Nov. 27, 1951 F. WETZEL 2,576,373

OIL BURNING BOILER FIRE BOX WITH AIR AND STEAM FEEDING MEANS

Filed Nov. 7, 1947 2 SHEETS—SHEET 1

Fig. 1.

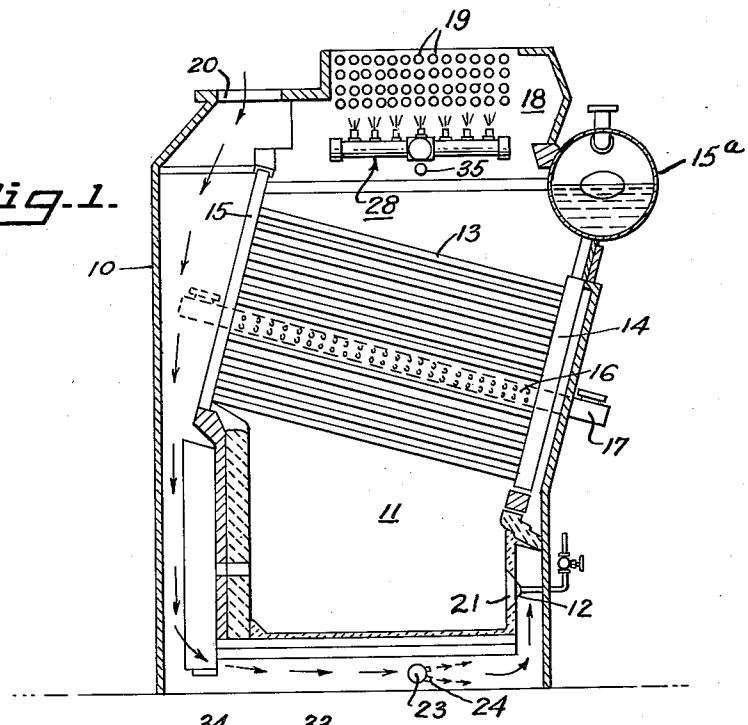
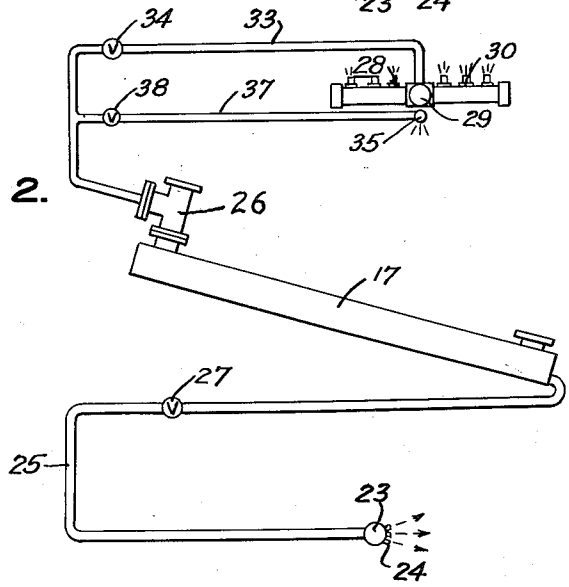


Fig. 2.



INVENTOR.
FREDERICK WETZEL
BY
Charles M. Fryer
ATTORNEY

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Fig. 3.

