

Sept. 21, 1965

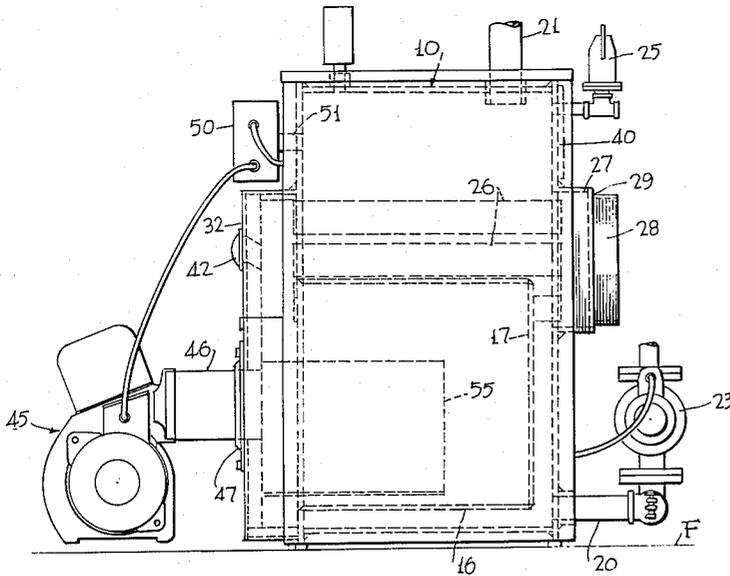
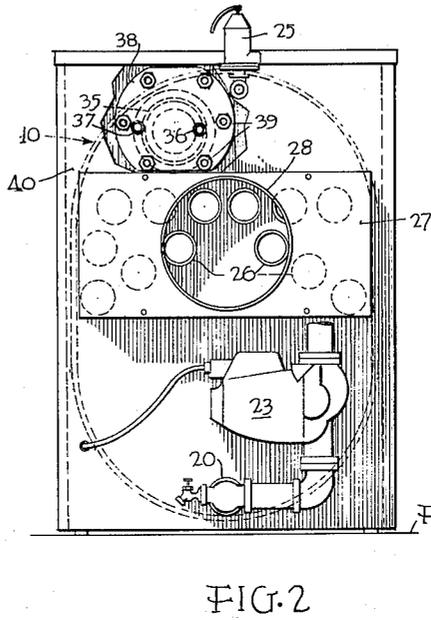
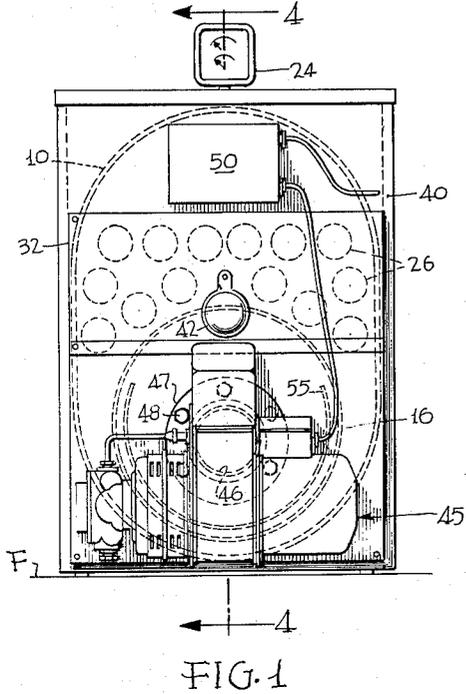
J. E. AXEMAN

