July 13, 1965 F. W. SCHWARTZ, JR., ETAL 3,194,183

VEHICLE HATCH COVER

Filed Oct. 24, 1962

2 Sheets-Sheet 1

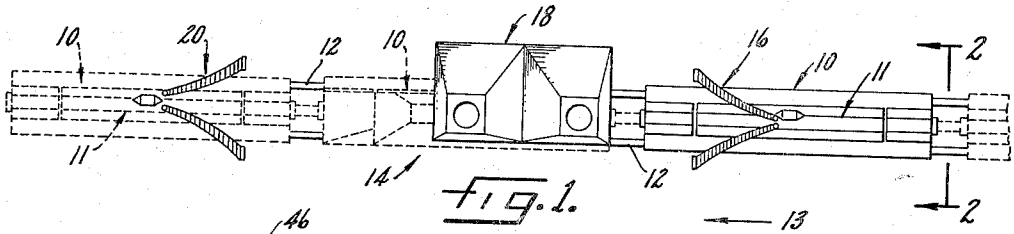


Fig. 1.

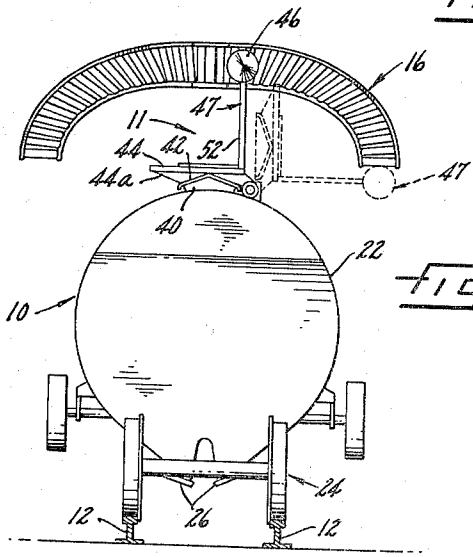


Fig. 2.

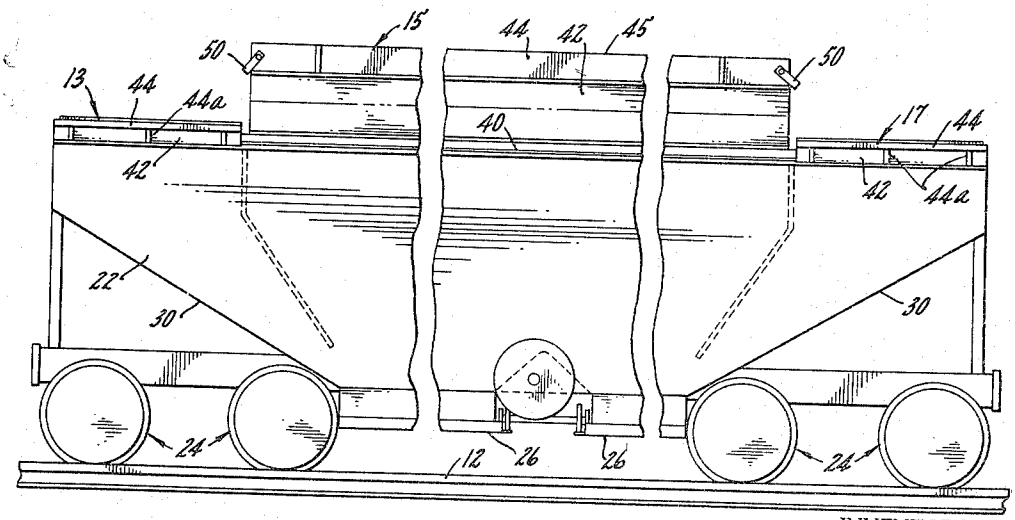


Fig. 5.

