Dec. 22, 1953 J. F. BAKER 2,663,156

APPARATUS FOR COOLING AND DEHUMIDIFYING AIR

Filed March 24, 1952 5 Sheets-Sheet 1

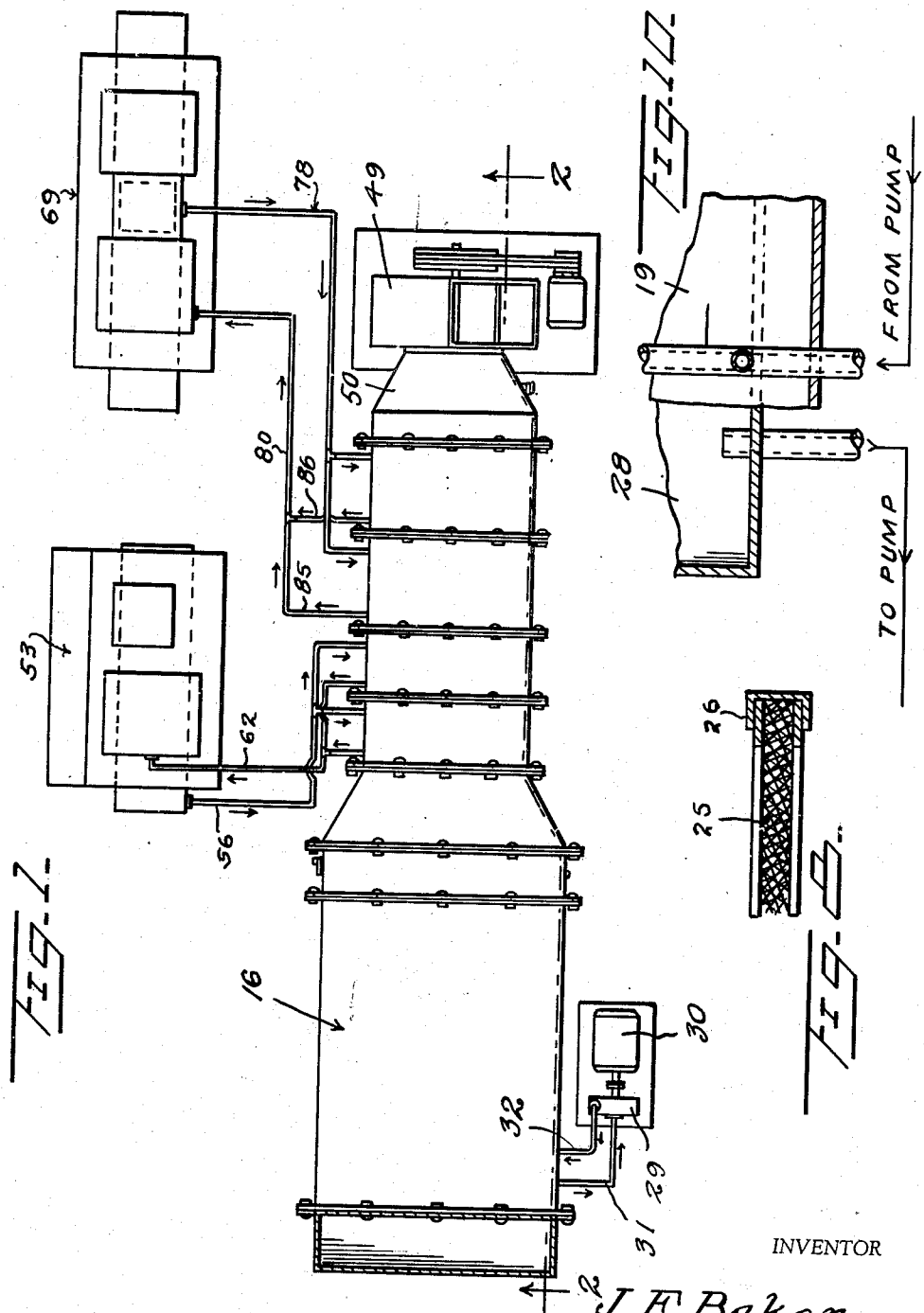


FIG. 1

FIG. 1A

FIG. 2

INVENTOR

J. F. Baker

BY Kimmel & Crowell

ATTORNEYS

