Nov. 1, 1938. F. B. RENTZ 2,134,802

AIR CONDITIONING DEVICE

Filed May 27, 1937 2 Sheets-Sheet 1

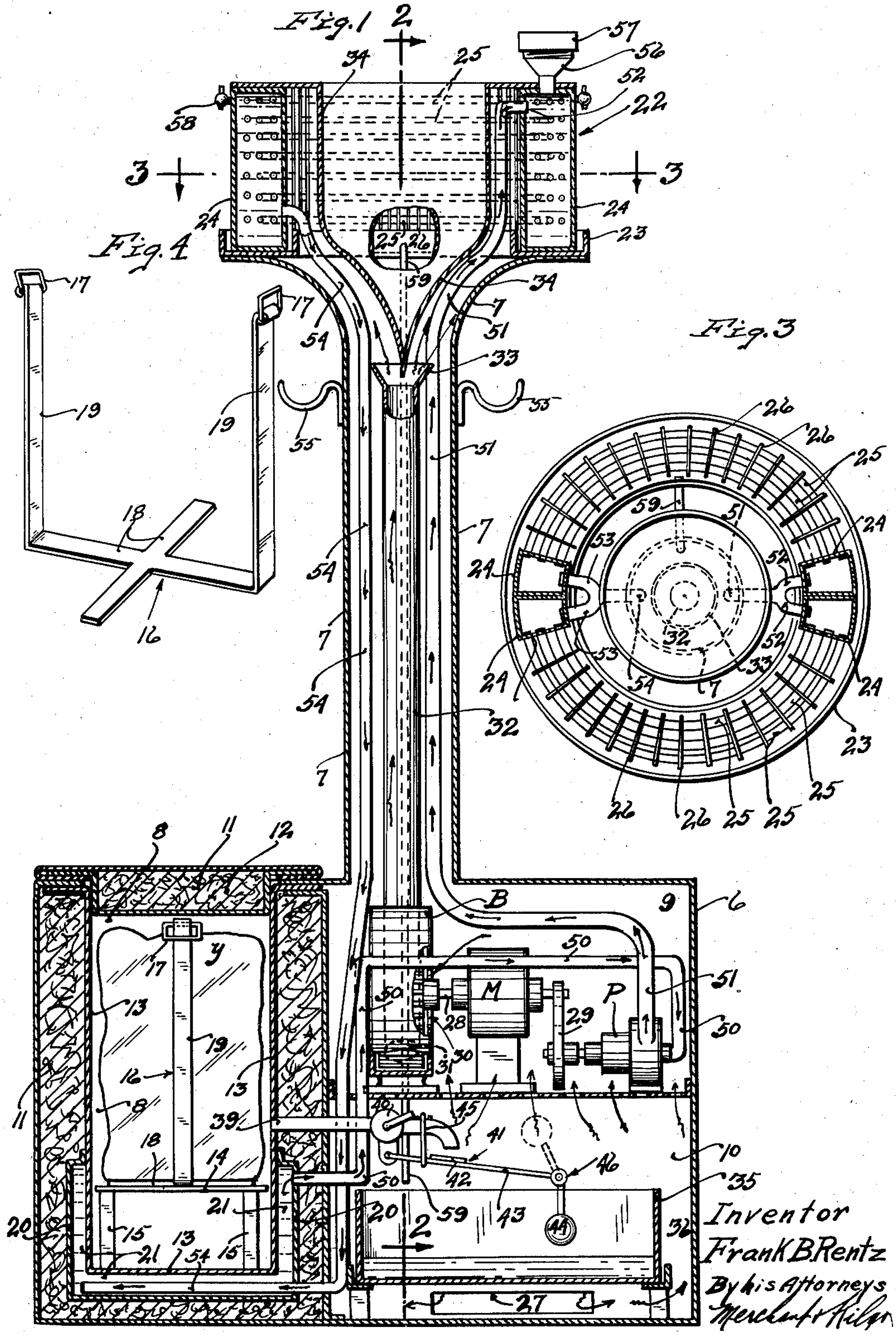

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Fig. 2

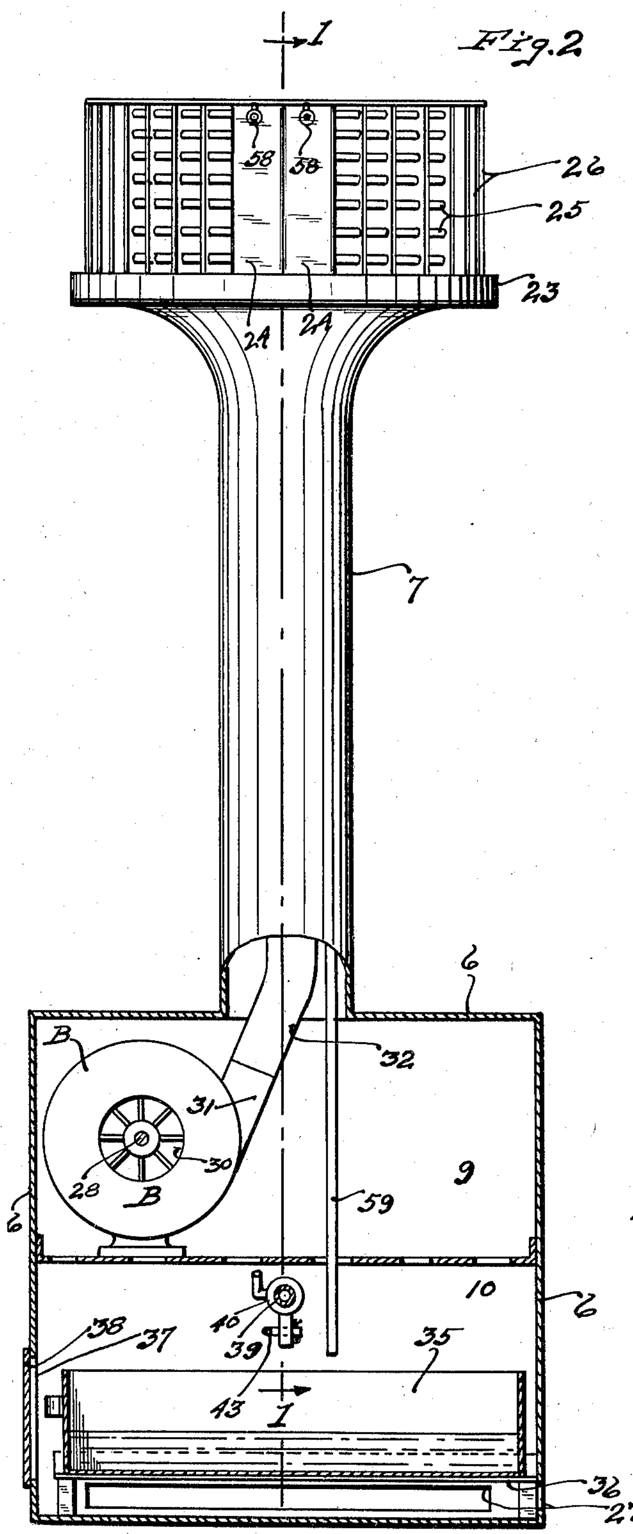
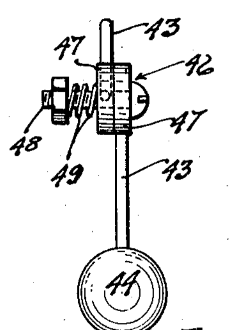


Fig. 5



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AIR CONDITIONING DEVICE

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16 Claims. (Cl. 62—134)

My present invention relates to air conditioning devices and has among its important objectives the provision of a relatively low cost, readily portable air conditioning unit which is capable of changing the temperature of an enclosed space in which it is located at a very minimum of cost.

Another and more specific object of the invention is the provision of an air conditioning unit of the kind described in which conditioned air is evenly and uniformly distributed throughout the space in which the device is located and the ability to accomplish this result with low air velocities so as to thereby minimize or entirely eliminate any possible draft effects which are so common to devices of this character.

The above and other important objects and advantages of the invention will be apparent from the specification and claims.

