COMPRESSION SWINGING HOPPER DOOR GASKET MEANS

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The present invention relates to railway hopper cars, and more particularly to means for sealing the railway hopper car doors to prevent granular or finely divided bulk materials within the hopper car from shifting out or being inadvertently discharged through the area surrounding the lading discharge opening.

It is well known that in railway hopper cars used in carrying and transporting lading or bulk material from one site to another, considerable loss is incurred due to the lading in the hopper car being discharged through the hopper car doors not being properly sealed.

It is, of course, necessary that the hopper car and the hopper car doors be made of rigid material and be of great strength as a large mass of heavy weight material is generally carried therein. Examples of such material are iron ore, coal, sand, gravel, cement and the like.

In many cases, the material, such as granular concentrates of iron ore may be in approximately the consistency of fine sand. Since the railway cars and the hopper doors must be made of strong material, they are generally made of materials, such as fabricated steel, iron and the like, and in the process of making this rigid structure, it is not always advisable from an economical standpoint to maintain close tolerances. Thus, as sometimes occurs, the parts do not fit or seat together in a precision manner and gaps are not uncommon in the range of three-eighths to one and a quarter inches between the hopper doors and the rim of the lading discharge opening when in fully closed position with the result that material carried in the railway car may be lost by shifting.

In addition to the loss of the lading, some of the materials carried in hopper cars cause serious fouling of the tracks and railroad right-of-way and may even interfere with switches and the like.

In the past, various sealing means have been used but these afforded only limited success. For example, compressible elastomeric materials have been utilized as well as jute wadding and semi-solid caulking materials such as coal tar. However, these materials have not been wholly satisfactory for various reasons. For example, some materials required adhesive securement to the mating surfaces of the hopper door or the lins of the discharge openings and this necessitated undue labor in precleaning the car parts and in the actual installation.

Further, the various materials used herefore were not sufficiently and uniformly resistant to the rigorous and varied conditions commonly encountered. Thus there has been a need for a material that would not deteriorate under high temperature conditions encountered with certain lading materials which are loaded in hopper cars with latent heat from processing operations. Alternately, a sealing means resistant to low temperatures and actual freezing was essential for winter shipments where in the open hopper cars are exposed to rain, snow and freezing and consequent deterioration of the door seal means or fracturing thereof if characterized by brittleness. In connection with the preceding it is often necessary to thaw the lading for discharge and it is a conventional practice to subject the hoppers to flame heat to thaw the same and this has deteriorated prior art sealing means in a manner that rendered them worthless for reuse.

Prior to the present invention economical means for meeting the described conditions were not apparent. However, the present invention has not only met with success under these severe tests but affords the additional advantages of firm resilience to insure an effective seal and readily adaptability to widely varying sized openings about the hopper doors as will be described hereinafter.

In accordance with the present invention, sealing means are provided for hopper car doors that may be readily inserted within the doors to properly seal them and prevent loss of any lading or material carried and transported within the hopper car from one site to another.

It is an object of the present invention to provide a simple gasket sealing means for insertion within the hopper door of a railway car which can be positioned therein by unskilled labor and with a minimum of effort and advance preparations of the car.

It is another object of the present invention to provide gasket sealing means for a hopper car door to prevent discharge of fine lading or material transported in a hopper car, which gasket means is not made of elastomer material, yet which material can be readily deformed by closing the hopper car door so that a seal is provided between the hopper car door and the hopper car chute or door frame.

It is another object of the present invention to provide a corrugated paperboard resilient sheet hopper gasket means having a multiple ply construction to permit separation or combining thereof to adapt to widely varying openings while providing uniform firm resilience.

It is another object of the present invention to provide a hopper car gasket means comprising a relatively planar resilient sheet entirely covering the lading discharge opening, said means being weather resistant and moisture absorbent.

Various other objects and advantages of the present invention will be readily apparent from the following detailed description when considered in connection with the accompanying drawings forming a part thereof, and in which:

FIGURE 1 is a transverse vertical sectional view of the lower portion of one half of a railway hopper car embodying the invention;
FIGURE 2 is a side elevational view of the portion of the car illustrated in FIGURE 1, taken on lines 2-2 thereof;
FIGURE 3 is an expanded cross-sectional view showing the mating of the car door and door rim with the sealing means of the present invention interposed therebetween as in FIGURE 2;
FIGURE 4 is a perspective view of a composite corrugated fibreboard sheet from which the hopper door gasket means is constructed;
FIGURE 5 is a cross-sectional view through line 5-5 of FIGURE 4;
FIGURE 6 is a perspective view of a hopper door gasket means cut away to show the multiple ply construction thereof with releasable securing means uniting the plies together and wire ties securing means for additional securement of the gasket to a hopper door;
FIGURE 7 is a perspective view of a hopper car door with the gasket means secured therein by means of the wire ties being wrapped around and secured on the exterior face of the door.

