Dec. 7, 1943. F. CAIN 2,336,066

AIR CONDITIONING APPARATUS

Filed May 28, 1941 2 Sheets-Sheet 1

Fig. 1

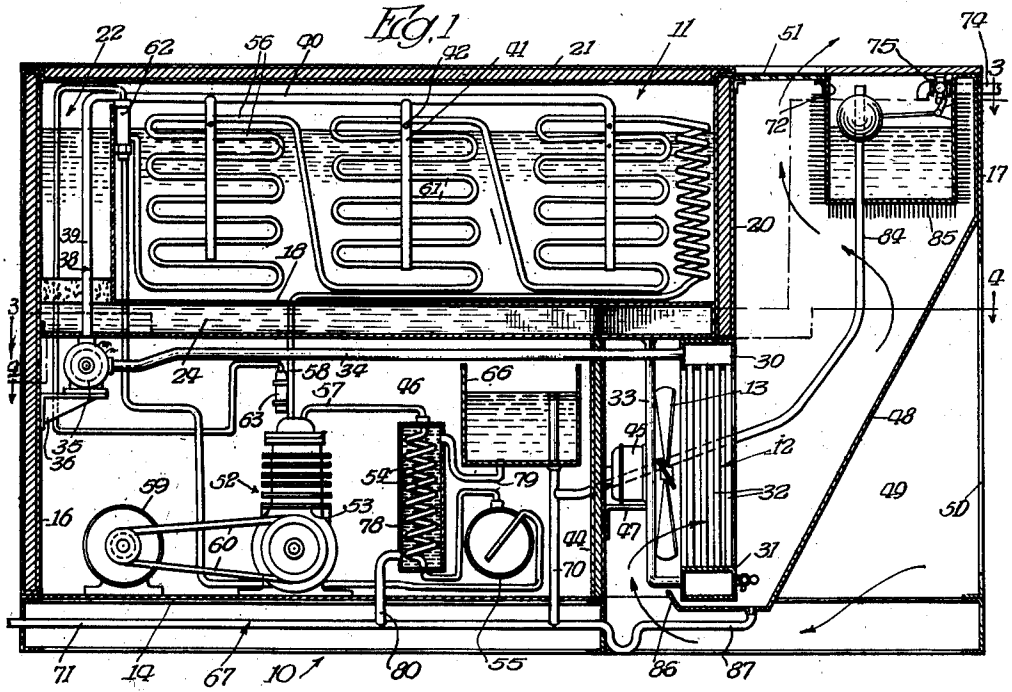
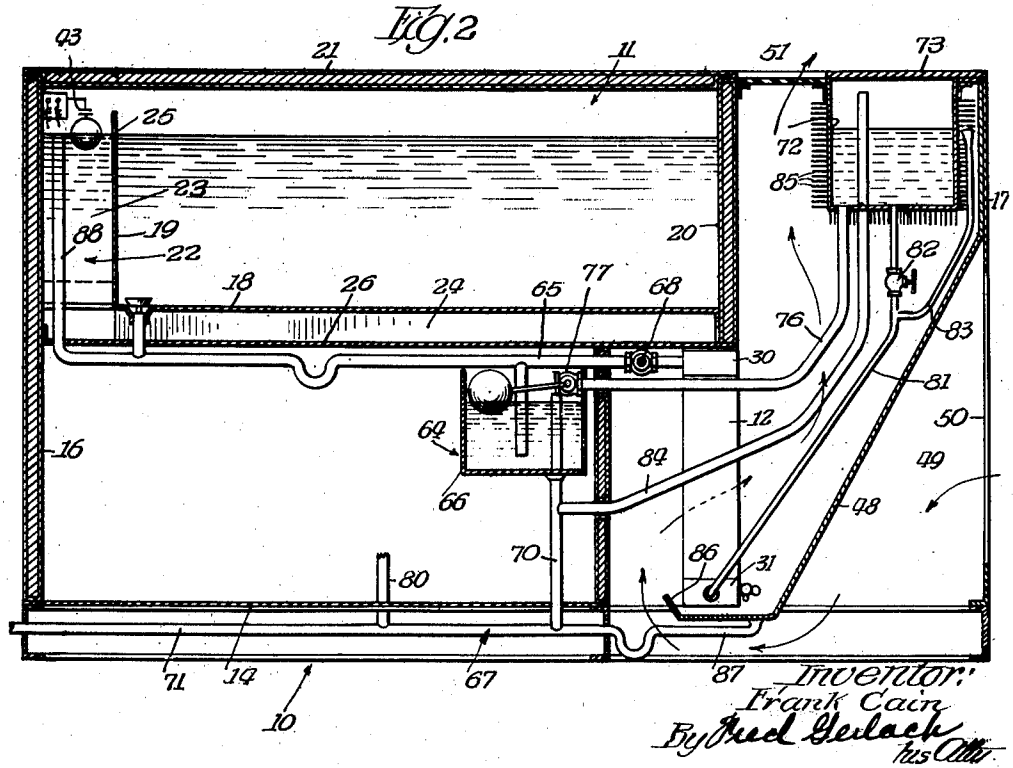


