Sept. 26, 1933. D. K. WARNER 1,928,580

APPARATUS FOR COOLING

Filed May 15, 1928

Fig. 1.

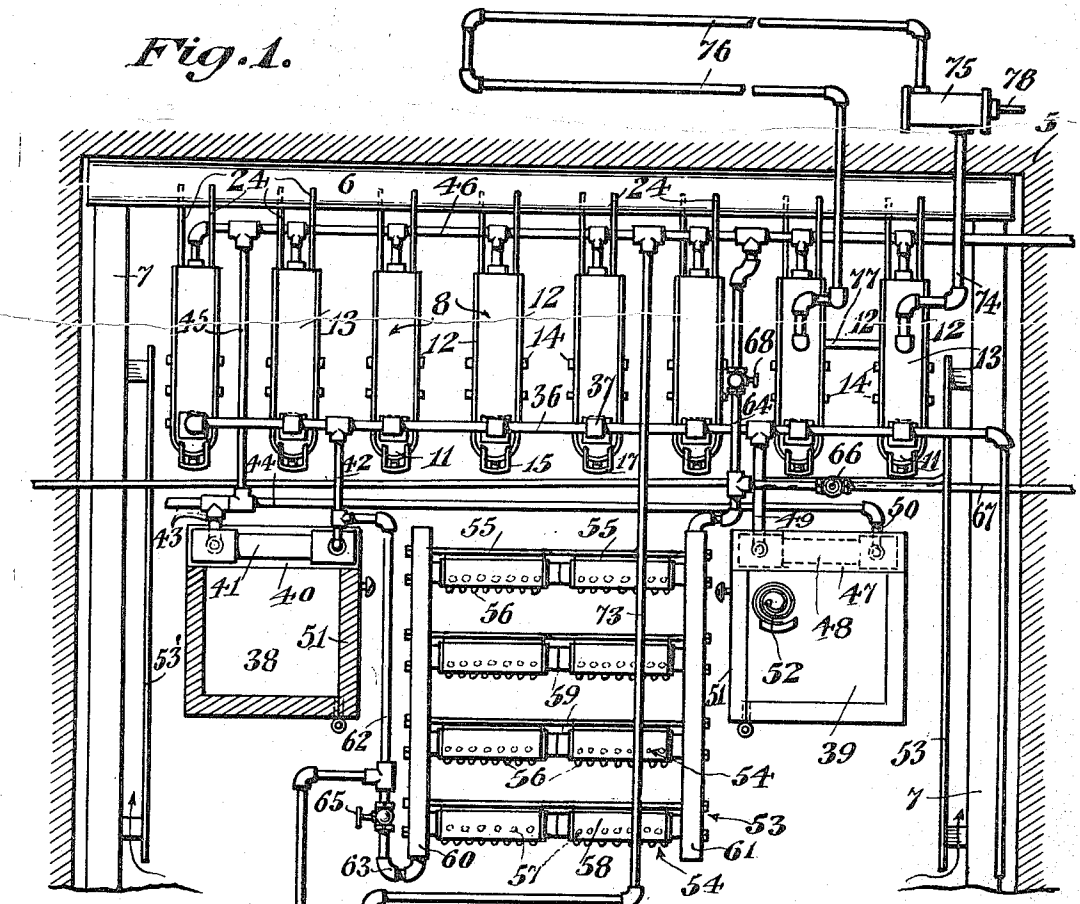


Fig. 3.

