# United States Patent [19]

**Coyle et al.**

[11] **3,731,053**

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[54] **RAILWAY CAR HAVING A HEATED FRESH AIR INTAKE**


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[73] Assignee: **ACF Industries, Incorporated,** New York, N.Y.



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[52] **U.S. Cl.** .....**219/202,** 98/6, 98/10, 105/247, 105/451, 165/41, 219/366

[51] **Int. Cl.**.....**H05b 1/00**

[58] **Field of Search**.....98/6, 8, 9, 10, 14; 105/247, 451; 219/202, 203, 366–368, 369, 370; 165/41–44



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*Primary Examiner*—A. Bartis

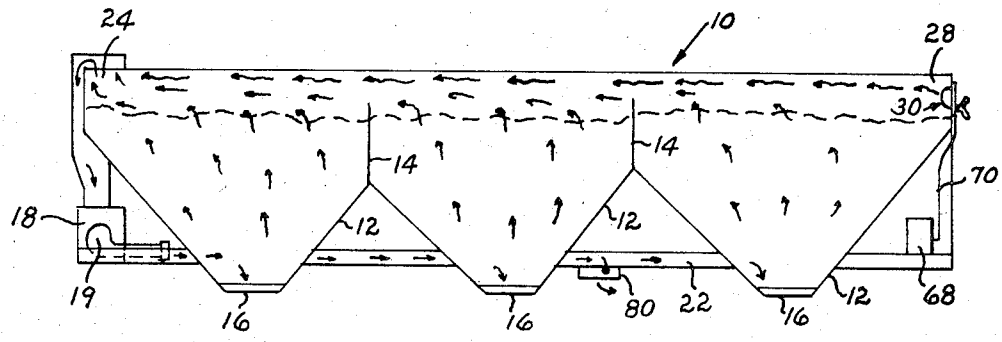
*Attorney*—Eugene N. Riddle et al.



[57] **ABSTRACT**

In a railway car, such as a closed hopper car, conditioned by circulated air, condensation may occur near the roof, which is difficult to insulate effectively. The conditioning air, which may be heated air, is fed into the bottom of the hoppers and exhausted at one end of the car. A shielding stream of electrically heated air admitted at the other end of the car near the roof flows along the roof and prevents moisture laden circulated air from striking the cold roof directly, and thus prevents condensation. A portion of the circulated air is exhausted to atmosphere to facilitate the inflow of fresh air, and thus increase the oxygen content and reduce the humidity when the car contains oxygen consuming, moisture emitting lading.


**7 Claims, 5 Drawing Figures**



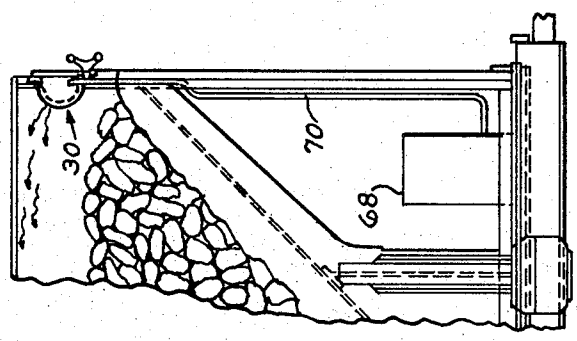



FIG. 2.

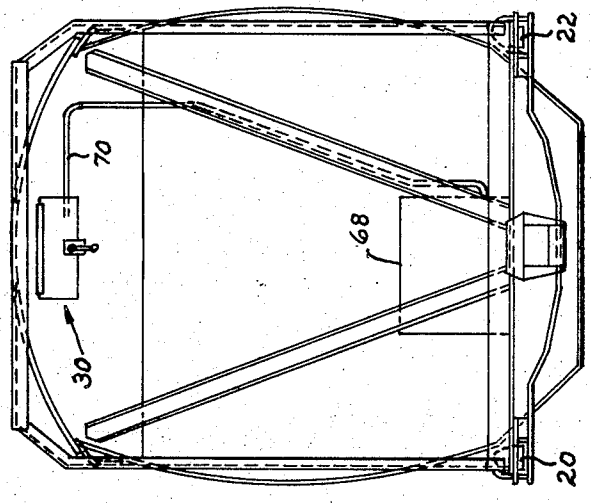



FIG. 1.