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2 Sheets-Sheet 2

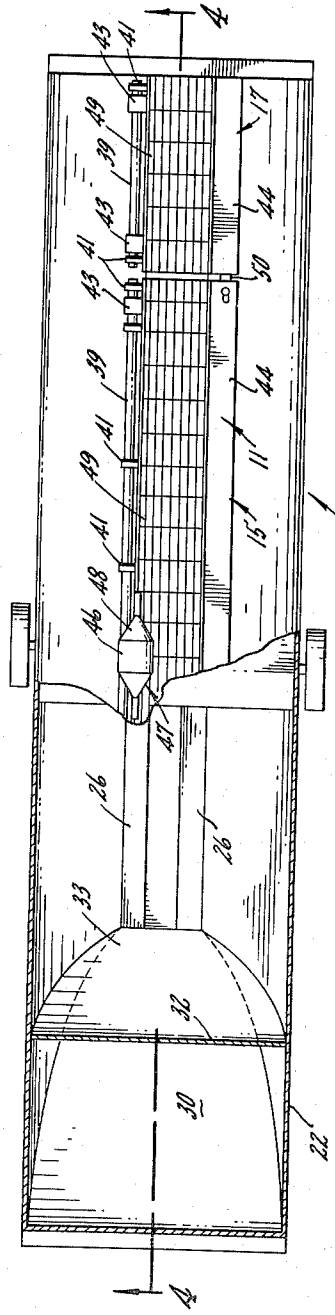


FIG. 3.

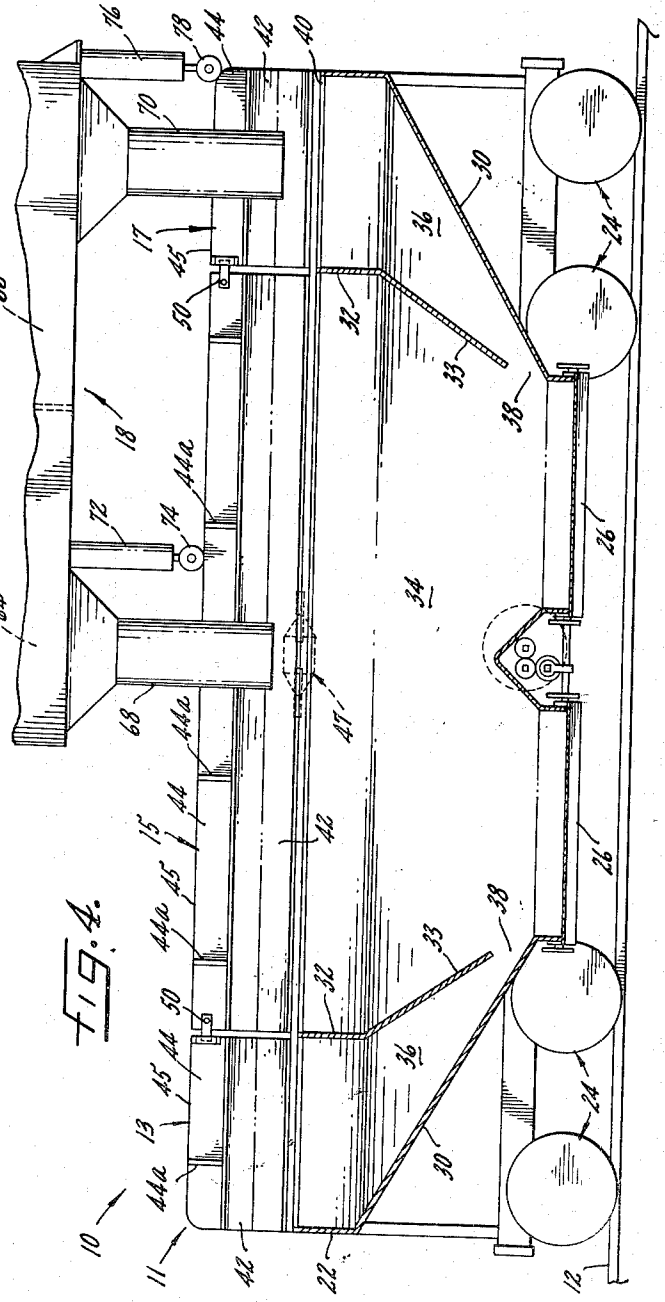


FIG. 4.

