United States Patent

[11] **3,530,803**

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[54] **LIGHTWEIGHT HOPPER GATE**
7 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **105/282,** 49/413, 52/309, 105/308, 105/424
[51] **Int. Cl.** **B61d 7/20,** B61d 7/22, F04f 1/00
[50] **Field of Search** 49/413; 52/309; 105/282, 282RP, 424, 253, 308, 305, 282RR

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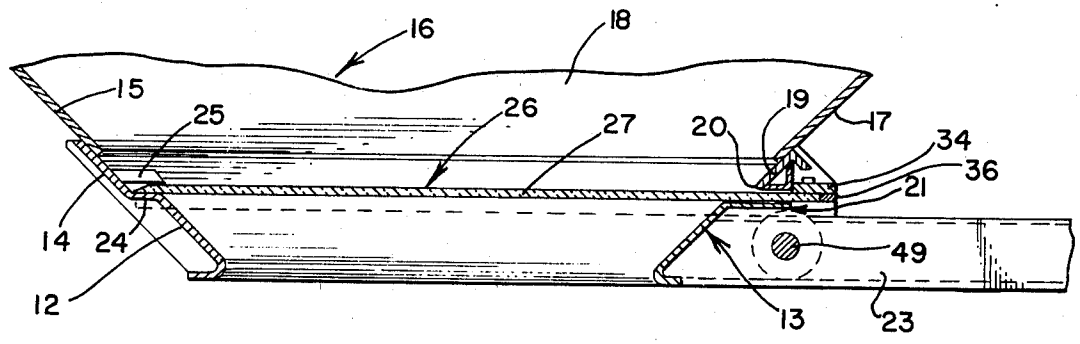
ABSTRACT: A lightweight gate for regulating the discharge opening provided by a four-sided wall structure attached to the hopper of a railway car, the said gate comprising a plate of fiber glass provided with metallic edging portions, which slide on metal surfaces formed on said walls disposed below the discharge opening. The fiber glass plate is connected to a U-shaped actuating member including racks which are disposed on opposite sides of the wall structure, the said racks being slidable on slide elements on said wall structure wherein the gate may be moved horizontally to either a closed or open position relative to said discharge openings.