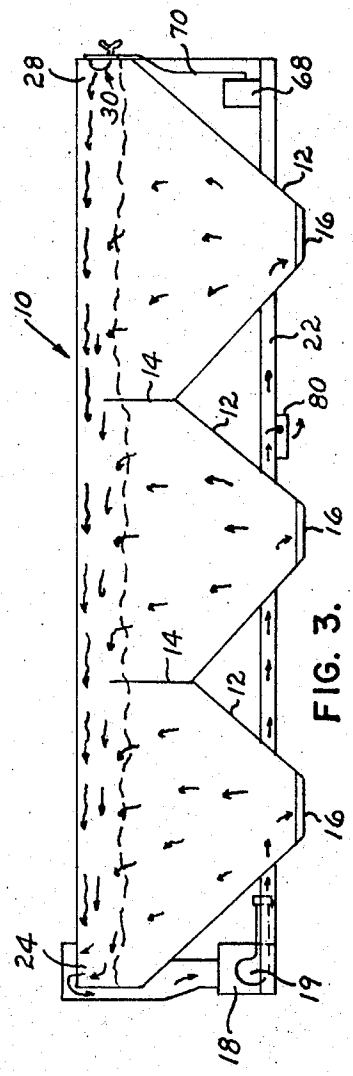



FIG. 3.