In the accompanying drawings wherein like characters indicate like parts throughout the several views:

Fig. 1 is a transverse sectional view of a preferred embodiment of the invention taken on the line 1—1 of Fig. 2, some parts being broken away and some parts being shown in full;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1, some parts on the section line being shown in full and some parts beyond the section line being omitted;

Fig. 3 is a horizontal sectional view taken on the line 3—3 of Fig. 1 and looking downwardly;

Fig. 4 is a detail perspective view of a removable ice handling frame; and

Fig. 5 is an enlarged fragmentary detail view illustrating certain details of construction of the float control mechanism of the overflow valve illustrated in Figs. 1 and 2.

The numeral 6 indicates a box-like shell or cabinet which is preferably formed of sheet metal and is provided with an upstanding tubular stack 7 that opens through the intermediate portion of the top of the cabinet 6. The interior of the cabinet 6 is divided into three compartments, to wit: a supply compartment 8; a mechanism compartment 9; and a condensation compartment 10. The supply compartment 8, which is adapted to contain a suitable source of air conditioning effect, such as a cake of ice illustrated and indicated by *y*, is insulated against heat exchange by suitable insulating material 11 and access to the supply compartment 8 is had through a removable insulated cover 12. The interior of the supply compartment 8 is lined with sheet metal to afford water-tight walls and bottom 13. The cake of ice *y* is supported from the bottom 13 of the supply compartment 8 by a false bottom plate 14 that is spaced from the bottom of the supply compartment by legs 15. For the purpose of making the insertion and possible removal of a large cake of ice a relatively easy matter, the ice is preferably placed in a skeleton frame 16 and lifted in by means of handles 17. The frame 16 comprises a cross-bar bottom 18, a pair of uprights 19 extending from opposite ends of one of the cross-bars 18 and equipped at its upper end with the handles 17. Through the use of this skeleton frame 16, the ice can be gently lowered onto the false bottom 14.

Surrounding the lower portion of the metallic inner walls and bottom 13 of the supply compartment 8 is a jacket 20, which jacket is spaced from the walls and bottom 13 to form a fluid circulation chamber 21. The jacket 20 terminates preferably just slightly above the false bottom 14 and at that point is turned inwardly and welded, soldered, or otherwise secured to the walls 13 so as to form a leak-proof joint or seam.

The upper end of the main stack 7 is flared outwardly and serves as a support for an annular heat exchange device 22 which is disposed with its axis concentric to the stack 7. The annular heat exchanger 22 is seated in an annular drip pan 23 which is, in turn, seated on and preferably secured to the peripheral portion of the flared upper end of the stack 7. The heat exchange device, in its preferred form herein illustrated, comprises two like semi-circular sections each of which semi-circular sections is made up of a vertically disposed pair of end tanks 24 connected by a plurality of segmental heat transfer tubes 25. The heat transfer tubes 25 are horizontally disposed and have interposed thereover suitable vertically disposed radiation fins 26. The opposite end tanks 24 of opposite semi-cylindrical sections of the heat exchange unit 22 are positioned face to face, as illustrated best in Figs. 2 and 3.

The bottom of the mechanism compartment 9 is perforated so that the said compartment 9 is in communication with the compartment 10 and the lower portion of the compartment 10 is provided with air inlet openings 27 near the bottom thereof. Mounted on the perforated bottom of the mechanism compartment is a "sirocco" type fan or blower B that is directly coupled to and driven by the shaft 28 of an electric motor M, which motor drives through suitable pulleys and belts 29, a fluid-circulating pump P also mounted on the perforated bottom.

It will be seen, by reference particularly to Fig. 1, the fan or blower B draws air into its eye portion 30 through the openings 27 in the bottom of the compartment 10 and the perforated bottom of the mechanism compartment. The blower B discharges its air through a tangential outlet 31 and a vertical air delivery pipe 32 that is concentrically disposed within the main stack 7 and terminates in a flared upper end 33. For distributing air delivered from the pipe 32 evenly through the annular heat exchange unit in a radial direction only, there is provided a truncated conical baffle 34 that is concentrically disposed within the heat exchange unit 22 with its sides spaced from the annular core of the unit and its apex concentrically disposed with respect to and located just above the flared upper end 33 of the air delivery pipe 32. The upper end portion of the baffle 34 serves to shut off upward flow of air through the heat exchange unit. Located in the compartment 10 is a condensation pan 35, which pan is slidably and removably supported on angle iron supports 36 in spaced relation to the bottom of the compartment 10. This condensation pan 35 is removable through an opening 37 provided in the front of the cabinet 6 and which is normally closed by a door 38.

