Oct. 8, 1935. R. L. HASCHE ET AL 2,016,428

UNIT AIR COOLER

Filed May 24, 1932

Fig. 2

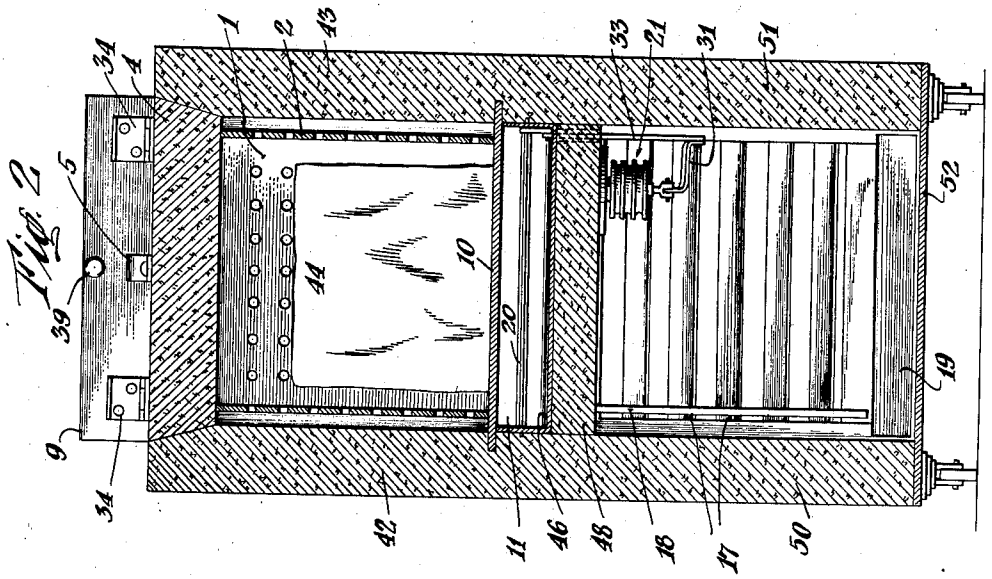
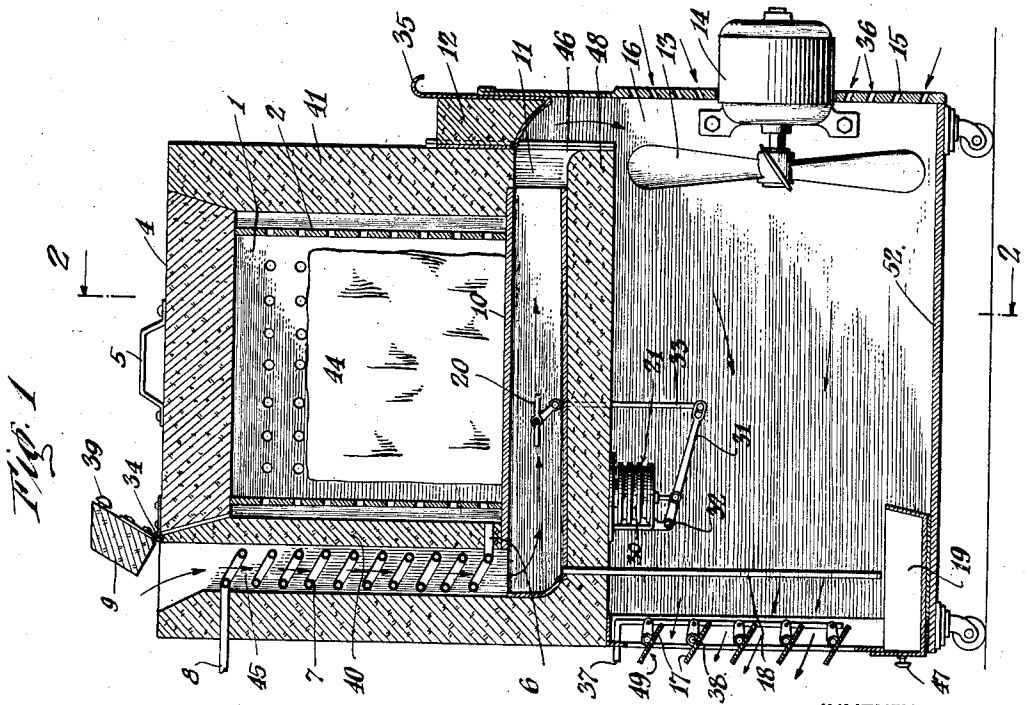


