June 6, 1933. J. C. GOOSMANN 1,912,446

REFRIGERATING AND VENTILATING APPARATUS

Filed Aug. 21, 1931 2 Sheets-Sheet 1

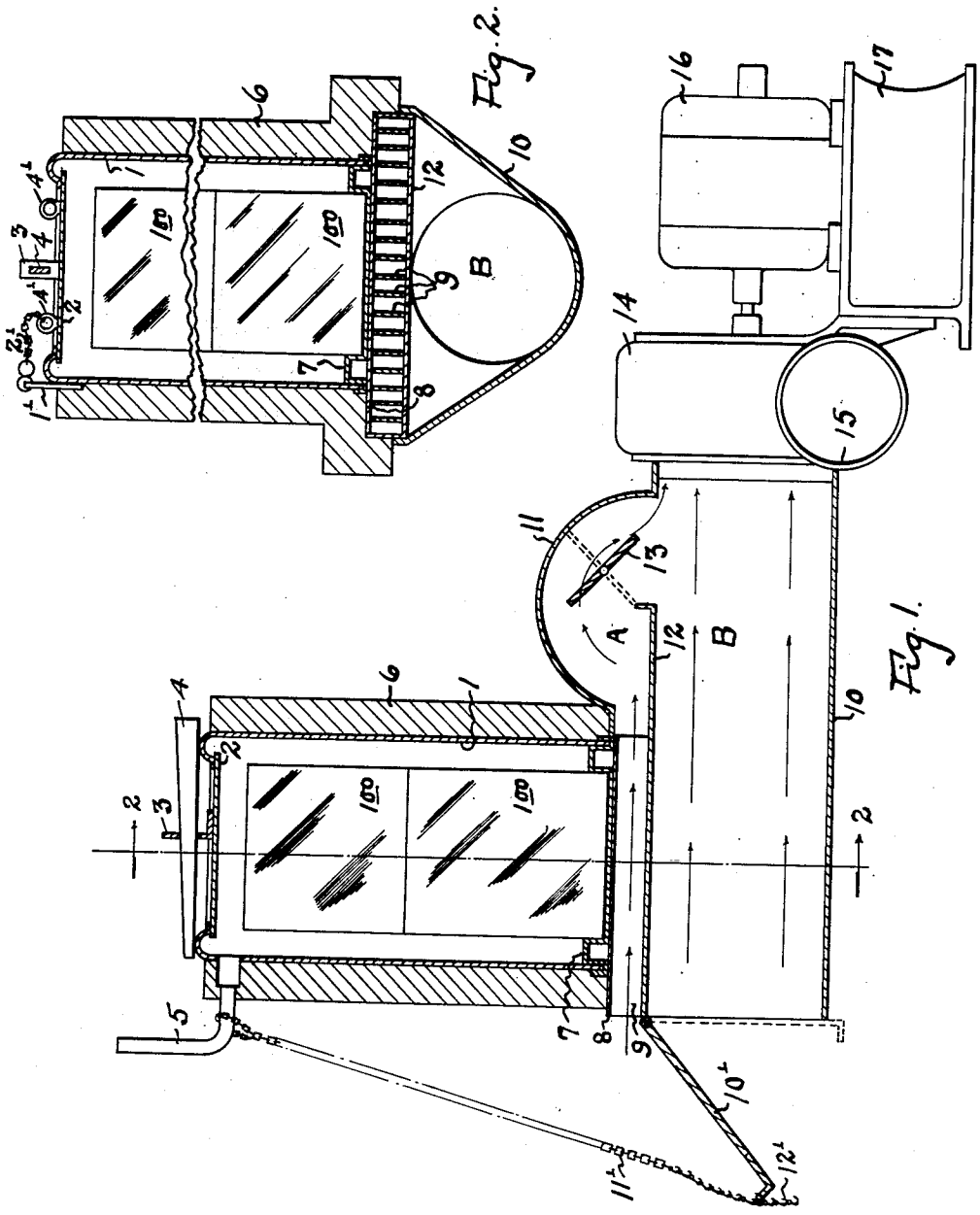


Fig. 2.

Fig. 1.

INVENTOR
Justus C. Goosmann

BY Darby & Darby
ATTORNEYS.

