United States Patent [19]

Bolin

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[54] **BOILER**

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[51] **Int. Cl.** **F22b 5/00**

[58] **Field of Search** ..... 122/13 R, 13 A, 14, 122/156

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[57] **ABSTRACT**

A circulating liquid heated heating system in which a boiler is connected to a conduit system having an outlet for heated liquid leading to the conduit system and an inlet for liquid returned from the conduit system. A heating space in the boiler has a closed upper end and an open lower end in communication with the return liquid, and a heating means extends into or through the heating space, whereby liquid in the heating space is heated and converted to steam. The steam forces liquid out of the heating space and into the outlet from the boiler to the conduit system. The lowering of the liquid level in the heating space cools and condenses the steam in the heating space, thereby reducing the pressure to a pressure below the pressure of return liquid to the inlet. Liquid from the inlet then raises the level of liquid in the heating space, the liquid volume of the boiler is increased, the sound level of the system is reduced and the risk of overheating is reduced by surrounding the heating space with a liquid containing vessel and interposing an insulating layer between at least the upper portion of the heating space and the body of liquid. Because of the high efficiency of the boiler, the boiler can be combined with tube sets laterally displaced from the boiler and having additional heating units between each unit.

10 Claims, 3 Drawing Figures

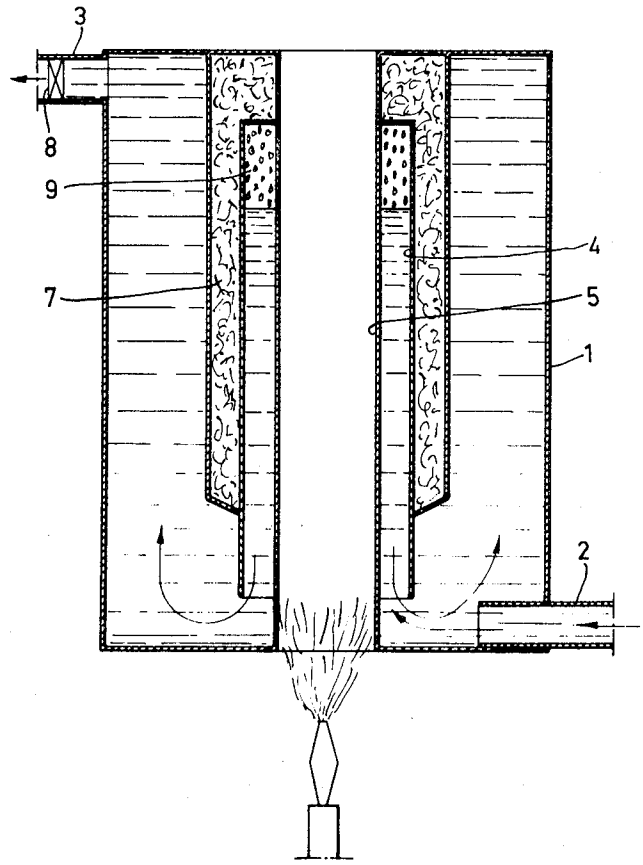


FIG.1

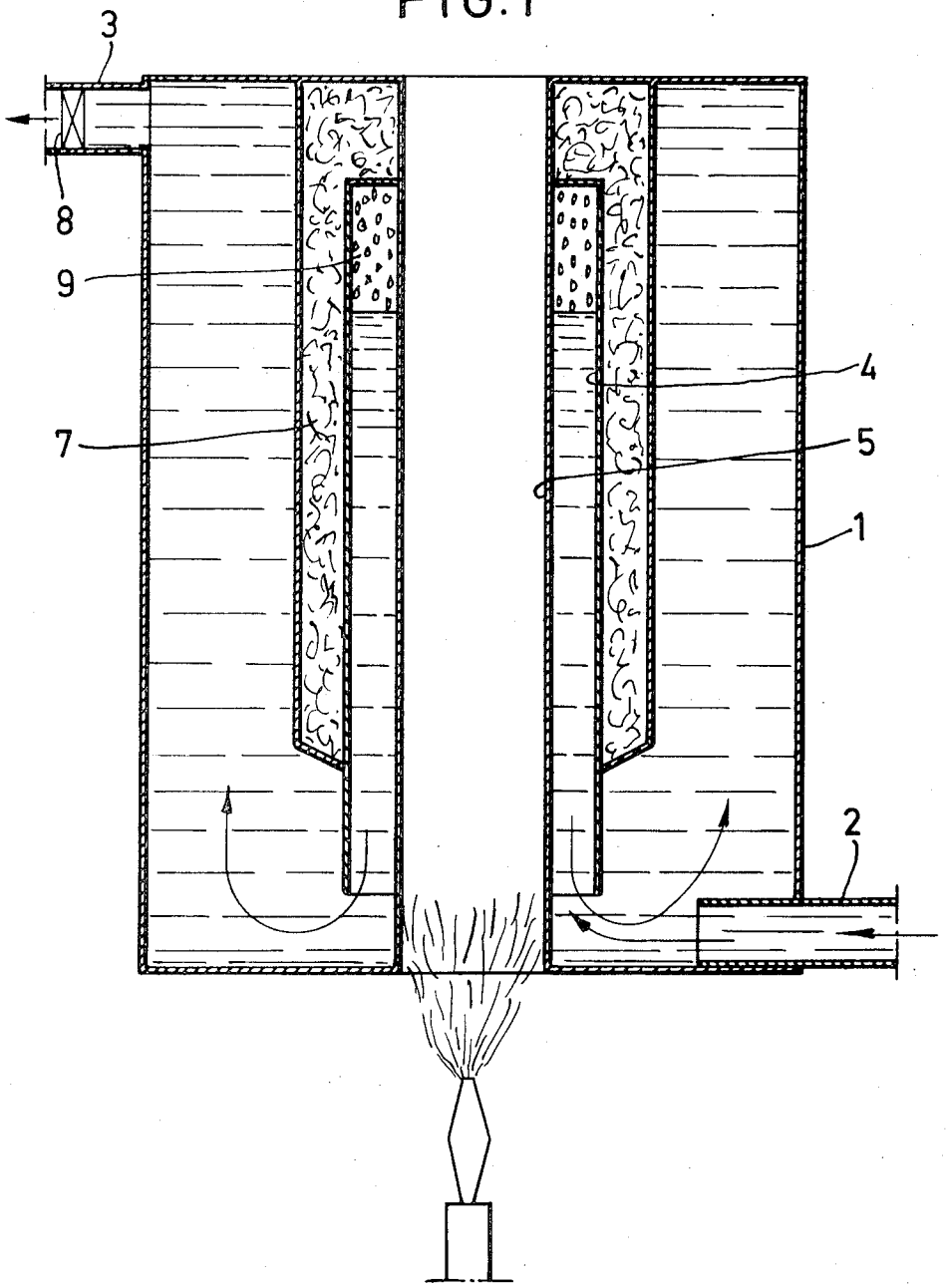
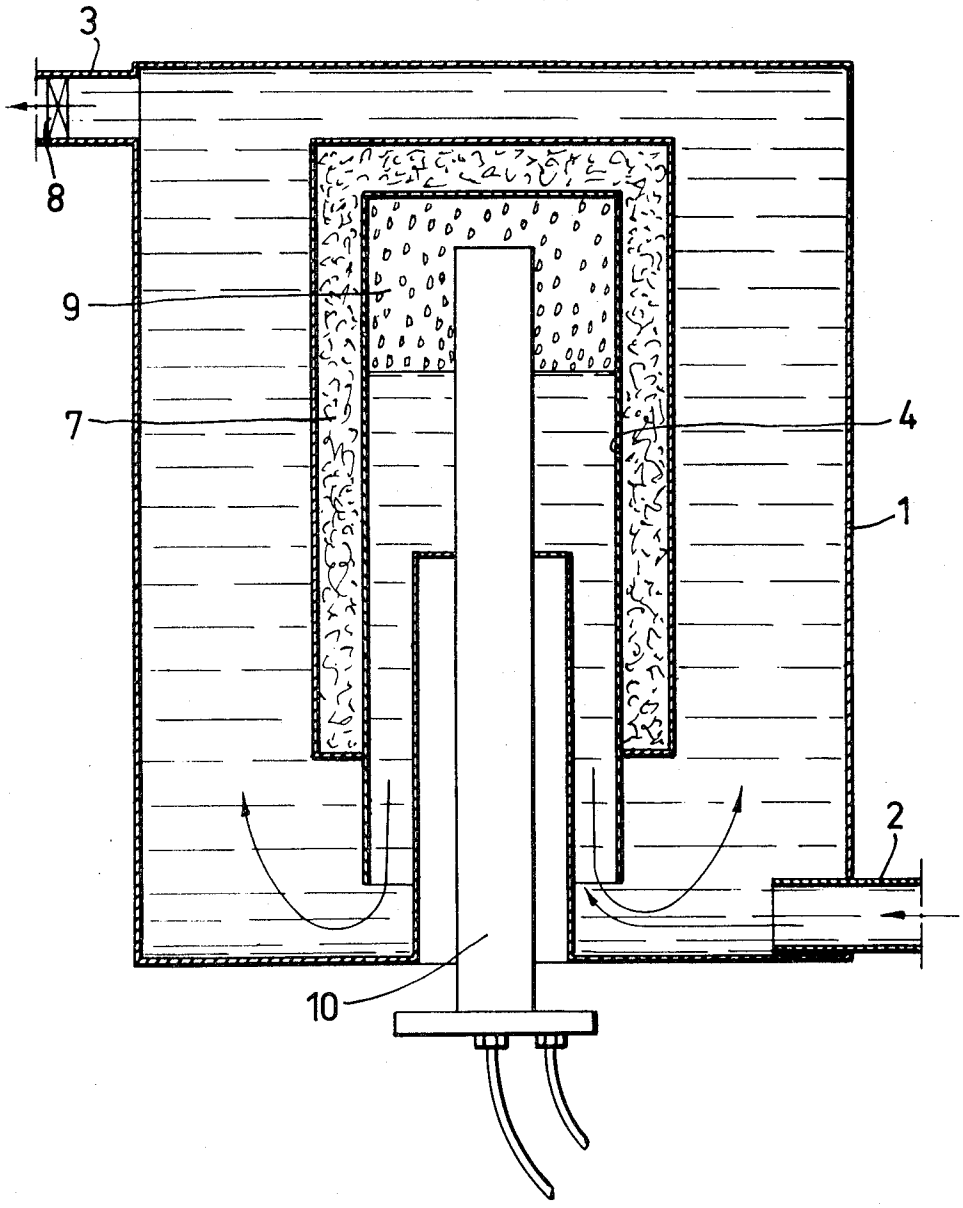


