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HUMIDIFYING AIR-HEATING FURNACE

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7 Claims. (Cl. 126-113)

1

The present invention relates to a humidifying heating furnace, and has two primary objects. The first, and perhaps more important, of these is the provision of means whereby dry steam, in suitable quantities, is supplied to the air chamber of a furnace connected in a warm air house heating system. Amazing results in uniformity of heat distribution, in cost of heating, and in the health of occupants of a home so humidified have flowed from the use of my invention in an actual installation, although the associated parts of the installation, and the home itself, were in no way modified.

The second primary object has to do with supplying steam to the combustion chamber of a solid-fuel-burning system, and introducing that steam into the combustion chamber through what may be termed an injector assembly including an air inlet pipe muffled at its outer end in a valved housing. As a result of the provision of such means, I have found that the poorer grades of Indiana coal can be burned effectively to produce a clean, hot fire, with less smoke than usually arises from the combustion of even better grades of bituminous coal.

Further objects of the invention will appear as the description proceeds.

To the accomplishment of the above and related objects, my invention may be embodied in the form illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that change may be made in the specific construction illustrated and described, so long as the scope of the appended claims is not violated.

Fig. 1 is a more or less diagrammatic illustration of a heating furnace with which my steam producing and distributing means has been associated; and

Fig. 2, likewise more or less diagrammatic, is a horizontal section of the same.

Referring more particularly to the drawings, it will be seen that I have indicated a furnace of conventional type by the reference numeral 10. Said furnace comprises a firepot 11 and combustion chamber 12, all surrounded by an outer wall 13 which, in conjunction with the combustion chamber wall 14, defines an air heating chamber 15 including a dome 16 positioned above the top wall 17 of the combustion chamber.

Suitably mounted in the combustion chamber, and preferably hung upon the wall 14 in the manner illustrated, is a boiler box 18 having a restricted port 19 formed in its top wall 20. Supported upon said boiler is a superheater cham-

2

ber 21 interiorly provided with one or more baffles 22, 23, the interior of said chamber 21 being in communication with the port 19. It will be clear that, when water is vaporized in the boiler 18, the resultant steam will be ejected through the port 19 into the superheater chamber 21; and that the passage of the restriction provided by the port 19, together with the provision of the baffles 22, 23, will tend to separate or disengage the steam from entrained water vapor. As further heat is supplied to the steam within the chamber 21, it is completely dried and superheated.

Suitably supported at a suitable point outside the furnace is a water level regulating tank 24 to which water is supplied, from a suitable line 25, through a valve 26 controlled by a float 27 to maintain the water level 28 in the tank 24. Water may flow from the tank 24 through an outlet fitting 29 to which is connected a small pipe 30 leading, through a check valve 31, to a somewhat larger pipe 32 which extends through the air heating chamber 15 and enters the boiler 18 near the base thereof. The check valve 31 opens, of course, toward the boiler 19, so that water may not be forced, by the pressure within said boiler, back through the conduit 13 to the tank 24. The tank 24 is so positioned, and the float valve 26, 27 is so calibrated, that the water level within the boiler 18 will always be maintained well below the top wall 20 of said boiler.

From the upper portion of the superheater chamber 21 leads a pipe 33 through the air heating chamber 15 to the outside of the furnace where, through a reducing coupling 34, it is connected to a small pipe 35 which communicates with a generally spherical trap 36 suitably supported outside the furnace.

The trap 36 is formed with a depending collecting chamber 37 through the bottom wall of which opens a petcock 38, by means of which the collecting chamber 37 may be drained. If, by any chance, entrained water is carried into the trap 36, the expansion of the steam from the small conduit 35 into the chamber 36 will cause that water to drop out of suspension and to be collected in the chamber 37.

A conduit 39, controlled by a valve 40, leads from the upper portion of the trap 36 back into the air heating chamber 15 and, preferably, to the mid-point of the dome 16. Thus steam, at a rate depending upon the condition of the fire in the furnace and the setting of the valve 40, will be discharged into the heated air in the dome 16, at the point at which such air is at its maximum temperature and therefore most ca-

pable of receiving the dry steam so supplied. Obviously, the humidified air will flow from the dome 16 through the usual heat pipes to the outlets into the house.