Sheet 1 of 2

FIG. 1

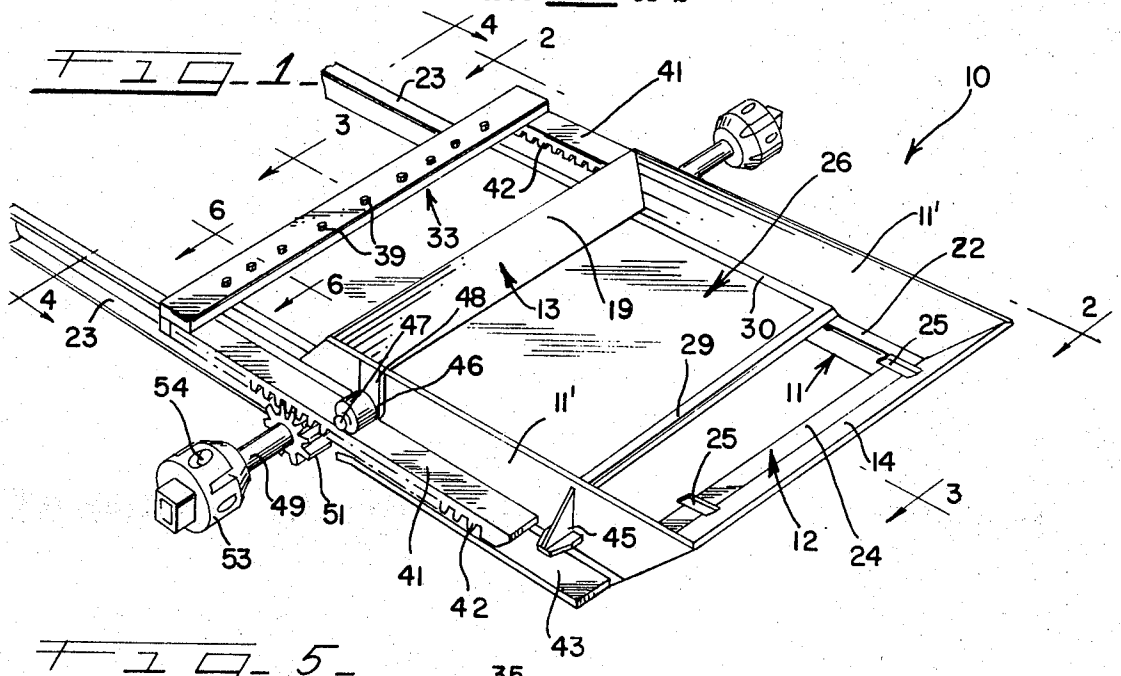


FIG. 5

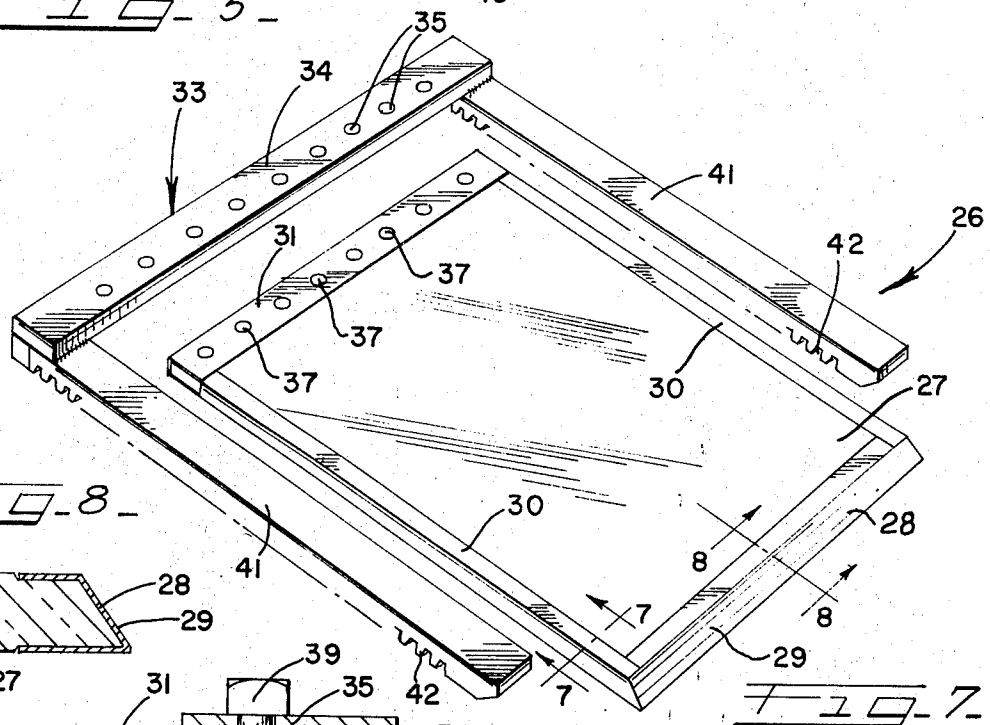


FIG. 8

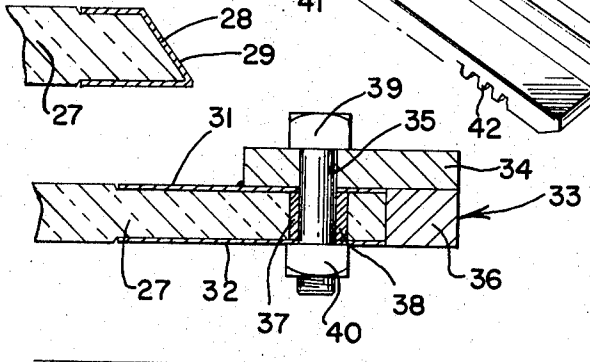