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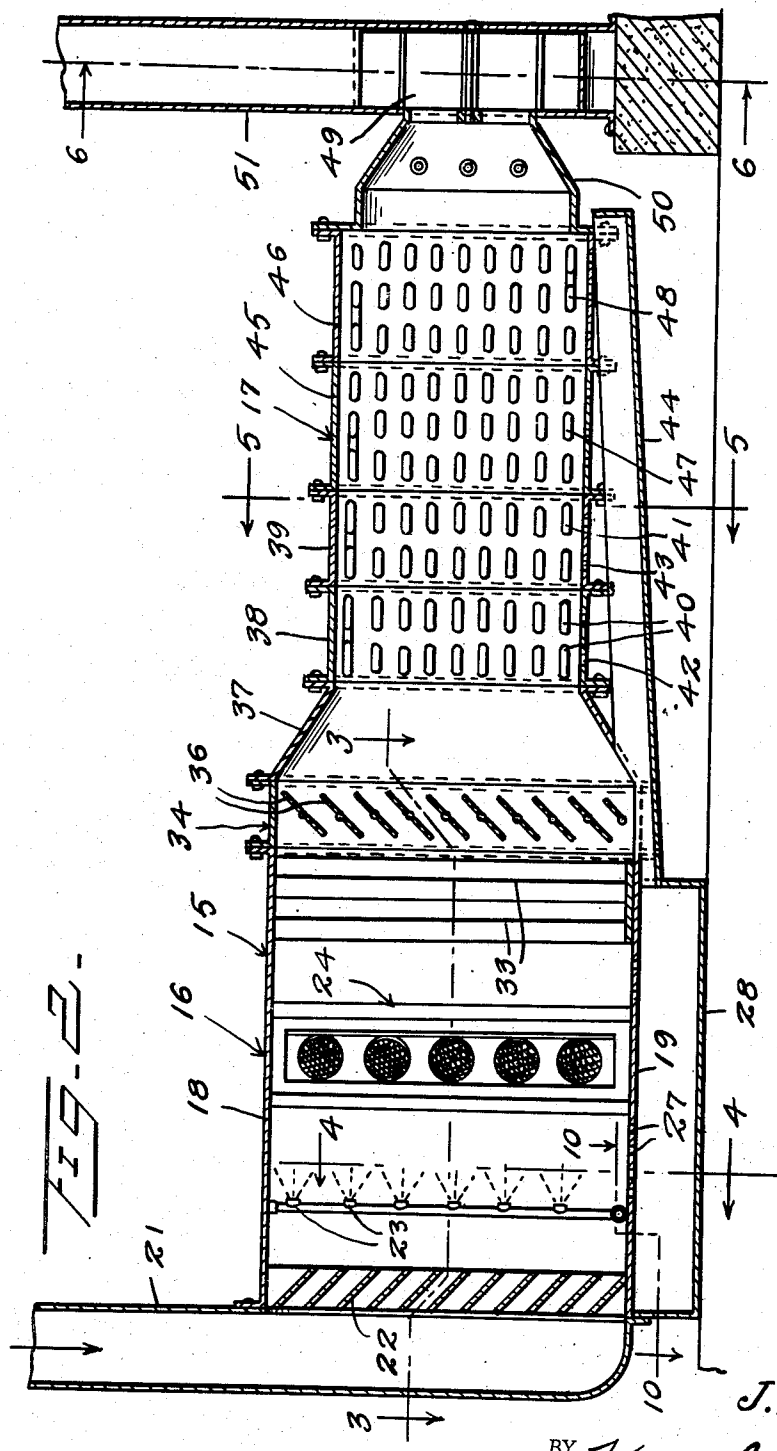


FIG. 2.

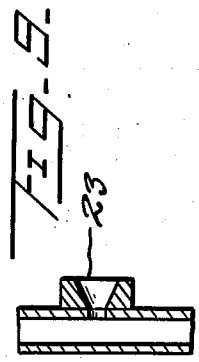


FIG. 5.

INVENTOR

J. F. Baker

BY Kimmel & Crowell

ATTORNEYS

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FIG. 3.

