

Dec. 26, 1944.

S. W. MEARS

2,365,829

HUMIDIFYING APPARATUS

Filed Sept. 17, 1942

3 Sheets-Sheet 1

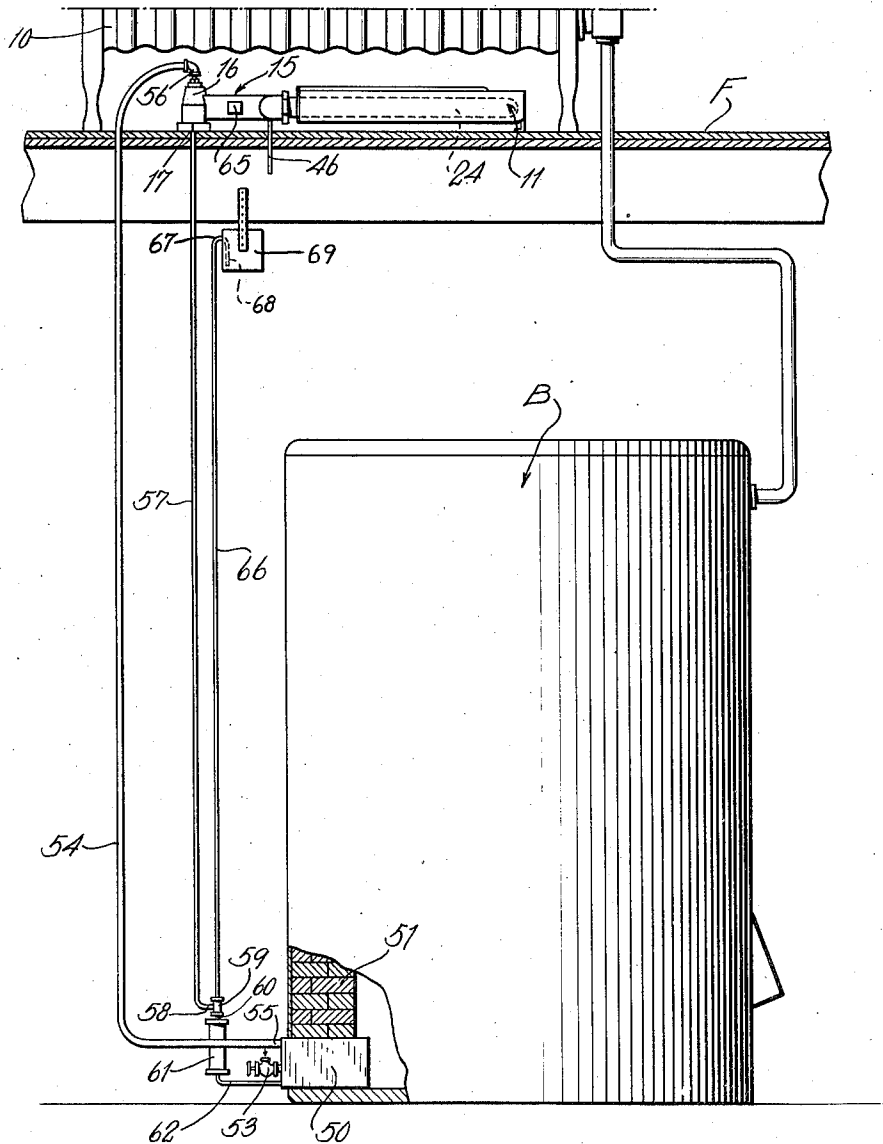


Fig. 1.

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Fig. 2.