The invention is embodied in the sealing means for lading discharge openings in the hoppers of railway hopper cars. Such hopper cars are of common usage for bulk granular flowable commodities. Such materials are commonly loaded through the open top of the cars and are discharged through a series of funnel like arrangements or hoppers in the under body portion of the cars. Such hoppers are comprised of generally upright or inclined sides and a discharge opening which is normally closed by a hopper door.

Referring to the drawings, the reference numeral 10 indicates a center sill beam of a railway hopper car and 11 indicates one of the side sills thereof. The hoppers are generally arranged in a series of pairs on opposite sides of the hopper car center sill, and as the hoppers of each pair are of similar construction, only one of them is illustrated in the drawings as shown generally at 15.

The hopper comprises inner and outer side walls or sheets 12 and 13 respectively. An inclined floor sheet 14 forms the bottom of the hopper.

A door frame 19 best shown in FIGURE 2 is connected to the transverse hood sheet 16 of the hopper by rivets.

A peripheral outwardly projecting rim 21 has free edges 22 defines the lading discharge opening 23 of the hopper 15.

Referring particularly to FIG. 1, the lading discharge opening 23 of the door frame 19 is normally closed by a swinging hopper door 25 having hinge straps 26 pivotally connected by pins 27 to hinge lugs 28 which are secured to the upper portion of the door frame 19.

The outer face of the door 25 is provided with a spreader 29 by which it is connected to the door of the hopper on the opposite side of the center sill, or the other hopper door forming the other member of the pair of the hopper doors.

The door is maintained in a closed position by a locking arm 30 fixed to the outer end of the spreader 29 on the front of the door. The locking arm 30 is adapted to be engaged by an arm, not shown, which is secured to the door frame 19 and projects therefrom to engage the arm 30.

The lading discharge opening 23 is defined by the peripheral rim 21 and in particular the free edge 22 thereof. The discharge opening 23 is generally trapezoidal in shape and is provided with an outwardly projecting peripheral rim or flange 21.

The hinged door 25 is provided with a peripheral flange or rim 31 extending around the periphery of a relatively planar margin or mating surface 32. The central portion 33 of the door 25 is commonly contoured outwardly whereby the inner surface presents a concave surface to the interior of the car. The door rim 31 has a size and configuration to enclose the door frame outwardly projecting rim 21 with the free edge 22 thereof in juxtaposition with the inner surface of the door planar margin 32 as best shown in FIGURES 2 and 3.

It is, of course, realized that the outwardly projecting rim 21 and the door 25 are made of relatively thick rigid material, such as steel, cast iron and the like, in order to retain great weights of lading within the hopper car. It is further obvious that in making such capital equipment, it is not always possible to machine or maintain the material in the most desirable fashion due to the expense involved. Consequently, the free edge portion of the rim 21 that is adapted to extend within the complementary rim 31 of the door 25 may not always completely contact the inner mating surface 32 of the door.

25. This results in gaps between the adjacent portions of the free edge 21 and the planar margin or mating surfaces 32 and 34 which may range from three-eighths of an inch up to one and one quarter inches.

Thus, the portions of these two parts may have spaces therebetwixt of such dimensions so that if the hopper car is loaded with lading material of a fine consistency, such as granular concentrates of iron ore of approximately the consistency of fine sand, the gaps between the hopper door 25 and door frame 19 will permit the loss of material through the lading opening 23, because of the sifting nature of the material as it is transported.

In accordance with the present invention, a seal is provided between the rim 21 of the lading discharge opening, and the hopper door 25 by providing sealing means 35 therebetween.

The sealing means 35 comprises a composite sheet of successive layers of corrugated fibreboard material 36 with flat chip board or kraft liner 37 in adhesive secured together relation. Referring to FIGURES 4 through 6, a preferred embodiment is shown wherein the sealing means 35 is comprised of four plies of combined corrugated board 38 and an inner weatherproof facing sheet 39 of heavy solid fibre which may be on the order of 0.060 of an inch thick. As shown in FIGURE 4, the plies may be conveniently manufactured by laminating rectangular sheets in the desired formation and the individual sealing means 35 cut therefrom as by band saw. Alternatively, the plies may be die cut and combined together.

In size and conformation the individual sealing means 35 conform closely to the contours of the hopper door 25 flange or rim 31 so that they have a press fit in the door 25 as shown in FIGURE 2.

In view of tolerances in the mating of the hopper doors 25 with the door frame 19, it has been found convenient in order to attain the required thicknesses to form the sealing means 35 with the individual combined corrugated board members 38 comprised of so-called double wall board with the exception that one outer facing sheet or liner 37 is omitted. Thus, the individual combined corrugated plies 38 as best shown in FIGURE 5 are comprised of a first outer liner 37, corrugated medium 40, an intermediate liner 41 and a corrugated medium 42. A similar result may be gained through an appropriate number of plies 38 of so-called single face board comprised of a corrugated medium 40. In either event, the plies 38 having a corrugated medium exposed on one side thereof afford advantage in economy of materials, facilitate separation of the individual plies as hereinafter described in greater detail, and afford uniformity of resilience. It is to be noted that the double wall board as commonly manufactured by the corrugated paperboard industry normally includes corrugated mediums of different thickness or amplitude of corrugations and this is satisfactory for the purposes of the invention. Further, it is evident that the sealing means or pads 35 may be constructed of combinations of double wall and single face board as desired to attain the necessary thickness.

