

P. J. HARRIGAN.
DUMP CAR.

APPLICATION FILED MAR. 23, 1910.

Patented Feb. 7, 1911.

3 SHEETS-SHEET 1.

983,277.

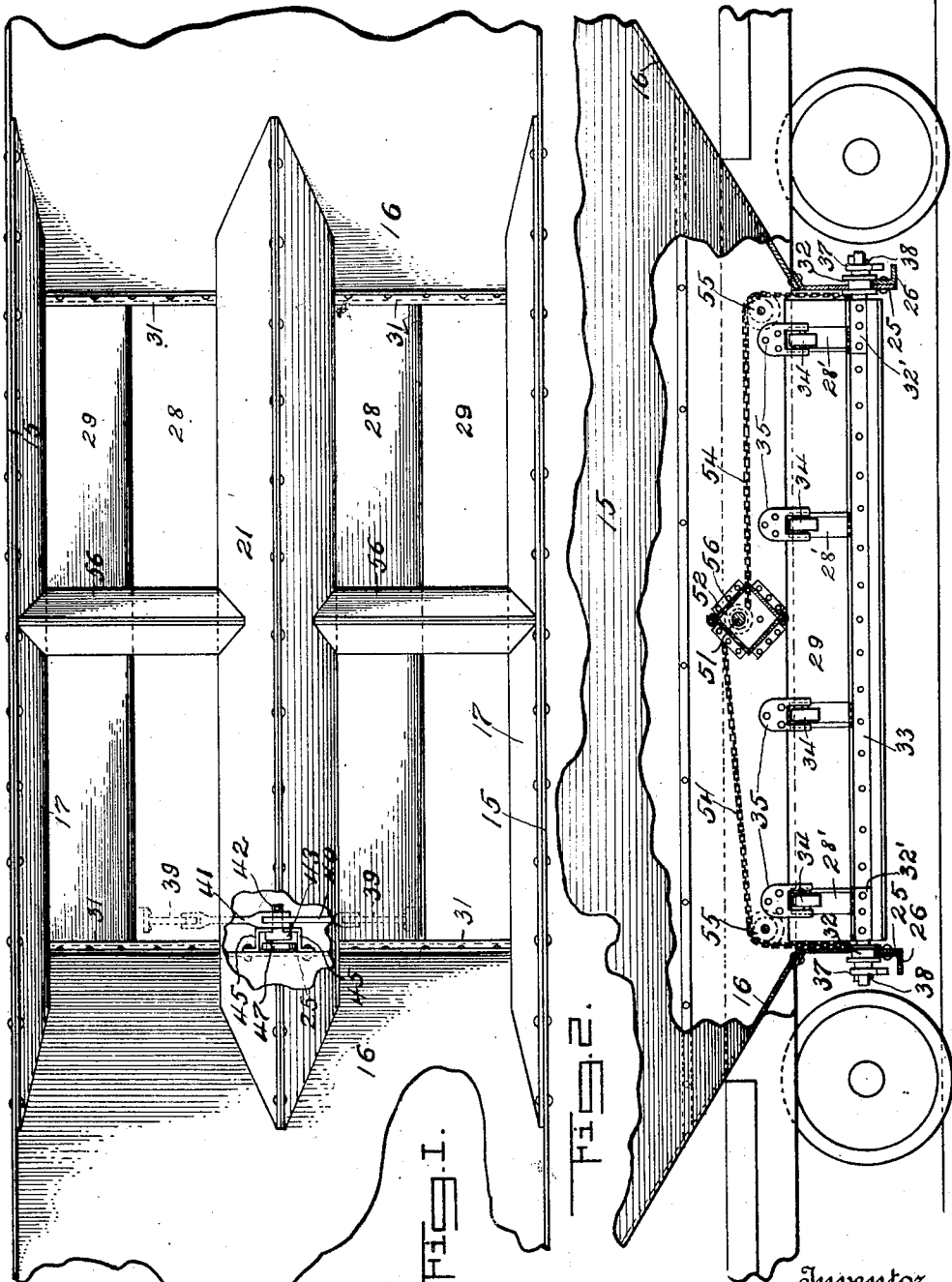


FIG. 1.

FIG. 2.

