July 29, 1941. W. F. DIETRICHSON 2,250,524

HOPPER DISCHARGE

Filed May 18, 1938 4 Sheets-Sheet 1

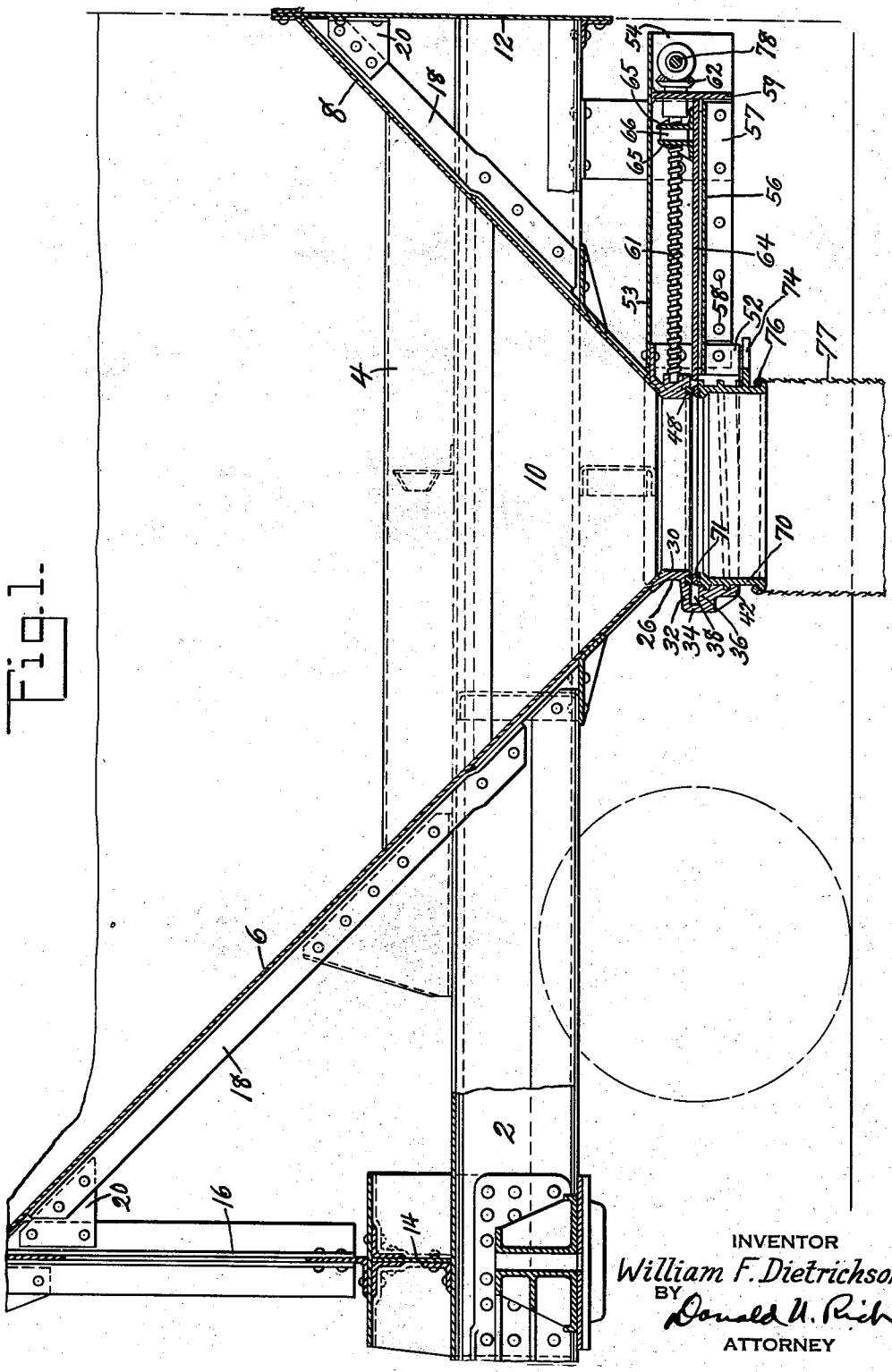


Fig. 1.