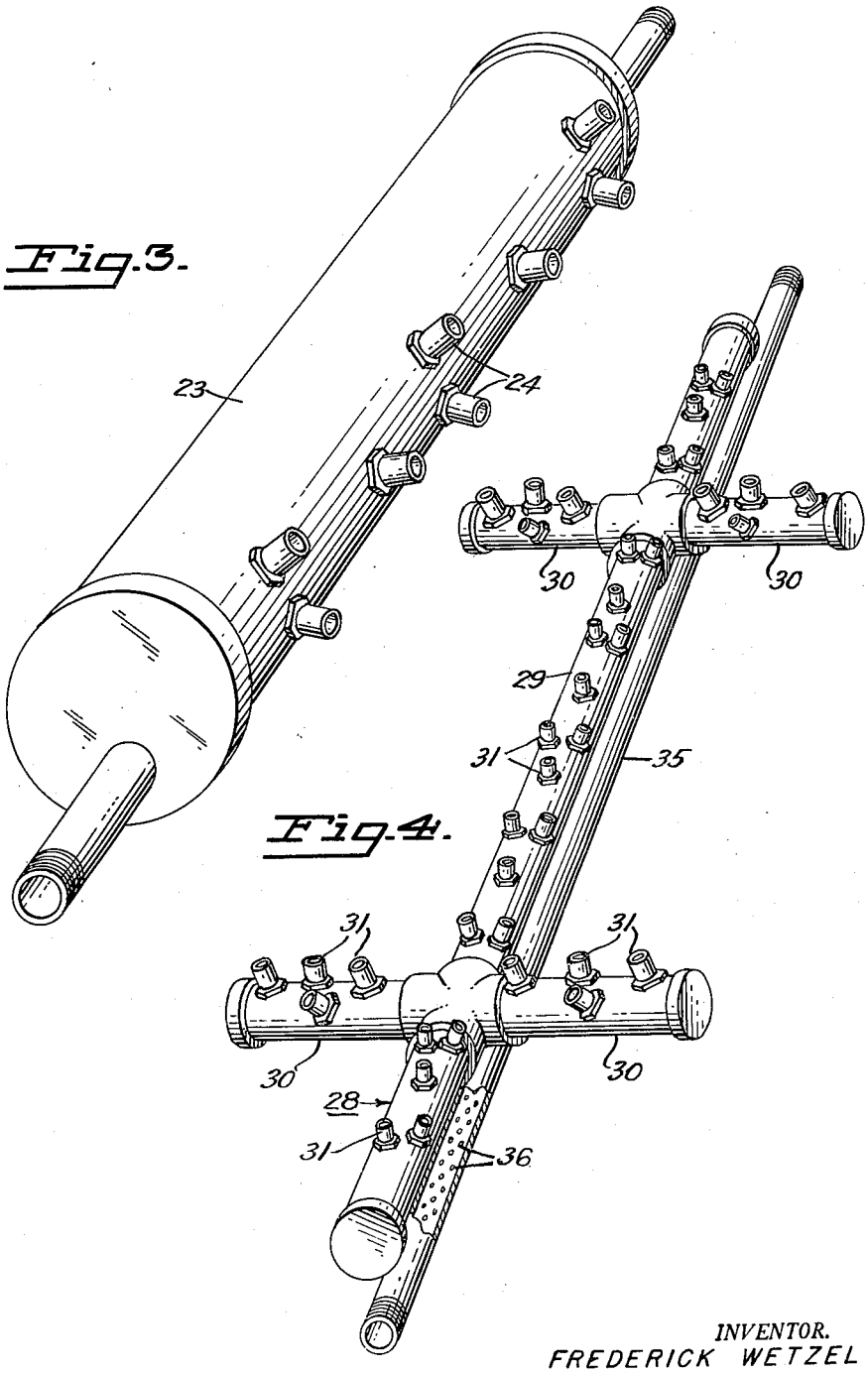


Fig. 4.

INVENTOR.
FREDERICK WETZEL
BY
Charles the Fryer
ATTORNEY

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OIL-BURNING BOILER FIRE BOX WITH AIR AND STEAM FEEDING MEANS

Frederick Wetzel, Beaverton, Oreg.

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2 Claims. (Cl. 158—4)

1

This invention relates to boilers and particularly to a new construction and method of operation of steam boilers.

The invention is disclosed and described herein in its application to a steam boiler of the oil-fired marine type, though its applicability to other types of boilers will be readily apparent.

