

March 7, 1933.

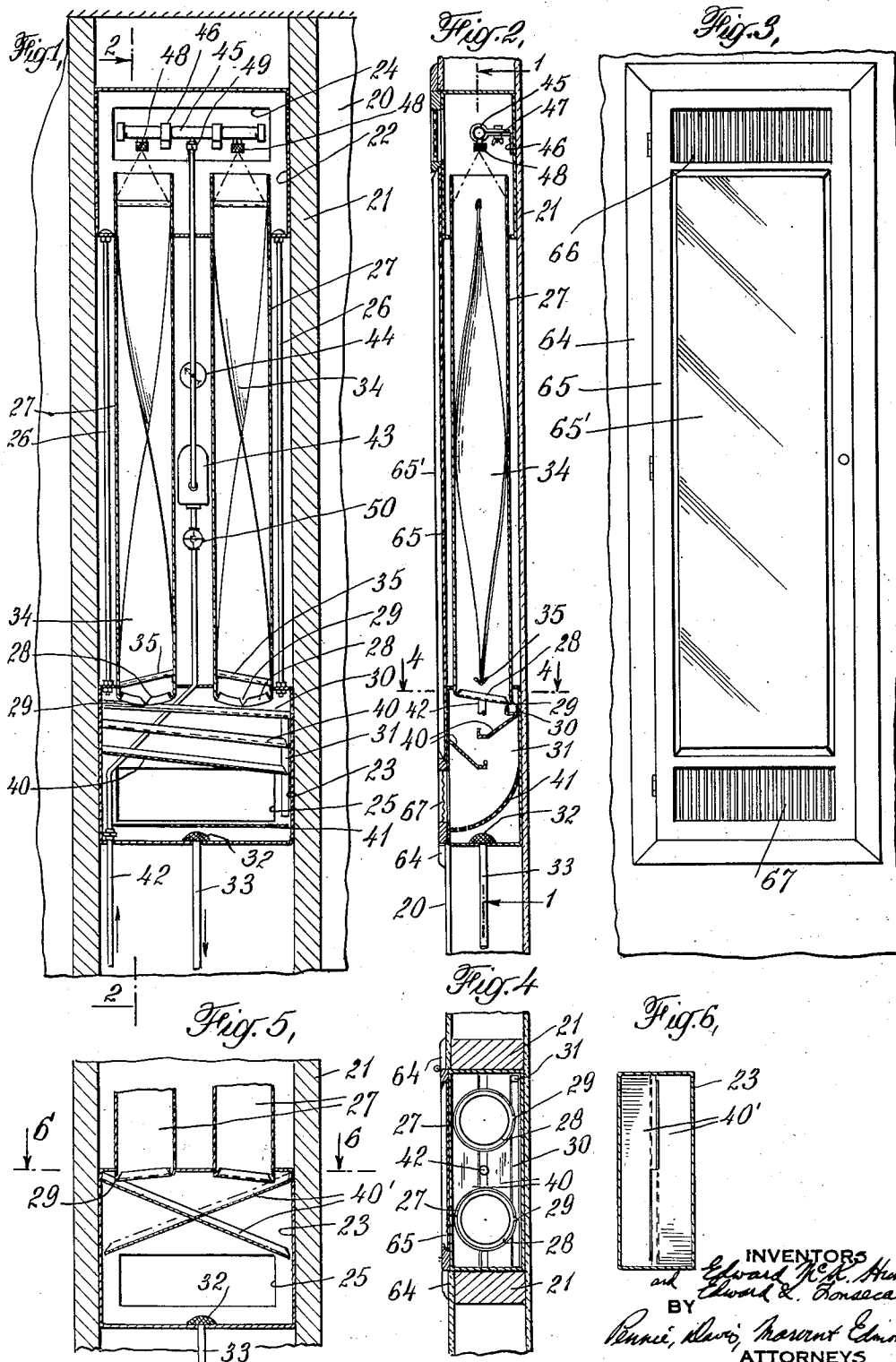
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1,900,501