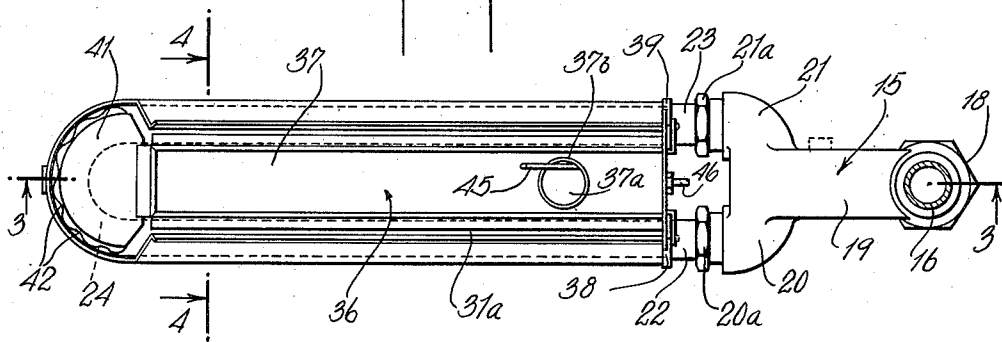


Fig. 3.

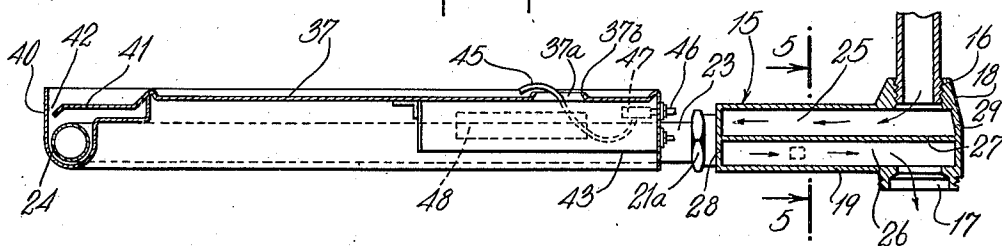
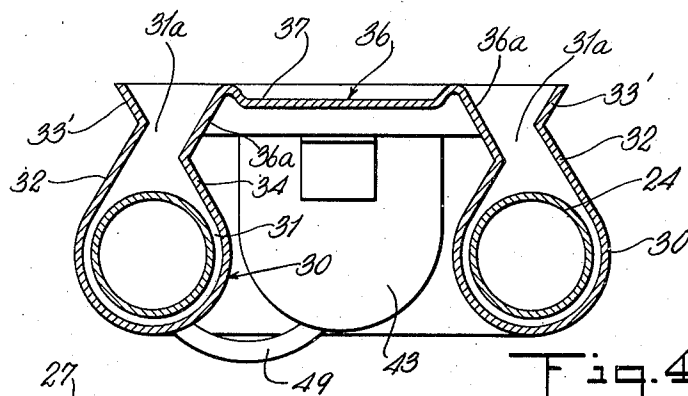


Fig. 4.

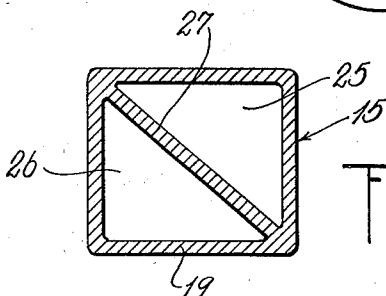


Fig. 5.

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3 Sheets-Sheet 3

Fig. 2.

