Jan. 4, 1966 J. T. SMITH ET AL 3,227,100

HOPPER CAR DOOR ACTUATING MECHANISM

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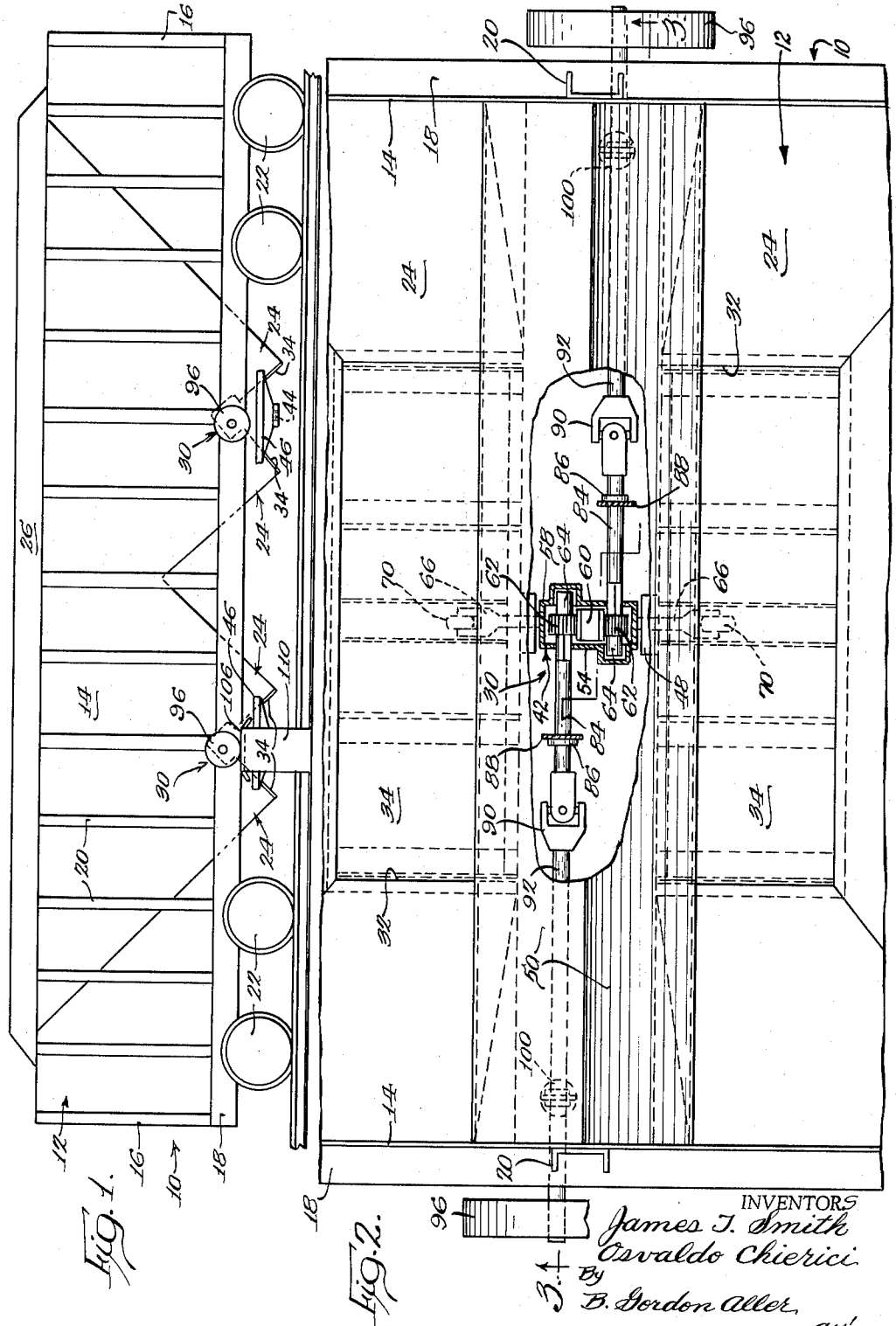


Fig. 1.

Fig. 2.