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HOPPER DISCHARGE

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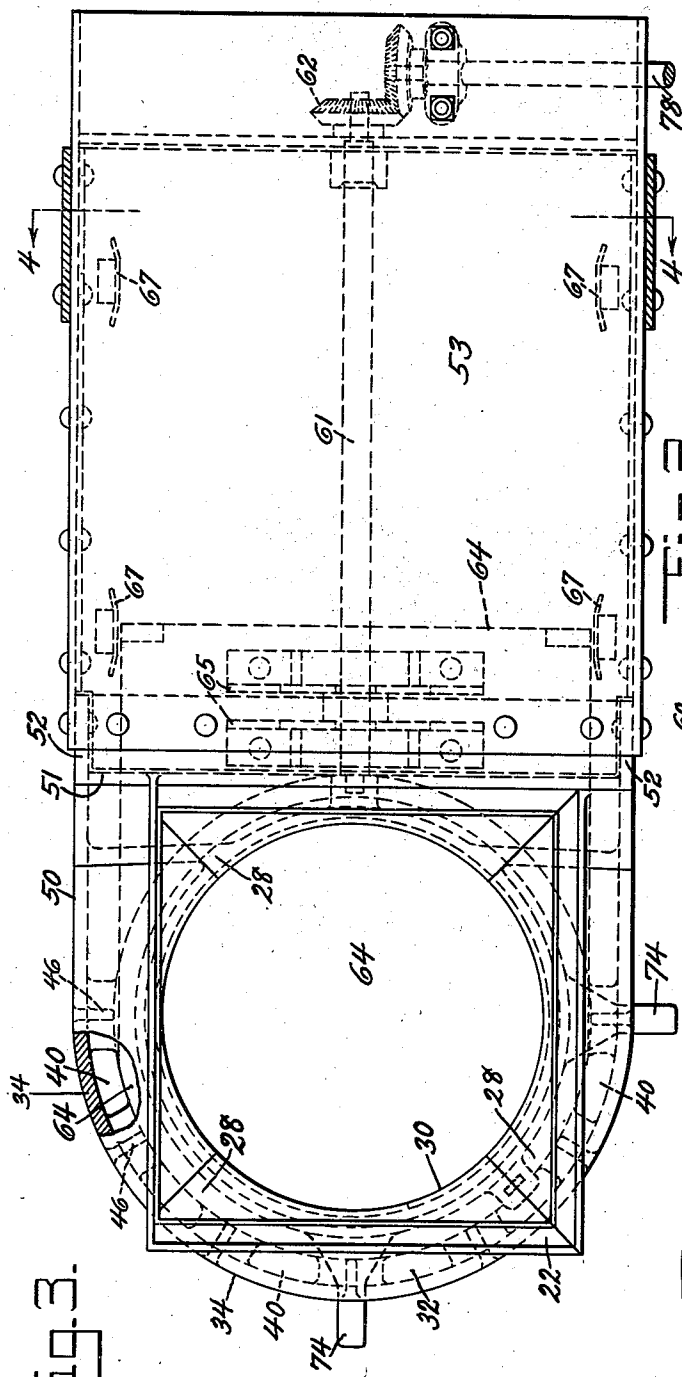


Fig. 3.

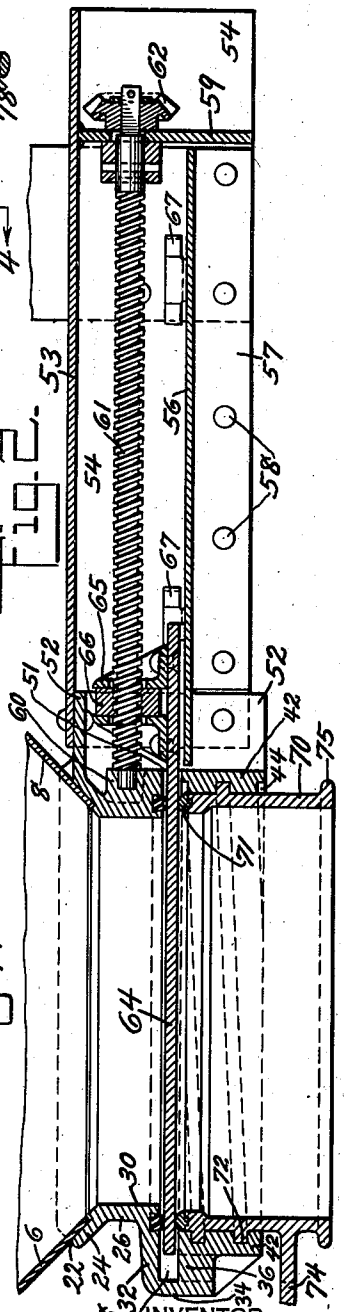


Fig. 2.

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HOPPER DISCHARGE

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Fig. 5.