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United States Patent Office 3,194,183 Patented July 13, 1965

3,194,183

VEHICLE HATCH COVER

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Filed Oct. 24, 1962, Ser. No. 232,704
1 Claim. (Cl. 105—377)

The present invention relates to hopper cars adapted to carry solid particulate material, such as iron ore and the like.

In addition, many solid particulate materials are adversely affected by excessive moisture and the like which may result from exposure to natural environmental conditions, such as rain, snow, and the like. For this reason hopper cars of the closed type were developed and are well known in the art. However, hopper cars of the closed type heretofore employed have been difficult to load and have not readily lent themselves to automatic loading. It is therefore desirable to provide, in combination with a hopper car adapted to carry solid particulate material of different densities, a hatch cover assembly whereby the hopper car may be automatically loaded.

It is a further object of the present invention to provide for such a hopper car a hatch cover assembly whereby said hopper car may be automatically opened, filled with a solid particulate material, and automatically closed while the hopper car is moving.

It is yet a further object of the present invention to provide for such a hopper car a hatch cover assembly whereby overloading of said hopper car by wayside loading means is precluded.

The invention, both as to its organization and method of operation, taken with further objects and advantages thereof, will best be understood by reference to the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a top plan view of a hopper car embodying the features of the present invention, illustrating the hopper car in selected ones of its loading positions;

FIG. 2 is an enlarged end view of the hopper car of FIG. 1 taken along line 2—2 of FIG. 1;

FIG. 3 is an enlarged plan view, partially cut-away, of the hopper car of FIG. 1;

FIG. 4 is a side cross-sectional view of the hopper car of FIG. 1 taken along line 4—4 of FIG. 3, the hopper car being beneath wayside loading means and illustrated with its hatch cover assembly in an open position; and

FIG. 5 is a side cross-sectional view of the hopper car of FIG. 1, illustrating its hatch cover assembly in another open position.

Referring now to the drawings and more particularly to FIG. 1, the hopper car embodying the features of the present invention is illustrated generally by reference numeral **10**. It will be understood that the hopper car **10** is just one of many such hopper cars which may be connected to form a freight train moving for purposes of illustration, from right to left on tracks **12** as indicated by the arrowed line **13** in FIG. 1. As the hopper car **10** approaches the loading zone, indicated generally by reference numeral **14**, it is empty and its hatch cover assembly **11** is closed.

In the loading zone **14** the hatch cover assembly **11** is opened, the hopper car **10** is filled with solid particulate material, and the hatch cover assembly **11** is closed in a sequential operation effected as the hopper car **10** moves on the track **12** at a speed in the range of about one to five miles per hour. The loading zone **14** includes a wayside hatch opening mechanism, indicated generally by reference numeral **16**, a wayside loading bin **18**, and a wayside hatch closing mechanism, indicated generally by reference numeral **20**.

When the locomotive (not shown), for example, of the freight train passes the hatch opening mechanism **16**, it trips a switch (not shown) whereby the hatch opening mechanism **16** is lowered into an operative position with respect to the trailing hopper car **10**. As the hopper car **10** passes beneath the hatch opening mechanism **16**, the hatch cover assembly **11** of the hopper car **10** is opened to permit solid particulate material from the loading bin **18** to pass into the hopper car **10**. The hatch cover assembly **11**, itself, actuates the loading bin **18** in a manner more apparent hereinafter to cause solid particulate material therefrom to be dropped into the open hopper car **10**.