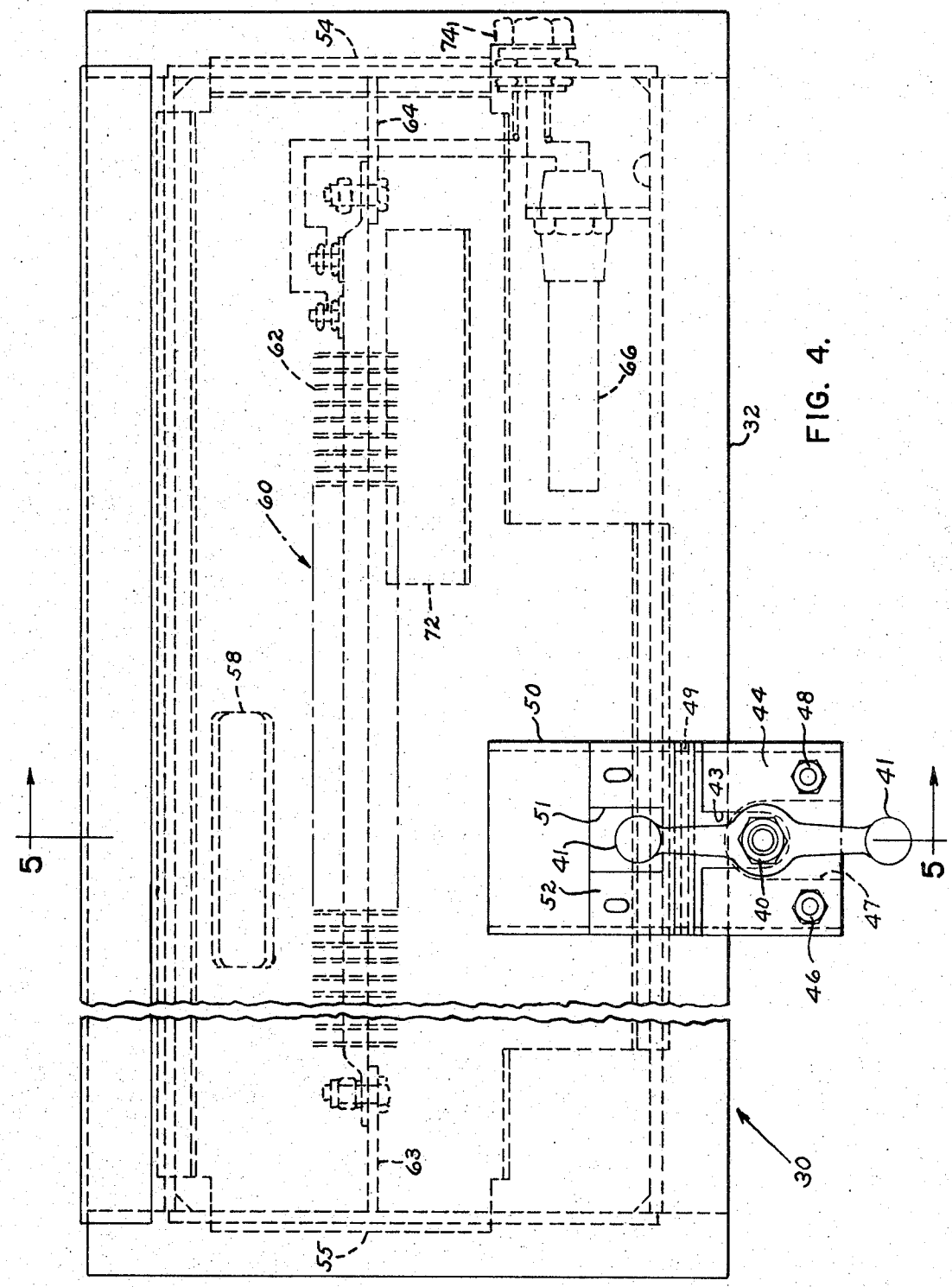

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FIG. 4.