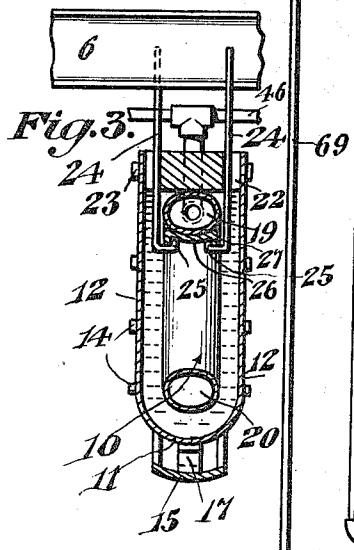
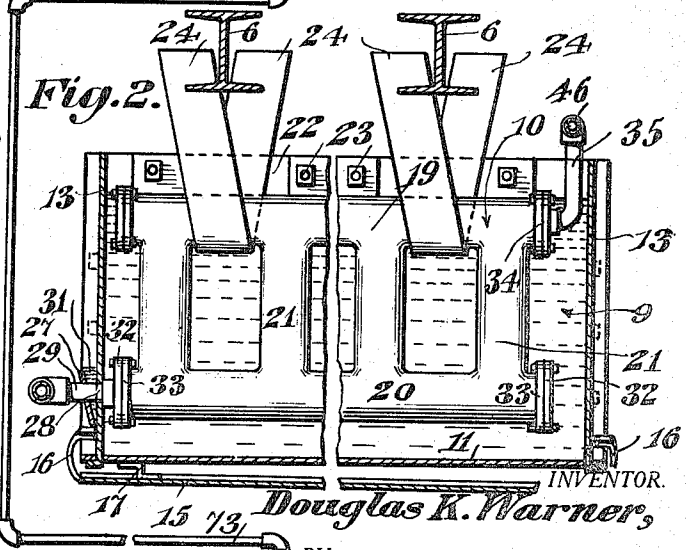


Fig. 2.



INVENTOR.
Douglas K. Warner
BY
Geo. P. Kimmel.
ATTORNEY.

Patented Sept. 26, 1933

1,928,580

UNITED STATES PATENT OFFICE

1,928,580

APPARATUS FOR COOLING

Douglas K. Warner, Bristol, Conn.

Application May 15, 1928. Serial No. 277,931

7 Claims. (Cl. 62—95)

This invention relates to apparatus for utilizing the temperature of a frozen body by which a constant temperature is maintained in a cooling room and whereby the temperature of said frozen body may be transmitted to enclosed spaces or receptacles removed therefrom for the purpose of cooling the same.

The principal object of the invention is to provide, in a manner as hereinafter set forth, an apparatus for the purpose above stated, whereby enclosed spaces or receptacles, such as show cases, window display spaces, and the like, removed from a cooling room, may be maintained at a constant temperature.

Heretofore, refrigeration has been provided for show cases and the like by the ice machine which maintains a low temperature in a cooling room, the machine being controlled by a thermostat in the cooling room and adapted to absorb the heat in show cases and the like while the machine is running. An ice machine of proper size and installation runs about one-half the time in hot weather and about one-eighth of the time in cold weather. As show cases and the like are practically always very poorly insulated, the interiors thereof warm up much more rapidly than the interior of the cooling room wherein the thermostat is located, consequently the show cases are not kept cold much more than one-half the time in hot weather or one-eighth the time in cold weather, the remainder of the time the apparatus in the show cases having no utility and being in the way.

In apparatus according to my invention, the cooling room is maintained at a constant temperature by freezing a solution of brine in containers in the top of the cooling room and permitting the frozen solution to melt, meanwhile circulating the air in the room between the containers. I utilize the melted solution to maintain a constant temperature in show cases and the like by piping the same through such show cases and back to the containers. I also pipe the refrigerant, which is maintained by the frozen solution at the same temperature as the solution when the machine is not running, to such show cases where it is evaporated by the heat in the show cases and passed back in the form of gas to the conductors within the frozen solution where it is cooled and condensed by the solution, ready to be returned by gravity or other suitable means to the show cases.

In the accompanying drawing in which like numerals are employed to designate like parts throughout the same,

Figure 1 is an elevation of an embodiment of my invention showing the position of the same with relation to a cooling room,

Figure 2 is a longitudinal vertical section through a cooling element, and

Figure 3 is a transverse vertical section through the same.

In the drawing wherein for the purpose of illustration is shown an embodiment of my invention, the numeral 5 designates the walls of a cooling room, at the top of which are supported I beams 6, by means of vertical supports 7. Suspended from the I beams is a plurality of cooling elements 8, each of which consists of a brine pan and a refrigerant conductor, indicated generally at 9 and 10 respectively.