INVENTORS
James T. Smith
Osvaldo Chierici
By
B. Gordon Aller
Atty

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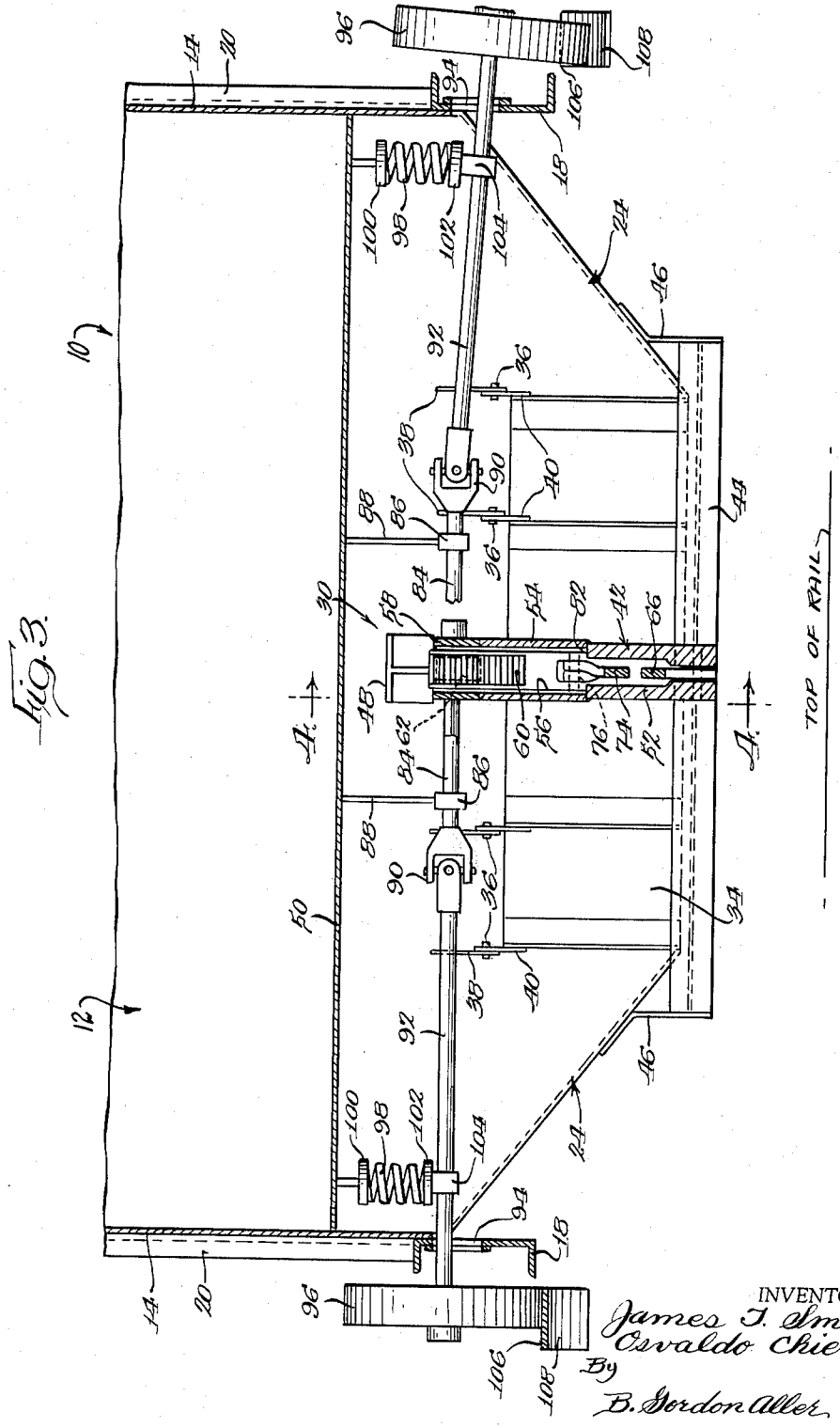


Fig. 3.

INVENTORS:
James T. Smith
Osvaldo Chierici
By
B. Gordon Aller
Atty

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Fig. 4.