Fig. 2



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AIR CONDITIONING APPARATUS

Filed May 28, 1941 2 Sheets-Sheet 2

Fig. 3

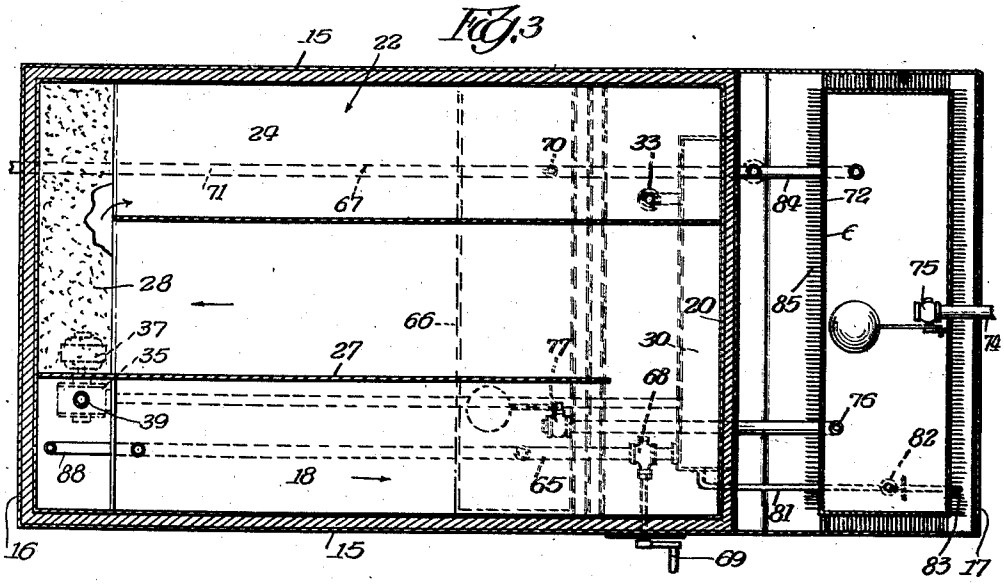


Fig. 4

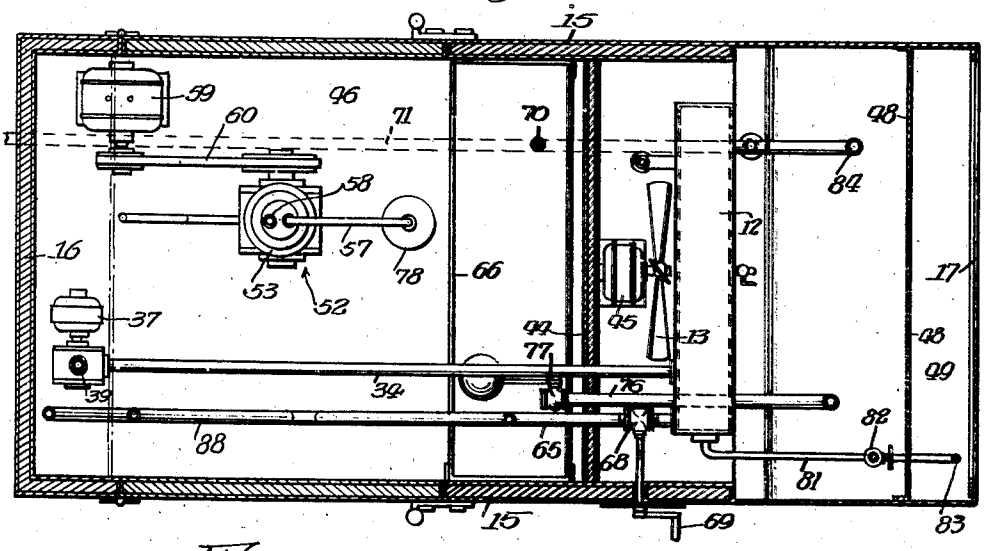
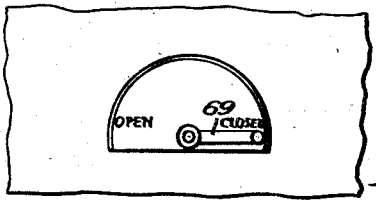


Fig. 5



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Patented Dec. 7, 1943

2,336,066

UNITED STATES PATENT OFFICE

2,336,066

AIR CONDITIONING APPARATUS

Frank Cain, Park Ridge, Ill.

Application May 28, 1941, Serial No. 395,677

12 Claims. (Cl. 62—134)

The present invention relates generally to apparatus for conditioning or cooling air. More particularly the invention relates to that type of air conditioning apparatus which is designed for use in a room for human occupancy and as its main parts comprises a box-like supporting structure, a cooling tank on the structure and with a column of water therein, a radiator-like heat exchanger also on the supporting structure, a pipe system for circulating cool water from the tank through the heat exchanger and then back to the tank in order to cool the exchanger, and a motor driven fan opposite the heat exchanger for so flowing the air in the room that it passes repeatedly through the heat exchanger and hence is cooled as a result of the absorption of heat by the exchanger.

One object of the invention is to provide an air conditioning apparatus of this type which is generally an improvement upon, and has certain advantages over, previously designed apparatus for the same purpose and not only efficiently and effectively fulfills its intended purpose but also is in the form of a self-contained unit.

Another object of the invention is to provide an apparatus of the type under consideration in which the various operating parts, such as the tank, heat exchanger and the fan, are compactly arranged with respect to the supporting structure and the supporting structure is shaped and designed to serve as a housing for such parts and includes an open ended duct which encompasses or surrounds the heat exchanger and fan and is adapted to have the air in the room circulate therethrough during drive or operation of the fan.

