Dec. 4, 1962 S. V. JAKOBSSON 3,066,655

DOUBLE FIRED COMBINED HEATING BOILER

Filed Dec. 14, 1960 2 Sheets-Sheet 1

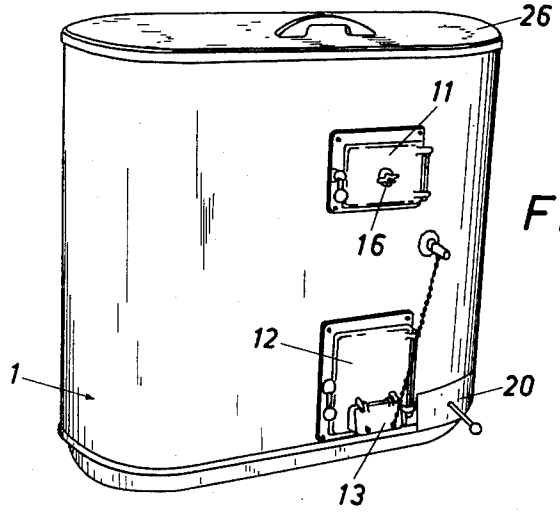


Fig. 1

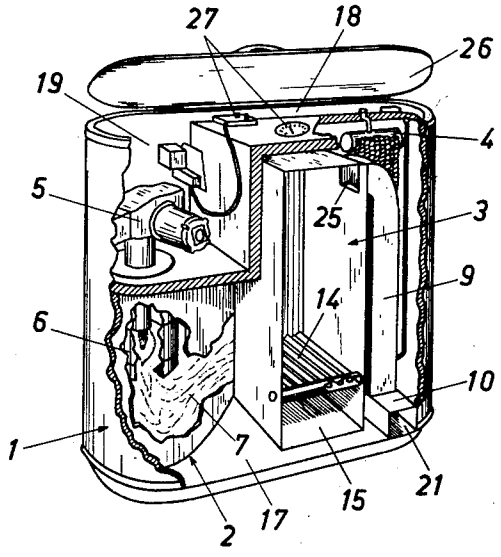


Fig. 2

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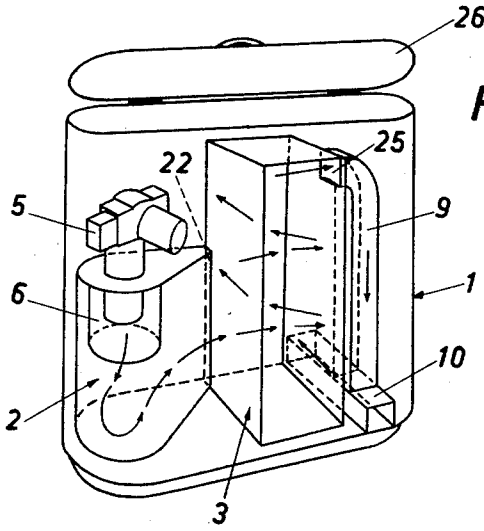
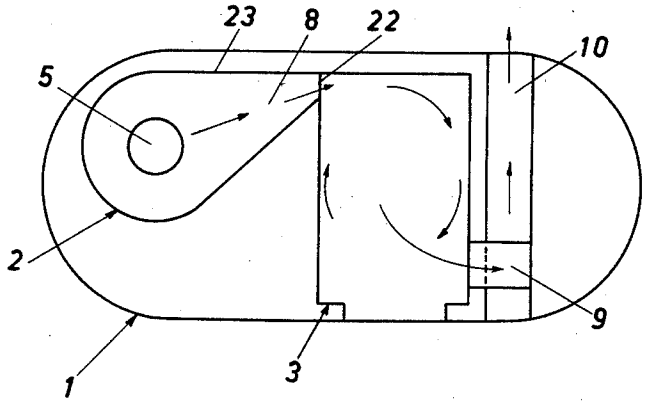


Fig. 3

Fig. 4



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DOUBLE FIRED COMBINED HEATING BOILER

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This invention relates to combined heating boilers having a combustion chamber for solid fuels and a chamber for liquid fuels, such fuels being, for example, coal, wood and the like and fuel oil, respectively.

