

Feb. 21, 1939.

H. J. KRACKOWIZER

2,148,238

AIR CIRCULATOR

Filed Oct. 24, 1936

3 Sheets-Sheet 1

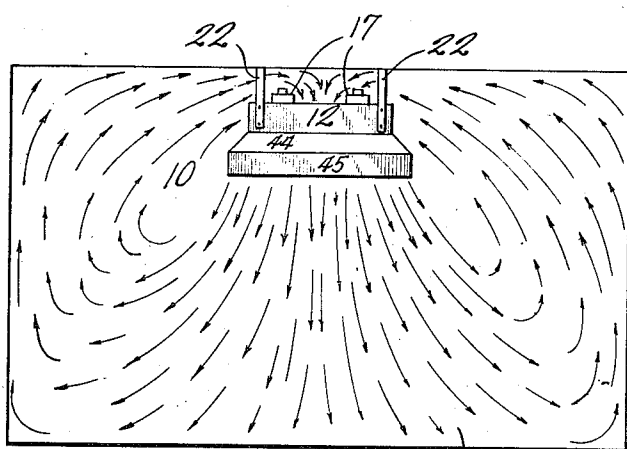


Fig. 1.

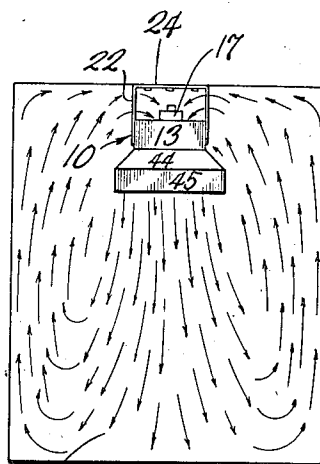


Fig. 2.

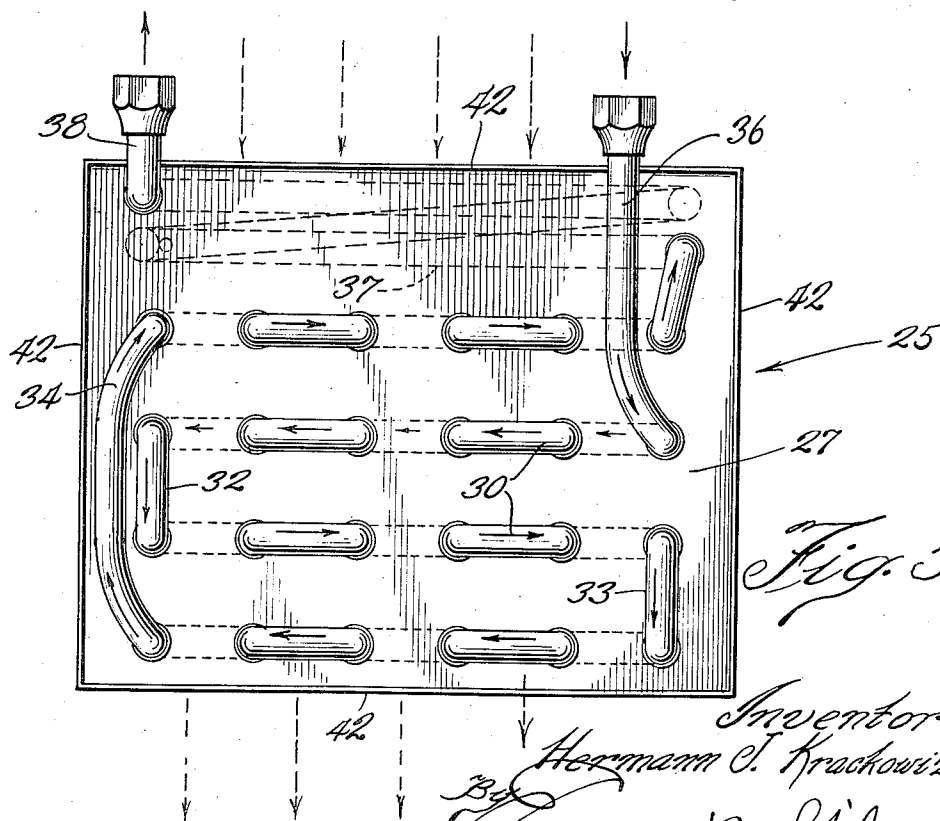


Fig. 5.