FIG. 2



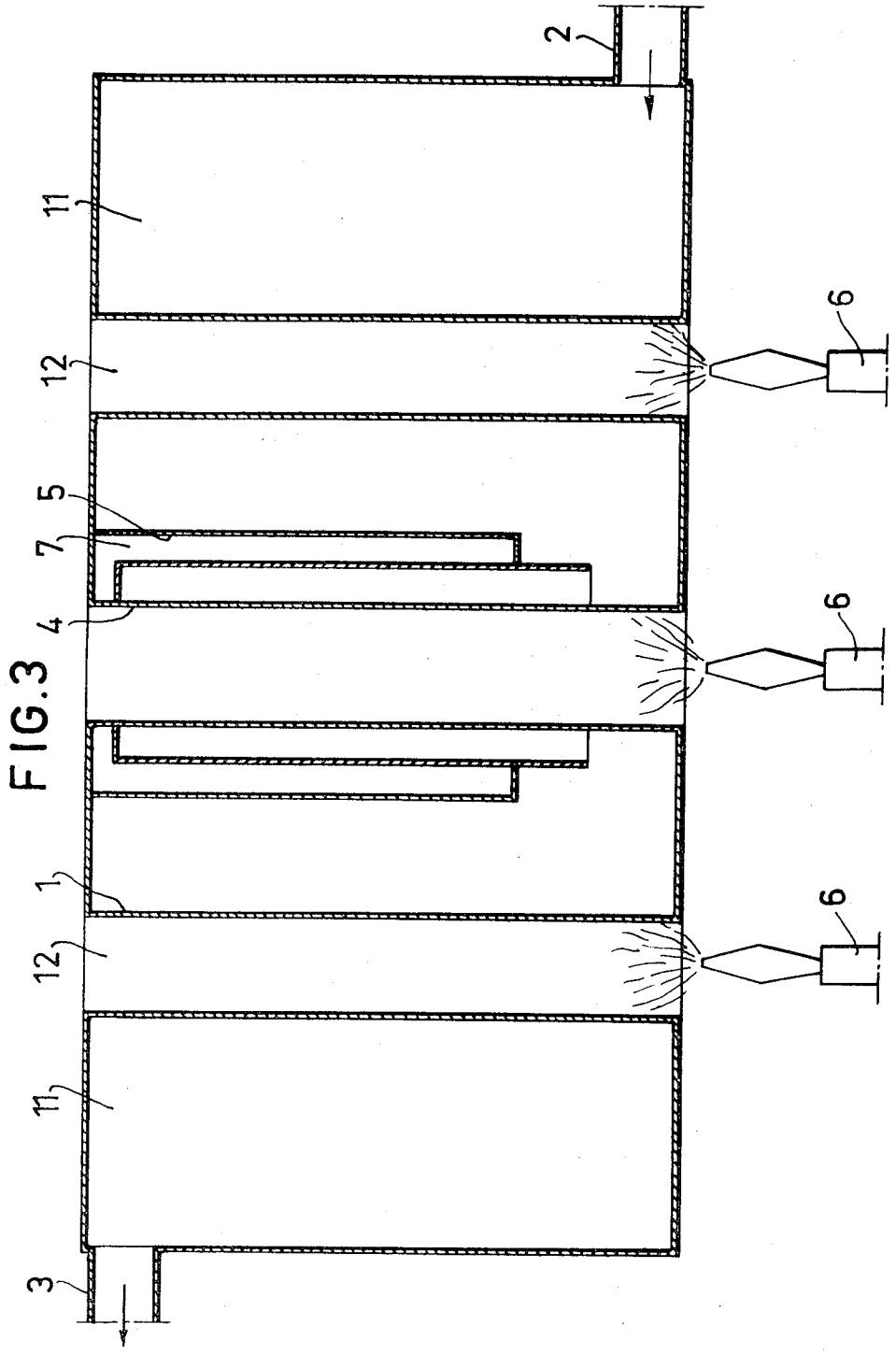


FIG.3

BOILER

This invention relates to a boiler comprised in a conduit system including a circulating liquid heated in the boiler and at least one return conduit drawn from the conduit system to the boiler, and with at least one conduit for heated liquid extending from the boiler to the conduit system, said boiler comprising an upwardly closed heating space for the circulating liquid and a heating means provided in or through the heating space, at the lower end of said heating space liquid is supplied to be heated in said heating space and, respectively, heated liquid flows out of said heating space, and due to the heating of the liquid in the heating space by said heating means steam is generated in the upper portion of said heating space, said steam producing a pressure, which presses liquid out of the heating space into the conduit extending from the boiler, but which pressure drops at the enlargement of the steam zone downwardly in the heating space and upon the condensation of the steam when arriving at a colder zone in said heating space whereby liquid from the return conduit of the conduit system again ascends in the heating space.

At the operation of a boiler of the aforesaid kind, the heating space acts as a pump means for the circulating liquid. The boiler shows several essential advantages, for example it maintains a high efficiency degree both with respect to pumping and heat transfer, even if the effect supplied to the boiler varies within wide limits, and it further renders possible with maintained economy a flexible control of the effect delivered by the eating system in response to varying heating demands.

The boiler, however, also has several disadvantages. When being started as well during its operation, the boiler has proved to be noisy with an inconveniently high sound level. Due to its construction, furthermore, the boiler has a small liquid volume with a resulting risk of overheating.

