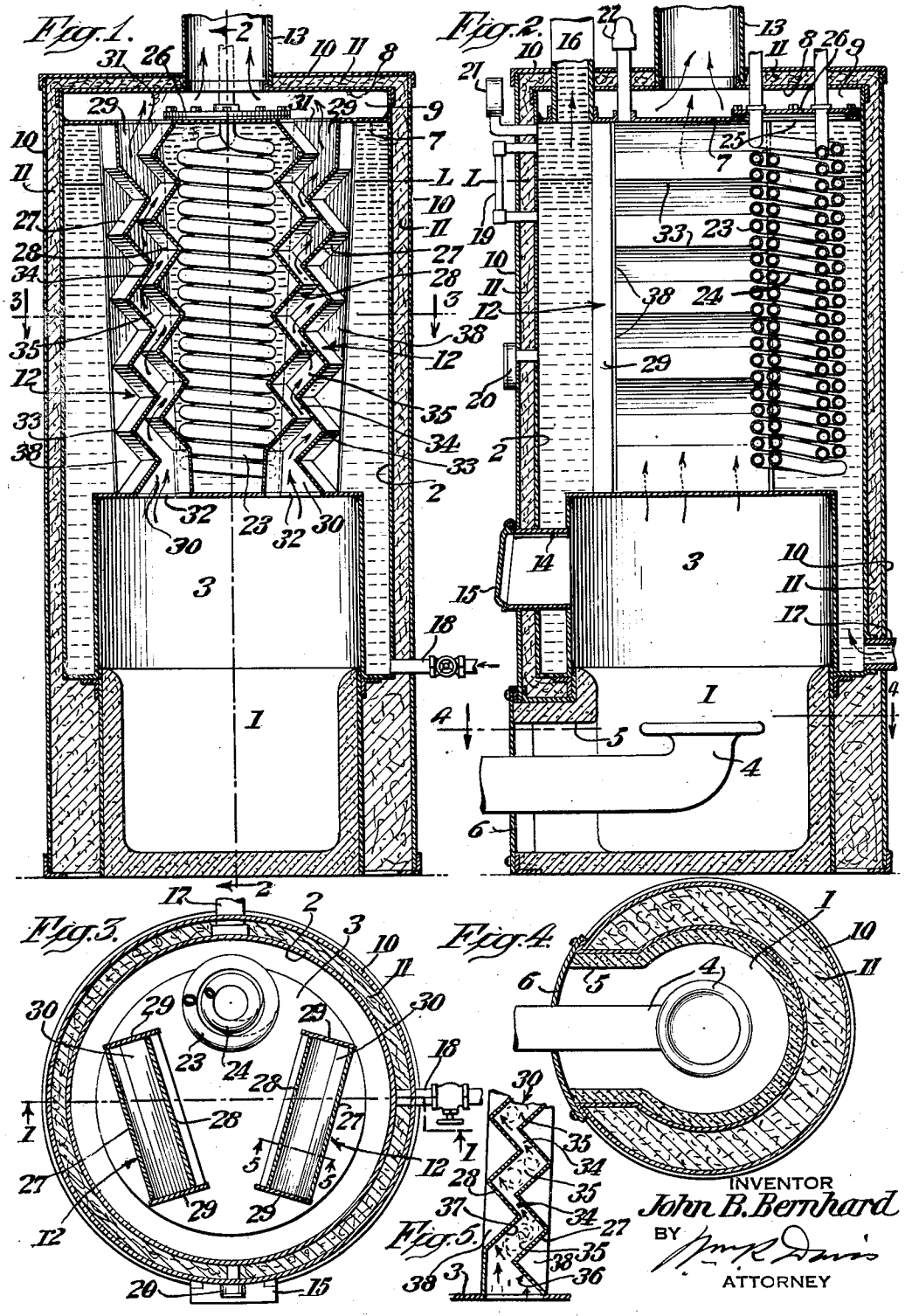
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HEATING APPARATUS

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HEATING APPARATUS

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7 Claims. (Cl. 122—156)

The present invention relates more particularly to improvements in boilers for heating water or generating steam for house heating.

Important objects of the invention are, to provide such a boiler designed for high efficiency and inexpensive manufacture; to provide such a boiler with improved, flue means designed for more efficient transmission of heat from the firebox to the water in the boiler; and to provide such a boiler of extremely simple construction.

Other objects of the invention will appear hereinafter.

In the drawing, Fig. 1 is a vertical section through the boiler, on the line 1—1 of Fig. 3;

Fig. 2 is a vertical section through the boiler, on the line 2—2 of Fig. 1;

Fig. 3 is a horizontal section on the line 3—3 of Fig. 1;

Fig. 4 is a horizontal section on the line 4—4 of Fig. 2; and

Fig. 5 is a detail vertical section on the line 5—5 of Fig. 2.