A further conduit 42 leads from the collecting chamber 37, through a valve 43, to a pipe 44 which extends from the interior of the combustion chamber 12 through the walls 14 and 13 to the outside of the furnace. The internal diameter of the pipe 44 is considerably larger than the external diameter of the conduit 42, and a substantial portion of the length of the pipe 42 is entered in said pipe 44 through the outer end 45 thereof. Obviously, steam flowing through the conduit 42, at a rate determined by the condition of the fire in the furnace and the setting of the valve 43, will provide an injector effect in the pipe 44 to establish an air flow through said pipe into the combustion chamber. Preferably, a housing 46, secured to the furnace wall 13 and enclosing the outer end 45 of the pipe 44, is provided with valve or damper means 47, whereby the rate of air flow to the end 45 of the pipe 44 may be regulated.

I have found that the mixture of air and steam introduced into the combustion chamber through the present operative assembly not only minimizes the production of smoke but accelerates the combustion of poor grades of coal, resulting in a hotter, cleaner fire, with the production of more heat than is otherwise obtainable from such fuel. I have further found that humidification of the air in the dome 16, in the manner herein disclosed, results in enormously improved heat distribution in the building in which the assembly is installed. My own experience followed the installation of a system of the character herein disclosed in connection with a furnace, heat pipes, and return pipes unmodified in any other way. Whereas my home had been very difficult to heat prior to the installation of the devices herein disclosed; and whereas certain rooms had been invariably frigid during the winter, and certain other portions of still other rooms had been so uncomfortably cold as to be substantially unuseable; and whereas only the best grades of solid fuel had been capable of bringing even portions of my home to a liveable temperature, while lower grades of coal had been impossibly unsatisfactory; I found, upon installing the humidifying system herein disclosed, that all of these troubles were cured. Temperatures, from room to room in my house, no longer varied more than a degree or two; no difference measurable by ordinary mercury thermometers could be found in any individual room in the house; I learned that I could burn low grades of coal entirely satisfactorily; and my heating bills were enormously reduced. Because of the fact that dry steam, which is a true gas, as distinguished from wet steam, which is a vapor, is introduced into the air circulating through the house, no condensation and no frosting appears upon my windows even in the coldest of weather. My family and I find that we can sit comfortably in rooms at lower temperatures than were bearable prior to the installation of the humidifying means; and most important of all, my family and I have found that respiratory infections and disturbances to which we were all subject prior to the installation of the structures herein disclosed, are entirely absent from our home.

If desired, a vapor-soluble deodorizing substance, or perfume, or even a vaporizable medication, may be introduced, in desired quantities,

into the tank 24 to flow therefrom through the described system, and so to be introduced into the atmosphere of the space to be heated.

A peculiar phenomenon which I have noticed in the operation of my invention lies in the fact that the steam appears to be injected into the combustion chamber and into the air heating dome in slugs or gulps. As one stands beside the furnace during operation, one hears a periodic swish. It is my present opinion that this phenomenon occurs because the water supply is prevented, during periods of boiling, from entering the boiler, because of a differential in pressure on the two sides of the check valve 31. As that pressure builds up in the boiler, steam flows at a higher and higher rate into the superheater chamber 21, where it is dried, and whence it flows into the trap 36. Pressure, of course, builds up more slowly in the trap 36 because of its increased volume. When the water level in the boiler has dropped almost to zero, the rate of flow of steam out of the boiler begins to exceed the rate of production of steam, whereupon the pressure in the boiler drops to permit a further flow of water from the tank 24 into the boiler, to return the water level in the boiler to that illustrated in the drawings.

While I recognize the fact that I am not the first to have conceived the thought of introducing steam into the combustion chamber of a furnace or into the air circulating through the space to be heated, I believe that the present invention is novel in its production of dry steam and in the fact that it supplies such dry steam to the air to be circulated in relatively small quantities and in recurrent slugs or gulps. The results achieved are entirely different from those produced by any installations heretofore known to me; and I have defined in the appended claims the features of novelty which, in my opinion, combine to produce those novel and improved results.