Combined heating boilers hitherto have had several drawbacks. They are for example very sooty and dirty and for this reason have to be arranged in special boiler rooms or in cellars and so on. Furthermore they take up a good deal of space, are of low efficiency, noisy in operation, and non-aesthetic in appearance.

The aim of the invention is to provide a silent, clean, aesthetic and simultaneously strong heating boiler with good efficiency and durability which is adapted to be used especially in houses and villas without cellars. The boiler is such that it might be arranged in the bathroom or analogous and since all its control means are enclosed and protected, the boiler can even be located in a hobby room or children's playroom.

According to the invention a double fired combined heating boiler capable of burning solid or liquid fuels or both has a liquid fuel burner assembly with a downwardly directed jet in a combustion chamber the walls of which converge towards a flue gas outlet and a combustion chamber for solid fuels having a downwardly directed flue gas channel which at its lower end terminates in a gas outlet channel extending transversely of the boiler, and the gas passing from the liquid fuel combustion chamber enters the solid fuel combustion chamber and the gas outlet from the solid fuel combustion chamber are situated at opposite sides of the solid fuel combustion chamber.

So that the invention will be better understood an example in accordance with it will now be described with reference to the accompanying drawings in which:

FIG. 1 is a perspective front view of the heating boiler according to the invention,

FIGURE 2 is a perspective front view of the boiler with part of the casing broken away,

FIGURE 3 is a diagrammatical "X-ray"-view of the boiler and,

FIGURE 4 is a diagrammatical plan view of the boiler.

Referring to the drawings, an outer housing 1 encloses an oil combustion chamber 2 for the oil firing, a fireplace 3 for solid fuels, a hot-water boiler 4 and an oil-burner assembly 5.

The oil-burner assembly 5 has at its lower part a vertically arranged burner jet 6 the walls of which are of a stainless alloy, such as that sold under the name of "Canthal" and which is able to withstand a temperature of 3000° F. The jet is formed in such a way that its flame 7 will taper downwardly towards the bottom of the jet. The walls of the jet are conical so that almost the whole combustion of the oil gases takes place within the jet and it is designed so that the flame 7 gives in the jet a temperature of about 1950° F.

Radiation energy from the walls of the jet 6 and the heat from the remaining rudimental part of the oil flame from the jet 6 are transmitted to a surrounding water mantle and thus to the heating medium.

The combustion gases flow from the oil combustion chamber 2 through a tapering flue channel 8 (see FIGURE 4), to the fireplace 3 for the solid fuels and thence through a vertical downwards directed exhaust channel 9

through the water near the hot water boiler 4 to a channel 10 extending transversely through the boiler to a flue connection. Due to this construction, the path of the flue gases will be extremely long and the heat transmitting surface can be relatively great compared to the size of the whole installation. For example a typical boiler according to the invention has a heat transmitting surface of about 3.35 sq. yards in spite of being externally only 47" long, 20" wide and 42" high. Experiments have shown that in this manner most of the heat in the fuels is used most efficiently.

The central front portion of the boiler casing is provided with doors 11 and 12 opening into the solid fuels fireplace 3. Door 12 is provided with a draught control valve 13.

The grate of the solid fuel fireplace 3 is formed of hollow grate bars 14 through which water flows for cooling the bars. Due to the fact that they are water cooled the grate bars are well suited to serve as a cinder separator for a cinder receiver 15 below.

The flue gases from the fireplace 3 follow the same path as the oil flue gases via the channels 9 and 10 to the chimney (not shown).