FIG. 6

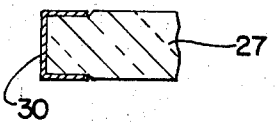


FIG. 7

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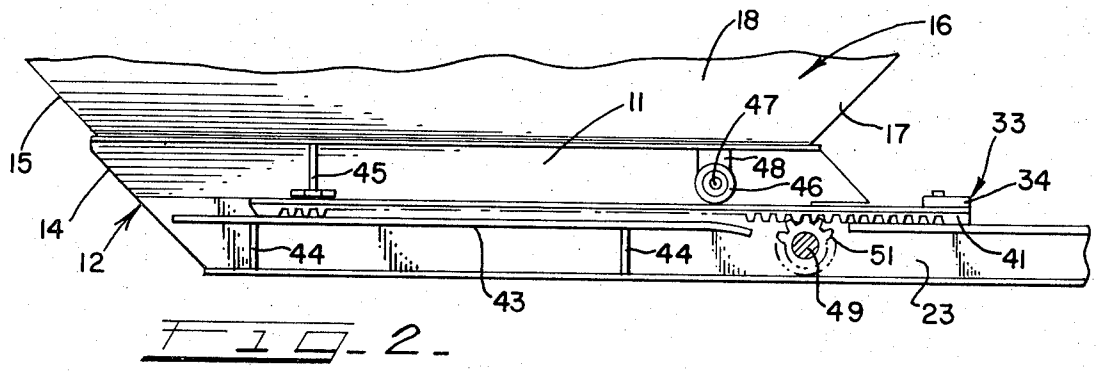