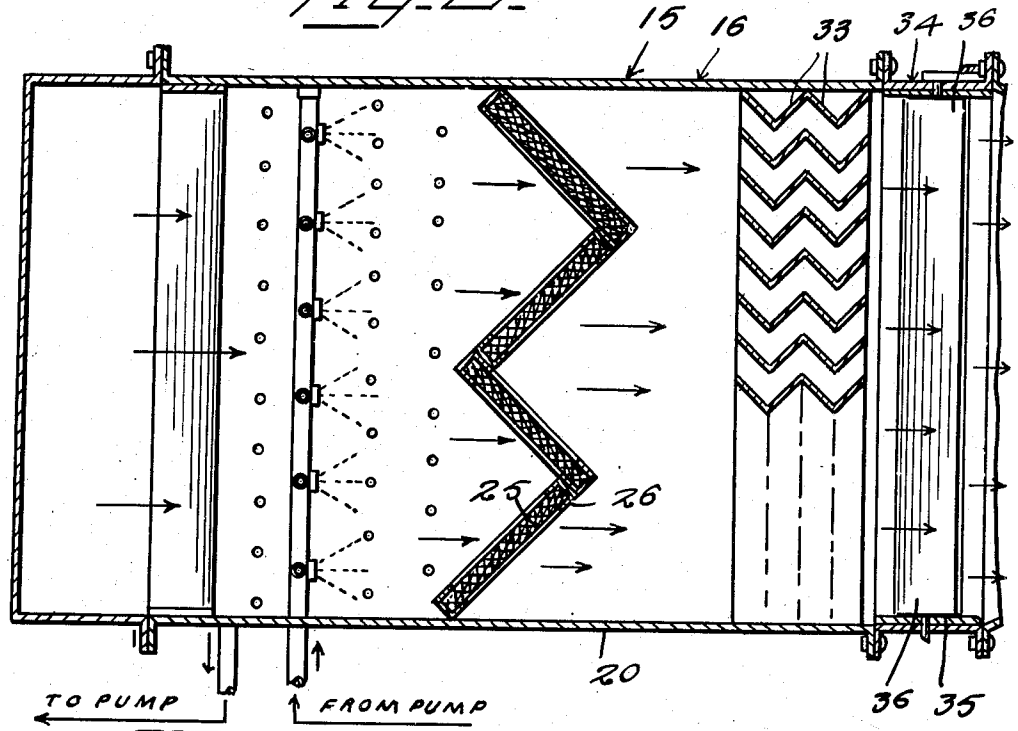
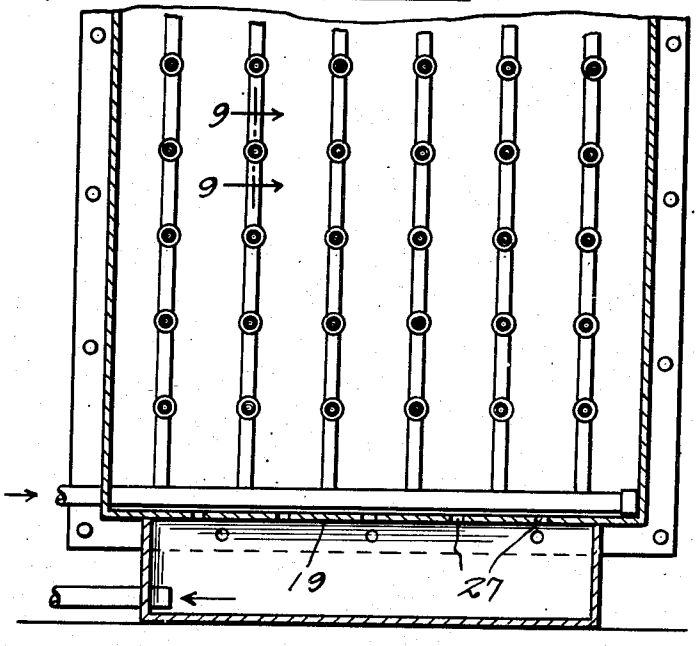


FIG. 4.



