

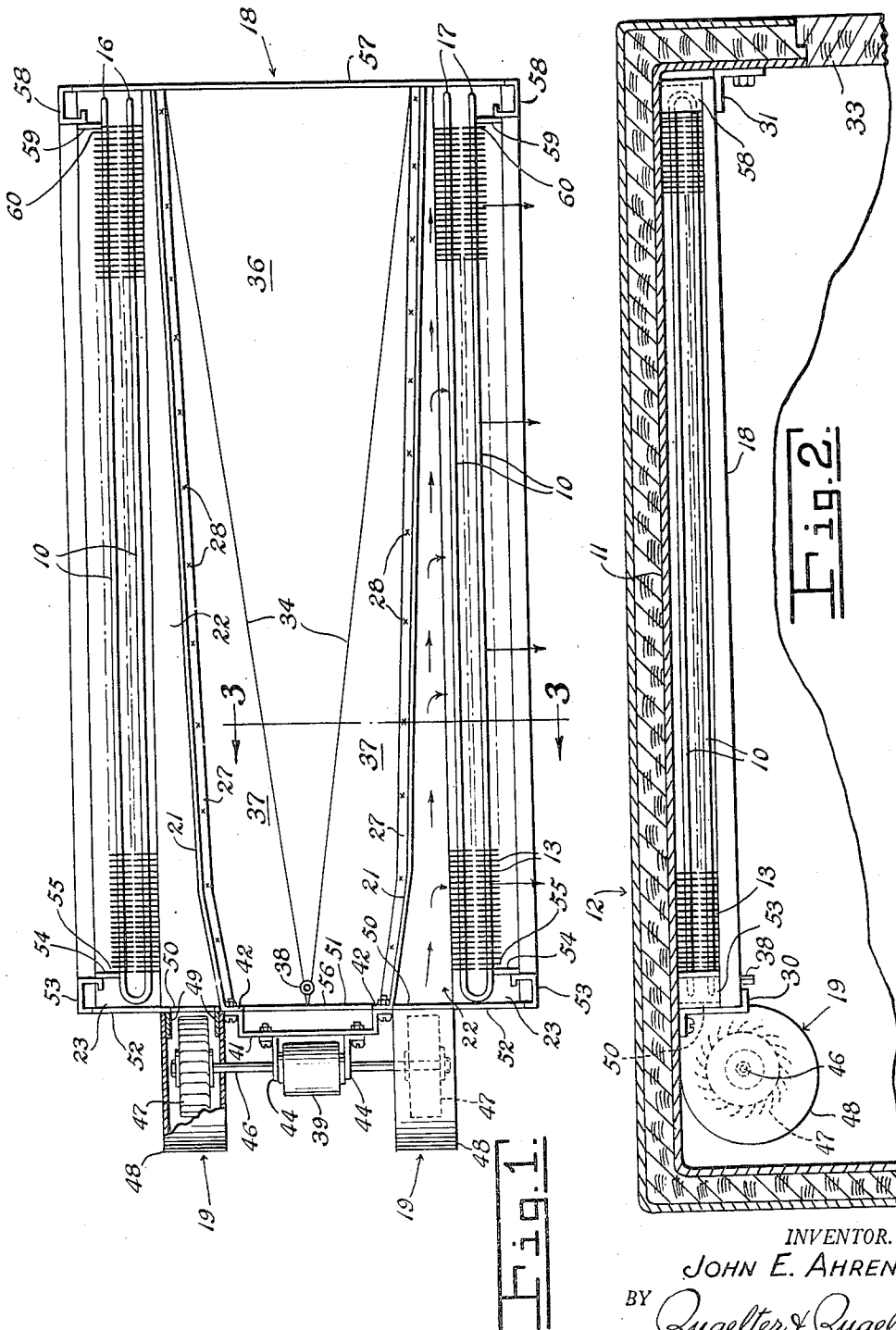
Feb. 7, 1950

J. E. AHRENS
REFRIGERATION UNIT

2,496,652

Filed March 3, 1948

2 Sheets-Sheet 1



INVENTOR.
JOHN E. AHRENS
BY *Jugelger & Jugelger*
Attys.