FIG. 2

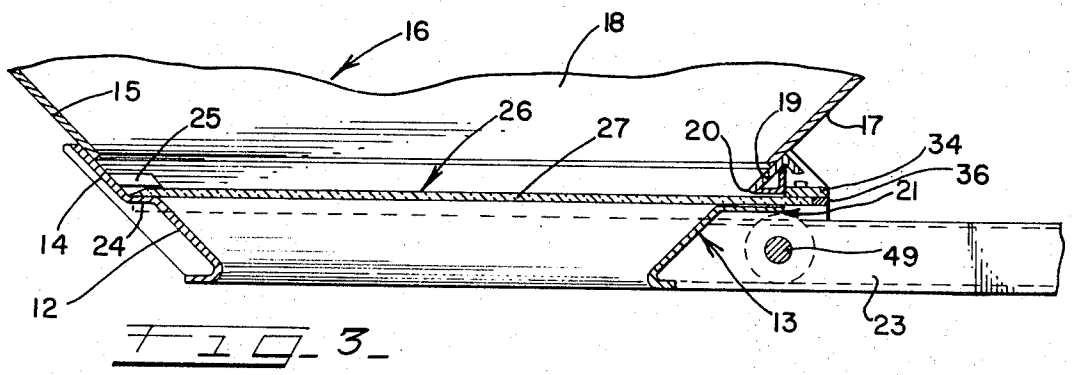

FIG. 3

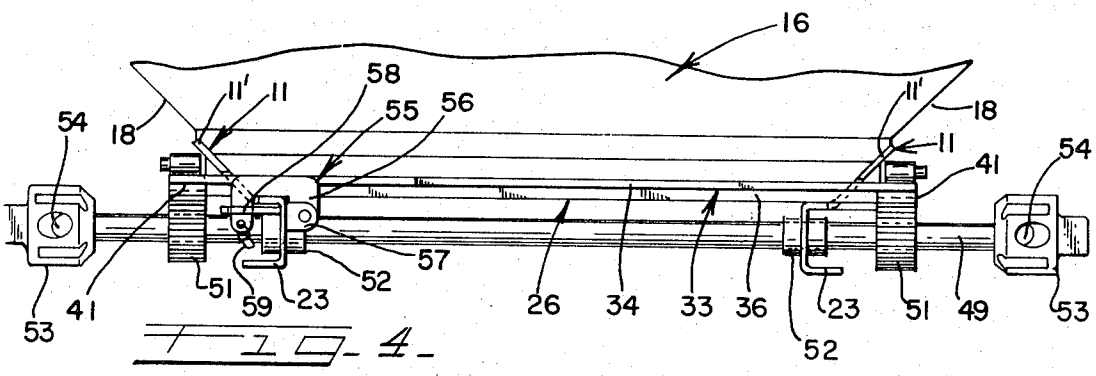

FIG. 4

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LIGHTWEIGHT HOPPER GATE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present improvement is concerned with either stationary or movable bins, such as in the case of railway hopper cars, wherein the bins include hopper portions having at their lower ends a gravity discharge outlet which is controlled by a movable gate.

2. Description of the Prior Art

In the prior art gravity outlets for discharge hoppers generally are controlled by means of a metal gate which is slidable horizontally to and from a closed position. Such gates are usually constructed of a metal plate with metal racks attached to the underside. A rotatable shaft is usually mounted on the frame with a pair of pinions which engage the teeth on the rack. The metal gate frequently is difficult to open and close because of its heavy weight. Further, the racks are usually positioned underneath the discharge gate, and can easily become clogged with material being discharged, this jamming the mechanism. This provides for a dangerous condition in that pry bars, hammers, etc., and excessive force must be used to open the gate which may cause injury to the operator.

Further, with the present designs, the opening in the back of the gate must be irregular in shape to clear the metal gate with the racks attached. If the gate is partially opened during unloading, material can escape between the opening in the frame and the slide gate in the area of the rack since the rack teeth do not fully close the opening. Lading can filter around the rack teeth and out the back of the gate. With the proposed arrangement, a simple rectangular opening, which closely approximates the size of the slide gate, can be used. This minimizes leakage and there are no rack teeth to permit the lading to filter out.

SUMMARY OF THE INVENTION

The invention comprises a lightweight gate for a hopper discharge outlet wherein said gate is constructed of a lightweight material and is removably connected to an actuating mechanism so disposed that the gate will not readily jam in a closed position, is easily opened and is easily closed since it will effectively cut through the material being discharged from the hopper. The improved construction is also designed to prevent leakage of material.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a gravity discharge gate for a hopper arrangement;

FIG. 2 is a side elevational view taken substantially along the line 2–2 of FIG. 1;

FIG. 3 is a cross sectional view taken substantially along the line 3–3 of FIG. 1;

FIG. 4 is a rear elevational view taken substantially along the line 4–4 of FIG. 1;

FIG. 5 is a perspective view showing a gravity gate and actuating rack arrangement in exploded fashion;

FIG. 6 is a cross sectional view taken substantially along the line 6–6 of FIG. 1;

FIG. 7 is a detailed sectional view of an edging portion of a gate taken along the line 7–7 of FIG. 5; and

FIG. 8 is a cross sectional view taken along the line 8–8 of FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now particularly to FIGS. 1, 2 and 3, a gravity discharge gate arrangement for a railway hopper car is generally designated by the reference character 10. The discharge gate arrangement 10 comprises a wall structure including a pair of opposed upright side walls 11 suitably connected to a front wall 12 and a rear wall 13. The upright side walls 11, as best shown in FIG. 4, are provided at their upper ends with outwardly inclined wall portions 11'. The front wall 12, as shown in FIG. 3, is provided at its upper end with an outwardly inclined wall portion 14 and the rear wall 13 is provided with an upwardly outwardly inclined wall portion 19. As best shown in FIG. 3 the wall portion 14 is suitably connected to a sloping wall 15 of a hopper generally designated by the reference character 16. The hopper 16 also includes a sloping wall 17 which is suitably connected to the inclined wall portion 19. As best shown in FIG. 4, the hopper 16 also includes opposed side wall portions 18 which are suitably connected to the upper inclined wall portions 11' of the side walls 11. The inclined wall portion 19, as shown in FIG. 3, is provided with an opening 20 which extends transversely coextensive with the wall portion 19 and a horizontally extending flange 21 formed on the rear wall 13.

