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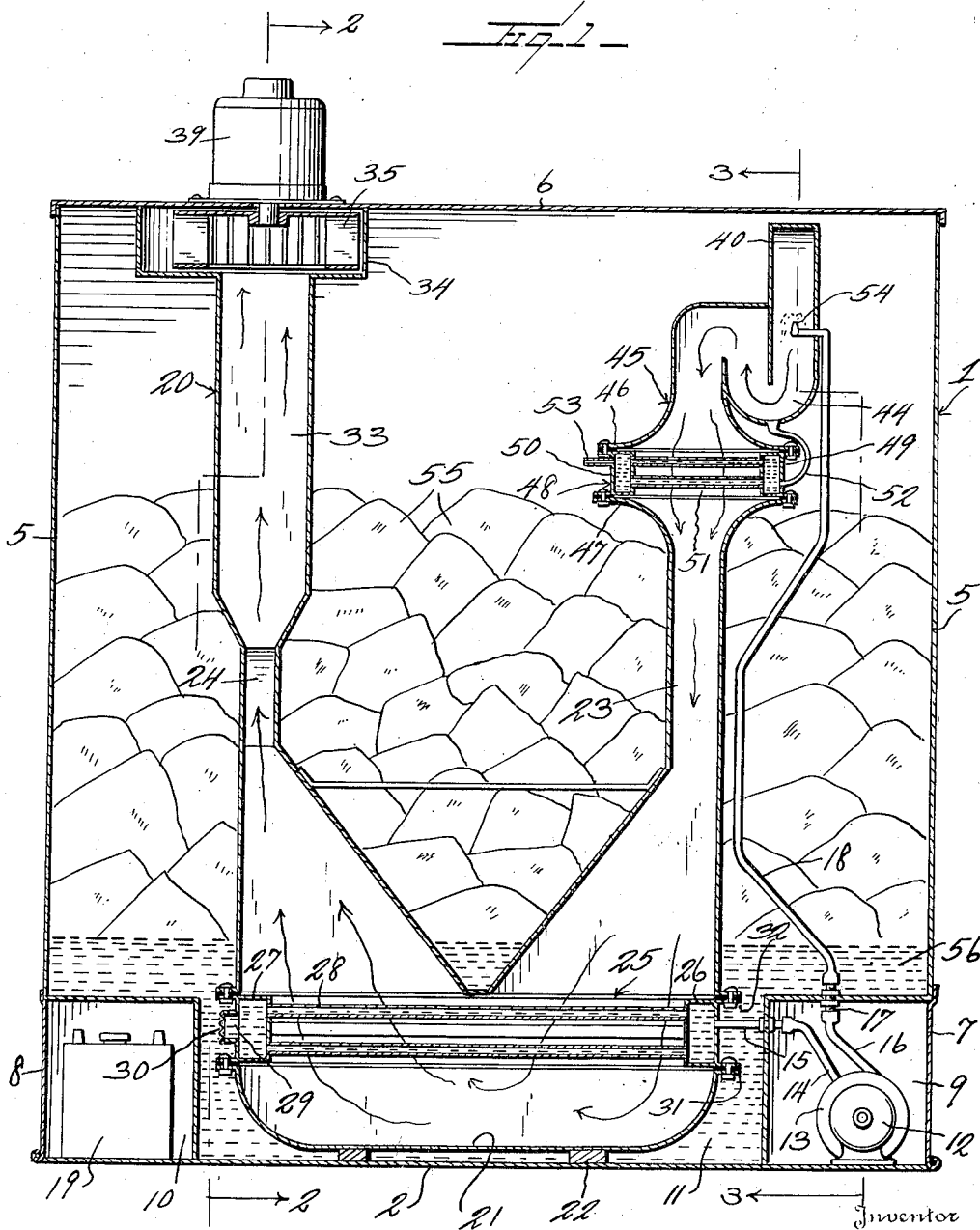
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2,304,804