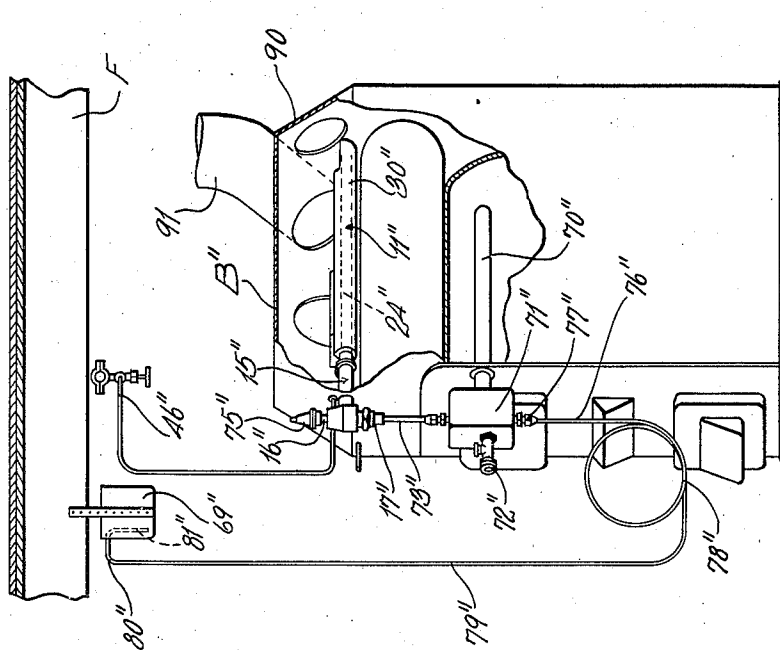
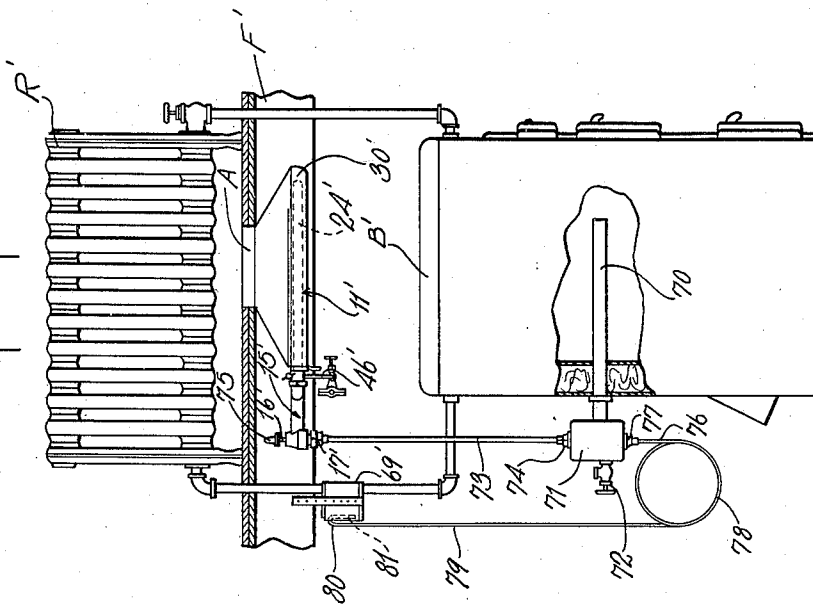


Fig. 6.



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HUMIDIFYING APPARATUS

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Application September 17, 1942, Serial No. 458,655

7 Claims. (Cl. 126—113)

The present invention relates to apparatus for humidifying air and principally to means for using such apparatus with hot water and hot air heating systems.

Humidifying apparatus of the type comprising a pipe or conduit adapted to be connected in the heating line and which is in contact with humidifying medium, for example, being surrounded by an envelope adapted to contain such humidifying medium, which latter is evaporated by the heated material passing through the pipe, cannot ordinarily be used successfully in hot water or hot air systems. The reason for this is that the heat of the hot water or hot air available for passage through the pipe or conduit is insufficient to vaporize the conditioning medium in the envelope at a rate necessary to properly humidify the atmosphere. It is necessary to provide some means of obtaining a temperature within the pipe or conduit of at least the boiling point of the conditioning medium in the envelope which, if water, would, of course, ordinarily be 212° F.

To provide the necessary temperature in the pipe or conduit, a novel arrangement including a special steam generator adapted to be used as an adjunct in connection with hot water or hot air systems is provided by this invention. The steam generator is adapted to be positioned in the fire box of the boiler or furnace or elsewhere, for example, in the combustion chamber of the boiler or furnace. In the case of oil burning furnaces the steam generator replaces several of the bricks in the combustion chamber. Connections from the steam generator are made to the pipe or conduit of the humidifying device in such way that an auxiliary small steam heating system is provided which is independent either of the hot air system or of the hot water system and whose sole purpose is to provide steam heating medium for the pipe or conduit of the humidifier at the correct temperature to cause evaporation of the conditioning medium with which said pipe or conduit is in contact.