AIR CONDITIONING APPARATUS

Filed March 12, 1929

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 8,

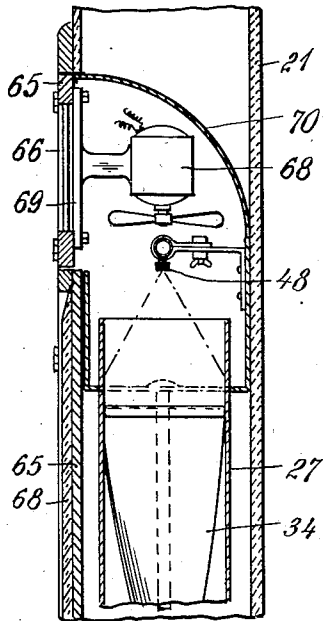


Fig. 7,

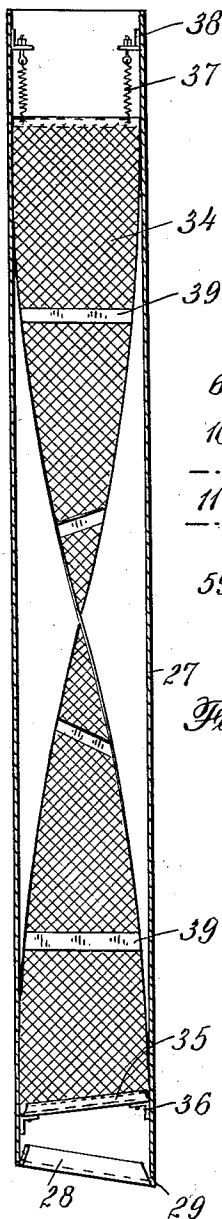


Fig. 9,

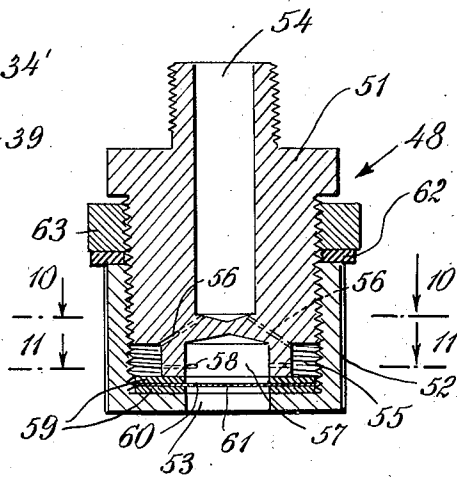


Fig. 12,

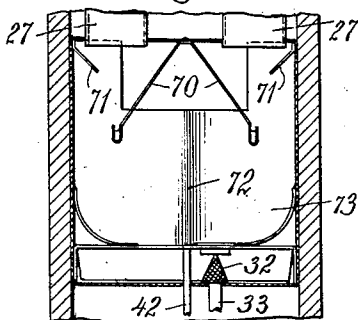


Fig. 10,

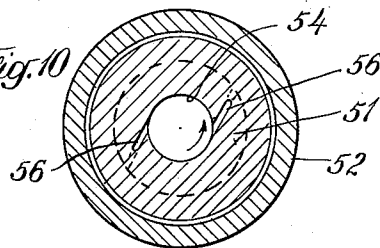


Fig. 11,

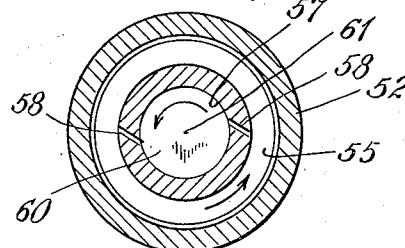
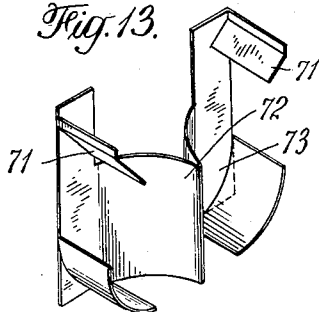


Fig. 13.



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AIR CONDITIONING APPARATUS

Application filed March 12, 1929. Serial No. 346,285.

This invention relates to air conditioning apparatus and has particular reference to apparatus which will provide the air in one or more rooms with the proper degree of humidity which is most healthful to the occupants or which may be required for carrying on certain manufacturing or other processes in which a definite amount of moisture is necessary in the surrounding air.