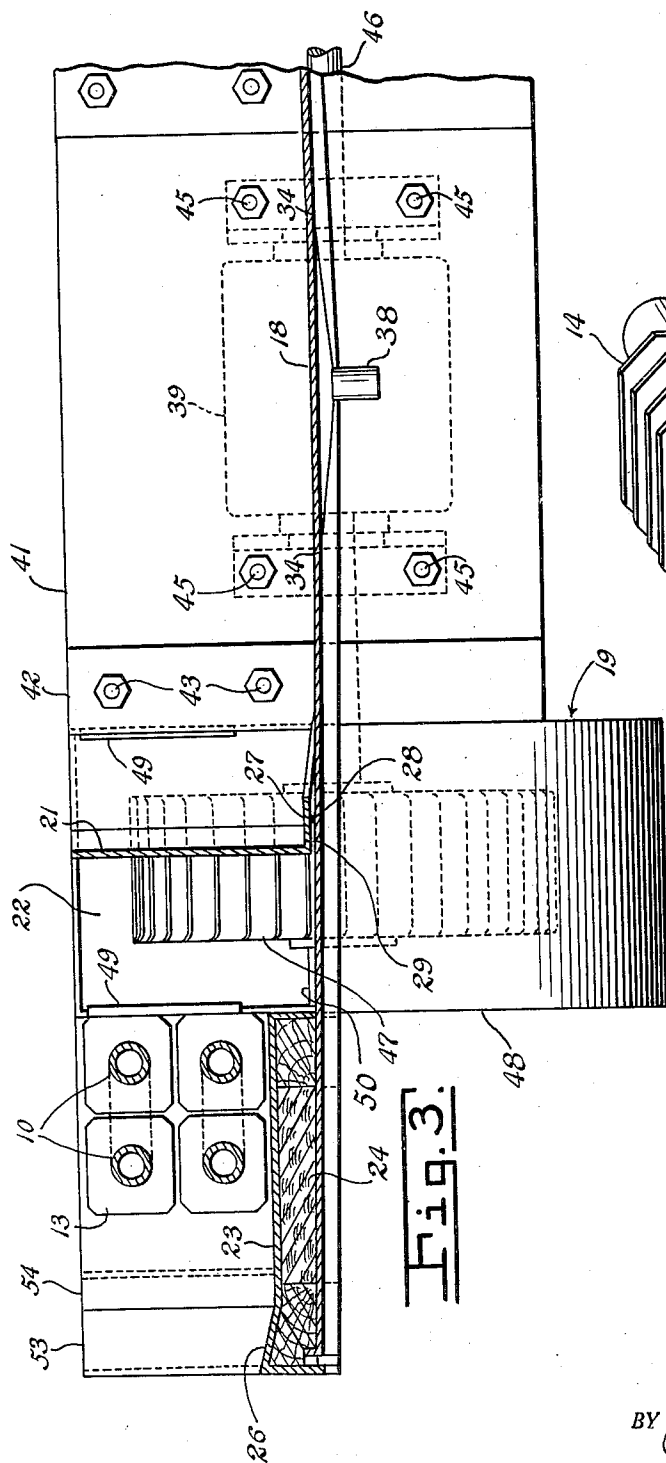
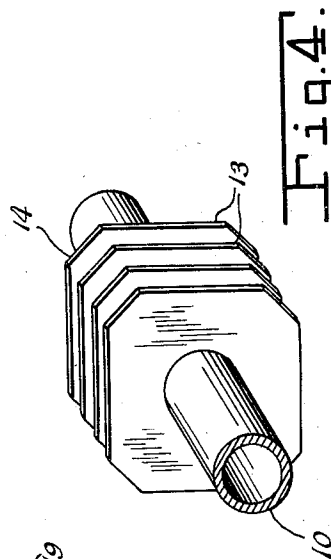
Feb. 7, 1950

J. E. AHRENS
REFRIGERATION UNIT

2,496,652

Filed March 3, 1948

2 Sheets-Sheet 2



INVENTOR.
JOHN E. AHRENS
BY *Jugelter & Jugelter*
Attys.

