June 30, 1942. J. A. NILES 2,288,140

BOILER

Filed Nov. 6, 1939

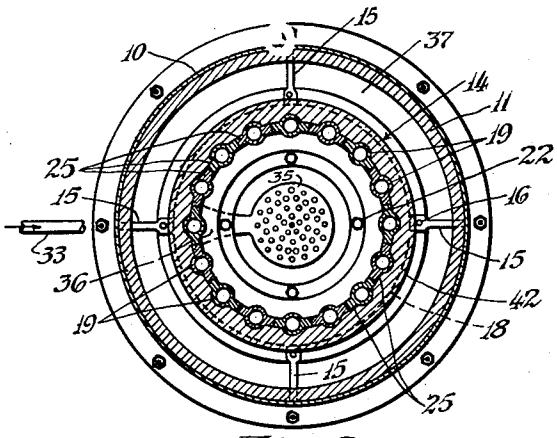


Fig. 2.

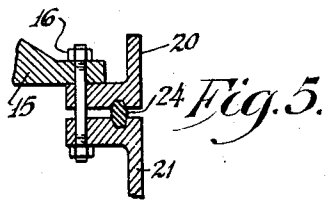


Fig. 5.

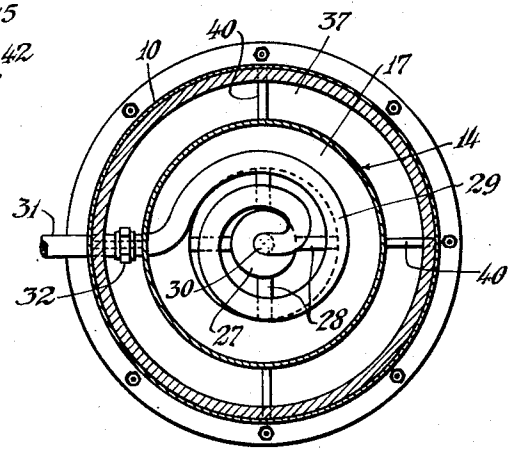


Fig. 3.

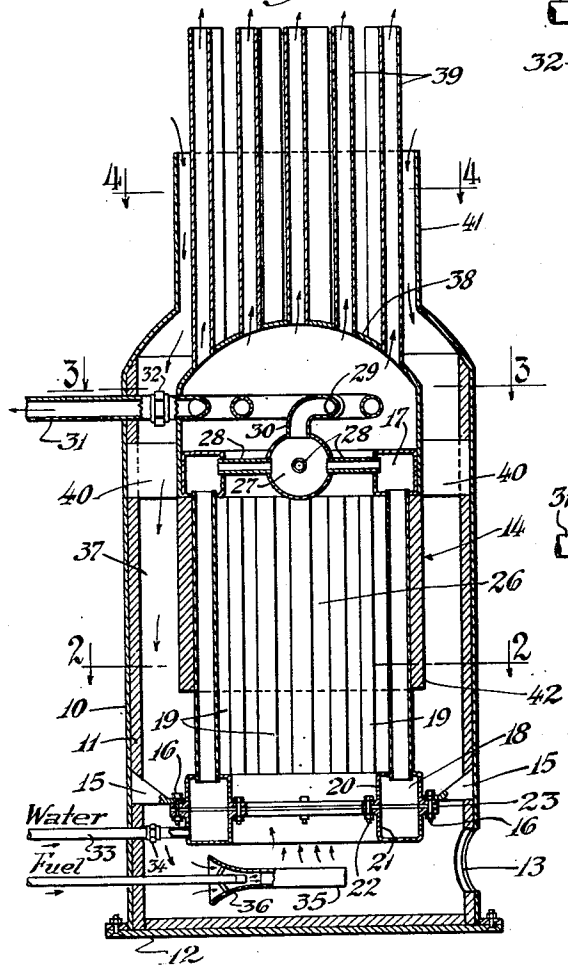


Fig. 1.

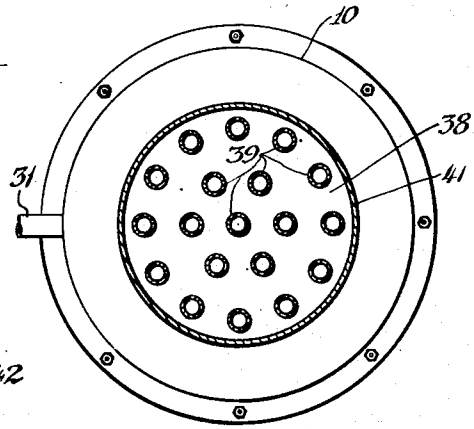


Fig. 4.

