Feb. 23, 1965 G. B. DOREY 3,170,609

SLIDING HOPPER CLOSURE OPERATING AND SUPPORTING MECHANISM

Original Filed June 16, 1960 4 Sheets-Sheet 1

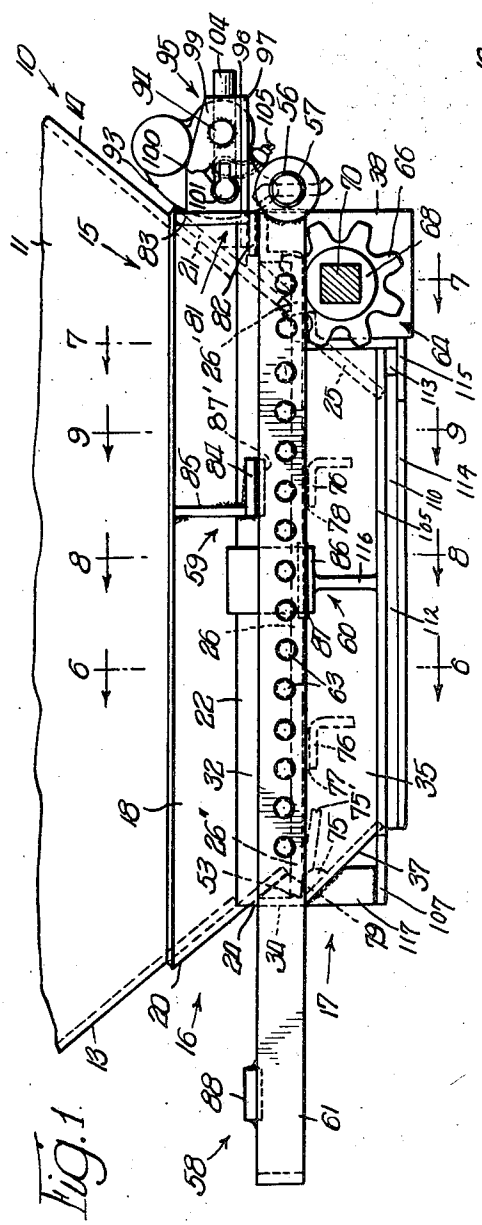


