Dec. 6, 1938. J. A. WILSON 2,139,429

HUMIDIFIER

Filed Feb. 21, 1936

Fig. 1

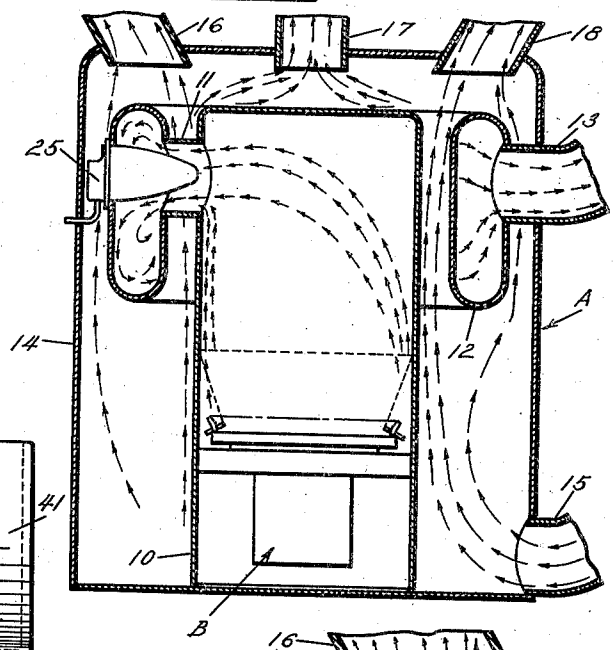


Fig. 3

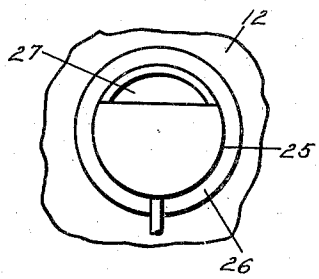
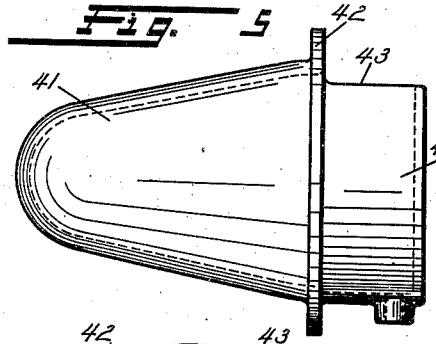


Fig. 5



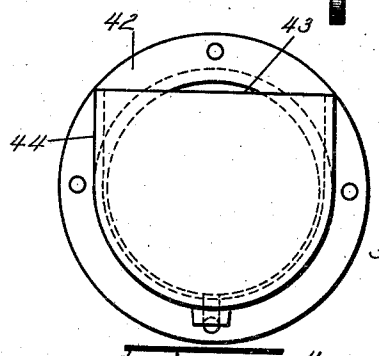


Fig. 4

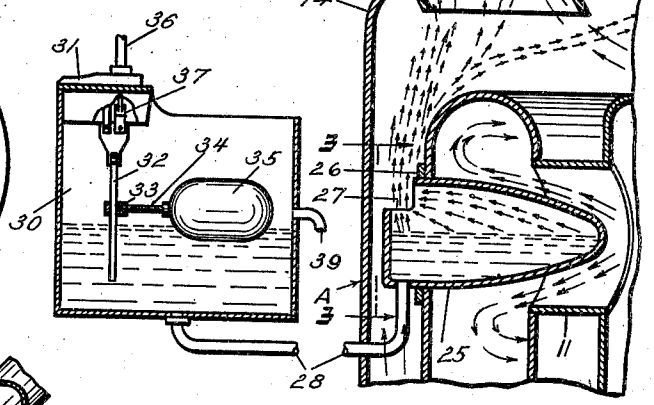


Fig. 2

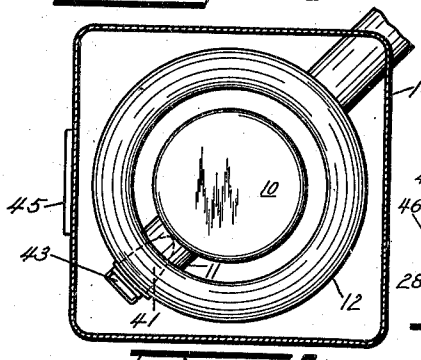


Fig. 6

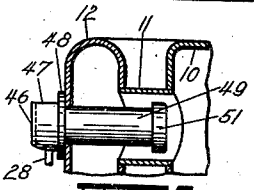


Fig. 7

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UNITED STATES PATENT OFFICE

2,139,429

HUMIDIFIER

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Application February 21, 1936, Serial No. 65,137

8 Claims. (Cl. 126—113)

This invention relates to humidifying apparatus, and more particularly to such apparatus as employed in connection with furnaces employing oil burning means or other intermittently operated heating means. The present application constitutes a continuation-in-part of my application Serial No. 22,246, filed on May 18, 1935, entitled Liquid fuel burning apparatus.