Witnesses
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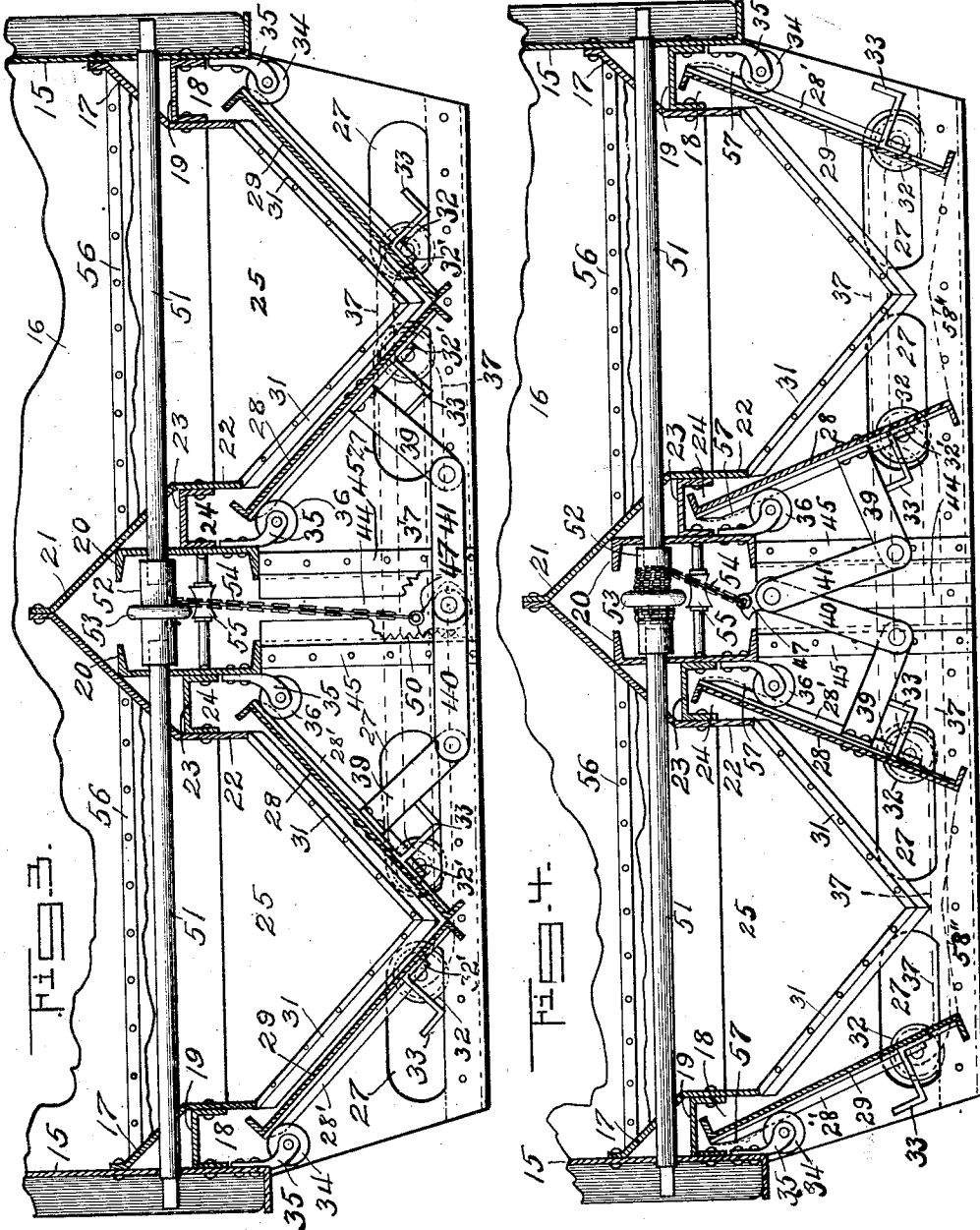
