United States Patent

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[54] **VENT STRUCTURE FOR COVERED HOPPER CARS**
9 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **98/6**, 98/13, 55/385, 302/52
[51] **Int. Cl.** **B60l**
[50] **Field of Search** 98/6, 13

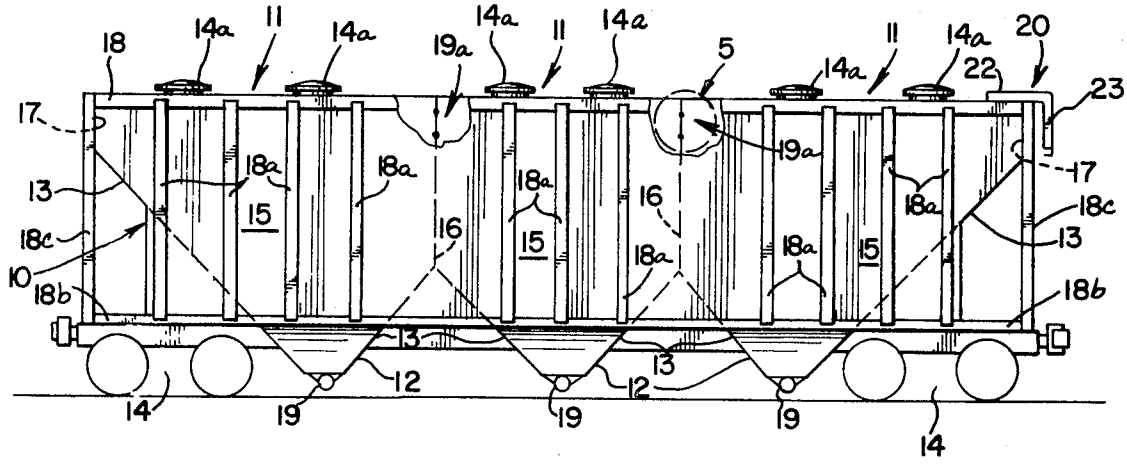
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ABSTRACT: A venting device attached about an opening in the roof of a hopper car to permit air to enter the interior of the car during pneumatic unloading thereby equalizing pressure within the hoppers with atmospheric pressure to prevent collapsing of the car walls, and having a horizontal portion overlying the roof and a vertical depending portion disposed over the end wall in spaced relation thereto. Replaceable screening and filtering members are included with the vent arrangement to prevent contamination of the inside of the car by foreign objects which could enter with the air.