Fig. 1

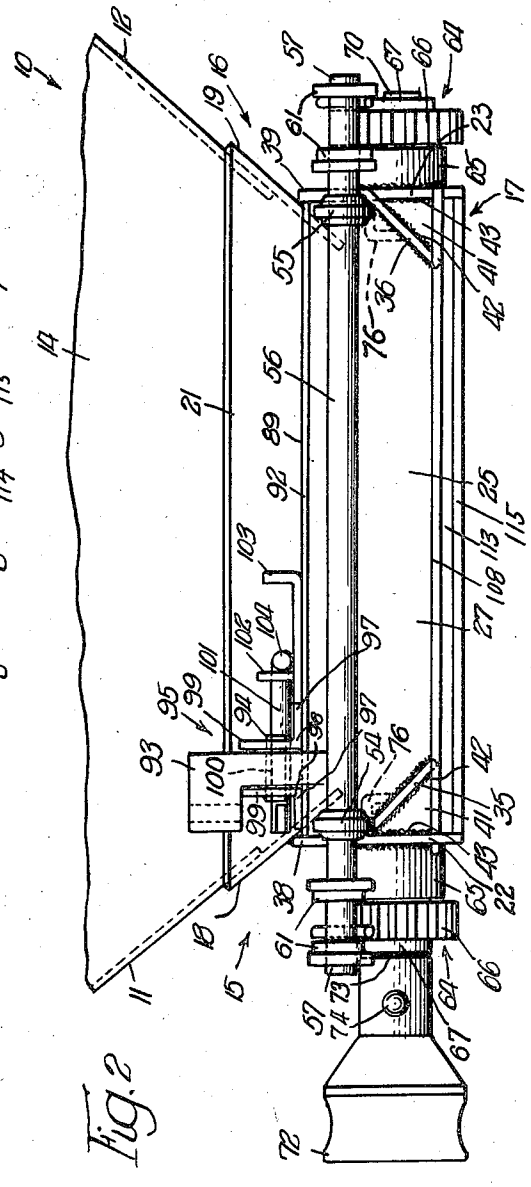


Fig. 2

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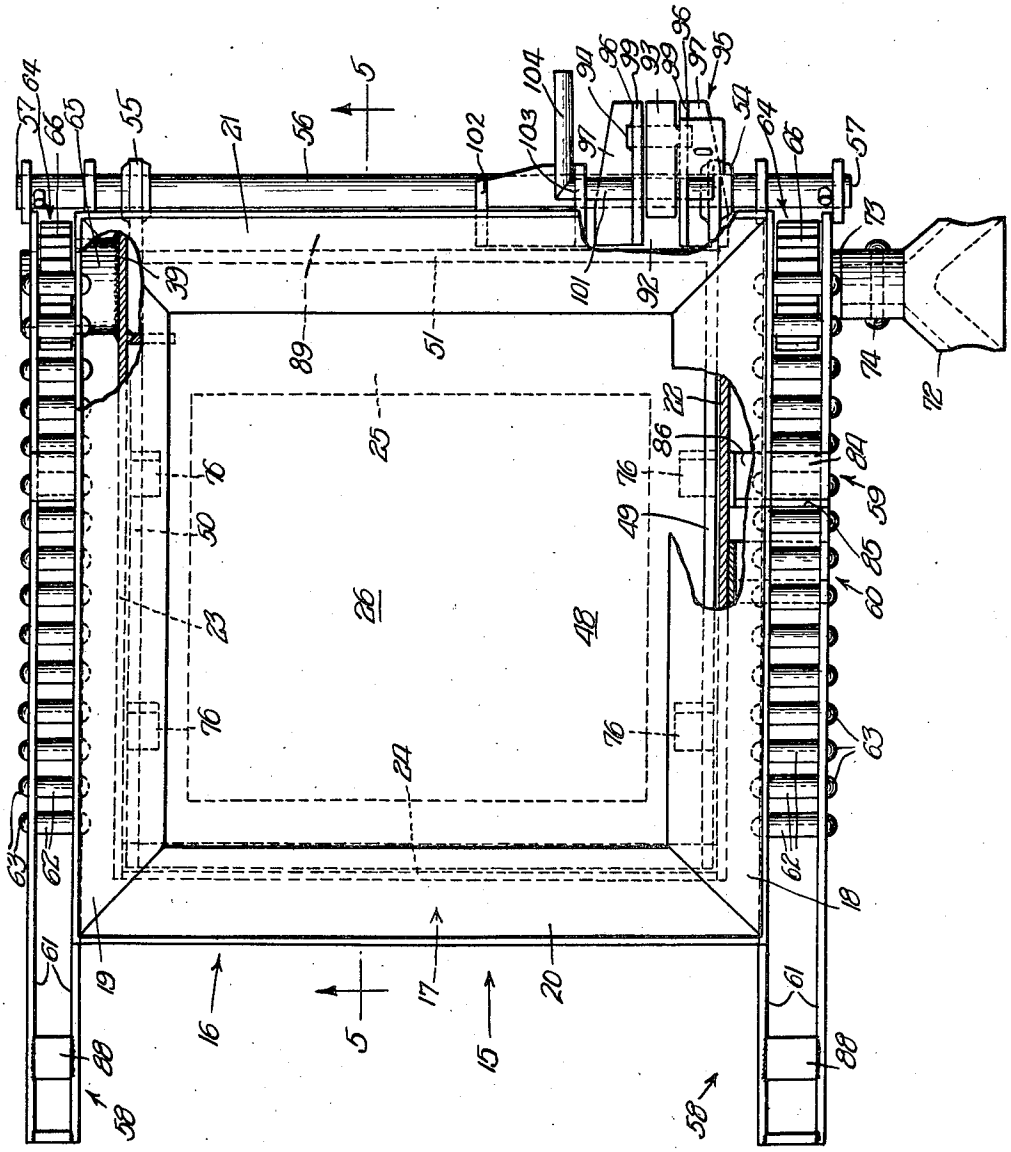