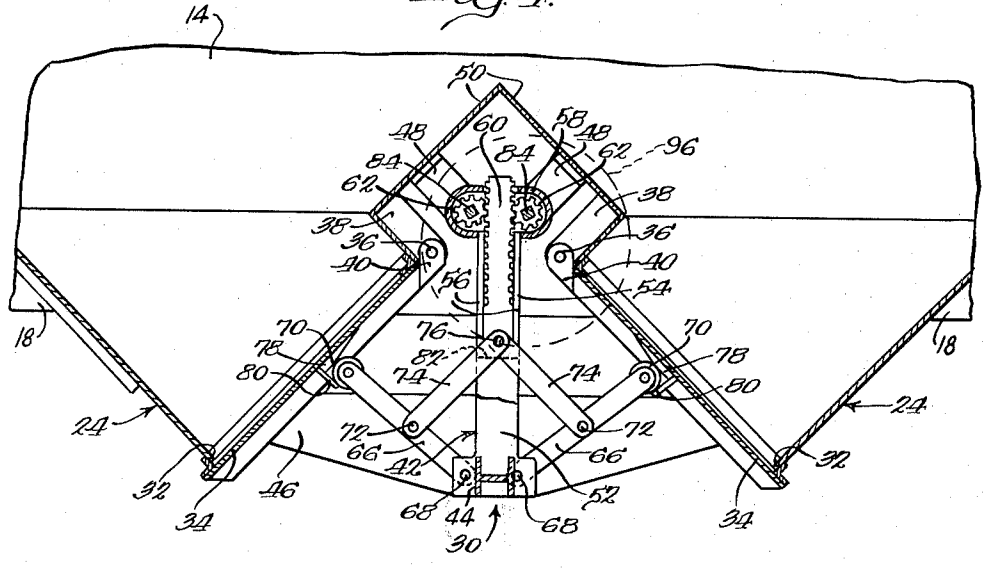
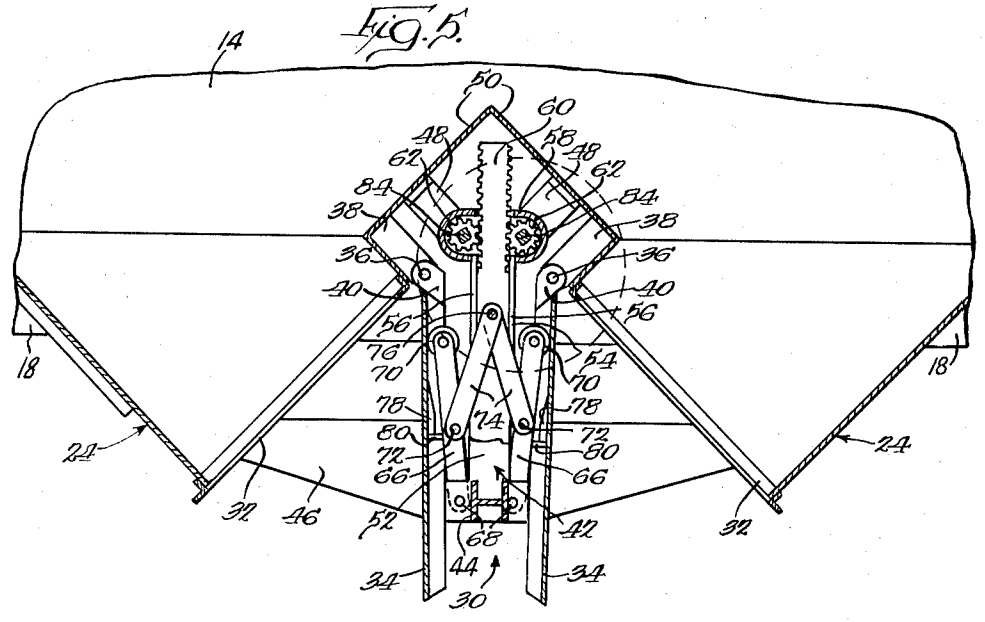


Fig. 5.



INVENTORS:
James T. Smith
Osvaldo Chierici
By
B. Gordon Aller, Atty

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HOPPER CAR DOOR ACTUATING MECHANISM

James T. Smith, Wilmette, and Osvaldo Chierici, Elmhurst, Ill., assignors to Jay R. Sheesley, Glencoe, Ill.

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4 Claims. (Cl. 105—286)

The present invention relates to an improvement in hopper cars and in particular to a novel automatic hopper door opening and closing mechanism and a loading hatch cover opening and closing mechanism.