Fig. 1



INVENTORS
Rudolph L. Hasche
Austin Gudmundsen
BY
Austin & Dix
ATTORNEYS

Patented Oct. 8, 1935 2,016,428

UNITED STATES PATENT OFFICE

2,016,428

UNIT AIR COOLER

Rudolph L. Hasche, Milwaukee, and Austin Gudmundsen, Wauwatosa, Wis.

Application May 24, 1932, Serial No. 613,192

6 Claims. (Cl. 62—91.5)

The invention relates to air coolers, and more particularly to air coolers using refrigerant, such as solid carbon dioxide.

According to one form which the invention may assume, the air cooler may be in the form of a portable casing having a refrigerant chamber at the top and a mixing chamber at the bottom. At one side of the refrigerant chamber may be located an economizer chamber. Suitable heat exchange devices may be provided in said economizer chamber through which the vaporized refrigerant may flow from the refrigerant chamber.

The bottom of the refrigerant chamber may be made of heat conducting material and a cooling chamber may be placed thereunder, receiving air from said economizer chamber. The air in the cooling chamber is cooled by direct heat transfer from the solid refrigerant itself.

If desired, a fan may be placed in the mixing chamber which draws uncooled air from the room and mixes it with the cooled air drawn through said economizer and cooling chambers.

If desired, a suitable thermostat may be placed in the mixing chamber for controlling the proportion of air that is cooled. Suitable means may be provided for draining away any water which is condensed due to the cooling of the air.

If desired, suitable insulated dampers or closures may be placed in the entrance and exit of the cold air passage comprising the economizer and cooling chambers respectively, so that, when no refrigeration is desired, the refrigerant may be kept for a considerable period of time.

The invention also consists in certain new and original features of construction and combinations of parts hereinafter set forth and claimed.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, and the manner in which it may be carried out, may be better understood by referring to the following description taken in connection with the accompanying drawing, forming a part thereof, in which

Fig. 1 represents a central vertical section taken through the cooler; and

Fig. 2 is a section on the line 2—2 of Fig. 1.

In the following description and in the claims, various details will be identified by specific names for convenience, but they are intended to be as generic in their application as the art will permit.

Like reference characters denote like parts in the several figures of the drawing.

In the drawing accompanying and forming part of this specification, certain specific disclosure of the invention is made for purposes of explanation, but it will be understood that the details may be modified in various respects without departure from the broad aspect of the invention.

Referring now to the drawing, the unit cooler (as shown) comprises a casing built up of suitable structural members in accordance with ordinary ice box or refrigerator construction. It is preferably portable, being mounted upon suitable casters 22 so that it may be moved from place to place.

Located at the top of the cooler is a refrigerant chamber 1 adapted to hold a block of solid carbon dioxide or any other suitable refrigerant. This chamber is enclosed by side walls 40, 41, 42 and 43. These side walls may be made up of suitable heat insulating material. At the top may be provided a door 4 suitably hinged at 34 and having a handle 5 whereby the chamber may be opened to put in the refrigerant.

Forming the bottom of the refrigerant chamber 1 is a plate 10 of good conducting material, such as copper, on which the refrigerant, indicated by 44, rests. Surrounding the refrigerant 44 on the four sides may be a jacket indicated by 2. This jacket may be of perforated sheet material. This jacket forms a jacket space with the side walls insuring a space to which the vaporized refrigerant can go.