UNITED STATES PATENT OFFICE

2,496,652

REFRIGERATION UNIT

John E. Ahrens, Cincinnati, Ohio

Application March 3, 1948, Serial No. 12,837

16 Claims. (Cl. 62-103)

1

This invention relates to refrigeration apparatus and more particularly relates to a refrigeration unit for use in cooling refrigerated spaces of sufficient size that they can be entered by a person.

The use of large refrigerated spaces or rooms has been hampered heretofore by condensation of moisture which occurs particularly in the upper portion of a refrigerated room, on the roof and on cooling pipes from which drops of water may fall on meat and the like stored in the room to render it undesirably wet.

It is a principal object of the present invention to provide a refrigeration unit which prevents the dripping of condensed moisture from the upper portion of a refrigerated room or compartment.

A further object is to provide a refrigeration unit which collects and catches moisture which may condense in the upper portion of a refrigerated room.

Another object is to provide a unit which distributes high volume low velocity cooled air uniformly throughout a refrigerated room, without causing a draft or blast which might dry out certain products stored in the room, and which would afford discomfort to persons working therein.

A further object is to provide a unit which directs cooled air along the roof and walls of a refrigerated room to maintain the roof and walls cold and abstract heat therefrom before the heat can reach the contents of the refrigerated room, this being accomplished efficiently without drawing air from, or directing air toward, the entrance door of the refrigerated room.

A further object of this invention has been to provide a refrigeration unit which may be mounted in the upper portion of a refrigerated room which collects any condensation which may form in the upper portion of the room yet is sufficiently compact that it leaves adequate head room.

The foregoing objects are attained by the means described herein and disclosed in the accompanying drawings in which:

Figure 1 is a plan view of a refrigeration unit constructed in accordance with this invention.

Figure 2 is a side elevational view of the unit shown in Figure 1, the unit being shown attached to the roof of a refrigerated room, the room being shown in section.

Figure 3 is an enlarged sectional view taken on the line 3-3 in Figure 1.

Figure 4 is an enlarged fragmentary view in

2

perspective showing details of fins covering a cooling tube.

Briefly, the refrigeration unit includes a blower which directs air collected inside a refrigerated room about a series of cooling tubes. The cooling tubes are mounted near the roof of the room, and a pan under the tubes together with walls and baffles about the tubes directs the flow of air so that it flows about the tubes to be chilled and then, upon leaving the tubes, flows parallel to the roof of the room. Thus, cooled air sweeps over the roof of the room and down the side walls to prevent condensation on the roof, and the pan collects any moisture which condenses over the cooling tubes. The underside of the pan is insulated below the cooling tubes so that condensation does not occur under the pan.

Referring to Figures 1 and 2, the unit includes a series of horizontal cooling tubes 10 mounted parallel to and spaced a short distance below a roof 11 of a refrigerated room 12. An appropriate cooling fluid is circulated through the tubes 10 in a conventional manner. The tubes 10 are preferably equipped with a series of cooling fins 13. As shown in Figure 4, the fins may be square metal sheets having corners cut away, as at 14. The fins are mounted at spaced intervals along the length of each cooling tube 10.

Two banks of tubes 16 and 17 are spaced on either side of a main pan 18 which catches any condensation which may collect on the roof 11 between the banks of tubes and also, as will be explained more fully hereinafter, catches any water which condenses on the tubes and on the roof area above the tubes. Air from the inside of the room 12 is picked up by blowers 19 and is directed about the cooling tubes 10 and through the fins 13. Vertical walls 21 along the banks of tubes running between the main pan 18 and the roof 11, channel the air from the blowers 19 to the tubes 10. As shown clearly in Figure 1, the walls 21 are located between the banks of tubes and are spaced from the banks of tubes, the spacing between walls and tubes being greatest adjacent the blowers 19 and least at the end of the tubes away from the blowers 19 so that the walls and tubes define channels 22 of a width which narrows as the channels extend away from the blowers 19 to cause a flow of air which is at a constant rate at all points along the length of each tube, as indicated by arrows in Figure 1.