Another object of the invention is to provide an air conditioning apparatus of the aforementioned type which includes as another main part thereof a mechanical refrigerator unit of the compressor-condenser-receiver-evaporator type for cooling the tank.

Another object of the invention is to provide an apparatus of the last mentioned character in which the refrigerator unit is mounted on the housing forming supporting structure beneath the tank, and has the evaporator thereof disposed in the column of water in the tank so that it is adapted when the unit is in operation and the fan is inoperative to form part of the water in the tank into ice so that the latter is available for tank cooling purposes when the fan is again set into operation during use of the apparatus for air cooling purposes.

Another object of the invention is to provide an air conditioning apparatus of the type and character last mentioned which in addition to the mechanical refrigerator unit, includes means for flowing cool water from a tap or other independent source of supply through the exchanger when the pipe system between the exchanger and the tank is closed against the circulation of water therethrough.

Still another object of the invention is to provide an air conditioning or cooling apparatus of the type heretofore specified which is so designed that the mechanical refrigerator may be operated or driven continuously, that is, twenty-four hours per day, and hence the user or owner may benefit from low current rates which are based upon continuous current consumption as distinguished from intermittent consumption.

A further object of the invention is to provide an air conditioning apparatus of the type and character here under consideration which includes as parts thereof: (1) a novel form of moisture eliminator in the discharge end of the open ended duct which surrounds the heat exchanger and fan; (2) novel means for cooling by tap water the condenser of the mechanical refrigerator unit; and (3) improved control means for the mechanical refrigerator.

A still further object of the invention is to provide an air conditioning apparatus which is generally of new design and may be manufactured as well as operated and maintained at a comparatively low cost.

Other objects of the invention and the various advantages and characteristics of the present air conditioning apparatus will be apparent from a consideration of the following detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by claims at the conclusion hereof.

In the drawings which accompany and form a part of this specification or disclosure and in which like numerals of reference denote corresponding parts throughout the several views:

Figure 1 is a vertical longitudinal section of an air conditioning apparatus embodying the invention;

Figure 2 is another vertical longitudinal sectional view of the apparatus taken however on a line or plane which is laterally offset with respect to the line or plane on which the section constituting Figure 1 is taken;

Figures 3 and 4 are horizontal sections taken respectively on lines 3—3 and 4—4 of Figure 1; and

Figure 5 is a side view of the control handle of one of the valves of the apparatus.

The apparatus which is shown in the drawings constitutes the preferred embodiment of the invention. It is essentially a self-contained unit and is primarily designed or adapted to condition or cool the air in a room for human occupancy, in order to afford comfort against excessive or oppressive heat. As parts thereof the apparatus comprises a supporting structure 10, a cooling tank 11, a heat exchanger 12 and a fan 13.

The supporting structure 10 is of box-like design and serves as a housing for the various operating parts of the apparatus. It is adapted to rest upon the floor of the room in which the apparatus is employed and consists of a bottom forming base 14, a pair of side walls 15 and a pair of end walls 16 and 17. The side walls 15 rest upon and project upwardly from the side margins of the base 14 and are disposed in parallel relation. The end walls 16 and 17 rest upon and project upwardly from the end margins of the base and extend between and serve laterally to space the side walls 15.

The tank 11 is located in the upper portion of the supporting structure 10, as shown in Figures 1 and 2. It is designed to hold a column of water and embodies a bottom 18 and a pair of ends 19 and 20. The bottom 18 is positioned substantially midway between the top and bottom of the supporting structure 10 and overlies one end of, and extends in parallel relation with, the base 14 of the supporting structure. It extends between and is suitably secured to the side walls 15 of the supporting structure and preferably is formed of plate metal. The end 19 of the tank extends upwardly from one end of the bottom 18 and is spaced inwardly a comparatively small distance from the upper portion of the end wall 16. Its length corresponds to the width of the bottom 18 and its end margins are secured to the adjacent portions of the side walls 15 of the supporting structure. The end 20 of the tank 11 is spaced inwardly from the end wall 17 of the supporting structure and is secured at the end margins thereof to the adjacent portions of the side walls 15. The inner faces of the ends 19 and 20, the upper face of the bottom 18 and the portions of the side walls 15 which extend between the ends 19 and 20 and are above the bottom 18, define the interior of the tank 11. The top of the tank is normally closed by a cover 21 which is preferably of hollow design and filled with insulating material and has its end margins resting loosely upon the upper margins of the end wall 16 of the supporting structure 10 and the end 20 of the tank 11. When it is desired to have access to the interior of the tank 11 it is only necessary to remove the cover 21. The end 20 of the tank, the end wall 16 of the supporting structure, and the portion of the side walls of the supporting structure which form the sides of the tank 11 are of hollow design and filled with insulating material, as shown in the drawings, so that the tank interior is insulated from the atmosphere surrounding the apparatus. The bottom 18 and the end 19 of the tank 11 are surrounded by an L-shaped jacket 22. This jacket is normally filled with water and consists of a vertical leg 23 and a horizontal leg 24. The vertical leg is formed between the end 19 of the tank 11 and the upper portion of the end wall 16 of the supporting structure 10 and receives water from the tank interior by way of a horizontal series of laterally spaced holes 25 in the upper margin of said end 19. The horizontal leg 24 of the jacket is formed between the bottom 18 of the tank and a horizontally extending wall 26. The wall 26 is secured to the adjacent portions of the sides 15 of the supporting structure and has one end thereof secured to the lower end of the tank end 20 and its other end secured to the central or intermediate portion of the end wall 16 of the supporting structure. When the water in the tank 11 rises above the bottom portions of the holes 25 in the upper margin of the tank end 19 it flows or spills into the vertical leg 23 of the jacket 22 and then flows downwards into the horizontal jacket leg 24. Two laterally spaced baffles 27 (see Figure 3) are disposed in and extend longitudinally of the horizontal leg 24 of the jacket and are so arranged that the water in flowing through such leg travels in a serpentine or sinuous course. A block 28 of cork or other material is located in the lower end of the vertical leg 23 of the jacket and forms at one end thereof a restricted passage between said lower end of the vertical leg and the inlet or water receiving end of the horizontal leg 24.