Fig. 3

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Fig. 4

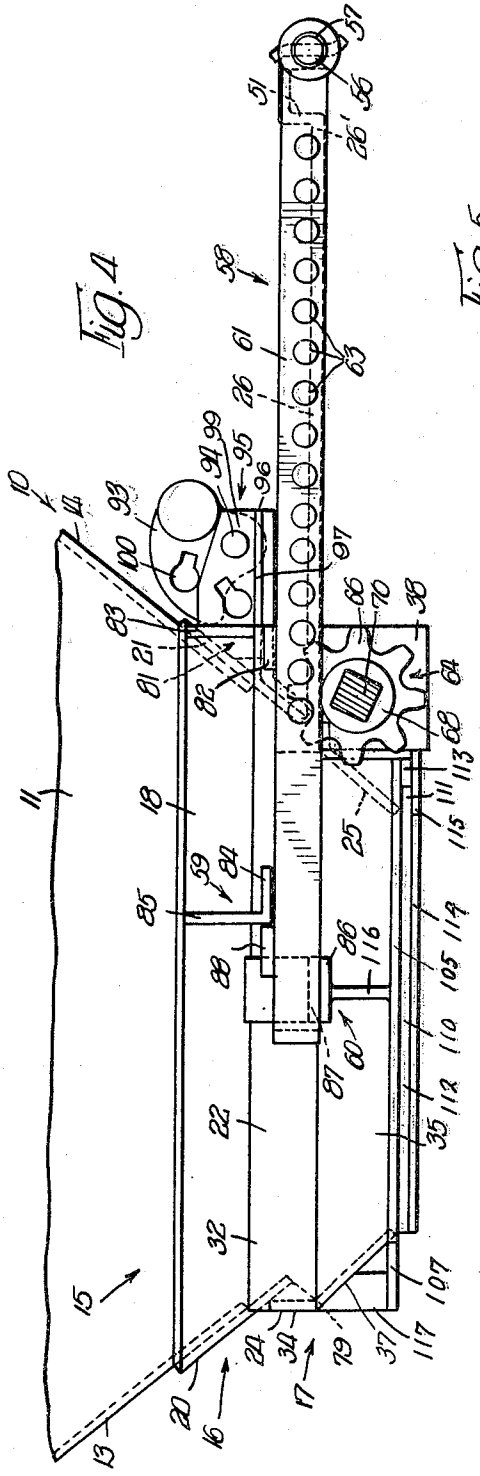
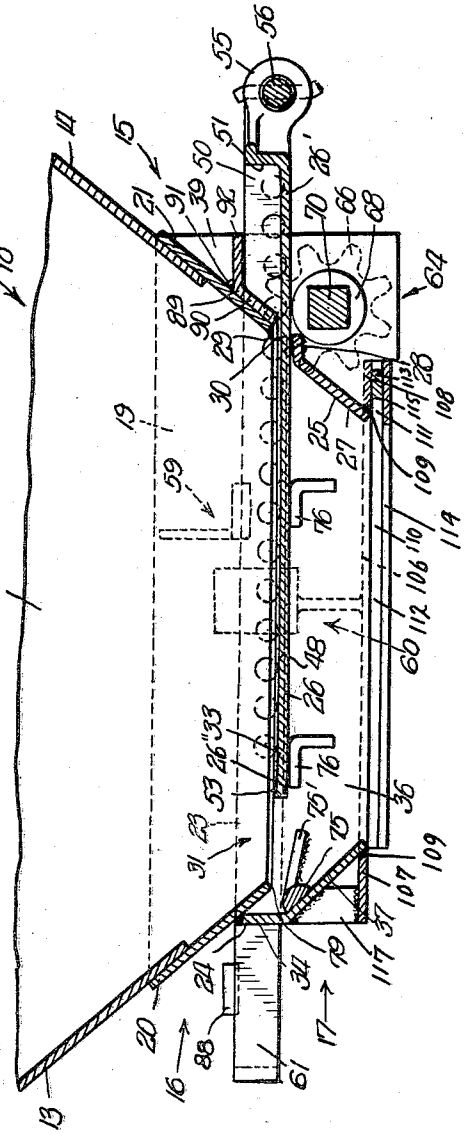