Hopper cars, particularly those carrying coal, gravel, sand and the like, frequently must be unloaded or dumped at places which are inconvenient for an individual to reach, such as a trestle over a coal yard. It is necessary for the yardman to attend to each car in the train and manually open the hopper doors. When the cars have been unloaded, it is necessary that the yardman manually close and lock each of the doors. This is hard work since the doors are extremely heavy, weighing as much as 125 pounds each, and some hopper cars may have as many as eight doors. It is easily appreciated that the work of attending a train of hopper cars for unloading is not only laborious but may under some circumstances be hazardous.

The prior art designers have suggested various devices for automatically opening the hopper doors, but nearly all of these suggestions have involved substantial and elaborate modifications in the basic car structure and the addition of appreciable equipment at or in the road bed to operate these devices. Usually one device was used to open the door and another to close it or the closing was done manually.

It is a principal object of the present invention to provide a hopper car incorporating a novel and simple hopper door opening and closing mechanism which also serves to lock the door in closed position.

Another object is to provide a novel hopper door opening and closing mechanism which acts on a pair of opposed doors simultaneously.

Another object is to provide a novel hopper door opening and closing mechanism which is operated by movement of the car past a specific position.

Another object is to provide a novel hopper door opening and closing mechanism which is operated from one side of the car to open the door and the other side of the car to close the door as the car travels in a single direction past spaced actuators at trackside, or to open and close the door from the same side of the car by moving it in opposite directions past a single actuator.

Other objects and advantages will become apparent from the following description taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a side elevational view of a hopper car incorporating the automatic hopper door opening and closing mechanism of the present invention;

FIG. 2 is a plan view on an enlarged scale, partly broken into section, of a portion of the hopper car showing one of the automatic hopper door opening and closing mechanisms;

FIG. 3 is a transverse sectional view taken along the line 3—3 of FIG. 2, looking in the direction of the arrows;

FIG. 4 is a fragmentary longitudinal sectional view taken along the irregular line 4—4 of FIG. 3, looking in the direction of the arrows, showing the hopper doors in closed position; and

FIG. 5 is a sectional view similar to FIG. 4 showing the hopper doors in open position.

Referring to the drawings, and in particular to FIGS. 1 through 5, the reference character 10 indicates a hopper car having a load carrying body 12 formed of side and end walls 14 and 16, respectively, side sills 18 from which upstand outwardly facing wall supporting channels 20, running gear 22, dumping hoppers 24, and a loading hatch cover assembly 26. The car illustrated also incorporates the novel hatch cover opening and closing mechanism 28 illustrated in FIGS. 6 and 7 and the novel hopper door opening and closing mechanism 30.

Each hopper 24 has a framed opening 32 which is closed by a hopper door 34 pivoted on pins 36 at the top of the opening 32, the pins extending through brackets 38 carried on the hopper, and a hinge plate 40 on the door which is secured to a conventional reinforcing flange.

FIGS. 1, 4, and 5 show a conventional arrangement of hoppers in pairs with the openings 32 faced generally toward each other at an included angle of about 90° or slightly less. The hopper door opening and closing mechanisms 30 are positioned between the pairs, and each includes a column 42 supported at its lower end by a transverse beam 44 mounted on the sloping walls of the hoppers 24 by end brackets 46. The column 42 is supported at its upper end by brackets 48 secured to diagonal walls 50 of the hoppers 24. The column 42 has a lower bifurcated section 52 and an upper extension 54 which is welded to the lower section 52 and is formed with side apertures 56 and an upper gear housing 58. A rack bar 60 having teeth on opposite sides is vertically slidable in the upper extension 54 of the column and between a pair of pinions 62 which engage the teeth on the opposite sides of the rack bar 60. The pinions 62 are enclosed within the gear casing 58 and are journaled therein at 64 (FIG. 2). A pair of levers 66 are pivoted on pins 68 at the bottom of the column and extend diagonally oppositely away therefrom. At its outer end, each lever is fitted with a roller 70 which rides on the outer surface of the door 34. At its midpoint, each lever 66 has a link 74 pivoted thereto on a pin 72, the other end of which is pivotally connected by a pin 76 to the lower end of the rack bar 60.