The heat exchanger 12 is located beneath the inner end of the tank 11. It is of radiator-like design, and consists of an upper header 30, a lower header 31 and a series of tubes 32 between the two headers. The upper header 30 is secured in any suitable manner to the inner end of the wall 26. The lower header 31 communicates with the upper header by way of the tubes 32 and is disposed over one end of the base 14 of the supporting structure 10. A pipe 33 (see Figure 1) extends between the lower header 31 of the heat exchanger and the discharge end of the horizontal leg 24 of the jacket 22 and permits any water in the water jacket to flow downwardly into the lower header 31 for up-flow through the tubes 32 and into the upper header 30. The upper header 30 is connected by a pipe 34 to the housing inlet of a pump 35, which, as shown in Figures 1 and 4, is located beneath the wall 26 and is supported on a bracket 36 on the inner face of the end wall 16 of the supporting structure 10. The pipe 34 extends substantially horizontally and underlies the wall 16. The pump 35 is connected for drive by an electric motor 37 and has a discharge pipe 38 leading from the outlet of its housing. This pipe 38 consists of a vertically extending section 39 and a horizontally extending section 40. The section 39 projects through a hole in the wall 26 and leads upwardly through the vertical leg 23 of the water jacket 22. The horizontally extending section 40 of the pipe 38 overlies the bottom 18 of the tank and is disposed directly beneath the cover 21 when the latter is in its closed or normal position. It is positioned above the column of water in the tank 11 and has one end thereof connected to the upper end of the vertically extending section 39. The other end of the section 40 supports, in a depending manner, and is in communication with, a plurality of depending discharge tubes 41. These tubes terminate above the tank bottom 18 and have discharge holes 42. When the pump 35 is in operation water flows from the jacket 22 downwardly through the pipe 33 into the lower header 31 of the heat exchanger 12, then flows upwards through the tubes 32 into the upper header 30 and thence to the pump 35 via the horizontally extending pipe 34. From the pump the pumped water flows through the pipe 38 and

thence into the tank 11 by way of the discharge tubes 41. From the tank 11 the water flows back into the jacket 22 through the holes 25 in the upper margin of the tank end 19. When the level of the water in the tank is above the bottom of the holes 25 and the jacket 22 is filled with water, drive of the pump operates to cause the water to circulate from the jacket to and through the radiator and thence into the tank and back to the jacket. The motor 37 for driving the pump 35 is controlled by a float controlled switch 43 in the upper end of the vertical leg 23 of the jacket 22. When the float for controlling the switch is in an elevated position due to the leg 23 of the jacket 22 being filled with water, the switch 43 is held in its closed position with the result that the pump 35 operates, as hereinbefore described, to effect circulation of cool water from the tank 11 to and through the heat exchanger 12. When the float drops in connection with hereinafter described drainage of water from the jacket 22 it serves to open the switch and thus stops drive of the pump 35 by the motor 37.

The fan 13 is positioned between the heat exchanger 12 and a vertically extending partition 44. It is driven by means of an electric motor 45. The partition extends between the inner end of the bottom forming base 14 of the supporting structure 10 and the horizontally extending wall 26 and defines with said base and the lower portions of the side walls 15 and the end wall 16 a compartment 46. The motor 45 is mounted on a bracket 47 on the partition 44 and is controlled by a switch (not shown). An inclined partition 48 extends between the lower header 31 of the heat exchanger 12 and the upper portion of the end wall 17 of the supporting structure 10 and forms a substantially U-shaped air circulating duct 49. An opening 50 in the lower portion of the end wall 17 constitutes the inlet end of this duct and a grill equipped opening 51 between the upper end of the tank end 20 and the upper portion of the end wall 17 constitutes the duct outlet. The fan 13 is so designed that when it is driven by the electric motor 45 it operates to draw air into the duct through the hole 50 from the space around the apparatus and then to force the air through the heat exchanger 12 and out of the duct via the opening 51. When cool water is being circulated through the heat exchanger and the fan is in operation the air which flows through the duct is cooled as it comes in contact with the heat exchanger.