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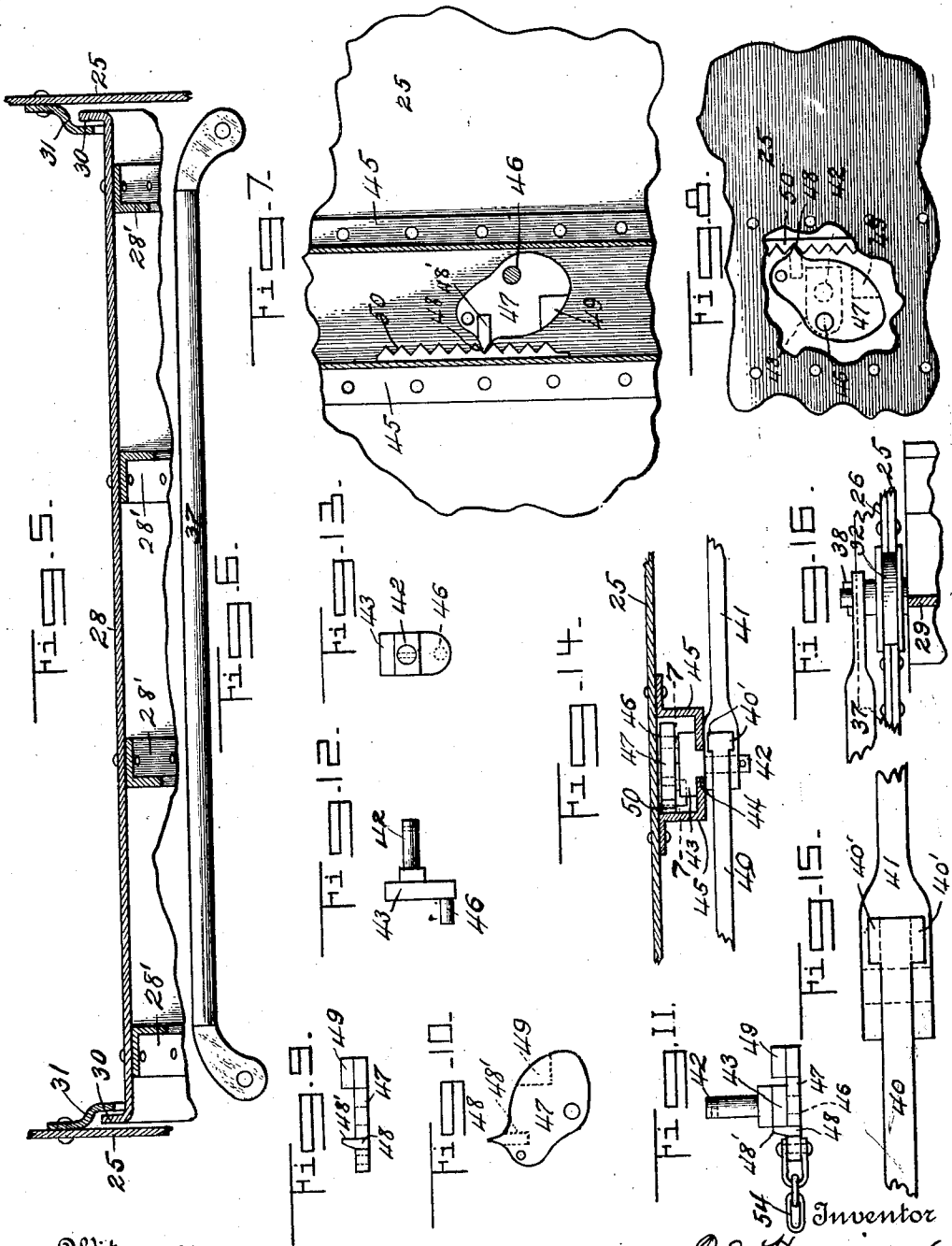
DUMP CAR.