3,207,131

FUEL BURNER BOILER UNIT

Filed Jan. 16, 1964

2 Sheets-Sheet 1



INVENTOR.  
James E. Axeman

Sept. 21, 1965

J. E. AXEMAN

3,207,131

FUEL BURNER BOILER UNIT

Filed Jan. 16, 1964

2 Sheets-Sheet 2

FIG. 4

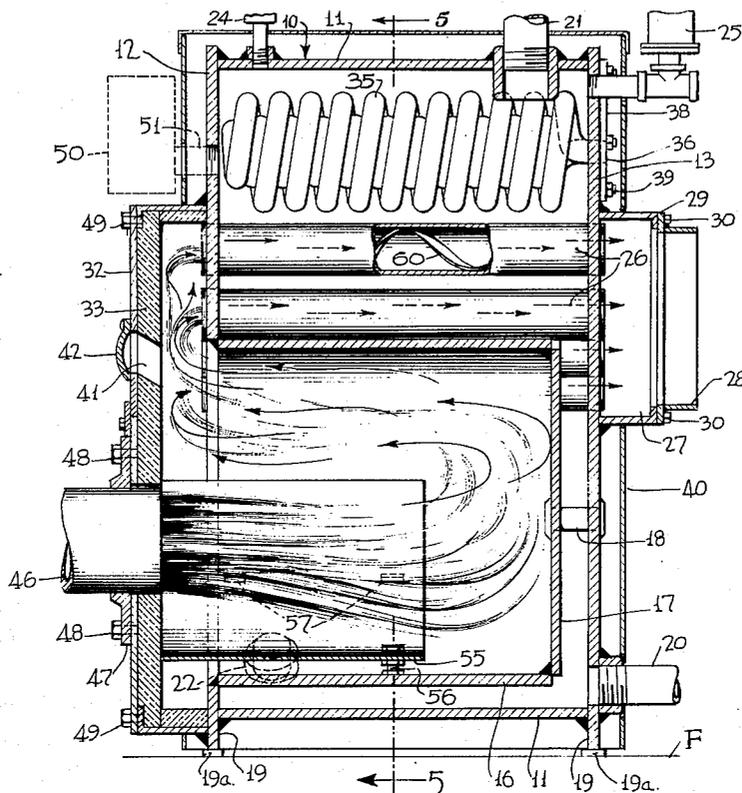
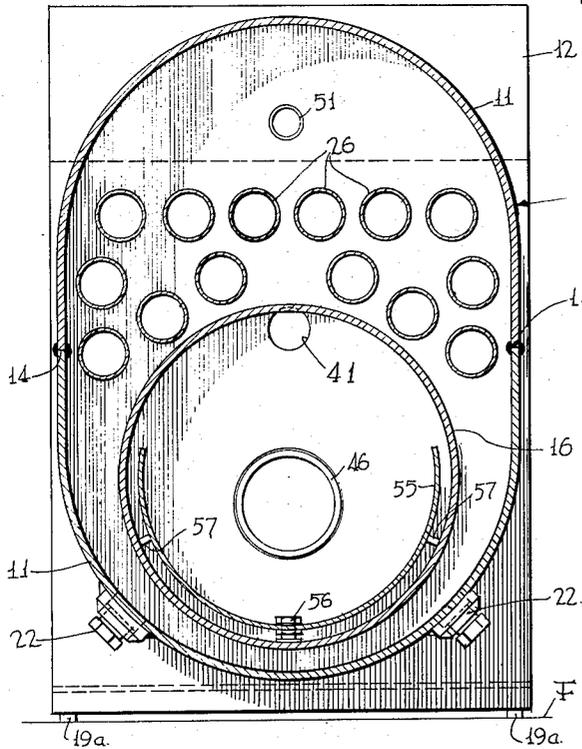


FIG. 5



INVENTOR.  
James E. Axeman

1

3,207,131

**FUEL BURNER BOILER UNIT**  
 James E. Axeman, 1328 Woodmont Ave.,  
 Williamsport, Pa.  
 Filed Jan. 16, 1964, Ser. No. 338,142  
 9 Claims. (Cl. 122-149)

This invention relates to a fuel burner boiler unit and has for an object the provision of improvements in this art. The term "fuel burner" herein refers to a gun type burner which directs a blast or jet of fuel and air into a combustion chamber, the fuel being gas or atomized oil, powdered coal or the like. The term "boiler" includes any liquid heater, such as is often referred to as a steam or hot water boiler or furnace, in which the liquid is heated by the burning fuel and the hot products of combustion.