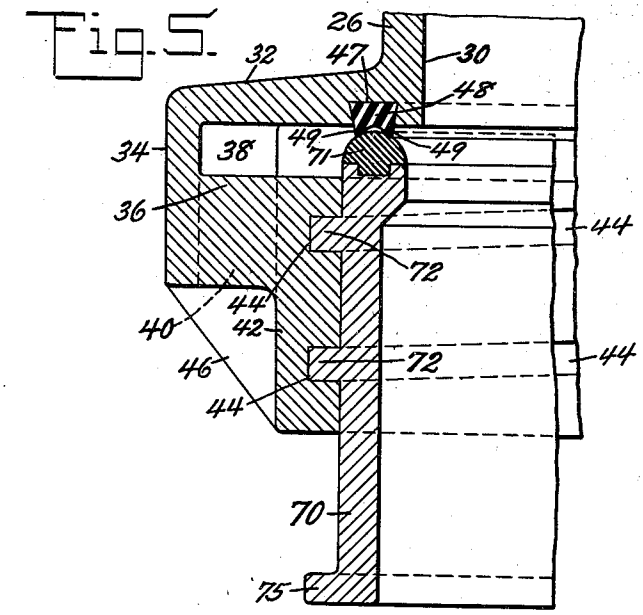


Fig. 4.

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HOPPER DISCHARGE

Filed May 18, 1938 4 Sheets-Sheet 4

Fig. 6.

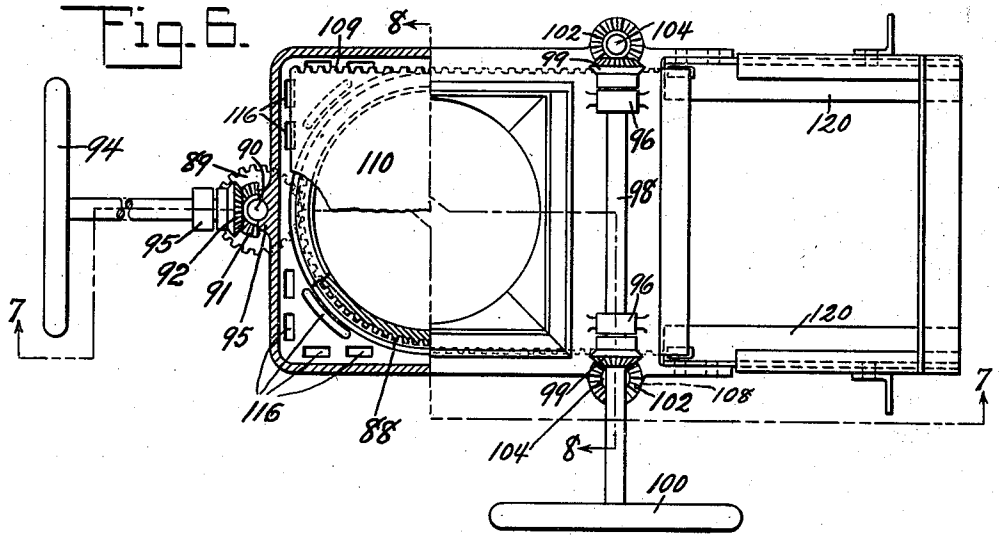


Fig. 7.

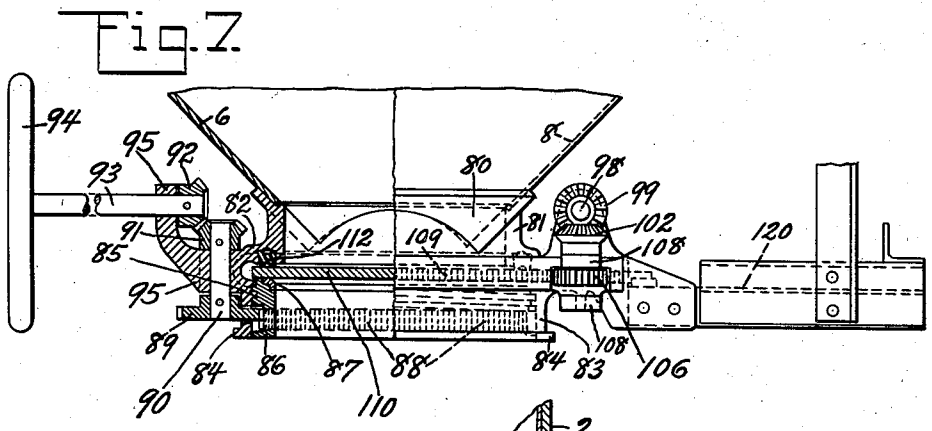
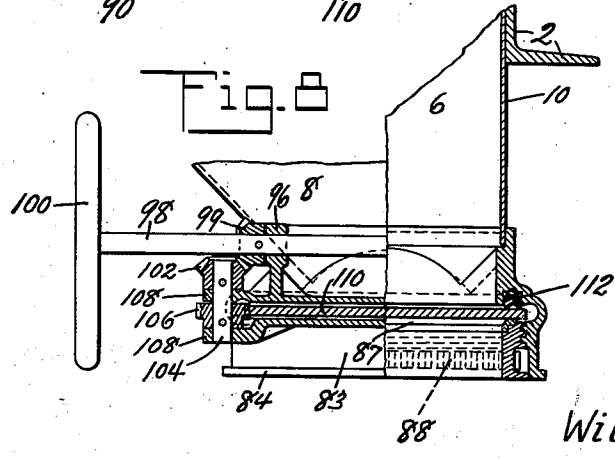