As the locomotive, for example, passes the hatch closing mechanism **20** it trips another switch (not shown) which lowers the hatch closing mechanism **20** into an operative position whereby it will close the hatch cover assembly **11** of the trailing hopper car **10** passing beneath it. In this manner, the hopper cars **10** of the freight train, while traveling at speeds in the range of about one to about five miles per hour, are opened, loaded with material, and closed as they move through the loading zone **14**. The caboose, for example, of the freight train actuates additional switches (not shown) to raise the hatch opening mechanism **16** and hatch closing mechanism **20**.

Referring now to FIGS. 2, 3 and 4, the hopper car **10** and its associated hatch cover assembly **11** embodying the features of the present invention are illustrated in more detail. The hopper car **10** includes a hollow main body **22** having a generally tear-shaped cross-section mounted upon trucks, indicated generally by reference numeral **24**, which ride upon the tracks **12**. In this instance, the hopper car **10** has four hopper doors **26** of the type illustrated and described in co-pending William E. Fritz application, Serial No. 232,729, filed October 24, 1962, and assigned to the same assignee as the present application. The specific structure of the hopper door **26** does not constitute a part of the present invention and it will be understood that any suitable type of hopper door may be provided on the hopper car **10**.

The ends of the body **22** of hopper car **10** have inclined bottom portions **30** which converge inwardly toward each other and aid in unloading the particulate material from the hopper car **10** by directing the material toward the hopper doors **26**. These end bottom portions **30** of the body **22** are downwardly inclined about 30° from the horizontal toward the hopper doors **26** and thereby, in a manner more apparent hereinafter, assist in unloading the hopper car **10**.

The main body **22** of the hopper car **10** is divided into three longitudinally aligned compartments, i.e., a center compartment **34** and two end compartments **36**, by partitions **32** which extend transversely across the interior of the main body **22**. These partitions **32** have lower portions **33** downwardly converging toward one another at an angle from the horizontal greater than about 35°. The partitions **32** form with the end bottom portions passages **38** by which the end compartments **36** communicate with the central compartment **34**.

At the top of the hopper car **10** is a hatch opening **40** extending longitudinally along its entire length. The hatch cover assembly **11** is composed of three sections, end sections **13** and **17** and center section **15** intermediate thereof, which sections **13**, **17**, and **15** function to open and close the end compartments **36** and the central compartment **34**, respectively. Each of the sections **13**, **15**, and **17** is pivotally attached to the main body **22** and includes a cover means **42** and a cam track **44**. A pivot actuator means **47** is associated with the center section

15 of the hatch cover assembly 11 whereby the center section 15 only or all three sections may be opened, depending upon whether it is desired to load merely the central compartment 34 or the end compartments 36 also.

The cover means 42 of the sections 13, 17, and 15 are adapted to close the hatch opening 40 over the end compartments 36 and the central compartment 34, respectively. However, when the respective cover means 42 of the sections 13, 15, and 17 are in their open position, solid particulate material may enter the hatch opening 40 and the respective compartments. For example, in FIG. 4, all three sections 13, 15, and 17 are in their open position and in FIG. 5 only section 17 is in its open position. Suitable seals (not shown) may be placed about the opening 40 and on the cover means 42 to insure that moisture will not enter the hopper car 10.

The cam track 44 in each section 13, 15, and 17 comprises a metallic member having an outwardly extending free edge 45 which acts as a cam in a manner more apparent hereinafter to actuate the loading bin 18 and effect loading of the particular compartment or compartments of the car 10, as desired. The cam tracks 44 extend the entire length of the car compartment with which they are associated as seen in FIGS. 3, 4, and 5. The cam tracks 44 are substantially horizontally disposed when its section of the hatch cover assembly 11 is in its normal position, as shown in FIGS. 2 and 3, and is substantially vertically disposed when its sections are in their open positions as shown in FIGS. 4 and 5. As shown in FIG. 3, the hatch cover assembly 11 may have a walk-way 49 thereon which is usable when assembly 11 is in its normally horizontal position. Each cam track 44 is rigidly secured to its associated cover means 42 by braces indicated generally by reference numeral 44*a*.