Fig. 5



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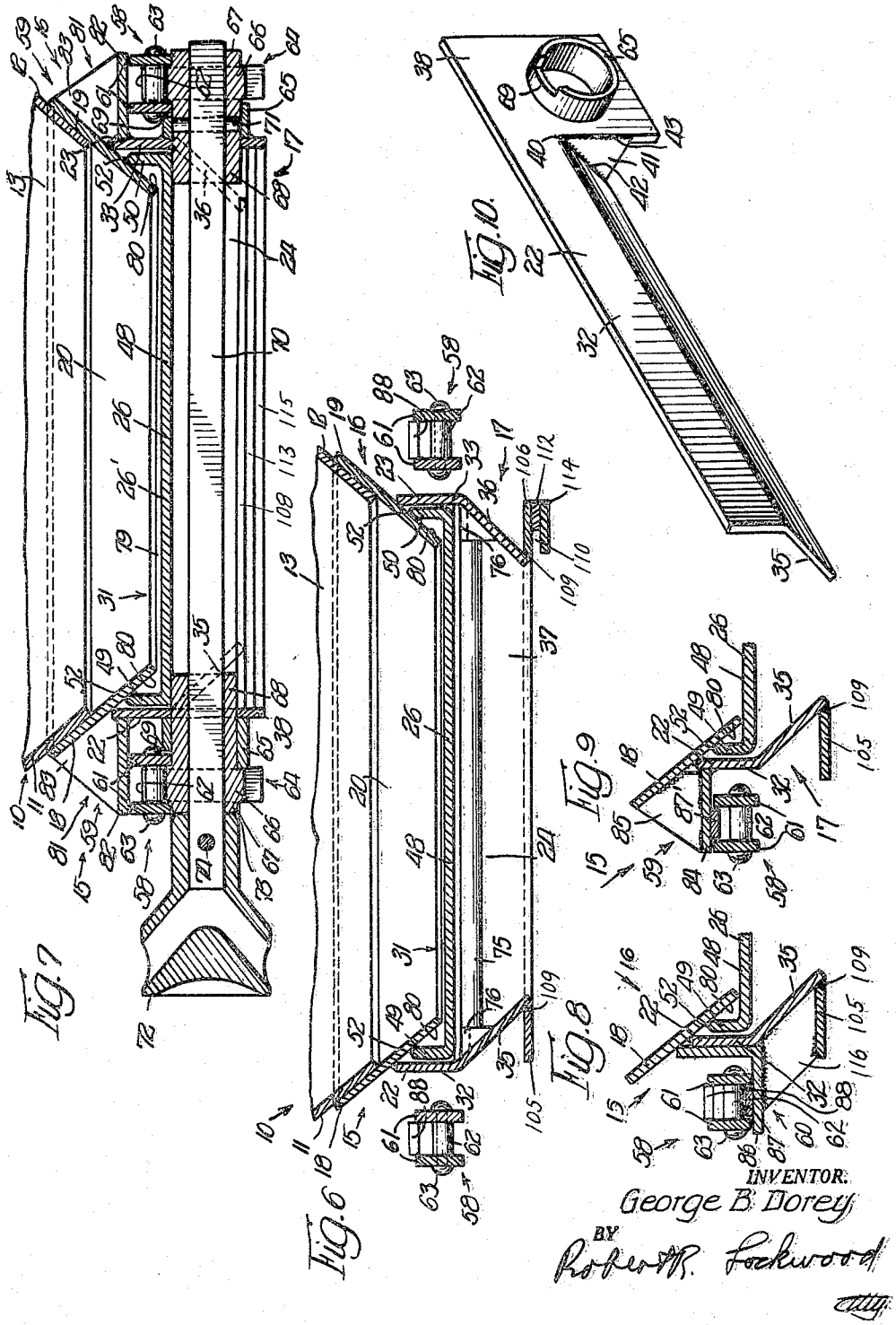