Fig. 8



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UNITED STATES PATENT OFFICE

2,250,524

HOPPER DISCHARGE

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Application May 18, 1938, Serial No. 208,665

20 Claims. (Cl. 105—307)

This invention relates to discharge outlets for hoppers in general and in particular to such discharge outlets for use on railway or similar hopper cars.

In the past discharge outlets for hoppers have been provided in which the outlet was controlled by slides, doors or various other means but in all these constructions it was impossible to provide a proper moisture and air tight seal between the slide or door and the hopper. It has become the practice in recent years to carry a large variety of bulk materials in hopper cars which had previously been carried only in package form; for instance, sugar, cement and certain chemicals. In transporting certain chemicals it is very necessary that all joints be not only water-proof but also substantially air tight, since the chemical may attract moisture and generate dangerous gases. For instance, if calcium carbide is carried in a hopper which is not air and moisture tight the carbide will attract moisture generating acetylene gas with the liability of an explosion. It is an object, therefore, of the present invention to provide a hopper discharge which is substantially air and water tight at all times either during transit or during discharge of the contents.

A further object of the invention is the provision of a hopper discharge device in which the outlet is controlled by a slide gate, the ways for which are effectively sealed during discharge of the lading from the hopper.

A yet further object of the invention is the provision of a slide controlled discharge for hoppers in which the slide may be jammed against one portion of the discharge by another portion movable relative thereto.

A still further object of the invention is the provision of a hopper discharge having a rotatable part which may be shifted into engagement with a fixed part to form a substantially smooth and continuous discharge outlet.

These and other objects of the invention will be apparent to persons skilled in the art from a study of the following description and accompanying drawings, in which

Figure 1 is a sectional view showing the improved discharge mechanism with gate open as applied to a railway hopper car;

Fig. 2 is an enlarged sectional view of the hopper discharge mechanism showing the gate in closed position;

Fig. 3 is a plan view showing the discharge outlet and mechanism;

Fig. 4 is an enlarged sectional view taken substantially on line 4—4 of Fig. 3 with certain parts broken away to better disclose the construction;

Fig. 5 is an enlarged detail view of a portion of the discharge outlet with the gate in open position;

Fig. 6 is a plan view of a modified form of hopper discharge mechanism with parts broken away to better disclose the construction;

Fig. 7 is a sectional view taken substantially on line 7—7 of Fig. 6, and

Fig. 8 is a sectional view taken substantially on line 8—8 of Fig. 6.

Referring now to the drawings in detail, it will be seen that the discharge mechanism has been illustrated as applied to a railway hopper car but it is obvious that the mechanism is of general application and may be used with other hoppers, whether they be of the transportable type or stationary. The railway car in the present instance is of generally conventional form having channel center sills 2 connected by a deflector formed cover plate 4 having connected thereto the end slope sheets 6, intermediate slope sheets 8 and center closure plates 10. The intermediate slope sheets are tied together and braced by customary cross bearer plate 12, while the end slope sheets are connected to and supported by the center sills through bolster 14 and truss or other form bracing members 16. The usual or necessary bracing angles 18 and gussets 20 are applied to the end and intermediate slope sheets to brace the same and to interconnect various elements of the car structure. The various slope sheets forming the hopper discharge are, in the present instance, located substantially at right angles to each other, thus forming a rectangular opening bound by the lower edges of the sheets which are attached to the outlet casting preferably in recessed areas 22 formed in the upper and outwardly inclined flanges 24 of the outlet casting. The outlet casting illustrated is formed by the before-mentioned flanges located substantially at right angles to each other to form a rectangular upper portion which merges by means of vertical webs 26 and inclined corner areas 28 into a substantially circular opening 30. The lower edge of the web portions 26 merge into an outwardly directed ledge portion 32 which in turn is connected at its outer edge by a short vertical portion 34 to an inwardly directed ledge portion 36 located substantially parallel to the upper ledge but spaced therebelow in order to provide slideways 38 on at least three sides of the casting. The ledge 32 is continuous in order to prevent entrance of moisture as is also the connecting portion 34 between the ledges but the