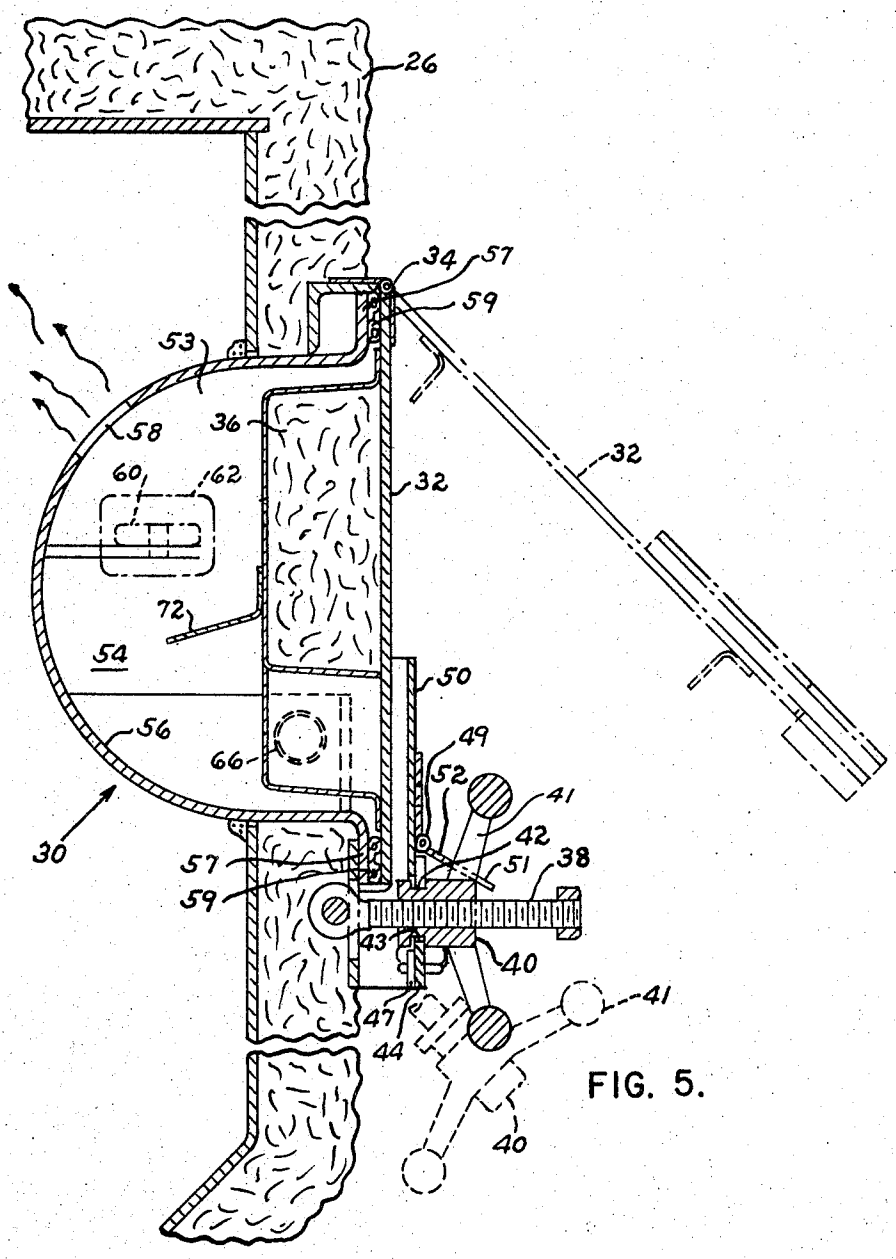

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FIG. 5.

# RAILWAY CAR HAVING A HEATED FRESH AIR INTAKE

## BACKGROUND OF THE INVENTION

The invention pertains particularly to railway hopper cars hauling fruits and vegatables. Such cars are heated, when necessary, by circulated air. Fruits and vegetables, being living organisms, take in oxygen and give off carbon dioxide. During this respiratory, moisture is sometimes emitted which needs to be removed from the car to eliminate any excess moisture content from the fruits and vegetables. The moisture content varies with the type of fruit or vegetable and with the temperature of the commodity.

Excessive moisture content may be in certain commodities, such as fresh fruits or vegetables, due to storage conditions or to a partially deteriorated condition. For example, potatoes in a partially deteriorated condition may emit an excess amount of moisture when placed within the car. Further, depending on ambient temperatures, excessive condensation may occur within the car such as the roof areas of the car during cold weather and this condensation may be partially absorbed by the commodity.

The quality of fruits and vegetables is affected by the amount of moisture in the air surrounding them in transit. A high relative humidity of around 90 percent is desirable in most commodities to minimize any deterioration and to have the commodity in top quality upon unloading. An excess of moisture in the commodity might require an excessive drying time after the commodity is unloaded and before it is processed. Thus, in addition to a specific temperature range for the commodity during transit, the moisture content of the commodity should be maintained within a specific range for maintaining the top quality of the commodity.

The object of the invention is to improve the environment of the lading in all these respects by the use of only very simple means.

## SUMMARY OF THE INVENTION

In a heated covered hopper car hot air is supplied to the bottom of the hoppers and is exhausted at one end near the top of the car. At the top of the other end of the car an inlet is provided with a door which can be positively held open to any degree, or closed. Round the opening is a hood or housing, in which is mounted an electric heater and a thermal switch controlling the heater. In winter, when condensation may occur in the roof area, the door is opened to allow cold air to sweep in over the thermal switch and the heater and then through an opening in the housing into the car. The heated fresh air thus supplied flows along the roof of the car to the exhaust end thereof. This heated air prevents the circulated air, which may have a very high humidity, from striking the roof, which is generally not as well insulated as other portions of the car. Thus condensation from the circulated air in contact with the cold roof is avoided. A part of the circulated air is preferably bled off to atmosphere.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an end elevation of the body of a covered hopper car to which the invention is applied.

FIG. 2 is a side elevation of one end of the car, partly broken away.



FIG. 3 is a schematic side view of the car body illustrating the air flow pattern.

FIG. 4 is a front elevation of the auxiliary air intake and heating apparatus.