One of the particular objects of the invention is to provide a fuel burner boiler unit in which the fire box in which the combustion chamber is located is surrounded on the sides and rear end by wet-wall, i.e., liquid backed, metal surfaces and in which the combustion chamber provides for the return flow of combustion gases within the fire box.

Another object is to provide a combustion chamber having a wall or shell which is disposed closely adjacent but spaced from the inner liquid-backed fire box wall so that the combustion wall heats the fire box wall by radiation and is kept sufficiently cool by its close proximity to the fire box wall as to minimize distortion and deterioration of the combustion chamber wall. The walls of the combustion chamber shell, however, must be kept sufficiently hot to maintain complete vaporization and combustion of the fuel mixture.

Another object is to provide a combustion chamber wall which extends into the fire box for a distance about equal to the length of the actual combustion flame, leaving part of the length near the rear of the fire box fully exposed to the hot combustion gases. In the present example where the flame from the fuel gun begins burning at the front end of the fire box and where the fire box is relatively short the combustion chamber wall extends for somewhat more than half of the length of the fire box.

Another object is to provide a combustion chamber which is located near one side of the fire box to leave a relatively large space on the other side for the return flow of hot combustion gases.

Another object is to provide a combustion chamber which is open on one side to cause the hot combustion gases to pass alongside the burning zone and thereby aid the efficiency of the burning action.

Another object is to provide improved overall liquid heating and fuel burning efficiency.

Another object is to provide a type and form of combustion chamber wall and a support therefor which will provide free expansion and contraction without warping or straining of parts.

Another object is to provide a fire box which is free from refractory material, such as fire brick or the like, which would reduce the thermal efficiency and which is subject to deterioration requiring replacement.

The above and other objects of the invention, together with various features of novelty and advantages, will be apparent from the following description of an exemplary embodiment, reference being made to the accompanying drawings, wherein:

FIG. 1 is a front elevation of a gun type oil burner heated boiler embodying the invention;

2

FIG. 2 is a rear elevation with the smoke pipe removed;

FIG. 3 is a side elevation;

FIG. 4 is an enlarged vertical section taken on the line 4-4 of FIG. 1;

FIG. 5 is a transverse vertical section taken on the line 5-5 of FIG. 4.

Referring first to FIGS. 4 and 5, the furnace comprises a main body shell 10 having a belt portion 11, a front end plate 12 and a rear end plate 13. The shell is oval vertically and the belt portion 11 is formed of two semi-oval shell plate parts which are welded together at seam lines 14 on the sides. The end plates are welded to the belt portion.

A fire box shell 16 is secured within the main body shell 10, as by welding its open front end to the front end plate 12 and by securing its closed rear end plate 17 to the rear end plate 13 of the main body shell by one or more stays 18, leaving ample liquid space below and at the rear end of the fire box.

The fire box shell may be formed by welding together the edges of rolled plate material but the weld line is not shown herein. This forms what is known as a wet base boiler. With the main shell end plates extended down below the belt portion of the shell to form supports 19 for the boiler unit and having support pads 19a, it is not necessary to provide heat insulation even on finished floors, the floor being indicated at F.

A main liquid inlet 20 is shown at the bottom and a main liquid outlet 21 is shown at the top. Clean out openings with plugs 22 are provided at the bottom. A liquid circulating unit 23 is shown in FIGS. 2 and 3.

A gage 24 is shown at the top front and a relief valve 25 is shown at the top rear.

Between the front end plate 12 and the rear end plate 13 above the fire box there are provided a plurality of fire tubes 26 anchored and sealed to the plates in known manner. Over the rear ends of the tubes there is provided a smoke box 27, here shown as being welded to the rear shell plate 13. A smoke pipe connection 28 is secured in any suitable manner to a removable back cover 29 which is secured over the smoke box, as by stud bolts 30.