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3 SHEETS-SHEET 3.

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Witnesses

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UNITED STATES PATENT OFFICE.

PATRICK JOSEPH HARRIGAN, OF McKEESPORT, PENNSYLVANIA.

DUMP-CAR.

983,277.

Specification of Letters Patent.

Patented Feb. 7, 1911.

Application filed March 23, 1910. Serial No. 551,115.

To all whom it may concern:

Be it known that I, PATRICK J. HARRIGAN, a citizen of the United States of America, residing at McKeesport, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Dump-Cars, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to certain new and useful improvements in dump cars, and relates more particularly to that class of cars generally known as hopper bottom cars provided with doors constituting either the bottom or a portion of the bottom of the car and movable to open position to permit the discharge of the lading.

The invention relates particularly to an improvement in the doors and operating mechanism therefor, one of the principal objects of the present invention being to provide gravity-closing doors and operating mechanism therefor which can be applied to the standard form of hopper bottom cars without necessitating any alteration in location of the center sills or other structure of such car.

The invention also has for its object the provision of gravity-closing doors which may be applied to the standard form of hopper bottom cars and which are so disposed with relation to the car sides that as the lading begins to discharge from the car, the weight of the lading is directed against the doors in such manner as to effect a rapid opening thereof, the doors in the completely open position however, being still so disposed with respect to the car sides, that their natural tendency is to automatically return to closed position when the weight of the lading is removed therefrom.

A further object of the invention is to provide means for positively locking the doors in closed position, and to also provide means cooperating therewith whereby the doors will be locked and held against opening movement under the weight of the lading should it happen that the doors were but partially closed when the lading was placed thereon.

A further object of the invention is to provide for reducing to a minimum, the friction encountered by the doors during their movements to open and closed positions.

A still further object of the invention is to

provide an operating mechanism for the doors of dump cars wherein all danger of injury to the workmen operating the same is eliminated, and in which the work required for the manipulation of the doors is reduced to a minimum.

The invention further contemplates the provision of novel door supporting means so disposed that the door or doors ride thereon in their opening and closing movements, the supporting means acting as the pivot of the door or doors and guiding same in their movement.

Further objects of the invention will appear as the same is hereinafter described in detail and then claimed, and in describing the invention in detail, reference will be had to the accompanying drawings showing a practical embodiment of the invention as practiced by me, and wherein like numerals of reference will be employed to designate like parts throughout the several views, in which:—

Figure 1 is a top plan view of a hopper bottom car of standard form, partly broken away, with my improved doors and operating mechanism applied thereto. Fig. 2 is a view of the same, partly in side elevation, partly broken away, and partly in section. Fig. 3 is a transverse vertical sectional view of the car body and doors, showing the latter in closed position, the car body being partly broken away. Fig. 4 is a similar view showing the doors in the open position. Fig. 5 is a longitudinal sectional view of a part of one of the doors and of a part of the end walls of the car body. Fig. 6 is a detached detail plan view of the tie rods employed in connection with the doors for unifying the movements of the latter. Fig. 7 is a detail side elevation of locking dog employed in connection with the doors, taken on line 7—7 of Fig. 14, a portion of the car end wall being shown. Fig. 8 is a detail view of a portion of one of the end plates broken away to show the opposite side of the locking dog. Figs. 9, 10 and 11 are detail edge, side and plan views of the locking dog. Figs. 12 and 13 are detail plan and elevation views respectively of the headed-pin which carries the locking-dog. Fig. 14 is a detail plan view of the locking mechanism, parts of the car being in horizontal section. Fig. 15 is an enlarged detail plan view of the joint of the toggles, and, Fig. 16 is a detail plan of one of the grooved rollers carried by

the doors, showing a portion of the track therefor, and a part of the door.

In the embodiment of the invention as herein illustrated, I have shown the same as comprising two pairs of doors, that is, a pair of inner doors, and a pair of outer doors, in which form the invention would be used when applied to hopper bottom cars of standard form and size, but I do not wish to be understood as confining myself to the use of two pairs of doors, as obviously, a pair of doors arranged to operate in the manner herein set forth would be clearly within the scope of the invention. Furthermore, the doors being herein shown as applied to the standard form of hopper bottom car, they are arranged longitudinally thereof, in which manner they are best adapted for use in connection with the said type of car. It is obvious that the arrangement of the doors and the operating mechanism with the doors transversely of the car or other body as might be required to adapt them thereto also falls within the scope of the invention claimed.

The body of the car herein shown for illustrative purposes, is in general, of the usual form, having vertical side walls 15, and inclined end walls 16, which latter are usually placed at an incline to the vertical of from 33° to 55°. Attached to the inner faces of the side walls 15, are auxiliary side walls 17, which, except at the point of attachment, are spaced from the side walls 15, and extend downward a sufficient distance to form a recess 18 to receive the upper edges of the outer two doors of the series of doors, the walls 17 being made rigid by braces 19 attached thereto and to the side walls 15.