AIR COOLING MECHANISM

Filed June 20, 1940

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 2

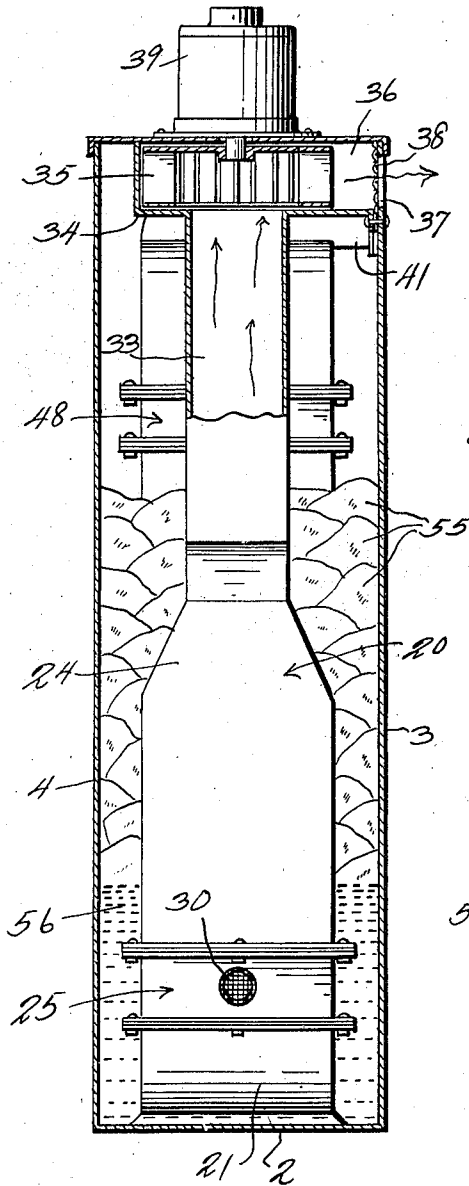
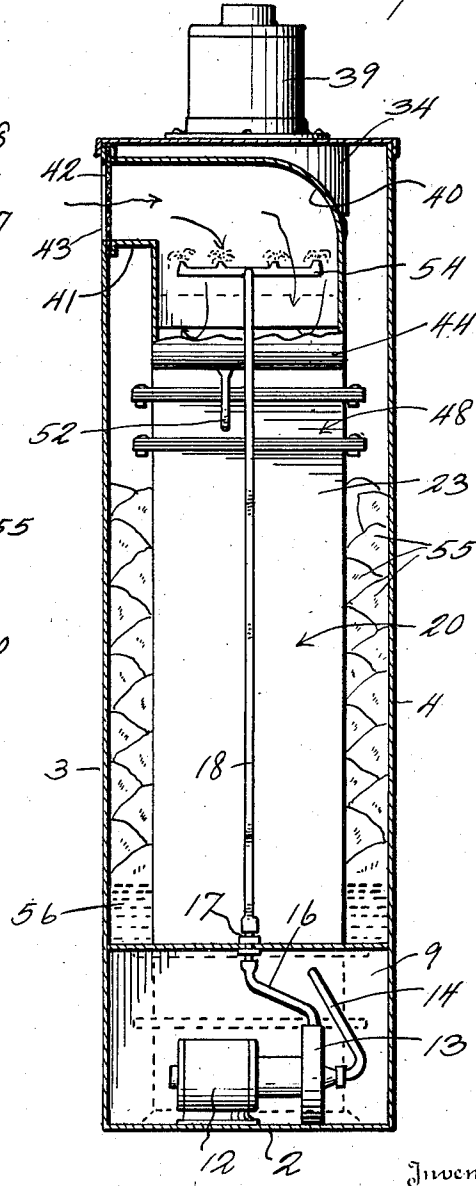


Fig. 3



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2,304,804

AIR COOLING MECHANISM

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Application June 20, 1940, Serial No. 341,559

11 Claims. (Cl. 62—131)

This invention relates primarily to improvements in air cooling or chilling devices and pertains particularly to an improved air cooling unit designed for use in motor trucks or similar carriers for foodstuffs or other materials which must be kept cool while in transport.

The primary object of the present invention is to provide an air cooling device which is entirely self-contained and which is so designed as to be readily installed in a truck or other chamber to be cooled and to take up a minimum of space therein.

Another object of the invention is to provide an air cooling device which is so designed that it will remove from air passing therethrough the maximum of heat units without the employment of an extensive or complicated mechanical system so that such air will be reduced in temperature to a degree where it will efficiently preserve perishable substances.

Another object of the invention is to provide an air cooling mechanism wherein an ice and brine mixture is employed, in which the parts are so constructed and arranged that the device may be put into operation immediately upon the formation of a relatively small amount of brine and wherein the parts are so designed that the air passing through the device will be circulated between a plurality of brine conducting tubes so that the temperature of the air will be quickly reduced.