In prior solid fuel burning furnaces and like apparatus of the hot air type wherein substantially continuous combustion takes place, it has been the practice to incorporate a humidifying device, usually in the form of a trough, adjacent one of the heated walls of the furnace to increase the moisture content of the heated air discharged from the furnace. Such systems have proven generally satisfactory as combustion in such apparatus is continuous and the water in the humidifying apparatus is maintained at a sufficiently high vaporizing temperature. In oil burning and gas burning hot air furnaces and other types of furnaces wherein intermittent operation of the fuel burning means is characteristic, I have found that by reason of the entirely different conditions encountered, humidifying devices of the prior art are unsatisfactory.

One of the reasons why prior humidifying apparatus will not operate successfully in a furnace of the intermittently heated type is that combustion takes place at spaced intervals and is not continuous with the result that, during the idle period when the burner or like heating unit is shut off, the water in the humidifying trough cools to such an extent that when operation is again resumed, considerable time is required for the water to again resume the required vaporizing temperature with the result that proper humidification of the air being heated is not obtained.

Humidification problems are rendered even more complex when a fan or like means is employed to force the air through the air heating chamber of a furnace at a relatively high velocity because the air by reason of such forced circulation is not heated to as high a temperature as in a natural draft system. The relatively high velocity of the air increases the rate of heat transfer as compared to the rate in old systems with the result that the temperatures are much lower and therefore water in a humidifier located therein does not begin to properly vaporize much less boil.

In overcoming the disadvantages of the prior art, it is a major object of my invention to provide novel humidifying means that fully meet the peculiar requirements of oil burning and other intermittently operating heating apparatus such as gas furnaces and the like.

It is a further object of my invention to provide a novel container for use in connection with humidifying apparatus employed in a furnace wherein a maximum portion of the surface of the container is subjected to the products of combustion from the heating means of the furnace at their highest temperature.

It is still a further object of my invention to provide novel humidifying means for use in connection with a furnace or like device wherein the liquid container employed in connection therewith is readily accessible for cleaning purposes and for inspection whereby such means may be maintained at its highest efficiency at all times.

It is still a further object of my invention to provide a humidifier of novel design having a maximum surface area subjected to heat to insure a maximum rate of vaporization with a minimum volume of water so that the humidifier may be satisfactorily employed in combination with a humidostat or like automatic control.

A further object of my invention is to provide a novel humidifier particularly for use in connection with furnaces of the hot air type, wherein on increasing the volume of water contained therein, a relatively greater proportional increase of vaporizing area is obtained than in humidifiers of prior design, thus insuring increased vaporization with an increased volume of water whereby the rate of vaporization may be easily controlled.

Still a further object of my invention is to provide novel humidifying apparatus wherein the rate of vaporization is readily controlled by varying the level of the liquid in the humidifier.

A further object of my invention is to provide novel humidifying apparatus wherein the evaporating capacity thereof may be easily changed to suit different installations and conditions of operation.

Still a further object of my invention is to provide a humidifier of novel design wherein the area thereof subjected to heat may be readily reduced or enlarged to correspondingly change the evaporating capacity of the humidifier.

Further objects of this invention will become apparent as the description proceeds in connection with the annexed drawing, and from the appended claims.

In the drawing—

Figure 1 is a vertical sectional view of a hot air furnace embodying a fuel burner and a pre-

ferred form of humidifier of the present invention.

Figure 2 is a fragmental vertical sectional view through the furnace of Figure 1, illustrating the humidifier on a larger scale, and the float tank assembly preferably employed therewith.

Figure 3 is a view illustrating the humidifier unit as viewed on line 3—3 of Figure 2.

Figure 4 is a view similar to that of Figure 3 illustrating a second modification of the humidifier of the present invention.

Figure 5 is a side view of the humidifier shown in Figure 4.