The principal object of this invention is to provide air conditioning apparatus which treats the air already in the room so as to render it fresh and pure without requiring the introduction of outside air, and which also continuously purifies and cools the air treated thereby in large volume so that all of the air in the room or rooms is conditioned by the apparatus in a relatively short time.

A further object of this invention is to provide apparatus of the type described which may be inserted in the space between the studs in the wall of a room so as to lie flush with the surface thereof and present an attractive appearance in the form of a decorative panel having two louvred apertures, one for the intake of the air from the room, and the other for the return of the conditioned air into the room. After inserting the apparatus into the wall in this way, no other operations in the room, such as replastering, repapering or the like are necessary.

A further object of the invention is to provide an air conditioning apparatus which is simple to operate and install, requires no attention beyond occasional inspection, and which has no moving parts, so that it is not likely to get out of order during long periods of operation.

These and other apparent objects are obtained in a preferred embodiment of the invention which consists of a casing having a transverse cross-sectional area no greater than the area defined by adjacent studs in one direction and between the adjacent inner surfaces of a wall in the other direction, so that it can be readily inserted between the walls of the average building already constructed merely by cutting out the wall sur-

face between any selected pair of studs, and where the building is being constructed the casing may be inserted in the wall without change in the structure thereof. This casing comprises upper and lower box-like headers, in the front walls of which the respective intake and outlet apertures are formed. These headers are connected by one or more circular tubes, into the upper end of each of which is introduced a rotating circular spray of relatively high velocity, which is obtained by a novel nozzle connected to the water supply main which normally supplies the building with water. The circular water spray acts as a piston moving continuously down through the interior of each tube and serves to draw air through the opening in the upper header and force it through the opening in the lower header, while humidifying, washing and cooling the air thus circulated. Within each of these circular tubes is preferably mounted a spiral baffle which imparts a swirling motion to the descending spray in order to precipitate surplus particles of water carried by the descending air, this action being augmented by a series of baffles in the lower header by means of which the direction of flow of the air is suddenly changed several times, whereby further surplus water entrained therein is precipitated.

This casing is removably secured by suitable means between the studs of the wall in which it is mounted. It is covered by, but is made accessible through a movable panel having louvres at its upper and lower ends which register with the corresponding apertures in the headers of the casing. This panel may be suitably hinged to the wall as a door, or may be held in place by clips or the like so as to be entirely removable therefrom, and is formed of decorative wood, metal or the like, preferably fitted with a mirror, picture, tapestry or combinations of these and the like, between the upper and lower louvres.

For increasing the amount of air circulated by the apparatus described, the number of tube and nozzle combinations may be increased or an electric fan may be mounted opposite the upper or lower louvres, this fan

being preferably mounted upon the inner surface of the panel, together with the electric wiring required therefor.

The novel nozzle for creating the circular spray within each of the tubes includes three chambers connected in series by small tangential holes, whereby the water, under normal pressure, flows at increased velocity from the first chamber into the second chamber with a swirling action and from the second chamber into the third chamber with further increased velocity and swirling action, from which it flows through a small orifice in the shape of a conical spray of circular cross-section, which completely closes the tube against the admission of any air except that which is drawn through the spray because of the suction created thereby.

Other features of the preferred embodiment of this invention will become apparent upon examination of the accompanying drawings, in which

Figure 1 is a vertical cross-section of the air conditioning apparatus of this invention as seen along the line 1—1 of Fig. 2;

Fig. 2 is another vertical section as seen along the line 2—2 of Fig. 1;

Fig. 3 is an exterior view of the apparatus inserted in the wall and covered by a decorative panel;

Fig. 4 is a horizontal cross-section taken along the line 4—4 of Fig. 2;

Fig. 5 is a vertical section of the lower portion of an alternative form of the apparatus;

Fig. 6 is a plan view of the baffle arrangement in this alternative form as seen along the line 6—6 of Fig. 5;

Fig. 7 illustrates an alternative form of the spiral baffle contained in the tubes of the apparatus;

Fig. 8 is a fragmentary vertical section of a modified form of the apparatus employing an electric fan for increasing the air circulation;

Fig. 9 is an enlarged axial cross-section of the spray nozzle;

Figs. 10 and 11 are cross-sectional views thereof as seen along the lines 10—10 and 11—11 respectively of Fig. 9; and

Figs. 12 and 13 show a modified baffle.