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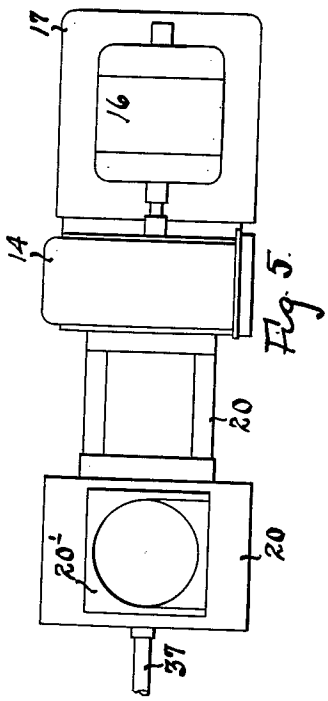


Fig. 5.

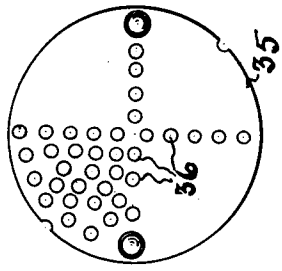


Fig. 7.

Fig. 3.

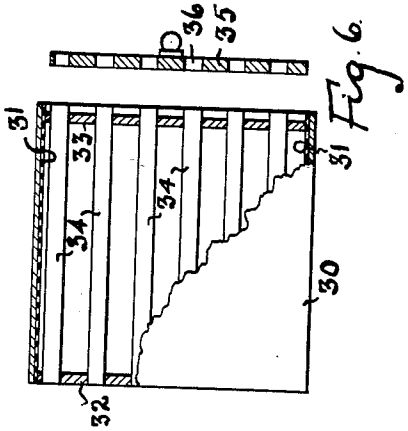


Fig. 6.

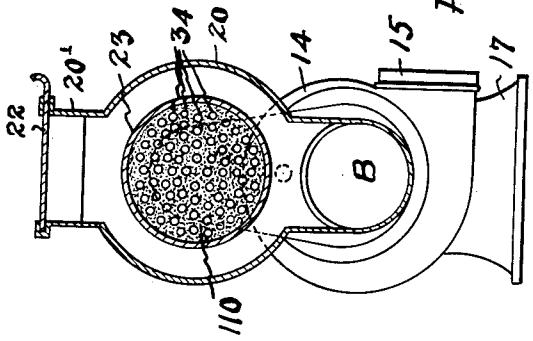


Fig. 4.

INVENTOR
Justus C. Goosmann
BY Darby & Darby.
ATTORNEYS.

Patented June 6, 1933

1,912,446

UNITED STATES PATENT OFFICE

JUSTUS C. GOOSMANN, OF MOUNT VERNON, NEW YORK

REFRIGERATING AND VENTILATING APPARATUS

Application filed August 21, 1931. Serial No. 558,456.

This invention relates in general to apparatus by means of which air may be cooled and circulated for any desired use.

The main object of this invention is the provision of relatively simple apparatus which may be made in portable form if desired for cooling and circulating air for use in buildings, transportation vehicles, and the like.

An object of this invention is the provision of relatively simple apparatus of this nature adapted to use various forms of refrigerants such as ice, solid carbon dioxide ice, and the like.

A further object of this invention is to provide means for passing a portion of an air stream in heat exchange relation with a refrigerant and then recombining the by-passed portion after cooling with the main air stream.

A further object of this invention is the provision of apparatus for controlling the relative portions of the main stream and the by-passed stream.

A still further object of this invention is to provide apparatus for dividing an air stream into two portions, each of which is passed in heat exchange relation with a refrigerant so that one portion is cooled to a lower temperature than the other portion and then recombining the streams into a single stream of the desired temperature.

A further object of this invention is to provide apparatus particularly adapted to use solid carbon dioxide for cooling air.

A still further object of this invention is to provide an apparatus employing a replacable unit which may be charged with solid carbon dioxide and inserted in the apparatus.

These and other objects as will appear from the following disclosure are secured by means of this invention.

This invention resides substantially in the combination, construction, arrangement and relative location of parts all as will be described in greater detail below.

Referring to the drawings—

Figure 1 is a view of one form of apparatus of this invention showing a portion thereof in longitudinal cross-section;

Fig. 2 is a cross-sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a diagrammatic view of a modified form of the device showing a portion in longitudinal cross-section;

Fig. 4 is a cross-sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is a top plan view of this device;

Fig. 6 is a view partly in section and with a portion broken away of the refillable unit; and

Fig. 7 is a plan view of the closure plate for this unit.