A further object is to provide a mechanism for cooling air employing an ice and brine mixture wherein a novel means is employed for chilling the air as it enters an air conduit by spraying the brine mixture into the air and for immediately collecting and passing the sprayed brine mixture through a radiator or heat transfer unit through which the air is passed and by means of which its temperature is further reduced.

The invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawings forming part of this specification, with the understanding, however, that the invention is not to be confined to any strict conformity with the showing of the drawings but may be changed or modified so long as such changes or modifications mark no material departure from the salient features of the invention as expressed in the appended claims.

In the drawings—

Fig. 1 is a view in vertical section transversely

through the air cooling mechanism embodying the present invention.

Fig. 2 is a sectional view on the line 2—2 of Fig. 1.

Fig. 3 is a sectional view on the line 3—3 of Fig. 1.

Referring now more particularly to the drawings, the numeral 1 generally designates the body or housing of the air cooling device embodying the present invention, which housing is provided with a bottom wall 2, front and rear walls 3 and 4, side walls 5 and a removable top wall or cover 6. This housing will be made of any suitable material which will withstand the corrosive action of brine.

In the lower part of each of the side walls 5, a door is fitted, one of the doors being indicated by the numeral 7 and the other one by the numeral 8, and these doors give access to chambers 9 and 10, which are formed across the bottom 2 at each side of the housing. Due to the formation of these chambers 9 and 10, the central lower part of the housing is reduced in width so as to form a relatively narrow well portion 11. The chamber 9 houses an electric motor 12 and a fluid pump 13 which is connected with the motor to be driven thereby. This pump has an inlet pipe 14 which extends to a pipe 15 which passes through a wall of the chamber 9, and an outlet or discharge pipe 16 which is connected with a suitable nipple or coupling 17 in a wall of the chamber 9, which nipple, outside of the chamber, is connected with an upwardly extending pipe 18, the purpose of which will be hereinafter more fully described.

The chamber 10 is provided to house a source of electric potential such as a battery 19, which battery may be the standard battery for the motor vehicle in which the mechanism is mounted, or an extra battery for the operation of the motor 12 and a second motor, hereinafter described, forming a part of the mechanism.

Disposed within the housing 1 is an air conducting channel or conduit unit which is generally indicated by the numeral 20. This unit is, generally speaking, substantially U-shaped in outline.

The lower portion of the air conduit is divided horizontally to provide the pan-like bottom part 21 which rests upon the bottom wall 2, being raised therefrom by cleats or feet 22. Above this pan-like bottom portion of the air conduit are the air conducting legs 23 and 24, the leg 23 conducting the air downwardly and the leg 24 conducting the air upwardly. The

lower ends of these two leg portions 23 and 24 increase in width downwardly as shown in Fig. 1, and interposed between these enlarged lower ends of the downflow and upflow legs of the conduit and the pan or bottom portion 21, is a heat transfer unit indicated generally by the numeral 25. This heat transfer unit is generally similar in construction to a motor vehicle radiator unit disposed upon its side. The heat transfer unit comprises the spaced fluid chambers 26 and 27, which are connected together by the horizontal fluid transfer tubes 28 of the usual thin-walled construction employed in units of this type and the fluid chamber 26 has the pipe 15 connected therewith whereby its interior is put into communication with the pump 13. The fluid chamber 27 is provided with an inlet aperture which opens into the well 11, this aperture being indicated at 29 and, as shown, it is covered by a suitable screen 30 which prevents the entrance into the radiator of any solid objects which might interfere with the operation of the system.

The lower portions of the legs 23 and 24 of the conduit and the upper edge portion of the pan 21 are provided with lateral flanges 31 which coact with outwardly directed flanges 32 which encircle the radiator unit 25 to facilitate securing the radiator unit horizontally in the lower part of the air conduit, in fluid type connection with the legs and the pan portion thereof.

The upflow side or leg 24 of the air conduit increases in width throughout the major portion of its extent to its upper end, as indicated at 33, and the upper end of this part 33 of the upflow leg connects with and discharges into a housing 34 for an air propelling fan 35. The outlet for the housing 34 is indicated at 36 in Fig. 2, and is secured over a discharge opening 37 in the front wall 3 of the mechanism housing 1, which opening is covered by a suitable screen 38. Upon the cover 6 is mounted a motor 39 which is connected with the fan 35 so as to rotate the latter and draw air through the conduit for discharge through the opening 37.