In these drawings numeral 20 designates the wall of the room in which the air conditioning apparatus of this invention is to be mounted, the studs in the wall being designated 21. In the vertical section illustrated in Fig. 1, the upper and lower box-like housings or headers 22 and 23, respectively, are preferably formed of sheet metal such as sheet copper, and are made identical for manufacturing purposes, each being provided with a side opening, the opening in upper header 22 being designated 24, and the opening in the lower header 23 being designated 25. These upper and lower headers

are spaced and secured together by suitable tie rods 26. Circular apertures are formed in the adjacent surfaces of the headers 22 and 23, for the insertion of vertical tubes 27, which are preferably straight tubes of circular cross-section, the lower edges of which are turned inwardly and upwardly to form an inclined gutter 28 having a notch 29 at its lowermost point, which discharges surplus water into a trough 30 secured to the rear inner surface of lower header 23 communicating with a down-spout 31, which terminates near the bottom or sump of header 23. The surplus water collecting in the bottom or sump of lower header 23 flows through a screen dome 32 into a discharge pipe 33 which is connected to the sewer or other suitable drain.

Within each of tubes 27 is mounted a spiral baffle 34, which may be made of a strip of sheet metal such as copper twisted through an angle of 180 or more degrees. This baffle 34 is spot-soldered or otherwise fastened within tube 27 and is provided at its lowermost edge with an inclined V-shaped gutter 35, which discharges into gutter 28 formed on the lower edge of each of the tubes 27. An alternative form of this spiral baffle 34 is designated 34' in Fig. 7, and is preferably made of a strip of metal fabric or the like secured at its lower edge to brackets 36 mounted adjacent the lower end of tube 27, and held taut at its upper end by means of springs 37 adjustably mounted in brackets 38 mounted near the upper end of tube 27. In order to keep this strip of metal mesh forming baffle 34' in proper shape, a series of stiffening battens 39 are secured thereto at spaced intervals. This alternative type of spiral baffle 34' has a certain advantage over the sheet metal type of baffle 34 shown in Fig. 1 in that the air may flow through the openings in the mesh in intimate contact with the water adhering to the mesh, whereby an additional air screening and humidifying action takes place.

Within lower header 23 are mounted a series of baffles 40, alternate ones of which extend respectively from the front and rear inner surfaces of header 23 so as to cause the air passing between them to follow a zig-zag path. Thus the stream of air is suddenly reversed in direction several times, so that the excess water entrained therein is precipitated upon these baffles 40, which are inclined and provided with up-turned lips forming troughs which discharge against one side of header 23 so as to allow the precipitated water to flow away into the bottom or sump of header 23. An alternative baffle arrangement is shown in Figs. 5 and 6, in which baffles 40' cross each other, one extending from the rear wall of header 23, and the other extending from the front wall

thereof. With this arrangement the air is reversed in two directions, that is, from front to rear and from side to side, as seen in Fig. 5, whereby a most effective precipitation

of excess water from the air is obtained. In both of these arrangements, the streams of moisture-laden air emerging from the lower ends of tubes 27 is unrestricted so that its velocity is not changed substantially, and is freed of excess moisture by the sudden changes in direction imparted thereto by the baffles 40 and 40', so that the washed and humidified air emerges from opening 25 without precipitating water outside of the apparatus. A curved deflector 41 is mounted within lower header 23 for the purpose of deflecting the air at right angles through the opening 25, and also serves to house the strainer 32 and the sump of header 23. Deflector 41 is perforated at its forward edge to allow the excess water to flow into the sump for discharge through drain 33.

Inserted water-tightly through the bottom of header 23 is the water supply pipe 42, which preferably passes upwardly between tubes 27 through a suitable filter 43, which removes the particles of dirt or grit which may be contained in the water. A pressure gauge 44 is inserted in pipe 42 and is visible from the front of the apparatus, whereby the velocity of the spray may be determined and consequently the volume of air circulated. Pipe 42 is connected to a manifold pipe 45 extending transversely of upper header 22 so as to lie directly over the upper open ends of tubes 27. Manifold 45 is mounted in suitable brackets 46 secured to the rear wall of upper header 22, which clamp it securely in position, but which may be loosened by manipulating wing nuts 47, so that the entire manifold 45 may be turned at right angles for inspection or cleaning of nozzles 48 through aperture 24. This may be done by disconnecting nipple 49 after the water is shut off by means of hand regulating valve 50, or a piece of flexible tubing may be inserted in place of the nipple 49, so that the manifold 45 may be turned in brackets 46 after the wing nuts 47 have been loosened without disconnecting the water pipe 42 therefrom.