This invention relates broadly to improved and simplified apparatus by means of which air may be cooled and circulated. The apparatus is of a nature to adapt it for permanent installation in buildings and the like or for mounting on a portable truck for use in temporarily cooling rooms and other spaces such as Pullman cars and the like. The apparatus as disclosed is particularly adapted to use carbon dioxide ice as the refrigerant. In general, the apparatus involves means for creating an air current which may be divided into two or more streams each of which or only one of which, as desired, may be chilled and the two streams then mixed in the desired proportion to give a resilient air stream of the desired temperature. The chilled air may then be blown into the space to be cooled.

The nature of the invention will be best understood by detailed reference to the drawings. As shown in the form of device of Figs. 1 and 2 a container 1 for the refrigerant is provided having a removable cover 2 provided with a bracket 3 by means of which the cover may be held against its seat by a wedge bar 4. The cover preferably rests on an inwardly directed seat so that the gas pressure within the container aids in holding it seated when a gas producing refrigerant such as carbon dioxide ice is employed. Of course, a suitable gasket may be employed within the cover and the seat to prevent leakage of the gas. The container is provided with a gas outlet pipe

5 which may discharge directly into the atmosphere or into a suitable receptacle as desired. The container is provided with a metal conducting bottom 1 of any suitable form and as shown in the drawings is provided with a central depression in which the refrigerant blocks 100 rest. The casing or container 1 is suitably enclosed in the heat insulating casing 6. A metallic air duct 12 is placed so that its upper wall 8 is in direct contact with the metallic bottom 7 of the refrigerant chamber so that they are in heat exchange relation. This air duct is provided with a plurality of vertical fins 9 which are likewise in heat conducting relation with the metal duct 12 and the bottom of the container. A larger metal casing 10 forms a second air passage and is provided with a suitably shaped portion 11 for interconnecting the duct 12 with the casing 10. By the construction shown two independent air paths A and B are provided which merge as shown. A suitable damper valve 13 is provided in the casing to control the relative amount of air flowing through the paths A and B. Duct 12 is directly open to the atmosphere as shown and casing 10 is open to the atmosphere at one end and provided with a door 10′ which may be supported in any one of a number of positions by means of a chain 11′ and a series of hooks 12′. Thus by properly positioning the door 10′ and the damper 13 the relative amounts of air flowing through the passages A and B may be controlled. The intake port of a suction blower 14 connects to the casing 10 and is provided with a discharge outlet 15 which may be connected to a suitable pipe distributing system or may discharge directly into the space to be cooled. A suitable motive device 16 is provided to drive the blower and the apparatus may be mounted on a base such as shown at 17. As indicated in Fig. 2 the cover may be attached to a bracket 1′ by means of a chain 2′ and the handles 4′ so that it cannot get lost by dropping into the bottom of the tank when it is unlocked.

It is believed that the operation of this apparatus is obvious. When the blower is operating and door 10′ is open and damper 13 properly adjusted air will be drawn along the two paths A and B. The portion of the air passing along the path A will be cooled by the abstraction of heat therefrom by means of the heat conducting fins 9. This heat flows through the walls 8 and 7 and does work causing the sublimation of the heat carbon dioxide blocks 100 or the melting of these blocks if they are water ice. The resilient air stream delivered from the discharge port 15 may have the desired volume and temperature by the control of the door 10′ and the damper valve 13.

A modified form of apparatus is shown in Figs. 3 to 7 inclusive, in which a refillable casing is employed which may be first charged in a suitable machine with carbon dioxide slush which is then solidified therein. A suitable apparatus for charging such a casing with carbon dioxide slush and solidifying the slush therein is shown in my copending application Serial No. 549,498 filed July 8th, 1931. The device, as before, comprises a blower 14 and a driving motor 16 mounted on a base 17. A suitably shaped casing providing the air paths A and B and a control damper 21 is employed as before. The casing 20 is provided with an intake extension 20′ controlled by means of a slidable gate 22. Formed concentrically within the upper portion 20 is an inner cylindrical casing 23 which receives the refillable casing containing the refrigerant. This refillable casing comprises a series of metallic tubes 34 extending between the walls 32 and 33. These tubes and walls are surrounded by a cylindrical perforated wall 31 which may be slipped within an outer shipping casing 30. The end may be closed off by means of a removable cover plate 35 having apertures 36 into which the ends of the tubes 34 project. The perforated casing without the outer shell 30 may be filled with carbon dioxide slush which will flow in around the tubes as indicated at 110 and is then frozen therein. For shipping the outer shell 30 is slipped over the perforated casing and tubes and the cover 35 is secured in place. The perforated casing is slipped into the shell 23 of the machine after the outer shipping 30 and cover 35 have been removed. As the solid carbon dioxide sublimes the gas formed may be withdrawn through the pipe 37.