Connected with the jacket space is a pipe 6 leading to a suitable heat transfer device, the heat transfer device 7 forming part of the economizer built in the side wall 40. This economizer is made up of an economizer chamber 45 in which the heat transfer coil is located. The economizer chamber 45 is provided with a cover 9 suitably hinged at 34. The cover is provided with a knob 39 by which the same may be moved to closed position. It will be seen that the gas resulting from the sublimation of the solid carbon dioxide or other refrigerant passes into the jacket space around the jacket 2, through the pipe 6 into the economizer tubing 7, whence it is discharged through pipe 8. This discharge may be into the room or it may be led out-doors.

Located under the heat transfer plate 10 is a cooling chamber 11 communicating with the economizer chamber 45. Cooling chamber 11 communicates with the mixing chamber 16 at the opposite end. If desired, the bottom of the

cooling chamber 11 may be provided with a metal pan 46 to catch water which condenses due to the cooling of the air. The pipe 18 may lead this water into a suitable receptacle 19 which may be removed and emptied from time to time. This receptacle may be in the nature of a drawer having a knob 47 by which it may be pulled out.

The walls of the mixing chamber 16 comprise the top wall 48, side walls 49, 50, 51 and 36, and the bottom wall denoted by 52.

Located in the wall 36 is an electric motor 14 driving a fan 13. The wall 36 may be provided with vents or openings 15 through which the warm air is drawn. Slidably mounted between the wall 36 and the wall 41 may be a closure 12 having a suitable handle 35 which may be lowered to block off the outlet of the cooling chamber 11. When the cooler is in operation, the closure 12 is raised to the position shown. The lower end thereof is curved, as indicated, to direct the cooled air into the fan.

The opposite wall 49 of the mixing chamber 16 is provided with a plurality of adjustable air deflecting vanes 17. These vanes are pivoted at 38 to the frame of the cooler and are connected to operating rod 37 by which the vanes may be adjusted to direct the discharge of cooled air as desired.

Located within the mixing chamber is a suitable thermostat 21. This thermostat may comprise a suitable bellows 30 filled with ether or other suitable material and may be connected to a lever 31 pivoted at 32 and connected to a link 33 passing through wall 48 and connected to a butterfly damper 20 located in the cooling chamber 11.

In operation, the refrigerant chamber 1 will be filled with suitable refrigerant, such as solid carbon dioxide and the fan 13 started. The cover 9 will be opened and the closure 12 will be raised. The fan 13 will draw warm air through the openings 15 and will also draw air through the economizer chamber 45 and cooling chamber 11.

As the air to be cooled flows in the direction of the arrows, the part flowing through the economizer is cooled first by the metal tubing 7 of the economizer. The circulation of air and cooling medium in the economizer is countercurrent so that the warmest air is in contact with the economizer at its warmest end.

The air is pre-cooled by the economizer and then passes through the cooling chamber 11 where it is further cooled by direct heat transfer through the metal plate 10. This cooled air then passes into the mixing chamber 16 where it is mixed with uncooled air, lowering the temperature thereof to the proper and desired degree. This cooled air is then forced through the air deflecting vanes 17 back into the room.

The thermostat 21 operates in such manner that, when the air in the mixing chamber gets too cold, the damper 20 will be closed, limiting the cold air drawn through the economizer and cooling chamber. Similarly, when the air in the mixing chamber gets warmer than the temperature at which the thermostat is set, the damper 20 will be opened, feeding additional cold air into the mixing chamber.

The pan 46 will collect any water which is condensed due to the cooling of the air and drain it into the drawer 19 at the bottom, which may be emptied from time to time.

Thus an air cooler is provided which is portable, which is inexpensive to construct and which uses an inexpensive refrigerant, and maximum efficiency is obtained in the utilization of the refrigerant. Cooling action is obtained not only from the latent heat of sublimation of the refrigerant, but cooling action is also obtained due to the difference in the sublimation temperature which in the case of carbon dioxide is −109.6° F. and the temperature of the room.

Only a small proportion of the air to be cooled is drawn through the cooling chamber. This limits the condensation of water. This air is then mixed with the larger quantities of the recirculated warmer air.