In addition to the supporting structure 10, cooling tank 11, heat exchanger 12 and fan 13 the apparatus comprises or includes as a part thereof a mechanical refrigerator unit 52. This unit is disposed for the main part in the compartment 46 beneath the cooling tank and operates as hereinafter described to chill the water in the tank when the pump 35 is in operation and to freeze the water in the tank when the pump is inoperative. It is designed and intended to operate constantly and consists of a compressor 53, a condenser 54, a receiver 55, an evaporator 56, a high pressure refrigerant line 57 and a low pressure refrigerant line 58. The high pressure refrigerant line leads from the compressor to the evaporator and includes the condenser 54 and the receiver 55. The low pressure refrigerant line constitutes a refrigerant return and leads from the evaporator to the suction side of the compressor. The compressor is of the air cooled variety and is positioned in the compartment 46. It rests on the base 14 and is driven by an electric motor 59 by way of a belt and pulley connection 60. When the compressor is in operation it operates, as well understood in the art, to compress the refrigerant prior to passage of the latter to the evaporator. The condenser 54 of the unit is located in the compartment 46 in close proximity to the compressor and serves to condense the compressed refrigerant. The receiver 55 is also located in the compartment 46. It is connected to the high pressure refrigerant line 57 at a point between the condenser and the evaporator and serves as a storage tank for the refrigerant after the latter is condensed or liquified by the condenser. The evaporator 56 consists of a plurality of serially connected coils 61 in the tank 11 and is connected to the discharge end of the high pressure refrigerant line 57 by way of an expansion valve 62. The latter is controlled by a thermo bulb 63 in the compartment 46. The bulb 63 is located at the discharge or outlet end of the low pressure refrigerant line 58 in the immediate proximity of the inlet part of the compressor. By so locating the bulb the mechanical refrigerating unit 52 is so controlled that it is adapted for twenty-four hour a day operation. If the bulb were located in the cooling tank it would not properly control the expansion valve for full time operation of the unit. By locating the bulb as shown there is no "slack" in the low pressure line and the spent refrigerant enters the compressor at a low temperature and assists in cooling the compressor. The coils 61 of the evaporator 56 correspond in number to the discharge tubes 41 and are associated with said tubes respectively. They are substantially fully immersed in the column of water in the tank 11 and serve, when the refrigerator unit is in operation, either to chill or freeze the water in the tank. The low pressure refrigerant line 58 extends between and connects the outlet end of the evaporator and the suction side of the compressor. When the unit is in operation the refrigerant is drawn into, and compressed by, the compressor and then flows through the condenser and the receiver and to the expansion valve 62 via the high pressure refrigerant line 57. When the refrigerant passes through the expansion valve into the evaporator it expands and thus reduces the temperature of the evaporator. After passing through the evaporator the spent refrigerant returns to the compressor by way of the low pressure refrigerant line 58. When the water is being circulated through the tank, the water jacket and the heat exchanger, as the result of operation of the pump 35, chilling of the water takes place due to the action of the evaporator and as a result the air which is circulated past the heat exchanger by the motor driven fan 13 is reduced in temperature. When the water in the tank is stagnant due to stoppage of the pump 35 it freezes due to the chilling or refrigerating effect of the evaporator.

It is contemplated that during the warm or hot period of the day the pump 35 will be in operation and that during the cool parts of the day or at night when no air cooling or conditioning is necessary the pump shall not be in operation. When the pump is not in operation, as heretofore pointed out, there is no circulation of water through the tank and the water in the tank turns into ice as the result of the action of the evaporator 56 of the mechanical refrigerator unit 52. When the pump is started after the formation of ice in the tank 11 water in the jacket 22 is drawn through the heat exchanger and is then forced under

pressure into the tank 11 through the tubes 41. The pumped water is chilled or cooled as a result of contact with the ice in the tank and then flows back into the vertical leg 23 of the jacket through the holes 25 in the upper margin of the tank end 19.

For the purpose of draining the jacket 22 and thus preventing the freezing of water therein when the mechanical refrigerator unit 52 is operated to form the water in the tank 11 into ice drain means 64 is provided. This means consists of a drain pipe 65, a drain tank 66 and a drain pipe 67. The tank 66 is suitably supported in the compartment 46 adjacent the upper end of the partition 44. It is open at the top thereof as hereinafter described and carries at all times during normal operation of the apparatus, a column of water. The drain pipe 65 leads from the upper header 30 of the heat exchanger 12 to the tank 66, as shown in Figure 2, and includes a valve 68. It has a comparatively large diameter and is positioned beneath the horizontally extending wall 26. The valve 68 is of any suitable type or character and embodies a control handle 69 adjacent one of the side walls 15 of the supporting structure 10. When it is desired to drain the jacket 22 the valve 68 is opened by proper manipulation of the control handle 69. As soon as the valve is opened the water in the jacket 22 drains into the drain tank 66 by way of the heat exchanger 12 and the drain pipe 65. The drain pipe 67 is of L-shaped construction and consists of a vertically extending pipe section 70 and a horizontally extending pipe section 71. The section 70 (see Figure 2) extends through the bottom of the drain tank 66 and is of such length that the upper end thereof terminates slightly beneath the top of the tank 66. The horizontal section 71 of the drain pipe 67 underlies the bottom forming base 14 of the supporting structure 10 and leads from the lower end of the section 70 to a waste pipe or sewer (not shown). When the valve 68 is in its open position the water which flows through the drain pipe 65 from the jacket flows into the tank 66 and then after rising to the top of the latter passes from the apparatus via the drain pipe 67.