In the operation of this form of the device a portion of the air stream flows down through casing 20, around casing 23 to be partially cooled and then along path B to the blower. Another portion of the air stream is drawn directly through the tubes 34 and flows along the path A past the damper valve 21 to combine with the portion B of the stream which flows through the blower and out of the discharge port 15.

From the above disclosure it will be apparent that this invention resides in certain principles of construction and operation which may be carried out in other physical forms and I do not, therefore, desire to be strictly limited to the disclosure as given for purposes of illustration but rather to the scope of the appended claims.

What I seek to secure by United States Letters Patent is:

1. In an apparatus of the type described, the combination comprising two air ducts, a common duct into which said ducts discharge, a refrigerant container, heat conducting fins of extensive area projecting into one of said air ducts, means for drawing

air through said ducts and means providing heat conducting connections between said two ducts.

2. In an apparatus of the type described, the combination comprising two air ducts, a common duct to which said ducts are connected, a container for solid carbon dioxide, heat conducting fins of large area projecting into one of said air ducts and connected to said container, means for drawing air through said ducts, and means for controlling the relative amount of air flowing through said first two ducts, said two ducts having heat conducting connection.

3. In an apparatus of the type described, the combination comprising a metallic refrigerant container, a plurality of metallic air ducts, one of said ducts being in heat conducting relation with said container, heat conducting fins of extensive area associated with the other of said air ducts and in heat conducting relation with said container, and means for drawing air through said ducts.

4. In an apparatus of the type described, the combination comprising a refrigerant container, a plurality of air ducts in heat exchange relation with said container, large heat conducting fins associated with one of said air ducts and in heat conducting relation with said container, and means for controlling the relative amount of air flowing through said ducts.

5. In an apparatus of the type described, the combination comprising two air ducts, means having a common discharge port for drawing air through said ducts and mixing it, a refrigerant container and heat conducting members of extensive area associated with one of said air ducts and in heat conducting relation with said refrigerating chamber, the other of said ducts being in heat exchange relation with the container.

6. A refrigerating apparatus employing solid refrigerants comprising a casing providing two separate paths of air flow, power means for drawing air along said paths and provided with a common discharge port, means for controlling the amount of air flowing through said ducts, and a refillable container for the refrigerant connected with said air ducts by heat conducting members.

7. An apparatus of the type described, comprising a casing having an inner shell arranged to provide two independent air ducts, means for drawing air through said ducts, and a removable container insertible in said inner shell.

8. An apparatus of the type described, comprising a casing having an inner shell arranged to provide two independent air ducts, means for drawing air through said ducts, and a removable casing having a plurality of tubes adapted to be surrounded by a refrigerant within said inner shell.

9. In an apparatus as described the combination comprising an air duct, a plurality of heat conducting members extending longitudinally of said duct and within the duct, a refrigerant receptacle in heat exchange relation with said duct and members, a second air duct in communication with the first air duct and in heat conductive connection with said receptacle, means for controlling the relative amount of air reaching the large duct from the first mentioned duct, and a common means for drawing air through both of said ducts.

10. A cooling device as described, comprising a casing having an inlet and an outlet port, an inner casing forming two chambers with said first casing, a perforated casing within said inner casing having a plurality of tubes mounted therein, said perforated casing providing a container for solid carbon dioxide, and a discharge connection from one of said chambers through which the carbon dioxide gas formed may escape after passing through the perforated casing.

11. A cooling device as described, comprising a casing having an air inlet and an air outlet port, an inner casing forming an inner and outer chamber, a perforated casing within said inner chamber, a plurality of tubes mounted within said casing open at one end to the atmosphere and at the other end to the outer chamber, and a gas discharge connection for the inner chamber.

12. The method of cooling air to a desired temperature employing a constant temperature refrigerant which comprises dividing an air stream into two smaller streams of relatively different volume, abstracting heat from the stream of smaller volume by heat exchange with a constant temperature refrigerant to cool the smaller stream to a temperature below that of the desired temperature of the resultant stream, and mixing the divided stream to produce a resultant stream of the desired temperature.

13. The method of cooling a resultant stream of air to a desired temperature which comprises dividing the stream into two streams of different volume, cooling the smaller stream to a temperature below that of the desired temperature of the resultant stream, and combining the two streams to produce a resultant stream of the desired temperature.

In testimony whereof I have hereunto set my hand on this 20th day of August A. D. 1931.

JUSTUS C. GOOSMANN.