As best shown in FIG. 4, the side walls 11 are each provided with a shelf 22 coextensive therewith. The side walls 11 are suitably connected to a pair of longitudinally extending channel members 23 which project horizontally to one side of the hopper 16, as best shown in FIGS. 2 and 3. As best shown in FIG. 3, the front wall 12 is provided with an offset horizontal ledge 24 extending substantially coextensive with the width of said front wall 12. A pair of fingers 25, as best shown in FIGS. 1 and 3, project substantially parallel above and with respect to the horizontal ledge 24.

A gate or closure member is generally designated at 26 and consists of a flat plate 27 which is preferably constructed of fiber glass material. The plate 27, as best shown in FIG. 5, includes a tapered front edge 28 containing a substantially U-shaped edging strip 29. The edging strip 29 preferably comprises stainless steel which is attached to the fiber glass plate by suitable means. A U-shaped edging strip 30, as best shown in FIGS. 5 and 7, also is attached by suitable means to opposite edges of the plate 27. These edging strips 30 are preferably made of stainless steel material. The plate 27 is connected to an actuating frame 33 which comprises a transversely extending beam 34 having a plurality of horizontally spaced vertical openings 35. A depending strip 36, as best shown in FIG. 6, is suitably connected to the beam 34. The rear portion of the plate 27 is provided with upper and lower metal plates 31 and 32 best disclosed in FIG. 6. Bushings 38 are retained in the openings 37 by the metal plates 31 and 32 and bolts 39 extend through the openings 35, through the bushings 38, and by means of a threaded nut 40 tightly secure the frame 33, plates 31 and 32, and the plate 27 in assembly as indicated.

As best shown in FIGS. 1 and 5, a pair of rack bars 41 are welded to the beam 34 and extend therefrom in U-shaped relation. The rack bars 41, as shown in FIG. 1, straddle or are disposed outwardly and parallel to the walls 11. The walls 11 have connected thereto horizontal guide members 43 supported by gussets 44. Rack teeth 42 of the rack bars 41 slide horizontally on the guide brackets 43. The rack bars 41 also are further retained and guided by means of guide elements 45 connected to the side walls 11 and engaging the upper surfaces of the rack bars 41. The walls 11 also support a pair of rollers 46 each being journaled on a shaft 47 connected to a vertical bracket 48 suitably connected to the outer sides of the side walls 11.

A shaft 49 includes sprockets 51 for rotation therewith, the said sprockets 51 as shown in FIG. 4, being in engagement with the rack teeth 42. Bearings 52 on the channel-shaped members 23 support for rotation the shaft 49 which is provided at opposite ends, as shown in FIG. 1, with operating heads 53 having bores 54 adapted to receive a suitable lever to provide for manual rotation of the shaft 49.

As shown in FIG. 4, wherein the gate 26 has been moved to its closed position, a stop 55 retains the said gate 26 against undesired opening. The stop 55 comprises a hinged element 56 which is rotatable on a bracket 57. The hinged element 56 has a portion thereof extending through a slotted plate 58. The hinged element 56 can be further retained in its locked position by means of a conventional car seal 59. The stop 55 is positioned on one of the channel members 23 in a position

where in the closed position of the gate **26**, the hinged element **56** is in the path of movement of the gate **26** so that it cannot open.