One of the problems in connection with such auxiliary steam system to make it practical, is that a small quantity only of water should be capable of being used over and over again in it in order to avoid the necessity of replenishment of the water over long periods of time. For example, it is preferable to provide a steam system whose water need only be replenished once or twice during an entire heating season. This is accomplished in part by the provision of a tight,

closed system from which leakage has been eliminated.

Any steam system requires a steam safety relief. Yet where so small a quantity of water is used in the system (only about two quarts in a practical embodiment of the invention) it is not practical to utilize an ordinary relief valve. This is so because each time such valve vents or blows off, the water from the system is lost and, of course, has to be replaced. Such venting or blowing off occurs very often in such a small system. Thus the use of a relief valve requires frequent replenishment of the lost water and hence it makes the system undesirable.

One of the objects of this invention is to provide a substitute safety relief means which will replace the relief valve and eliminate the problem of frequent replenishment without sacrificing any of the safety features of an ordinary relief valve.

Another object of this invention is the provision of a simplified steam system which renders practical the utilization of humidifying apparatus with hot water and hot air systems without the necessity of exorbitantly expensive alterations in such systems.

Still another object of the invention is to provide adequate humidification systems for use with hot air and hot water heating plants which will be economical in operation and which will require a minimum of attention.

To the accomplishment of the foregoing and such other objects as may hereinafter appear, this invention consists of the novel construction and arrangement of parts to be hereinafter described and then sought to be defined in the appended claims, reference being had to the accompanying drawings forming a part hereof and which show, merely for the purposes of illustrative disclosure, preferred embodiments of the invention, it being expressly understood, however, that various changes may be made in practice within the scope of the appended claims without digressing from the inventive idea.

In the drawings in which similar reference characters denote corresponding parts:

Fig. 1 is a diagrammatic elevational view of one embodiment of the steam system showing one manner of connection to a humidifying apparatus;

Fig. 2 is a top plan view of one form of humidifying apparatus that may be conveniently used with the steam system constituting the subject matter of this invention;

Fig. 3 is a longitudinal vertical section taken

along line 3—3 of Fig. 2 and viewed in the direction of the arrows;

Fig. 4 is a transverse vertical section taken along line 4—4 of Fig. 2 and viewed in the direction of the arrows;

Fig. 5 is a transverse vertical section taken along line 5—5 of Fig. 3;

Fig. 6 is a diagrammatic elevational view of a modified form of the system embodying the principles of this invention showing specifically its application in a hot water heating system; and

Fig. 7 is a similar view of a modified system adapted for application with a hot air heating system.

Referring to the drawings and first to Fig. 1, 10 denotes a conventional radiator which may be adapted for use with a hot water heating system. A humidifying device 11 associated therewith is shown as supported above the floor F in the space below the radiator. This humidifying apparatus 11 may be of any suitable type which involves the evaporation of conditioning medium by the use of steam or other similar heating medium in a conduit in contact with said conditioning medium.

One form of suitable humidifier is shown in Figs. 2 to 5 inclusive. It comprises a connector member 15 which has an inlet 16 and an outlet 17. The connector member 15 generally has T-Y-shape. The cross arm 18 of the T terminates at its opposite ends respectively in the opening 16 and the opening 17. The long arm 19 of member 15 is provided at its outer end with branches 20 and 21 providing substantially Y-shape thereat. These branches have openings fitted with suitable couplings 20a, 21a to which the respective legs 22, 23 of a substantially U-shape pipe conduit 24 are attached.