The center sills of the car body are designated at 20, and these sills are shown herein in the manner in which they are placed in the standard form of hopper cars, being spaced apart, and shielded or protected by a longitudinal ridge 21 usually formed of two inclined plates having their upper meeting edges firmly secured together. The lower portions 22 of these plates are extended vertically, and held in spaced relation from the sills by braces 23, thus forming recesses 24 for the reception of the upper edges of the inner pair of doors shown.

To adapt the doors and operating mechanism to be hereinafter described to the form of hopper car shown, I provide the end walls of said car with depending end-plates 25, which lie in vertical planes, and since, with the form of doors employed, it is not necessary to make any provision for a swinging movement thereof, the said end-plates are extended relatively close to the track, and the doors are also placed so that their lower edges are relatively close to the track. Preferably, I reinforce the lower edges of the end-plates by track-rails 26 of angle bar

as shown or other form, and each end plate is provided adjacent its lower edge with elongated openings 27, the lower edges of which are preferably on a plane with the upper edges of the reinforcing bar 26 whereby to provide a broader track for the wheels which travel in said openings and reinforce the end-plates as well.

The doors in the present illustration are shown as comprising two pairs, namely, an inner pair designated 28, and an outer pair designated 29. Each door is preferably provided with upturned ends 30, which are received back of deflectors 31 riveted to the inner faces of the end plates, the said construction preventing the material in the car from interfering in any manner with the free and easy movement of the doors. The doors may or may not be provided with the flanged upper and lower edges as shown, though it is preferable to provide the latter flanges to insure a perfect seating of the doors.

The doors are disposed at such an angle with respect to the car sides that the weight of the car lading will be directed against the doors so as to have a tendency to hold them in closed position, the angle at which the doors are placed however, being such that the doors may be easily shifted to a more acute angle in order that the weight of the load will then be directed against the doors to effect a rapid movement thereof.

The doors at their ends, near the lower edges thereof, carry travelers, preferably in the form of peripherally grooved rollers 32 which travel in the openings 27, on the track afforded by the lower walls of said openings and the upper edge of the reinforcing bar 26. Preferably the doors are provided on their under or rear faces in line with the rollers 32 with strengthening or reinforcing bars 33, which may be of Z-bar form as shown or other desirable form, which bars besides acting as a reinforce for the doors, also act as braces for the arms to which the toggles hereinafter described are connected. The rollers 32 are carried on pintles formed on the outer ends of straps 32' attached to the rear faces of the Z-bars 33 at the ends of the latter.

The doors are therefore roller-supported at their lower edges and in order to provide for the free and easy movement of the doors both in the opening and closing movement thereof, I also provide roller-supporting means for the upper edges of the doors. This latter door-supporting means comprises a plurality of rollers 34 supported beneath the recesses 18 for the outer pair of doors, by brackets 35 attached to the car sides or other convenient point, and a similar plurality of rollers 36 for the inner pair of doors, said latter rollers being supported beneath the recesses 24, by brackets 35 at-

5 attached to the center sills 20, or at any other convenient point. The rollers are so positioned with respect to the recesses 18, 24, as to leave clearance movement for the doors up into said recesses as the doors are moved to open position. The doors may be made from a sheet of material having the ends and longitudinal edges stamped or pressed to form the angles at said ends and edges, or from a sheet of material to which angle iron may be secured at said ends and edges as will be obvious. In order to stiffen the doors throughout and to prevent any possibility of the rollers 34, 36 bulging through the doors, due to the weight of the lading on the doors, I preferably employ transverse angle bars 28' extending from the Z-bars 33 to the upper edges of the doors, providing these angle-bars at each point where there is a roller 34 or 36 and on which the rollers ride, thus reinforcing the doors transversely or in a direction opposite to the reinforcing bars 33 and insuring against bulging of the doors where they ride on the rollers.

25 Where two pairs of doors are operated from a single operating mechanism, the doors must all move in unison, and to accomplish this, I employ tie members as 37, (see detail Fig. 6) which are provided preferably at both ends of the doors, these tie members connecting one door of the inner pair with the farthest removed door of the outer pair, and the other door of the inner pair with the door of the outer pair farthest removed therefrom. (see Fig. 4). These tie-members are advantageously attached by providing extended pintles for the rollers 32 to which pintles the tie-members are connected and retained thereon as by cotter pins 38, (see Fig. 2).