FIG. 5 is a section taken along line 5—5 of FIG. 4.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing, a covered hopper car is provided with a heating system for circulating heated air through the body of the car. The car **10** includes a plurality of covered hoppers **12**, with partitions **14** and bottom outlets **16**. A suitable heater **18** and blower **19** supply the heated air to the side sills **20**, **22** which feed air to the bottom of hoppers **12**. Heated air flows through the car generally as indicated by the arrows in FIG. **3** and is exhausted at the top of end **24** of the car. The particular manner in which the air is conveyed to the bottom of the hoppers is not important so far as this invention is concerned. It is noted, also, that air conditioned cars for hauling perishable commodities are generally insulated and include cooling means as well as heating means, although for simplicity the cooling means are not shown in this application. Air conditioned cars of the type here concerned are shown in U.S. Pat. Nos. 3,486,241; 3,570,592 and 3,584,564, and may contain the heating and cooling equipment of these patents.

Covered hopper car **10**, as shown in FIG. **5**, has exterior insulation **26**, and is indicated in FIG. **2** as being loaded with potatoes, as an exemplary commodity. At end **28** of the car is air intake apparatus **30**. It consists of door **32** pivoted at **34**, and provided with insulation **36**. Door **32** can be locked closed or adjustably opened by pivoted screw **38** and wing nut **40**. Nut **40** has a slot **42** adapted to fit an upwardly opening cutout **43** of U-shaped plate **44**, which is held by bolts and nuts **46**, **48** on plate **50**. Plate **50** has a slot **47** which receives screw **38** and nut **40** as in FIG. **5**. Plate **50** is fixed to door **32**. Stop member **52** pivoted at **49** receives handle **41** within slot **51** and prevents nut **40** from being rotated after door **32** has been positioned at the desired location by rotation of nut **40**. FIG. **4** shows stop member **52** pivoted to an upward disengaged position with respect to handle **41** and FIG. **5** shows stop member **52** in an engaged position with respect to handle **41** and preventing rotation of nut **40**. To fully open door **32** as shown in broken lines, plate **44** must be removed to permit the downward pivoting of screw **38** as shown in broken lines. Door **32** forms the outer side of a housing **53** including sides **54**, **55** and a hood **56** provided with opening **58**. A flange **57** extends about hood **56** and a gasket **59** is inserted between door **32** and flange **57**. Heater **60**, having fins **62**, is supported on hood **56** by plates **63**,**64**. Thermal switch **66** is connected in series with heater **60** and a suitable current source **68**, such as a generator or batteries, by cable **70**. Baffle **72** on the back of the door prevents direct radiation of heat from the heater to thermal switch **66**. Cable **70** enters housing **54** through connector **74**.

As shown in FIG. **5**, door **32** is shown in a fully closed position and ambient air is not being taken into covered hopper car **10**. Wing nut **40** includes handles **41** and when backed off from the position shown in FIG. **5** will provide spacing between door **32** and the lower flange **57** of hood **56** providing a fresh air inlet and permitting

ambient air to enter. The amount of spacing between door **32** and lower flange **57** may be varied by the amount of "backing off" of wing nut **40**. The arrows indicated at opening **58** indicate the flow of air when ambient air is provided from the spacing between door **32** and hood **56**.

The apparatus herein described is intended to operate in cold weather when heated air will be circulated upward through the hoppers and will absorb moisture from such ladings as fruits and vegetables. Although the car is insulated, the roof is generally not as well insulated as other portions of the car, because of structural difficulties, and hence the roof may be cold enough to cause a considerable amount of condensation, resulting in an undesirable wetting of the lading. However, in winter door **32** will be opened and allow cold air to strike thermal switch **66**. When the temperature of the switch drops to about 35° F, it closes and causes energizing of heater **60**. The air heated by the heater **60** passes through opening **58** and flows along the roof of the car to the exhaust end **24** of the car and thus provides a layer of warm air adjacent the roof. The flow of the air from apparatus **30** along the roof is produced by the pressures and flow of the circulated air and does not require auxiliary propulsion means. The intake and flow of fresh air through heating apparatus **30** is facilitated by exhausting circulated air through suitable ports or openings **80** in the air circulating ducts. The stream of warm air from apparatus **30** shields the circulated moisture laden air from direct contact with the roof and thus reduces condensation and obviates excessive wetting of portions of the lading. The intake of fresh air in place of exhausted circulated air is also helpful in reducing excess carbon dioxide, where the lading produces carbon dioxide. Should the door be closed accidentally or by inadvertence, thermal switch **66** will be heated above threshold temperature and open the circuit to prevent burning out of the heater. In the warm parts of the year door **32** will be closed, for then apparatus **30** is not needed.