As shown in Figure 3, an auxiliary pan 23 un-

3

derlies each bank of tubes. Each auxiliary pan is separated from the main pan 18 by thermal insulation 24 which prevents overcooling of the underside of the main pan beneath the tubes 10. Each pan 23 is spaced only a short distance below the bank of tubes above it so that no substantial amount of air can pass between the pan 23 and tubes 10. An outer edge 26 of each auxiliary pan 23 is raised, as shown, so that any water which may collect on the tubes or on the roof over the tubes cannot fall into the room 12 but instead collects in the main pan 18. The finned tubes 11 are supported above the pan 23 by brackets or blocks, not shown, in any convenient manner so that, when the unit is in place, the upper fins are adjacent the roof and the finned tubes reach substantially from the pan 23 to the roof.

Water which collects in the auxiliary pans 23 flows into the central portion of the main pan 18 under the walls 21. Each wall 21 is equipped with a lower, substantially horizontal flange 27 by which it is attached to the main pan 18 and spaced therefrom by a series of soldered connections 28, as shown in Figures 1 and 3. Each connection 28 is sufficiently thick to maintain a narrow space 29 between the pan 18 and the flange 27 which is sufficiently wide to permit the flow of water but not sufficiently wide to permit the passage of substantial amounts of air from the channel 22.

The weight of the walls 21 and of the insulation 24 and auxiliary pans 23 and the tubes 10 is carried by the main pan 18. As shown in Figure 2, the main pan is supported by brackets 31 attached to a wall 32 of the room 12 which contains a door 33 for entry to the refrigerated room at the end of the unit opposite the blowers 19. Thus, the soldered connections 28 between the pan 18 and the walls 21 act essentially as spacers and do not have to carry any part of the weight of the pan.

As shown in Figures 1-3 inclusive, the pan 18 is creased along lines 34 to form a central triangular section 36 and side sections 37 all of which slope downwardly to a drain pipe 38 near the blower end of the pan through which water can be removed. Thus, any moisture which collects above the pan 18 on the roof 11 or on the tubes 10 and fins 13 is caught in the pan and can be removed through the drain pipe 38 without falling on refrigerated foods in the room 12.

An electric motor 39 operated by a suitable electrical circuit, not shown, is carried at the blower end of the pan 18 by a main motor bracket 41 which, as shown in Figure 1, is bolted to vertical flanges 42 which form integral extensions of the walls 21. Bolts 43 attach the bracket 41 to the flanges 42. Secondary motor supports 44 attached to the bracket 41 by bolts 45 carry the motor. A drive shaft 46, which projects horizontally in opposite directions from the motor 39, drives a rotor 47 in each of the blowers 19. A housing 48 surrounds each rotor 47, and the housings 48 are supported by brackets 49 of suitable construction. Air is driven by the blowers 19 through an opening 50 in the housing 48 into the channels 22. An edge 51 of the main pan 18 adjacent the blowers 19 is turned upwardly at its outer portions as shown in Figure 1 to form barriers 52 along outer edges of the blowers 19 extending from the pan 18 to the roof 11 about the ends of the tubes 10 to direct air from the blowers 19 about the tubes 10. The fan support

4

brackets 49 are attached to the edge 51. Baffles 53 attached to the barriers 52 and extensions 54 attached to the baffles 53 and to a terminal set 55 of fins adjacent the blower end of the tubes 10 prevent air from by-passing the finned section of the tubes 10. The central portion of the edge 51 is also turned upwardly as shown at 56 to direct liquid collected in the pan 18 into the drain pipe 38. An opposite edge 57 of the pan above the door 33 of the refrigerated room 12 is also turned upwardly and similar baffles 58 attached to the edge 56 and extensions 59 attached to the baffles 57 and to an initial set of fins 60 adjacent the edge 57 prevent air from by-passing the finned section of the tubes 10 at the door end of the room 12.

