July 24, 1962 E. F. CHANDLER 3,045,450

AIR TREATING AND COOLING DEVICE

Filed March 30, 1960 2 Sheets-Sheet 1

Fig. 1

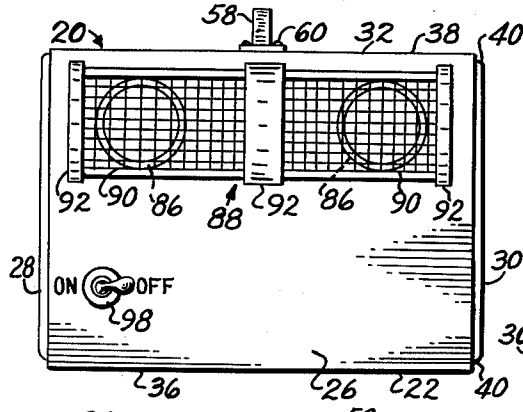
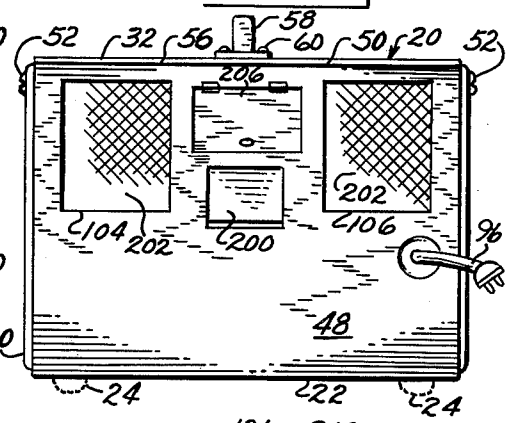


Fig. 2



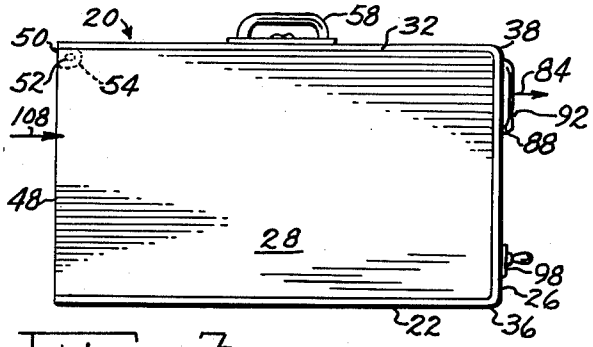


Fig. 3

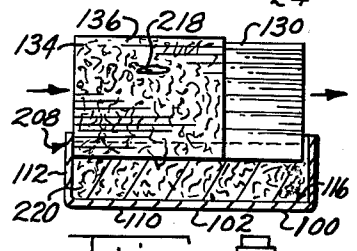


Fig. 8

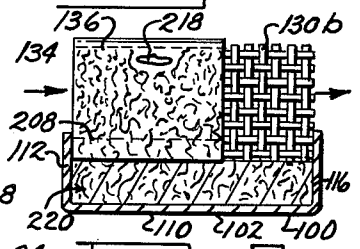


Fig. 9

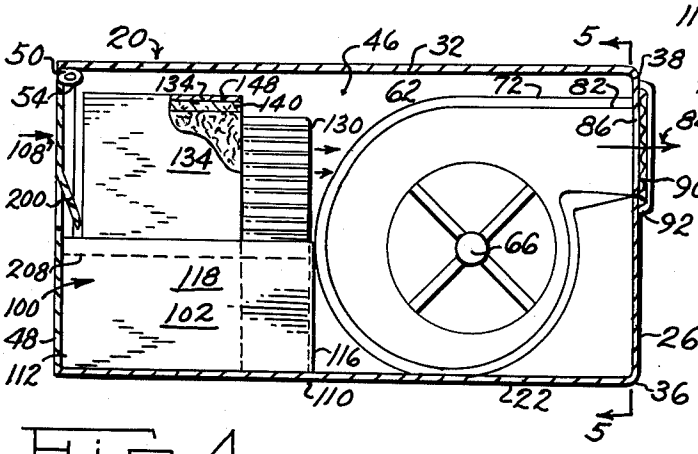


Fig. 4

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July 24, 1962 E. F. CHANDLER 3,045,450