While air intake apparatus **30** has been illustrated as positioned adjacent the roof of a railway car to remove condensation, it will be understood that apparatus **30** may be positioned, if desired, adjacent other portions of the railway car to minimize condensation. For example, apparatus **30** could be positioned adjacent the floor of a "box type" refrigerator railway car.

It is thus apparent that the problem of condensation in cold weather is solved, and other advantages are obtained with very simple inexpensive apparatus.

What is claimed is:

**1.** In a railway car having a closed body adapted to carry moisture containing lading and having means for circulating conditioned air about the lading in the body, the improvement comprising apparatus for minimizing condensation on a surface of said body, said apparatus including an electric heater energized from a power source on the car and located generally adjacent said surface at end of the car, a fresh air inlet at said end of the car for providing a stream of ambient air past the heater, a thermal switch located in the stream of air ahead of the heater and connected in circuit with the heater for closing the circuit when the temperature of the ambient air is below a given value, said means for circulating conditioned air being so arranged relative to said air inlet that during operation of said air circulating means a shielding stream of fresh air is caused to flow within the car across said surface to prevent condensation thereon of moisture from the humid air being circulated about the lading by said air circulating means.

**2.** Apparatus according to claim **1**, including an adjustable closure means for closing said fresh air inlet or opening it a selected amount.

**3.** Apparatus according to claim wherein said air circulating means includes means for continuously exhausting a portion of the circulated air, thereby permitting fresh air to be supplied to said car body through said air inlet.

**4.** Apparatus according to claim **3**, wherein said car is a closed hopper car having a plurality of hoppers, the conditioned air is introduced into the body at the bottom of each hopper and withdrawn at the other end of the car near the top thereof, whereby the pressures in the car body cause the fresh air from said inlet to flow adjacent the roof across the length of the car to prevent condensation on the inner surface of the roof.

**5.** Apparatus according to claim **1**, including a housing for said heater and thermal switch, said housing including a pivoted door forming an outer wall of said housing and providing the fresh air inlet when opened, whereby the heater heats the thermal switch and causes it to turn off the heater unless cold air is flowing over the switch and heater.

**6.** In a railway car having a closed body adapted to carry moisture containing lading and having separate means for circulating heated air through the body from the lower portion of the body to the upper portion thereof, the improvement comprising apparatus for minimizing condensation on the upper surfaces of said body, said apparatus including an electric heater at one end of the car adjacent the roof thereof said heater being energized from a power source on the car, a fresh air inlet at said end of the car for providing a stream of ambient air past the heater, a thermal switch located in the stream of air ahead of the heater and connected in circuit with the heater for closing the circuit when the temperature of the ambient air is below a given value, said means for circulating conditioned air being so arranged relative to said air inlet that during operation of said air circulating means a shielding stream of heated fresh air is caused to flow within the car over said upper surfaces to prevent condensation thereon in cold weather of moisture from the humid air being circulated about the lading by said air circulating means, a housing for said heater and thermal switch, said housing including a pivoted door forming the fresh air inlet and adjustable between open and closed positions, and means to adjust the spacing between the door and housing to permit the entry of a predetermined amount of fresh air.

**7.** Apparatus as set forth in claim **6** wherein said means to adjust the spacing between the door and housing includes a manually rotatable member engaging the pivoted door for varying the amount of fresh air admitted.

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