United States Patent

[11] **3,570,592**

[72] Inventor **Dallas W. Rollins**
St. Charles, Mo.

[21] Appl. No. **800,215**
[22] Filed **Feb. 18, 1969**
[45] Patented **Mar. 16, 1971**
[73] Assignee **ACF Industries, Incorporated**
New York, N.Y.

[54] **AERATING SYSTEM FOR A COVERED HOPPER RAILWAY CAR**
8 Claims, 9 Drawing Figs.

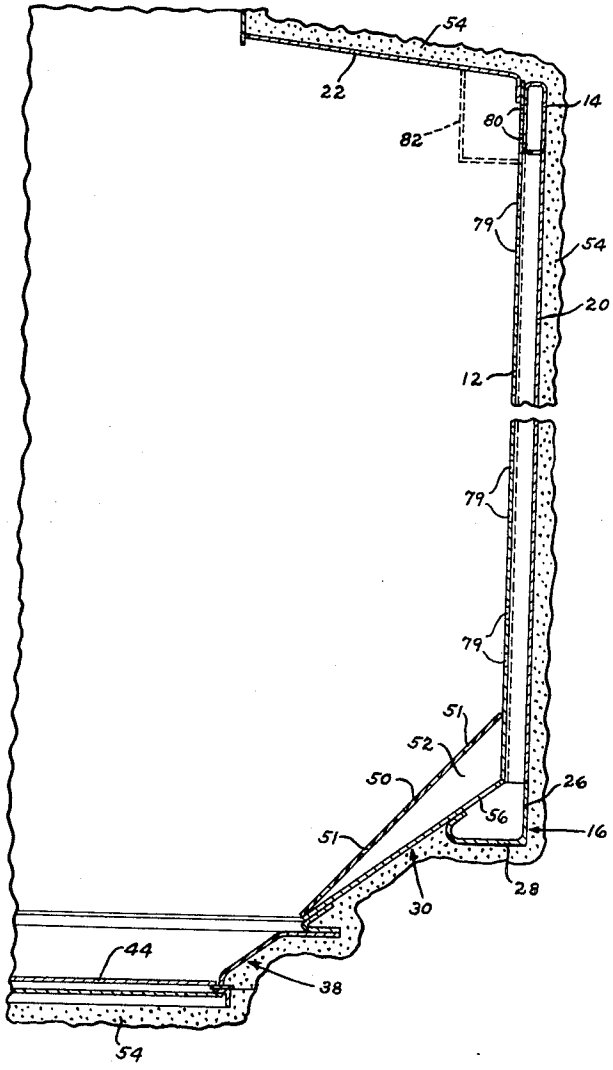
[52] **U.S. Cl.** **165/42,** 165/41, 98/40
[51] **Int. Cl.** **F26b 3/00**
[50] **Field of Search** ..... 98/10, 40; 165/42—44, 41; 34/22

[56] **References Cited**
UNITED STATES PATENTS

2,605,690	8/1952	Henney	98/10
3,486,241	12/1969	Coyle et al.	98/6

Primary Examiner—Charles Sukalo
Attorneys—Samuel J. Snyder and Eugene N. Riddle

ABSTRACT: A system for aerating and controlling the temperature of ladings, such as perishable commodities, in a covered hopper railway car, includes a blower communicating with the interior of the car through the side sills and side stakes, formed as conduits, and through perforations in the side stakes and in slope plates of the hoppers. To complete the air circuit, there are also provided ducts at the top of the car. The flow of air may be reversed and the air may be heated or cooled.