inwardly directed ledge 36 is discontinuous in order to provide a plurality of openings 40 permitting discharge from the ways of any material that may be forced therein. As clearly shown in Fig. 3 the outer edges of the ledges are curved substantially concentric with the discharge opening to provide a substantially semi-circular portion merging into a substantially straight portion, thus permitting the use of a slidable gate member. The inner edge of the lower ledge 36 merges into a downwardly directed flange 42 having threads 44 cut in its inner surface and being braced by gussets 46 extending between the flange and lower ledge (Figs. 3 and 5). In order to provide an efficient seal in the guideways adjacent the discharge opening a groove 47 is cut in the upper ledge adjacent the point of mergence between the ledge and web 26, which groove is adapted to receive a rubber or other resilient gasket 48 having its lower surface preferably cupped to provide at least two contacting edges 49. As clearly shown in Figs. 2 and 3, the upper and lower ledges are extended as at 50 to merge with the connecting portion 34 which has been extended at a tangent to the curved portion thereof. The connecting portion 34 has been eliminated on the fourth side of the casting, thus providing an opening 51 to the guideways through which the slide plate may move. Projecting flanges 52 are provided on this fourth side of the casting, which flanges are adapted to receive a U-shaped pressing having an upper web 53 and depending side flanges 54, the lower edges of which are adapted to receive a similar U-shaped pressing having a web 56 and downwardly directed short side flanges 57 secured by means of rivets or other devices 58 to the lower edge of the flanges first mentioned (Fig. 4). The forward edges of the flanges 53 and 54 are securely fastened to the flanges 52 of the casting, while the rear portions of the web and flanges are connected together by a plate 59 welded or otherwise secured in place, thus forming a substantially closed box-like member extending from the casting and giving access to the slideways of the casting. A portion of the web 26 on the casting is enlarged as at 60 and provided with an opening to form a bearing for one end of a screw threaded rod 61, the opposite end of which is carried by the rear closure plate 59 and extends therethrough to receive a bevel or other gear 62.

In order to close the discharge opening a slide plate 64 is provided having its forward edge curved to conform with the curvature of the connecting portion 34 and its rear straight portion extended to receive spaced angular brackets 65 between which is mounted an internally threaded nut 66 adapted to engage the screw threaded shaft to cause movement of the slide in the guideways either to open or closed position. Guide projections 67 are provided connected and welded or otherwise secured to the web 56 of the lower U-shaped pressing previously referred to in order to guide the sliding movements of the gate and insure its proper entrance and exit from the guideways of the casting. The slide plate or gate may be urged upwardly against the resilient gasket by means of an annular discharge member 70 having its upper edge preferably provided with a bronze or similar bearing ring 71 and its surface formed with threads 72 adapted to engage the threads 44 cut in the outlet casting. This annular discharge member is rotatable in the rigid discharge member or casting and in order that it may be readily rotated it is provided with handles or other means 74 accessible from at least one side of the hopper in order that the member may be either raised or lowered relative to the rigid casting member. It is also preferable that the annular discharge member be provided on its lower edge with a lip 75 over which a ring 76 may be snapped, which ring preferably carries a flexible canvas or other tube 77 (Fig. 1), thus permitting discharge of material while protected from moisture in the atmosphere. A more or less conventional operating means is provided for the screw threaded shaft and is shown as consisting of a shaft 78 suitably operated exterior of the hopper construction and having a gear on its inner end meshing with the gear 62.

The operation of this mechanism is as follows and assuming the gate or slide plate to be in the closed position as shown in Fig. 2 with the rotatable discharge member forced upwardly against the slide plate and jamming the same against the resilient gasket to make an absolutely moisture tight joint. The annular discharge member will be rotated lowering the same away from the slide plates and permitting the gate or slide plate to come in contact with the lower surface of the guideways and relieving the pressure of the resilient gasket upon the slide plate partially if not entirely. With the gate lowered upon the slideways rotation of the shaft 78 in the proper direction will cause the gate or slide to be moved from the discharge opening to a position within the box-like extension, after which the rotatable discharge member may be turned to bring the bronze or other bearing ring thereof into sealing engagement with the gasket (Fig. 5), thus preventing the escape of any dust or particles from the outlet while at the same time preventing ingress of moisture from the outside. There is, of course, a short period of time during which the gate is being moved and before the annular member can be brought into contact with the gasket which will permit the entrance of a small amount of material to the guideways but this material will be readily pushed out of the guideways through openings 40 when the slide plate is returned to its closed position after emptying of the hopper. After the hopper has been emptied or it is desired to close the gate, the annular discharge member is rotated to lower the same away from the gasket and the shaft 78 again turned in the proper direction forcing the gate or slide plate along the guideways to completely close the discharge opening. With the gate or slide plate in closed position the annular discharge member is rotated to raise the same and lift the gate from its slideways and jam the same against the resilient gasket. It is thus seen that a water-proof joint is provided and also that due to the pressure applied to the gate it would be practically impossible to retract the same without a movement of the annular member, which member must be positively moved since the screw threads are cut at such an angle as to be of the so-called self-locking type.