The boiler is a unitary structure, and includes a firebox 1 and an upright cylindrical water tank 2 formed of metal and supported upon the firebox. The firebox has a metal dome portion 3 projecting upward into the lower portion of the water tank and surrounded by the water-containing space within the tank. An oil burner 4 projects into the firebox through a front opening 5 in the latter. Provision may be made, however, for use of a different kind of fuel. The said opening 5 is closed, around the burner, by a detachable front plate 6. The tank has a flat upper end wall 7, and the side walls of the tank extend beyond said wall and have a metal cap 8 fitted thereon to thereby define a smoke chamber 9 at the upper end of the tank. A metal jacket 10 encloses the firebox, the water tank and the smoke chamber and contains heat-insulating material 11. The firebox dome is connected, through the water space of the tank, to the smoke chamber by flues 12, and a pipe 13 leads upward from the center of the firebox cap 8 to conduct the products of combustion to a chimney or other outlet, not shown. A tubular member 14 leads forwardly from the front of the firebox dome to the exterior of the jacket 10 and defines a peep opening for the firebox. At its outer end said tubular member has a hinged door 15.

A pipe 16 leads from the upper end of the water tank to conduct from the tank either hot water or steam for room heating. A hot water return pipe 17 is connected to the lower end portion of the tank. There is also connected to the lower end portion of the tank a valved cold water supply pipe 18. Outside of the jacket 10 there are a water column gauge 19 and an aquastat 20, both connected to the water-containing space of the tank. The aquastat will have the usual operative connections with the burner to control combustion. Said connections and the outer portion of the burner are here omitted in order to simplify the illustration. In the present illustration the water tank and the piping 16 and 17 are shown charged with water, for hot water heating. For steam heating the water in the tank will be maintained at approximately the level indicated by the line L in Figs. 1 and 2. Outside of the jacket 10 there is a steam gauge 21 connected to the upper end portion of the tank. A steam safety valve 22 is also connected to the upper end of the tank.

Provision is also made in the boiler for heating water for faucet supply. For that purpose there are coils of water piping including a helical outer coil 23 extending downwardly within the water tank and a helical inner coil 24 continuous with the lower end of the coil 23 and extending upwardly within the latter. The upper end of one of said coils is connected to cold water supply piping and the upper end of the other coil is connected to the hot water faucets of the house. The upper wall 7 of the tank has an opening 25 materially offset from the center of the wall and closed by a cover disk 26 detachably secured to said wall around the margins of said opening. Said coils are vertically arranged and supported at their upper ends by the cover 26. The diameter of said opening exceeds that of the larger coil so that the coils are insertible and removable through the opening. The coils and cover disk form a unit for installation and removal. When the coils are in place they are entirely surrounded by the hot water in the tank, for efficient heating of the water in the coils.

The flues 12 are of improved design, for efficient heating of the water in tank 2 by conduction of heat from the hot air and products of combustion from the firebox. They are also designed for inexpensive manufacture. Each flue comprises a pair of side walls 27 and 28 in spaced opposition and each formed of sheet steel or other suitable material of high heat conductivity. Opposite end walls 29 of the same material as said side walls, are welded to the adjacent longitudinal edges of the side walls and form with said side walls the flue passage 30. As shown, the side walls are much wider than the end walls and the

flue passage defined is of elongated, rectangular form in horizontal cross section. The flues are welded at their upper and lower ends to the top wall 7 of the tank and the top wall of the firebox dome respectively, and said walls have openings 31 and 32 registering respectively with the upper and lower ends of the flue passages 30. The flues are arranged at a horizontal angle to each other and diverge toward the coil unit to provide clearance for the latter. The flues also diverse upward slightly. This horizontal and vertical angularity of the flues better distributes them within the volume of water in the tank.

The walls 27 and 28 of each flue are each bent approximately at right agles along a series of spaced horizontal lines to provide each wall with a vertical series of approximately V-shaped corrugations 33. Said corrugations of the opposed walls are in vertically staggered arrangement. That is, the internal ridges of the corrugations of one wall are opposed to the internal troughs of the other wall. The said ridges are also offset from the centers of the opposed troughs. By means of the staggered arrangement of the opposed corrugations the flue passage 30 is given a tortuous form and by means of the off-center arrangement of the opposed ridges and troughs the flue passage is provided with a series of restricted spaces 34 alternating with expanded spaces 35. At the upper and lower ends of each flue the walls 27 and 28 diverge to provide the flue passage with a flared inlet and a flared outlet.