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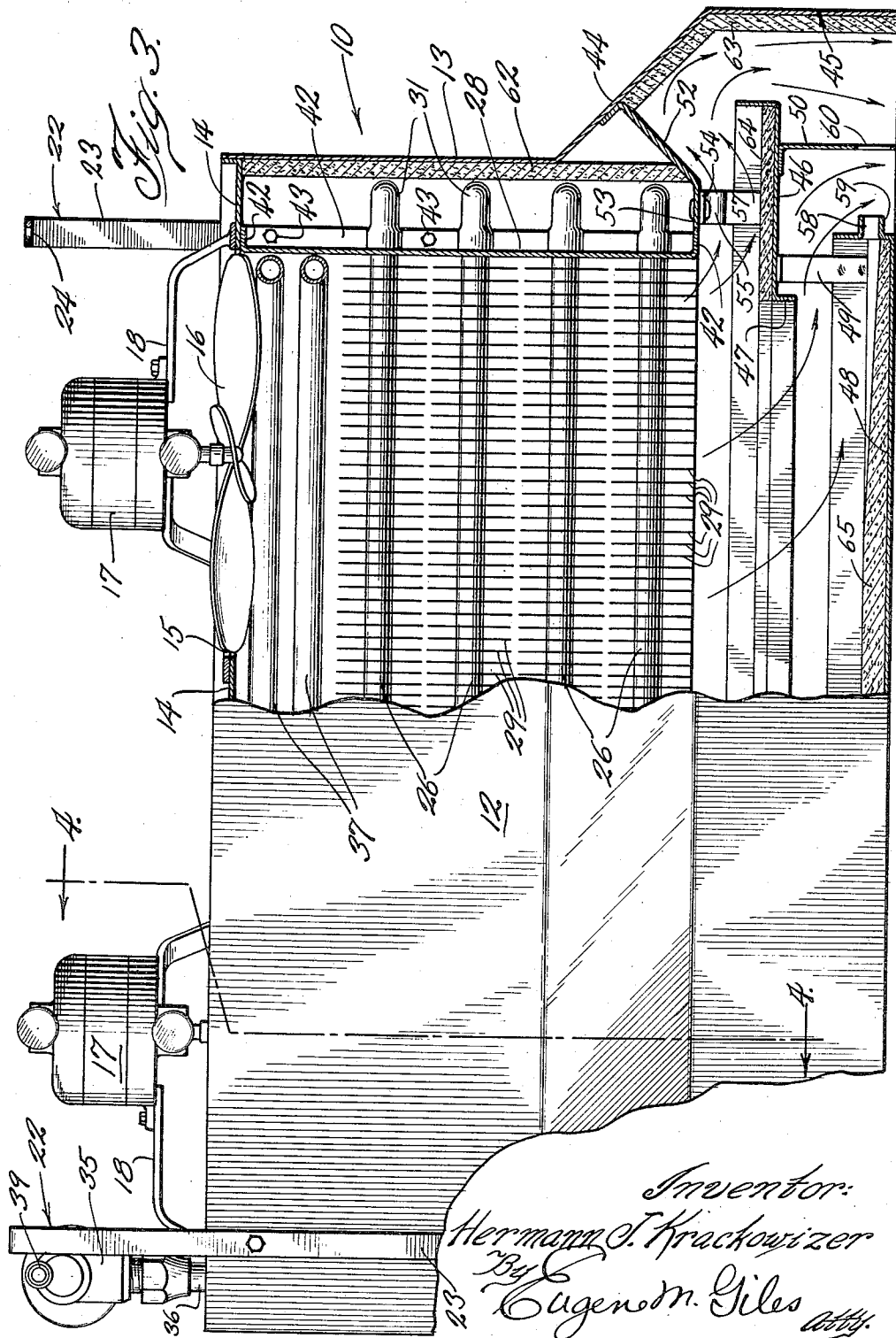
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3 Sheets-Sheet 3