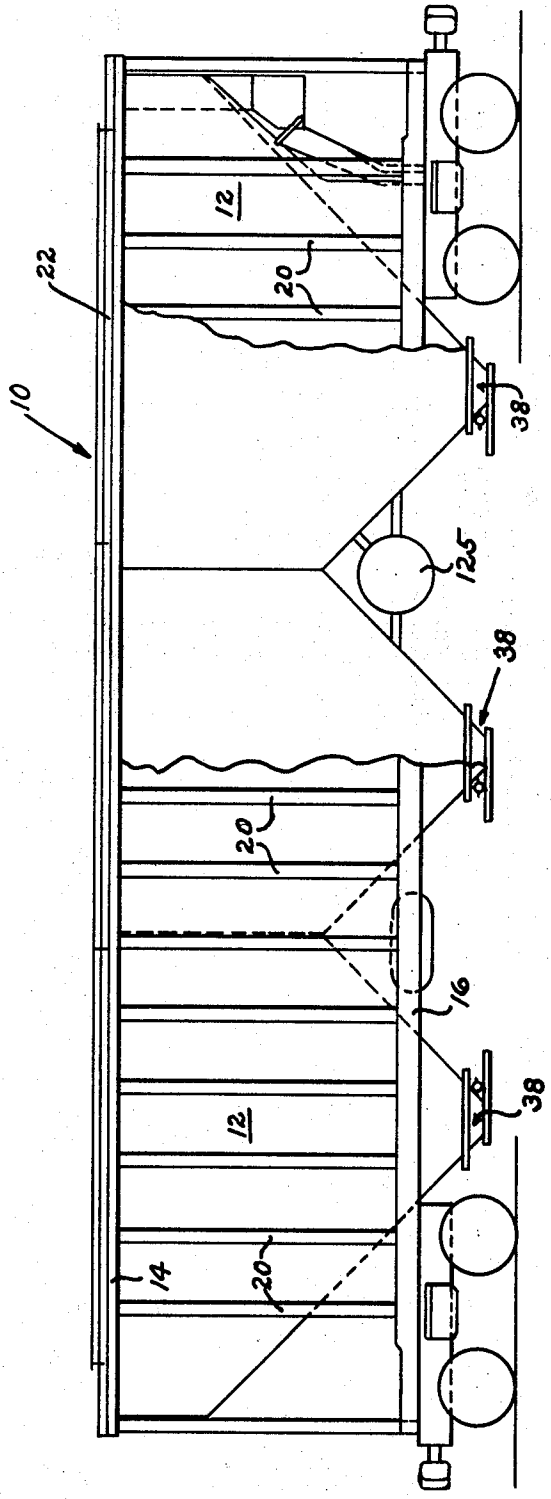


FIG. 1.

INVENTOR.
DALLAS W. ROLLINS
BY
Samuel J. Snyder
ATTORNEY

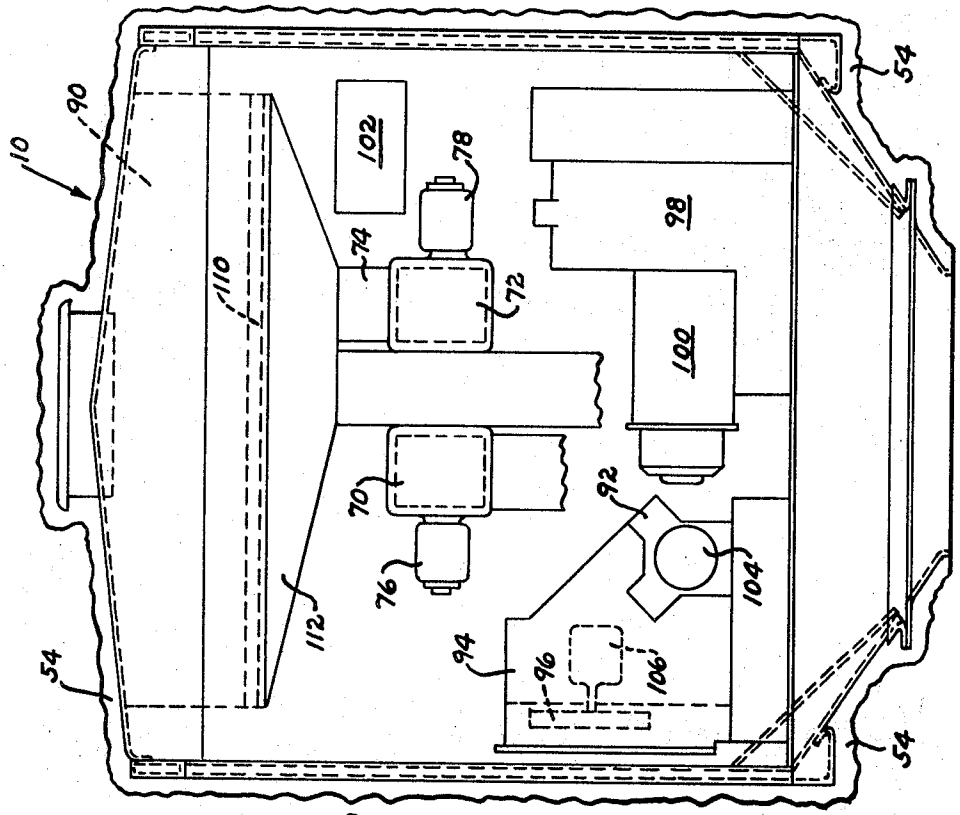

10
90
54
102
78
74
72
98
100
110
112
70
76
92
104
94
96
106
54
54

FIG. 6.