When solid fuels are burnt either alone or at the same time oil firing is in operation, a turnable disc valve 16 on the upper door 11 is opened. The return water from the radiators in the heating system is distributed in the form of a fan at the bottom 17 of the heating boiler in the vicinity of the fireplace 3 for solid fuels.

The hot water boiler 4 is of the combined type, that is to say, it is of the storing and battery type. It comprises two storing tanks and a tube system of considerable length therebetween and is designed to ensure a practically constant temperature of the delivered hot water. In a typical installation the tube length is 65 yards and the capacity of the hot water boiler with such an installation is indicated in the following table. The furnace temperature of the heating boiler was 175° F. and the water temperature about 130° F.

Table 1

Heating effect B.t.u./H.		Fuel volume, gallons	Water volume, gallons	Hot water,[1] gallons/min.
Coke firing	Oil firing			
40,000 60,000	80,000 120,000	12	73	10

[1] Water of 130° F. at a heating boiler temperature of 175° F.

In connection with the heating effect in B.t.u. two different values have been given above. This is due to universal character of the boiler. The combustion chamber 2 and the fireplace 3 are shaped in such a way that different fuel quantities can be burned within the limits given in the aforegoing table, i.e. for coke, 40,000–60,000 B.t.u. per hour, and for oil 80,000–120,000 B.t.u. per hour.

The heating boiler is preferably well insulated. To this end it can conveniently be provided with an outer and an inner casing, between which is arranged a glass fiber insulation. Also at the bottom of the boiler there can be arranged an extra insulating air layer.

The boiler casing is provided at its top with a protecting cover 26 beneath which such apparatus as control means 27, such as a hydrothermometer and a heat regulator can be located. Also located beneath the cover 26 in a recess 19 is the connection and disconnection device for the high pressure oil-burner assembly 5.

The flue channel 10, extending transversely through the heating boiler is at its front portion provided with an opening 21 covered by a door 20 through which opening the channels 9, 10 can be reached when being swept.

As is indicated in FIGURES 3 and 4 the oil flame is directed downwardly into the combustion chamber 2, flows through the tapering channel 8 to the gas outlet 22. The flue gases then stream towards the wall of the fireplace 3 by the outlet 22, swirls with high speed and a turbulent motion against the wall in which the doors are located thereby transferring their heat to all the walls of the fireplace 3. A further opening 25 is arranged at the upper end of the fireplace 3 in the wall opposite the outlet 22. The gas which passes upwardly through this opening, which has already delivered some of its heat, streams through a vertical channel 9 and horizontal channel 10 to the chimney. As the combustion chamber 2, the fireplace 3 and the flue gas channels 9 and 10 are surrounded by water, the heat transferred from the flue gases will be high and the temperature of the flue gases in the chimney will be extremely low. The efficiency of the heating boiler therefor will be extremely high. In fact efficiencies of as high as 92% have been achieved.

The present invention has been described in detail above for purposes of illustration only and is not intended to be limited by this description or otherwise except as defined in the appended claims. Various modifications lie within the scope of the invention. Thus the fireplace for the solid fuel could have a circular cross section instead of a rectangular one. The gas outlet channels 9 and 10 and the hot water boiler could change places with the combustion chamber 2 and the oil-burner assembly 5 this being advantageous when the connection to the chimney is arranged to the right instead of to the left of the fireplace 3.

Test results of a typical boiler are set out in Table II below:

Table II

Test No.	1	2	3	4	5	6	7	8
Jet size (all having an opening angle of 80°)	1/40	1/40	1/40	1/32	1/32	1/25	1/32	1/40
Measured oil consumption, lb./hr.	3.75	3.75	4.2	5.3	5.3	6.6	5.3	4.2
Sootvalue, lb./hr.	3	2-3	3	3	3	2	2-3	2
CO_2, percent	9.8	9.8	10.4	10.0	10.8	12.2	11.0	10.2
O_2, percent	6.2	7.0	6.8	6.8	6.0	3.8	5.8	6.0
CO, percent	0.2	0.3	0.2	0.2	0.3	0.3	0.2	0.6
Air in excess, percent ca.	37	46	45	45	37	20	35	35
Heating boiler, ° F. temperature	194	131	149	185	194	176	194	194
Flue gas temperature, ° F.	266	266	275	320	338	374	347	275
Heating boiler room temperature, ° F.	72	72	72	72	75	75	75	75
Draught in flue channel, in. water column	1/40	1/40	1/40	1/40	1/40	1/40	1/40	1/35
Flue gas losses, percent	7.5	7.5	7.5	9.3	9.4	9.2	9.5	9
Efficiency, percent	92.5	92.5	92.5	90.7	90.6	90.8	90.5	91

As is clear from the aforegoing extract from the testing records it is possible to obtain with oil a smaller injection quantity and thus a lower flue gas temperature. This is of course quite dependent of the nature of the chimney. The fire surface will according to the invention be so great that even with a large deposit of soot the flue gas temperature can be maintained at suitable low value.

What I claim is:

1. In a double fired heating boiler using liquid and solid fuels, a combustion chamber for liquid fuels, a combustion chamber for solid fuels disposed alongside said combustion chamber for liquid fuels, a liquid fuel burner mounted above and directing a jet downward into said combustion chamber for liquid fuels, a gas outlet from said combustion chamber for liquid fuels debouching in said combustion chamber for solid fuels in the lower portion of said combustion chamber for solid fuels, said combustion chamber for liquid fuels having walls converging towards said outlet from said combustion chamber for liquid fuels, an outlet from said combustion chamber for solid fuels communicating with the uppermost portion of said combustion chamber for solid fuels, a downwardly directed flue gas channel extending from the outlet from said combustion chamber for solid fuels to a level at least as low as the bottom of said combustion chamber for solid fuels, and an exhaust channel connected to the lower end of said flue gas channel.

2. The combination according to claim 1 wherein said gas outlet from said combustion chamber for liquid fuels debouches in said combustion chamber for solid fuels away from the center of said combustion chamber for solid fuels.

3. A double fired heating boiler using liquid and solid fuels comprising, in combination, a heating boiler having higher and lower side portions, a combustion chamber for liquid fuels disposed within the lower side portion of said heating boiler, a liquid fuel burner mounted above the lower side portion of said heating boiler directing its jet downward into the combustion chamber for liquid fuels, a combustion chamber for solid fuels disposed within the higher side portion of said heating boiler, said combustion chamber for solid fuels being disposed alongside and extending above said combustion chamber for liquid fuels, a gas outlet from said combustion chamber for liquid fuels extending laterally and debouching in said combustion chamber for solid fuels away from the center of said combustion chamber for solid fuels, door means giving access to said combustion chamber for solid fuels, and a downwardly directed flue gas channel connected to the upper portion of said combustion chamber for solid fuels, said downwardly directed flue gas channel being within the higher side portion of said heating boiler and extending to the bottom portion of said heating boiler.

4. The combination according to claim 3 with the addition of a transverse exhaust channel disposed from front to back through the bottom of the higher side portion of said heating boiler, the lower end of said flue gas channel being connected to said exhaust channel.

5. The combination according to claim 4 wherein said combustion chamber for solid fuels has back, side and front walls, said front wall containing said door means, said gas outlet from said combustion chamber for liquid fuels debouching in said combustion chamber for solid fuels adjacent to the back wall of said combustion chamber for solid fuels.

6. The combination according to claim 5 wherein said combustion chamber for liquid fuels has converging walls extending to said gas outlet from said combustion chamber for liquid fuels, said outlet and said converging walls extending substantially from the top to the bottom of said combustion chamber for liquid fuels.

7. The combination according to claim 6 with the addition of water heating means within said heating boiler, said water heating means being disposed beyond said combustion chamber for solid fuels adjacent to said downwardly directed flue gas channel.

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