Fig. 7

Fig. 10

Fig. 9

Fig. 8

Fig. 6

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SLIDING HOPPER CLOSURE OPERATING AND SUPPORTING MECHANISM

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Continuation of application Ser. No. 36,502, June 16, 1960. This application Feb. 20, 1964, Ser. No. 346,187

11 Claims. (Cl. 222—505)

This invention relates to an improved hopper outlet assembly such as employed for controlling the discharge of lading from load containing hoppers utilized for handling finely comminuted lading, and is a continuation of application Serial No. 36,502, filed June 16, 1960.

The objects of the invention, among others, are: to provide an assembly having a sliding gate employing retractable rails for supporting the gate in opened position; to provide retractable rail members performing the dual function of moving a sliding gate and supporting the overhanging end of the gate when in closed position; to provide an operating shaft having seats associated therewith on which a sliding gate rests throughout a substantial range of its sliding movement; to provide guiding and supporting means for retractable supporting rail members for a sliding gate; to provide an improved arrangement of geared pinions and associated rack members for moving a sliding gate; to provide an improved frame structure for receiving a sliding gate and associated operating means therefor; to provide an upwardly flanged beading along the leading marginal edge of a sliding gate to coact with an overlying wall for restricting outward flow of fine lading and thereby provide sealing security; and to provide for cooperating engagement between the lower marginal edge of an overlying wall and an upwardly flanged beading of a gate for positively insuring downward displacement of the gate.

The invention further resides in the combination of parts and details of construction whereby the desired results are obtained as will be evident from the specification and drawings.

In said drawings:

FIG. 1 is a side elevational view of the lower portion of a load containing structure incorporating the improved outlet assembly.

FIG. 2 is a vertical elevational end view of the structure shown in FIG. 1 as viewed from right to left, the operating shaft and rack support brackets being omitted.

FIG. 3 is a plan view of the structure shown in FIG. 1 with the hopper floor sheets eliminated and certain parts broken away to better illustrate the details of construction.

FIG. 4 is a view similar to FIG. 1 except that the sliding gate is shown in opened position with the overhanging portion of the gate supported by the retractable members.

FIG. 5 is a longitudinal vertical elevational view taken through the assembly on a line 5—5 of FIG. 3 and showing the sliding gate in partially opened position.

FIG. 6 is a vertical transverse sectional view taken on a line 6—6 of FIG. 1.

FIG. 7 is a vertical transverse sectional view taken on a line 7—7 of FIG. 1.

FIG. 8 is a fractional vertical sectional view taken on a line 8—8 of FIG. 1.

FIG. 9 is a fractional vertical sectional view taken on a line 9—9 of FIG. 1.

FIG. 10 is a perspective view of one of the side wall sub-assemblies of the frame.

In said drawings the improved outlet assembly is shown as applied to a four sided hopper 10 formed, in part, by oppositely sloping longitudinally extending outer

and inner walls 11 and 12 which meet with transversely extending walls 13 and 14. Surrounding the lower portion of the hopper 10 is a frame assembly 15 which includes an upper section 16 and a lower section 17. The upper section 16 is generally of inverted truncated shape with longitudinally extending side walls 18 and 19 which meet with transversely extending walls 20 and 21. The side walls 18, 19, 20 and 21, respectively, overlie the walls 11, 12, 13 and 14.

The lower section 17 is formed of side wall members 22 and 23 and transversely extending wall members 24 and 25. The said wall members 22, 23 and 24 form a three sided enclosure within which the truncated upper portion 16 nests and the other wall member 25, which extends transversely beneath a sliding gate 26, includes a sloping wall section 27 and an upper flange 28. The said upper flange 28 is spaced from the lower marginal edge 29 of the transversely extending overlying wall 21 to form a slotted opening 30 through which the sliding gate 26 extends. The lower marginal edges of the truncated upper section 16, as formed by the lower edges of the walls 18, 19, 20 and 21, thus form the boundaries of a discharge area 31 which is closed by the sliding gate 26.