A certain percentage of humidity is required in the air which supports combustion of a boiler fire. Frequently the humidity of the air in the vicinity of a boiler is depleted by the presence of hygroscopic surfaces and materials such as porous metals, rust, pipe lagging, dust, concrete and others. Likewise the high temperature of air in and about a boiler room tends to reduce its humidity.

One object of the present invention is to provide for the addition of moisture to the air which supports combustion of the boiler fire. Another object is to add moisture in such a manner and in such locations in the boiler as to beneficially alter the firing and heating characteristics of the boiler. A still further object of the invention is to provide means for controlling dangerously excessive boiler fire such as might be caused by mishandling of the boiler, through the same system employed for increasing efficiency of combustion in the boiler. Still further and more specific objects and advantages of the invention are made apparent in the following specification wherein the invention is described in detail by reference to the accompanying drawings.

In the drawings:

Fig. 1 is a schematic view in vertical section of a boiler embodying the present invention;

Fig. 2 is a diagrammatic view of a piping system employed in connection with the present invention;

Fig. 3 is a perspective view of steam header which forms a part of the present invention; and

Fig. 4 is a perspective view of another header also illustrating a pipe associated therewith for use in conjunction with the suppression of excessive fire in the boiler.

Referring to Fig. 1 of the drawings, a typical boiler is shown as comprising a boiler casing 10 disposed within which is a fire box 11 of conventional form to which fuel is supplied as by a fuel nozzle 12. Conventional boiler tubes 13 extending between headers 14 and 15 are supported above the fire box and water is supplied to these tubes from a steam and water drum illustrated at 15a.

Superheater tubes 16 are associated with a superheated steam manifold or header 17 from

2

which steam is drawn for use in the engine and other parts of the ship. At its uppermost end the boiler casing has an uptake portion 18 for communication with a stack (not shown) and an economizer unit comprising a set of tubes 19 is disposed within this uptake. In some boilers an air preheater would occupy the same position as the economizer here shown. In operation feed water is directed to the boiler through the economizer tubes 19 so that it becomes preheated before it enters the drum 15a and passes therefrom into the main boiler tube system.

Air is supplied to support combustion of the oil emitted by the fuel nozzle 12 through an air duct disposed at the back of the fire box and beneath the fire box. Fresh air enters an opening 20 at the upper back portion of the boiler casing and passes downwardly as indicated by the arrows in Fig. 1 to flow behind and beneath the fire box where it is preheated and then to flow upwardly forwardly of the fire box and enter through a port 21 through which the fuel oil is sprayed by the nozzle 12.

Because of conditions usually existing in the vicinity of an operating boiler the humidity of the air entering through the air duct is below normal and insufficient to support perfect combustion of the fuel burned in the fire box. Therefore, according to the present invention a steam header 23 is disposed in the air duct beneath the floor of the fire box. This steam header, shown in detail in Fig. 3, is provided with a plurality of nozzles 24 directed forwardly of the boiler or in the direction of the flow of air through the air duct. The header 23 is connected as by a pipe 25, as shown in Fig. 2, with a drain at the lower end of the superheated steam header 17 and flow through the pipe 25 is under control of a valve 27. Consequently superheated steam may be directed to the header 23 and projected through the nozzles thereof in the direction of the air flow and added to the air which supports combustion of the fuel within the fire box 11. This creates more complete combustion of the fuel in the fire box than would otherwise be obtainable.

A second steam header shown at 28 is disposed in the uptake of the boiler casing just below the economizer 19 or below the air heater if one is present. This header, which is shown in detail in Fig. 4, comprises a straight pipe 29 and cross members 30 branching outwardly therefrom, all of which have upwardly projecting nozzles 31. The header 28, as illustrated in Fig. 2, is also connected as by a pipe 33 with a fitting 26 on the

superheated steam header 17 and the flow of steam to the header 28 is under control of a valve 34. By projecting superheated steam through the header 28 and upwardly through the uptake of the boiler any obstruction caused by the economizer tubes in the uptake is overcome by the increased upward fluid flow through the throat. Thus the fire in the fire box 11 tends to be drawn upwardly through the main bank of boiler tubes 13 and superheater tubes 16 so that the efficiency of the boiler is increased and any tendency of the fire to strike the back wall of the fire box and swirl therein is minimized. Furthermore, the superheated steam projected upwardly by the nozzles of the steam header 28 directly contacts the tubes 19 of the economizer and heat is added to the normal heat of the gases passing upwardly through the uptake of the boiler to preheat the water which is being added to the boiler tube system.

