragm 13 of heavy refractory material sets apart a firebox 14 in the top of the combustion chamber 1, said diaphragm extending rearwardly from the front wall 2 and terminating short of the rear wall 3 of the boiler as shown in Fig. II. About midway of the height of the lower subdivision of the chamber occupied by the tubes 12, is a substantially horizontal baffle 16 which reaches forwardly from the rear wall 3 and terminates short of the front wall 2. By virtue of this construction, a devious course is defined for the heated gas of combustion in the lower subdivision of the firebox 1 as indicated by the full line arrows in Fig. II, the gases flowing between and along the tubes 12 throughout the length of the latter in opposite directions before passing into the flue 11. In practice, the water is maintained approximately at the level shown at 17 in the upper arched hollow of the boiler, its circulation through the jacketing and tubing being as indicated by the dotted line arrows in Fig. II. Water is introduced into the boiler at the front end near the bottom through a pipe 18, see Fig. III; and the generated steam passes out of the top of the boiler at the center through a pipe 19, see Figs. I and II. The boiler is also provided at the top with a tapped opening 20 for connection of a safety valve (not shown), and with a tapped opening 21 which may be used for installation of a steam injector. The additional tapped pipe openings shown at 22 and 23 respectively at the top and at one side of the boiler (Figs. I–III) are intended to be used for connection of a water column. There is also a tapped opening for a fusible safety plug, which latter is shown at 24 in Fig. II. In order that the exterior surfaces of the tubes 12 may be cleaned when required from time to time an opening 25 is provided in the side wall 4 of the boiler, said opening being normally closed by a removable panel or door 26 which is preferably lined with refractory material after common practice in the art.

In its construction, my improved boiler comprises suitably shaped and spaced inner and outer

head sheets 27, 28 and 29, 30 of steel (Fig. II) which respective pairs jointly form the hollow end walls 2 and 3; and suitably shaped and spaced enveloping sheets 31, 32 likewise of steel, which jointly form the hollow side walls 4, 5 and the arched top 6. As shown, continuous inwardly-directed marginal flanges 27*a*, 28*a* and 29*a*, 30*a* extending around the sides and top edges of the outer and inner head sheets 27, 28 and 29, 30 are overlapped by the side edges of the enveloping sheets 31 and 32. The water jacketing of the boiler is well reinforced by suitably allocated stay bolts 33 certain of which serve to unite the sheets 27, 29 and 31 at the regions of overlap; while rivets shown at 34 and 35 serve to unite the sheets 28, 30 and 32 at the regions of overlap. The arched portion of the outer enveloping sheet is additionally reinforced by diagonal braces shown at 36.

The hollow end walls 2 and 3 are closed at the bottom by filler bars 37 and 38 respectively to which the sheets 27, 28 and 29, 30 are permanently secured either by riveting or welding. The jacketings of the side walls 4 and 5 are similarly closed at the bottom by fillers 39 and 40 respectively; and the four walls are joined at the bottom by a base plate 41 which is secured by screw bolts 42 engaging upwardly into the several filler blocks, see Figs. II and IV. At the door openings 9 and 10, the edge margins of the head sheets 27, 28 and 29, 30 are directed inwardly toward each other into abutting relation as shown and the abutting edges welded together as conventionally indicated at 43, 44 to form water tight joints. The opening 25 for the door or panel 26 in the side wall 4 of the boiler is similarly formed as shown in Fig. IV, and the inner abutting edges of the inwardly-directed margins likewise permanently united by welding. The water tubes 12 are accessible for internal cleaning or for removal when replacement becomes necessary, upon removing the screw plugs shown at 45 from aligned openings in the outer head sheets 28 and 30 of the end walls 2 and 3.

From the foregoing it will be apparent that I have provided a highly efficient power boiler embodying in its construction but a few preformed parts which lend themselves individually to economical manufacture, and which, when assembled, form a strong, rigid and compact unit capable of resisting rupture or distortion under high pressures. Due to down draft and devious flow of the combustion gases between and along the length of the water tubes (which provide the greater part of the heating surface of the boiler) in the lower part of the firebox, most of the available heat is employed to the best advantage and the temperature of the gases reduced to a degree slightly above the dew point before being discharged into the flue. As a consequence I secure a high output of dry steam with minimum consumption of fuel, and without requiring the aid of superheating tubes as ordinarily.

Having thus described my invention, I claim:

1. A power boiler having a combustion chamber formed by a horizontal top wall, vertical side walls and vertical front and rear end walls; a continuous water jacket extending over said top and down said vertical front and rear end walls; a longitudinal diaphragm at an intermediate level forming the bottom of a firing chamber within the combustion chamber at the top, said diaphragm sloping upward slightly from the front end wall and terminating short of the rear wall, with provision of a connecting passage between the upper and lower subdivisions of the combustion chamber by the diaphragm; a second diaphragm below the first in parallel relation thereto but extending from the rear end wall and terminating short of the front end wall; a multiplicity of water tubes connecting the hollows of the opposite end walls, said tubes being inclined in parallel relation to the diaphragms and disposed, some above and others below the lower diaphragm; a firing opening in the front end wall above the upper diaphragm; and a flue opening in the rear end wall beneath the lower diaphragm.

2. A power boiler according to claim 1, in which the water jacketing also extends down the side walls of the boiler.

ERNEST H. TAYLOR.