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SHEET 1 OF 2

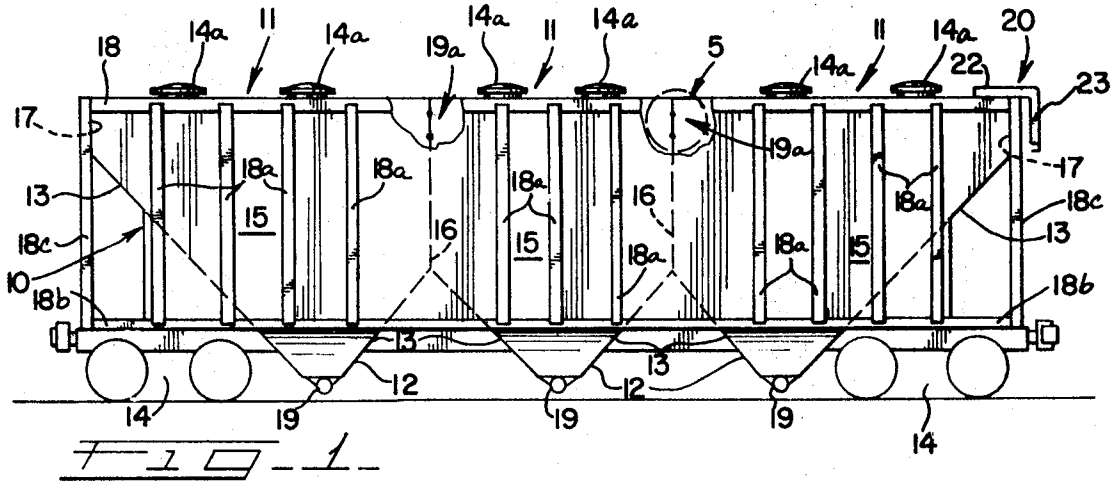


FIG. 1

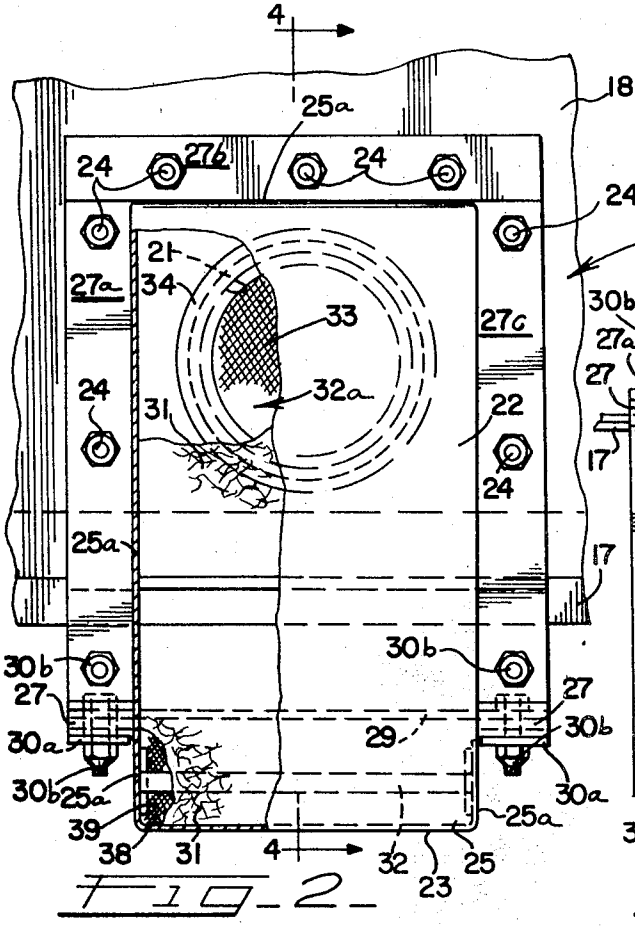


FIG. 2

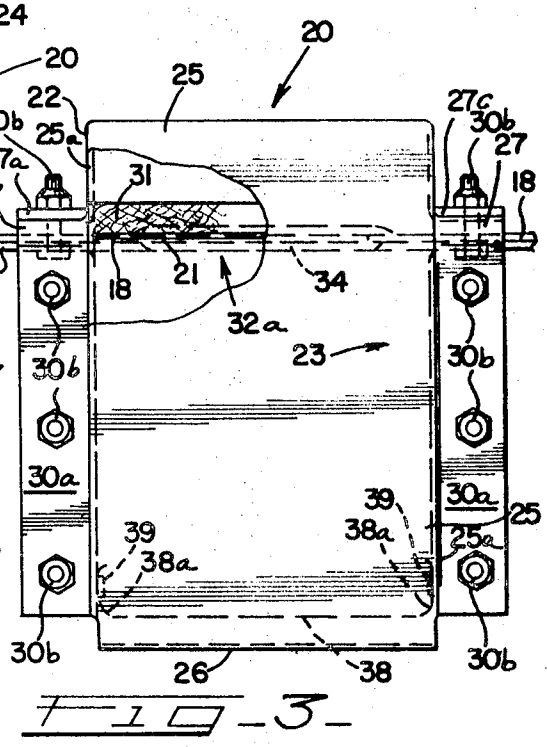


FIG. 3

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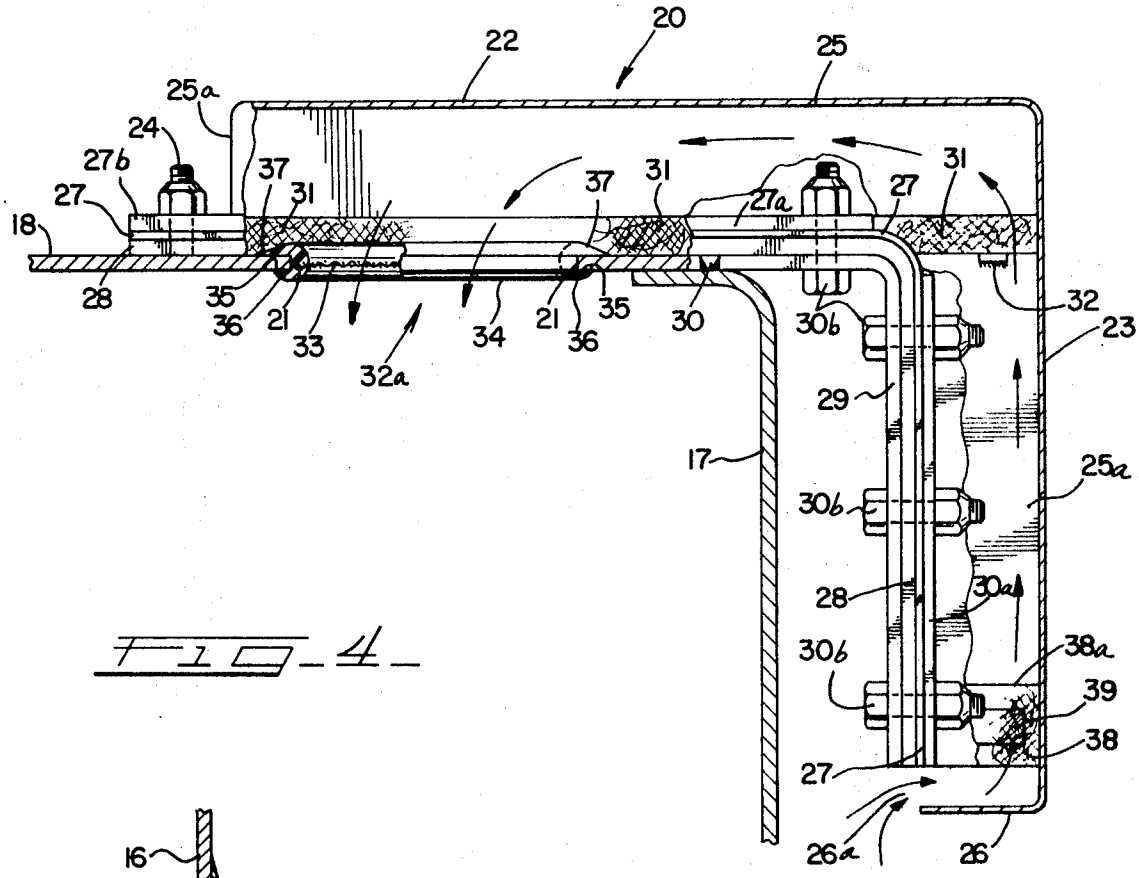


FIG. 4

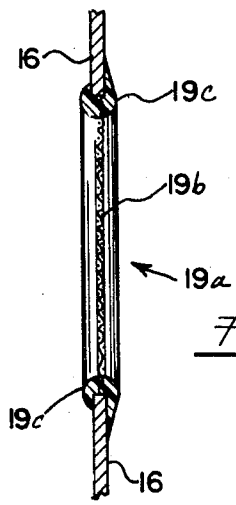


FIG. 5

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VENT STRUCTURE FOR COVERED HOPPER CARS

SUMMARY

The present invention pertains to a venting device used in railway hopper cars to equalize the pressure inside the hoppers with atmospheric pressure when the cars are unloaded pneumatically with their hatches closed thereby facilitating discharge of the lading and preventing damage to the slope sheets and walls of the hoppers by forces caused by the pressure differential between the inside of the hoppers and the outside atmospheric pressure.

The venting device of the present invention is positioned adjacent an opening in the roof of the hopper car and admits atmospheric air through this opening, thus a location has been chosen which is least susceptible to blockage from a buildup of the lading in front of the opening which admits air. Venting devices located at the end bulkheads or in the sides of hoppers are easily blocked when an impact of the car causes the lading within the hopper to shift and this shift produces a buildup of the lading which obstructs the opening to the venting device which is located in the sidewalls or end bulkheads. Venting devices which allow air to enter through the roof are less susceptible to this blocked condition because lading generally will not be loaded into a hopper to a point which allows a lading shift which occurs on impact to be great enough to reach the roof of the hopper and thereby block an opening for a venting device.

It is an object of the present invention to provide an improved venting structure which is easily adapted to present hopper car structures.

Another object of the invention is to provide a vent structure which includes replaceable filter elements.

Still a further object of the invention is to provide a venting device which admits air through the roof of a hopper car and is least susceptible to blockage by lading.

A further object of the invention is to provide a vent which does not have any fastening devices or filtering elements or other parts of the vent structure extending into the hopper in a manner which would retain lading and present contamination problems for subsequent loads after discharge of the hoppers.

These and other objects of the invention will become apparent from reference to the following description, attached drawings and appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevation of a covered railway hopper car illustrating the venting device of the present invention;

FIG. **2** is an enlarged partial top plan view illustrating the vent device of FIG. **1** with parts broken away;

FIG. **3** is an enlarged partial end elevational view illustrating the vent device with parts broken away;

FIG. **4** is a partial cross-sectional view taken generally along line **4**—**4** of FIG. **2**; and

FIG. **5** is a view greatly enlarged of a portion of FIG. **1** contained within the dotted-line circle indicated by the numeral **5**.