The entire member 15 is hollow and the long arm 19 is sub-divided into a separate upper chamber 25 and a separate lower chamber 26 by a partitioning member 27. The latter lies diagonally, in the embodiment shown, and extends from the end wall 28 to the opposite end wall 29 of the cross head 18. Opening 16 communicates with chamber 25. The chamber 25 in turn communicates directly with the leg 22 of the U-shaped conduit 24. The other leg 22 communicates directly with the chamber 26 and the latter in turn communicates directly with the opening 17. There is no passageway between the chambers 26 and 25 inside the member 15. Thus any fluid such as steam entering the opening 16 must flow through chamber 25, the legs 22 and 23 of the U-pipe 24, the chamber 26 and thence through the opening 17 of the member 15 or vice versa.

The pipe or conduit 24 is surrounded by an envelope 30. This envelope is substantially concentric about the legs 22, 23 and U bend of said pipe or conduit 24 and spaced from the outer walls thereof to provide a conduit 31 between said outer walls and the inner walls of said envelope.

The envelope is open at 31a along its top and is provided with the upwardly extending outer flange 32, which near its upper edge is bent outwardly to form a flared flange 33'. The envelope is also provided with an upwardly extending inner flange 34. A cover plate 36 having downwardly sloped edge flanges 36a extends across and joins the flange 34. This cover plate on its top face is provided with a shallow basin 37, for a purpose to be presently described. The basin has an opening 37a. This opening is provided with

an upstanding rim 37b whose height is somewhat greater than the depth of basin 37.

Suitable end plates 38, 39, respectively, carried on the respective pipe legs 22, 23 adjacent their connection with the branches 20 of the connector 15, close off the ends of the channel or conduit 31. Also, in the region of the U-bend, the outer wall 40 of the envelope extends vertically instead of being sloped and flared for simplicity of manufacture chiefly. A suitable cover plate 41 attached to the plate 36 covers over the exposed portion of the tube 24 at its U-bend. This plate 41, however, is so shaped and admeasured as to leave a space 42 between its outer edge and the inner surface of wall 40 of the envelope to permit escape there of vapor as will be presently described.

A float tank 43 admeasured to fit in the space between the legs 22, 23 below the cover plate 36 is suitably supported therebetween. A conditioning medium such as water is adapted to be delivered to the basin 37 of the cover plate 36 through a delivery pipe 45. This delivery pipe is adapted to be connected to any suitable line of water supply 46.

A suitable valve 47 in the water supply line 46 and suitably associated with the float tank is provided. This valve is controlled suitably through the agency of a float 48 within the float tank so that the conditioning medium delivered through the pipe 45 to the cover 36 may be automatically controlled in response to the rate of evaporation of water or other conditioning medium from the envelope 30. The conditioning medium delivered to the basin 37 spills over the edges thereof into the conduit 31 from whence it is evaporated by the heated conduit. Suitable interconnection 49 is provided between the float tank and the envelope so that the level of conditioning medium in the envelope is equalized with that in the float tank. As a result, the level of the float 48 is responsive to the level of the liquid in the envelope 31 and, therefore, serves to control the opening and closing of the valve 47 through suitable coupling means to cause automatic feed of conditioning medium through the delivery pipe 45 to replenish that evaporated from the envelope. The construction or arrangement of the automatic means for controlling delivery of conditioning medium does not constitute a part of the present invention and may be of any suitable type. It may, for example, be that shown in the application of Gregory Brown, entitled "Humidifying apparatus and control therefor," about to be filed.

In adapting the humidifying device 11 above described for use with a hot water system, the steam heating medium for the pipe or conduit 24 may be obtained as shown in Fig. 1.

A water heater 50 is inserted into the combustion chamber of the furnace B. In case this furnace is of the oil heater type the heater 50 may replace some of the bricks 51 in the combustion chamber. The heater 50 is of any suitable type. It has a suitable inlet valve or faucet 53 for filling it with water to the required level. A steam riser pipe or conduit 54 is suitably connected at 55 to the heater 50 and also at 56 to the opening 16 of the connector member 15 of humidifier 11. A return flow pipe 57 is connected suitably to the opening 17 of the member 15 and at 58 to a T-joint 59. The T-joint is connected by a pipe 60 to a nipple 61 and the latter, in turn, is connected by a pipe 62 to the heater 50. Thus steam generated in the heater 50 moves upwardly through the riser 54 through the connect-

ing member 15, through the U pipe 24 of the humidifying device 11 and the condensate returns to the heater 50 through the pipe 57, T-joint 59, nipple 61 and pipe 62.