Each brine pan is formed with a curved bottom 11, side walls 12, and end walls 13. The end walls 13 are spaced inwardly from the ends of the side walls 12, and are formed on the sides and bottoms thereof with bendable tongues 14, which extend through openings formed in the side walls, and are bent laterally to lie against the outer faces of the side walls to hold the end walls in position. A drip pan 15 is positioned under each brine pan 9 and slopes downwardly from front to rear. The drip pan 15 is secured in position by means of upstanding end portions 16 which curve over the bottom 11 of the brine pan.

Suitable spacing elements, as 17, may be interposed between the drip pan and the brine pan. The brine pans are adapted to contain brine of a predetermined density.

Positioned within each of the brine pans is one of the refrigerant conductors 10, which is substantially of radiator shape having an upper portion 19, a lower portion 20, and vertical portions 21, connecting the upper and lower portions. Extending along the inner face of the side walls 12, adjacent the top of the brine pan 9, are suspension blocks 22, which are held in place by means of suitable holdfast devices 23, and are adapted to seat on the upper portion 19 of the refrigerant conductor 10, when the refrigerant conductor and brine pan are in assembled relation. The brine pan and refrigerant conductors are suspended from the I beams by means of hangers 24, which are provided with slits to receive therein the lower flanges of said I beams. The hangers 24 extend into the brine pan and are provided at their lower ends with hook portions 25 which are disposed below the lower surface of the upper portions 19 of the refrigerant conductors 10. A plurality of coupling members 26 support the upper portions 19 of the refrigerant conductors, and are formed with

downturned ends 27 which engage the hooks 25 of the hangers 24. Thus it will be seen that the brine pans 9 and refrigerant conductors 10 are supported by the hangers 24 with the lower portions 20 of the refrigerant conductors spaced from the bottoms 11 of the brine pans.

Spaced from the bottom thereof, the forward end wall 13 of each brine pan is formed with an opening 28 for the passage therethrough of a lead-in pipe 29. The pipe 29 also extends through a perforated plate 30, which is positioned with its lower end against the outer surface of the end wall 13, rests on the upper surface of the end 16 of the drip pan 15, and extends in an upwardly and outwardly inclined direction. A sealing medium such as pitch, indicated at 31 may be interposed between the plate 30 and the end wall 13. The inner end of the lead-in pipe 29 is formed with a flanged coupling 32, which coacts with a similar flanged coupling 33 formed on the lower portion 20 of the refrigerant conductor 10, thereby forming a connecting means between the pipe 29 and the refrigerant conductor. The opposite end of the lower portion 20 is closed, so that refrigerant entering the lower portion immediately rises through the vertical portions 21 to the upper portion 19. The upper portion 19, at the rearward end thereof, is formed with a similar flanged coupling 34 for similar connection with a discharge pipe 35. The upper portion 19 is closed at the forward end thereof.

Extending across the forward end of the cooling elements is a common refrigerant supply pipe 36, which is adapted as at 37, for connection with each of the lead-in pipes 29.

Disposed beneath the cooling elements is a pair of cabinets 38 and 39 respectively. Disposed within the top of the cabinet 38 is a brine pan 40, within which is disposed a refrigerant conductor 41. The brine pan 40 and refrigerant conductor 41 are similar to the brine pans 9 and refrigerant conductors 10, except that the brine pans 40 and refrigerant conductor 41 are disposed horizontally instead of vertically. The brine within the pan 40 is of greater density than the brine in the pan 9, for a purpose to be hereinafter disclosed. The conductor 41 is connected with the supply pipe 36 by means of a lead-in pipe 42, and is also provided with an outlet pipe 43, which is connected with a discharge pipe 44, common to both cabinets 38 and 39.

The pipe 44 is connected, through the pipe 45, to a main discharge pipe 46. The pipe 46 is common to all of the discharge pipes 35 of the refrigerant conductors 10.