When the hot air and products of combustion enter the lower end of one of the flue passages 30 from the firebox they are first deflected laterally by an inclined surface 36 so that they strike an oppositely inclined surface 37 forming a wall of the first of the wider spaces 35. Thereby the hot air and products of combustion are caused to swirl in said space, the swirl being prolonged by the restricted outlet 34 from said space. This prolonged swirl is repeated in each of the series of expanded spaces along the flue by reason of the angular relation of the restricted inlet to each space and the choking effect of the restricted outlet from each space. Thereby the hot air and products of combustion are caused to give up a maximum amount of their heat to the heat-conducting walls of the flues. All of the flue walls are externally exposed to the water in the tank and the surface areas of the walls 27 and 28 are materially increased by the corrugated form of said walls. This increase in heating area contributes further to the heating efficiency.

In order to further increase the conduction of heat from the flues to the water the walls 28 of each flue are made of a uniform width to extend outward from the outer troughs of the corrugations and form heat-conducting fins 38 exposed to the water in the tank.

It will be seen that my invention provides an improved boiler-type heater of high efficiency and simple, compact and inexpensive construction. While a very satisfactory form of the boiler is disclosed, structural details thereof may be modified without departing from the invention as defined in the appended claims.

What I claim is:

1. A heating apparatus comprising an upright water tank, a firebox beneath said tank and having a dome portion protruding upwardly into the lower portion of the tank, for heating the water in the tank, and a flue extending upwardly from the top of said dome portion of the firebox through the water-containing space within the tank to conduct the products of combustion from the firebox through said space for heating the water, and comprising opposed spaced walls of heat-conducting material exposed to the water at their outer surfaces and bent along parallel horizontal lines to form each with a series of substantially V-shaped corrugations, with the corrugations of one wall in staggered relation to those of the opposed wall and with their internal ridges displaced crosswise from the centers of the opposed interal troughs of the corrugations of said opposed wall, to thereby define a tortuous flue passage alternately contracted and expanded at a series of points therealong, for the purpose set forth.

2. A heating apparatus according to claim 1, characterized in that there are a plurality of flues constructed and arranged as defined in claim 1, each flue is of elongated form in horizontal section, and said flues are arranged at a horizontal angle to each other.

3. A heating apparatus comprising a water tank, a heating chamber associated with said tank, and a flue extending from said firebox through the water-containing space within the tank, to conduct hot air through said space for heating the water and comprising opposed spaced walls of heat-conducting material exposed to the water at their outer surfaces and bent along parallel lines to form each with a series of substantially V-shaped corrugations with the corrugations of one wall in staggered relation to those of the opposed wall and with their internal ridges displaced crosswise from the centers of the opposed internal troughs of the corrugations of said opposed wall, to thereby define a tortuous flue passage alternately contracted and expanded at a series of points therealong, for the purpose set forth.

4. A heating apparatus according to claim 3, characterized in that there are a plurality of flues constructed and arranged as defined in claim 3, each flue is of elongated form in horizontal section, and said flues are arranged at a horizontal angle to each other and extend upwardly and outwardly through the water-containing space, to place the lower ends of said flue closer together than the upper ends.

5. A heating apparatus comprising a water tank, a heating chamber associated with said tank, and an open ended flue extending from said firebox through the water-containing space within the tank and comprising wide opposed spaced side walls of heat conducting material exposed to the water at their outer surfaces and bent along parallel lines to form each with a series of substantially V-shaped corrugations with the corrugations of one wall in staggered relation to those of the opposed wall and with their internal ridges displaced crosswise from the centers of the opposed internal troughs of the corrugations of said opposed wall, and end walls secured to the edges of the opposed side walls, said end walls extending outward to the outer points of the corrugations to close the ends of the pockets formed by the exterior surfaces of said corrugations and to form heat-conducting fins extending into the water-containing space, the said side walls and end walls defining a tortuous flue elongated in horizontal section and alternately contracted and expanded at a series of points therealong.

6. A heating apparatus according to claim 5,

characterized in that the side walls of the flue are disposed to form at their lower ends an enlarged entrance for the products of combustion from the firebox and at their upper ends to form an enlarged outlet from the flue.

7. A heating apparatus comprising a water tank, a firebox associated with said tank, and a plurality of flues formed of heat-conducting material and extending from said firebox through the water-containing space within the tank to conduct the products of combustion from the firebox through said space for heating the water, said flues being elongated in transverse section and arranged at an angle to each other in transverse section, and a unit of coiled piping disposed within the tank to contain water for faucet supply to be heated by said water in the tank, the said flues diverging toward said unit in transverse section to afford space for the unit therebetween.

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