

- [54] **AIR TREATMENT APPARATUS**
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- [22] Filed: **July 16, 1974**
- [21] Appl. No.: **488,927**

- [52] U.S. Cl. **55/257**; 62/314; 165/20;
165/60; 165/124; 261/20; 261/DIG. 34;
261/64 R; 261/130
- [51] Int. Cl. **B01f 3/04**
- [58] Field of Search..... 261/DIG. 34, 23 R, 117,
261/64 R, 43, 129, 130, 20; 55/257; 62/314;
165/19, 20, 60, 124, 126, 127

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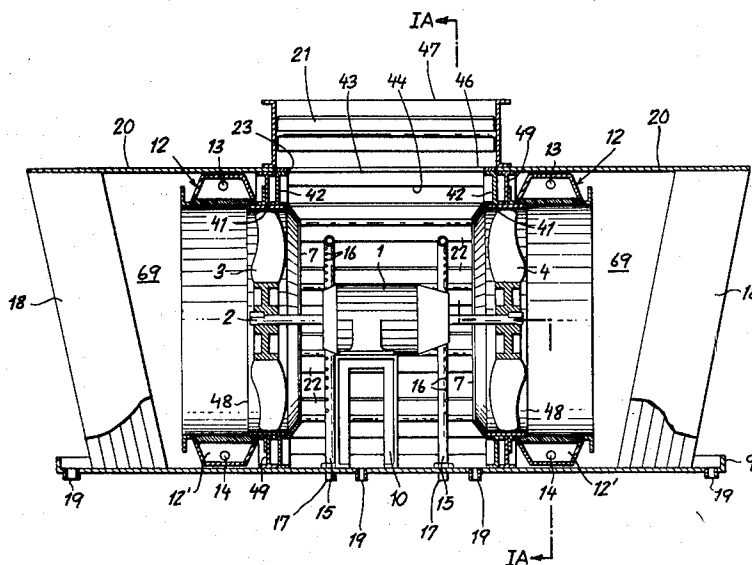
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[57] ABSTRACT

An air treatment apparatus having a pair of oppositely effective axial-flow fans in a centrally disposed blending chamber with a rectangular prismatic shape from which rectangular air ducts extend from either side for carrying air which has been cooled and humidified, heated and humidified, heated, fresh or recycled, with or without filtering. Each duct delivers similarly treated air or dissimilarly treated air. The blending chambers is provided with adjustable dampers for admitting selected ratios of fresh and recycled air which passes through water sprays and is driven by the fans through heaters and demisters provided in the ducts.