The cabinet 39 is provided with a brine pan 47 and refrigerant conductor 48, which are disposed within the cabinet 39 in the same manner as the brine pans 40 and refrigerant conductor 41 are disposed in the cabinet 38. The conductor 48 is connected with the supply pipe 36 by means of a lead-in pipe 49, and is connected with the discharge pipe 44 by means of an outlet pipe 50. The brine within the pan 47 is of greater density than the brine within the pan 40. The cabinets 38 and 39 are adapted to have contained therein perishable foods, or foods which it is desired to expose to an extremely low temperature, and each cabinet is provided with a hinged door 51, so that ready access may be had to the interior thereof. Disposed within the cabinet 39 is a thermostat 52, by means of which the operation of the ice machine, not shown, is controlled.

When the ice machine is running, the brine within the pans 9, being of less density than the brine within the pan 40, will start to freeze first giving up its heat to the refrigerant circulating through the conductors therein, and the refrigerant within the conductors 10 will be evaporated and pass off in the form of gas through the discharge pipe 46. When the ice forming within the pans 9 becomes thicker, the heat from the brine will be given up less rapidly, and the brine within the pan 40 will begin to freeze, while the refrigerant within the conductor 41 will begin to evaporate and pass off in the form of gas through the pipes 43 and 45 to the discharge pipe 46. The brine within the pan 47 is of still greater density, and the thermostat 52 is set to stop the machine before the brine in the pan 47 freezes. When the machine stops, the frozen brine within the pans 9 and 40 will begin to melt, and before the brine within the pan 9 has completely melted, the operation of the thermostat 52 will again start the machine. Thus it will be seen that ice is either forming or melting in the pans 9 at all times.

The room is kept at a constant temperature by reason of the air therein circulating downwardly between the spaced pans 9 and being returned to the top of the room adjacent the walls thereof. A series of baffle plates 53' are spaced from the walls of the room, by means of which a draft is created between the baffle plates 53' and the walls of the room.

Suitably disposed with relation to the cooling elements and at a lower level, is an ice making element indicated generally at 53. The element 53 includes a plurality of rows of trays which are indicated generally at 54, and are positioned in superposed relation. Each row consists of a plurality of trays 55, which are connected together in horizontal alignment, in a manner to be hereinafter disclosed. The trays are formed with open tops and are provided on the bottoms thereof with a series of longitudinally extending, downwardly projecting ribs 56. Formed in the bottoms of the trays and extending longitudinally thereof is a plurality of tubes 57, which open into headers 58 extending transversely along the outer surfaces of the ends of the trays, adjacent the bottoms of the latter. The ends of the headers 58 are formed with flanged couplings 59, by means of which adjacent trays are connected together, and by means of which the rows of trays are connected with an inlet header 60 and an outlet header 61. The inlet header 60 is connected with the pipe 42 by means of a connecting pipe 62 which extends downwardly below the element 53 to form a trap 63. The refrigerant is admitted into the header 60, which is in connection with the tray headers 58 located at the rearward ends of the trays. From the rearward headers 58 the refrigerant passes through the tubes 57 to the tray headers 58 at the forward ends of the trays.

The tray headers 58 at the forward ends of the trays are connected with the outlet header 61 which is connected by means of a pipe 64 with the discharge pipe 46. The trays 55 are adapted to contain brine, which is preferably of less density than the brine in the brine pans 9, in order that the action of the melting brine in the brine pans 9 may be utilized to freeze the brine in the trays 55. The valve 65 in the pipe 62 is normally open and the refrigerant is permitted to flow by gravity from the conductors 10 to the