FIG. 4 shows the hopper doors 34 in closed position with the levers 66 extending diagonally upwardly away from the bottom of the column 42, with the included angles therebetween greater than 90°, and the rollers 70 engaged on wedges 78 and against stops 80 in an over dead center position to effect locking of the doors 34 in closed position. It will be obserbed from FIG. 4 that the levers 66 do not make direct right angles with the face of the door when the doors are in closed and locked position, but that the included angle on the hinge side of the door between the lever 66 and the door face is slightly less than 90°. In this position of the mechanism 30, the rack bar 60 is abutted against a shoulder 82 between the bottom portion 52 and upper extension 54 of the column 42.

As the pinions 62 drive the rack bar 60 upwardly toward the position of FIG. 5, the links 74 are pulled upwardly and their lower ends are converged, thereby pulling the rollers 70 from the wedges 78 and onto the face of the door in a movement direction toward the hinges at the upper edges of the door openings 32. This action frees the doors, and they fall to the open position shown in FIG. 5 by their own weight and that of the load contained within the car.

When the pinions 62 drive the rack bar 60 downwardly, the links 74 pivot the levers 66 outwardly and downwardly. The rollers 70 carried on the outer ends

of the levers 66 ride on the surfaces of the doors 34 and swing them toward closed position. At the end of the downward movement of the rack bar 60, the rollers 70 ride up onto the wedges 78 and against the stops 80, thereby locking the doors 34 in closed position.

Each pinion 62 is mounted on the squared end of a short shaft 84 extending outwardly and sidewardly of the car 10 from the gear box 58 and is supported near its outer end in a bearing 86 suspended on a hanger 88 from the walls 50 of the hoppers. Each shaft 84 is connected through a universal joint 90 to a longer shaft 92 which projects sidewardly of the car through an opening 94 in the side sill 18. A wheel 96 is secured on the outer end of the shaft 92. The outer end of the shaft 92 is limited in its vertical movement by the upper and lower ends of the slot 94 and is prevented from sideward movement by the sides of the slot which is only very slightly wider than the diameter of the shaft. The shaft 92 is biased toward the bottom of the slot 94, as shown at the right-hand side of FIG. 3, by a spring 98 confined between a pair of keepers 100 and 102, the upper keeper 100 being supported from and secured to the walls 50 of the hopper, and the lower keeper 102 being mounted on a bearing 104 embracing the shaft 92.

The wheels 96 are adapted to cooperate with short sections of rail 106 provided with entry and exit ramps 108 which are mounted alongside the roadbed at the places where it is desired that the hopper car be unloaded, as shown most clearly in FIG. 1. The rails 106 are mounted on standards 110 adjacent to the roadbed. The main surface of the short rails 106 is above the bottom position of the wheel 96, and therefore as the car approaches the track section 106, the wheel first rides up the incline or ramp 108 to the top of the track 106 and across it, dropping off the other ramp or inclined surface 108. The compression springs 98 insure a full and firm contact of the wheel 96 against the rail, and if desired, the surface of either the rail or the wheel may be serrated, roughened, or provided with some other friction creating means, to make certain that the wheel 96 is rotated even though there might be some resistance to it in the hopper door opening and closing mechanisms 30.

If it be assumed that it is desired to open the hopper doors of the car illustrated in FIG. 1, it is moved from right to left. The first wheel 96 engages the rail 106 riding up the ramp 108 and compressing the spring 98. It is driven in the counterclockwise direction and rotates the pinion 62 associated therewith in the counterclockwise direction through the shafts 92 and 84. As the pinion is rotated through an angle of about 240°, it draws the rack bar 60 upwardly which in turn pulls the links 74 upwardly. This movement is transmitted to the levers 66, and the rollers 70 ride upwardly along the surfaces of the hopper doors 34 toward the hinges. The doors swing open under their own weight and that of the load contained within the car, which load falls from the car through the openings 32 to the pile below. The second set of doors on the car is similarly opened.

When the cars have been emptied, the doors may be closed by continuing the movement of the car in the same direction and past a rail 106 placed on the opposite side of the roadbed to be engaged by the wheel 96 on the opposite side of the car. The rack bar 60 is driven downwardly by driving the other of the set of pinions 62 in the counterclockwise direction, as viewed in FIGS. 4 and 5. However, the doors can be closed by driving the pinions 62 used in opening the doors in the opposite or clockwise direction by moving the car in the opposite direction, engaging the same wheels 96 with the same track section 106. During the closing operation, the rack bar 60 is driven downwardly, the links 74 are likewise driven downwardly with their ends moving outwardly as the levers 66 and their rollers 70 are forced down the face of the doors toward the wedges 78 and stops 80. At the conclusion of this operation, the rollers 70 ride onto the wedges 78 and against the stops 80 to lock the doors in closed position.