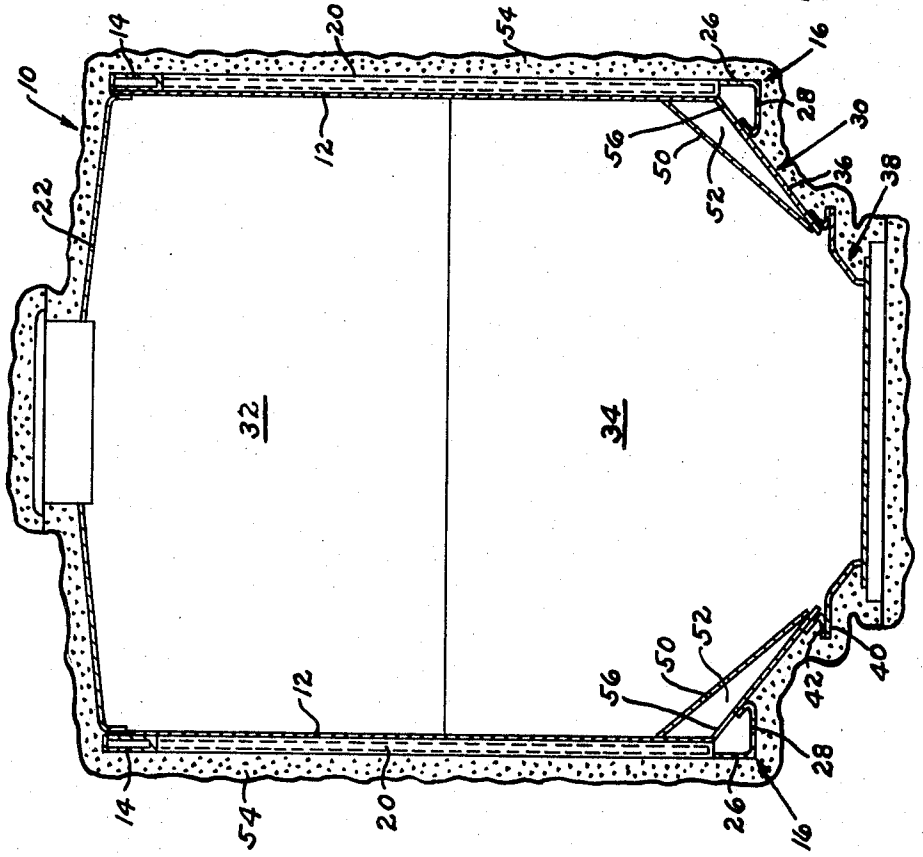

10
14
20
54
26
16
28
30
12
56
50
52
36
38
22
32
34
12
56
50
52
40
42
28
14
54
20
26
16

FIG. 2.

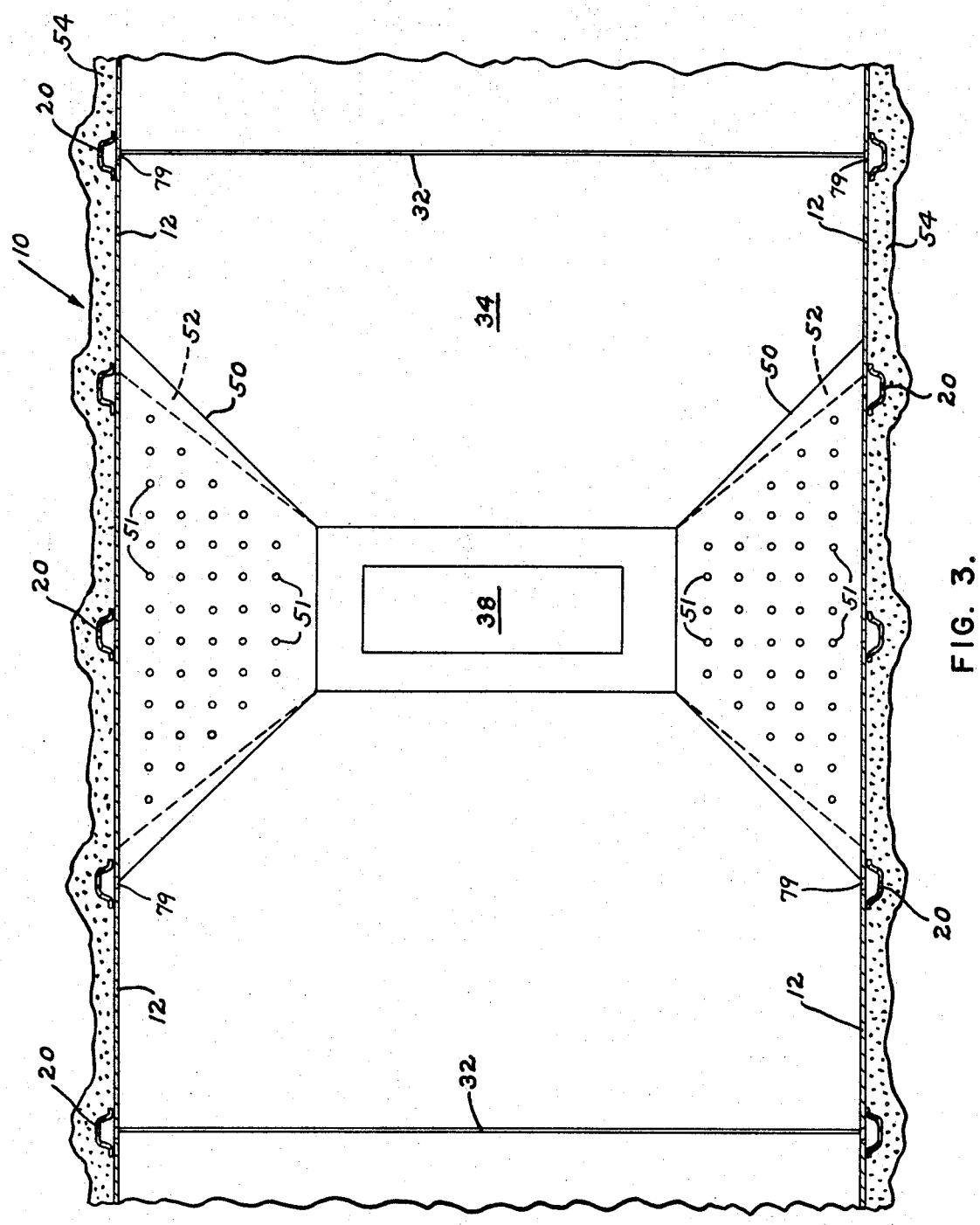


FIG. 3.