I claim as my invention:

1. In a humidifying heating furnace having a combustion chamber and an air heating chamber surrounding said combustion chamber and including a dome positioned above said combustion chamber, a boiler within said combustion chamber and having a substantially flat top wall, means for supplying water to said boiler and for maintaining the water level in said boiler always well below said top wall, means defining a superheater chamber within said combustion chamber, said boiler top wall being provided with a restricted part providing communication between said boiler and said superheater chamber, and conduit means leading from said superheater chamber into said dome.

2. In a humidifying heating furnace having a combustion chamber and an air heating chamber surrounding said combustion chamber and including a dome positioned above said combustion chamber, a boiler within said combustion chamber and having a substantially flat top wall, means including a check valve opening toward said boiler for supplying water to said boiler and for maintaining the water level in said boiler always well below said top wall, means defining a superheater chamber within said combustion chamber, said boiler top wall being formed with a port providing restricted communication between said boiler and said superheater chamber, and conduit means leading from said superheater chamber into said dome.

3. In a humidifying heating furnace having a

5

combustion chamber and an air heating chamber surrounding said combustion chamber and including a dome positioned above said combustion chamber, a boiler within said combustion chamber and having a top wall, means for supplying water to said boiler and for maintaining the water level in said boiler always well below said top wall, and an element defining a superheater chamber supported on said boiler top wall within said combustion chamber, said boiler top wall being provided with a restricted port communicating with said superheater chamber at the base thereof, and means for conducting steam from said superheater chamber to said dome, the area of said boiler top wall being substantially greater than the area of said port.

4. In a humidifying heating furnace having a combustion chamber and an air heating chamber surrounding said combustion chamber and including a dome positioned above said combustion chamber, a boiler within said combustion chamber and having a top wall, means for supplying water to said boiler and for maintaining the water level in said boiler always well below said top wall, means defining a vertically elongated superheater chamber having its base supported on said boiler top wall, said boiler top wall being provided with a restricted port communicating with said superheater chamber at the base thereof, baffle means in said superheater chamber defining a tortuous flow path from the base to the top of said superheater chamber, and conduit means communicating with said superheater chamber above said baffle means and discharging into said dome.

5. In a humidifying heating furnace having a combustion chamber and an air heating chamber surrounding said combustion chamber and including a dome positioned above said combustion chamber, a boiler within said combustion chamber, means for supplying water to said boiler and for maintaining the water level therein well below the top thereof, means providing a superheater chamber within said combustion chamber and having restricted communication with the upper portion of said boiler, a substantially spherical trap mounted outside said furnace, conduit means providing communication between said superheater and said trap, second conduit means opening into the upper portion of said trap and discharging into said dome, and third conduit means opening into said trap and discharging into said combustion chamber.

6. In a humidifying heating furnace having a combustion chamber and an air heating chamber surrounding said combustion chamber and

6

including a dome positioned above said combustion chamber, a boiler within said combustion chamber, means for supplying water to said boiler and for maintaining the water level therein well below the top thereof, means providing a superheater chamber within said combustion chamber and having restricted communication with the upper portion of said boiler, a substantially spherical trap mounted outside said furnace and having a depending collecting chamber, valved means opening from said collecting chamber to waste, conduit means providing communication between said superheater and said trap, second conduit means opening into the upper portion of said trap and discharging into said dome, and third conduit means opening into said collecting chamber and discharging into said combustion chamber.

7. In a humidifying heating furnace having a combustion chamber and an air heating chamber surrounding said combustion chamber and including a dome positioned above said combustion chamber, a boiler within said combustion chamber, means for supplying water to said boiler and for maintaining the water level therein well below the top thereof, means providing a superheater chamber within said combustion chamber and having restricted communication with the upper portion of said boiler, a substantially spherical trap mounted outside said furnace and having a depending collecting chamber, valved means opening from said collecting chamber to waste, conduit means providing communication between said superheater and said trap, second conduit means opening into the upper portion of said trap and discharging into said dome, third conduit means opening into said collecting chamber and discharging into said combustion chamber, and independently manipulable valve means controlling flow through said second and third conduit means.

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