10 Claims, 11 Drawing Figures



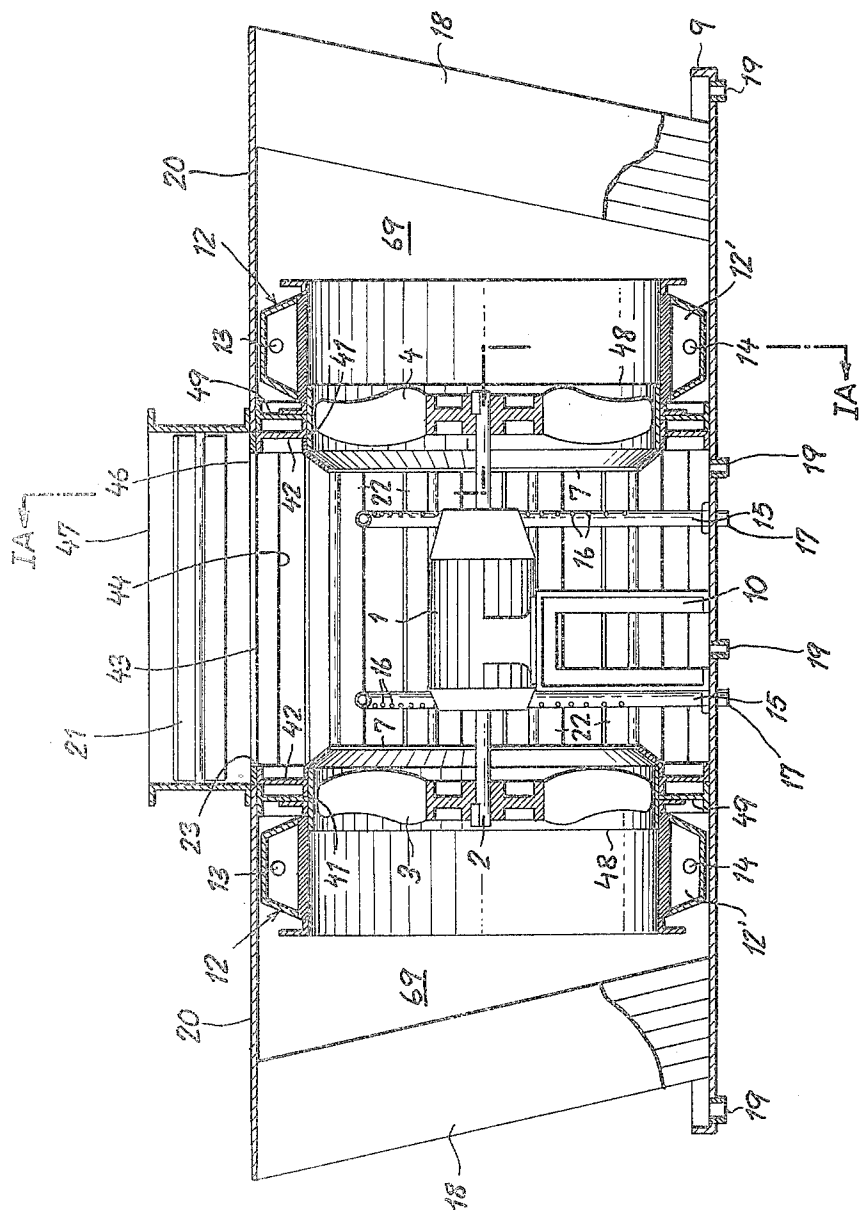


FIG. 1

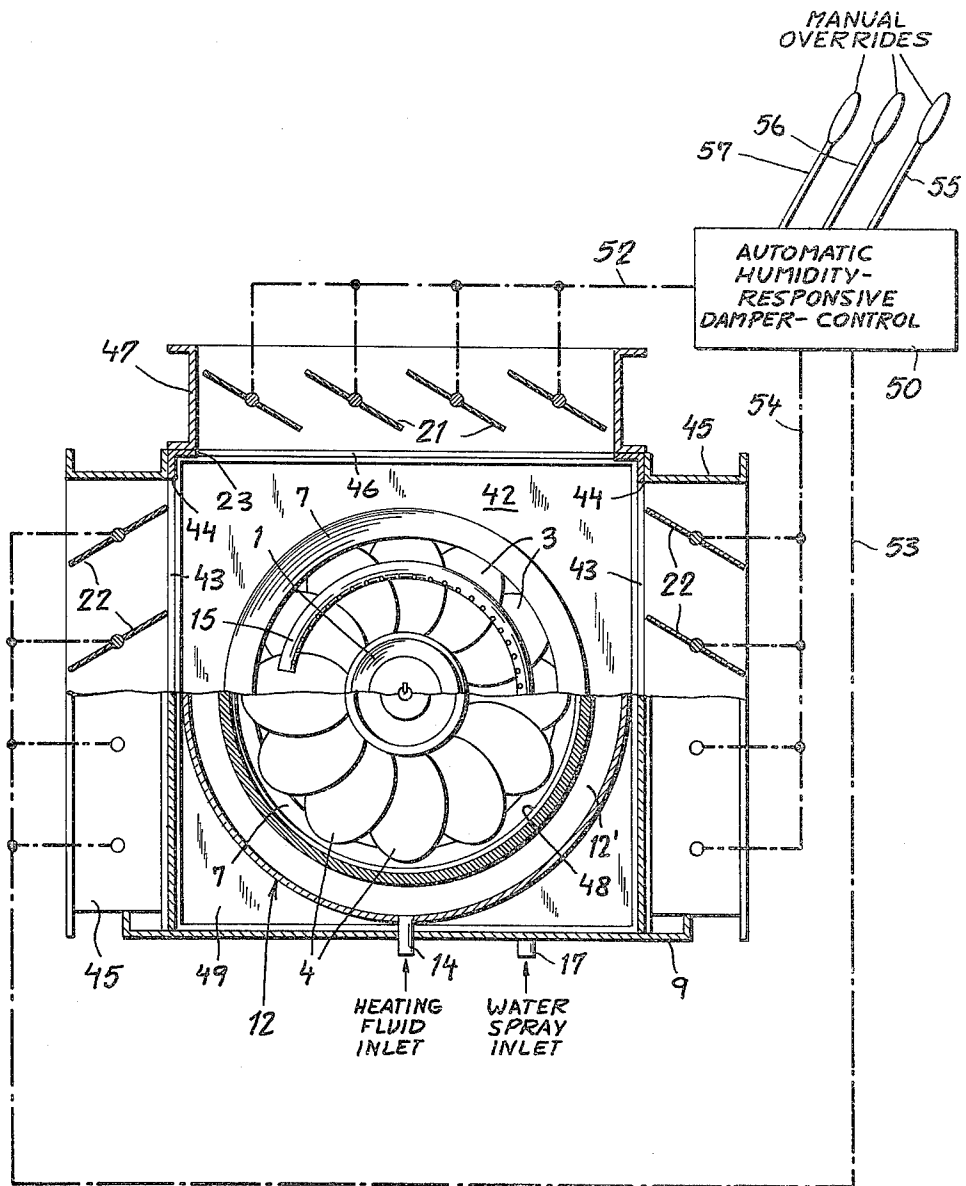


FIG. 1A

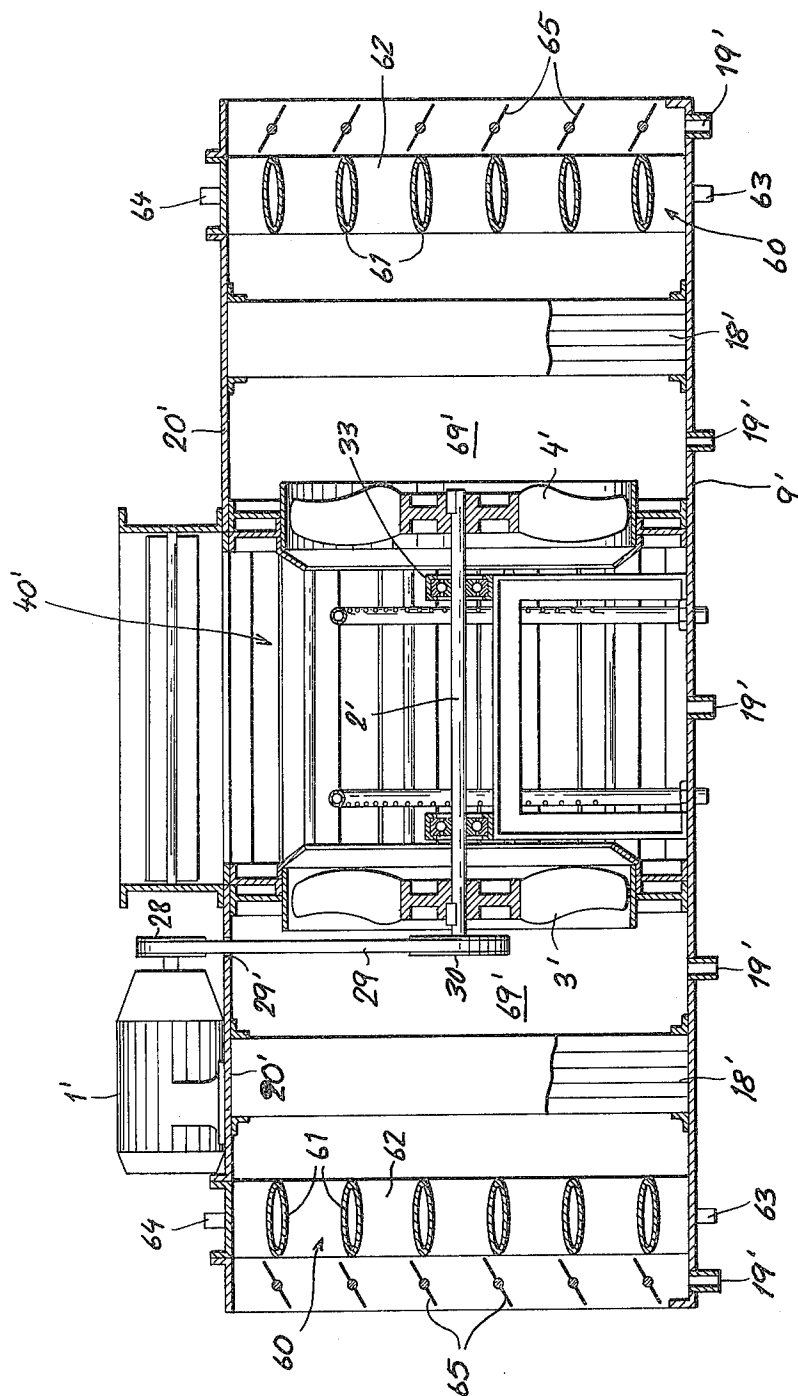


FIG. 2

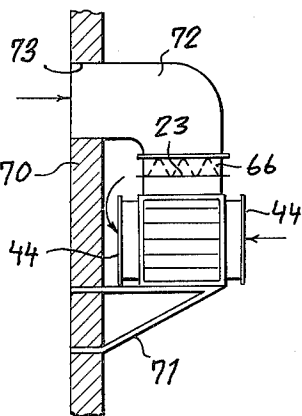


FIG. 3

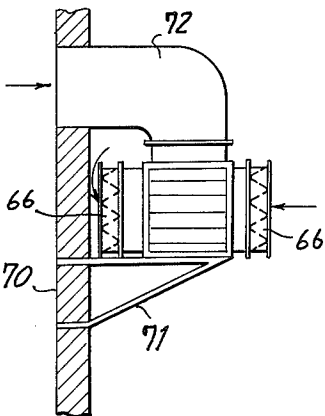


FIG. 4

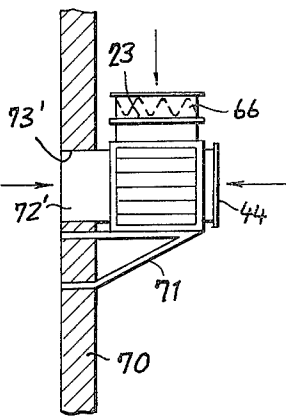


FIG. 5

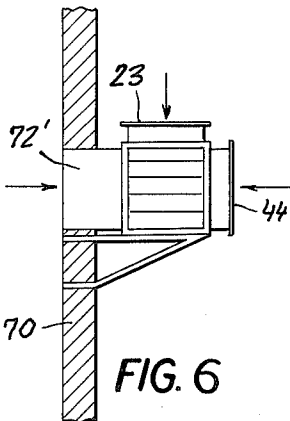


FIG. 6

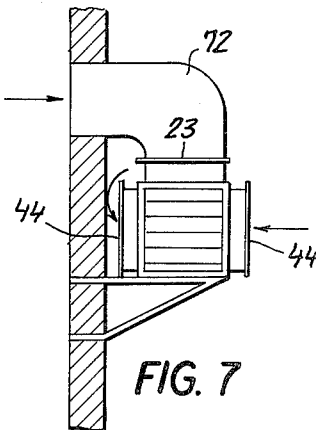


FIG. 7

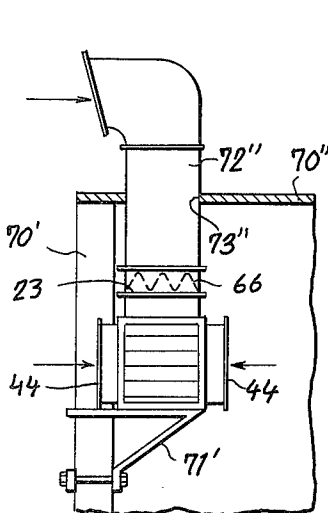


FIG. 8

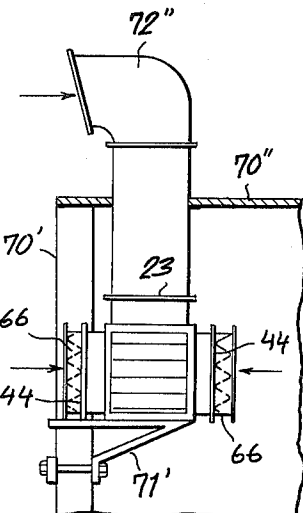


FIG. 9

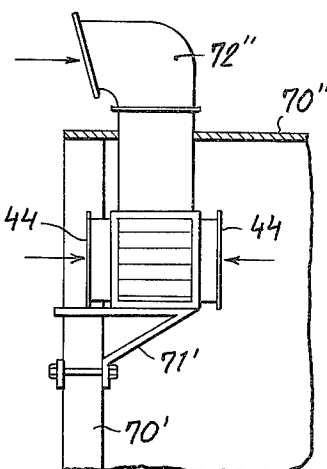


FIG. 10

AIR TREATMENT APPARATUS

FIELD OF THE INVENTION

The present invention relates to an air treatment apparatus and, more particularly, to an apparatus in which air can be cooled and humidified, heated and humidified, heated, fresh or recycled, with or without filtering.

