Feb. 27, 1934. T. B. BRUNT 1,948,647

AIR CONDITIONING APPARATUS

Filed April 27, 1932 2 Sheets-Sheet 1

Fig. 1.

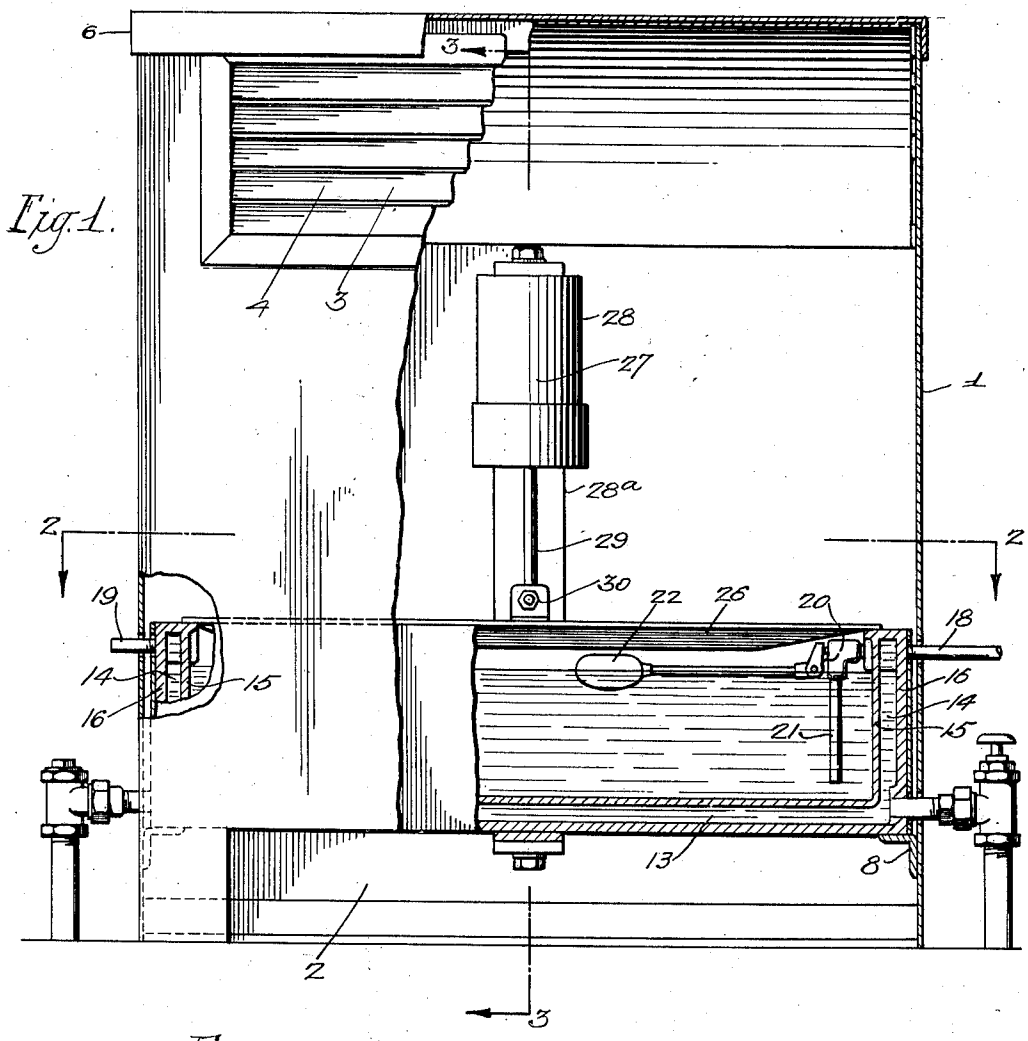

Fig. 2.