INVENTOR
J. F. Baker

BY Kimmel & Crowell
ATTORNEYS

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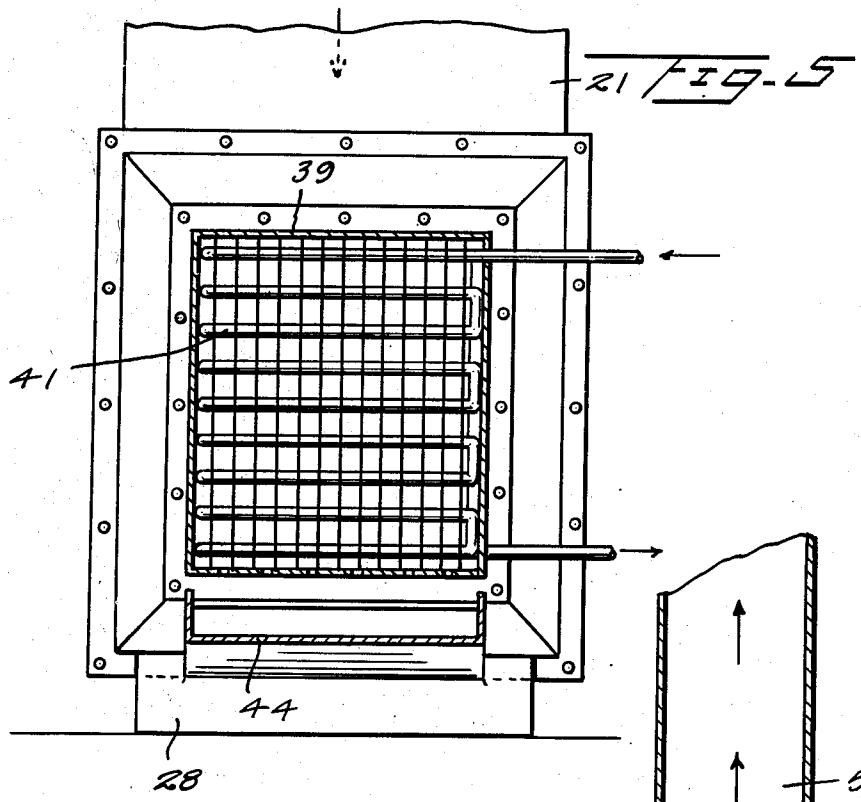