BACKGROUND OF THE INVENTION

Air treatment apparatus of this type are known but are limited in that they can either heat or cool but usually not with the same unit. In the case of heating, apparatus usually heats air without humidifying it, causing the air to become drier and possibly unhealthy.

In the limited cases where these apparatuses cool with a water spray and also heat, their use is limited with fresh air during the winter because of the small capacity of their heaters, so that it becomes necessary to use recycled air to achieve comfortable temperatures.

OBJECTS OF THE INVENTION

It is therefore an object of the present invention to provide an improved air treatment apparatus in which air can be heated or cooled.

It is another object of the invention to provide an air treatment apparatus which can supply heated air which is humidified.

It is still another object of the invention to provide an air treatment apparatus which can supply fresh heated air when the outside temperature is low.

It is a further object of the invention to provide an air treatment apparatus which can supply two differently treated types of air simultaneously.

It is still a further object of the invention to provide an air treatment apparatus which can be mounted in the interior of a structure on a wall or pillar.

SUMMARY OF THE INVENTION

The above and other objects of the invention are realized in an air treatment apparatus in which a blending chamber having a rectangular prismatic shape is provided with rectangular ducts on either side for delivering air, which is further treated in the ducts, to the surrounding area.

Air is drawn into the blending chamber through inlets, at least one of which communicates with fresh outside air, the inlets being provided with adjustable dampers which can control the ratio of fresh air to recycled air. The air is drawn in by oppositely effective axial-flow fans mounted in the blending chamber where the air can be humidified and cooled by water sprays supplied by spray pipes provided therein.

The fans are juxtaposed with windows provided in opposite walls of the blending chamber and feed the blended air to the ducts where it can be selectively heated by heaters surrounding each window and then passed on to turbulence abatement chambers downstream of each heater where the air is calmed before entering demisters downstream of each turbulence abatement chambers where excess water particles are removed before the air leaves the apparatus.