AIR TREATING AND COOLING DEVICE

Filed March 30, 1960 2 Sheets-Sheet 2

Fig. 5

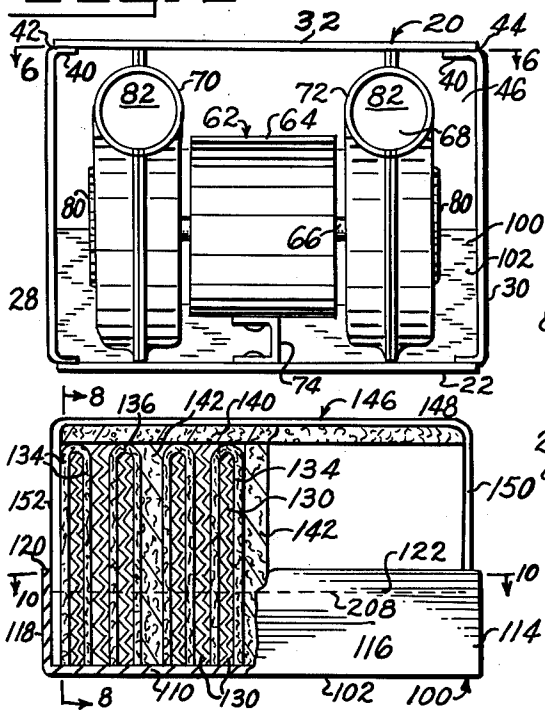

Fig. 6

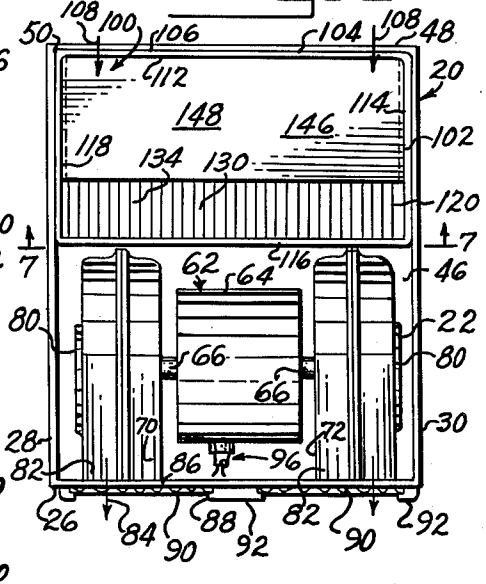

Fig. 7

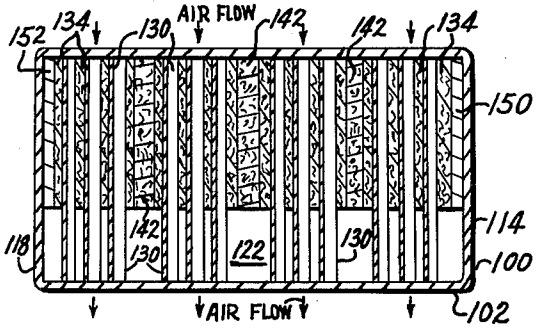

Fig. 10

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AIR TREATING AND COOLING DEVICE

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3 Claims. (Cl. 62—311)

This invention relates to improvements in devices for impelling, cooling and otherwise conditioning air.

An object of the invention is to provide a novel and improved air cooling and conditioning device which may be disposed in any desired location for providing a zone of comfort thereat, with temperature decrease, a reasonable amount of humidification, and all around convenience.

Another object of the invention is to provide a novel and improved air cooling and conditioning device which is quite compact and easily contained in a small portable housing, so that it may be carried out of a building with other luggage and the like, for use on trips, and also in the home and office.

A further object of the invention is to provide a novel and improved air cooling and conditioning device in which there is an air impeller for moving the ambient air into and out of the housing in which the cooling and conditioning takes place, and means disposed inside the housing in the path of the moving air for reducing its temperature and making it more comfortable to the persons in the zone it is serving.

Still another object of the invention is to provide a novel and improved air conditioning device which makes use of fluid carried up from a trough or tank on air engaging elements of novel type, to absorb moisture from the air, and from the air engaging elements, thus cooling the air itself without need for mechanical compressors, valves and the like.