At the front, the space over the open end of the fire box and the fire tubes is enclosed by a flue box 32 which is secured, as by welding, to the front shell plate 12. The flue box is lined interiorly by a layer of heat insulating material 33 to reduce heat loss to the outside air. Insulation here is not subject to flame deterioration as is material which is exposed to combustion flames, hence refractory material is not needed and it is not necessary to replace the heat insulating lining as here arranged. Many known types of heat insulating material which are resistant to the deteriorating effects of hot fuel combustion gases are known and can be used here.

A hot water heating coil 35, provided with pipe connections 36 and 37, is mounted on a removable plate 38 secured to the rear shell plate 13, as by stud bolts 39.

The entire boiler unit is enclosed by an ornamental outer casing 40 which is provided with insulation on the inside, such as fiber glass pads (not shown) in a usual manner. A sight inspection opening 41 closed by a swinging closure plate 42 is provided in the flue box.

A gun type oil burner unit 45 of known type has its gun tube or nozzle 46 disposed in an opening provided in the front wall of the flue box, the gun tube being held in position by its plate 47 which is secured to the front of the flue box, as by cap bolts 48. Preferably the whole

front wall of the flue box 32 is removably held in place, as by stud bolts 49.

A control box 50 may be mounted on the front of the boiler unit with a well tube 51 for the reception of a liquid temperature responsive device (not shown) of usual character. It is not necessary to describe the several control lines which are shown since they are entirely usual.

Within the fire box 16 there is provided a combustion chamber shell 55 of a material, such as stainless steel, which is highly resistant to flame corrosion and deterioration. The combustion chamber shell extends from the rear surface of the lining 33 of the flue box rearwardly for a considerable distance, specifically for about the length of the main body of the flame which starts at the end of the gun 46, but terminates a distance short of the rear wall 17 of the fire box.

The combustion chamber shell 55 is open on one side, preferably at the top side since combustion gases rise, so that the hot combustion gases are forced to flow back alongside the flame and thus aid greatly in its burning speed and efficiency. The burner tube 46 is located nearer the bottom of the fire box 16 than the top so that space is provided above the flame for the forwardly returning hot combustion gases.

The combustion chamber shell 55 is so mounted that it is free to expand in any direction with changes in temperature, which necessarily are frequent. As shown, it is secured at a single point to the shell plate 16, as by a stud bolt 56 which is welded to the shell plate, and which holds the shell 55 in position as by suitable nuts. At other places the shell 55 is slidably supported, as by lugs 57 which are welded either to the shell 55 or the plate 16 and are slidable on the other.

The shell 55 is placed sufficiently close to the plate 16 to provide good radiation to the plate, the spacing for example being about  $\frac{1}{2}$ ". The shell 55 can be quickly replaced is necessary, although when made of stainless steel it will last a very long time.

The arcuate extent of the shell 55 is subject to variation. Preferably, as shown, it extends up to about the top of the gun tube 46 so as substantially to embrace the flame on the bottom and sides. It could be somewhat shorter in arcuate extent; and it could be longer. It could even be a full cylinder if the front end at the top were cut out to allow combustion gases to flow back alongside the flame and enter the smoke flue. However, when the flame is spaced sufficiently from the upper part of the fire box shell and protected and heated by reversely flowing gases, as herein shown, there is no need to extend the shell 55 to protect the upper part of the fire box shell—and the free exposure to combustion gases wherever possible is economical of heat. If desired, the space around the front end of the shell 55 may be closed but this space may be left open, as shown, for gas flow if any should move in this direction.

Because of the fact that the combustion chamber shell is so near a liquid-backed surface, it rapidly radiates its heat to the liquid. This minimizes warping and deterioration of the combustion chamber shell. However, the shell 55 becomes sufficiently hot to maintain efficient combustion; and being thin metal, heats rapidly to the desired temperature. Because no refractory is used in the fire box there is no heat loss of the type experienced when refractory is used.