Figure 6 is a sectional plan of a modified form of furnace embodying the humidifier of Figures 4 and 5.

Figure 7 is a side elevation of a further preferred embodiment of a humidifier of the present invention wherein the surface thereof may be readily changed in extent to change the evaporating capacity of the humidifier.

With continued reference to the drawing wherein like reference characters have been employed to designate like parts throughout the several views thereof, and with particular reference to Figure 1, a furnace A, in which a preferred embodiment of the humidifying apparatus of the present invention is installed, is illustrated as comprising an inner member 10 in the shape of an upright cylindrical shell. Adjacent the top of shell 10 is an opening with which a short pipe 11 registers. Encircling the upper part of shell 10, but spaced therefrom is an annular flue pipe 12 which is connected to pipe 11. The products of combustion, produced by the fuel burning apparatus designated generally at B, which may be an oil or gas burner of conventional design operable either intermittently or constantly, pass upwardly along the inner surface of shell 10 and through pipe 11 into annular flue 12. As the products of combustion pass into annular flue 12 they divide, one half of the gases going in each direction and passing through the opposite portions of the annular member to a point where they again join and are discharged through a pipe 13.

The air to be heated by shell 10 is maintained in contact with the latter by means of a jacket or second shell 14 which completely encloses shell 10 and is spaced therefrom to provide an air heating chamber. Preferably the cool air exhausted from the rooms or other space that is being heated is conducted through an air inlet pipe 15 secured to jacket 14 adjacent the lower part thereof. As the air is heated and passes upwardly through the jacket 14 around the shell 10, it is conducted into the rooms by means of conduits such as shown at 16, 17 and 18.

In Figure 1, the paths taken by the air currents have been diagrammatically indicated by arrows. It will be noted that the cool air entering the jacket 14 by way of member 15 passes upwardly along and is contacted with the outer surface of the combustion chamber or shell 10. Portions of the upwardly moving air current pass over the inner and outer sides of annular member 12 and are heated thereby. The heated air after rising in the shell passes into the various rooms through conduits 16, 17 and 18. In some cases, fans or other means to force circulation are employed in connection with conduit 15.

In order to satisfactorily humidify the air passing through the conduits 16, 17 and 18, the present invention contemplates the provision of a humidifying container 25 as shown in Figure 1, container 25 being positioned with a portion thereof in contact with the products of combustion and a portion thereof in contact with the air being heated.

With particular reference to Figures 2 and 3, the elongated container 25 extends through an opening in the outer wall of annular member 12 and is provided with a flange 26 which is secured to annular member 12 in gas tight relation. Container 25 is provided with an opening 27 through which the vapors generated in the container may escape and mingle with the air passing into conduits 16, 17 and 18.

It will be noted from an inspection of Figures 2 and 3 that container 25 is relatively small and has comparatively small water capacity. Because of its registry with and extension into pipe 11, it is located in the direct path of the products of combustion and therefore the water contained therein is subjected to maximum heat when the fuel burning means B is operating. As shown in Figures 1 and 2, that section of container 25 which is exposed to the flow of the products of combustion through pipe 11 may be of the general shape of a hollow cone and be streamlined, but preferably it is shaped substantially as the end portion of a prolate spheroid. This arrangement provides a maximum of heat exchange surface with a minimum of resistance to the flow of the products of combustion through pipe 11.

Because of the relatively small water capacity of container 25 it is preferred to employ a float mechanism in connection therewith for maintaining the water at a selected level in the container, a preferred form of the float mechanism being shown in Figure 2. The float control as shown in Figure 2 comprises a chamber 30 having a support portion 31, and a pipe 28 tapped into the bottom wall thereof. Pipe 28 is connected to container 25 exteriorly of shell 10 so that none of the hot products of combustion come into contact with any part of pipe 28. Mounted for rocking movement in container 30 is a lever 32 having a collar 33 adjustably mounted thereon. Collar 33 supports a float arm 34, the latter being threaded into collar 33 and functioning as a set screw, so that by rotating the arm 34, collar 33 may be loosened and adjusted upwardly or downwardly on lever 32 so as to adjust the water level within chamber 30. A float 35 is secured to arm 34 in any suitable manner.