DETAILED DESCRIPTION

With reference now to the drawings and in particular to FIG. **1**, there is illustrated a covered hopper railway car **10** including a plurality of hoppers **11** having a bottom material discharge portion **12** defined by converging wall sections or slope sheets **13** and projecting downwardly below the main car body structure between the spaced wheel trucks **14**. Hatches **14***a* permit material to be loaded into the hoppers **11** from above the hopper car **10**. The side sheets **15** and the intermediate partitions or bulkheads **16** and end bulkheads **17** combine with the slope sheets **13** and the car roof **18** to define the end hoppers and the intermediate hopper. Vertical sidewall posts **18***a* are longitudinally spaced and connected to the side sheets **15** and the side sill **18***b*. Cornerposts **18***c* are located at the four corners of the hopper car **10**.

Attached to the bottom of the discharge portion of the hopper is a pneumatic feed device **19** which is adapted for attachment to a pneumatic conveying system (not shown). As a vacuum is applied to the pneumatic feed device **19** particles of the lading contained within each hopper will be discharged. Also, since the hoppers are virtually airtight when the hatches **14***a* are in a closed position, a vacuum applied to the pneumatic device **19** creates a vacuum in the interior of the hopper resulting in a pressure differential between the hopper interior and the atmospheric pressure. This pressure differential results in forces being exerted on the sides of the hopper and on the bulkheads which can result in a damage caused by a collapsing or bulging inward of these members.

In a hopper car the hoppers **11** of the car **10** may be in communication with one another above the bottom discharge devices **12** or may be isolated from each other by various wall structures or partitions **16** as illustrated in FIG. **1**. Such arrangements are well known and are not illustrated in detail in the accompanying drawings. If the hoppers are individually isolated, venting arrangements must be provided for each hopper. Accordingly, in the present invention the hoppers are divided by the intermediate bulkheads **16** to prevent movement of lading between the hoppers; however, a screening device **19***a* in an opening in the bulkheads **16** provides for the flow of air between adjacent hoppers.

The screening device **19***a* includes a screening member **19***b* secured in a resilient mounting member **19***c* which is fitted in a circular opening in the bulkhead **16** in a manner as illustrated in FIG. **5**. Thus in the hopper car illustrated in FIG. **1** there is a requirement for only one venting device **20** to function as a pressure relief mechanism for all three hoppers; however, a second venting device could be utilized at the upper left portion of the car illustrated in FIG. **1** to further ensure complete venting of all the hoppers in the event the screening devices contained in the bulkheads **16** would become clogged or obstructed with lading. The venting device **20** is easily adapted to existing hopper cars or new cars and the only modification required to employ the vent is that a circular opening **21** be made in the roof **18**.

The venting device **20**, as best illustrated in FIG. **4** is substantially L-shaped and includes an upper horizontal portion or extension **22** and a vertical portion or extension **23** which is spaced outward at the cornerposts **18***c* and end bulkheads **17**. The horizontal portion **22** is positioned adjacent the opening **21** in the roof **18** and held in place between studs **24** which function both as fastening devices and as positioning means for the venting device **20**. The fastening studs **24** are welded to the roof **18** and do not extend into the interior of the car.

The horizontal and vertical portions **22** and **23** respectively include an L-shaped cover member **25** having a hat-shaped cross section with flanged portions **27** extending outward from its vertical sides **25***a*. The part of the cover **25** extending over the vertical portion **23** includes a horizontally extending end portion **26** and thereby defines one side surrounding the bottom opening **26***a*. Flat-fastening members **27***a*, **27***b*, **27***c* are located on top of the horizontal flanged portion **27** of the cover **25**. A resilient gasket member **28** which extends the length of the flange **27** is positioned between the flanged member and the car roof **18**. The vertical portion **23** of the venting device is spaced from the end bulkhead **17** by an L-shaped closure member or bracket **29** which also serves to close off the open side of the hat-shaped cover, thus forming the hollow boxlike vertically extending portion **23**. The bracket member **29** is attached at **30** by a weldment to the end bulkhead **17**, and as indicated in FIG. **4**, extends a short distance therefrom and then extends in a substantially vertical direction. The cover **25**, plate members **27***a*, **27***b*, **27***c* and the gasket **28** are secured to the roof of the hopper car by means of fasteners **24**. The vertically extending portion of the cover **25**, the flat rectangular fastening bars **30***a*, bracket **28** and the vertical portion of the gasket **28** are secured together by means of fasteners **30***b*. The gasket member **28** is substantially U-shaped around the periphery of the cover **25** and compresses when the fastening devices **24**, **30***b* are tightened to thereby effect a seal between the flange **27** and both the roof **18** and the angle bracket member **29**.