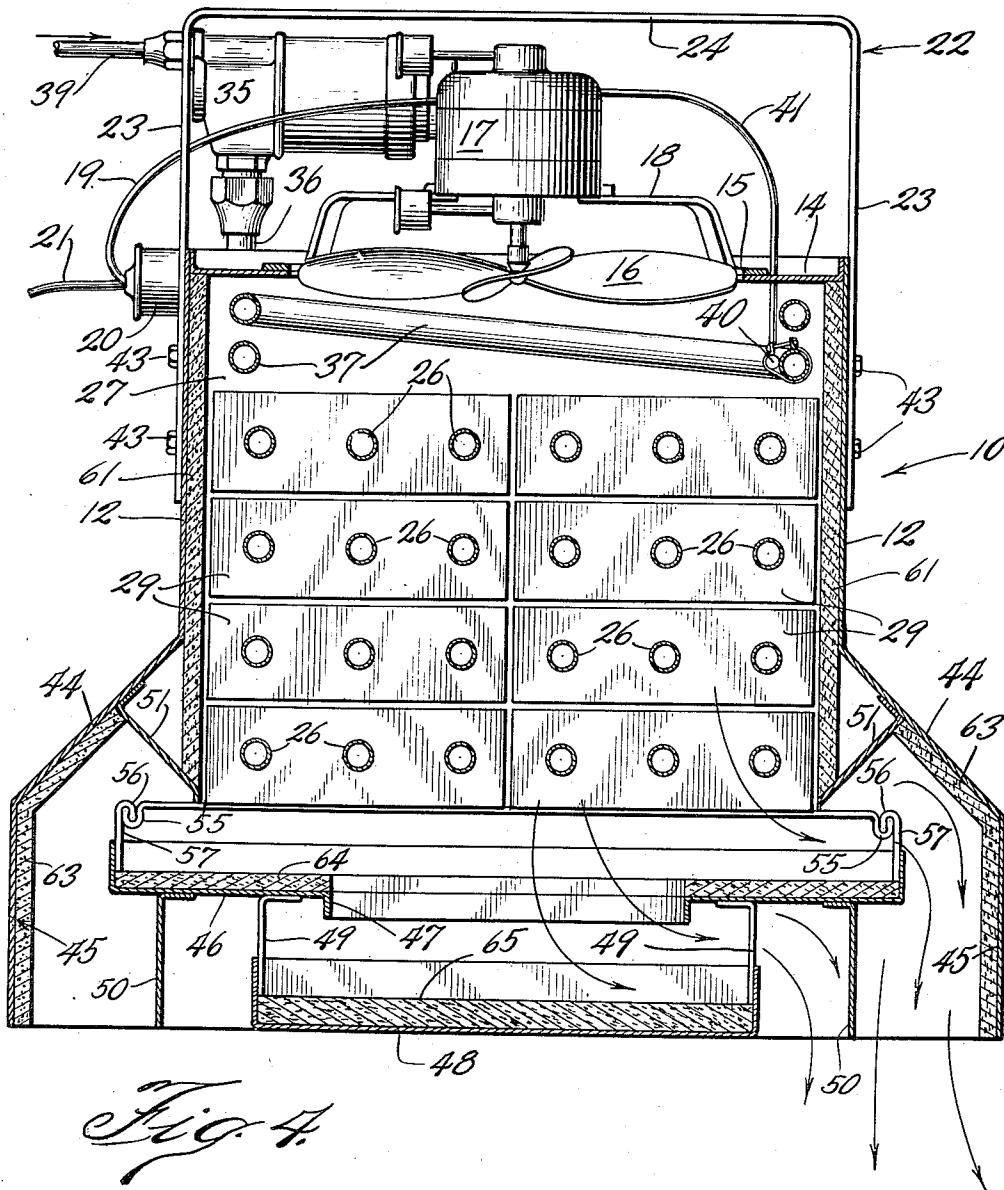


Fig. 4.

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UNITED STATES PATENT OFFICE

2,148,238

AIR CIRCULATOR

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Application October 24, 1936, Serial No. 107,343

5 Claims. (Cl. 62-103)

My invention relates to cooling systems and the like and has reference more particularly to improved means for providing efficient circulation of cooled air within a refrigerator compartment.

Owing to the accumulation of moisture on the cooling units of refrigerators and the dripping of such moisture therefrom, it is the usual practice to install drip pans or the like under the cooling units to collect and drain away the moisture therefrom. Such cooling units, however, are frequently located at the top of the refrigerator compartment and provided with forced draft facilities to circulate air downwardly therethrough for cooling the compartment and the drip pans as provided heretofore under the cooling unit tend to deflect the current of cold air toward the sides of the refrigerator compartment thereby short circuiting the cold air back to the intake at the top of the cooling unit and interfering with proper circulation of cooled air to the lower portion of the refrigerator compartment with the result that the compartment is not thoroughly and uniformly cooled and the efficiency of the refrigerator is thereby impaired. Moreover as the merchandise in the compartment is usually located around the sides thereof the cold air is blown directly against the merchandise and this causes objectionable dehydration thereof.