FIG. 5

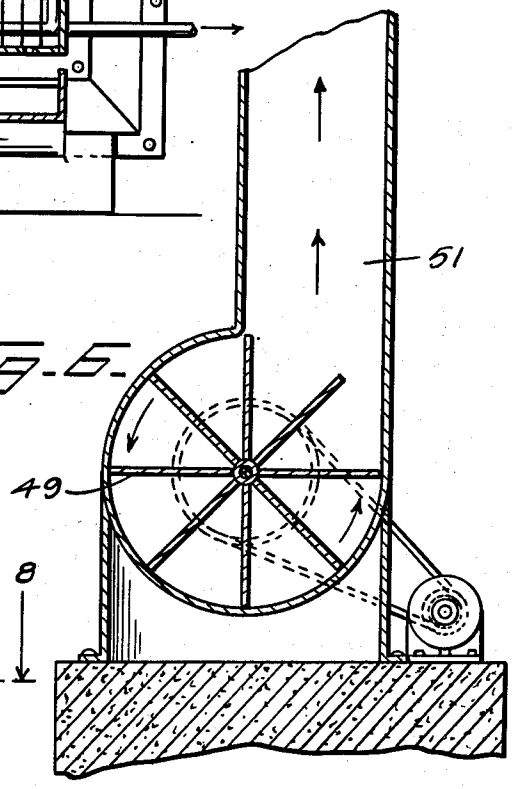


FIG. 6

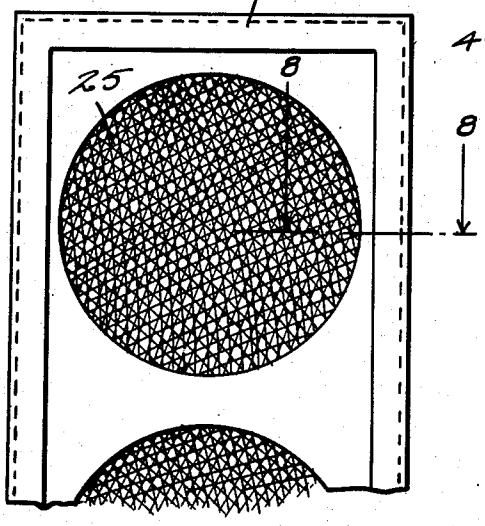


FIG. 7

INVENTOR

J. F. Baker

BY Kimmel & Crowell

ATTORNEYS

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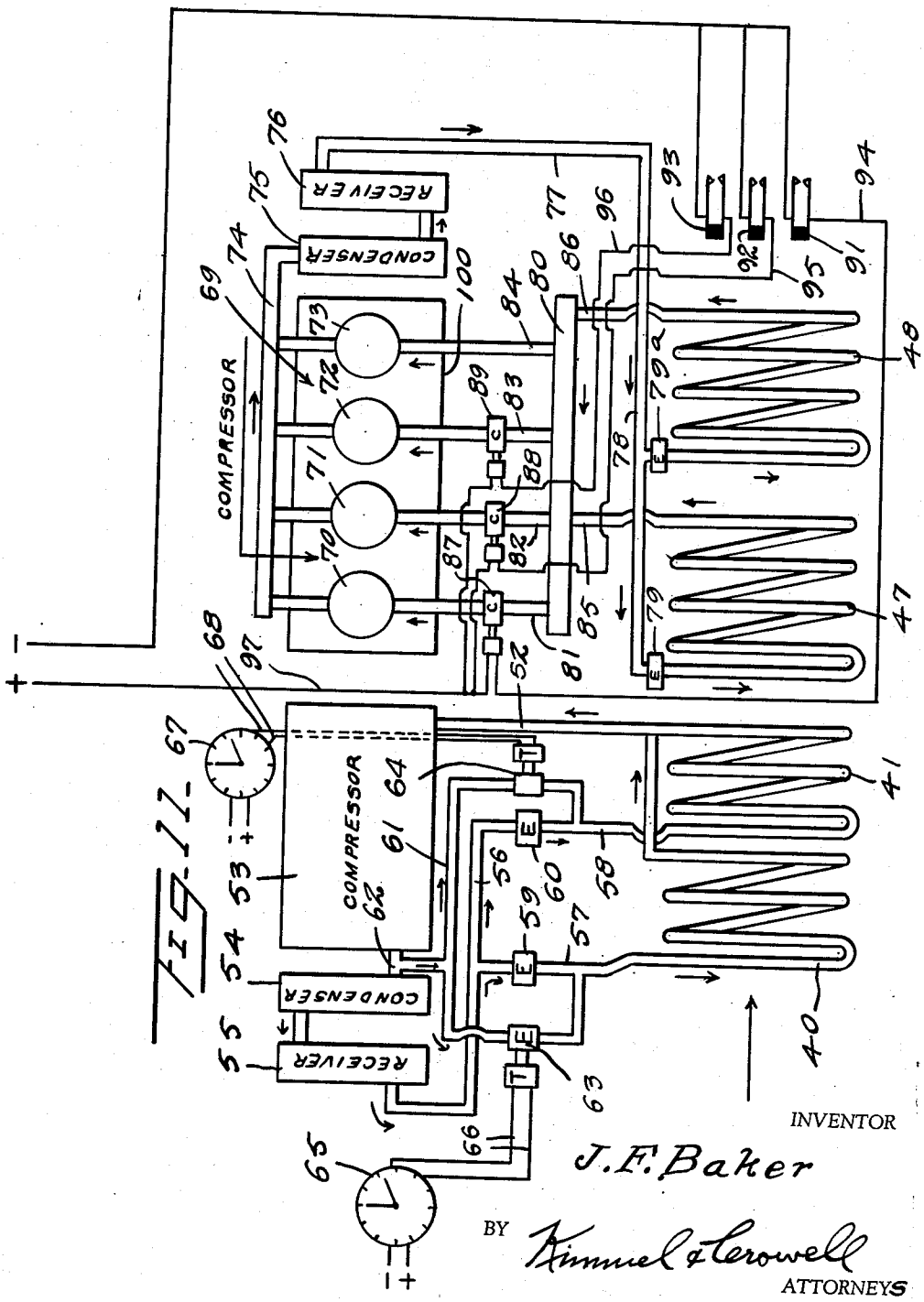


FIG. 11

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UNITED STATES PATENT OFFICE

2,663,156

APPARATUS FOR COOLING AND DEHUMIDIFYING AIR

Jess F. Baker, Peoria, Ill.

Application March 24, 1952, Serial No. 278,267

3 Claims. (Cl. 62—6)

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This invention relates to a cooling system for producing cool, clean air.

An object of this invention is to provide a cooling system embodying an elongated housing having an air intake at one end and a suction fan at the other end with a cooling means within the housing for cooling and de-humidifying the air passing therethrough.