The overall rectangular shape of the apparatus, with treated air forced from both ends, makes the apparatus particularly adaptable for interior installation on a wall or pillar with fresh air being supplied by a duct communicating through a wall or ceiling with the outside.

BRIEF DESCRIPTION OF THE DRAWING

The above and other features of the invention will now be described in detail with reference to the drawing in which:

FIG. 1 is a sectional view of an air treatment apparatus according to the invention;

FIG. 1A is a sectional view taken along line IA—IA of FIG. 1;

FIG. 2 is a view similar to FIG. 1 showing another embodiment of the invention; and

FIGS. 3 through 10 are end views of the apparatus showing different arrangements of the air intakes and mountings.

SPECIFIC DESCRIPTION

The air treatment apparatus shown in FIG. 1 comprises a blending chamber 40 having a rectangular box-like shape and occupying a central position from which rectangular ducts 20 extend from either side. Two circular windows 41 are formed in opposite side walls 42 of the blending chamber 40 and open into the ducts 20. The two remaining opposite facing side walls 43 are formed with rectangular air inlets 44 which are surrounded by rectangular cowlings 45 provided with adjustable dampers 22 for controlling the flow of air therethrough. An additional air inlet 23 is formed in the top wall 46 of the blending chamber 40 and is surrounded by a rectangular cowling 47 provided with adjustable dampers 21.

An electric motor 1 in alignment with windows 41 is held within the chamber 40 by a mounting 10, the motor 1 having a drive shaft 2 extending from either end and carrying thereon a pair of fans 3 and 4 positioned within the windows 41, the fans having oppositely pitched blades so that rotation in the same direction will draw air from the blending chamber 40 and drive it through the ducts 20.

The fans 3 and 4 are surrounded by circular cowlings 48 provided in the windows 41 and extend on either side of walls 42, the ends extending into the chamber 40 being provided with inwardly converging flanges 7 which define a construction through which the air flow is speeded up.

The cowlings 48 are held in place by windows 41 by supports 49 provided in ducts 20 which engage those portions of the cowlings 48 which extend into the ducts, the supports 49 forming walls parallel to walls 42.

Adjacent each of the fans 3 and 4 in the blending chamber 40 are a pair of spray pipes 15 provided with nozzles 16, the pipes 15 having arcuate portions centered on the drive shaft 2 for creating evenly distributed arrays of water particles which can blend with the air flow.

Immediately adjacent each of the fans 3, 4 on the downstream side in the ducts 20 are provided heaters 12 comprising conduits 12' defining toroids in registration with windows 41. These conduits 12' are fed by inlets 14 with a heated fluid medium which is discharged through outlets 13.

Downstream of each of the heaters 12 are turbulence abatement chambers 69 defined by the walls of the ducts 20 which serve to claim the flow of air from the fans 3 and 4.

Downstream of each of the turbulence abatement chambers 69 there are provided demisters 18 of the

type described in Chemical Engineers' Handbook, ed. by John H. Perry on pages 18-85 of the fourth edition (McGraw-Hill Book Co., Inc. N.Y. 1963) spanning the ducts 20 at their output ends and tilting slightly forward from top to bottom.

Underlying the entire air treatment apparatus is a catch basin 9 provided with drains 19, the catch basin 9 forming the floor of the ducts 20 and blending chamber 40 for collecting excess water from the spray pipes 15 and the demisters 18.

Protruding from the underside of the catch basin 9 are inlets 17 for feeding water, which can be chilled if extra cooling is desired, to the spray pipes 15.

In operation, the ratio of fresh air to recycled air drawn into the blending chamber 40 by the fans 3 and 4 can be adjusted by a membrane lever of an automatic humidity-responsive damper control 50 having manual overrides 55, 56 and 57 connected to the dampers 21, 22 by linkages 52, 53 and 54 for independent adjustment of each set of dampers, or automatic adjustment by the control 50 for operating the dampers 21 and 22 in an interlocked relationship whereby when one set of dampers is open the other is closed and vice versa. The regulated air thus drawn in can be cooled and humidified by water sprayed from the pipes 15, the cooled and humidified air then being drawn through the constrictions 7 which increase the velocity of the air and causes a more thorough mixing of the air and the water particles produced by the water spray.