Referring now to the slight modification shown in Figs. 6, 7 and 8, it will be seen that in general the casting and hopper arrangement is substantially similar to that just described. In this form, however, the outlet casting has been modified slightly and as shown is provided with a hopper sheet attached flange 80 merging into a vertical web portion 81 which in turn merges with the inner end of an upper ledge 82 from which a flange 83 depends and this flange is pro-

vided upon its lower edge with a lip 84 adapted to receive a removable chute previously described. In connection with Figure 7 the inner surface of this depending flange is provided with screw threads 85 adapted to engage similar threads cut on the outer surface of a rotatable discharge member 86. This rotatable discharge member is preferably provided on its upper edge with a bronze or similar bearing ring 87 and is also provided with gear teeth 88 cut therein upon the outer surface adjacent the lower end thereof to provide in effect a gear ring for operation of the rotatable member. As clearly shown in Figs. 6 and 7 an opening is provided in the casting through which a gear 89 may extend to mesh with the gear teeth to operate the rotatable member. The gear 89 is keyed to the lower end of a shaft 90 and carries at its upper end a bevel gear 91 adapted to mesh with a gear 92 carried upon one end of shaft 93, the opposite end of which carries a hand wheel 94. The intermediate portions of the shafts 93 and 90 have bearing engagement in a bracket extension 95 preferably cast integral with the outlet casting. One portion of the outlet casting is extended outwardly and upwardly to provide spaced bearings 96 in which an operating shaft 98 is journaled and carries a pair of bevel or other gears 99 and an operating hand wheel 100. The bevel or other gears mesh with similar gears 102 keyed or otherwise secured to vertical shafts 104, the lower ends of which carry spur or similar gears 106. The vertical shafts are journaled in bearing portions 108 extending outwardly from the casting upon either side thereof and to the rear of the discharge opening. The spur gears are located substantially in the same horizontal plane as the guideway of the outlet casting and are adapted to mesh with the rack teeth 109 cut in the side edge portions of rectangular slide plate or gate 110. A gasket 112 of rubber or other resilient material is provided surrounding the discharge opening and of a type similar to that described in Figs. 1 to 5 inclusive. It is, of course, obvious that since a rectangular plate is used the casting must be modified slightly from that described in connection with Figs. 1 to 5; that is, the ledge and connecting portions must be modified to accommodate the plate but in any case the lower ledge will be provided with openings 116 through which material may escape from the guideways.

The operation of this modification is as follows and assuming the gate in closed position: The hand wheel 94 will be rotated in the proper direction causing the spur gear 89 to rotate the discharge member 86 lowering the same together with the slide plate away from the resilient gasket. As soon as the discharge member has been lowered operation of hand wheel 100 will cause the spur gears 106 to pull the slide gate rearward to open the discharge outlet in which position the discharge plate will be supported in the extension guideways 120. When it is desired to close the outlet, reverse rotation of hand wheel 100 will force the slide plate back into the casting guideways closing the opening and pushing any material which may be lodged therein out through the opening in the lower ledge. The hand wheel 94 may now be operated causing the spur gear 89 to rotate the discharge member forcing the same upwardly against the slide plate and jamming the latter tightly against the resilient gasket to form a water-proof joint. In this form it will be practically impossible to retract the gate and open the discharge outlet unless the supporting discharge member has been lowered relieving the pressure upon the slide plate; therefore, if suitable locks are provided for the operating mechanisms it will be almost impossible for unauthorized persons to discharge material from the hopper.

Although the hopper discharge mechanism has been described more or less in detail, it is obvious that various modifications and rearrangements of parts thereof will be apparent to persons skilled in the art and all such modifications and rearrangements of parts are contemplated as fall within the scope of the following claims.

What is claimed is:

1. In a railway hopper car, a hopper discharge arrangement comprising a frame secured to the hopper at its discharge end portion and provided with an opening and door supporting means, a door movable relative to said supporting means to open and close said opening, and means forming a part of the hopper discharge opening and being carried by the frame, said means being operable independently of the door to force the door upwardly into tight engagement with a portion of said frame to provide a weatherproof joint at the opening and to lower the door out of such tight engagement.