Another object of this invention is to provide a cooling system which includes means for dehumidifying and cooling air to a predetermined degree.

A further object of this invention is to provide a cooling system which includes thermal control means for producing air at a relatively constant cool temperature.

A further object of this invention is to provide in a cooling system an improved means for defrosting the cooling units.

A further object of this invention is to provide in an air cooling system an improved means for cleaning the air passing through the cooler.

With the above and other objects in view, my invention consists in the arrangement, combination and details of construction disclosed in the drawings and specification, and then more particularly pointed out in the appended claims.

In the drawings:

Figure 1 is a plan view partly diagrammatic and partly in section of a combined air dehumidifying and cooling structure embodying this invention.

Figure 2 is a sectional view taken on the line 2—2 of Figure 1.

Figure 3 is a fragmentary sectional view taken on the line 3—3 of Figure 2.

Figure 4 is a fragmentary sectional view taken on the line 4—4 of Figure 2.

Figure 5 is a sectional view taken on the line 5—5 of Figure 2.

Figure 6 is a fragmentary sectional view taken on the line 6—6 of Figure 2.

Figure 7 is a fragmentary front elevation of one of the filter elements.

Figure 8 is a fragmentary sectional view taken on the line 8—8 of Figure 7.

Figure 9 is a fragmentary sectional view taken on the line 9—9 of Figure 4.

Figure 10 is a fragmentary horizontal section taken on the line 10—10 of Figure 2.

Figure 11 is a diagrammatic view showing the cooling and electric circuits embodied in this invention.

Referring to the drawings, the numeral 15 designates generally an elongated hollow or tubular housing which is formed of a rear air cleaning section 16 and a forward air cleaning and dehumidifying section 17. The rear section 16 is formed of a housing having upper and lower walls 18 and 19 respectively and opposite side walls 20. A vertically disposed air intake duct 21 is connected with the rear of the housing section 16, and duct 21 is communicated with the atmosphere which may be at a point remote from the housing 16. A series of horizontally disposed downwardly and inwardly inclined baffles or deflectors 22 extend across the rear of the housing section 16 and are adapted to deflect the incoming air downwardly as well as evenly distribute the incoming air entering the rear housing section 16.

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A plurality of water jets 23 are disposed within the housing section 16 forwardly of the baffle or reflector members 22 and are adapted to project a finely comminuted water spray forwardly in the direction of the movement of the air. An air filter structure generally designated as 24 is disposed within the housing section 16 forwardly of the jets 23, and the filter structure 24 comprises a plurality of angularly related vertically disposed elements 25 shown more clearly in Figure 3, which are carried by channel-shaped frame members 26.

The bottom wall 19 of the housing section 16 is provided with a plurality of drain openings 27 whereby the water dropping into the housing section 16 from the sprays or jets 23 may drain out of the housing section 16 into a collector or pan 28, which is disposed below the housing section 16. A water pump 29 is disposed at one side of the housing section 16 and is operated by means of a motor or power member 30. The intake side of the pump 29 is connected by means of a pipe 31 to the collector 28 and the outlet or pressure side of the pump 29 is connected by means of a pipe 32 to the spray nozzle 23. The housing section 16 also has disposed therein forwardly of the filter members 25 a series of vertically spaced apart pairs of V-shaped baffles 33.

An intermediate damper unit 34 is disposed between the rear housing section 16 and the housing section 17 and includes a rectangular housing 35 having a series of horizontally disposed elongated dampers 36 rockably positioned between the side walls of the rectangular housing 35. The dampers 36 form a valve or regulating means for regulating the flow of the air from the rear housing 16 through a forwardly tapered connecting member 37 into the rear of the dehumidifying and cooling section 15.

The combined de-humidifying and cooling section 15 includes a pair of connected together housings 38 and 39 having cooling coils 40 and 41 disposed therein. The housings 38 and 39 are formed with drain openings 42 and 43 in the bottoms thereof whereby water may drain from the housing members into a drain pan 44, which is inclined downwardly and rearwardly and communicates with the collector 28.

