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APPARATUS FOR HUMIDIIFYING AN AIR STREAM

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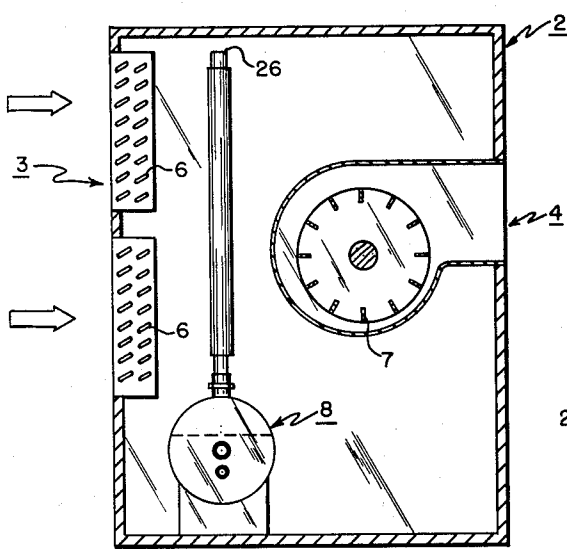


FIG. 1

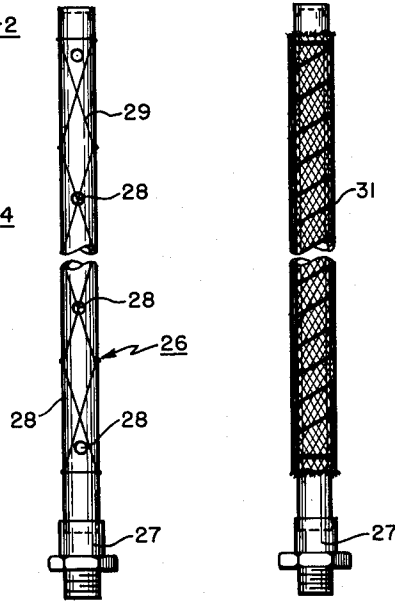


FIG. 3

FIG. 4

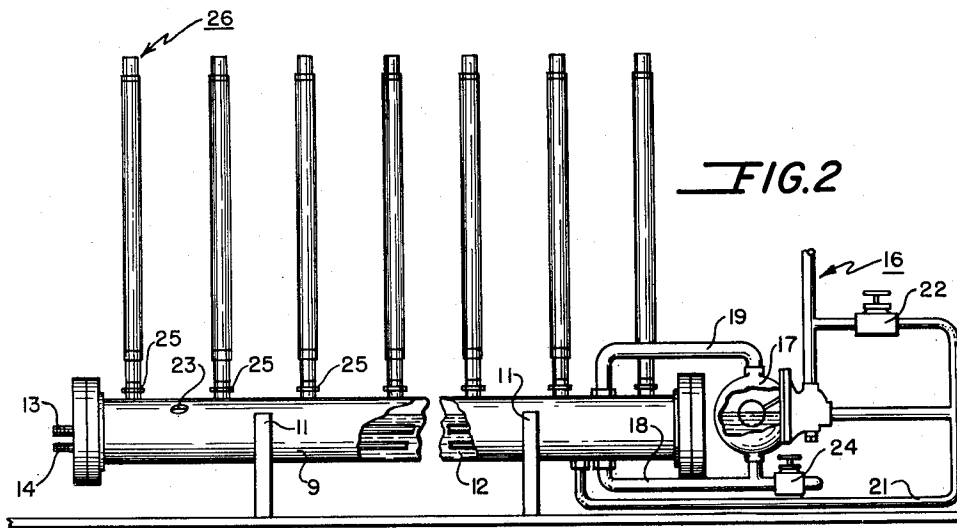


FIG. 2

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APPARATUS FOR HUMIDIFYING AN AIR STREAM

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1 Claim. (Cl. 165—60)

The present invention relates to air humidification and more particularly to an apparatus for delivering water vapor to an air stream in an air conditioning system.

Various means have been utilized in the past in the art of air conditioning to humidify an air stream. For example, it is known to humidify such a stream by either spraying a fine mist of water under pressure into the stream or by cascading a sheet of water over a series of spaced baffles positioned in the stream. It also is known in the art to heat a pan or vessel of water so that the resulting vapor from the water passes from the surface of the water to the stream of air. These past arrangements, however, have required extensive and costly equipment which has been difficult to maintain in operational order because of such problems as scaling and contamination. Further, these past arrangements have presented an undesirable resistance to or have created an undesirable turbulence in the air stream to be treated and have not assured a uniform distribution of vapor along the cross-sectional area of the stream.

The present invention avoids the above-mentioned disadvantages by providing a straightforward and uncomplicated arrangement which is readily accessible for operation and maintenance and which assures a highly efficient, uniform introduction and distribution of uncontaminated vapor into an air stream of large cross-sectional area without creating an undesirable resistance or turbulence in such stream.

Various other features of the present invention will become obvious to one skilled in the art upon reading the disclosure set forth herein.

More particularly, the present invention provides a novel structural arrangement to carry out a method for uniformly humidifying an air stream of large cross-sectional area in an air conditioning system comprising the steps of heating a humidifying fluid indirectly in an enclosed zone removed from such air stream, passing the resulting humidifying vapor along narrow, spaced passages communicating with such zone and extending across the air stream, and introducing such humidifying vapor from such passages into the air stream through fluid permeable media surrounding and communicating with the passages.

It is to be understood that various changes can be made by one skilled in the art in the arrangement, form and construction of the apparatus disclosed herein without departing from the scope or spirit of the present invention.