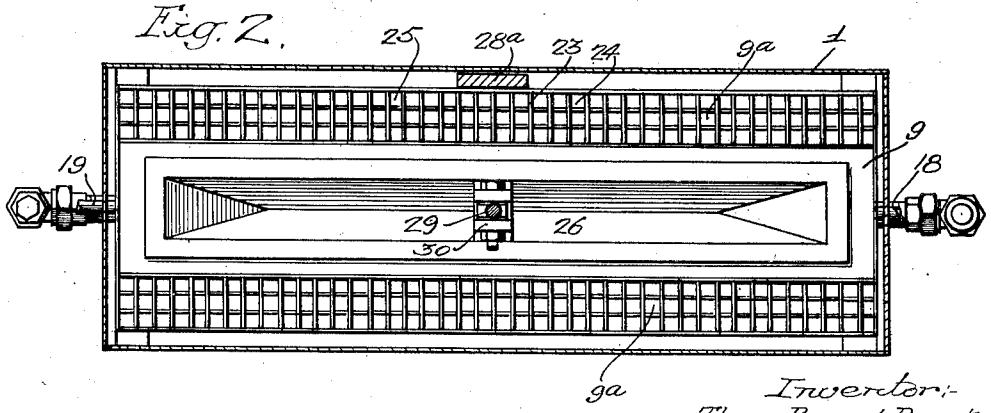

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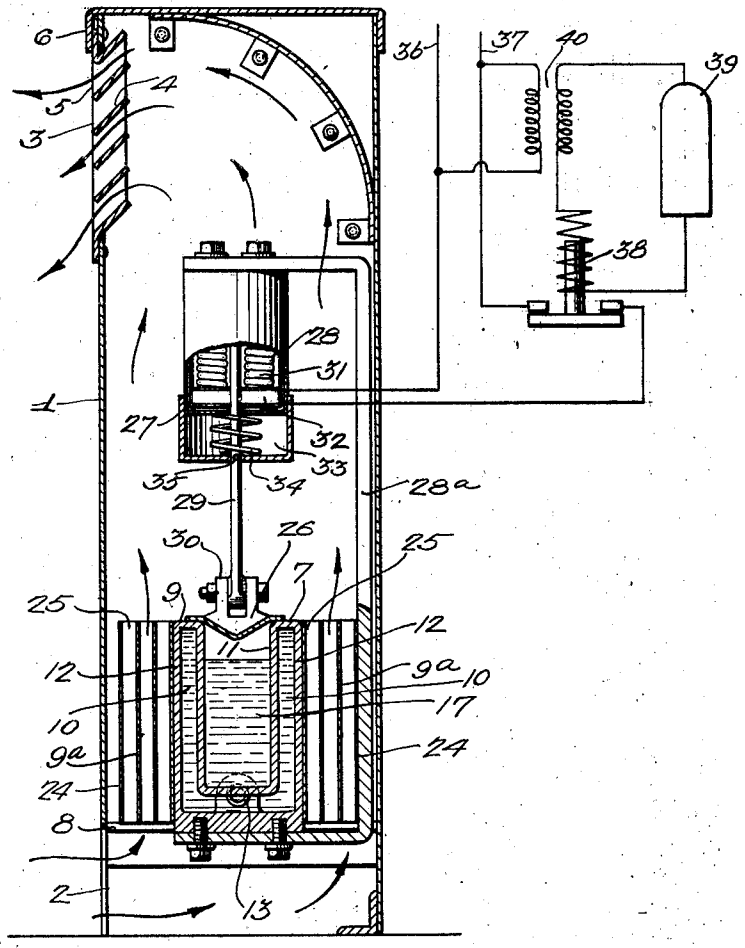
Fig. 3.



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AIR CONDITIONING APPARATUS

Thomas Bayard Brunt, Philadelphia, Pa.

Application April 27, 1932, Serial No. 607,864

10 Claims. (Cl. 257—138)

This invention relates to air-conditioning apparatus and more particularly to improvements in heating and humidifying apparatus. The general object of the invention is to provide simple but highly efficient apparatus of this nature.

A more specific object of the invention is to provide a novelly constructed heating and humidifying device which functions efficiently to radiate a maximum amount of heat and to evaporate a maximum amount of humidifying liquid.

Another object of the invention is to provide a device as above specified which is housed in a novelly constructed cabinet and forms therewith a unit which performs the desired function and presents a pleasing appearance.

A further object of the invention is to provide means for controlling the humidifying function of the device in accordance with the humidity of the surrounding atmosphere.