A column of water is maintained in the tank 66 of the discharge means 64 by way of a supply or make-up water tank 72. This tank, as shown in Figures 1 and 2, is located in the upper or discharge end of the air circulating duct 49. It is suspended from a top plate 73 at the upper end of the end wall 17 of the supporting structure and supplied with water by way of a pipe 74. The latter leads from a tap or other water supply and is provided with a float controlled valve 75 at its discharge end. The float for the valve 75 is so arranged that it closes the valve when the level of the column of water in the tank 72 is the same as the level of the water in the tank 11 and opens the valve when the water drops below such level. As a result of the action of the float the water in the tank 72 is always at a constant level. A pipe 76 (see Figure 2) leads from the bottom of the supply tank 72 to the drain tank 66. The discharge end of the pipe 76 terminates within the tank 66 and is provided with a float controlled valve 77. The float for the last mentioned valve so controls such valve that a column of water of constant height is maintained in the tank 66. The tank 66 serves not only as a part of the drainage means 64 for the jacket 22 but also as a medium for constantly supplying water to a jacket 78 around the condenser 54 of the mechanical refrigerator unit 52. The jacket 78 completely surrounds the condenser. A pipe 79 leads from the bottom of the tank 66 to the top of the jacket 78 and a drain pipe 80 leads from the bottom of the jacket to the horizontal section 71 of the drain pipe 67. When the apparatus is in operation water from the tank 66 flows constantly through the jacket 78 and assists in condensing the compressed refrigerant in the condenser. A normally open water supply pipe 81 extends between the bottom of the supply tank 72 and the lower header 31 of the heat exchanger 12. This pipe serves to supply the heat exchanger with cool tap water for air cooling purposes when the valve 68 is open and there is no water in the jacket 22 and operates when the valve 68 is closed to fill said jacket 22 with water from the tank 72. A valve 82 is connected to the upper end of the pipe 81 and serves to regulate the flow of water through the pipe to the heat exchanger. To prevent the pipe 81 from becoming air bound a vent pipe 83 is attached to the pipe 81 at a point beneath the valve 82. This pipe 83 extends upwardly alongside of the tank 72 and is of such length that the upper end thereof is positioned above the level of the column of water in the tank 72. An overflow pipe 84 leads from the top of the tank 72 to the vertically extending section 70 of the drain pipe 67 and serves to prevent the tank 72 from overflowing in the event that the float for the valve 75 should become inoperative or the valve should stick or freeze in its open position. The tank 72 is provided on the exterior thereof with protuberances or baffles 85 and these, together with the tank, serves as a medium for eliminating moisture in the cooled air which is discharged from the apparatus via the discharge opening 51 at the upper end of the duct 49. Any moisture which is collected is eliminated by the protuberances and the tank and drains down the inclined partition 48 into a trough 86 beneath the heat exchanger and is discharged from said trough into the drain pipe 67 by way of a drain tube 87. To prevent excessive building up of water in the tank 11 and the jacket 22 an overflow pipe 88 is provided. This pipe is L-shaped and extends from the top of the vertical leg 23 of the jacket 22 to the drain pipe 65 of the drain means 64. The lower part of the pipe 88 has a U-shaped loop in it as shown in Figure 2, so as to form an air trap or lock whereby air is precluded from flowing from the compartment 46 into the cooling tank 11 should there be no water in the drain tank 66. Whereas the upper leg or part of the pipe 88 has been described or shown as being located in the vertical leg of the jacket 22 it is to be understood that it may be otherwise placed or positioned. For example, it may be disposed in the cooling tank 11 at a point in close proximity to the end 20 of the tank. The pipe 65 is of much larger diameter than the supply pipe 81 in order that when the valve 68 is opened there is complete drainage of water from the jacket even though tap water is permitted to flow through the heat exchanger 12 from the tank 72.

When it is desired to set the apparatus in operation the valve 68 is first closed and then tap water is permitted to flow into the tank 72 via the pipe 74. A portion of the water which is introduced into the tank 72 flows through the pipe 81 into the heat exchanger 12 and from the latter into the jacket 22 and cooling tank