Referring to the drawings:

FIGURE 1 is a schematic, cross-sectional, elevational view of an air conditioning system incorporating a novel unit humidifier assembly which can be used in carrying out the present invention;

FIGURE 2 is a partially broken away, elevational view of the humidifier assembly of FIGURE 1;

FIGURE 3 is an enlarged elevational view of a conduit which serves as part of the vapor distribution means of the assembly of FIGURE 2; and

FIGURE 4 is a further enlarged elevational view of the conduit of FIGURE 3, with a permeable socking surrounding the conduit to provide an extended vapor surface to the air stream to be treated.

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Referring to FIGURE 1, a housing 2 is disclosed having an upstream inlet 3 and downstream outlet 4. Disposed within housing 2 is an air conditioning system which includes heating and chilling coil sets 6 positioned at the upstream inlet 3, a blower 7 positioned at the downstream outlet 4 and the inventive unit humidifier assembly 8 positioned within housing 2 between coils 6 and blower 7. It is to be understood that the disclosed air conditioning system can be used in any one of a number of environments where it is essential that the treated air be of controlled, uniform humidity.

As can be seen in FIGURE 2 of the drawings, the unit humidifier assembly 8, includes the enclosed narrow, elongated water chamber 9 removed from the air stream and supported on suitable pedestal members 11 on the floor of housing 2. Disposed within and extending along the length of the lower portion of chamber 9 is a steam conduit system 12, the conduit system 12 being connected to supply fitting 13 and outlet fitting 14 mounted at one end wall of chamber 9. A suitable steam supply and return header (not shown) can be connected to fittings 13 and 14 respectively to provide the necessary steam heating medium to the conduit system 12 in order to indirectly heat the water in chamber 9.

The water in chamber 9 is introduced and controlled through a control system, broadly indicated by reference numeral 16, connected to chamber 9 through suitable fittings at the end of the chamber opposite fittings 13 and 14. Control system 16 includes a water feeder float control valve 17 positioned outside chamber 9, the valve having its float chamber connected to water chamber 9 through water equalizer conduit 18 and pressure equalizer conduit 19. Float control valve 17, which can be any one of a number of commercially known valves of this type, serves to maintain the water level in chamber 9 constant during humidifying operations by metering the proper amount of water through a make-up and bypass line 21 which is connected at one end to a suitable water supply source (not shown) and at the other end to chamber 9. It is to be noted that a manually operated bypass valve and conduit arrangement 22 cooperates with line 21 to permit manual bypass of float control valve 17 whenever it is desired to adjust the water level in chamber 9. To prevent the water from reaching too high a level in chamber 9, an overflow fitting 23 is provided on the chamber wall. A suitable valve controlled drain conduit 24 can be provided to communicate with water equalizer conduit 18.

Positioned at the top of chamber 9 and extending along the length thereof are a plurality of spaced fittings 25 which are internally threaded to receive elongated vapor distribution conduits 26. As can be seen in FIGURE 3 of the drawings, each of conduits 26 is sealed at one end and is provided at the other end with an externally threaded connector 27 adapted to engage with an internally threaded fitting 25. Each conduit 26, which is of a sufficient preselected length to extend substantially across the air stream passing from coil sets 6, is provided with a plurality of small vapor outlet orifices 28 that extend in spaced relationship along the length of the conduit. A thin wire 29 wrapped in a number of spaced turns about each conduit 26 serves to provide vapor dispersing means for vapor which issues from orifices 28 of the conduit. This insures that permeable sock 31 (FIGURE 4), which is fitted in surrounding relationship with each conduit 26, is uniformly permeated with humidifying vapor. The sock 31, which can be some suitable material such as asbestos, in turn, serves to provide an extended, interstitial, vapor laden surface to the air stream to be treated to thus insure a uniform distribution of such vapor into the air stream.

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In a typical operation of the above described apparatus, water is introduced into chamber 9 to a preselected level. Steam is then introduced through steam conduit system 12 to indirectly heat the water in the chamber so that it passes off in uncontaminated vapor form from the chamber 9 to conduits 26, the control system 16 serving to maintain the water in chamber 9 at a preselected level during operation. The vapor passes through outlets 28 of conduits 26 to permeate the interstitial surfaces of surrounding socks 31 and be carried off in the air stream to be treated. It is to be noted that since the vapor is produced in an enclosed chamber by an indirect steam heating system extending into the chamber, the vapor is sufficiently uncontaminated to insure its uniform distribution over the socks 31 without any undesirable contaminant clogging. Thus, in a straightforward, space saving and uncomplicated manner vapor is introduced uniformly into the overall air stream of housing 2 without creating undesirable resistance or turbulence in such stream and without requiring frequent operational shut-downs because of contaminant clogging.

The invention claimed is:

In an air conditioning system including a housing having an air stream to be treated passing therethrough, a unit humidifier assembly for distributing uncontaminated water vapor continuously and uniformly into such air stream comprising an enclosed, narrow, elongated water chamber positioned within said housing and removed from such air stream, a heating means extending within

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said chamber to heat and convert water within said chamber indirectly to uncontaminated self-rising vapor, means to feed water into said chamber, water feed control means positioned outside said chamber to maintain a proper amount of water in said chamber during humidifying operations, and a plurality of vertically extending elongated spaced vapor distribution conduits communicating with said chamber immediately thereabove and extending in spaced columns across the entire air stream path substantially within a common plane transverse the direction of flow of the air stream to be treated, said vapor distribution conduits including a plurality of orifices spaced therealong and having a vapor permeable sheet of material surrounding such orifices to provide an extended vapor laden intersitial surface to insure uniform distribution of the uncontaminated vapor which rises in said conduits in substantially sheet-like form across the overall path of the air stream to be treated so that such air stream must pass through said sheet-like vapor.

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