The wet base vertical oval-shaped arrangement produces good liquid circulation. To increase heat exchange in the fire tubes 26 spiral economizers 60 may be disposed therein, as shown in FIG. 4.

The arrows in FIG. 4 show the flow of hot gases from the flame from the burner nozzle tube, the flame being largely located within the length of the combustion chamber shell and the hot combustion gases flowing back above and adjacent the flame to increase its efficiency, as stated.

It is thus seen that the invention provides a simple and

efficient fuel burner boiler unit which has a superior fire box and combustion chamber arrangement which avoids warping and deterioration of the combustion chamber shell and which provides good flame and thermal exchange efficiency.

While one embodiment of the invention has been described for purposes of illustration it is to be understood that there may be various embodiments and modifications within the general scope of the invention.

I claim:

1. A gun-type fuel burning boiler unit, comprising in combination, a main liquid holding shell having a band shell plate and end shell plates, a tubular fire box shell having an open front end secured in an opening in the front end plate of the main body shell and a rear end closed by a rear end plate, there being liquid space above, below and at the closed rear end of the fire box shell, fire tubes between the main shell end plates above the fire box, a smoke box having a flue pipe connection secured over the rear end of the fire tubes, a flue box secured over the front end of said fire tubes and fire box, a fuel burner tube extending through the front wall of the flue box into said fire box, and a combustion chamber shell secured in the fire box closely adjacent but spaced from the bottom wall thereof, said combustion chamber shell being open at the rear end and top to cause combustion gases to return immediately above and past the flame to travel to the flue box, fire tubes and smoke box, the combustion chamber shell, when heated, and the returning hot combustion gases maintaining the fuel mixture at effective combustion temperature.

2. A boiler unit as set forth in claim 1, in which said combustion chamber shell is of a length to contain the burner flame but shorter than the length of the fire box, leaving the rear end of the fire box exposed to combustion gases.

3. A boiler unit as set forth in claim 1, in which said combustion chamber shell extends up to about the top of the burner tube to enclose the bottom and sides of the flame.

4. A boiler unit as set forth in claim 1, in which said combustion tube shell is arcuate and is somewhat greater than a semi-circle.

5. A gun type fuel burning boiler unit, comprising in combination, a main liquid shell, a tubular fire box shell in said main shell which is closed at the rear end and open at the front end, a burner nozzle tube extending into the front end of said fire box, and a combustion chamber shell in and spaced from the bottom of said fire box, said combustion chamber shell being open at the top and rear end for causing hot combustion gases to return immediately above and alongside the flame of the burner, the combustion chamber shell being disposed closely adjacent but spaced from the liquid-backed wall of the fire box to heat said wall by radiation and to have its temperature limited by proximity to the liquid-backed wall, the combustion chamber shell, when heated, and the returning hot combustion gases maintaining the fuel mixture at efficient combustion temperature.

6. A boiler unit as set forth in claim 5, in which said combustion chamber shell is secured at one point to the fire box wall and provided with sliding spacers engaging the fire box shell at other points to provide free dimension change with temperature change without stress loading.

7. A boiler unit as set forth in claim 5, in which said combustion chamber shell is somewhat longer axially than half the length of the fire box and somewhat longer circumferentially than half the circumference of the fire box.

8. A boiler unit as set forth in claim 5, in which said combustion chamber shell is formed of a material having high heat and corrosion resistance.

9. A boiler unit as set forth in claim 5, in which said combustion chamber shell is formed of stainless steel.

**5**

**References Cited by the Examiner**

**UNITED STATES PATENTS**

2,329,271 9/43 Jorolemon ----- 158—4  
2,592,216 4/52 Watts ----- 122—149

**6**

**FOREIGN PATENTS**

1,236,509 6/60 France.

FREDERICK L. MATTESON, Jr., *Primary Examiner*  
KENNETH W. SPRAGUE, *Examiner*.