2. In a railway hopper car, a hopper discharge arrangement comprising a frame secured to the hopper at its discharge end portion and provided with an opening and door supporting means, a slidable door adapted to be reciprocated upon the door supporting means to open and close the opening, and annular means carried by the frame and movable laterally toward the plane of the door to force the same into tight engagement with a portion of the frame to provide a weatherproof joint at said opening, said annular means being movable laterally away from the plane of the door to free said door from said tight engagement.

3. In a railway hopper car, a hopper discharge arrangement comprising a frame secured to the hopper at its discharge end portion and provided with an opening and door supporting means, sealing means carried by the frame and surrounding said opening, a slidable door movable relative to said supporting means to open and closed positions, and annular means carried by the frame and movable laterally toward the plane of the closed door to force the same into tight engagement with said sealing means thereby forming a weatherproof joint at the opening, said annular means being movable laterally away from the plane of the door to free the same from said tight engagement.

4. In a railway hopper car, a hopper discharge arrangement comprising a frame secured to the hopper at its discharge end portion and provided with an opening and door supporting means, sealing means carried by the frame and surrounding said opening, a slidable door movable relative to said supporting means to open and closed positions, and means carried by the frame and movable laterally of the plane of the closed door to force the same into tight engagement with said sealing means thereby forming a weatherproof joint at the opening, said means being also movable into contact with the sealing means when the door is in open position whereby the door supporting means is protected from material discharging through the said opening.

5. In a railway hopper car, a hopper discharge arrangement comprising a frame secured to the discharge end portion of the hopper and pro-

vided with an opening, guideways carried by the frame and substantially surrounding the opening, a slidable door supported by the guideways and movable therein to open and closed positions for controlling the said opening, and means defining a portion of the discharge opening carried by the frame and movable relative thereto to force the door into tight engagement with a portion of the frame to form a weatherproof joint and to lower the door out of such tight engagement.

6. In a railway hopper car, a hopper discharge arrangement comprising a frame secured to the discharge end portion of the hopper and provided with an opening, guideways carried by the frame and substantially surrounding the opening, a slidable door supported by the guideways and movable therein to open and closed positions for controlling the said opening, and rotatable means threaded into the wall of the hopper opening, said means moving laterally in the direction of the plane of the door during said rotation thereby forcing the door into tight engagement with a portion of the frame to form a weatherproof joint.

7. In a railway hopper car, a hopper discharge arrangement comprising a frame secured to the discharge end portion of the hopper and provided with an opening, guideways carried by the frame and substantially surrounding the opening, sealing means carried by the frame and substantially surrounding the opening, a slidable door supported by the guideways and movable therein to open and closed positions controlling the said opening, and rotatable means threaded into the wall of the hopper opening, said means movable laterally against the door during its rotation thereby lifting the closed door and forcing the same into tight engagement with the sealing means to form a weatherproof joint.

8. In a railway hopper car, a hopper discharge arrangement comprising a frame secured to the discharge end portion of the hopper and provided with an opening, guideways carried by the frame and substantially surrounding the opening, sealing means carried by the frame and substantially surrounding the opening, a slidable door supported by the guideways and movable therein to open and closed positions controlling the said opening, and means carried by the frame and rotatable relative thereto, said means moving laterally against the plane of the door during said rotation thereby lifting the closed door and forcing the same into tight engagement with the sealing means to form a weatherproof joint, and said means being also movable into direct engagement with the sealing means when the door is open to prevent discharging material blocking the guideways.

9. In a railway hopper car, a hopper discharge arrangement comprising a frame secured to the discharge end portion of the hopper and provided with an opening, guideways carried by the frame and substantially surrounding the opening, sealing means carried by the frame and substantially surrounding the opening adjacent the guideways, a slidable door supported by the guideways and movable therein to open and closed positions controlling the said opening, means carried by the frame and rotatable relative thereto, a passageway removably carried by said means for receiving material discharging from the hopper, said means moving laterally against the plane of the door during said rotation thereby lifting the closed door and forcing the same into tight engagement with the sealing means to form a weatherproof joint, said means being also movable into contact with the sealing means when the door is in open position whereby the guideways are protected from the discharging material and a weatherproof connection is formed between the passage and hopper.

10. In a railway hopper car, a hopper discharge arrangement comprising a frame secured to the discharge end portion of the hopper and provided with an opening, guideways carried by the frame and substantially surrounding the opening, sealing means carried by the frame and substantially surrounding the opening adjacent the guideways, a slidable door supported by the guideways and movable therein to open and closed positions controlling the said opening, rotatable means carried by the frame, said rotatable means having threaded engagement with the frame beneath said door whereby rotation thereof will shift said means against the closed door to force the door into tight engagement with the sealing means to form a weatherproof joint, a flexible passageway removably carried by said rotatable means for receiving material discharging from the hopper, said rotatable means being also movable during rotation into tight engagement with the sealing means when the door is in open position thereby forming a weatherproof connection between the passageway and hopper.