The thermostatically controlled damper provides means for automatically regulating the temperature so that the room can be cooled and kept at a comfortable and uniform temperature. If desired, the closures 9 and 12 may be closed when no cooling is desired, thus effectively insulating the refrigerant and enabling it to be kept for a considerable time.

While certain novel features of the invention have been disclosed and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. In a cooler, a casing, a refrigerant chamber adapted to use solid carbon dioxide as a refrigerant, an economizer chamber, a cooling chamber and a mixing chamber, means for supplying the gaseous refrigerant, after it has given up its latent heat, to said economizer chamber, means for directly conducting heat from said cooling chamber to the refrigerant in said refrigerant chamber, means for supplying the substance to be cooled first to said economizer chamber and then through the cooling chamber to said mixing chamber, and means for also supplying uncooled substance to said mixing chamber.

2. In a unit air cooler, a casing having a refrigerant chamber at the upper part thereof for holding the refrigerant, said chamber having a bottom wall of heat conducting material, a jacket space to receive used refrigerant, an economizer conduit alongside said chamber, a cooling conduit connecting with said economizer conduit extending under said bottom plate, a mixing chamber adjacent said refrigerant chamber, a motor driven fan in said mixing chamber, said cooling conduit communicating with said mixing chamber, said chamber having openings through which uncooled air is drawn and through which mixed uncooled and refrigerated air is discharged, and an economizer coil in said economizer conduit communicating with said jacket space.

3. In a portable air cooler, a casing having a refrigerant chamber at the upper part thereof for holding the refrigerant, said chamber having a bottom wall of heat conducting material, a jacket having perforated side walls within said chamber and forming a jacket space therewith, an economizer conduit opening at the top of said casing and extending downwardly alongside one of said chamber walls, a cooling conduit connecting with said economizer conduit extending under said bottom plate, a mixing chamber under said cooling conduit, a motor driven fan at one end of said mixing chamber, openings in the side wall adjacent said fan through which uncooled air is drawn, said cooling conduit communicating with said mixing chamber at said fan, an adjustable ventilator at the opposite end of said mixing chamber, and an economizer coil in said econo-

mizer conduit communicating with said jacket space at the bottom thereof and having its discharge at the top thereof.

4. In a unit air cooler for a room, in combination, a refrigerant chamber for solid carbon dioxide, an economizer chamber, a cooling chamber and a mixing chamber, means for supplying the sublimated carbon dioxide, after it has given up its latent heat, to said economizer chamber, means for directly conducting heat from said cooling chamber to said solid carbon dioxide, means for supplying air first to said economizer chamber and then through the cooling chamber to said mixing chamber, means for supplying uncooled air from the room to said mixing chamber, and means for returning the mixed air from said mixing chamber to the room.

5. In a unit air cooler for a room, in combination, a refrigerant chamber for solid carbon dioxide, an economizer, a cooling chamber and a mixing chamber, means for supplying sublimated carbon dioxide, after it has given up its latent heat, to said economizer, means for directly conducting heat from said cooling chamber to said solid carbon dioxide, means for supplying the air to be cooled both to said economizer chamber and to said cooling chamber, means for adding uncooled air to said mixing chamber, and means for returning the mixed air from said mixing chamber to the room.

6. In a unit cooler for lowering the temperature of the atmosphere in a room, a refrigerant chamber having heat insulating walls adapted to hold solid carbon dioxide, a jacket within said chamber forming a jacket space therebetween and said walls, means causing sublimed carbon dioxide to fill said jacket space, means for withdrawing said sublimed carbon dioxide through said jacket space and using it to cool the atmosphere to be cooled, a cooling chamber having direct heat-transfer relation with said refrigerant chamber, and means for passing said atmosphere through said cooling chamber to cool said atmosphere while keeping said atmosphere from directly contacting said solid carbon dioxide.

RUDOLPH L. HASCHE.
AUSTIN GUDMUNDSEN.