The present invention, which shows the advantages of the boiler referred to in the introductory portion, eliminates the aforesaid disadvantages and provides additional advantages.

The invention is substantially characterized in that the heating space is inserted in a vessel containing circulation liquid, the lower end of the heating space being in connection with the liquid in the vessel and insulated, at least about the portion including the zone of generated steam, against the liquid in the vessel by an insulating layer of such insulation capacity that a desired steam pressure is produced, and that the conduit extending from the boiler is located at the vessel below the liquid level therein.

By the invention, the sound level has been reduced considerably compared with that of the aforementioned conventional boiler. This has been achieved both by the insulation layer and by the liquid-containing vessel in which the heating means acting as a pump means is inserted. The arrangement of the liquid vessel, furthermore, brings about a large liquid volume and thereby eliminates the risk of overheating. Owing to the insulation it has also been possible to substantially reduce the number of heat sources for heating the liquid in the heating space. The boiler referred to in the introductory portion shows further the shortcoming that the conduits to and from the heating space (return conduit and, respectively, riser) must be located on the same level, i.e. below the heating space. At the present invention, however, the conduits can be placed on different levels, which results in self-circulation with small effects. There is no risk that the liquid flow may cease. At small effects the boiler operates as a self-circulation boiler, and at higher effects the pump effect is started in the heating space. The boiler according to the invention shows the further advantage that it can be extended and form a tube boiler.

Some embodiments of the invention are described in the following with reference to the accompanying drawing.

FIGS. 1 and 2 show in a schematic way two different embodiments of a boiler according to the invention by central sections, and

FIG. 3 shows in a schematic way a boiler according to the invention extended to form a tube boiler.

The boiler shown schematically in FIG. 1 comprises a vessel 1 filled with liquid, a return conduit 2 connected to the vessel from a conduit system (not shown) comprising radiators or like heating elements, and a conduit or riser 3 from the vessel to said conduit system. The vessel 1 includes inserted therein a heating space 4 for heating the liquid to flow out through the conduit 3 to the conduit system and subsequent to its cooling in the conduit system to return to the vessel via the return conduit 2. Said heating space 4 is upwardly closed and downwardly open to the liquid in the vessel, and it encloses a gas passageway 5 flown through by gas heated by a gas burner 6. Within said gas passageway 5 there may be disposed screens or flanges (not shown) to improve the heat transfer to the heating space 4. About the heating space 4 is provided an insulating layer 7 which, for example, may consist of a suitable insulation material or of an air gap, or of a combination of insulation material and air gap. The insulation layer 7 is shown upwardly closed, but it may also be open. Said layer further is shown to terminate some distance above the lower edge of the heating space 4, but it may also terminate at another place along the heating area. An essential requirement for the height extension of the insulation layer is that it encloses at least an upper portion of the heating zone, viz. the steam zone 9, in which the liquid by heating is vaporized. The riser 3 extending from the vessel includes a valve shown schematically at 8.

FIG. 2 shows another embodiment of a boiler according to the invention. This embodiment differs in principle from that shown in FIG. 1 only in that instead of the gas passageway 5 and gas burner 6 an electrically heated heating body is provided which does not pass through the heating space and the insulation layer upwardly.

The embodiments of the invention shown in FIGS. 1 and 2 operate as follows.

Upon ignition of the gas burner 6 or heating of the heating body 10, the liquid in the heating space 4 is heated and steam is generated in the upper space portion. By said steam generation the pressure increases whereby the liquid in the heating space 4 is pressed out of said space, and liquid flows out through the conduit 3 via the valve 8 then being open. The liquid level in the heating space 4 is thereby lowered. The hot steam arrives at a colder zone and condenses. The pressure drops and becomes lower than the pressure in the return conduit 2. The valve 8 closes, the liquid in the heating space 4 again rises and generates steam, which again increases the pressure. The cycle is repeated.