A suitable air relief valve 65 of any conventional type is provided, for example, on the connector member 15. This valve is so located in the connector member 15 as to provide proper venting of air from the closed steam system just described to insure circulation of steam in the said system to provide the necessary heat in the U pipe 24 for evaporating the conditioning medium in the envelope 30 surrounding said pipe 24. It may, for example, communicate with chamber 26. The steam system just described requires a safety relief. Such safety relief, as has been hereinbefore pointed out, should be of such a type as to prevent loss of water from the said steam system. To this end, a relief pipe or conduit 66 is connected to the T-joint 59. This relief pipe has a bent over portion 67 at its upper end and the shorter leg 68 extends nearly to the bottom of a suitably supported over-flow tank 69. Pipe 66 and its leg 68 form a siphon arrangement for a purpose to be presently described.

The steam system is adapted to operate at comparatively low normal pressure, for example about 2 pounds. Under such conditions the length and diameter of relief pipe 66 are so ad-measured that the pressure of the steam in the system raises water therefrom to a point in the relief conduit 66 well below the level of the over-flow tank 69. However, should the pressure in the system increase above the normal pressure, water therefrom will be forced to escape through the outlet end 68a of the relief conduit 66 into the overflow tank 69 thereby relieving the excessive steam pressure in the system. When the excessive pressure terminates or returns to normal, the water in the overflow tank 69 is automatically returned to the system by the siphon action of the relief pipe 66 and its leg 68.

Since there can be little or no evaporation of the water in the overflow tank 69 during the short period it is in the tank, and since the water therein is automatically returned to the system through the said siphoning action, it will be seen that the safety relief construction provided is very effective in conserving the water of the system. That is, the steam system remains essentially a closed one so that there is little chance of water loss. Therefore, replenishment is required only at very rare intervals.

An alternative steam system supply for utilizing a humidifier with a hot water system is shown in Fig. 6. In this figure, the radiator R' is connected in conventional manner in a hot water system including the furnace B'. The humidifier 11' is of substantially identical construction with that shown in Figs. 1 to 5 inclusive. In this instance, it is shown supported below the level of the floor F'. The floor is suitably apertured at A to permit the vaporized humidifying medium from the humidifier to rise through said aperture A and around the coils of the radiator R' before circulating in the room or building.

The auxiliary steam system for supplying the necessary steam in the conduit 24' of the humidifier 11' has the following construction: A heater 70 of any suitable type is inserted into the fire box of the boiler or furnace B'. This heater is connected to a header 71. The latter is of any suitable type and serves as a separator for steam and water. The header 71 is provided with an inlet supply faucet 72 for replenishment of the

water necessary in the auxiliary steam system. It is so located on the heater that it serves also as a gauge to the level of water in the container. Thus if water is poured into it until the faucet tends to overflow the water level is such then that the heater is almost full. A riser pipe 73 is connected to the header at 74 above the normal water level in the heater and header and to the connector member 15' of the humidifier at 17'. An air valve 75 of any conventional type is attached in the opening 16' of the connector member 15'. Thus steam generated in the heater 70 rises through the header 71 and riser pipe 73 into the connector member 15' and circulates through the steam pipe or conduit 24' of the humidifier. Any air in the system vents through the air valve 75. Water condensate flows back to the header 71 and the heater 70 through the same riser pipe 73. The system just described constitutes a miniature single return steam heating system of conventional type in which the humidifier pipe 24' replaces a radiator. The steam flowing through pipe 24' serves to heat the conditioning medium in the envelope 30' and to vaporize it in sufficient quantity to provide proper humidification. Water for conditioning medium may be supplied to the envelope 30' from the supply line 46'.