INVENTOR
Joseph A. Niles
BY
Geo. L. Parkhurst
ATTORNEY

Patented June 30, 1942 2,288,140

UNITED STATES PATENT OFFICE

2,288,140

BOILER

Joseph A. Niles, Tulsa, Okla., assignor to Stanolind Oil and Gas Company, a corporation of Delaware

Application November 6, 1939, Serial No. 302,968

5 Claims. (Cl. 122—338)

This invention relates to boilers and particularly to improved portable, vertical, water tube boilers.

Small boilers are used in the oil fields for the production of power. These boilers must be portable and simple. However, in the past, simplicity and portability have been obtained at the expense of efficiency, capacity and other desirable features.

It is an object of my invention to provide a boiler useful for various purposes but particularly adapted to oil field use, which will be characterized by simplicity of design and portability and which will at the same time be capable of operation at high pressures, will be highly efficient, will give improved steam capacity, will yield superheated steam and will be easy to maintain. Other and more detailed objects, advantages and uses of my invention will become apparent as the description thereof proceeds.

My invention will be described with particular reference to the accompanying drawing which shows one embodiment of my invention. However, the drawing and the accompanying description are by way of illustration rather than by way of limitation and it will be understood that various changes in the design can and will be made by those skilled in the art without departing from the spirit of my invention. In the drawing:

Figure 1 is a vertical sectional elevation of a boiler in accordance with my invention;

Figure 2 is an horizontal section taken along the line 2—2 of Figure 1;

Figure 3 is an horizontal section taken along the line 3—3 of Figure 1;

Figure 4 is an horizontal section taken along the line 4—4 of Figure 1; and

Figure 5 is a detailed section of an alternative ring seal for the lower drum of the steam generating section of my boiler.

It will be noted that this boiler is of the vertical water tube type and includes an outer shell 10 which is preferably lined with insulation 11. This outer shell 10 is bolted to a base 12 and is provided with a manhole 13 which is shown with the cover removed. The steam generating section 14 is mounted in this shell 10, resting on lugs 15 to which it is affixed by bolts 16.

This heating element consists of annular drums 17 and 18 which are connected by and in communication with a series of vertical tubes 19. The lower drum 18 is a casting or forging made in two parts 20 and 21 which are bolted together by bolts 16 and 22. A ring type seal 23 is used between the parts to make the joint pressure tight. Alternatively a ring seal 24 of hexagonal cross-section can be used as shown in Figure 5.

The upper drum 17 is likewise made in two parts which are welded together after the tubes 19 are rolled into it. Each of the tubes 19 is formed with two longitudinal ribs 25 (best seen in Figure 2) and these ribs fit with the ribs carried by adjacent tubes in such manner that when the heating element is assembled they form a continuous heat absorbing surface as well as a more or less air-tight cylinder laterally defining the combustion zone 26. Alternatively but less desirably, a single rib can be used with each tube or other types of connecting members can be used to fill the spaces between tubes.

At the top of the heating element or steam generating section 14 is a chamber 27 which may be in the form of a sphere located at the center of annular drum 17. This central sphere is connected to drum 17 by a plurality of connecting tubes, for instance four equally spaced connecting tubes 28.

Above this heating element a superheater is preferably located and this can be in the form of a flat spiral coil 29 (see Figure 3) connected with sphere 27 by a vertical riser 30. From this superheater 29 the steam is led off by pipe 31 (equipped with union 32) through shell 10 to the point of use.

Feedwater is introduced through pipe 33 (equipped with union 34) and is preferably continuously injected in a fixed proportion to the steam delivered by the boiler since this avoids any possible danger of the boiler running dry and exploding. This fixed ratio of injection can be accomplished by various automatic means known to the art or can be manually controlled.

Heat is supplied by burner 35 which may be of conventional design although it is preferably designed to give a circular whirling motion to the burning gases. Gas is the normal fuel for this burner but oil and other fuels can be used. Part of the combustion air is preferably drawn into the burner with the fuel by means of inductor 36. The updraft caused by the combustion supplemented by the induction action of the burner draws combustion air in from the annular space 37 between the steam generating section 14 and the shell 10.

As the hot combustion gases pass upward through the combustion zone 26 they heat the water in drum 18 and tubes 19, the longitudinal ribs or fins 25 serving to conduct heat to the vertical tubes 19. Passing upward the hot gases also supply heat to the upper drum 17, the tubes 28, the central chamber 27 and the superheater 29. They are then deflected by dome 38 into which the steam generating section 14 fits and thence pass upward through a plurality of flue tubes 39 which serve as a chimney. Dome 38 is held in place by radial plates 40 which are preferably welded to shell 10 and dome 38.

Flues 39 can extend above the upper part 41 of shell 10 to any desired distance to give the requisite amount of draft and they can, if necessary, be joined at their upper ends and attached

to a stack but this is not normally either necessary or preferred.