As shown in FIGURES 3 through 6 inclusive, the inner face of the sealing means 35, that is facing the interior of the car, is comprised of a facing sheet or liner 39. The heavy inner facing 39 is particularly advantageous when the sealing means 35 is intended for reuse and the lading in the car is of an abrasive character such as sintered ore which tends to abrade the seal 35 as the lading is discharged through the opening 23 with the door 25 hinging in the open position.

In view of the impact of the car lading on the sealing paid 35 during normal discharge or unloading of the lading it may be desirable in some instances to supplement the press fit or frictional engagement of the pad 35 edges with the rim 31 of the hopper door 25 by utilizing additional securing means. For example, wire ties 43 may
be inserted through the open flutes or corrugations of the corrugated board member 38 as shown in FIGURES 6 and 7 and these ties wrapped around and secured to the outer face of the door.

As before mentioned, the gaps between the door 25 and door frame rim 21 may vary over a considerable range and it is necessary, in order to obtain a firm resilient seal that the sealing means 35 accommodate itself to such variation. It is not enough that the sealing pad 35 be made of one maximum thickness as this would provide difficulty in closing and latching the door when the gap is relatively narrow. Further, the use of excessive plies 38 would be wasteful of materials and add to the overall cost. Therefore, the plies 38 are separably connected together as best shown in the cut away view FIGURE 6, wherein narrow lines of adhesive 44 are used to secure the plies together. The interrupted or discontinuous pattern of adhesive facilitates the desired separation of the plies and this is aided by the fact that such separable bonds are between a liner 37 and an exposed corrugated medium 42 whereby the adhesive bonds is limited to the relatively minor area of contact of the flute or corrugation tips against the juxtaposed liner 37. For this purpose, it has been found convenient to provide three strips of adhesive transversely to the directions of the corrugations with the strips being on the order of three-eighths of an inch wide and there being three such strips which are positioned respectively three inches in from a pair of opposed sides of the pad 35 and one strip on the median line of the pad. The adhesive used may be selected from numerous known formulations which are characterized by high shear resistance but having comparatively weak tensile strength to facilitate the delamination of separation of the plies 38. Examples of such adhesive are the doctrine types which may be diluted with waxes or the like and the vinyl acetate adhesives which may be diluted by the addition of heavy clays. Such an adhesive may be characterized by having less adhesive strength than the internal adhesion of the fibre to fibre bond of the paperboard materials.

It will be apparent that such a separable ply construction not only provides flexibility in decreasing the thickness of the sealing means 35 to accommodate the particular gap to be sealed, but also permits the unused separated plies to be combined together with each other or with other pads 35 to attain desired thicknesses, in particular instances and to avoid waste of materials.

In regard to the inner facing sheet 39, it is not required that this individual ply of the sealing pad 35 be separable and normally an overall adhesive application is used to secure it to the juxtaposed ply 38. The inner facing sheet 39 facing the interior of the car not only obtains the brunt of the abrasion from the lading but also is exposed to the action of moisture in the lading and to weather and it is preferable that this be protectively coated with paraffin or other well known coatings suitable for paperboard application. It is to be noted, however, that such coatings, particularly under the very rigorous conditions commonly encountered, does not completely resist moisture and such sealing pads 35 being of paperboard construction are absorptive and will absorb moisture and retain the same. Surprisingly, this is not disadvantageous as regular paperboard grades are commonly provided with sufficient wet strength that they will withstand the heretofore described conditions even when infused with a high moisture content. To the moisture content can be ascribed the heat and flame resistance which has been experienced with the present sealing means 35 in contrast to sealing materials and gaskets heretofore used for sealing the lading discharge opening of hopper cars.

It is to be understood that the embodiments herein described are illustrative and not restrictive, it is also to be understood that the invention may be susceptible to em-
board, means for releasably securing the plies together whereby the pad may be divided intervening the plies to provide a sealing pad of sufficient thickness to seal the opening existing between the hopper door and the rim in the closed position of the pair.

6. The combination as set forth in claim 5 wherein the sealing means is provided with wire ties secured to the closure door preventing dislodgment of the corrugated paperboard pad during discharge of the railway car loading.

7. The combination as set forth in claim 5 wherein the corrugated paperboard plies are comprised of single-faced corrugated board, each ply having a corrugated member on one face thereof and a liner on the opposite face, the securing means being adhesive disposed in a discontinuous pattern adhering a corrugated member of one ply to the liner of the adjacent ply.

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