When the refrigerating apparatus is in operation, a chilling refrigerating medium is circulated through the tubes 10. The motor 39 drives the blowers 19 to force air into the channels 22. The walls 21 and baffles force the air to pass through the fins 13 to be cooled. Any moisture which is condensed from the air during cooling collects in the auxiliary pans 23 and flows therefrom under the walls 21 through the spaces 29 into the center of the pan 18 and out through the drain pipe 38. The insulation 24 below the tubes 10 and between the main pan 18 and auxiliary pans 23 prevents the chilling action from being conveyed to the lower surface of the pan 18. Moreover, cooled air leaving the fins 13 is directed horizontally along the underside of the roof 11 so that the cooled air sweeps along the under side of the roof and down the side walls of the room, and condensation does not occur at any surface from which moisture could drip upon contents of the refrigerated room 12.

As shown in Figure 2, the entire unit is of narrow depth and takes up very little head room. Since the cooled air is directed along the roof and walls of the room, drafts inside the room are minimized, and since the cooled air picks up heat from the walls and roof of the room as the heat enters the room, the temperature of the room can be controlled with a minimum of fluctuation. The absence of drafts and strong air currents resulting from the unrestricted discharge of air provided for past the fins, avoids discomfort to persons entering or working within the cooling room or chamber. Losses of efficiency thereby are minimized also, since in the arrangement disclosed there is no tendency for air to be driven through the doorway in either direction, upon opening of the door.

The fins 13 may extend substantially the entire length of the tubes 10, only some of the fins being shown in Figures 1 and 2, the remaining fins being indicated by dotted lines.

Having described my invention, I claim:

1. A refrigerating unit which comprises, a plurality of cooling tubes mounted in a bank parallel to a roof of a refrigerated compartment, a pan beneath said cooling tubes, a wall extending along a side of said bank of tubes, said wall in conjunction with the pan and the roof defining a channel along a side of said bank, the pan sloping away from the tubes to form a floor for the channel, the lower edge of said wall being spaced above the pan, a blower attached to said channel for forcing air through said channel and about said tubes, and means for removing water from said pan on the side of said wall away from said tubes, whereby the air is cooled and moisture condensed during cooling of the air flows between said pan and said wall to be removed.

5

2. A refrigerating unit which comprises, a plurality of cooling tubes mounted in a bank parallel to the roof of a refrigerated compartment, a pan beneath said cooling tubes, a wall extending along a side of said bank of tubes, said wall in conjunction with the pan and the roof defining a channel along a side of said bank, the pan sloping away from the tubes to form a floor for the channel, the lower edge of said wall being spaced above the pan, a blower attached to said channel for forcing air through said channel and about said tubes, means for removing water from said pan on the side of said wall away from the tubes, and thermal insulation attached to said pan beneath said tubes, whereby the air is cooled and moisture condensed during cooling of the air flows between said pan and said wall to be removed.

3. A refrigerating unit which comprises, a plurality of cooling tubes mounted in a bank parallel to the roof of a refrigerated compartment, a pan beneath said cooling tubes, a wall extending along a side of said bank of tubes, said wall in conjunction with the pan and the roof defining a channel along a side of said bank, the portion of the pan which forms a lower side of the channel sloping away from the tubes to form a floor for the channel, the portion of the pan underlying the tubes being substantially horizontal, whereby cooled air leaving the tubes is projected parallel to the roof to sweep the roof with cooled air, the lower edge of said wall being spaced above the pan, a blower attached to said channel for forcing air through said channel and about said tubes, and means for removing water from said pan on the side of said wall away from said tubes, whereby the air is cooled and moisture condensed during cooling of the air flows between said pan and said wall to be removed.

4. A refrigerating unit which comprises, a bank of cooling tubes, a pan and thermal insulation mounted beneath said tubes, said pan extending beyond and sloping downwardly away from said tubes, a wall extending upwardly from said pan to define a channel along a side of said bank of tubes, a side of said channel adjacent said bank of tubes being open, a lower edge of said wall being spaced above said pan, means for forcing air into said channel to pass through said bank of tubes, whereby the air is cooled and moisture condensing from the cooled air is collected in said pan and flows between said wall and said pan, and means for removing condensed moisture from said pan.