Still a further object of the invention is to provide a novel and improved air conditioning zone cooler, of the type described, which is simple in design, formed of few parts, and which may be made at low cost.

These and other objects and advantages of the invention will be apparent from the following description of a preferred embodiment thereof, as illustrated in the accompanying drawings, forming a part hereof, and in which,

FIGURE 1 is a front elevational view showing the device in its cabinet.

FIGURE 2 is a rear elevational view of the device shown in FIGURE 1.

FIGURE 3 is a left side elevational view of the device shown in FIGURE 1.

FIGURE 4 is a longitudinal sectional elevational view taken substantially on plane 4—4 of FIGURE 1.

FIGURE 5 is a transverse sectional elevational view taken substantially on plane 5—5 of FIGURE 4.

FIGURE 6 is a top plan view taken substantially on plane 6—6 of FIGURE 5, with the top wall 32 removed.

FIGURE 7 is a transverse sectional elevational view taken substantially on plane 7—7 of FIGURE 6, the view being partly broken out to show the constructional features, and some of the evaporator units to the right of the middle being omitted for clarity.

FIGURE 8 is a sectional elevational view showing a modified form of the evaporator unit, as might be seen on plane 8—8 of FIGURE 7, with corrugated metallic plates, and lower interior elements inside the trough.

FIGURE 9 is a sectional elevational view similar to FIGURE 8, but showing a modified form of the evaporator unit, with woven wire fabric replacing the corrugated plates of FIGURE 8.

FIGURE 10 is a sectional plan view taken substantially on plane 10—10 of FIGURE 7.

In order to understand clearly the nature of the invention, and the best means for carrying it out, reference may now be had to the drawings, in which like numerals denote similar parts throughout the several views.

In connection with the manufacture and installation of devices for cooling and comfortizing the air in a small space, room or area, various factors must be considered as quite important. Thus the air must be cooled and should be brought to a comfortable degree of humidity, upon which so much comfort depends. Where, as in the present device, resort is had to use of evaporative means for cooling the air, in conjunction with an impelling fan, the construction must be such as to give a marked cooling effect with a small unit, and yet to be able to withdraw from humidified air, some of the entrained moisture, so that it is not too humid for comfort. This is accomplished in the present unit with very simple construction.

As seen in FIGURES 1, 2 and 3, there is a main housing or cabinet generally indicated at 20, with a floor wall 22 adapted to rest upon a surface directly, such as a table top, stand, or the like, although, if desired, small rubber feet may be secured to the undersurface of the floor 22, as at 24 to furnish cushioned support and shock absorbing action if desired. The floor wall 22 is secured at its front edge to the front wall 26 of the cabinet, and similarly to the left and right side walls 28 and 30 in any convenient manner, and it is seen that there is a top wall or roof member 32 overlying all the three walls mentioned, and secured to them in any suitable manner. For example, the floor 22, front wall 26 and roof member 32 may all be interconnected integrally at edges 36 and 38, being formed from a single continuous sheet of metal or plastic sheeting, and the side walls 28 and 30 may be formed slightly dished, that is, with edge flanges 40 allowing the flanges to be inserted into the openings formed on each side of the cabinet at 42 and 44, as seen best in FIGURE 5, and secured therein by welding, brazing, or by means of screws or other fastenings. In the views, the thickness of the walls and flanges is somewhat exaggerated for clarity of illustration only.

There is thus formed a main housing chamber 46, inside which various components are disposed as hereinbelow described. A rear closure or wall member 48 may be fitted over or into the rear opening 50 of the main housing, being secured therein in any suitable manner, as by means of screws 52 extending through flanges 54 and through the abutting walls 30 and 28 of the cabinet. The rear wall 48 may also be hinged at the top edge 56 to the rearward portion of the roof wall 32, in which event, the chamber would be opened by swinging the rear wall 48 outwardly and upwardly to afford access to its interior.

A carrying and lifting handle 58 may be secured by screws 60 to the top wall 38 of the cabinet, thus making it readily portable, and movable to any point or location where the user desires to create a zone of comfort for himself or others. Inside the main chamber are several main actuating units or assemblies.