The principal objects of my invention are to improve the circulation and distribution of cooled air throughout the refrigerator compartment; to avoid interference by the drip pans with circulation of cooled air to portions of the compartment therebelow; to control the outflow of cooled air from an overhead cooling unit so as to avoid short circuiting of the cold air back to the intake and insure positive circulation of cold air to and throughout the bottom of the compartment; to provide an improved cooling unit which has facilities for directing the air downwardly therefrom beyond the drip pan; to effectively insulate the walls of the unit so as to prevent any condensation of moisture where it might drip into the compartment and onto the contents thereof; to provide an improved arrangement of coils and control of the refrigerant supply thereto; to supply moisture to the circulated air and preserve proper conditions of humidity in the refrigerating compartment; to permit convenient removal and replacement of the drip pan; and in general to provide a simple and compact refrigerating unit which is particularly suitable for overhead use, economizes space and is highly efficient, these and other objects being accomplished as will be apparent from the following description wherein

reference is had to the accompanying drawings in which:

Fig. 1 is a side view of a refrigerating unit constructed in accordance with my invention and suspended in a refrigerating compartment;

Fig. 2 is an end view of the unit within the compartment;

Fig. 3 is an enlarged side view of the refrigerator unit with parts broken away to disclose details of the construction;

Fig. 4 is a transverse vertical sectional view of the refrigerating unit taken substantially on the line 4-4 of Fig. 3; and

Fig. 5 is an end view of the coil assembly.

Referring to the drawings, in which I have shown, for purposes of illustration, a preferred embodiment of my invention, the reference numeral 10 indicates the refrigerating or cooling unit as a whole which is suspended from the ceiling of the refrigerator compartment 11 and comprises a coil in which liquid refrigerant is evaporated to absorb heat, said coil being enclosed in a casing through which the compartment air is circulated and recirculated downwardly by a blower so that the air repeatedly comes in contact with and is cooled by the coil and the temperature within the compartment thereby reduced.

In the present illustrated structure the refrigerating compartment 11 is of elongated rectangular form and the refrigerating or cooling unit 10, which also is preferably elongated, has a casing with side and end walls 12 and 13 respectively and a top wall 14, this top wall being provided with spaced openings 15 for the fans 16 of two blowers, each operated by a separate electric motor 17 which is supported on the top wall 14 by a spider 18. Separate conductors 19 (only one of which is shown) lead to these motors 17 from an electrical connection box 20 which is mounted on the side of the casing and to which current is supplied by the conductor 21. Inverted U-shaped hangers 22 straddle the casing and have depending legs 23 extending downwardly along and secured to the side walls 12 of the casing, the middle portions 24 of these hangers by which the cooling unit is secured to the ceiling being suitably elevated to suspend the casing 12-13 a sufficient distance below the ceiling to permit circulation of air thereover and to the fans 16.

Mounted within the casing 12-13 is a coil assembly which is indicated as a whole at 25 and comprises a group of parallel tubes 26 which are mounted on and supported by end plates 27 and

28 and have thin plates or fins 29 arranged thereon in spaced relation between the end plates 27 and 28 to facilitate absorption of heat by the coil. In the illustrated embodiment of the invention the tubes 26 are arranged in four vertically spaced or superposed banks or tiers with the tubes 26 of each bank connected in series by return bends 30 at one end and 31 at the other end and these banks of tubes are in turn connected in series by the return bends 32, 33 and 34. The expansion valve 35 through which liquid refrigerant is supplied in the usual manner to the coil is connected by the pipe 36 with the next to the highest bank of tubes as shown in Fig. 5, and from this bank of tubes the refrigerant is conducted through the return bend 32 to the next lowest bank of tubes, then through the return bend 33 to the bottom bank of tubes and from this bottom bank of tubes through the return bend 34 to the top bank of tubes directly above which is a marginal drying coil 37 through which the refrigerant is conducted from the top bank of tubes to the discharge end 38 of the coil assembly which said discharge end leads in the usual manner to facilities such as a compressor (not shown) which withdraws evaporated refrigerant from the coil and compresses same into the liquid form in which it is returned to the coil through the pipe 39 and expansion valve 35. The expansion valve has a thermostatic control of a type commonly employed for this purpose, which automatically regulates the feed of liquid refrigerant therethrough to the coil and the bulb 40 of this thermostatic control is clamped on the dryer coil 37 as shown in Fig. 4 and connected as indicated at 41 to the operating mechanism of the expansion valve 35 so that the latter is controlled by the temperature at the dryer coil.