11. Water also flows from the tank 72 through the pipe 76 into the drain tank 66. When the column of water in the drain tank approaches the top of the tank the float controlled valve 77 closes and there is no further flow of water from the tank 72 into the drain tank 66. Water will continue to flow into the tank 72 until the heat exchanger 12, the jacket 22 and the tank 11 are filled. At such time the column of water in the tank 72 will have a level equal to that of the level of the water in the tank and jacket, and the valve 75 will close. After filling of the tank 11 the mechanical refrigerator unit 52 is set in operation. It operates as hereinbefore described to chill or cool the water in the tank. When it is desired to cool the air in the space surrounding the apparatus the electric motors for the fan 13 and the pump 35 are started. As soon as these motors become operative cooled or chilled water is caused to circulate from the cooling tank 11 through the jacket 22 and the heat exchanger 12 and then back to the tank. In response to drive of the fan 13 by the electric motor 45 air is caused to circulate through the duct 45. As the air passes the heat exchanger 12 it is cooled. Because of the operation of the fan there is a constant circulation of air within the space around the apparatus and a cooling effect is obtained by the action of the heat exchanger. In normal operation of the apparatus water flows from the drain tank 66 through the jacket 73 around the condenser 54 and cools the condenser. When it is desired to freeze the water in the tank 11 and effect cooling of the heat exchanger by the flow of tap water therethrough the valve 68 is opened by proper manipulation of the handle 69 and the motor for driving the pump 35 is stopped. Immediately upon opening of the valve the water in the jacket 22 drains into the drain tank 66 and is discharged from the latter by way of the drain pipe 67. As soon as the jacket is empty the water in the tank 11 becomes stagnant or inert. It freezes and forms into a substantially solid cake around the coils 61 which constitute the evaporator 56 of the refrigerating unit 52. While ice is being formed in the tank 11 there is a continuous flow of tap water from the tank 72 to and through the heat exchanger 12 and this serves to cool the exchanger so that air cooling is obtained in connection with drive of the fan 13. As soon as the water in the tank 11 becomes frozen and it is desired to use the ice for cooling the heat exchanger the valve 68 is closed and thereafter the pump 35 is set in motion. As soon as the valve 68 is closed water from the tank 72 flows into and fills the jacket 22. As soon as the jacket is filled with water there is no further flow of water from the tank 72 into the heat exchanger 12. As soon as the pump 35 starts to operate water is drawn from the heat exchanger and forced under pressure into the tank 11 via the holes in the tubes 41. This water, as heretofore described, comes in contact with the ice and after being chilled thereby flows back into the jacket 22 and is recirculated through the heat exchanger. It is contemplated, as hereinbefore pointed out, that the mechanical refrigerator unit be constantly operated and that the pump 35 shall only be operated during extremely oppressive heat, such for example, as those temperatures which are encountered during the warm part of the day. It is further contemplated that at night when cooler temperatures are encountered the valve 68 be opened and the pump 35 stopped so as to form ice in the tank 11. By such operation there is ample cooling of the heat exchanger during the warm part of the day and the ice in the tank augments the cooling action of the unit. When ice is being formed in the tank 11 cooling of the heat exchanger 12 takes place as the result of flow of tap water through the exchanger, as heretofore pointed out. Should it be desired during the formation of ice in the tank to eliminate the flow of tap water through the heat exchanger it is only necessary to close the valve 82 in the supply pipe 81. When such valve is closed there is no flow of water from the tank 72 through the heat exchanger. Whenever the fan 13 is in operation there is a continuous flow of air through the duct 49 and past the heat exchanger. Because the apparatus includes the float controlled switch 43 for the pump driving motor 37 the pump is automatically stopped when the jacket 22 is drained as a result of opening of the valve 68 and is automatically set in operation when the jacket is filled with make-up water from the tap as the result of closing of said valve 68.

The herein described air conditioning apparatus efficiently and effectively fufills its intended purpose and may be operated economically, especially in territories where low current rates prevail in connection with continuous current consumption. It is essentially a self-contained unit and comprehends a compact arrangement of its component parts.

The invention is not to be understood to be restricted to the details set forth since these may be modified within the scope of the appended claims without departing from the spirit and scope of the invention.

Having thus described the invention what I claim as new and desire to secure by Letters Patent is:

1. In an air conditioning appartus of the character described, the combination of a cooling tank adapted to contain a column of water and having means for refrigerating the water therein, a hollow heat exchanger adapted to have air circulated past it, a system for circulating water from the tank through the heat exchanger and thence back to the tank, including a motor driven pump and a water jacket communicating with the top of the tank and adapted to have water flow from the tank into and through it, means for draining the jacket of any water therein, and means for automatically stopping the pump upon drainage of the jacket.

2. In an air conditioning apparatus of the character described, the combination of a cooling tank adapted to contain a column of water and having means associated therewith for refrigerating the water in it; a hollow heat exchanger positioned beneath the tank and adapted to have air circulated past it; a system for circulating water from the tank through the heat exchanger and thence back to the tank comprising a jacket extending between and communicating with the heat exchanger and the top of the tank and adapted during use of the system to have water spill directly into it from the tank and deliver the water to the heat exchanger, a return pipe leading from said heat exchanger and having the discharge end thereof arranged to discharge into the tank, and a motor driven pump in said pipe; valve controlled means for draining the jacket of any water therein when the system is not in use; and valve controlled means for filling the jacket with water from an outside

source when it is desired to render the system operative.

3. In an air conditioning apparatus of the character described, the combination of a cooling tank adapted to contain a column of water and having means associated therewith for refrigerating the water in it; a hollow heat exchanger positioned outside, beneath the level of, the tank and adapted to have air circulated past it; a system for circulating water from the tank through the heat exchanger and thence back to the tank comprising a jacket between and communicating with the heat exchanger and the top of the tank, a return pipe leading from the heat exchanger and having the discharge end thereof arranged to discharge into the tank, and a motor driven pump in said pipe, means for draining the jacket of any water therein when the system is not in use; and means for automatically stopping the pump upon drainage of the jacket.

4. In an air conditioning apparatus of the character described, the combination of a cooling tank adapted to contain a column of water, a mechanical refrigerator unit having evaporator coils disposed in the tank for chilling or freezing the water therein, a hollow heat exchanger, and a system for circulating water from the tank through the heat exchanger and back to the tank, normally filled with water and comprising a jacket extending between and communicating with the heat exchanger and the top of the tank, a return pipe leading from the heat exchanger and having the discharge end thereof overlying the tank and provided with depending apertured tubes adjacent the evaporator coils, and a motor driven pump in the return pipe.