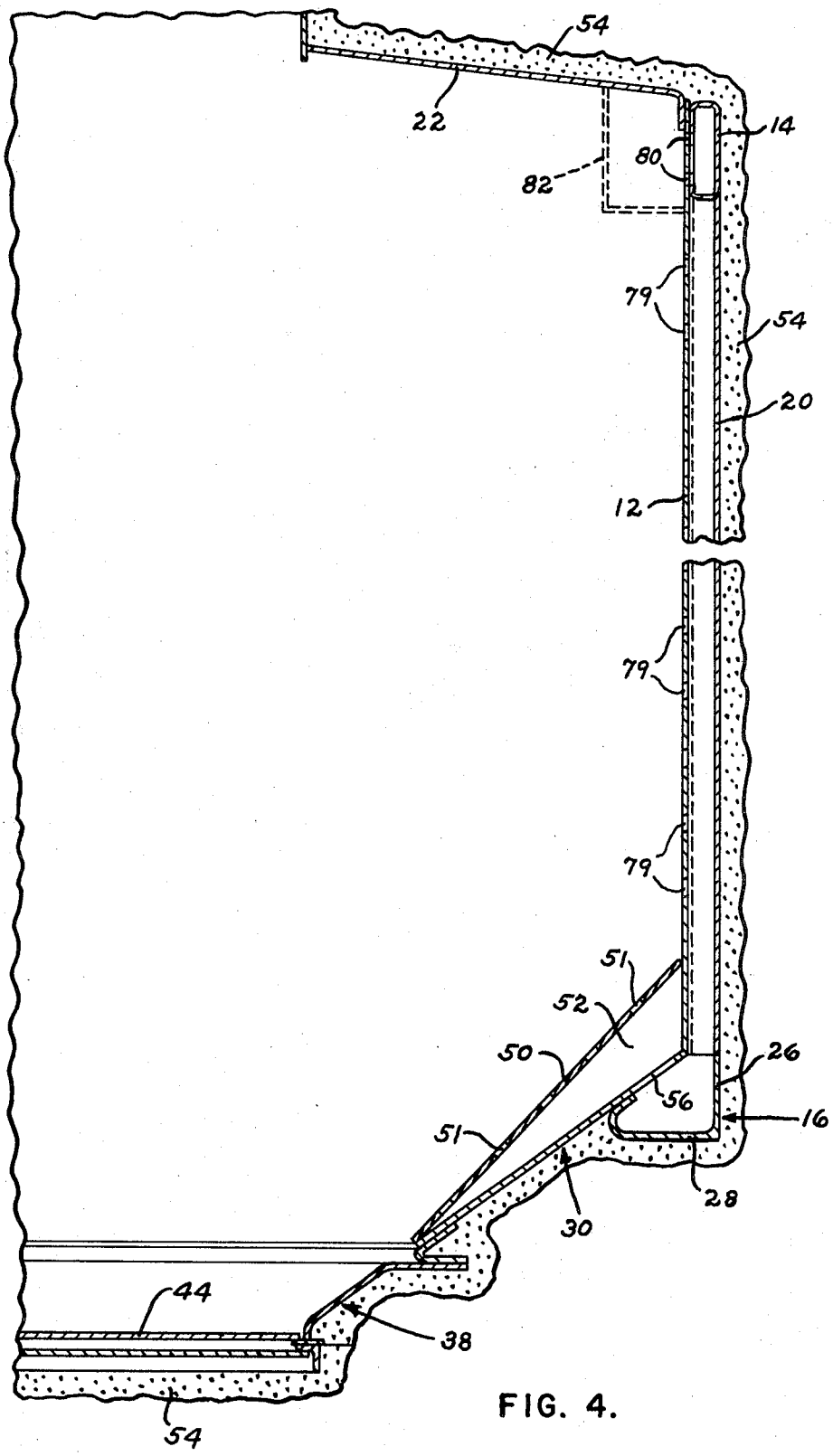


FIG. 4.