Forming a part of the inlet leg 23 of the air conduit is a casing structure 40 forming an entrance vestibule for air which is drawn into the cooling mechanism. This casing has an inlet end 41 which is secured over the inlet opening 42 formed in the front wall 3 of the mechanism housing, which inlet opening is covered by a suitable screen 43. At its inner end, the casing is shaped to form a return bend 44 which also functions as a fluid receiving basin. The air entering the casing 40 flows downwardly into one side of the basin or return bend 44 and upwardly out of the opposite side into the downwardly directed hook-like portion 45, the opposite sides of which are flared or belled outwardly, as indicated at 46.

The inflow leg 23 for the conduit is, as shown, divided into two portions, the upper portion including the flared part 46 while the lower portion has a similar outwardly flared terminus 47 which is arranged in opposed relation to the flared part 46 of the upper portion. Between these parts 46 and 47 is disposed a radiator unit indicated generally by the numeral 48 and having the oppositely disposed fluid chambers 49 and 50 which are connected by the horizontal fluid conducting tubes 51 which extend transversely of the path of flow of air into and through the leg 23 of the conduit. The fluid chamber 49 for the smaller upper radiator 51 has connected

therewith a pipe 52 which leads from the bottom of the return bend basin 44, as shown. The opposite fluid chamber for the small radiator, which chamber is indicated by the numeral 51, has connected with the upper part thereof the drain or overflow pipe 53.

Disposed within the vestibule formed by the casing 40 is a spray head 54 and with this spray head is connected the upper end of the pipe 18 which leads from the pump 13.

The electrical connections between the battery 19 and the motors 12 and 39 have not been illustrated as it will be obvious to anyone versed in the making of electrical connections, how these motors and the battery may be hooked up together with a suitable control switch. It is contemplated to provide a circuit arrangement with a control switch therefor whereby the battery 19 may be electrically coupled with the motors 12 and 39, so that they may be operated by the battery or whereby the motors may be coupled through a suitable step-down transformer with any suitable outside source of current. As previously stated, such an electrical hook-up may be readily made by an electrician and, therefore, the connections necessary for effecting the conduction of current from either of such two sources have not been illustrated.

In the operation of the present air cooling mechanism, the housing is filled or partially filled with broken or cracked ice, indicated by the numeral 55, to which rock salt has been added. There will thus be produced a freezing brine which will collect in the well 11, as indicated at 56. Due to the reduction in the size of the lower portion of the housing by the provision of the chambers 9 and 10 at opposite sides thereof, the well 11 is just large enough to receive the lower end of the conduit 20 in which the radiator 25 is housed, therefore, only a small quantity of the freezing brine would be required to fill this well around the lower end of the conduit, and when the level of the brine reaches the radiator inlet 29, the brine will fill the radiator and flow through the tubes 28 from one chamber 27 to the opposite chamber 26. The pump 13 may then be placed in operation together with the fan 35 with the result that as air is drawn in at the opening 42 and through the conduit to be discharged at the opening 38, it will flow between the brine carrying tubes 28 of the lower radiator. At the same time, the pump 13 will extract some of the brine from the lower radiator and force it upwardly for discharge through the spray head 54 into the casing 40, where the air will be initially chilled as it enters the casing. This brine will collect in the basin-like return bend 44 and flow down through the pipe 52 to fill the upper radiator 51, flowing out of the radiator by way of the pipe 53 and back into the main housing of the mechanism. Thus it will be seen that the air will be initially chilled by having the cold brine sprayed thereinto as it enters the upper end of the downflow leg of the conduit, and it will be further chilled as it passes between the brine conducting tubes 51 of the upper radiator. Passing downwardly, a further chilling action on the air will be obtained through the contact of the air with the wall of the conduit which is in contact with the ice and this applies also to the upflow side or leg 24 and as, a fourth chilling means, there is the lower radiator 25 through which the air passes before it starts to flow back upwardly toward the outlet 38. Thus it will be seen that the air is chilled from four different sources which

are the spray head, the two radiator units through which it passes and the walls of the downflow and upflow portions of the conduit which are in contact with the ice and brine. As a result, the maximum of efficiency is obtained with a minimum of structure and of ice.