Thus there is the air impeller unit or assembly generally indicated at 62, which includes an electric motor 64, the shaft 66 of which may extend outwardly in left and right directions as shown, to carry the air impeller fans 68 inside the fan housings 70 and 72, the fans being preferably of the centrifugal types as shown. A bracket 74 may be employed to support the electric motor 64, in the manner shown in FIGURE 5, but the actual mode of support will depend upon the actual construction of the motor and fan housings, which may vary, depending upon the source of supply for these elements, and their size and

shape. While I show a twin fin arrangement with a single motor, it is understood that I do not wish to be limited to this construction, and that in a modified form of the invention, there may be only one air impelling fan, of suitable capacity, or more than two fans, and each may have its own individual motor drive, depending upon the quantity of air per minute which is being drawn through the unit. Similarly, I do not wish to be limited to the particular cabinet construction, shown, since according to a modified form of the invention, the walls may be all integral with the exception of an access door or wall, and may be deep drawn, or otherwise formed in mass production. Also according to another modified form of the invention, the cabinet may be shaped differently, with one or more of its walls curved rather than planar, and even circular or oval in cross section when viewed as in FIGURE 5, rather than rectangular, to meet specific advantages in a particular use.

Where the device is to be mounted or used in a motor vehicle, for example, then it may be otherwise shaped so that it may be readily attached to a desired part of the car, and be out of the way, yet handy for effective cooling of the interior of the automobile. Use of the device in an automobile is particularly advantageous, since it may be constructed with a motor wound for use on the car battery, of six volts or twelve volts, and also suitable for use on 110 volts, the motor being of a so-called universal type, which operates on both alternating and direct currents. Where the user has a small current converter, for converting six volts of the car battery into 110 volts alternating current, then of course, it may be used with such converter, and if desired, a small converter may be mounted inside the cabinet near the motor **64**, since there is sufficient room at that location if desired.

It is seen that the fans have air intake openings at **80** for drawing the air in to the fan housings, where, under the influence of the blades of the impeller, the air is blown out through the discharge openings **82** in the direction of the arrows **84** in FIGURES 4 and 6, the front panel or wall **26** being provided with inner openings **86** in registry with the fan discharge openings. A grillwork assembly **88** may be applied over the discharge openings **86**, in the form of one or two sheets of wire netting **90** mounted in brackets or moldings **92** secured to the wall **26**. The electric motor **64** is connected to the power lines by means of a cord or wires **96**, through normally open switch **98**.

As best seen in FIGURES 4, 6 and 7, there is also a major air cooling unit or assembly **100** disposed inside the main chamber, to the rear of the fan assembly. This includes a pan, trough, container or the like **102** for the reception of the various elements to laminate the air flow and condition and cool it on the way to the fans and before discharge. It is seen that there are a pair of rear openings **104** and **106** formed through the rear panel **48**, as seen in FIGURE 2, to allow air to be drawn into the housing in the direction of arrows **108**. The pan **102** has a bottom wall **110**, and upstanding side and end walls **112**, **114**, **116** and **118**, defining an upwardly open chamber **120** for the reception of a fluid, such as water **122** and the other elements described.

An important purpose of the construction of the elements shown, is to laminate the air flow as it passes through the major unit **100** shown best in FIGURES 4, 6 and 7. To do this, I provide a number of thin metallic sheets **130**, which in one form are corrugated horizontally as seen in FIGURE 7, and extend downwardly into the liquid **122** in the trough. Between adjacent sheets **130**, I provide wick elements **134**, which are arranged so that there is one sheet wick element **134** between each pair of adjacent sheets **130**, the wick elements also dipping into the water in the trough. It is seen from FIGURE 7, that each pair of adjacent wick elements **134** may be joined at the top by a web **136**, and thus simply the assembly, while at the same time supporting the wick elements more easily in position, since then they are supported from the top, by hanging in U-shape over the sheet elements **130**. The specific construction and nature of the wick elements and sheet members is shown in detail below and in other views also.