5. In an air conditioning apparatus of the character described, the combination of a cooling tank adapted to contain a column of water, a mechanical refrigerator unit having evaporator coils disposed in the tank for chilling or freezing the water therein, a hollow heat exchanger, a system for circulating water from the tank through the heat exchanger and back to the tank, normally filled with water and comprising a jacket extending between and communicating with the heat exchanger and the top of the tank, a return pipe leading from the heat exchanger and having the discharge end thereof overlying the tank and provided with depending apertured tubes adjacent the evaporator coils, and a motor driven pump in the return pipe, and means for draining the jacket of any water therein and thus rendering the system inoperative.

6. In an air conditioning apparatus of the character described, the combination of a cooling tank adapted to contain a column of water and having means associated therewith for cooling the water in it, a hollow heat exchanger adapted to have air circulated past it, controllable means for circulating water from the tank through the heat exchanger and back to the tank, a water supply tank having means for continuously maintaining a column of tap water therein, and means for circulating tap water from the supply tank through the heat exchanger when said controllable circulating means is inoperative.

7. In an air conditioning apparatus of the character described, the combination of a refrigerating tank adapted to contain a column of water and having associated therewith means for cooling the water in it, a hollow heat exchanger disposed beneath the tank and adapted to have air circulated past it, means for circulating water from the tank through the heat exchanger and back to the tank including a hollow element leading from the top of the tank to the heat exchanger and adapted during use of the circulating means to have water spill directly into it from the tank and to deliver the water by gravity to the heat exchanger, a valve controlled drain pipe for draining the hollow element when the circulating means is not in use, a make-up water tank above the heat exchanger, and a pipe between, and serving to connect, said make-up water tank and the heat exchanger.

8. In an air conditioning apparatus of the character described, the combination of a cooling tank adapted to contain a column of water and having means for refrigerating the water therein, a hollow heat exchanger disposed beneath the tank and adapted to have air circulated past it, means for circulating water from the tank through the heat exchanger and then back to the tank, including a jacket extending between and communicating with the heat exchanger and the top of the tank and adapted during use of the circulating means to have water spill directly into it from the tank and deliver the water by gravity to the heat exchanger, a valve controlled drain pipe for draining the jacket of any water therein when the circulating means is not in use, a make-up water tank above said heat exchanger, and a valve controlled pipe extending between, and serving to connect, the make-up water tank and the heat exchanger.

9. In an air conditioning appartus of the character described, the combination of a cooling tank adapted to contain a column of water and having means for cooling the water in it, a hollow heat exchanger disposed beneath the tank and adapted to have air circulate past it, means for circulating water from the tank through the heat exchanger and back to the tank, a valve controlled drain pipe adapted when the valve thereof is opened to drain water from the circulating means and render the latter inoperative, a water supply tank disposed adjacent the cooling tank and above the heat exchanger and having means associated therewith for continuously maintaining it full of tap water, and a pipe connection between the supply tank and the heat exchanger adapted, when the circulating means is inoperative as a result of the valve being open, to circulate water from the supply tank through the heat exchanger and thence through the drain pipe and upon closing of said valve, to fill the circulating means with water from the supply tank.

10. In an air conditioning apparatus of the character described, the combination of a cooling tank adapted to contain a column of water and having means for cooling the water therein, a hollow heat exchanger positioned beneath the level of the tank bottom and adapted to have air circulated past it, means for circulating water from the tank through the heat exchanger and back to the tank, including a jacket leading from the top of the tank and connected to the bottom of the heat exchanger, and a return pipe between the top of said heat exchanger and the tank, a valve controlled drain pipe leading from the top of the heat exchanger and adapted when the valve thereof is opened, to drain the jacket of any water therein and thus render the circulating means inoperative, a water supply tank disposed adjacent the cooling tank and above the heat exchanger and having means associated there-

with for continuously maintaining it full of tap water, and a pipe extending between the supply tank and the bottom of the heat exchanger adapted, when the circulating means is inoperative as a result of the valve being open, to circulate water from the supply tank through the heat exchanger and thence through the drain pipe and upon closing of said valve, to fill the jacket of the circulating means with water from the supply tank.

11. In an air conditioning apparatus of the character described, the combination of a cooling tank adapted to contain a column of water, a mechanical refrigerator unit for cooling the water in the tank, including a water cooled condenser and in addition an evaporator in the tank, a hollow heat exchanger disposed beneath the cooling tank and adapted to have air circulated past it, a system for circulating water from the cooling tank through the heat exchanger and thence back to the tank, a valve controlled drain adapted when the valve thereof is opened, to drain said system and render the latter ineffective, a supply tank positioned adjacent the cooling tank and having means associated therewith for continuously maintaining it full of tap water, a pipe extending between the supply tank and the heat exchanger and adapted, when the valve of the drain pipe is opened, to circulate water from the supply tank through the heat exchanger and then into said drain pipe and when the valve is closed, to fill the system with water from said supply tank, and means for supplying water from said supply tank to the condenser of the refrigerator unit.

12. In an air conditioning apparatus of the character described, the combination of a supporting structure, a tank on the supporting structure adapted to contain a column of water and having means for cooling the water therein, means on the structure forming an open ended duct adjacent the tank, a heat exchanger in said duct, means for circulating water from the tank through the heat exchanger and back to the tank, means for draining the circulating means when the latter is not in use, a motor driven fan adjacent the heat exchanger and adapted when driven to circulate air through the duct and past the heat exchanger for cooling purposes, and means including a make-up water tank in the discharge end of said duct for filling the circulating means with water after draining of said circulating means preparatory to further use of the latter.

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