A modified form of baffle is illustrated in Figs. 12 and 13, which are front and front perspective views, respectively. The side wing baffles 71 deflect the air issuing from the tubes 27 upon the center wing baffles 70, so that the course of the air is suddenly changed and surplus moisture in the air is deposited on the baffles 70. These baffles 70 in turn deflect the air against the side walls of the bottom header 23 from which it is deflected inwardly against the curved sides of central rib 72 of the one-piece baffle plate 73. This rib extends toward the lower

louvre opening 67 and is of such shape as to deflect the air sidewise therethrough so that a wide air distribution without draft is obtained.

A nozzle 48 is mounted directly over the upper open end of each of tubes 27 and introduces into these tubes a fine conical water spray at high velocity, which completely closes tubes 27 and acts as a piston moving down each tube 27 so as to create a suction which induces a continuous flow of air in large volume, the air passing through the fine spray and being forced thereby downwardly through tubes 27. The construction of nozzle 48 is shown in detail in Figs. 9, 10 and 11, and includes a nipple 51 threaded at the smaller end for connection with manifold 45, and also threaded at its larger end for the reception of cup 52 having a large opening 53, through which the spray emerges. Nipple 51 is drilled axially at 54 so as to form a chamber for the reception of the water from manifold 45. The lower edge of nipple 51 is undercut so as to form with the inner walls of cup 52 an annular chamber 55. Two or more small holes 56, drilled tangentially, connect chamber 54 with annular chamber 55 as shown particularly in the cross-section of Fig. 10. The lower surface of nipple 51 is drilled axially to provide another or third chamber 57, which communicates with annular chamber 55 by means of small, tangentially-drilled holes 58 shown particularly in Fig. 11. Between gaskets 59 within cup 52 is mounted a circular disc 60, having a small central opening 61 communicating with chamber 57. A gasket 62 is interposed between the upper edge of cup 52 and a nut 63, which may be tightened down on the gasket 62 so as to render the device watertight at this point also.

It will be seen that water entering first chamber 54 at ordinary water main pressure is distributed at increased velocity through tangential holes 56 into second chamber 55 in which it swirls at high velocity in the direction of the arrow in Fig. 11, because of the tangential arrangement of the holes 56. The swirling water in second chamber 55 then passes in the same direction with increased velocity through smaller holes 58 to swirl in the direction of the arrow in Fig. 11 within third chamber 57, from which it emerges through pin hole 61 in the form of a swirling conical spray which completely closes the circular tube 27 arranged directly below the nozzle 48 as shown in Figs. 1 and 2.

The opening in the wall 20, into which the apparatus has been inserted, is preferably rimmed by a frame 64 of decorative wood, metal or other suitable material, this frame being attached to the surface of the wall by suitable means without in any way

marring or disturbing the paper, plaster, paint or the like with which the surface of the wall 20 is covered. The opening in this frame is preferably made slightly larger than the overall dimensions of the apparatus as a whole, so that the apparatus may be readily removed upon disconnecting the drain pipe 33 and water pipe 42 therefrom. Hinged within the opening in frame 34 is a door or panel 65 provided with upper and lower louvre openings 66 and 67, which register with corresponding openings 24 and 25 in upper and lower containers 22 and 23, respectively. Between louvre openings 66 and 67 is mounted a mirror, tapestry, picture, decorative panel 65', or combinations of these and the like, whereby the apparatus presents a pleasing appearance without in any way detracting from its efficacy as an air conditioning apparatus. Of course, instead of being hinged to the frame 64, the panel 65 may be removably clamped or screwed thereto. Also, the frame or casing of the apparatus may be mounted in a separate housing, instead of in the housing formed by a recess in a wall as described, so as to be portable, the front cover of the apparatus including the panel or door being secured directly to the frame or casing or to the portable housing.