The arrangement of the refrigerant supply so that it first enters the next to the highest bank of tubes 26 and then passes consecutively through the succeeding lower banks of tubes from the lowest bank of which it returns to the upper bank of tubes, thereafter passing through the dryer coil 37, is particularly advantageous as it insures exposure of the circulated air to cold tubes as it flows downwardly through the lower portion of the cooling unit and is discharged from the bottom thereof while the refrigerant, in its final passage through the cooling unit is subjected to the warmest air and complete evaporation and thorough drying of the refrigerant is assured before it is withdrawn to the compressor. Moreover the application of the bulb 40 to the dryer coil insures exposure thereof to the temperature of the dry gas and the expansion valve accordingly is not subject to erratic control which occurs when the bulb is applied where more or less liquid refrigerant is present.

The end plates 27 and 28 which support the coil are spaced from the end walls 13 of the casing to accommodate therebetween the return bends of the coil as well as the terminal extensions 36 and 38, and these plates 27 and 28 have out-turned flanges 42 therearound, the side flanges of which engage against the side walls 12 of the casing and are secured thereto and to the hangers 22 by the bolts 43 which secure the hangers to the casing.

Moisture condenses on and drips from the cooling coils of refrigerating devices and it is customary to provide drip pans thereunder for collecting and draining away the moisture that drips therefrom. Such drip pans, however, are necessarily located in the path of the air that is

circulated through the coils by the blower and tend to deflect the air laterally toward the sides of the refrigerator compartment with the result that positive circulation of the cold air to and throughout the bottom of the compartment is prevented and the compartment accordingly is not thoroughly and uniformly cooled and the efficiency of the refrigerator is impaired. To overcome this objectionable interference with proper circulation and distribution of cold air that has been occasioned by previous drip pan arrangements, I have provided the casing of the cooling unit with an enlarged skirt-like bottom within which the drip pan is located and by which any laterally deflected air is redirected downwardly so that short circuiting is avoided and positive circulation of the cold air to the bottom of the compartment and uniform cooling throughout the compartment is assured.

To this end the casing 12—13 which encloses the coils is flared as at 44 and terminates in an enlarged straight walled enclosure 45 within which the drip pan is located and by which air that is deflected laterally by the drip pan is redirected and discharged downwardly toward the bottom of the compartment. Preferably the drip pan is of double deck form with a top section 46 having a central opening 47 under which a lower section 48 is suspended from the top section 46 by straps 49 so that air may circulate freely through the opening 47 and outwardly between the sections 46 and 48 of the drip pan as well as outwardly between the section 46 and the bottom of the coils, and the top section 46 has a depending wall 50 around and spaced from the lower section 48 so that air that is deflected outwardly by the bottom section 48 is redirected downwardly by said wall 50, while the walls 44 and 45 serve to redirect and discharge downwardly the air that is deflected outwardly by the top section 46 so that the air which is deflected laterally by the drip pan is redirected downwardly in several separate streams.

Angle plates 51 and 52 are secured to and extend inwardly from the flaring wall 44 along the sides and ends respectively of the casing and terminate at the bottom of the coil unit 25 as shown in Figs. 3 and 4, and the angle plates 52 have flanges 53 at their lower ends which are at the same level as the bottom flanges 42 of the coil supporting end plates 27 and 28 and have cross bars 54 secured thereto for supporting the drip pan assembly within the enlargement 44—45 of the casing. These bars 54 have hook shaped ends 55 which provide seats for the downturned ends 56 of straps 57 on the upper drip pan section 46 which said parts 55 and 56 by their inter-engagement support the drip pan assembly in place. To remove the drip pan assembly it is necessary to merely slide same endwise whereupon the hook ends 56 of the straps 57 are slid sidewise from the end seats of the bars 54 and release the drip pan assembly whereas replacement thereof may be readily accomplished by engaging the strap ends 55 at one side of the assembly with the corresponding end seats of the bars 54 whereupon the drip pan assembly may then be swung up so that the straps 57 at the opposite side snap up over and engage the respective end seats 55 of the bars 54, said straps 57 being sufficiently springy for this purpose.