As ice *y* melts in the supply compartment 8 water will accumulate in the lower portion of the compartment 8 to a maximum level determined by the elevation of an overflow pipe 39 which preferably, and as illustrated, is located not far above the false bottom 14. Overflow water from the compartment 10 flows through the pipe 39 and discharges into the pan 35, which pan 35, when full, is removed and emptied. For the purpose of cutting off the overflow pipe 39 during the process of emptying the pan 35, there is provided in the overflow pipe 39 a manually operated valve 40.

In accordance with the present illustration, the overflow pipe 39 is automatically controlled to be cut-off when a certain predetermined maximum fluid level is obtained in the pan 35 by a float valve mechanism 41. This float valve mechanism 41 is, in accordance with the present illustration, in the nature of a resilient valve disc 42 carried by the intermediate portion of a pivoted float arm 43. Under extreme upward pivotal movements of the float arm 43, the valve disc 42 engages the downturned open end of the pipe 39 and closes off flow through the same. A suitable float 44 is applied to the free end of the pivoted arm 43 and floats on the fluid in the pan 35 after a certain near maximum level is reached, but extreme downward pivotal movements of the arm 43 are prevented by a stop device in the nature of a wire yoke 45 applied over the free end portion of the pipe 39 and passed under the arm 43. Since the float mechanism, when in its operative position, would interfere with removal of the pan 35, I preferably provide the intermediate portion of the pivoted arm 43 with a friction joint 46, the details of which are best illustrated in Fig. 5, in which it will be seen that opposite joined portions of the arm 43 are provided with friction discs 47 that are applied face to face and pivotally connected by a nut-equipped bolt 48 which carries a compression spring 49 that serves to lock the joint against accidental breaking movements in service but which permits the free float-equipped end of the arm 43 to be moved from its operative position, shown by full lines in Fig. 1, to its dotted line position of Fig. 1, in which latter position the float mechanism is above the level of the pan.

Heat transfer fluid, usually water, will be circulated from the upper portion of the circulation chamber 21 through a conduit 50 into the axial inlet of the pump P and will be forced from the tangential outlet of the pump P through a pipe or conduit 51 to the upper portions of adjacent end tanks 24 of opposite halves of the annular heat exchange unit 22. By reference particularly to Fig. 3, it will be seen that the conduit 51 is split at its upper end to afford a pair of branch conduits 52, one leading to each of the adjacent tanks 24. Fluid delivered to the upper portions of the right tanks 24, with respect to Fig. 1, passes through the horizontally disposed segmental tubes 25 to the adjacent tanks at the left in Fig. 1 and is drawn from the lower portions of these tanks through short branches 53 and the conduit 54 and is delivered to the bottom portion of the circulation chamber 21. In this manner chilled fluid from the chamber 21 is constantly circulated through the tubes 25 of the heat transfer unit 22 and air is constantly circulated radially outwardly through the tubes and fins of the heat transfer unit for even distribution about the space.

The main stack 7 is illustrated in Fig. 1 as being provided with a pair of hooks 55 which may serve for the hanging of coats or hats.

The fluid circulating system is filled through the medium of a funnel-shaped filler neck 56 applied through the top of one of the several tanks 24 of the heat exchange unit and which neck 56 is normally closed by a removable cap 57 that is preferably screw-threaded thereon. For the purpose of venting the system during the filling operation, the several tanks 24, other than the one to which the filler neck 56 is applied, are provided with small vent cocks 58 of conventional character.

Under operation of the device there will often be considerable moisture removed from the air by the process of condensation as the air is passed through the heat transfer unit 22 and this moisture will flow down the vertically disposed radiating fins 26 and be deposited in the annular drip pan 23 from which drip pan it will be drained off through a small conduit 59 into the pan 35.

By reference particularly to Figs. 1 and 2, it will be seen that the condensation or overflow pan 35 is so located in the compartment 10 that air entering the cabinet for delivery to the eye of the blower B must come in close association with the surfaces of said pan 35. This feature is important in that the pan 35 will contain a body of water which has been chilled by the ice *y* directly or indirectly by the heat exchange unit and will, therefore, be initially chilled before delivery to the heat exchange unit 22. Since this initial chilling is accomplished by waste fluid, the economy of operation of the device will be materially increased.