In order to place the air conditioning apparatus of this invention in operation, valve 50 is opened so that the water spray emerges from nozzles 48. The velocity of the water spray may be regulated by valve 50 in accordance with the pressure indicated by gauge 44, and as the volume of air circulated by the apparatus depends upon the velocity of the spray, the gauge 44 may be calibrated to indicate the cubic feet of air changed per minute. The descending spray of water creates a suction through upper louvre 66, so that air is drawn from the room at a point preferably near the ceiling and is forced through tubes 27 by the descending spray of water. The spiral baffles 34 or 34' within tubes 27 impart a spiral motion to the air and water mixture and the excess water flows down the inner surfaces of tubes 27 and the surfaces of baffles 34 or 34' to be carried off by gutters 28, drain trough 30 and down-spout 23 into drain pipe 33. The surplus water is removed from the air by the baffles 40, which rapidly reverse the direction of flow of the air. During this process the air has been humidified and washed of all dust and other impurities, and has been cooled down to approximately the temperature of the water used, so that it emerges from lower louvre opening 67 in the form of fresh, pure air. In the event that a greater air change is required, the velocity of the water may be increased by means of a booster pump or the like, or an electric fan 68 may be mounted

adjacent the upper louvre opening 66 as shown in Fig. 8. The fan 68 is preferably mounted on a bracket 69 secured to the rear of the door 65 and extending across upper louvre opening 66, and the electric wires may be inserted in a groove in the door so as to be invisible. It is also preferred that the interior of upper header 22 be shaped or provided with a curved hood 70 in order to prevent the formation of air pockets and eddies. A greater air change may also be obtained simply by increasing the number of nozzle and tube units without the need of additional apparatus. Another way of increasing the velocity of the air is to form tubes 27 in the shape of Venturi tubes, not shown.

It will be seen that the air conditioning apparatus of this invention offers many advantages over those which have been heretofore used, in that the volume of air treated thereby is greatly increased for the same water consumption without the necessity of employing auxiliary apparatus for procuring this advantage. The device is readily installed in the rooms of buildings already constructed or being constructed, and furnishes properly humidified and purified air which is most healthful for the occupants of the room or rooms. Furthermore, the device may be installed in larger sizes in factories or the like for properly conditioning the air where the humidity in the air is an important factor in a manufacturing process or the like.

While certain preferred embodiments of the invention have been illustrated and described herein, it is to be understood that the invention is not limited thereby, but is susceptible of various changes in form and detail.

We claim:

1. In an air conditioning device the combination of at least one vertically extending straight tube, two housings, one communicating with each end of said tube, the upper housing having an air intake opening and the lower housing having an air discharge opening, a liquid spray device introduced into said tube adjacent the upper end thereof for creating suction therethrough, a plurality of baffles in said lower housing extending in alternate directions into the air stream for precipitating surplus water therefrom, and a gutter on at least one of said baffles for conducting away the liquid deposited thereon.

2. In an air conditioning device the combination of at least one vertically extending straight tube, two housings, one communicating with each end of said tube, the upper housing having an air intake opening and the lower housing having an air discharge opening, a liquid spray device introduced into said tube adjacent the upper end

thereof for creating suction therethrough, and a spiral baffle in said tube.

3. In an air conditioning device the combination of at least one vertically extending straight tube, two housings, one communicating with each end of said tube, the upper housing having an air intake opening and the lower housing having an air discharge opening, a liquid spray device introduced into said tube adjacent the upper end thereof for creating suction therethrough, a plurality of baffles extending laterally into said lower housing, and a spiral baffle in said tube.

4. In an air conditioning device the combination of at least one vertically extending straight tube, two housings, one communicating with each end of said tube, the upper housing having an air intake opening and the lower housing having an air discharge opening, a liquid spray device introduced into said tube adjacent the upper end thereof for creating suction therethrough, a gutter formed above the air discharge-opening in said tube for collecting surplus liquid therefrom, and baffles extending in alternate directions in said lower housing for extending laterally into the air stream for precipitating excess moisture therefrom.