The thoroughly mixed air is then driven through the heaters 12 on either side of blending chamber 40 where the air on either side can be heated evenly or unevenly so that air leaving the unit on one end can be at a different temperature from the air leaving on the other end.

After leaving the heaters 12 the air enters the turbulence abatement chambers 69 where it is calmed before entering the demisters 18 where excessively larger water particles are removed from the air before it leaves the unit and the air is further calmed by the demisters 18.

Another embodiment of the invention similar to that shown in FIGS. 1 and 1A is shown in FIG. 2 in which parts identical to those shown in FIG. 1 are given the same but primed reference numerals.

A blending chamber 40' identical with that shown in FIG. 1 is shown in FIG. 2 and will not be further described.

The fans 3' and 4' are mounted on a drive shaft 2' which is journaled in bearings 33 and driven by a motor 1' mounted on the top of one of the ducts 20'. The shaft 2' is provided with a pulley or wheel 30 adjacent the fan 3' and clear of the blending chamber 40' the pulley 30 being engaged by a belt 29 which passes through an opening 29' in the top of the duct 20' and is engaged by a further pulley or wheel 28 mounted on motor 1'.

Immediately adjacent the fans 3' and 4' and downstream thereof are turbulence abatement chambers 69' which in this case calm the air before it enters the demisters 18' which function as described with regard to the embodiment of FIG. 1.

Downstream of each of the demisters 18' are heaters 60 having hollow transverse fins 61 connected at their ends to manifolds 62 provided with inlets 63 and outlets 64 for circulating a heating medium through the fins 61 over which the airflow passes and picks up the heat therefrom.

After the air is heated it can be directed by adjustable louvers 65 provided immediately downstream of each of the heaters 60.

Underlying the entire apparatus is a catch basin 9' provided with a number of drains 19' for removing any excess water.

As with the embodiment shown in FIG. 1 the air leaving the two output ends of this embodiment can have been heated to different degrees as well as not heated at all but only cooled or not humidified when heated and the air could be filtered by filters 66 which can be provided on some or all of the air intakes or the air could be left unfiltered, so that the apparatus can be used to produce many different kinds of air treatment.

FIGS. 3 through 10 are somewhat diagrammatic representations of the mounting and air gathering arrangements to which the embodiments shown in FIGS. 1 and 2 are particularly suited.

As shown in FIG. 3 the air treatment apparatus is mounted on the inside of a wall 70 by a bracket 71 which is imbedded in the wall. A duct 72 is set in a cut-out 73 provided in the wall 70 and feeds fresh air to the intake 23 formed in the top of blending chambers 40 and 40' through a filter 66. The recycled air enters the apparatus through the side intakes 44.

In FIG. 4 the filter 66 is removed from the intake 23 and a pair of such filters 66 are provided on both side intakes 44 for filtering the recycled air.

The arrangement in FIG. 5 is somewhat different in that one of the side intakes 44 is provided with a duct 72' which passes through a cutout 73' in wall 70 to the outside from where it draws fresh air to that particular side intake 44 while the other side intake 44 and the top intake 23 draw recycled air, intake 23 drawing through the filter 66.

The arrangement in FIG. 6 is identical to that of FIG. 5 with the exception that filter 66 is omitted at 23.

The arrangement of FIG. 7 is identical to that of FIGS. 3 and 4 with the exception that filters 66 are not used at the air intakes.

In FIG. 8 the apparatus is mounted on an interior column of a structure by a bracket 71' which is bolted to the column 70'. A vertical duct 72'' extends upwardly from intake 23 through an opening 73'' in the roof 70'' where fresh air can be drawn through the filter 66 and into the apparatus with recycled air entering through side intakes 44.