The space between flue tubes 39 and the upper part 41 of shell 10 acts as a preheater for the combustion air which is drawn in past these tubes and downward through the annular space 37 between the steam generating section 14 and shell 10. Insulation 42 partially or wholly surrounds the steam generating section. The hot air together in some cases with a little combustion gas which is automatically recycled from the top of flue tubes 39 passes with the fuel up through the inside of steam generating section 14 and ultimately out through flue tubes 39. The preheating of combustion air adds to the efficiency of operation of my boiler. The annular space 37 insulates the steam generating section 14 from the shell 10 and prevents heat losses.

My boiler has a number of important advantages. In the first place, it is very simple in its design with resultant low first cost and maintenance expense.

It is portable since all metal sections may be of comparatively light weight due to the compact nature of the device and due to its design to give minimum stresses. The pressure on the boiler tubes 19 is internal and they may have much thinner walls than in the case of a fire tube boiler. No stay-bolts or rivets are used and the shell is not under pressure. The insulation is all enclosed by the shell so that there is no danger of damaging it and the base 12 can rest directly on the ground so that no separate foundation is needed.

Another important advantage is the use of high pressures in a simple device of minimum weight. This use of high pressures gives increased efficiency and provides all the advantages of high pressure steam. Due to the fact that the design is symmetrical no unbalanced stresses are caused by the steam pressure and no unequal expansion is encountered.

My boiler also gives highly improved steaming capacity due in the main to three factors: (1) the preheating of the combustion air resulting in higher furnace temperature, (2) the large furnace volume and (3) the full use of radiant heat. It also has the important advantage of supplying superheated steam.

Also my boiler is very easy to maintain since when it is necessary to clean the tubes 19 the boiler can be placed on its side or tilted. The base 12 can then be removed as can the lower half 21 of ring 19, thereby giving access to the tubes Further either the steam generating section 14 or the shell 10 can be replaced without discarding the other.

As previously indicated, various modifications in my design can be made without departing from the spirit of the invention; for instance, another circular row of tubes can be added inside of tubes 19 but this is in general not preferred since it complicates the design and the construction.

I claim:

1. A portable oil field boiler comprising a vertically disposed water tube steam generating section defining a combustion zone, means for passing combustion air substantially vertically downward about the exterior of said steam generating section, means for passing hot combustion gases upward through said steam generating section, a plurality of flue pipes vertically disposed above said combustion zone and means for drawing in combustion air countercurrent to said hot combustion gases and parallel to said flue pipes by natural draft.

2. A portable oil field boiler comprising a vertical shell open at the top for the entry of combustion air, a vertically disposed water tube steam generating section disposed within but spaced from said shell to form between said shell and said steam generating section a combustion air passageway, said steam generating section comprising a row of vertical tubes, each tube having at least one longitudinal rib adapted to coact with an adjacent tube to form a cylinder laterally defining a combustion zone, a burner at the bottom of said combustion zone and vertical flue means associated with said combustion zone and at least partly within said vertical shell.

3. A portable oil field boiler comprising a vertical shell open at the top for the entry of combustion air, a vertically disposed water tube steam generating section disposed within but spaced from said shell to form between said shell and said steam generating section a combustion air preheater, said steam generating section comprising a row of tubes defining a combustion zone, each tube having at least one longitudinal rib adapted to coact with an adjacent tube completely to enclose the sides of said combustion zone, a burner at the bottom of said combustion zone, means for confining the gas from the combustion zone and vertical flue means communicating with said combustion zone and being at least partly laterally enclosed by said vertical shell.

4. A portable oil field water tube boiler comprising a vertical water tube steam generating section defining a laterally enclosed combustion zone, a burner at the bottom of said combustion zone, means for enclosing the top of said combustion zone, a large number of flue tubes projecting through and extending upward from said means, a shell surrounding said combustion zone but spaced therefrom and extending upward surrounding but spaced from the lower parts of said flue tubes, whereby combustion air is drawn in at the top of said shell and passes downward and outside said flue tubes countercurrent to the combustion gases in said flue tubes and then downward between said shell and said steam generating section to said burner and whereby combustion gases pass upward through said steam generating section and out through said flue tubes.

5. A portable oil field water tube boiler comprising a vertical water tube steam generating section defining a laterally enclosed combustion zone, a burner at the bottom of said combustion zone, a superheater disposed at the top of said combustion zone, means for conducting all of the flue gases from the top of said combustion zone, said means comprising a plurality of vertical flue tubes extending upwardly from said combustion zone, a shell surrounding said combustion zone but spaced therefrom and extending upward surrounding but spaced from the lower parts of said flue tubes and a burner disposed at the bottom of said combustion zone, whereby combustion air is drawn in at the top of said shell and passes downward past said flue tubes and then downward between said shell and said steam generating section to said burner and whereby combustion gases pass upward through said steam generating section past said superheater and out through said flue tubes.

JOSEPH A. NILES.