The wall members 22, 23 and 24 of the lower frame section 17 are preferably formed of upper vertically extending wall sections 32, 33 and 34 which lead to downwardly and inwardly sloping wall sections, as indicated at 35, 36 and 37 respectively. The sloping walls 35, 36 and 37 in combination with the sloping wall 27 of wall member 25 form a four sided chute-like hopper lying below the gate 26 for receiving lading flowing from the discharge area 31.

The side wall members 22 and 23, at the end of the frame adjacent the trailing end 26' of the gate 26, include vertically extending portions 38 and 39, respectively, forming continuations of the vertically extending wall sections 22 and 23. The sloping wall sections 35 and 36 in actuality are formed by separating a portion of the plates as at 40, FIG. 10, from the vertically extending wall portions of the side wall members 22 and 23 and bending the same inwardly. The separated portions are then united by transversely extending gusset plates 41 which are united by welding as indicated at 42 and 43.

The sliding gate 26 includes a flat body section 48 with vertically disposed longitudinally extending side flanges 49 and 50 and an end flange 51. The upper margins of the side flanges 49 and 50 are preferably of arcuate shape as indicated at 52, FIG. 6, and the leading end 26'' of the gate 26 is beveled upwardly as at 53 to form a beading along this edge to restrict flow of lading beyond the lower marginal edge of the sloping wall 20 when the gate 26 is in closed position as seen in FIG. 1. The gate 26 is guided in its longtiudinal movement by sliding between the vertically disposed side wall sections 32 and 33. Adjacent the trailing end 26' the gate 26 is provided with bearings 54 and 55 through which a shaft 56 extends to project beyond said bearings and provide trunnion portions 57—57 at the respective sides of the gate 26.

Pivotally connected with the shaft 56 are toothed rack elements 58—58 which slide between upper and lower brackets 59 and 60 on the sides of the frame 15. The rack elements 58 are preferably each formed of a pair of bars 61—61 spaced apart laterally to admit a series of cogs 62 therebetween which are held in place by rivets 63. Cooperating with the cogs 62 of the rack elements 58 in meshing relation therewith are toothed pinions 64 which are rotatably mounted in bearings 65—65. The bearings 65—65 are respectively welded to the vertically disposed end portions 38 and 39 of the side wall members

22 and 23. Each pinion 64 includes a central toothed portion 66 located between the spaced bars 61—61 of the racks 58—58. Extending from the opposite sides of the portions 66 are laterally extending hubs as indicated at 67 and 68. The hubs 68 are extended axially lengthwise beyond the bearings 65 to form rotary supports for the gate 26 and the hubs 67 extend outwardly of the tooth portions 66. Said hubs 67 and 68 form rests to support the bars 61—61 and to this end the upper portion of each bearing 65 is notched at 69 to receive the inner bar 61 of the associated rack 58.

The pinions 64 are apertured to receive an operating shaft 70 of square cross section therethrough to effect rotation thereof in unison. The pinion 64 on the right end of the shaft 70 is maintained in axial relation thereon by a pin 71. At the opposite end of the shaft 70 an operating head 72 is provided. Preferably it is welded to the adjacent pinion as indicated at 73. The operating head 72 and its welded pinion 64 are then retained in position on the shaft 70 by a rivet 74.

The gate 26 in its closed position is thus supported at its trailing end 26' by the hubs 68—68 and at its opposite or leading end 26'' by a ledge 75, FIG. 5. Plates 75' extending from and welded to the wall sections 35 and 36 are inclined upwardly to cooperate with the under side of the leading end 26'' of the gate 26 to direct it onto the ledge 75. Intermediate these end supports there are provided ledges 76 which are spaced slightly from the underside of the gate 26 to the extent shown at 77 and 78, FIG. 1, when the gate 26 is in closed position. Upon initial opening movement of the gate 26 there is a slight drop in the leading end 26'' thereof to the extent permitted by the spaces 77 and 78. This slight downward displacement of the leading end 26'' of the gate 26 results in relieving the pressure of the lading and is conducive to ease of operation by facilitating the breakaway movement of the gate 26. The slight positive downward displacement of the gate 26 is assured by reason of contacts between the beveled portion 53 at the lading end 26'' of the gate 26 and the lower marginal edge 79 of the end wall 20.