Other objects and features of the invention will appear hereinafter. The following detailed description and the accompanying drawings will afford a clear and complete understanding of the invention. In the drawings:

Fig. 1 is a front elevational view, partly in section, of apparatus constructed in accordance with the invention;

Fig. 2 is a sectional view taken along line 2—2 of Fig. 1; and

Fig. 3 is a sectional view of the apparatus taken along line 3—3 of Fig. 1 and a schematic wiring diagram of the electrical control system of the apparatus.

Referring to the several views of the drawings, there is shown a cabinet 1 which serves as an air-circulating chamber and also houses the apparatus. To this end, the cabinet is formed to provide an air-inlet opening 2 at its lower end and an air-outlet opening 3 at its upper end. Preferably, the cabinet is provided with air-deflecting louvres 4 which provide the outlet opening into a series of slot-like passages 5. The cabinet has a removable top which is illustrated at 6. By virtue of this construction, the air ensuing from the outlet passages of the cabinet is caused to take the desired course. It will be understood that continuously circulating currents of air pass through the cabinet, as indicated by the arrows on Fig. 3.

A novelly constructed heating and humidifying device 7 is mounted within cabinet 1 upon angle supports 8 attached to the walls of the cabinet. In accordance with the invention, device 7 comprises a long and continuous body 9 (see Fig. 3), which is formed so as to be U-shaped in cross section, and opposed fin structures 9a. Body 9 is formed as a continuous member to provide spaced long, wide and shallow conduit passages 10 with relatively thin inner walls 11 and outer walls 12. These passages, together with the shallow horizontal passage 13, serve to conduct the heating medium used in any particular instance, such as hot water, steam, etc., inlet and outlet pipes being provided to conduct such medium to and away from body 9. The ends of the body member are also formed to provide shallow passages 14 (see Fig. 1) having inner walls 15 and outer walls 16. It will be apparent that the interior space 17 bounded by the inner walls 11 and 15 takes the form of a trough. This trough is used as a reservoir for the humidifying liquid and to this end, suitable inlet and outlet pipes 18 and 19 extend through the ends of the device, as shown clearly in Fig. 1. Pipe 18 is connected through valve 20 to pipe 21 which terminates near the bottom of the reservoir. Valve 20 is controlled by a suitable float 22 to maintain the level of the humidifying liquid at a predetermined point or value.

It will be noted that by virtue of the shallowness of passages 10 of the heating device, a maximum quantity or amount of the heating medium is in contact with the interior surfaces of walls 11 and 12. It will also be noted that these surfaces, being long and wide, present a large contact area to the heating medium. The outer surfaces of these walls similarly present large contact areas to the humidifying liquid and to the heat-radiating fin structures respectively. By virtue of the construction, a maximum amount of heating and radiating surface per unit quantity of heating medium is exposed to the humidifying liquid and radiating fin structures respectively. It should be here noted that the term "U-shaped" as used herein and in the claims includes any channel or trough shaped structure and is not limited to a precise U-shaped construction. For example, a V-shaped structure might well be used. Moreover, the invention contemplates broadly the provision of a conduit for the heating medium having a continuous, long, wide, and shallow portion, a humidifying liquid reservoir on one side of the said portion and radiation fins on the other side thereof. While the U-shaped construction is preferable, it is not to be considered as limiting the invention except as is necessary in view of the prior art.

The opposed outer walls 12 of body 9, which are long and wide as above noted, have attached thereto or in contact therewith the fin structures

9a above mentioned. These structures, which are shown more clearly in Fig. 2, comprise sets of fins 23 and 24 arranged perpendicular to each other to provide honeycomb structures. The fins are, of course, formed of thin, heat-conducting metal. This construction provides vertically extending passages 25 which conduct the air currents flowing upward through the cabinet as illustrated in Fig. 3. The particular construction of the fin structures resorted to gives a maximum of heat radiation from the large heat-radiating surfaces of walls 12. It will be apparent that by having fins 24 in addition to fins 23, a much greater total heat-radiating surface is provided. Moreover, the fin structures may be more readily cleaned than is possible with known types of fin structures. The square spaces 25 formed by the fins will readily receive a long straight brush. Thus, it is merely necessary to insert such a brush into each of the spaces 25 to clean the surfaces of the fins. Obviously, it is easier to thus clean the device than is possible with structures having curved surfaces and requiring specially shaped brushes.