5. A refrigerating unit which comprises, a pair of spaced, substantially parallel, horizontal banks of cooling tubes mounted adjacent a roof of a refrigerated room, a pan beneath said banks of tubes, the portion of said pan between said banks sloping downwardly to a drain, a pair of walls extending between said pan and the roof, said walls being mounted intermediate said banks of tubes, the lower edge of each wall being spaced above the pan, thermal insulation mounted below each bank of tubes, means for forcing air between each wall and bank of tubes, whereby air is forced about said tubes to be cooled and condensed moisture formed during cooling of the air is caught by said pan and flows beneath said wall to be removed at said drain, and means for directing the cooled air leaving said tubes to flow horizontally along said roof.

6. The combination of a room having thermally insulated walls, a thermally insulated roof, a plurality of cooling tubes mounted parallel and adjacent to said roof to form a bank of tubes, a

6

pan beneath said bank of tubes, said pan extending beyond and sloping away from said bank of tubes to a drain, a vertical wall carried by said pan, a lower side of said wall being spaced from said pan, said wall extending to the roof along and spaced from one side of said bank of tubes to define a channel along the side of the bank, said channel having an open side along the bank of tubes, and means for forcing air into said channel to pass through said bank of tubes, whereby the air is cooled and moisture condensed from the cooled air is caught by said pan and flows beneath said wall to said drain.

7. The combination of a room having thermally insulated walls and a thermally insulated roof, a thermally insulated door in one of said walls, a plurality of cooling tubes mounted parallel and adjacent to said roof and substantially perpendicular to the wall which contains the door to form a bank of tubes, a pan beneath said bank of tubes, said pan extending beyond and sloping downwardly from said bank to a drain, a vertical wall carried by said pan, a lower side of said wall being spaced from said pan, said wall extending to the roof along and spaced from one side of said bank of tubes to define a channel along the side of the bank, said channel having an open side along the bank of tubes, and a blower at the end of said channel opposite said door for forcing air into said channel to pass through said bank of tubes, whereby the air is cooled and moisture condensed from the cooled air is caught by said pan and flows beneath said wall to said drain.

8. The combination of a room having thermally insulated walls and a thermally insulated roof, a thermally insulated door in one of said walls, a plurality of finned cooling tubes mounted parallel to and adjacent to said roof and substantially perpendicular to the wall containing said door, said tubes forming a pair of spaced banks of tubes, a pan beneath said banks of tubes, the portion of said pan between said banks sloping downwardly to a drain, a pair of walls extending between said pan and the roof, the lower edge of each wall being spaced above the pan, thermal insulation mounted beneath each bank of tubes, blowers mounted adjacent the ends of each of said banks of tubes opposite said door for forcing air between each wall and bank of tubes, whereby air is forced through said banks of tubes to be cooled and condensed moisture formed during cooling of the air flows between said pan and said walls to be removed by said drain, and means for directing the cooled air leaving said tubes to flow along said roof.

9. A refrigeration unit which comprises a bank of elongated parallel horizontal tubes, a substantially horizontal pan beneath said tubes, a wall along a side of said bank of tubes and spaced therefrom extending upwardly from said pan, said wall and said bank of tubes being adapted to fit under the roof of a refrigerated compartment and with the pan define a duct along the side of said bank of tubes, the tubes in said bank being spaced to permit passage of air, said duct being closed at one end and open at the other, and means for supplying forced air into the open end of said duct said air discharging through the spacing between tubes in said bank of tubes.

10. A refrigeration unit which comprises a bank of elongated parallel horizontal tubes, a substantially horizontal pan beneath said tubes, a wall along a side of said bank of tubes and spaced therefrom extending upwardly from said pan, said

7

wall and said bank of tubes being adapted to fit under the roof of a refrigerated compartment and with the pan define a duct along the side of said bank of tubes, the tubes in said bank being spaced to permit passage of air, said duct being closed at one end and open at the other, means for supplying forced air into the open end of said duct, said air discharging through the spacing between the tubes in said bank of tubes, and means for removing moisture from said pan.