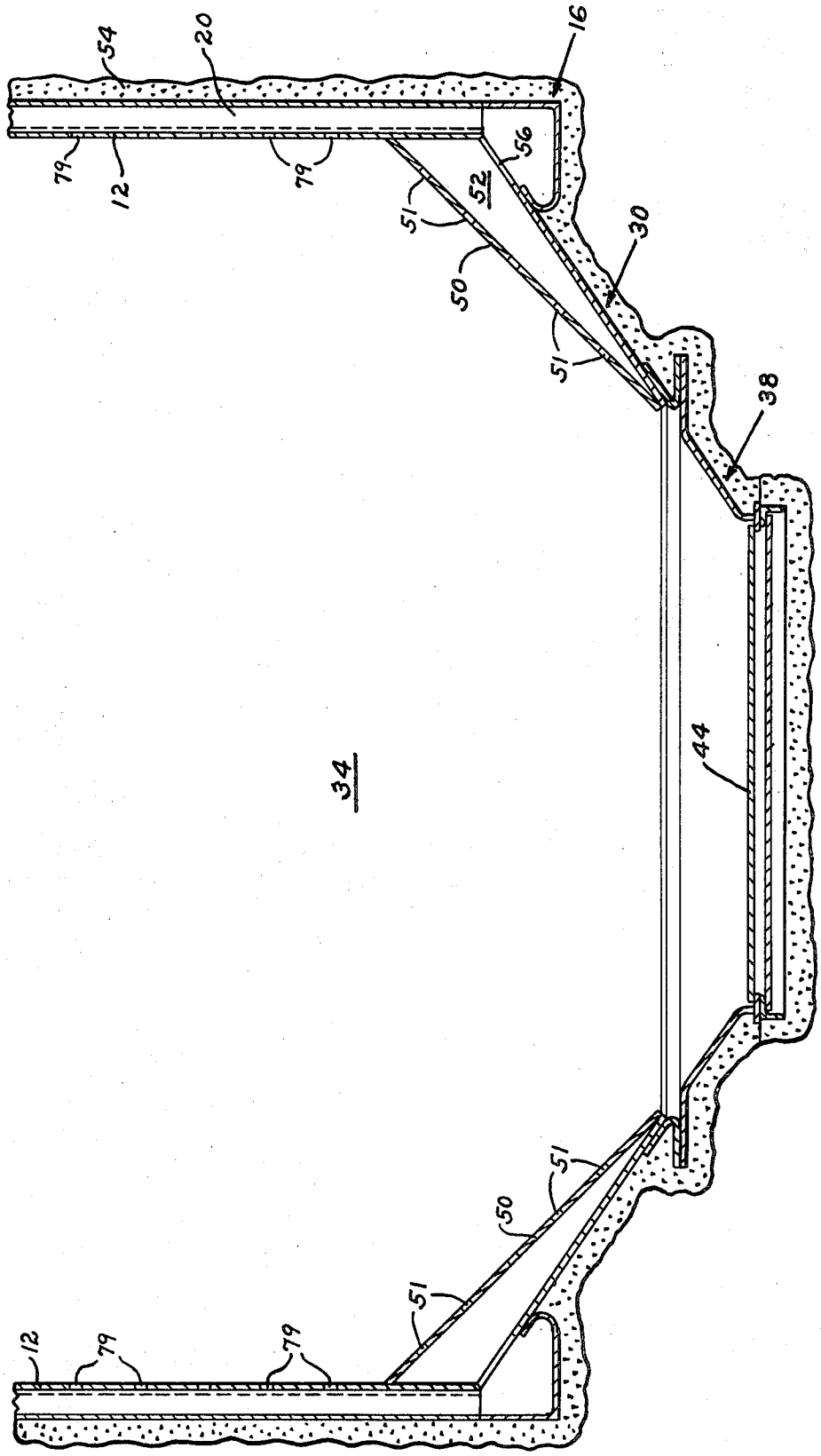


FIG. 5.

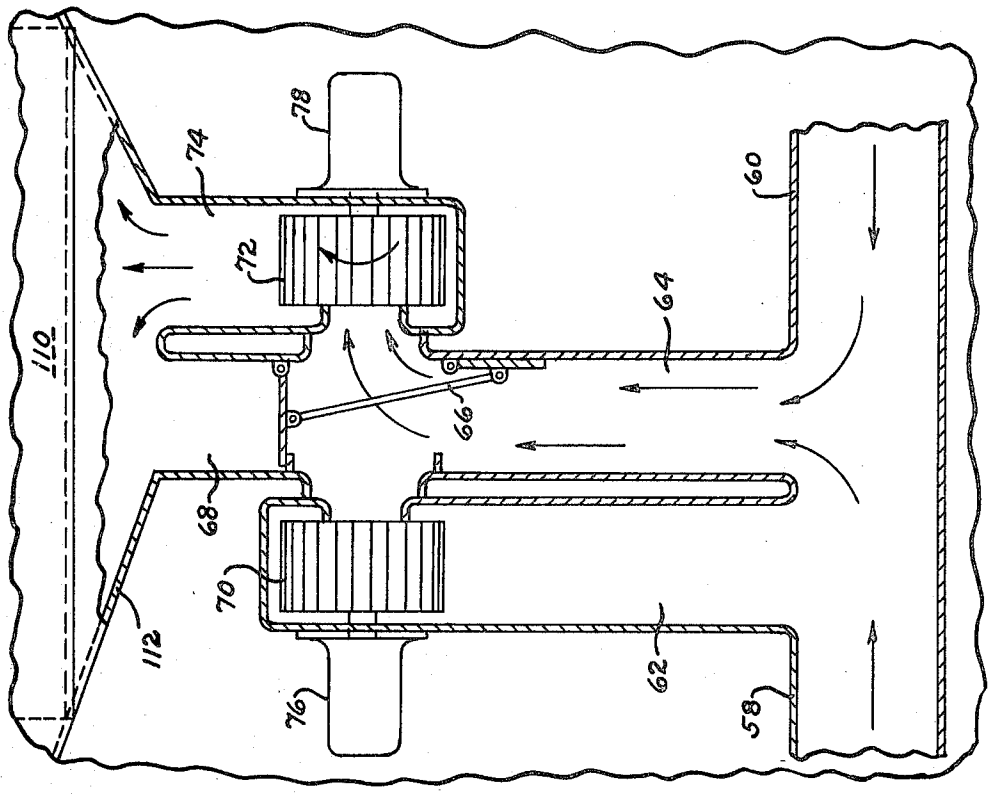

110
74
78
72
60
64
66
68
70
112
62
76
58

FIG. 8.