The de-humidifying and cooling section 17 also includes a forward pair of connected together housings 45 and 46. Housing 45 has disposed therein a coil 47, and housing 46 has disposed therein a coil 48. The air which passes through the cooling units hereinbefore described is drawn therethrough by means of a blower 49 which is connected with the forward end of the cooling section 17 by means of a tapered connecting member 50. The connecting member 50 communicates with the intake of the blower 49 and the outlet or pressure side of the blower 49 has a duct 51 connected therewith. The duct 51 is adapted to be extended to a suitable point for discharging the cooled and dehumidified air into a room or other enclosure which it is desired to cool.

The cooling coils 40 and 41 form part of a conventional refrigerating system, shown diagrammatically in Figure 11, which is modified as will be hereinafter described. The low sides of the coils 40 and 41 are connected to a low side manifold 52 which is connected to a compressor 53. Compressor 53 is connected at the high side thereof to a condenser 54, and condenser 54 is connected with a receiver 55. The receiver 55 is connected to a high side manifold 56, and pipes 57 and 58 connect manifold 56 with the high sides of coils 40 and 41 respectively. A conventional expansion valve 59 is interposed in pipe 57, and a conventional expansion valve 60 is interposed in pipe 58.

In order to provide a means whereby the coils 40 and 41 may be periodically defrosted, I have provided a pipe 61 which is connected to hot line 62, which connects compressor 53 with condenser 54. One end of pipe 61 is connected with pipe 57 between expansion valve 59 and coil 40, and the other end of pipe 61 is connected with pipe 58 between expansion valve 60 and coil 41. A normally closed solenoid valve 63 is interposed in pipe 61 adjacent pipe 57, and a second normally closed solenoid valve 64 is interposed in pipe 61 adjacent pipe 58. Solenoid valve 63 is connected to a time clock switch structure 65 by conductors 66, and solenoid valve 64 is connected to a second time clock operated switch 67 by means of conductors 68. The time clocks and switches associated therewith are adapted to periodically energize the solenoids of the valves 63 and 64 so as to open these valves and permit the discharge of hot gases from hot gas line 61 into the coils 40 and 41. These valves are adapted to be opened for relatively short periods at predetermined intervals so that any frost collecting on the coils will be melted. Preferably the solenoid valves are operated in sequence as to their defrosting cycles so that there will be one coil 40 and 41 in operative and cooling condition at all times.

Coils 47 and 48 are connected to a second cooling unit independent from the first cooling unit hereinbefore described, and this second cooling unit is of conventional construction, with the exceptions to be hereinafter noted. A compressor generally designated as 69 is formed of

a plurality of compressor cylinders 70, 71, 72 and 73. The cylinders 70, 71, 72 and 73 are connected at their high or pressure sides to a high side manifold 74, and the manifold 74 is connected to a condenser 75. Condenser 75 is connected to a receiver 76, and receiver 76 is connected by means of a pipe 77 to a common pipe 78 which is connected to the high sides of the coils 47 and 48. Expansion valves 79 and 79a of conventional structure are interposed between pipe 78 and coils 47 and 48, respectively. A common low side manifold 80 is connected by means of pipes 81, 82, 83 and 84 to the compressor cylinders 70, 71, 72 and 73, respectively, and low side manifold 80 is connected by means of a pipe 85 to the low side of coil 47.

The low side of coil 48 is connected by means of a pipe 86 to low side manifold 80. A solenoid valve 87 is interposed in pipe 81; a solenoid valve 88 is interposed in pipe 82, and a solenoid valve 89 is interposed in pipe 83. The valves 87 to 89 are normally closed and are adapted to be selectively opened by means of a series of thermostatic switches 91, 92 and 93, respectively. Thermostatic switch 91 is connected by means of a conductor 94 to one side of the solenoid of valve 87, and thermostatic switch 92 is connected by means of a conductor 95 to one side of the solenoid of valve 88. Thermostatic switch 93 is connected by means of a conductor 96 to one side of the solenoid of valve 89. The other sides of the solenoids of the valves 87, 88 and 89 are connected to a supply conductor 97. The solenoid valves 87, 88 and 89 illustrate one form of unloader for the compressor, and it will be understood that other forms of unloaders may be used in place of these valves.

The thermostatic switches 91, 92 and 93 are carried by the connecting housing or neck 50 and project into the neck 50 so that the refrigerant circulated through the coils 47 and 48 by the compressor 69 may be thermostatically controlled in accordance with the temperature of the air flowing through the neck 50 into the blower 49. In other words, in the event the air passing through the coils 47 and 48 is cooler than may be desired, due in part to the cooler temperature of the incoming air, any one or all of cylinders 70, 71 and 72 may be cut off from the low side or suction manifold 80 by closing of one or more of the thermostatic switches 91, 92 and 93.