What I claim is:

1. In a device of the kind described, an annular heat exchange unit having air passages opening radially therethrough, an annular baffle concentrically arranged within the annular heat exchange unit with its walls spaced from the inner surfaces of the annular heat exchange unit to afford an annular air passage, means closing one end of the said annular air passage, and means for forcing air into the other end of said annular air passage and radially outwardly therefrom through the passages of the heat exchange unit.

2. The structure defined in claim 1 in further combination with an annular drip pan surrounding the bottom portion of the said annular heat exchange unit.

3. A heat exchange unit comprising a plurality of similar separable segmental sections, each of said sections comprising a pair of spaced tanks and a plurality of heat exchange conduits connecting said tanks and spaced to afford air passages therebetween, said sections being arranged substantially to form an annulus, one tank of each section being provided with an inlet and the other tank of each section being provided with an outlet, said segmental sections being independently formed and separable.

4. The structure defined in claim 3 in further combination with circulating means connecting the several inlets in parallel and the several outlets in parallel.

5. The structure defined in claim 3 in further combination with an annular baffle concentrically disposed within the said annular heat exchange unit and being of less cross-sectional diameter than the internal diameter of the annular heat exchange unit to afford an annular air passage therebetween and the inner surfaces of the heat exchange unit, means closing one end of the said annular air passage, and means for forcing air into the other end of the annular air passage and radially outwardly through the passages in the heat exchange unit.

6. In a device of the class described, an annular heat exchange unit made up of a plurality of substantially like sections, each of said sections comprising a pair of vertically disposed spaced end tanks and a plurality of horizontally disposed ducts connecting said tanks, said like sections being arranged to form an annulus with the tanks of adjacent sections positioned in close parallel relation, an annular baffle disposed within the annular heat exchange unit in such spaced relation to the inner surfaces thereof as to provide an annular air passage, means closing one end of the said air passage, and means for delivering air under pressure to the other end of the said annular air passage for delivery radially outwardly through the heat exchange unit.

7. In a device of the class described, an annular heat exchange unit comprising two like semicylindrical sections, each of said sections comprising a pair of end tanks connected by horizontally disposed segmental fluid ducts arranged in spaced relation to provide air passages radially outwardly therebetween, the tanks of opposite of said sections being placed face to face, an annular baffle disposed within the annular heat exchange unit with its walls spaced therefrom to afford an annular air passage, means for closing one end of the air passage, and means for forcing air into the other end of the said annular air passage.

8. The structure defined in claim 7 in which the said segmental fluid ducts are in the nature of segmental tubes, and in further combination with vertically disposed radiating fins applied over said tubes.

9. A self-contained portable air conditioning device comprising a cabinet internally partitioned to afford a supply compartment adapted to contain a supply of air tempering medium, and a mechanism compartment, a jacket surrounding at least a portion of the walls of the said supply compartment and spaced therefrom to afford a fluid circulation chamber, a heat exchange unit located above but supported from the said cabinet, fluid circulating connections between the said heat exchange unit and fluid circulating chamber, a motor-driven pump located in the said mechanism compartment and interposed in said circulating connections, and a motor-driven blower also located in said mechanism compartment and having its intake in communication with the atmosphere outside of the said cabinet and its outlet connected to discharge through said heat exchange unit.

10. A self-contained portable air conditioning device comprising a portable cabinet internally partitioned to afford a supply compartment and a mechanism compartment, a fluid circulating chamber surrounding at least a portion of the walls of said supply compartment, a tubular stack rising from the top of said cabinet, a heat exchange unit mounted on the upper end of said tubular stack, said heat exchange unit comprising fluid tanks and fluid circulating ducts connecting the tanks and spaced to permit air to be circulated therebetween, fluid circulating connections leading from the said fluid circulating chamber to one of said heat exchange unit tanks and from the other of said heat exchange unit tanks back to the said fluid circulating chamber, said circulating connections being passed through said tubular stack, and a motor-driven blower located in said mechanism compartment and having its inlet in communication with the space outside of said cabinet and its outlet arranged to discharge through said tubular stack and the air passages of said heat exchange unit.