As with the system of Fig. 1, a safety relief must be provided. To this end a relief tube or conduit 76 is connected at 77 to the header 71. This conduit is suitably looped at 78 to provide a trap to prevent escape of steam therethrough in the event that the water level in the header or heater 71 falls too low. An extension 79 of the tube 76 rises upwardly from loop 78 and is bent over at 80 with a short leg 81 terminating in the overflow tank 69' supported suitably above the level of the heater 70. This relief arrangement operates substantially identically with that of Fig. 1. Normally the pressure in the steam system is about 2 pounds. The extension 79 of tube 76 is so admeasured in diameter and length that such normal pressure is insufficient to force water of the steam system in the pipe 79 to overflow into the tank 81. However, should the pressure in the steam system become excessive, the water will be forced outwardly through the end 81 of the pipe 79 into said tank 69' in sufficient quantity to relieve the excessive pressure in the system. When the pressure in the system returns to normal, the water in the overflow tank 69 will be automatically returned to the system through the siphoning action of the portions 79 and 81 of the tube 76. Little if any loss of water from the steam system occurs and replenishment of water is not required very often.

Fig. 7 shows a steam system identical with that shown in Fig. 6 except that the humidifier 11'' is shown located in the hot bonnet 90 of an air furnace F'', so that the humidifying medium vaporized in the humidifier 11'' co-mingles with the hot air in said hot bonnet before it passes through the ducts 91 leading to the room to be heated. All parts having the same reference characters as those shown in Fig. 6 but double primed operate in identical manner and for the same purpose and it is not believed necessary to redescribe the same.

While specific embodiments of the invention have been described, it is to be understood that variations in construction may be made in practice without departing from the principles of the invention. There is no intention of limitation to the exact details shown and described.

What is claimed is:

1. In combination, a humidifier, a heating conduit within said humidifier and in contact with humidifying medium therein for evaporating said medium by the heat of said conduit, steam generator means for heating said conduit with steam, means connecting said steam generator with said heating conduit for delivering generated steam thereto, an overflow container located above the level of said steam generator, a relief conduit connected to said generator in a portion thereof containing water, and a siphon constituting part of said relief conduit with its shorter leg extending into said overflow container and terminating adjacent the bottom thereof whereby excessive steam pressure will force temporary escape of water from said steam generator through said relief conduit and siphon into said overflow container and whereby said siphon will automatically return the temporarily escaped water in said container to said steam generator upon termination of excessive steam pressure.

2. In a heating system, means for providing heating medium for the system, a humidifier in conjunction therewith, a heating conduit within said humidifier and in contact with humidifying medium therein for evaporating the latter by the heat of said conduit, steam generator means for heating said conduit with steam, said steam generator means being independent of said first-named means, means connecting said steam generator means with said conduit for delivering generated steam thereto, an overflow container located above the level of said steam generator means, a relief conduit comprising an upwardly extending portion and a downwardly extending portion of shorter length than the upwardly extending portion, said portions acting as a siphon, means connecting the upwardly extending portion of said relief conduit to said steam generator means adjacent the bottom of the latter, and said downwardly extending portion of said relief conduit extending into said overflow container and terminating adjacent the bottom thereof, whereby excessive steam pressure will force water from said steam generator means through the portions of said relief conduit into said overflow container, and subsequent reduction of steam pressure will return the said forced water to said generator by siphoning action provided by said portions of said relief conduit.

3. In a heating system, a furnace, means therein for providing heating medium to said system, a humidifier, a heating conduit in said humidifier in contact with humidifying medium for evaporating the latter by the heat of said conduit, means for heating said conduit comprising an auxiliary water heater within said furnace for generating steam, said heater being independent of said first-named means, means connecting said heater with said heating conduit for delivering steam thereto, return flow means connecting said heating conduit with said water heater for returning steam condensate to said heater, an overflow container positioned above the level of said water heater, a relief conduit comprising an upwardly extending portion and a downwardly extending portion of shorter length than the upwardly extending portion, said portions being adapted to act as a siphon, means connecting the upwardly extending portion of said relief conduit to said water heater below the level of water in the water containing portion thereof, and said downwardly extending portion of said relief conduit extending into said overflow container and

terminating adjacent the bottom thereof, whereby excessive steam pressure will force water from said heater through the portions of said relief conduit into said container, and subsequent reduction of steam pressure will return the water in said container to said heater by the siphoning action provided by said portions of said relief conduit.