11. In a railway hopper car, a hopper discharge arrangement comprising a frame secured to the hopper at its discharge end portion and provided with an opening and door supporting means, a door movable to open and closed positions upon said supporting means, rotatable means having threaded engagement with the frame whereby said door when closed may be forced into weatherproof engagement with a portion of the frame, and a passageway removably carried by said rotatable means, said rotatable means being also movable into engagement with an upper portion of the frame when the door is open to form a weatherproof connection between the passageway and hopper.

12. In a railway hopper car, a hopper discharge arrangement comprising a frame secured to the hopper at its discharge end portion and provided with an opening and door supporting means, a door movable relative to said supporting means, operating means to move the door to open and closed positions, rotatable means having threaded engagement with the frame, said rotatable means shifting during rotation thereof into engagement with the closed door to force the same into weatherproof engagement with a portion of the frame, and additional operating means for rotating said rotatable means.

13. In a railway hopper car, a hopper discharge arrangement comprising a frame secured to the hopper at its discharge end portion and provided with an opening and door supporting means, a door movable relative to said supporting means, means to move the door to open and closed positions, rotatable means having threaded engagement with the frame, said rotatable means shifting during its rotation into engagement with the closed door to lift the same into weatherproof engagement with a portion of the frame, and means to rotate said rotatable means and shift the same into or out of engagement with the closed door.

14. In a railway hopper car, a hopper dis-

charge arrangement comprising a frame secured to the hopper at its discharge end portion and provided with an opening and door supporting means, a door movable relative to said supporting means, means to move the door to open and closed positions, rotatable means having threaded engagement with the frame, said rotatable means shifting during its rotation into engagement with the closed door to lift the same into weatherproof engagement with a portion of the frame, and means to rotate said rotatable means and shift the same into or out of engagement with the closed door, said last named means also being operable to shift the rotatable means into engagement with said portion of the frame when the door is open.

15. In a hopper the combination of a discharge opening for the hopper, a frame attached to the hopper at the discharge opening and itself provided with an opening, a door shiftable to open and close the opening in the frame, means carried by the frame independently of the door and shiftable to force the closed door into weatherproof engagement with a portion of the frame, and operating means for said door and means to control the shifting of the same, said first named means being also shiftable into weatherproof engagement with said portion of the frame when the door is in open position.

16. In a hopper the combination of a discharge opening for the hopper, a frame attached to the hopper at the discharge opening and itself provided with an opening, a door shiftable to open and close the opening in the frame, operating means to shift the door, means defining a portion of the hopper opening carried by the frame and shiftable into engagement with the door to force the door into weatherproof engagement with a portion of the frame, and additional operating means to shift said last named means, said operating means being inoperable to shift the door prior to operation of said additional operating means to free the door from said weatherproof engagement with the frame.

17. In a railway hopper car, a hopper discharge arrangement comprising a frame secured to the hopper at its discharge end portion and provided with an opening and door supporting means, a door movable relative to said supporting means to open and close said opening, and shiftable means forming a portion of the discharge opening constructed and arranged for movement into tight engagement with a portion of the frame to provide a weatherproof joint.

18. In a railway hopper car, a hopper discharge arrangement comprising a frame secured to the hopper at its discharge end portion and provided with an opening and door supporting means, a door movable relative to said supporting means to open and close said opening, and shiftable means forming a portion of the discharge opening for engaging the door when in its closed position to retain the same in tight engagement with a portion of the frame, said shiftable means also disengaging the door permitting the same to lower out of said tight engagement with the frame.

19. In a railway hopper car, a hopper discharge arrangement comprising a frame secured to the hopper at its discharge end portion and provided with an opening and door supporting means, a door movable relative to said supporting means to open and close said opening, and shiftable means movable within the discharge opening to seal the door opening when the door is in open position.

20. In a railway hopper car, a hopper discharge arrangement comprising a frame secured to the hopper at its discharge end portion and provided with an opening and door supporting means, a slidable door adapted to be reciprocated upon the door supporting means to open and close the opening, and means carried by the frame in cooperative relation with the door and angularly shiftable about an axis normal to the plane of the door to force said door into tight engagement with the frame to provide a weatherproof joint at said opening, said means also being angularly shiftafle in the opposite direction and in a plane normal to the plane of the door to free said door from tight engagement with said frame.

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