It has been found advantageous to place above all the assembled wick elements **134** and sheets **130**, a roof plate of water absorbent material **140**, as shown best in FIGURE 7, and one or more spacing wick members **142** at spaced locations along the stacks of wicks and sheets **130**. The spacing wick members **142** thus draw water up from the trough, and feed it to the roof plate **140**, and this provides added efficiency in fluid distribution and operation. A confining U-shaped casing member **146** is convenient for maintaining the entire assembly in the case and protecting it also. This member **146** has a top wall **148** and depending side walls **150** and **152**, which depend inside the trough. As the top wall **148** goes against the underside of the housing ceiling **38**, and the side walls **150** and **152** against the sides of the main chamber, it is seen that leaks are largely prevented, and the air flow constrained through the laminating elements.

A filler door **200** may be formed in the rear panel **48**, and it may be merely tongued out so as to extend inwardly slightly, to permit pouring water into the trough **102** as needed, or may be hinged to swing in or out for this purpose. Sufficient clearance will be left to accommodate the door **200**, as indicated in exaggerated form in FIGURE 4. Air filters may be disposed in the windows shown at **104** and **106**, as at **202**, including fibrous masses, fibreglass, or other suitable well known filters, to block passage of dust and dirt particles into the interior of the cabinet, and they may be mounted in any suitable manner. By hingeing the door **200**, it is seen that it also may be left closed so that all air enters through the filters. Another inspection and service door may be hinged at **206** also as needed.

Referring to FIGURES 4, 7 and 10, it is seen that the trough **102** has the water level standing at about **208**, with the various evaporator elements immersed therein. There are the plates **130**, which are shown corrugated according to one form, and the wick elements **134** on each side of the plates **130**. It is seen that it is preferred according to one form, to extend the plates **130** rightwardly as seen in FIGURE 4, past the right edges of the wick elements **134**, so that any entrained moisture still remaining in the air to excess, will be condensed on the plates **130** in the free space to the right of the wick elements, and thus dry the air or at least the air at this location, before it enters the impelling fans **62**.

FIGURES 8 and 9 show how, instead of extending the wick elements **134** and the evaporator sheet elements **130** right to floor **110** of the trough, they may be vertically shortened somewhat by placing a bottom spongy support member **220** below them and on the trough floor, to soak up the water in the trough to some extent, and keep the wick elements continuously supplied with water, it being seen that the wick and sheet elements **134** and **130** nevertheless are partially immersed in the water, since its level as shown is at as **208**. FIGURES 8 and 9 show how staples or other fasteners **218** may be used to clamp the sheet members **130** to the wick members **134**. It is also seen that in FIGURE 8 there is the corrugated metal foil type of member **130**, while in FIGURE 9 there is the woven wire mesh **130*b***, the mesh being somewhat exaggerated for clarity of illustration, but having sufficient overall thickness due to inter-twining of the wires, as to space the wick members and thus to provide laminated air flow therebetween. Where the wire is fine, it may be desirable to emboss or otherwise form grooves therein, to increase its overall thickness between wicks.

FIGURE 1 shows the outlets **86** for the fans **62**, it being understood that when viewed from the front they will not be so visible, but only shown so for clarity. It is also understood that the outlets of the fans register with

openings formed through the front wall **26** of the housing, fitting therewith so that there is no leakage around the fan outlets inwardly of the cabinet. The wire cages shown at **90** have some depth preferably, to permit diffused air exit into the vestibules formed inside the cages **90** after the air leaves the fan outlets, yet constraining it into a defined air flow pattern.

The evaporative elements or wick elements **134** may be of any material, preferably in relatively thin sheet form, that possesses capillary qualities, that is, wick action, sufficient to maintain the desired dampness of the surface area exposed to the moving air. The desired effect may be obtained with a ceramic plate; a plate composed of a suitable powdered metal; asbestos sheeting with or without a cotton or other fibre content, fibre glass, etc.; a blotting paper, paper sponge, non-woven fabrics, woven fabrics and other materials having characteristics making them suitable for use in the manner described where the air is caused to pass in laminated or other form over an extended area rather than being passed through one or more sheets or masses of absorbent material. The method shown, wherein the body of moving air is laminated or otherwise divided into a great number of streamlets favors the evaporative air cooling effect obtained because of the scrubbing action of the air in close contact with the evaporative surface.