In order to control the air-humidifying function of the device, there is provided a movable cover 26 which conforms with and fits nicely over the open top of the humidifying reservoir. The lower surface of this cover is formed as illustrated in Fig. 3 to deflect the vapor into the paths of the air currents. It is desired to control the cover to thus regulate the escape of the humidifying vapor in accordance with the humidity of the air surrounding the device which it is desired to condition. To this end, a control device designated generally by reference character 27 is provided. As shown more clearly in Fig. 3, this device comprises a housing 28 which may be attached to the upper end of bracket 28a whose lower end is attached to the base of body 9, the bracket being formed and arranged as illustrated. Rod 29 slidably extends through the housing, the lower end of the rod being connected as at 30 to cover 26. A pair of heat sensitive expansion members 31 are mounted within housing 28 and are connected at their upper ends to the upper end of rod 29. A suitable yoke (not shown), to which rod 29 is connected, bridges the expansion members and is connected to their upper ends. Beneath members 31, there is disposed an electrical heating element 32. It will be understood that rod 29 extends slidably through the heating element. The lower chamber 33 of housing 28 serves to house a coiled spring 34, which engages pin 35 on rod 29. It will be apparent that spring 34 urges rod 29 downward, thereby urging cover 26 to its closed position.

Heating element 32 is connected to a suitable source of electrical energy (not shown) by line conductors 36 and 37. This supply circuit of the heating element is controlled by relay 38, whose energizing winding is connected serially in a circuit including a humidistat 39 and the secondary of a step-down transformer 40. The humidistat is, as well known, a device which responds to the humidity or humidified condition of the air and controls an electrical circuit accordingly in the same manner as a thermostat controls an electrical circuit in accordance with temperature variations. The purpose of transformer 40 is, of course, to obtain a low voltage from the supply lines for the humidistat and relay circuit. It will be understood that any conventional type of humidistat may be used, this element of the system per se forming no part of the invention.

In operation, cold or unheated air will enter the inlet opening 2 of the cabinet and will pass in currents upward through the passages of the fin structures, as noted above. In passing through the fin structures and contacting the metallic surfaces thereof, the air will be heated, the heated air passing on upward through the cabinet and out through the outlet opening 3. At the same time, the humidifying liquid in reservoir 17 is being vaporized and if cover 26 is open, the humidifying vapor will intermingle with the heated air, the deflecting lower surfaces of cover 26 directing the streams of vapor into the path of air as it leaves the fin structures. If the humidity of the atmosphere surrounding the device is at or above a predetermined value, the relay circuit controlled by the humidistat 39 will be opened and the supply circuit for heating element 32 will likewise be opened. As a result, expansion members 31 will be in their contracted condition and spring 34 will urge cover 26 to its closed position, thereby preventing further humidification of the air.

Now if the humidity of the surrounding atmosphere falls below the predetermined value, the humidistat will respond, closing the circuit controlled by it and energizing relay 38. The relay will close the supply circuit of heating element 32, which element will heat the expansion elements 31, causing them to expand and raise cover 26 against the action of spring 34. As a result, the humidifying reservoir will be uncovered, allowing humidification of the heated air in the manner above set forth.

While there is disclosed herein a single embodiment of the invention, the apparatus may obviously be modified in its details without departing from the spirit and scope of the invention. Any such changes or modifications, therefore, as fall within the scope of the appended claims are deemed to be a part of the invention. Although the apparatus is essentially heating and humidifying apparatus, it may be used as air-cooling apparatus during warm weather by passing cooling brine or the like through it.

I claim:—

1. In an air conditioning device, a conduit for the conditioning medium having a continuous, long, wide, and shallow portion, said portion having opposed long and wide external surfaces, one of said surfaces forming a wall of a humidifying fluid reservoir, and a honeycomb radiating fin structure extending from the other of said surfaces, whereby maximum conditioning and radiating surfaces per unit quantity of conditioning medium in said portion are obtained.