The pivot actuator means 47 is adapted to cause the center section 15 of the hatch cover assembly 11 to pivot from its normally horizontal position to its open vertical position and vice versa. Furthermore, when it is desired to open the entire assembly 11, the end sections 13 and 17 are secured to the center section 15 by releasable means 50 or the like, whereby the pivot actuation means 47 opens the assembly 11 as a unit. The releasable means 50 illustrated in the drawings each comprise a U-shaped member having legs which are attached by suitable means to the cam track 44 of the end sections 13 and 17. A pivotable latch member attached to the cam track 44 of the center section 15 is associated with each U-shaped member. The latch member has an exterior handle (see FIG. 3) by which the latch member is pivoted into and out of cooperative engagement with the U-shaped member to attach the respective end sections 13 and/or 17 to the center section 15. It will be understood that the releasable means 50 may be operated from the outside of the car 10 and do not per se constitute a part of the present invention.

The pivot actuator means 47 includes a cylindrically shaped member 46 having conical ends 48, the longitudinal axis of which extends substantially parallel to the longitudinal axis of the car 10. The cylindrical member 46 is fixedly secured to the cover means 42 of the center section 15 by support members 52 which are extending upwardly when the center section 15 of the hatch cover assembly 11 is in its normally horizontal position.

The cover means 42 of each section is attached by a plurality of attachment members 41 to a torsion tube or rod 39 rotatably supported in pillow block type hinge butts 43 secured to the main body 22. In this manner, the rigidity of the sections of the hatch cover assembly 11 is enhanced and torque placed upon the cover means 42 during pivoting is minimized.

In FIG. 2, the hopper car 10 is shown approaching the hatch opening mechanism 16 with the entire hatch cover assembly 11 in its normally closed position. The hatch opening mechanism 16 is identical to that described and illustrated in William E. Fritz's co-pending application,

Serial No. 232,703, filed October 24, 1962, and assigned to the same assignee as the present invention, and therefore will not be described in detail herein. Briefly, the cylindrical member 46 engages the hatch opening mechanism 16 whereby the entire hatch cover assembly 11 (by virtue of the end sections 13 and 17 being attached to center compartment 15 by clamps 59) is opened, the hatch opening mechanism 16 acting as a cam whereby the cylindrical member 46 is cammed outwardly and downwardly in an arc to cause the hatch cover assembly 11 to pivot about the torsion tubes 39 into its open position shown in phantom in FIG. 2. This, of course, causes the cam tracks 44 to be moved from a substantially horizontal position to a substantially vertical position and the hatch covers 42 to be lifted off of the opening 40, with the result that the compartments 34 and 36 are conditioned to receive solid particulate material. When the assembly 11 is opened, the over-center position of the cam track 44 and the cover means 42 and the weight of cylindrical member 46 maintains the hatch cover assembly 11 in its open position. The hopper car 10 therefore approaches the loading bin 18 with the hatch cover assembly 11 in the open position as shown in FIG. 4.

The loading bin 18, which does not per se constitute a part of the present invention, is, in this instance divided into two hoppers 64 and 66. For purposes of illustration, it will be assumed that the hopper 64 is loaded with low density taconite pellets and the hopper 66 is loaded with high density iron ore powder. Each hopper 64 and 66 has a loading nozzle 68 and 70, respectively, which has been automatically lowered after the train locomotive, for example, has passed beneath the loading bin 18. The nozzle 68 is controlled by a vertically movable actuator 72 having a roller 74 rotatably attached to its free end. Similarly, the nozzle 70 has a vertically movable actuator 76 having a rotatable roller 78 attached to its free end. If it is desired to load the hopper car 10 with low density solid particulate material from the hopper 64, the end sections 13 and 17 are clamped to the center section 15 whereby all three sections open upon actuation of the pivot actuation means 47. In addition, the actuator 76 is automatically disconnected by means not shown whereby the nozzle 70 remains in a closed position at all times. As the hopper car 10 moves toward the left, when viewing FIGS. 1 and 4, the roller 74 of the actuator 72 engages and rolls upon the free edge 45 of the cam track 44 of the end section 13. In this manner, the actuator 72 moves upwardly slightly, this vertical movement being sufficient to open the nozzle 68 whereby the low density, taconite pellets flow by gravity from the hopper 64, through the nozzle 68, and into the end compartment 36 of the hopper car 10.