What is claimed is:

1. An air cooling mechanism, comprising a closed housing containing a fluid refrigerant, a substantially U-shaped air conduit in said housing and having two side portions and a yoke portion therebetween, the side portions having air inlet and outlet means and the yoke portion being submerged in the refrigerant, a radiator structure within said conduit in the yoke portion thereof and having a plurality of tubes opening through the remote sides of the said side portions, through which the refrigerant circulates and between which air passes in flowing through the conduit, and means for effecting the circulation of the refrigerant through said tubes and for effecting the circulation of air through the conduit.

2. An air cooling mechanism, comprising a closed housing containing a fluid refrigerant, means forming an air conduit extending through said housing and having inlet and outlet ends, a radiator structure within said conduit having a plurality of tubes through which the refrigerant circulates and between which air passes in flowing through the conduit, means for circulating the refrigerant through said tubes, means for spraying the refrigerant into the air conduit in a direction opposing the direction of flow of air therethrough, the sprayed refrigerant being returned from the conduit into the housing, and means for circulating air through the conduit and between the tubes of the radiator unit.

3. An air cooling mechanism, comprising a housing designed to contain a fluid refrigerant, an air conducting conduit within the housing having a portion for conducting air from an inlet end downwardly into the housing and a portion for conducting air upwardly through the housing to an outlet end, a radiator unit disposed in the lower part of said conduit between the said portions and including a plurality of refrigerant conducting tubes disposed horizontally, said tubes at one end being in communication with the housing to receive refrigerant therefrom, means for effecting a forced circulation of air through the conduit from the inlet to the outlet ends and between said refrigerant conducting tubes, means forming a part of said conduit adjacent said air inlet end providing a basin, a spraying unit within the conduit adjacent the air inlet end and above said basin, means for extracting refrigerant from the lower part of the housing and discharging the same through said spray means into the upper part of the conduit, the disposed refrigerant being received in said basin, and a drain for the lower part of the basin by which the sprayed refrigerant is returned to the housing.

4. An air cooling mechanism of the character described, comprising a fluid refrigerant containing housing, a vertically disposed substantially U-shaped air conduit within the housing, said conduit having a downflow air conducting leg communicating at its upper end with an inlet opening in the wall of the housing and an upflow air conducting leg communicating at its upper end with an outlet in a wall of the housing, means for effecting circulation of air through the conduit, a heat transfer unit in the lower part of said conduit between said legs and including horizontally disposed refrigerant conducting tubes be-

tween which air flows in its passage through the conduit, said tubes being in communication at one end with the interior of the housing to receive refrigerant therefrom, means forming a part of said downflow leg, adjacent the inlet end forming a fluid receiving basin, a drain for the basin, a spray unit within the conduit between the basin and said inlet opening, and a pump connected between the other ends of said tubes and the spray unit for circulating refrigerant from the tubes to the spray unit.

5. An air cooling mechanism, comprising a housing designed to contain a fluid refrigerant, a vertically disposed substantially U-shaped air conduit forming structure within the housing having vertically arranged legs one forming a downflow side and connected at its upper end to an air inlet opening and the other forming an upflow side and connected at its upper end with an air outlet opening, a heat transfer means in the lower part of said conduit for effecting the absorption by the refrigerant medium of heat carried by air passing through the conduit, means forming a part of the downflow leg of the conduit forming a fluid basin by which air entering the upper leg of the conduit is guided first downwardly, then upwardly and then downwardly, a drain for said basin, a spray head in the conduit between the basin and the air inlet opening, pumping means for extracting refrigerant fluid from the lower part of the housing and discharging it through said spray head, and means for effecting a forced circulation of air through the conduit.

6. An air cooling mechanism, comprising a housing designed to contain a fluid refrigerant, a vertically disposed substantially U-shaped air conducting conduit within the housing having one vertical leg connected at its upper end with an air inlet opening and a second vertical leg connected at its upper end with an air outlet opening, the lower part of said conduit being immersed in the refrigerant fluid, means for effecting a forced circulation of air through the conduit, means forming a part of the first leg of the conduit forming a basin which directs the flow of air first downwardly, then upwardly and then downwardly in its passage to the lower part of the conduit, a spray head within the first leg of the conduit between said basin and the air inlet opening, means for circulating refrigerant medium from the lower part of the housing through said spray head, a heat transfer unit interposed in the conduit in the path of flow of air therethrough and including a conducting means for the refrigerant fluid, means for conveying refrigerant fluid from the basin into the conducting means of the transfer unit, and means for discharging the refrigerant fluid from the said conducting means back into the housing.