The horizontal portion 22 of the venting device 20 contains a removable sheet-type filter element 31. This filter element 31 extends the length and width of the horizontal portion 22 and is supported over the vertical portion 23 by the support bar 32 which extends across the cover member 25 and is securely affixed as by a weldment to each side of the cover. This filter element 31 is of a fine mesh and is intended to trap very fine airborne particles. The second filtering element 32*a* is located in the opening 21 in the roof 18. A screen 33 is contained in an annular resilient member 34 which has an outer groove 35 permitting the resilient member to be fitted snugly into the opening 21. The lower edge 36 of the groove 35 is of a slightly larger diameter than the opening 21 in the roof 18 and will deflect upon insertion of the filtering element 32*a* to permit the opening 21 to be secured in the groove 35 and thereby provide a tight fit about the opening 21. Although the bottom edge portion 36 of the filter element 32*a* extends into the interior of the car, it will not retain or catch lading since the edge 36 is arcuate and smooth (see FIG. 4). The upper edge 37 of the resilient member 34 is of a larger diameter than the lower edge 36 and is of such diameter to restrain the screening device from falling or being pushed through the opening 21.

A third filtering element 38 in the form of a substantially horizontal screen with vertically extending end portions 38*a* is positioned at the opening of the venting device at the bottom of the vertical portion 23 and intended to initially filter air being drawn into the hopper. The screen is held in place by two tabs 39 which are welded to the cover 25. The horizontally extending portion 26 of the vertical portion of the cover 25 is spaced from the screen 38 to allow air to pass easily through the screen and yet placed in such a position as to protect the screen from airborne objects which could cause damage.

THE OPERATION

When the hoppers 11 are pneumatically unloaded and the pressure inside the hoppers is lower than the surrounding atmospheric pressure, air drawn in through the bottom opening 26*a* and through the screen 38 will progress vertically and through the Fiberglas filtering element 31 and then horizontally until it once again passes through the Fiberglas filter 31 and then through the second screening member 32*a*. Air entering from the atmosphere to the interior of the hopper is filtered twice by the Fiberglas filtering element 31 and once by each screening device 32*a* and 38, for a total of four filtering stages for entering air.

The horizontally extending end portion 26 of the cover 25 located at the bottom of the vertical portion 23 is utilized in protecting the screen 38 from airborne objects such as pebbles and stone which could puncture it and thereby seriously curtail its filtering ability.

With the automatic hopper-venting device above described, it is unnecessary to remove the hatch covers of the car during material unloading. This operational feature not only reduces unloading time and cost, but also substantially eliminates possibility of material contamination during unloading. Utilization of one of the venting devices with the closed pneumatic material-conveying systems establishes a completely closed material-unloading operation, fully protecting the material from contamination or from damaging effects of adverse weather conditions during unloading.

The venting device 20 may be disassembled by unscrewing the fastening devices 24, 30*b* which exposes the filtering devices for replacement or cleaning.

Because the venting device 20 is positioned adjacent a screened opening 21 in the roof 18 it is less susceptible to being blocked by lading within the hopper than similar venting devices located in end bulkheads.

The L-shape of the venting device 20 disposes the opening 26*a* in a position away from the roof 18 where it is protected from airborne objects during car movement thereby preventing damage to the interior of the device, and providing for free flow of air when the car is being unloaded.

The foregoing description and drawings merely explain and illustrate the invention and the invention is not limited thereto, except insofar as the appended claims are so limited, as those skilled in the art who have the disclosure before them will be able to make modifications and variations therein without departing from the scope of the invention.