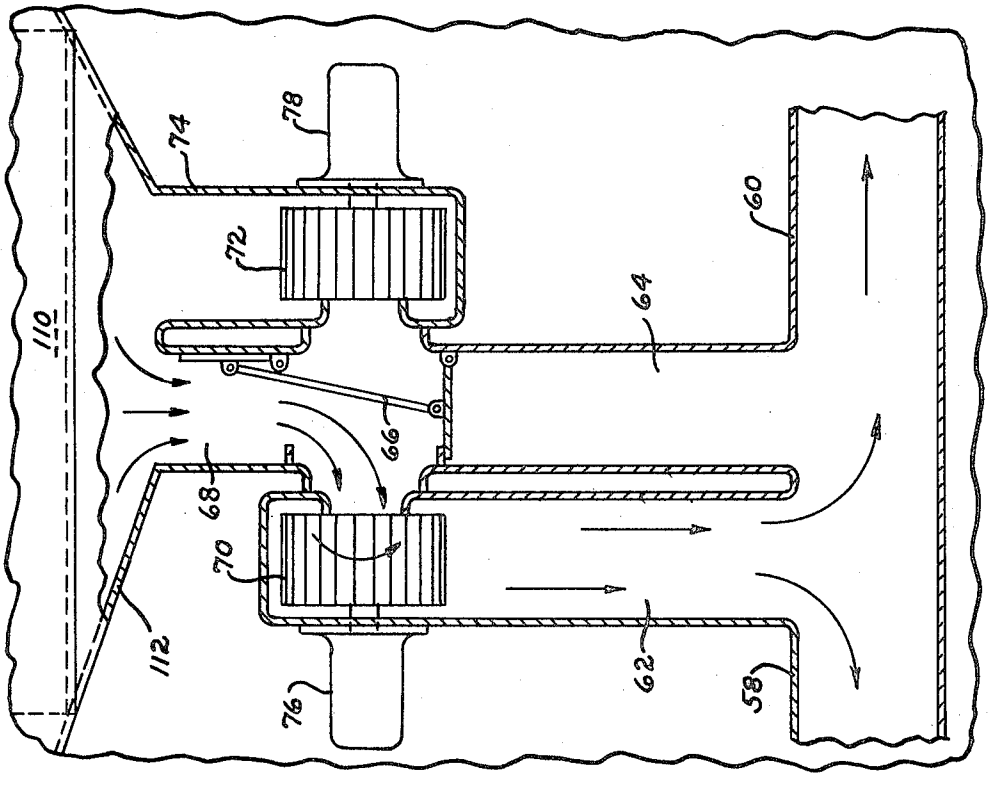

110
74
78
72
60
64
66
68
70
112
62
76
58

FIG. 7.

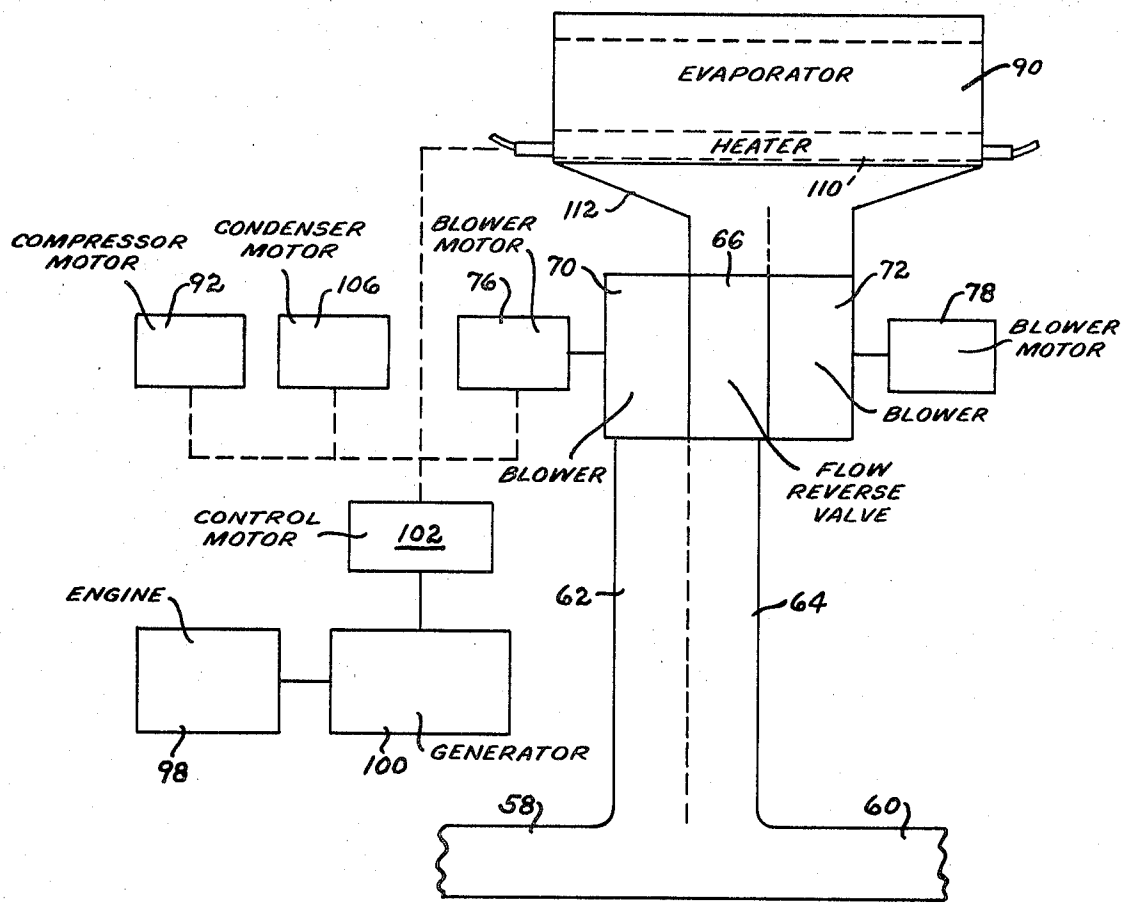

EVAPORATOR
90
HEATER
110'
112
66
COMPRESSOR MOTOR
92
CONDENSER MOTOR
106
BLOWER MOTOR
76
70
72
78
BLOWER MOTOR
BLOWER
BLOWER
FLOW REVERSE VALVE
CONTROL MOTOR
102
ENGINE
62
64
98
100
GENERATOR
58
60

FIG. 9.