Disposed directly beneath the steam header 28 is a pipe 35, also shown in Fig. 4 as having perforations 36 formed in its lower side to project steam downwardly toward the fire box of the boiler. The pipe 35, as illustrated in Fig. 2, is connected as by a pipe 37 with the superheated steam chamber 17 and is under control of a valve illustrated at 38.

In operation of the boiler normally both the steam headers 23 and 28 will be in open communication with the superheated steam chamber 17 and superheated steam will be projected through the nozzles of these headers. The header 23 in addition to adding the moisture of the steam to the air passing through the duct and entering the fire boxes for combustion therein will add to the velocity of this air and thereby minimize the requirements of blowers sometimes employed for this purpose. Furthermore, by adding moisture to the products of combustion within the fire box it will minimize the carbon accumulation therein and generally improve the quality of combustion. The steam projecting upwardly from the header 28 will increase the draft through the boiler and cause the greater heat of combustion in the fire box to be drawn directly upwardly from the fire box through the bank of boiler tubes 13, thus also increasing the efficiency of the boiler. In the event that excessive or destructive fire should occur in the boiler, steam may be admitted thereto through the steam pipe 35 and directly downwardly over the boiler tubes. The admission of steam in this manner can be effected by opening the normally closed valve 38 and will preferably be accompanied by closing the valve 34 to the header 28. However the steam should preferably still flow through the header 23 and may even be increased through this header. Thus in the event of fire, superheated steam will be directed downwardly toward the fire box, as well as upwardly and will tend to blanket and confine the fire therein to prevent the disastrous results of excessive fire in the boiler.

The invention herein described is also particularly useful in controlling variations in humidity which occur because of a ship travelling through different climates in different parts of the world. By adding humidity to the boiler fire in dry

climates the quality of combustion is maintained high and thus the accumulation of carbon on the boiler tubes and in other parts of the boiler is prevented. The superior combustion provided by proper regulation of humidity tends to destroy accumulated carbons and also tends to reduce any carbon within the boiler to a powdery form that does not readily adhere to boiler tubes and is held in suspended form where it may readily be carried away by the boiler draft.

The reference in the claims to a large volume low velocity air duct relates to the type of air conduit conventional in various makes of boilers which duct is as wide or almost so as the fire box itself, and into which air flows by a natural draft or by low pressure blowers as distinguished from high pressure air equipment where air is forcibly projected through a pipe. Such boilers are sometimes referred to in the trade as the double front or double cased forced draft type.

I claim:

1. In a steam boiler comprising a fire box, an oil burner operatively associated with said fire box for directing fuel thereinto, and an air duct communicating with said fire box adjacent said burner for directing a large volume of relatively low velocity air into the fire box in the vicinity of the burner, a steam pipe extending through the air duct in a direction transverse to the flow of air therethrough, a plurality of nozzles projecting from said pipe and extending generally in the direction of said flow, and means for introducing superheated steam to said pipe.

2. In a steam boiler comprising a fire box, an oil burner operatively associated with said fire box for directing fuel thereinto, and an air duct communicating with said fire box adjacent said burner for directing a large volume of relatively low velocity air into the fire box in the vicinity of the burner, a steam pipe extending through the air duct in a direction transverse to the flow of air therethrough, a plurality of nozzles projecting from said pipe and extending at diverging angles but all generally in the direction of said flow whereby steam issuing from the nozzles will tend to spread throughout substantially the entire cross sectional area of the duct, and means for introducing superheated steam to said pipe.

FREDERICK WETZEL.

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