WHAT IS CLAIMED IS:

1. In a covered hopper car having opposing sidewalls and opposing end walls and a roof structure attached to said end and said sidewalls, and an opening in said roof structure communicating with the interior of the car, a venting device adjacent said roof opening to permit flow of air into or from the interior of the car when air pressure within the car is higher or lower than ambient air pressure, said device comprising:
   - an open-ended vertical portion and a closed end horizontal portion,
   - said horizontal portion having an opening adjacent, and fitting about, said roof opening to form an enclosure about said roof opening,
   - said venting device having a passageway therethrough from the open-ended portion to the roof opening thereby permitting air to flow between the interior of the car and the open-ended vertical portion,
   - filtering screen means in the vertical portion to initially filter air entering the device through the open-ended vertical portion,
   - a filtering sheet means removably disposed in said horizontal portion and so disposed to filter air passing between the horizontal and vertical portions,
   - said sheet means extending across said roof opening to filter air passing between the horizontal portion and the car interior, and
   - a filtering screen means removably disposed in the roof opening.

2. The invention according to claim 1, and
   - said filtering screen means in said roof opening including a resilient mounting means removably secured in said roof opening,
   - said resilient mounting means including an annular member containing said filtering screen means and having an outer groove insertable about the roof opening releasably engaging the periphery of said roof opening for retaining the filtering screen means in position in the roof opening.

3. The invention according to claim 1, and
   - said open-ended vertical portion adjacent said end walls and spaced therefrom and including a horizontally extending end portion spaced from said filtering screen means in the vertical portion and extending across the said filtering screen means to protect said screen means from damaging airborne materials.

4. A vacuum relief device adapted to fit about an opening in the roof of a covered hopper car to permit air to flow into or from the interior of the car when air pressure within the car is higher or lower than ambient air pressure, said device comprising:
   - an open-ended vertical portion and a closed end depending horizontal portion,
   - said horizontal portion having an opening adjacent and fitting about said roof opening to form an enclosure about said roof opening,
   - said venting device having a passageway therethrough from the open-ended vertical portion to the roof opening thereby permitting air to flow between the interior of the hopper car and the opened-ended vertical portion,
   - filtering screen means in the vertical portion to initially filter air entering the device through the open-ended vertical portion,
   - a filtering sheet means positioned in said horizontal portion and so positioned to filter air passing between the horizontal depending portion and the vertical portion,
   - said sheet filtering means extending across said roof opening to filter air passing between the horizontal portion and the car interior, and
   - a filtering screen means positioned in the roof opening.

5. The invention according to claim 4, and

said open-ended vertical portion including a horizontally extending end portion spaced from said filtering means in the vertical portion and extending across said filtering screen means to protect said screen means from damaging airborne materials.

6. In a covered hopper car having opposing sidewalls and opposing end walls and a roof structure attached to said ends and said sidewalls, and an opening in said roof structure communicating with the interior of the car, intermediate bulkheads extending transversely between said sidewalls and said bulkheads spaced longitudinally to provide individual hopper means along the length of said railway car, said bulkheads including screened openings for passage of air between adjacent hopper means, a venting device adjacent said roof opening to permit flow of air into or from the interior of the car when air pressure within the car is higher or lower than ambient air pressure, said device comprising:

a closed end horizontal portion and an open-ended depending vertical portion,

said horizontal portion having an opening adjacent and fitting about said roof opening to form an enclosure about said roof opening,

said venting device having a passageway therethrough from the open-ended vertical portion to the roof opening thereby permitting air to flow between the interior of the car and the open-ended vertical portion,

filtering means in the vertical portion to initially filter air entering the device through the open-ended vertical portion,

a filtering sheet means positioned in said horizontal portion and so positioned to filter air passing between the horizontal depending and the vertical portions,

said filtering sheet means extending across said roof opening to filter air passing between the horizontal portion and the car interior, and

a filtering screen means positioned in the roof opening.

7. The invention according to claim 6, and

said horizontal portion of the vent device removably attached by threaded fasteners to the roof structure of said hopper car for retaining the vacuum relief device in position on the outer surface of said roof, and permitting its removal from the roof when replacement of the filter means is required, and

said open-ended vertical portion adjacent said end wall and spaced therefrom.

8. A venting device adjacent an opening in a railway vehicle to permit the flow of air into the interior of said vehicle when air pressure within the vehicle is lower than ambient air pressure, said device including:

a horizontal portion surrounding said opening,

a downwardly extending vertical depending portion having a rectangular cross section with an open lower end portion,

said vertical portion spaced from said vehicle to permit an unrestricted flow of air into said lower opening of the vertical portion, and

filtering means positioned in said venting device to purify air entering into said vehicle.

9. The invention according to claim 8, and

said venting device removably attached to said vehicle to facilitate replacement of said filter means,

said vertical portion including horizontally extending end portion spaced from said open end to prevent damaging airborne particles from entering venting device.