The downward movement of the leading end 26'' of the gate 26 is accompanied by a corresponding drop of the rounded upper margins 52 of the side flanges 49 and 50 away from the undersurfaces 80 of the sloping side walls 18 and 19 and the opening movement of the gate 26 is thereby further facilitated.

The trailing end 26' of the gate 26, when the latter is opened, is supported by the rack elements 58 which then operate as retractable supporting rails as seen in FIG. 4.

The supporting brackets 59 and 60 are preferably disposed substantially midway of the frame 15 and form guides between which the rack bars 61—61 are supported and guided. An additional bracket 81 is located adjacent the shaft 70 to restrain the rack bars 61—61 against upward movement. Each bracket 81 includes a laterally extending wall 82 above the bars 61 and braced to the frame by a web 83. In like manner the bracket 59, FIG. 1, includes a laterally extending shelf 84 overlying the bars 61 and a bracing wall to the frame indicated at 85. Each bracket 60 is preferably spaced lengthwise a limited distance from the respective upper bracket 59 and includes a laterally extending shelf 86 on which the rack bars 61 slide. The shelf 86 carries a pad 87, FIG. 8, which is straddled by the pair of bars 61—61 to prevent lateral displacement of the latter. A similar pad 87' is mounted on the underside of the shelf 84.

An abutment 88 is carried by each rack element 58 to engage with the upper bracket 59 and thereby limit opening movement of the gate 26.

An angle shaped reinforcing member 89, FIG. 5, which extends transversely of the frame 15 beneath the sloping wall 21, is disposed with one flange 90 welded to the said wall 20 at 91. It has another flange 92 which extends to lie above the gate 26 and parallel thereto.

The gate 26 is retained in closed position by a locking dog 93 which is pivotally mounted on pivot 94 on a bracket structure 95. The bracket structure 95 includes a pair of angle shaped members 96—96 each having one flange 97 resting on the flange 92 of the member 89 and welded thereto and having the adjacent flange 99 extending upwardly to receive the pivot 94. The locking dog 93 is provided with a key shaped opening 100 for receiving a key shaped sealing pin 101 therethrough. Stops 102 and 103 cooperate with a handle 104 on the sealing pin 101 to limit its movement. A sealing ribbon 105, FIG. 1, cooperates with the sealing pin 101 in a conventional manner.

Along the lower margins of and on the outer downwardly facing sides of the upwardly sloping wall sections 35, 36, 37 and 27 outstanding horizontal flanges 105, 106, 107 and 108, respectively, are secured by welding 109. These flanges provide a generally rectangular frame around the lower frame section 17 and serve to rigidify it. Two adjacent flanges of a discharge chute (not shown) can be clamped to the undersides of the flanges 105 and 107 while grooves 110 and 111 are provided in which two other adjacent flanges of the discharge chute can be inserted. The grooves 110 and 111 are formed, in part, by the undersides of the flanges 106 and 108. The grooves 110 and 111 are completed by spacers 112 and 113 and lower flanges 114 and 115 suitably secured to the flanges 106 and 108. A vertical 116, forming a part of the lower bracket 60 extends between the shelf 86, FIG. 8, and the upper side of the flange 105 and is welded in place. In a similar manner a web 17, FIG. 5, extends between the underside of the wall section 37 and the upper side of the flange 107 and is welded thereto.

What is claimed as new is:

1. In combination, a hopper having a discharge opening and a sliding gate for the opening, a frame supported by and surrounding the lower portion of the hopper and supporting said gate, means for moving said gate including a rotatable shaft journaled in the frame and interengaging pinions and rack means on the shaft and gate respectively, said pinions having laterally extending hubs and said rack means being formed of spaced bars pivoted at one end to the gate and disposed to straddle the pinions and rest on the hubs thereof, said rack means being slidingly supported by the frame and coextensive with said gate and extending beyond the other end of said gate.