It is desirable under certain circumstances to accelerate the heat exchange without unduly increasing the resistance to the air stream and this may be accomplished by either suitably embossing the otherwise smooth surface of the means **130**, metallic or otherwise, which separate the evaporative elements to form air channels therebetween or using in place thereof suitably formed wire screening **130***b* shown in FIGURE 9. A certain area of exposed evaporative surface is required to afford the desired air cooling effect and the method herein described whereby this area is obtainable in an extremely small space economically, thus greatly reduces the overall size of the unit for a given cooling capacity, and the elimination thereby of the need for mechanical pumping means to supply moisture to the evaporative surfaces is an important feature of the invention.

As an example, the Goodyear Tire and Rubber Company markets the Chemigum latex used as the binder material in the production of the non-woven fabric, which is suitable in the device at **134**. In order to obtain the desired wicking action, the flocking process might also be used, according to a modified form of the invention, spraying a flocculent substance upon an adhesively prepared metal or other surface. By use of the pad **220** of cellulose material sponge and the like as seen in FIGURES 8 and 9, not only is the cost of the materials reduced, but also it is seen that spillage of water is prevented, when the unit is moved about. The wicking sheets **134** are preferably permeable to air and water, with high wet strength, good wick action, and do not have to be rigid, since they are supported in sandwich fashion as shown. Pollen and other air impurities are filtered out by the air filters at **202**.

Although I have described my invention in specific terms, it will be understood that various changes may be made in size, shape, materials and arrangement without departing from the spirit and scope of the invention as claimed.

I claim:

1. An air treating and cooling device comprising a main housing defining a chamber, with air inlet and outlet means communicating with said chamber, air impelling means for drawing air into said chamber and discharging the same therefrom through said air outlet means, air evaporator unit means disposed in said chamber with at least a portion of said air evaporator unit in the path of flow of said air through said chamber, said evaporator means comprising trough means for containing a quantity of water or the like, fibrous wick means partially immersed in said water and extending upwardly out of said water for providing a continuously moist surface over which said air passes, condensing plate means disposed adjacent said wick means and forming a plurality of lamination passages therebetween for the said air to flow therethrough, said condensing plate means extending beyond said wick means in a direction toward said air impelling means, whereby air is cooled in passing through said lamination passages in evaporation, and any moisture entraining in said air is condensed in droplets onto said plate means in said extended portion for return to said trough means, whereby said air is cooled and conditioned prior to discharge from said chamber.

2. The construction according to claim 1, characterized further in that said wick means comprises a plurality of wick elements standing in said liquid in said trough for absorbing liquid continuously therefrom while the air passes over the surfaces of said wick elements.

3. The construction according to claim 1, characterized further in that said wick means comprises a plurality of wick sheet elements standing in said liquid in said trough for absorbing liquid continuously therefrom while the air passes over the surfaces of said wick elements, said wick sheet elements comprising felted bodies of fibrous material with good water absorption properties.

4. The construction according to claim 1, characterized further in that said condensing plate means comprises at least one piece of sheet material, and formed to spread the adjacent wick means so as to form air passages therebetween for laminating the air flow therethrough.

5. The construction according to claim 1, characterized further in that said condensing plate means comprises at least one piece of corrugated sheet material, formed to spread the adjacent wick means so as to form air passages therebetween for laminating the air flow therethrough.

6. The construction according to claim 1, characterized further in that said condensing plate means comprises at least one piece of corrugated sheet metal with the corrugations extending longitudinally of the air flow direction, so as to spread the adjacent wick means to form air passages between the said wick means and said sheet metal.

7. The construction according to claim 1, characterized further in that said condensing plate means comprises wire mesh material in sheet form, constructed as to spread adjacent wick means to form air passages therebetween.

8. The construction according to claim 1, wherein there is moisture absorbing roof wick pad overlying all said wick means, and main wick chimney means of substantial thickness interposed between at least one pair of adjacent wick means with the lower ends of said wick chimney means extending into the water in the trough and the upper ends in contact with said roof wick pad to carry water to said roof wick pad and to thereby maintain the upper portions of said wick means moist.

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