4. In a hot water heating system, a furnace, means within said furnace for heating hot water for the system, a humidifier, a heating conduit in said humidifier in contact with humidifying medium for evaporating the latter by the heat of said conduit, means for heating said conduit with steam comprising an auxiliary water heater within said furnace for generating steam, said steam generating means for the humidifier being independent of the hot water heating means within the furnace, a header connected to said heater, a common steam delivery and return flow conduit connecting said header with said heating conduit of said humidifier, an overflow container positioned above the level of said water heater, a relief conduit connected adjacent to the bottom of said header and below the level of water in said heater and extending upwardly to said overflow container, syphon means arranged at the upper end of said relief conduit and extending into said overflow container and terminating adjacent the bottom of the latter, whereby any excessive pressure of steam will force temporary escape of water from said heater through said relief conduit and syphon means into said container, and whereby on termination of excessive pressure said syphon means will effect return flow of the temporarily escaped water in said container through said relief conduit to said header.

5. In a heating system, a furnace, means within said furnace to provide heating medium for said system, a humidifier, a heating conduit in said humidifier in contact with humidifying medium for evaporating the latter by the heat of said conduit, means for heating said conduit with steam comprising an auxiliary water heater within said furnace for generating steam, said steam generator means being independent of said first-named means within said furnace, a header connected to said heater, a common steam delivery and return flow conduit connecting said header with said heating conduit of said humidifier, an overflow container positioned above the level of said water heater, a relief conduit connected adjacent to the bottom of said header and below the level of water in said heater and extending upwardly to said overflow container, syphon means arranged at the upper end of said relief conduit and extending into said overflow container and terminating adjacent the bottom of the latter, whereby any excessive pressure of steam will force temporary escape of water from said heater through said relief conduit and syphon means into said container, and whereby on termination of excessive pressure said syphon means will effect return flow of the temporarily escaped water in said container through said relief conduit to said heater, and said relief conduit being coiled in a portion thereof to provide a steam trap.

6. In a hot air heating system, a furnace, a hot bonnet, a humidifier in said hot bonnet, a heating conduit in said humidifier in contact with humidifying medium for evaporating the latter by the heat of said conduit, means for heating said conduit with steam comprising a

water heater within said furnace for generating steam, a header connected to said heater, a common steam delivery and steam condensate return flow conduit connecting said header with said heating conduit of said humidifier, an overflow container positioned above the level of said water heater, a relief conduit connected adjacent the bottom of said header and below the level of water in said heater and extending upwardly to said overflow container, siphon means arranged at the upper end of said relief conduit and extending into said overflow container and terminating adjacent the bottom of the latter, whereby any excessive pressure of steam will force temporary escape of water from said header through said relief conduit and said siphon means into said container, and whereby on termination of excessive pressure, said siphon means will effect automatic return flow of the temporarily escaped water in said container through said relief conduit to said header.

7. In a humidifying system for use with radiators or the like, a humidifier, a conduit in said

humidifier in contact with a humidifying medium, means for supplying steam heat for said conduit, said means comprising a steam generator and means for delivering steam generated therein to said conduit, and safety relief means associated with said steam generator, said last named means including a relief conduit communicating with said steam generator adjacent the bottom thereof and extending upwardly above the level of said generator, and an overflow tank located above the level of said generator, said relief conduit being bent over in a portion thereof and extending to said tank with its free end terminating adjacent the bottom of said tank to act as a siphon, whereby excessive steam pressure will force water from said steam generator through said relief conduit into said overflow tank, and subsequent reduction in pressure will return the said forced water to said generator by siphoning action provided by the bent-over portion of said relief conduit.

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