In FIG. 9 the mounting arrangement is the same as in FIG. 8 with the filter 66 removed from intake 23 and in place on both side intakes 44, whereas in FIG. 10 everything is identical to FIGS. 8 and 9 except for the removal of all filters 66 from all intakes.

It should be pointed out that the air treatment apparatus disclosed here is unique in that it can be mounted within a structure rather than outside as is the case with many devices of this type.

We claim:

1. An air treatment apparatus comprising:
 - a rectangular prismatic housing defining a blending chamber;
 - rectangular extensions of two opposite sides of said blending chamber defining ducts for carrying an air flow from said blending chamber;
 - air inlets formed in the top wall and two opposite facing side walls of said blending chamber at right angles to said ducts;

air outlets formed in the two remaining side walls of said blending chamber feeding into said ducts; a pair of oppositely effective axial flow fans mounted on a common drive shaft in said blending chamber and respectively juxtaposed with said outlets; means for rotating said fans in the same direction; respective means adjacent each of said fans for humidifying air drawn into said blending chamber by said fans; respective means adjacent each of said fans for cooling air drawn into said blending chamber by said fans; respective air heating means downstream of each of said outlets in said ducts for heating the air traversing same; respective turbulence abatement chambers downstream of each of said outlets; respective demisters spanning said ducts downstream of each of said outlets; and means connecting at least one of said inlets with a source of fresh air.

2. An air treatment apparatus as defined in claim 1, further comprising:
adjustable dampers across all of said inlets for controlling the flow of air therethrough.

3. An air treatment apparatus as defined in claim 2, further comprising:
means responsive to a predetermined level of humidity for automatically controlling said adjustable dampers interlockingly on each of said inlets; and a removable air filter on at least one of said inlets.

4. An air treatment apparatus as defined in claim 1, wherein:
said humidifying and cooling means are arcuate spray pipes centered on said drive shaft;
said spray pipes are provided with a plurality of nozzles; and
said spray pipes are connected with a source of temperature-controlled water under pressure for creating an array of water particles adjacent each of said fans.

5. An air treatment apparatus as defined in claim 1 wherein:
said air outlets are circular windows formed in said two remaining side walls of said blending chamber; and
said circular windows are provided with circular inwardly converging flanges facing the interior of said blending chamber defining constrictions for increasing the velocity and mixing of water particles with air flowing therethrough.

6. An air treatment apparatus as defined in claim 1

wherein:
said air heating means are annular heated-fluid passageways positioned in said ducts and surrounding said outlets.

7. An air treatment apparatus as defined in claim 1 wherein:
said turbulence abatement chambers are defined by the walls of said ducts.

8. An air treatment apparatus as defined in claim 1 wherein:
said means for rotating said fans is a motor mounted in said blending chamber in alignment with said outlets; and
said fans are mounted on drive shafts extending from said motor.

9. An air treatment apparatus as defined in claim 1 further comprising:
adjustable dampers across all of said inlets for controlling the flow of air therethrough;
means responsive to a predetermined level of humidity for automatically controlling said adjustable dampers interlockingly on each of said inlets; a removable air filter on at least one of said inlets; and
said humidifying and cooling means are arcuate spray pipes centered on said drive shaft;
said spray pipes are provided with a plurality of nozzles;
said spray pipes are connected with a source of temperature controlled water under pressure for creating an array of water particles adjacent each of said fans; and
said air outlets are circular windows formed in said two remaining side walls of said blending chamber;
said circular windows are provided with circular inwardly converging flanges facing the interior of said blending chamber defining constrictions for increasing the velocity and mixing of water particles with air flowing therethrough; and
said air heating means are annular passageways carrying a heated fluid and positioned in said ducts surrounding said outlets; and
said turbulence abatement chambers are defined by the walls of said ducts;
said fans are mounted on a common drive shaft; and a catch basin is provided said housing for collecting excess water from said spray pipes and said demisters.

10. The apparatus defined in claim 9 wherein said means for rotating said fan is a motor on said shaft between said fans.

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