5. In an air conditioning device the combination of at least one vertically extending straight tube, two housings, one communicating with each end of said tube, the upper housing having an air intake opening and the lower housing having an air discharge opening, a liquid spray device introduced into said tube adjacent the upper end thereof for creating suction therethrough, a spiral baffle in said tube, a plurality of air deflecting baffles extending laterally into the air stream in said lower housing, and means in said tube and lower header for collecting precipitated surplus liquid.

6. In an air conditioning apparatus, the combination of a vertically disposed casing having an air intake and an air discharge opening, a liquid spray device in said casing for inducing an air current through said openings, a housing for said casing, a movable panel enclosing said casing in said housing, and louvres in said panel adapted to register with the air intake and air discharge openings in said casing.

7. In an air conditioning apparatus, the combination of a vertically disposed casing having an air intake and an air discharge opening, a liquid spray device in said casing for inducing an air current through said openings, a housing for said casing, a door hinged to said housing for exposing said casing when opened, louvres in said door adapted to register with the air intake and air discharge openings in said casing, and a decorative panel between said louvres.

8. In an air conditioning apparatus, the combination of a casing adapted to be secured to a wall, said casing having a lateral air intake opening at the top thereof and a lateral air discharge opening at the bottom thereof, a liquid spray device in said casing for inducing an air current into said top opening and out of said bottom opening in the casing, a front cover for said casing, a movable panel in said cover, and louvres in said cover adapted to register with the top and bottom openings in said casing.

9. In an air conditioning apparatus, the combination of a vertical casing adapted to be inserted in a recess in a wall, said casing having an upper air intake opening and a lower discharge opening, a liquid spray device in said casing for inducing an air current through the openings in said casing, a front cover for said casing adapted to be secured to the wall adjacent the recess therein, a movable panel forming part of said cover, and louvres in said panel adapted to register with the air intake and air discharge openings in said casing.

10. In an air conditioning apparatus, the combination of at least one vertically extending tube, a housing communicating with each end of said tube, the upper housing having an intake opening and the lower housing having a discharge opening, means for introducing a liquid spray into said tube adjacent the upper end thereof for creating suction therethrough, and a baffle in said lower housing having laterally extending wings and a central ribbed deflector for directing the air toward the discharge opening.

11. In an air conditioning apparatus adapted to be inserted in a recess in a wall, the combination of a casing, a liquid spray device therein for inducing an air current therethrough, an open frame for said casing adapted to be secured to the wall, and a door hinged to said frame over the opening therein, whereby access may be had to said casing.

12. In an air conditioning apparatus adapted to be inserted bodily in an opening in a wall, the combination of a casing, a liquid spray device therein for inducing an air current therethrough, and a cover for said casing and wall opening including an open frame adapted to be secured to the wall to frame the opening therein, and a movable panel mounted on said frame over the opening therein, whereby access may be had to said casing.

13. In an air conditioning apparatus adapted to be inserted in a recess in a wall, the combination of a casing, a liquid spray device therein for inducing an air current therethrough, said casing having air intake and air outlet openings, and a cover for said casing including an open frame adapted to

be secured to the wall to frame the recess therein, a door hinged to said frame over the opening therein, and louvres in said door adapted to register with the air intake and
5 air outlet openings of said casing when the door is closed.

14. In an air conditioning apparatus adapted to be inserted in a recess in a wall, the combination of a casing, a liquid spray
10 device therein for inducing an air current therethrough, said casing having air intake and air outlet openings, and a cover for said casing adapted to be secured to the wall over the recess therein, and louvres in said cover
15 adapted to register with the air intake and air outlet openings in said casing.

15. In an air conditioning apparatus, the combination of a vertically disposed casing having upper air intake and lower air discharge openings, a plurality of vertical tubes
20 in said casing communicating at opposite ends with said openings, a liquid spray device in each of said tubes for inducing a current of air in said openings and tubes, a
25 movable panel closing the front of said casing, and louvres in said panel registering with at least one of said openings.

16. In air conditioning apparatus, the combination of a vertically extending casing having upper and lower air passages, a
30 liquid spray device in said casing for inducing the current of air through said openings and said casing, and a baffle in the lower portion of said casing adjacent said
35 lower opening having a central rib and curved surfaces extending laterally of said rib for deflecting the air laterally through said discharge opening.

In testimony whereof we affix our signatures.
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EDWARD L. FONSECA.

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