Cooperating with a water inlet is a valve seat which is carried by suitable linkage 37 pivotally connected to lever 32. A supply pipe 36 is secured to the chamber 30 and communicates with the water inlet. From the structure described it is apparent that the chamber 30 will be filled with water from pipe 36 to the level shown in Figure 2, when the float 35 will operate arm 34 and lever 32 to shut off the flow. As water seeks a constant level, it is apparent that the level of the water in the container 25 will always be the same as that in chamber 30. In order to prevent the water from rising sufficiently high to flow out of the opening 27 in the container 25 when for some reason or other the float should fail to shut off the flow of water, chamber 30 is preferably provided with an overflow spout 39 which is located below the level of opening 27 and connected to a drain.

So long as water pressure is available in pipe 36, chamber 30 and container 25 will have a constant water level maintained therein. It is apparent that the float mechanism can be embodied in container 25, but it is preferred to mount the float in

a separate unit so as to protect it from the highly heated parts of the container 25 and the adjacent elements of the furnace to thereby insure long life of the float mechanism. While the float mechanism has not been shown as supported on the furnace, it is preferably mounted on the exterior of casing 14 and toward the rear thereof.

From the structure thus far described, it is apparent that as the burner B is intermittently put in operation, heated air will be supplied to conduits 16, 17 and 18, and by reason of the comparatively small volume of water located in container 25 and because of the location of the latter in a highly heated region, the flue gases will rapidly heat the water to boiling temperature, whereupon the vapor therefrom will rise and mix with the air being heated.

By reason of the construction and location of container 25, it is possible to readily inspect and service it. Upon the formation of a deposit or scale of lime or the like (which precipitates out of the water at temperatures above 140° F.) in container 25 of sufficient thickness to interfere with the efficiency thereof, a cover on the front of casing 14 similar to door 45, Figure 6, may be removed and the deposit easily removed with a suitable scraper.

In Figures 4 and 5 I have illustrated a preferred modification of the humidifier of Figures 2 and 3. In this modification, the tapered portion of a container 41 is of slightly different shape from that of container 25 as shown, a flange 42 being provided to secure the container in gas tight relation to annular member 12. An opening 43 is provided corresponding to the opening 27 of container 25, the opening 43 being of slightly different shape than the opening 27 in that as shown in Figure 4, the side walls 44 serve to define a passage 43 extending vertically above the center of container 41 to a point adjacent the top thereof. This arrangement enables the maintenance of a higher water level in the container 41 when greater humidification is desired.

In Figure 6, I have shown a construction corresponding generally to the construction shown in Figure 1, with the exception that the outer shell 14' is square or generally rectangular in shape rather than circular as is the shell 14 of the furnace of Figure 1. In such an arrangement, it has been found preferable to mount the container 41 adjacent a corner of the outer shell towards an upper front door 45 of the furnace, communicating with the space between the inner and outer shells 10 and 14. Such an arrangement in a corner not only insures the passage of a maximum quantity of air over the opening of the humidifier but also provides for ready access to the humidifier for inspection and cleaning thereof. The arrangement shown in Figure 6 illustrates a furnace of the type which is ordinarily supplied with a door provided for the purpose of gaining access to a humidifier pan or the like supported upon the front wall of the combustion chamber of the furnace. In such furnaces no additional door need be provided for gaining access to the humidifier of the invention as shown in Figure 6.

It is to be noted that the containers 25 and 41 of the present invention are of such shape that as the water level increases therein, there is a material increase of surface area of the container that is directly in contact with the water contained therein. This shape of container which may be termed "shoe-shaped" has been found to be particularly useful in the heating of water for humidifying purposes where intermittently-operating heating means is employed and has proven much more satisfactory in practice than the prior types of containers.

By controlling the level of the water in containers 25 or 41, it has been found possible to vary the humidifying action thereof. Since the control of the level of the water in the containers may readily be varied by adjustment of the float control device without the furnace, it follows that the float control device affords a ready and convenient control for controlling humidification at all times.

Figure 7 illustrates a further preferred embodiment of the humidifier of the present invention wherein the size of the portion of the container exposed to the heating gases may readily be changed to vary the evaporating capacity of the humidifier. As shown a hollow outer casting or casing 46 is provided substantially of the same shape as casing 41 of Figure 5, an opening 47 being provided at the top thereof as shown for the escape of vapors generated in the container. Casing 46 is formed with a flange 48 to permit of ready fastening to the annular chamber 12 of a furnace, and a liquid inlet 48 is provided corresponding to the inlet 28 of Figure 2.