11. A self-contained portable air conditioning device comprising a cabinet internally partitioned to afford a supply compartment and a mechanism compartment, a fluid circulating chamber surrounding at least a portion of the walls of the supply compartment, a tubular stack rising from the top of said cabinet and flared at its upper end, an annular heat exchange unit mounted on the flared upper end of the tubular stack in substantially concentric relation thereto, said annular heat exchange unit comprising fluid inlet and outlet tanks and fluid conduits connecting said tanks, the latter being spaced to afford air passages radially outwardly through the heat exchange unit, an annular baffle concentrically located within the annular heat exchange unit with its walls spaced from the inner surfaces of the annular heat exchange unit to form an annular air passage, means closing the upper end of said annular air passage, fluid circulating connections between said fluid circulating chamber and heat exchange unit, said circulating connections including a motor-driven pump located within the mechanism compartment, and a motor-driven blower also located in the mechanism compartment and having its inlet in communication with the space outside of the cabinet and its outlet connected to discharge into the annular air passage between said baffle and the heat exchange unit for delivery to the space radially outwardly through the air passages in said unit.

12. A self-contained portable air conditioning device comprising a cabinet internally partitioned to provide a supply compartment, the walls of which are spaced from the outer walls of the cabinet, and a mechanism compartment, a fluid circulating heat transfer chamber surrounding a portion of the walls and bottom of the said supply compartment, a tubular stack rising from the top of the cabinet and flared

outwardly at its upper end to afford an annular supporting ledge or shelf, an annular drip pan seated on the said annular shelf in concentric relation to the stack, an annular heat exchange unit seated in the said annular drip pan, said heat exchange unit comprising spaced fluid circulating ducts and inlet and outlet tanks, fluid circulating connections between the fluid circulating heat exchange chamber and the said annular heat exchange unit, said circulating connections extending through said tubular stack, a conical baffle concentrically disposed within the annular heat exchange unit with its walls spaced from the inner surfaces of the heat exchange unit to afford an annular air passage therebetween and the heat exchange unit, the apex of said conical baffle being substantially concentric with respect to the upper end portion of the stack and the upper end portion of said conical baffle being turned outwardly to afford a closure for the upper end of said annular air passage, a motor-driven blower located in the mechanism compartment of the cabinet with its inlet in communication with the space outside of the cabinet, an air delivery duct leading from the outlet of the said blower upwardly through the tubular stack and terminating at its upper end in close relation to the apex of said conical baffle.

13. The structure defined in claim 12 in which said cabinet is further provided with a condensation compartment located below the said mechanism compartment, and in further combination with a removable condensation-receiving pan located in said condensation compartment, a drain pipe extending from the supply compartment and discharging into the condensation compartment above the said pan, and a drain pipe or conduit leading from the said annular drip pan downwardly through the stack and discharging into the condensation compartment above said removable condensation pan.

14. The structure defined in claim 12 in which said cabinet is further provided with a condensation compartment located below the said mechanism compartment, and in further combination with a removable condensation-receiving pan located in said condensation compartment, a drain pipe extending from the supply compartment and discharging into the condensation compartment above the said pan, and a drain pipe or conduit leading from the said annular drip pan downwardly through the stack and discharging into the condensation compartment above said removable condensation pan, said condensation pan being located in spaced relation to the bottom and sides of the cabinet and the inlet to the intake of the fan through the cabinet being through inlet openings in the cabinet through the walls of the condensation compartment below the level of said condensation pan.

15. In a self-contained portable air conditioning device, a cabinet vertically partitioned to afford an ice supply compartment and a condensation compartment, a fluid circulating chamber surrounding the lower wall portions of said ice supply compartment, a normally closed opening leading through a wall of the cabinet into the condensation compartment, a condensation pan located within the condensation compartment for removal through said normally closed opening under horizontal sliding action, an overflow pipe leading from the ice supply compartment and arranged to discharge directly above and into the said removal condensation pan, a valve interposed in the said overflow pipe for closing after the same, and a fluid level controlled mechanism for operating said valve, said mechanism including a pivoted valve operating arm provided at its free end with a float normally projecting into said condensation pan.

16. The structure defined in claim 15 in which the said arm is pivoted above the level of said pan and is provided at its intermediate portion with a friction joint.

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