AERATING SYSTEM FOR A COVERED HOPPER RAILWAY CAR

BACKGROUND AND DESCRIPTION OF THE INVENTION

This invention is related to the invention disclosed in application Ser. No. 760,933, filed Sept. 19, 1968, and now U.S. Pat. No. 3,486,241, granted Dec. 30, 1969 and assigned to the assignee of this application.

It is apparent that an extensive system of ducts is required to provide good distribution and freedom from dead spots in a railway car. The construction of a car having such a system of ducts would be complex and expensive, and might appreciably reduce the capacity of the car. It is, accordingly, an object of the invention to provide an air distribution system extending over substantially the entire length and height of the car using substantially only the existing structure of the car.

SUMMARY OF THE INVENTION

The invention provides a covered hopper car for perishable lading, particularly a car in which hollow side sills, hollow reinforcing side plates, and reinforcing stakes extending over the entire sidewalls of the car are placed in communication with the interior of the car. These car structures are used as air ducts to obtain an aeration of the lading of a uniformity which would otherwise require an extremely extensive network of ducts and supporting structures. Means are mounted on the car for heating or cooling the air circulated through the car.

BRIEF DESCRIPTION OF THE DRAWING

In the accompanying drawing, the following FIGS. illustrate embodiments of the invention:

FIG. 1 is a side elevation, partly schematic, of a covered hopper railway car, with one side partly broken away, illustrating the air system for aerating the interior of the car from bottom outlet structures and providing a continuous recirculation of air.

FIG. 2 is a sectional view of the car of FIG. 1.

FIG. 3 is a top plan of one of the hoppers.

FIG. 4 is substantially a half section, similar to FIG. 2, on an enlarged scale.

FIG. 5 is an enlarged section of the bottom portion of one hopper.

FIG. 6 is an end elevation of the end portion of FIG. 1 with the heating and cooling equipment shown mounted thereon.

FIGS. 7 and 8 are partial sectional views showing the air pumping apparatus and valves for selectively reversing the air flow.

FIG. 9 is a schematic of the power supply and driving apparatus of the aerating system.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

Referring to the drawings, a covered hopper railway car is generally indicated 10 and comprises a pair of side sheets 12, a hollow reinforcing side plate 14 extending longitudinally along the upper marginal portion of each side sheet 12 for the length of car 10, and a hollow side sill 16 extending longitudinally along the lower marginal portion of each side sheet 12 for the length of car 10. Box-shaped hollow vertical stakes 20 extend along side sheets 12 a over the entire length thereof.

Side plate 14 is generally channel-shaped, or more particularly, a hollow airtight box-shaped structure. A roof 22 is secured to side sheets 12. Side sill 16, which extends along the lower marginal portion of each side sheet 12, has an upper leg 26 and a lower leg 28 secured to the outer surface of adjacent side sheet 12 to form a hollow airtight box-shaped structure therewith.

Car 10 has a plurality of hoppers 30 separated by partitions 32. End slope sheets 34 and side slope sheets 36 lead to bottom discharge structures generally indicated 38. Bottom

discharge structures 38 are adapted to permit a flow of air upwardly into the lading for aerating the interior of the car in addition to permitting the discharge of lading from the car. Each bottom outlet structure 38 includes a housing having an upper rectangular flange 40 which may be bolted or welded to a flange 42 on the underside of each hopper 30. A gravity gate 44 carried by bottom outlet structure 38 is mounted thereon for sliding movement between open and closed positions. A rack and pinion combination of any suitable known type, such as those shown in above-mentioned application Ser. No. 760,933, or U.S. Pat. No. 3,332,363, dated Jul. 25, 1967, may be provided for opening and closing and gate 44. Positioned above slope sheets 36 and spaced therefrom are perforated sheets 50 having openings 51 and suitably welded at the edges thereof to provide chambers 52. The car may be covered with insulating material 54, as indicated in FIGS. 4 and 6.

The bottom of stakes 20 open into side sills 16. Openings 56 permit air to pass from side sills 16 to chamber 52. Conduits 58, 60 extend to side sills 16 from conduits 62, 64. A valve mechanism 66 is adjustable as shown in FIGS. 7 and 8 to reverse the direction of flow of air, so that air may flow from conduit 68 through blower 70 to conduit 62 (FIG. 7), or from conduit 64 through blower 72 to conduit 74 (FIG. 8). Blowers 70 and 72 are driven by motors 76, 78 and are of the centrifugal paddle wheel type. Air flowing down conduit 62 passes through conduits 58 and 60 to side sills 16, and then into chambers 52 and through openings 51 in plates 50 into the interior of the car, as well as flowing from side sills 16 through openings 79 in side stakes 20 into the car. Air in the car is returned to blower 70 by side plates 14, which have openings 80 to the interior of the car, or by conduits 82 in the upper corners of the car, or both. When valve 66 is placed in the position shown in FIG. 8, the flow occurs through blower 72, instead of blower 70, and the direction of flow is reversed. In either case, the air flows over an evaporator 90. If desired, the air flow may be reversed by any suitable means, at predetermined temperature levels. Generally, it is desirable to supply heated air to the bottom and sides of the car, and supply cool air to upper portions of the car.