header 60. The brine in the trays 55 being of less density then the brine in the brine pans 9 gives off is heat to the relatively cold refrigerant entering the tubes 57, causing the refrigerant to evaporate and pass off in the form of gas through the outlet header 61 and pipe 64 to the discharge pipe 46. When the ice machine is not running the gas will not be sucked through the discharge pipe 46, but will be condensed by the cooling elements at the top of the room and flow back in to the refrigerant conductors 10 to repeat the cycle through the element 53. If desired the ice which is formed in the trays 55 may be removed and utilized for cold packing and the like. The ice may be loosened by opening a valve 66 in a hot gas pipe 67 which permits the hot gas to be forced through the pipe 67 into the header 61 of the element 53. During this operation the valve 65 in the pipe 62 is closed, to prevent the hot gas from being forced upwardly through the pipe 62 to the cooling elements at the top of the room. The hot gas passing through the tubes 57 loosens the ice from the bottoms of the trays and permits the ready removal of the ice. The pipe 64 is provided with a valve 68 which is also closed during the loosening operation to prevent the hot gas from escaping into the discharge pipe 46. After the ice has been loosened the valve 66 is closed and the valve 68 opened to permit the gas remaining in the tubes 57 and headers 60 and 61 to escape into the discharge pipe 46.

Brine is again placed in the trays 55 and the valve 65 is open to permit refrigerant to again enter the header 60. During the normal evaporation of the refrigerant in the tubes 57, the gas cannot escape back into the pipe 62 due to the trap 63 provided therein. The brine in the trays 55 need not necessarily be of less density than the brine in the brine pans 9, however unless the brine in the trays 55 is of less density than that in the pans 9, the elements 53 can only operate during the time that the ice machine is running. By using a brine of lesser density in the trays 55, the melting action of the brine in the pans 9 may be utilized to cause the freezing action in the element 53. The trays 55 may not only be utilized for the purpose of making ice as above set forth, but may also be utilized for absorbing the heat in any enclosed space desired.

Connected with the pipe 62, at a point above the valve 65, is a pipe 69, which is formed with a trap 70 and terminates in an evaporating element 71. The element 71 is adapted to be positioned in an enclosed space, such as a show case or the like, which is removed from the cooling room. The element 71 is provided with a plurality of radially extending fins 72, for the purpose of absorbing heat. Cold refrigerant flows by gravity from the refrigerant conductors 10 through the pipes 42, 62, and 69 to the element 71. The heat within the enclosed space wherein the element 71 is positioned evaporates the refrigerant therein and passes the same in the form of gas through the pipe 73 to the discharge pipe 46. The trap 70 in the pipe 69 prevents the gas formed in the element 71 from passing back into the pipe 69. When the machine is not running, the gas passing through the pipe 73 into the pipe 46 is re-cooled and thereby condensed by the cooling elements at the top of the room, after which it may again flow by gravity back through the element 71.

The melting action of the brine in the pan 9 may be further utilized for cooling an enclosed space by circulating the brine through the space. This may be accomplished by connecting a pipe, such as 74, with the interior of one of the brine pans 9, and connecting the pipe 74 with a suitable pump, indicated at 75. The action of the pump draws the brine from the pan 9 through the pipe 74 and forces it through the pipe 76 which leads through the space which it is desired to cool and is connected with the interior of another of the brine pans 9.

Preferably two adjacent brine pans 9 are connected with the outlet pipe 74 and inlet pipe 76 respectively, and the adjacent pans 9 connected together by means of a short pipe 77. Any suitable means may be employed in connection with the portion of the pipe 76 which is disposed within the space to be cooled to facilitate the absorption of the heat within the space. The pump 75 is adapted, as indicated at 78, for connection with any suitable source of power.

In the operation of my apparatus, the brine within the pans 9 is maintained at a constant temperature by means of the thermostat 52, which is located in the colder cabinet 39. The brine within the pans 9 is either freezing or melting at all times. The air within the room is maintained at a constant temperature at all times due to its circulation downwardly between the cooling elements and its upward return between the baffle plates 53' and walls of the room. When the machine is not running, the refrigerant within the conductors 10 is maintained at the same temperature as the brine within the pans 9. This refrigerant may freely flow by gravity to the elements 53 and 71, as any gas which may be formed in these relatively warmer elements is prevented from passing back through the inlet refrigerant pipe by means of the traps 63 and 70 respectively.