It is clear from the foregoing that by the present invention there have been provided a novel automatic means for opening and closing the loading hatch doors and for opening and closing the hopper doors of a hopper car, and that the objectives which were claimed for this invention at the outset of the specification are fully attained by the disclosed structure.

While a preferred embodiment of the present invention has been shown and described, it will be apparent that numerous modifications and variations thereof may be made therein without departing from the underlying principles of the invention. It is therefore desired, by the following claims, to include within the scope of the invention all such variations and modifications by which substantially the results of this invention may be obtained through the use of substantially the same or equivalent means.

What is claimed as new and desired to be secured by United States Letters Patent is:

1. In combination with a hopper car having a hopper door pivoted to the hopper adjacent the upper edge of the opening, a mechanism for opening and closing the hopper door, a shaft connected to said mechanism to operate said mechanism and rotatable in opposite directions and having an outer end extending beyond the side of the car, said shaft including a universal driving joint permitting vertical movement of the outer end of said shaft, a wheel fixed to the outer end of said shaft, a rail positioned adjacent the path of movement of the car and adapted to be engaged by said wheel as the car moves therepast, and means acting between a fixed portion of the hopper car and the outer position of said shaft for forcibly and resiliently urging said wheel downward into driven engagement with said rail whereby movement of the hopper car in one direction past said rail will cause said mechanism to release the hopper door for opening and movement of the car in the opposite direction past said rail will cause said mechanism to close the hopper door.

2. In combination with a hopper car having a pair of adjacent hopper doors pivoted to swing toward each other in opening direction from the upper edges of the hopper openings, a mechanism interposed between said doors for opening and closing the hopper door, a pair of shafts connected to said mechanism to operate said mechanism, said shafts being rotatable in opposite directions and having outer ends extending beyond the sides of the car, each shaft including a universal driving joint permitting vertical movement of the outer end of each shaft, a wheel fixed to the outer end of each shaft, a pair of longitudinally spaced rails alongside the path of movement of the hopper car and adapted to be engaged by said wheels as the car moves therepast, and means acting between a fixed portion of the hopper car and the outer portions of said shafts for forcibly and resiliently urging said wheels downward and into driven engagement with said rails, whereby rotation of either wheel in one direction will operate said mechanism to open the hopper doors and rotation of the same wheel in the opposite direction or the other wheel in the same direction will operate said mechanism to close said hopper doors.

3. An automatic hopper door opening and closing apparatus for hopper cars having a pair of adjacent hopper doors pivoted to swing toward each other in opening direction from the upper edge of the hopper openings, comprising in combination, a rack bar having rack teeth on opposite sides, means mounting said rack bar for vertical movement in a position between the hopper doors, a pair of levers pivoted to the lower end of said rack bar mounting means, a roller carried on the outer end of each lever and riding on the outer face of the adjacent door, a link interconnecting each lever at its midpoint

with the lower end of said rack bar, a pair of pinions meshed with said rack bar on said opposite sides, a pair of shafts each having a driving connection with one of said pinions and oppositely extending to and beyond the corresponding side of the hopper car, the outer ends of said shafts being vertically movable, means limiting the vertical movement of said shafts, a pair of longitudinally spaced rails alongside the path of movement of the hopper car, a rail engaging wheel carried on the outer end of each shaft at the side of the hopper car and adapted to engage and ride upon the surface of one of said rails alongside the hopper car as it rolls therepast, and a spring means acting between a fixed part of the hopper car and each shaft to urge said wheel into positive engagement with the rail, whereby rotation of either wheel in one direction will raise said rack to release the hopper doors to swing open and rotation of the same wheel in the opposite direction or the other wheel in the same direction will drive said rack downwardly to cause said levers to push the hopper doors to closed position.

4. The combination claimed in claim 3, including a wedge and stop on the outer face of the door adapted to be engaged by said roller when said lever is in over dead center position to lock the door in closed position.

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EUGENE G. BOTZ, *Primary Examiner.*

LEO QUACKENBUSH, *Examiner.*

ARTHUR L. LA POINT, H. BELTRAN,
Assistant Examiners.