THE OPERATION

In the operation of opening the gate **26** from the position shown in FIG. **4**, the seal **59** is broken and the hinged element **56** is rotated to an out-of-the-way position relative to the gate **26**. Rotation of the operating heads **53** now effectuates turning movement of the pinions, and the rack bars **41** are moved horizontally whereby, as shown in FIG. **1**, the gate **26** is withdrawn from the closed position. The reverse action takes place for moving the gate to its closed position. By virtue of the fiber glass construction of the plate **27** a lightweight construction is achieved which is yet rugged to withstand the most severe operating conditions. The stainless steel edging strips **30** provide for dissimilar metal-to-metal contact with the portions of the walls **11'** within which the shelves **22** are provided. The wall portions **11'** are of a low grade steel and the dissimilarity of the material provides for good wearability and ease in opening of the gate **26** from its closed position. As shown in FIGS. **1** and **4**, the edging strips **30** slide in the shelves **22** provided adjacent the upper ends of the channel shaped members **23** and the lower ends of the upwardly inclined wall portions **11'**. The guide members **43** facilitate sliding of the rack bars **41** to provide a trouble free operation of the gate **26** during the opening and closing stages. Upper vertical displacement of the rack bars **41** is prevented by means of the guide elements **45** and rollers **46**, with sliding action facilitated to provide ease of operation.

Thus it is readily apparent that an improved lightweight gate has been provided for controlling the discharge of a hopper outlet. The gate will be tight and will not readily leak since the rack bars **41** are placed outwardly of the rectangular opening provided by the upright walls **11**, **12** and **13**. Replacement of a damaged plate **27** can be easily accomplished by merely disassembling the bolts **39** as shown in FIG. **6**. The fiber glass plate is lightweight and is about one-third as heavy as the conventional steel gate now in use. The stainless steel edge strips **30** result in dissimilar metals bearing against each other to overcome sticking or binding of the gate, since the gate material may be usually of a conventional low grade steel. Also a simple lock is disclosed which is visible from either side of the car and effectuates a positive lock during operation.

It is believed that the advantages and structure of the improvement have been fully disclosed and it must be understood that changes and modifications may be made which do not depart from the spirit of the invention or from the scope of the appended claims.

I claim:

1. A hopper discharge arrangement including a plurality of interconnected upright walls forming a discharge opening, a sliding gate disposed beneath said opening, supporting means associated with said walls and disposed below said gate for supporting said gate for sliding movement, actuating means for moving said gate from a closed position beneath said opening to an open position; said gate comprising:

a flat plate of non-metallic relatively lightweight material relative to the material of the lower portion of the hopper supporting the plate;

said gate plate including opposed side edge portions, and a flat edge strip connected to each of a lower surface of said edge portions, being substantially coextensive therewith;

said strips engaging said supporting means in relative sliding relation;

said actuating means comprising a U-shaped frame including;

a pair of laterally spaced rack elements;

a transversely extending connector bar connected to one end of each rack element;

said rack elements being disposed laterally outwardly of opposed upright walls;

means removably connecting said plate to said connector bar; and

pinion means rotatably positioned on said discharge arrangement engaging said rack elements for moving the same and the plate therewith.

2. The invention in accordance with claim **1**, said material of said plate being of fiber glass material.

3. The invention in accordance with claim **1**, said plate including flat edge strips coextensive along upper surfaces of said edge portion, said strips consisting of a metal material.

4. The invention in accordance with claim **1**, said racks being slidingly supported on said opposed upright walls by horizontally extending surfaces provided by guide means connected to said opposed upright walls.

5. The invention in accordance with claim **4**, including second guide means supported on said opposed upright walls being disposed above and engaging said rack elements.

6. The invention in accordance with claim **5**, said second guide means including roller elements.

7. The invention in accordance with claim **1**, including a stop means for locking said gate in a closed position under said discharge opening, comprising:

a bracket connected to said supporting means; and

a hinged element connected to said bracket movable from a non-locking position below said gate into a locking position blocking the path of movement of said gate.