Owing to the insulating layer 7 and the vessel 1 filled with liquid, the boiler operates very quietly without disturbing noise. A further result of the insulation layer 7 and the vessel filled with liquid enclosing the heating space 4 is the elimination of the risk of overheating. By placing the vessel filled with liquid about the heating space it also is possible, as shown, to arrange the riser 3 and the return duct 2 on different levels, thereby improving the circulation in the system. These and other advantages of a boiler according to the invention have been dealt with in greater detail in the introductory portion of the description.

FIG. 3 illustrates in a schematic way a further advantage of a boiler according to the invention. Owing to its high efficiency, the boiler can be extended with lateral units of tube sets, two of such tube set units 11 being shown in FIG. 3. Between the tube set units and the vessel 1, for example, the gas passageway 12 with underlying gas burner 6 may be provided as shown.

The scope of the invention comprises a plurality of different embodiments of a boiler according to the invention. The vessel 1 as well as the heating space 4 may be of cylindric or box shape or have another suitable design. The vessel need not entirely enclose the heating space, but this, for example, after two opposed sides may be adjacent directly to the surrounding atmosphere. The insulating layer 7 may have another form and another downward extension, and it may, for example, terminate adjacent the lower edge of the heating space. The return conduit 2, which is shown connected to the vessel 1, may also be connected to the heating space 4. The boiler may be equipped with more than one gas burner 6 and one heating body 10 as well with more than one return conduit 2 and one riser 3. It is, of course, also possible to interconnect several boilers. Also other variants are imaginable within the scope of the following claims.

What I claim is:

1. A boiler useful in a system for heating and circulating a liquid which includes a conduit system through which the heated liquid will circulate, the boiler comprising:

a liquid inlet for connection to the return end of the conduit system and a liquid outlet for connection to the input of the conduit system,

a liquid reservoir zone communicating with said outlet and having therein a heating space provided with a closed upper end and a lower end in liquid flow communication with the reservoir zone, at least the upper portion of the heating space being heat insulated from the reservoir zone,

the inlet and outlet being located with respect to the reservoir zone and the heating space, and the heating space being located in relation to the reservoir zone, in such a way that when liquid within the heating space is heated, steam is generated in the upper portion of the space creating a steam zone and pressure which forces heated liquid from the space through the reservoir and from the outlet, which in turn causes a drop in pressure due to the enlargement of the steam zone downwardly in the heating space until the steam condenses upon its arrival at a cooler area in the heating zone, whereby liquid from the inlet is caused to ascend into the heating zone.

2. A boiler according to claim 1 wherein the outlet is located so as to be below the liquid level in said reservoir.

3. A boiler according to claim 2 wherein said heating space comprises a double-walled conduit means extending into said reservoir, the zone defined within the inner-most walls being in communication with a source of heat for heating the liquid and the zone defined between the inner and outermost walls being closed at its upper end and being in open, liquid flow communication with the reservoir zone.

4. A boiler according to claim 3 wherein the zone defined within the inner and outermost walls is entirely surrounded by said reservoir.

5. A boiler according to claim 3 wherein the zone defined within the inner-most walls is formed by, and the innermost walls define an open ended conduit and said source of heat is a gas heater which blows heated gas through said conduit.

6. A boiler according to claim 3 wherein the zone defined within the innermost walls is formed by, and thus the walls define, an open ended conduit whose upper end terminates within the confines of the zone defined between the inner and outermost walls, said outermost walls extending upwardly beyond the upper end of the innermost walls and terminating in a cap portion which also defines and closes said zone between the inner and outermost walls and wherein said boiler also includes a means for heating said liquid which extends through the zone defined by the innermost walls and into the zone defined by the inner and outermost walls at a point above the termination of the innermost walls.

7. A boiler according to claim 2 wherein the outlet includes a valve which opens and closes in response to the pressure produced.

8. A boiler according to claim 1 wherein said inlet communicates with said heating space.

9. A boiler according to claim 1 wherein said inlet communicates with said reservoir.

10. A boiler according to claim 1 which is quiet in operation, wherein said heating space is substantially surrounded with insulation and by said reservoir, and said boiler is so designed that during operation said reservoir is filled with liquid.

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