2. In an air conditioning device, a conduit for the conditioning medium having a pair of spaced continuous, long, wide, and shallow portions, said portions each having opposed long and wide external surfaces, two of said surfaces forming opposite walls of a humidifying fluid reservoir, and a honeycomb radiating fin structure extending from each of the other of said surfaces, whereby maximum conditioning and radiating surfaces per unit quantity of conditioning medium in said portions are obtained.

3. In an air conditioning device, a continuous long U-shaped conduit for the conditioning medium having a pair of spaced long, wide, and shallow portions, said portions each having opposed long and wide external surfaces, the space between said portions constituting a humidifying fluid reservoir, and honeycomb radiating fin structures extending from outer surfaces of said portions, whereby maximum conditioning and

radiating surfaces per unit quantity of conditioning medium in said portions are obtained.

4. Air-conditioning apparatus, comprising an enclosure having bottom and top openings for ingress and egress of air, an air conditioning device in said enclosure, said device having a continuous long U-shaped conduit for the conditioning medium, the space between the substantially vertical portions of said conduit constituting a humidifying fluid reservoir, and fin structures having vertical passages therethrough extending from the outer sides of said conduit, whereby streams of air pass upward through said fin structures on each side of said reservoir.

5. Air-conditioning apparatus, comprising an air-conditioning device having a conditioning medium conduit with a continuous long, wide, and shallow portion, said portion having its width disposed substantially vertically, one side of said portion forming a wall for a humidifying fluid reservoir, radiating fins extending from the other side of said portion, means for directing a stream of air upward through said fins, a damper for opening and closing said reservoir to the atmosphere, said damper having a deflecting surface for directing humidifying vapor into the path of said stream of air and means for controlling said damper in accordance with the humidity of the atmosphere about said device.

6. Air conditioning apparatus, comprising an enclosure having bottom and top openings for ingress and egress of air, an air-conditioning device in said enclosure, said device having a continuous U-shaped conduit for the conditioning medium, the space between the substantially vertical portions of said conduit constituting a humidifying fluid reservoir, fin structures having vertical passages therethrough extending from the outer sides of said conduit, whereby streams of air pass upward through said fin structures on each side of said reservoir, a damper for opening and closing said reservoir to the atmosphere, said damper having deflecting surfaces for directing humidifying vapor into the paths of said air streams, and means for controlling said damper in accordance with the humidity of the atmosphere about said device.

7. In air-conditioning apparatus, an enclosure having air ingress and egress openings, an air-conditioning device in said enclosure, said device comprising a conduit for conditioning medium having opposed external surfaces, one of said surfaces forming a wall of a humidifying fluid reservoir, a fin structure having air passages therethrough extending from the other of said surfaces, whereby streams of air pass through said fin structure adjacent said reservoir, and means for controlling the humidifying vapor and directing it into the path of said air streams.

8. In air-conditioning apparatus, an air-conditioning device comprising a conduit for conditioning medium having opposed external surfaces, one of said surfaces forming a wall of a humidifying fluid reservoir, radiating fins extending from the other of said surfaces, means for directing a stream of air through said fins, and means for controlling the humidifying vapor and directing it into the path of said air stream.

9. In air-conditioning apparatus, an enclosure having air ingress and egress openings, an air-conditioning device in said enclosure, said device comprising a conduit for conditioning medium having opposed external surfaces, one of said surfaces forming a wall of a humidifying fluid reservoir, a fin structure having air passages therethrough extending from the other of said surfaces, whereby streams of air pass through said fin structure adjacent said reservoir, and means controlled by the humidity of the atmosphere about said apparatus for controlling the humidifying vapor and directing it into the path of said air streams.

10. In air-conditioning apparatus, an air-conditioning device comprising a conduit for conditioning medium having opposed external surfaces, one of said surfaces forming a wall of a humidifying fluid reservoir, radiating fins extending from the other of said surfaces, means for directing a stream of air through said fins, and means controlled by the humidity of the atmosphere about said apparatus for controlling the humidifying vapor and directing it into the path of said air stream.

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