As the hopper car 10 continues to pass beneath the loading bin 18, the roller 74 moves onto the free edge 45 of the center section 15. The nozzle 68 continues to be open at this stage and thus to drop low density material into the hopper car, and more particularly, into center compartment 34. The loading operation remains the same as the roller 74 moves onto the free edge portion 45 of the other end section 17 whereby low density material is dropped in the other end compartment 36 also. The low density material from the hopper 64 is therefore deposited in all three compartments of the hopper car 10, whereby a maximum amount of material may be loaded in the hopper car 10 without overloading. It will be understood that the size of the nozzle 68 and the speed with which the train or hopper car 10 passes beneath the loading bin 18 will determine the extent to which the hopper car 10 is filled with low density material. However, in accordance with the present invention, when all the compartments 34 and 36 are completely filled with the low density material, in this instance taconite pellets, the hopper car 10 is loaded to the maximum permissible A.A.R. limits. When the roller

74 leaves the end section 13, the actuator 72 moves downwardly sufficiently to close the nozzle 68.

After the hopper car 10 has been loaded with solid, particulate material, the car 10 passes beneath the hatch closing mechanism 20, which has been lowered into position to close the hatch cover assembly 11. The hatch closing assembly 20 is identical to that described and illustrated in William E. Fritz's co-pending application Serial No. 232,703, filed October 24, 1962, and assigned to the same assignee as the present application, and therefore will not be discussed in detail herein. Briefly, the cylindrical member 48 associated with the center section 15 of the hatch cover assembly 11 contacts the door closing mechanism 20 and is thereby directed upwardly and inwardly to pivot the hatch cover assembly 11 back to its normal position and thereby close the opening 40. In this manner, the hopper car 10 in the train is sequentially opened, loaded, and closed while the train moves through the loading zone 14.

If, on the other hand, the hopper car 10 is to be loaded with high density material, loading the entire hopper car 10 would cause an overload in violation of the A.A.R. requirements. Dividing the hopper car into compartments 36 and 34 affords a means by which the problem of shifting material and overloading is obviated. The compartment 34 is utilized as the loading zone for the high density material and, in accordance with the present invention, is sized such that when completely filled with the high density material, in this instance iron ore powder, the hopper car 10 is loaded to the permissible maximum A.A.R. limits. To this end, the actuator 72 is de-energized by means not shown, whereby the nozzle 68 remains closed regardless of the vertical movement of the actuator 72. The actuator 76 is, on the other hand, energized. In addition, the end sections 13 and 17 are disengaged from the center section 15 whereby only the center section 15 is opened by the door opening mechanism 16, as shown in FIG. 5. In this instance, the end compartments 36 are closed by the end sections 13 and 17 and the center compartment 34 is opened to receive material through the hatch opening 40.

Accordingly when the roller 78 of the actuator 76 contacts the free edge 45 of the cam track 44 of the section 15, it is moved upwardly in the same manner as the actuator 72 described hereinbefore, whereby the high density material from the hopper 66 flows through the nozzle 70 into the compartment 34. Likewise, the nozzle 70 is shut off when the roller 78 has moved off of the free edge 45 of the center section 15. The closed end sections 13 and 17 assist in preventing high density, solid particulate material from entering the end compartments 36. The high density material does not act as a liquid though a small amount of this material will flow into the end compartments 36 through the passages 38. In this manner the center compartment 34 of the hopper car 10 is completely loaded, the volume of this compartment being slightly less than the maximum amount of such high density material which may be carried without violating the A.A.R. requirements.