2. In combination, a hopper having a discharge opening and a sliding gate for the opening, a frame supported by and surrounding the lower portion of the hopper and supporting said gate, means for moving said gate including a rotatable shaft and interengaging pinions and rack means carried by the shaft and connected to one end of the gate respectively, the shaft being journaled in bearings on the frame disposed outwardly thereof, said pinions lying adjacent the bearings and having hubs on each side thereof with one of said hubs extending within a bearing with the pinion adjacent thereto to limit inward axial movement of the shaft, said rack means including spaced walls straddling the pinions and resting on the hubs thereof and coextensive with and extending beyond the other end of said gate, said bearings receiving the pinions being cut away at the upper side thereof to accommodate a rack wall in resting position on the hub.

3. In combination, a hopper having a discharge opening and a sliding gate for the opening, a frame supported by and surrounding the lower portion of the hopper and supporting said gate, means for moving said gate including a shaft journaled in the frame and interengaging pinion and rack means on the shaft and connected to one end of said gate respectively, said rack means including laterally spaced walls adapted to straddle the pinions and coextensive with and extending beyond the other end of said gate, guiding means for the rack means including walls extending laterally from the frame across the plane of the rack means, and pads on the said walls lying between the spaced walls of the rack means.

4. The invention, as set forth in claim 3, wherein laterally extending shelves with guiding pads thereon are disposed above and below the rack bars to guide to rack means laterally and vertically.

5. In combination, a hopper having a discharge opening and a sliding gate for the opening, a frame supported by and surrounding the lower portion of the hopper and supporting said gate, means for moving said gate including a rotatable shaft journaled in the frame and interengaging pinions and rack means on the shaft and gate respectively, said frame including a pair of side wall members having vertical wall sections, and a pair of vertical end portions, said vertical wall sections being integral with said vertical end portions and sloping wall sections integral with said vertical wall sections and angularly extending from said vertical end portions, and gusset plates interconnecting juxtaposed edge portions of said sloping wall sections and said vertical end portions.

6. The invention, as set forth in claim 5, wherein bearing means supported by the vertical end portions of the side wall members provide the rotatable mounting for the shaft on the frame.

7. The invention, as set forth in claim 5, wherein ledges are supported on the inner and upwardly facing sides of the sloping wall sections for engaging the underside of the gate to support it in sliding movement on the frame.

8. The invention, as set forth in claim 5, wherein the lower margins of the sloping wall sections are reinforced by outwardly extending horizontal flanges secured thereto.

9. In a hopper having an opening for the discharge of lading and an outlet assembly for controlling discharge of lading the improvement comprising:

(*a*) a sliding gate for the opening,

(*b*) a frame bordering the opening forming a support for the gate,

(*c*) said frame having longitudinally extending side wall components and

(*d*) transversely extending wall components forming with said side wall components,

(*e*) a foursided chute-like enclosure including inwardly converging wall means lying below the gate,

(*f*) said side wall components forming guiding means at the sides of the gate and

(*g*) having longitudinal extensions projecting beyond the chute-like enclosure;

(*h*) means for moving the gate including:

(*i*) an operating shaft journaled in the extensions,

(*j*) interengaging rack and pinion means associated with the gate and shaft respectively for moving the gate by rotation of the shaft;

each said side wall component including an upright side wall plate portion forming

(1) the side wall guides for the gate.

(2) the extension beyond the chute constituting a support for the shaft,

(3) an inwardly directed portion forming the converging wall means for the chute-like enclosure,

(4) said inwardly directed portion being formed by imparting a cut in the upright plate extending upwardly from its lower margin to the line of convergence to provide

(5) a length of plate juxtaposed to the chute and

(6) bending said juxtaposed parted length of plate inwardly.

10. The invention, as set forth in claim 9, wherein the inwardly converging portion of the plate is united with the upright extension by a transversely extending gusset.

11. The invention, as set forth in claim 10, wherein the inwardly converging wall is reinforced at its lower margin by a horizontal flange secured thereto and to the uniting gusset.

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