By means of the uniform temperature of the refrigerant flowing to the element 71 and the constant circulation of the refrigerant from the conductors 10 through the element 71 and back to the conductors 10, a constant low temperature may be maintained wherever the element 71 is placed. The operation of the element 71 and the cycle of the refrigerant therethrough is entirely independent of the operation of the ice machine. The only portion of the apparatus having a variable temperature is the cabinet 39 wherein the thermostat is located. This is due to the fact that the brine in the pan 47 is of such density that it will not freeze.

The conductors 41 and 48 are continually flooded with refrigerant, which is unaffected by the operation of the ice machine until the ice formed on the conductors 10 is so thick as to retard the heat flow and permit a lower temperature of the refrigerant in them. The temperature within the cabinet 38 is lower than the room temperature, and the temperature within the cabinet 39 is lower than that within the cabinet 38.

It is to be understood that the embodiment of the invention herewith shown and described is to be taken as the preferred example of the same, and that various changes in the size, shape and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the appended claims.

What I claim is:

1. A cooling apparatus comprising a cooling unit for maintaining a room at a constant temperature and including an evaporating refrigerant container, a pipe leading from the refrigerant

container, a second and lower evaporating element connected with the pipe, and means for returning the evaporated refrigerant from the lower evaporating element to the container.

2. A cooling apparatus comprising a cooling unit for maintaining a room at constant temperature and including an evaporating refrigerant container, a second and lower evaporating element remotely located from said cooling unit, a pipe for conducting a refrigerant by gravity from the container to the second evaporating element, a trap in the pipe located below the level of the second evaporating element, and a conduit located wholly above the second evaporating element for guiding the evaporated refrigerant back to said cooling unit.

3. A cooling apparatus comprising a cooling unit for maintaining a room at constant temperature and including a brine pan and a refrigerant container, a second and lower evaporating element remotely located from said cooling unit, a pipe for conducting a refrigerant by gravity from the container to the evaporating element, a trap in the pipe located below the level of the evaporating element, and a conduit located wholly above the evaporating element for guiding the evaporated refrigerant back to said cooling unit.

4. In combination, a plurality of cooling devices, each including a pan containing brine, the brine in the pans of the respective cooling devices being of different density and the brine in each pan serving to cool that device of which such pan forms a part, an evaporator within each pan, and refrigerant circulating pipes common to all evaporators and arranged whereby the liquid will drain to and fill the lower evaporator and the gas rise to a higher evaporator thereby permitting said lower evaporator to absorb heat, by liquid evaporation when the pressure on the system is low, due to compressor operation, or by vapor condensation on previously cooled evaporators at a higher level, said filling preventing said lower evaporator from absorbing heat by condensation when the upper evaporators have attained a higher temperature.

5. A cooling apparatus comprising a cooling unit for maintaining a room at constant low temperature and other remotely located cooling units connected therewith but at a lower level, each unit including an evaporator, together with means for draining liquid from upper to the lower evaporator and of passing the vapor from the lower to the upper evaporator.

6. In combination, a plurality of cooling devices, each including a pan containing brine, the brine in the pans of the respective cooling devices being of different density and the brine of each pan serving to cool that device of which such pan forms a part, an evaporator within each pan, a refrigerant supply pipe common to said evaporators continually flooding the latter, a discharge pipe common to said evaporators, and thermal means disposed within the cooling device wherein the brine is of greater density for so controlling the temperature of the refrigerant that the brine of greater density will be prevented from freezing and the brine of lesser density will be constantly freezing or melting whereby the brine of lesser density will be maintained at a constant temperature while the brine of high density will vary rapidly in temperature and thereby operate the thermostatic means to operate the compressor without any appreciable change in temperature of the ice filled cooling units.

7. A refrigerator comprising a refrigerator cabinet, a plurality of containers suspended in the top of said cabinet carrying a liquid to be frozen, a refrigerant conductor in each container, said conductors being connected together and the refrigerant in said conductors freezing said liquid and being controlled by a thermostat located in an insulated box below the containers, said box having a cooling unit in its top surrounded by a non-freezing fluid, the temperature of which is lower than that of the cabinet and will vary according to the thickness of the insulation around it which will in turn control the operation of the thermostat to regulate the thickness of the ice in the containers.

DOUGLAS K. WARNER.