7. An air cooling mechanism, comprising a housing adapted to contain a fluid refrigerant, a vertically disposed substantially U-shaped air conducting conduit within the housing having two vertical side legs one being connected with an air inlet opening and the other being connected with an air outlet opening, the lower part of said U-shaped conduit being immersed in refrigerant fluid, the said lower part of the conduit being horizontally divided, a horizontally disposed radiator unit secured between the upper and lower portions of the conduit formed by said horizontal division, said radiator unit including opposite chambers connected by horizontally disposed tubes, one of said chambers being in com-

munication with the housing for the reception of the fluid refrigerant, a pumping means connected with the other chamber for effecting the flow of refrigerant through the tubes and its discharge back into the housing, and means for effecting a forced circulation of air through the conduit.

8. An air cooling mechanism of the character described, comprising a housing adapted to contain a fluid refrigerant, a substantially U-shaped vertically disposed air conduit within the housing with the lower end thereof arranged for immersion within the refrigerant, one side of the conduit constituting an air downflow leg having its upper end connected with an inlet opening and the other side of the unit constituting an air upflow leg having its upper end connected with an outflow opening, a fan in the upper end of the upflow leg for drawing air through the unit, a horizontally disposed heat transfer body in the lower part of the unit having horizontally spaced fluid chambers connected by tubes, one of said chambers being adapted to receive refrigerant fluid from the housing, a heat exchange body disposed transversely of the air downflow leg and including horizontally spaced fluid chambers and tubes connecting the chambers, one of said last chambers being directly in communication with the housing, means forming a part of said downflow leg above the last-mentioned heat exchange body forming a basin by which the inflowing air is conducted first down, then up and then down toward the last-mentioned heat exchange body, a drain pipe connecting the lower part of the basin with the other chamber of the last-mentioned heat exchange body, a spray unit disposed within said downflow leg above the basin, and a circulating pump connected with the other fluid chamber of the first-mentioned heat exchange body and with said spray unit for withdrawing fluid from the first-mentioned body and discharging the same through said spray unit.

9. An air conditioning apparatus, comprising an air conduit having an inlet end and an outlet end, a pair of heat transfer units in the conduit and each including a plurality of spaced tubes disposed to extend across the path of travel through the conduit, one of said units being adjacent the inlet end of the conduit, means for discharging an air treating fluid into the conduit between said inlet end and the said one unit, means for collecting the discharged fluid and passing the same through the tubes of the said one unit, means for imparting a desired temperature to said fluid, and means for circulating the tempered fluid through the tubes of the other unit, the air in

passing through the conduit circulating between the tubes of the two units.

10. An air conditioning apparatus, comprising an air conduit having an inlet end and an outlet end, a pair of heat transfer units in the conduit and each including a plurality of spaced tubes disposed to extend across the path of travel through the conduit, one of said units being adjacent the inlet end of the conduit, means for spraying an air treating fluid into the conduit between said inlet end and the said one unit, a fluid collecting basin forming a part of the conduit structure adjacent the spraying means, a conducting means leading from said basin to the said one unit for carrying the collected fluid to the one unit to flow through the tubes thereof, means for imparting a desired temperature to the fluid, and means for circulating the tempered fluid through the tubes of the other unit, the air in passing through the conduit circulating between the tubes of the two units.

11. An air conditioning apparatus, comprising an air conduit having a vertical portion provided with an air inlet means, a horizontal portion and an outlet means connected with the horizontal portion, a heat transfer unit within said horizontal portion including a pair of fluid chambers disposed upon opposite sides of said horizontal portion in connection with opposite walls thereof and spaced tubes connecting the chambers and opening at their ends thereinto, said tubes extending across the path of travel of air through the conduit from the inlet to the outlet, a second heat transfer unit including a pair of fluid chambers disposed at opposite sides of the vertical portion of the conduit and a plurality of spaced tubes connecting the second-mentioned fluid chambers together and extending across the path of travel of air through the vertical portion of the conduit, means forming a part of the conduit structure between the second unit and the air inlet forming a fluid catch basin, a fluid conducting line leading from the lower part of said catch basin to one of the fluid chambers of the second-mentioned unit, means for discharging an air treating fluid into the conduit between said basin and the inlet means, means for circulating a fluid between the fluid chambers of the first unit and through the tubes thereof, and means for imparting a desired temperature to the fluid which is discharged into the conduit and which is circulated through the tubes of the two units for conditioning the air passing through the conduit and between said tubes.

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