In the use and operation of this system, suction blower 49 will draw air through the housing 15, and as air enters the rear housing section 16, this air will be cleaned by the spray from nozzles 23 and the air additionally cleaned by the filter structure 24, which will also remove any water globules in the air. The flow of air forwardly is regulated by the dampers 36 in intermediate housing 34, and as air passes through the first pair of coils 40 and 41, the moisture in the air will be removed and the de-humidified air will then pass through the cooling coils 47 and 48. In the event the air initially entering rear section 16 is of relatively low temperature, the cooling effect of coils 47 and 48 may be reduced or decreased by closing of one or more of the thermostatic switches 91, 92 and 93. When the thermostatic switches are in closed position, the solenoid valves 87, 88 and 89 will be in open position permitting flow of refrigerant to the low sides of the compressor cylinders 70, 71 and 72.

When the system has been in operation for a predetermined time, the rear coils 40 and 41 will

be coated with frost and these coils may be selectively defrosted by means of the time switch means 65 and 67. When time switch 65 is closed, solenoid valve 63 will be opened so that hot gas from hot line 61 will be discharged into the high or intake side of coil 40. At this time, solenoid valve 64 will be in closed position so that coil 41 will be cooling the air passing therethrough. In view of the temperature of the gases passing through hot line 61, the coils 40 and 41 will be defrosted relatively fast so that the cooling cycle of each of these coils will not be interrupted for any lengthy period.

This system will provide dehumidified air at a predetermined temperature for circulation through food products such as dried eggs, milk, alfalfa meal, during the processing and packaging process, it being the intention to provide large quantities of air at a desired temperature with low moisture content for circulation through such products prior to packaging.

The device may also be used for air cooling purposes such as air conditioning, and with slight alterations in position and operation of coils, for the obtaining of low temperatures for refrigeration purposes.

I do not mean to confine myself to the exact details of construction herein disclosed, nor to the exact positional order of the various cooling and de-humidifying coils, but claim all variations falling within the purview of the appended claims.

What is claimed is:

1. An air de-humidifying and cooling means comprising an elongated housing, means circulating air through said housing, spray means adjacent the intake end of said housing, filter means inwardly of said spray means, dampers inwardly of said filter means, a rear pair of cooling coils in said housing, a cooling means connected with said coils, a second pair of cooling coils forwardly of said first pair of coils, a second cooling means connected with said second pair of cooling coils, thermostatically operated means carried by said housing and connected with said second cooling means for varying the effectiveness of the latter in accordance with the temperature of air leaving said housing, and timed means connected between said first pair of coils and said first cooling means for effecting a defrosting of said first pair of coils.

2. An air de-humidifying and cooling means comprising an elongated housing, means circulating air through said housing, spray means adjacent the intake end of said housing, filter means inwardly of said spray means, dampers inwardly of said filter means, a rear pair of cooling coils in said housing, a cooling means connected with said coils, a second pair of cooling coils forwardly of said first pair of coils, a second cooling means connected with said second pair of cooling coils, thermostatically operated means carried by said housing and connected with said second cooling means for varying the effectiveness of the latter in accordance with the temperature of air leaving said housing, and timed means connected between said first pair of coils and said first cooling means for effecting a defrosting of said first pair of coils, said last-mentioned means comprising a time clock switch and a solenoid valve operable thereby.

3. An air de-humidifying and cooling means comprising an elongated housing, means circulating air through said housing, spray means adjacent the intake end of said housing, filter means inwardly of said spray means, dampers inwardly of said filter means, a rear pair of cooling coils in said housing, a cooling means connected with said coils, a second pair of cooling coils forwardly of said first pair of coils, a second cooling means connected with said second pair of cooling coils, thermostatically operated means carried by said housing and connected with said second cooling means for varying the effectiveness of the latter in accordance with the temperature of air leaving said housing, and timed means connected between said first pair of coils and said first cooling means for effecting a defrosting of said first pair of coils, said last-mentioned means including a time clock switch and a solenoid valve operable thereby interposed in the intake line of each of said first pair of coils, each timed means being separably operable to discharge a heating medium into one of said coils in sequence.

JESS F. BAKER.

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