Flange 48 is formed with a tapped bore of a size to accommodate the threaded end of a pipe section 49. Section 49 may be a nipple of which there are a number of conventional sizes available commercially at very low price and is preferably closed at its inner end by a standard pipe cap 51.

Since the portions 49 and 51 of the container are subject to the heated gases passing into and through the annular chamber 12, it is evident that by the single step of changing the size of the nipple of pipe section 49, the surface area of the container in contact with the heating gases may readily be varied and the evaporating capacity of the humidifier correspondingly varied.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A humidifier for use in connection with hot air heating systems wherein products of combustion are employed to heat air, a container for liquid to be vaporized and discharged into the heated air, said container being formed in the general shape of a cone, a substantially horizontally extending conduit for conducting products of combustion in heat exchange relation with the air to be heated, said cone being disposed with its axis extending substantially horizontally and in such a manner that the apex thereof is positioned approximately in the center of said conduit in the path of the products of combustion whereby a maximum rate of vaporization of the liquid in said container is maintained.

2. In a hot air heating system, a source of products of combustion surrounded by a substantially circular shell, a second shell surrounding said first shell to define a chamber for the air to be heated, a hollow annulus spaced from said shells and positioned therebetween, a conduit connect-

ing said annulus with said inner shell to conduct products of combustion from said inner shell to said annulus, a container for liquid positioned in said annulus and extending into said conduit, wherein it is subject to the heat of said products of combustion, said container having an aperture opening into the space between the two shells whereby vapors from the liquid in the container will be discharged into the air being heated.

3. In a hot air heating system, a source of products of combustion surrounded by a substantially cylindrical shell, a second shell of generally rectangular cross section surrounding said first shell to define a chamber for air to be heated, a hollow annulus spaced from said shells and located therebetween, a conduit connecting said annulus with said inner shell to conduct the products of combustion from the inner shell to said annulus, and a container positioned in said conduit where it is subject to the heat of the products of combustion, said container being provided with an aperture opening into the space between said inner shell and a corner of said outer shell, whereby the vapors generated in said container are discharged into a maximum quantity of the air surrounding said annulus.

4. In a hot air heating system, a shell for surrounding a fuel burning means and confining the products of combustion therefrom, a second shell surrounding said first shell and spaced therefrom, an elongated substantially horizontally extending conduit arranged in the space between said shells, means affording fluid communication for the passage of products of combustion between said first shell and said conduit, and a humidifier comprising a substantially horizontally disposed container extending into the direct path of the product of combustion flowing through said fluid communication means and having an opening through which vapors may escape to the space between said shells.

5. A humidifier for use in connection with hot air heating systems comprising a container for liquid to be vaporized, said container being formed with a portion of substantially the shape of the end portion of a prolate spheroid having an enlarged lateral opening provided adjacent the base of said container portion to permit free escape of the vapors generated therein.

6. In a hot air heating system of the character wherein combustion of a fluid fuel takes place intermittently, said system embodying means for confining the products of combustion, a heated air chamber at least partly surrounding said confining means, said confining means having an apertured lateral heat exchange wall, a humidifier comprising a hollow fluid container extending substantially horizontally through the aperture in said wall into the path of the products of combustion, that portion of said container which is disposed in the path of the products of combustion being of generally conical shape with its base adjacent the aperture in said wall and its apex within said confining means, means defining a gas tight joint where said container enters said lateral wall so that the products of combustion are prevented from escaping to said chamber, and means externally of said confining means for introducing liquid into said container, said container having an unobstructed opening formed therein above the liquid level and outside said confining means whereby vapors generated in said container may escape directly into the warm air in said heated chamber.

7. In the hot air heating system defined in claim 6, said means defining a gas tight joint comprising a lateral flange on said container larger than the aperture in said lateral wall and means for securing said flange to said lateral wall.

8. In combination with a lateral wall of a combustion chamber and a humidifier adapted to be mounted upon and extend through the lateral wall of said combustion chamber comprising an elongated liquid container having one end of relatively large cross-section and being provided with integral curved tapering walls converging to form a closed portion of relatively small cross-section at the other end of said container, said container being supported upon said lateral wall with its axis generally horizontally disposed, the larger end of said container being adjacent the chamber wall and extending outside thereof and the smaller inner end of said container being disposed within said combustion chamber, and said container being apertured at its larger end outside said chamber and above the normal water level in said container to permit free escape of vapors generated in said container.

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