If air in the interior of the car is above a predetermined temperature, such as 60°F., evaporator 90 will be controlled so as to cool the air. Evaporator 90 includes a plurality of generally horizontally extending coils having vertical fins or plates connected thereto with the air flowing between the plates. A conventional refrigeration cycle is employed with refrigerant liquid in the coils absorbing latent heat from the moving air until the liquid is completely evaporated and forms a gas.

The conventional refrigeration apparatus here utilized is indicated in FIGS. 6 and 9, and is shown and described more fully in above-mentioned application Ser. No. 760,933.

Compressor 92 compresses the refrigerant gas drawn from evaporator 90 and discharges the gas to condenser 94. Condenser 94 includes a fan 96 for cooling the gas and the refrigerant changes from gas to liquid. The liquid refrigerant is then forced by pressure to an expansion valve, not shown herein, leading to evaporator 90. The expansion valve controls the flow of liquid refrigerant to evaporator 90 and is responsive to the outlet temperature of evaporator 90. The expansion valve releases the pressure of the liquid and reduces it from the condenser pressure to that of the evaporator. The reduction of pressure allows the refrigerant to boil at a low temperature since heat from the air flows through the evaporator surface into the liquid which is at a lower temperature. Thus, the refrigerant system cycle includes four functions: (1) absorbing heat as the liquid refrigerant evaporates; (2) forcing the heat contained in the resulting gas to a higher temperature level by compression; (3) rejecting heat by the condensation of the compressed refrigerant vapor; and (4) reducing the pressure of the liquid refrigerant to the evaporator level so that the cycle may be repeated.

To supply power for the operation of the aerating system, a diesel engine 98 drives a generator 100. Controls for the phasing of the various operations are arranged in control panel

102. Electric energy from generator 100 drives compressor motor 104, condenser fan motor 106, and blower motors 76 and 78.

When the exhaust air from the interior of car 10 reaches a predetermined minimum, such as 40° F., the cooling cycle is stopped by various thermostatic controls in control panel 102, and a heat cycle may be started at around 35° F., for example. A heating element is located in the bottom of evaporator 90 and comprises spaced parallel heat conduits 110 extending between the ends of evaporator 90. Heat conduits 110 are of the electric resistance type, and air passing downwardly between the spaced heat conduits 110 into hood 112 is heated before entering blower 74.

The car may be provided with a tank 125 for a cryogenic fluid, such as liquid nitrogen, if it is desired to supplement the conventional refrigerating apparatus with cryogenic cooling. It is apparent that the car, and particularly the aerating system thereof, will be provided with other accessories which are not part of the present invention and have, therefore, been omitted for the sake of simplicity.

I claim:

1. In a covered hopper railway car having sidewalls including side sheets and an array of reinforcing vertical hollow side stakes on said side sheets extending throughout the length and height thereof; means for aerating lading in said car, comprising air propelling means mounted on the car; first air conveying means connecting the bottom of said side stakes to one side of said air propelling means; means for placing said side stakes in communication with the interior of said car; second air conveying means connecting the other side of said air propelling means to the interior of said car, whereby air is circulated through said car via said air conveying means and said stakes.

2. A car according to claim 1, wherein said stakes are on the outside of said sidewalls, said sidewalls having perforations along each of the stakes in registry therewith.

3. A car according to claim 2, wherein said first air conveying means includes channel-shaped side sills extending along said sidewalls and communicating with said stakes.

4. A car according to claim 1 having a plurality of hoppers each having a bottom outlet structure, and means for discharging air into said bottom outlet structure, including an air conduit between said first air conveying means and each bottom outlet structure.

5. A car according to claim 4, including opposed perforated slope sheets forming a false bottom for said outlet structure.

6. A covered hopper railway car for aerating lading transported by the car and comprising a pair of opposed sides; an array of hollow stakes on each side, said stakes having air passages communicating with the interior of the car; a plurality of hoppers between the sides, each hopper having a bottom outlet structure with discharge opening therein for unloading the lading from the car; a closure for the discharge opening movable between open and closed positions; means to provide a continuous supply of air to lading within the car, said means comprising a blower mounted on said car, air conduits leading from the blower to the stakes to provide a supply of air to the interior of the car to aerate the lading, said air conduits including a hollow side sill extending along the lower portion of each side for substantially the length of the car, the stakes on each side of the car extending upwardly from one of the side sills; and an air outlet adjacent the upper end of the car.

7. A car according to claim 6, wherein the air outlet includes an upper hollow side plate member extending longitudinally along the upper portion of each side for substantially the length of the car.

8. A car according to claim 2, wherein said second air conveying means includes a pair of channel-shaped side sills extending along the upper edges of the sidewalls of the car for substantially the entire length of the car and being in communication with the interior of the car.