11. A refrigeration unit which comprises a bank of elongated parallel horizontal tubes, a plurality of spaced heat transfer fins disposed at substantially right angles to the longitudinal axes of the tubes, a substantially horizontal pan beneath said tubes, a wall along a side of said bank of tubes and spaced therefrom extending upwardly from said pan, said wall and said bank of tubes being adapted to fit under the roof of a refrigerated compartment and with the pan define a duct along the side of said bank of tubes, the tubes in said bank being spaced to permit passage of air, said duct being closed at one end and open at the other, and means for supplying forced air into the open end of said duct, said air discharging through the spacing between the tubes in said bank of tubes, said fins guiding the air across the tubes to be projected in a direction perpendicular to the axes of the tubes.

12. A refrigeration unit which comprises a bank of elongated parallel horizontal tubes, a substantially horizontal pan beneath said tubes, a wall along a side of said bank of tubes and spaced therefrom extending upwardly from said pan, said wall and said bank of tubes being adapted to fit under the roof of a refrigerated compartment and with the pan define a duct along the side of said bank of tubes, the tubes in said bank being spaced to permit passage of air, said duct being closed at one end and open at the other and converging toward the closed end, and means for supplying forced air into the open end of said duct, said air discharging through the spacing between the tubes in said bank of tubes.

13. A refrigerating unit which comprises a bank of elongated parallel horizontal tubes, a substantially horizontal pan beneath said tubes, a wall along a side of said bank of tubes and spaced therefrom extending upwardly from said pan, a roof extending from said wall over the bank of tubes, said pan, wall, and roof forming a duct along a side of said bank of tubes, the tubes in said bank being spaced to permit passage of air, said duct being closed at one end and open at the other to permit passage of air, and means for supplying forced air into the open end of said duct, said air discharging through the spacing between tubes in said bank of tubes.

14. A refrigerating unit which comprises a bank of elongated parallel horizontal tubes, a substan-

8

tially horizontal pan beneath said tubes, a wall along a side of said bank of tubes and spaced therefrom extending upwardly from said pan, a roof extending from said wall over the bank of tubes, said pan, wall, and roof forming a duct along a side of said bank of tubes, the tubes in said bank being spaced to permit passage of air, said duct being closed at one end and open at the other to permit passage of air, means for supplying forced air into the open end of said duct, said air discharging through the spacing between tubes in said bank of tubes, and means for removing moisture from said pan.

15. A refrigerating unit which comprises a bank of elongated parallel horizontal tubes, a plurality of spaced heat transfer fins disposed at substantially right angles to the longitudinal axes of the tubes, a substantially horizontal pan beneath said tubes, a wall along a side of said bank of tubes and spaced therefrom extending upwardly from said pan, a roof extending from said wall over the bank of tubes, said pan, wall and roof forming a duct along a side of said bank of tubes, the tubes in said bank being spaced to permit passage of air, said duct being closed at one end and open at the other to permit passage of air, and means for supplying forced air into the open end of said duct, said air discharging through the spacing between tubes in said bank of tubes, said fins guiding the air across the tubes to be projected in a direction perpendicular to the axes of the tubes.

16. A refrigerating unit which comprises a bank of elongated parallel horizontal tubes, a substantially horizontal pan beneath said tubes, a wall along a side of said bank of tubes and spaced therefrom extending upwardly from said pan, a roof extending from said wall over the bank of tubes, said pan, wall and roof forming a duct along a side of said bank of tubes, the tubes in said bank being spaced to permit passage of air, said duct being closed at one end and open at the other to permit passage of air, said duct converging toward the closed end, and means for supplying forced air into the open end of said duct, said air discharging through the spacing between the tubes in said bank of tubes.

JOHN E. AHRENS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,079,069	Starr	Nov. 18, 1913
1,813,250	Moore	July 7, 1931
2,206,631	Clark	July 2, 1940
2,272,302	Krackowizer	Feb. 10, 1942