The upper drip pan section 46 drains through the opening 47 into the lower drip pan section, and to convey away the water that accumulates

in the latter section an outlet 58 may be provided at one end with a nipple 59 for convenient attachment of a drain pipe which may lead to any desired place of disposal and the wall 50 which depends from the upper section 46 may have an opening 60 therethrough to accommodate said pipe.

To avoid condensation on any cooled surfaces from which moisture might drop into the refrigerator compartment and onto the contents thereof, the walls 12 and 13 are provided as indicated at 61 and 62 respectively with heat insulating linings which extend down to the angle plates 51 and 52 respectively and the walls 44 and 45 of the casing enlargement below these angle plates 51 and 52 are also provided with a heat insulating lining 63. Moreover, the drip pan sections 46 and 48 are also lined with heat insulating material as indicated at 64 and 65 respectively, and by reason of this insulation of these walls and the drip pans, no condensation can occur on the unit except where it will be collected in the drip pans.

From the foregoing it will be apparent that while my drip pan arrangement is adapted to collect moisture from the coils as effectively as drip pans heretofore employed, my drip pan arrangement does not interfere with the supply and distribution of the cold air to the bottom of the refrigerator compartment as all the deflected air is redirected and discharged downwardly from the cooling unit and the entire compartment is accordingly uniformly subjected to circulation of the cold air. Moreover, as the blowing of the air against the wet surfaces of and the water in the drip pan sections tends to humidify the circulated air, the proper humidity of the air is assured at the bottom of the compartment as well as throughout the rest of the compartment and by reason of the resultant uniformity of humidity and the uniformity of circulation of air throughout the entire compartment, greater efficiency of operation and more satisfactory preservation of foodstuffs in the compartment is effected.

While I have shown and described my invention in a preferred form, I am aware that various changes and modifications may be made without departing from the principles of my invention, the scope of which is to be determined by the appended claims.

I claim as my invention:

1. A cooling system comprising superposed banks of horizontally spaced tubes with fins thereon, a marginal coil above the uppermost bank of tubes, means for supplying refrigerant to an intermediate bank of tubes, said banks of tubes and marginal coil being arranged to con-

duct the refrigerant supplied by said means through said intermediate bank of tubes then consecutively through the successive banks of tubes thereunder, then through the upper bank of tubes and then through the said marginal coil, a housing containing said tubes, a blower discharging downwardly through said housing, a drip pan under said banks of tubes and in the path of discharge from said blower, and means around the bottom of the housing whereby the air deflected by the drip pan is redirected in the direction of the discharge from said blower.

2. The combination with a cooling unit of a housing therefor having a skirt-like enlargement at the bottom, a drip pan within the said enlargement and spaced therefrom, a blower discharging downwardly through the housing against the drip pan, said skirt-like enlargement being arranged to redirect deflected air from the drip pan downwardly around the drip pan.

3. The combination with a cooling unit of a housing therefor having a skirt-like enlargement at the bottom, a drip pan within the said enlargement and spaced therefrom, a blower discharging downwardly through the housing against the drip pan, said skirt-like enlargement being arranged to redirect deflected air from the drip pan downwardly around the drip pan, and heat insulating means on the inner faces of the housing and enlargement walls and in the drip pan.

4. In a cooling unit, the combination of a housing, a blower operable to circulate air downwardly through the housing, said housing having therein cooling coils with moisture collecting means thereunder, said housing, cooling coils and moisture collecting means being arranged to confine the downwardly circulated air to a path leading through a zone between the moisture collecting means and the cooling coils, and said housing being provided with means to redirect the air from said zone downwardly below the moisture collecting means.

5. In a cooling unit, the combination of a housing, a blower operable to circulate air downwardly through the housing, said housing having therein cooling coils with moisture collecting means thereunder, said housing, cooling coils and moisture collecting means being arranged to confine the downwardly circulated air to a path leading through a zone between the moisture collecting means and the cooling coils and therefrom laterally against the side walls of the housing, said side walls being arranged to redirect the air downwardly below the moisture collecting means.

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