It will be understood that the closing operation in this instance is essentially the same as when the entire assembly 11 is opened as discussed hereinbefore.

Assuming that the hopper car 10 has been loaded with high density material, i.e., only the center compartment 34 has material therein, the inwardly inclined bottom portions 33 of the partitions are of particular importance during unloading. High density material, such as iron ore powder, generally has an angle of repose or slide angle of greater than 30°. In particular iron ore powder has a slide angle of about 33°. In other words, if iron ore powder is dumped into a pile, it would have a generally conical shape the sides of which would form an angle of about 33° with a horizontal plane. For this reason the bottom portions 33 of the partitions 32 have an angle with respect to the horizontal of greater than 33°, in this instance about 35°. As a result, during unloading the high density material will slide out of the compartment 34 and not stay on the bottom portions 33 of the compartment 34. If, for example, the high density iron ore powder is also loaded in the end compartments 36, when the hopper doors 26 are opened to unload the material, high density material would remain on the bottom end portions 30 because the angle of the end portions 30 is about 30° and, therefore, less than the angle of repose of the high density material. Low density solid particulate material, such as taconite pellets, generally has an angle of repose less than 30° and therefore the bottom end portions 30 are generally of a sufficient angle from the horizontal at 30° to assure that during unloading all the low density material is unloaded from the hopper car 10.

A further advantage of the hopper car 10 is that its assembly of hopper doors 26, which all open during unloading and are actuated by a single opening means in a manner apparent from the previously identified application, will handle the unloading operation whether only compartment 34 or all the compartments are loaded with material by virtue of the particular communication between the compartments discussed hereinbefore.

It will be understood that the hopper car 10 may have more than three compartments with combinations thereof adapted to be completely filled to achieve maximum loading depending upon the density of the material to be hauled. It will also be understood that the bottom portions 33 may have an angle with respect to the horizontal of greater than 35°, for example 90° and may also extend outwardly away from one another. If the bottom portions 33 extend outwardly away from one another they must not do so in a manner which would prevent complete unloading of the end compartments 36 when they are filled with light density material, as will be apparent from the previous detailed discussion.

It will be further understood that though it is preferred to have the compartments in the hopper car 10 disposed along the longitudinal axis of the car 10 that they may be transversely disposed with respect to one another in a concentric-type arrangement.

The cam tracks 44 do not constitute a part of the present invention and are merely illustrative of suitable means which may be employed to load the hopper car 10 when the particular sections of the hatch cover assembly 11 are open and the car 10 is moving. It will be understood that other suitable loading actuation means may be employed and, of course, such actuation means need not be associated with the hatch cover assembly 11.

While the embodiments described herein are at present considered to be preferred, it is understood that various modifications and improvements may be made therein and it is intended to cover in the appended claims all such modifications and improvements as fall within the true spirit and scope of the invention.

What is desired to be claimed and secured by Letters Patent of the United States is:

A hopper car including a main body, said main body having a longitudinally extending hatch opening in the top thereof, said hopper car including, in combination, partitions mounted within said main body to divide said main body into a large center compartment having smaller end compartments adjacent the ends thereof, said hatch opening including a center hatch opening portion for said center compartment and an end hatch opening portion for each end compartment, and a hatch cover assembly having two end sections and a center section, means pivotally connecting each of said sections to said hopper car, said center section being adapted to cover said center hatch opening portion and each of said end sections being adapted to cover one of said end hatch opening portions, means connected to said center section and adapted to cooperate with an overhead opening and closing mechanism to pivot said center section to an open or closed

position, releasable means connecting said end sections to said center section whereby when said releasable means are in their unconnected position said center section may be pivoted independently of the end sections and when said releasable means are in their connected position either one or both of said end sections may be pivoted in response to pivoting said center section.

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