40 The means by which the doors are secured or locked in closed position, and the means for releasing the doors will now be described. Attached to the under or inner face of each inner door 28 is an arm 39, which projects away from the under face of the doors at right angles thereto, these arms at their free ends being pivotally-attached to toggle-links 40, 41 respectively and supported intermediate their ends by the Z-bars 33. It will be seen by the drawings, and will be understood, that these arms 39 and toggle-links 40, 41 are provided at each end of the doors. The end of the toggle-link 40 is received within the bifurcated end of the toggle-link 41, and said interengaged ends are received on a pin or bolt 42, having a head 43, which rides in a vertical guide-way 44 provided therefor at the ends of the doors. This guide-way 44 is formed by attaching to the end-plates 25, Z-bars 45 so spaced as to leave a way between them in which the pin 42 may ride as clearly seen in Fig. 13. The toggle arm 40 is provided with shoulders 40' at its pivoted end, which

are adapted to engage with the upper face of the toggle arm 41 when the arms are in a straight position, (or just slightly below the center) and thus lock the arms against further downward movement. These toggle-links as above described, are adapted to lock the doors in closed position, but I have found by experience, that sometimes an obstruction between the meeting edges of the doors prevents the complete closing of the doors, and consequently the toggles are not permitted to move to the straight line position. If lading is placed in the car with the doors not completely closed, and the toggles unlocked, the doors are liable under the weight of the lading, and due to the jarring of the car in transit, to move to open position. To positively insure against this, I have provided means in connection with the toggles to automatically lock the same at the point to which they have moved in their closing movement, whether this be in the completely closed position, or a point approaching the closed position. To this end, I provide the head 43 of the pin or bolt 42 with a stud 46, located adjacent one side of the head 43, and on which is pivotally hung, a locking-dog 47 which lies within the way 44, and back of the head 43. This locking dog is provided with a tooth 48 which projects from the heavier edge of the dog near the upper end thereof and engages with a rack 50 provided therefor in the way 44, and which may be in the form of a casting and secured to the Z-bar 45. The dog is also provided near its upper end, substantially in the same plane with the tooth 48, with a shoulder 48' located on the side of the dog that lies adjacent the head 43, and further provided on the same side, near the lower end of the dog with a shoulder 49, these two shoulders 48' and 49 respectively limiting the downward and upward swinging movement of the dog by their engagement with the head 43. Since the dog is heavier on that edge carrying the tooth 48, and shoulders 48' and 49, and since its upward swinging movement is limited by the shoulder 49, it will be evident that when not subjected to pull of the releasing chain, the dog will normally lie so that the tooth thereof will be in engagement with the rack 50.

The mechanism for releasing the lock and imparting initial opening movement to the doors is connected to said dogs, so that when actuated, the pull of the operating chains is directed first against the dogs to swing the same on their fulcrum or pivot and release the tooth of each dog from the racks 50, and then against the toggles at their joint to break said toggles and permit doors to open.

In order that the doors may be operated from either side of the car, I provide two operating shafts 51, the inner ends of which

are squared and extend through the center sills 20, into a drum 52 mounted between said sills and provided with a central shoulder 53 to divide the chains 54 running from the drum to opposite ends of the doors, where they are carried over guide-rollers 55, and have their other ends attached to the dogs 47. The chains 54 as will be noted are attached to the drum 52 so as to run in opposite directions and it will be obvious that a wrench applied to the outer end of either of the shafts 51 and the shaft rotated in either direction, will cause the chains to be wound upon the drum, swing the dogs on their pivots so as to disengage the tooth 48 of each dog from the racks 50 and pull upward upon the pins 42 so as to break the toggles and start the doors on their opening movement. In case the locking dogs are not employed, the chains are connected direct to the toggles at the joint of the latter.

As heretofore stated, the doors are so positioned that when an initial opening movement has been imparted thereto, their angle is such that the weight of the lading is directed against them to complete their opening movement. In this connection, I wish to call attention to the fact that, with the mechanism shown and described for imparting the initial movement to the doors, the chains 51 are entirely free from pulling strain the moment that the weight of the lading in the car begins to act against the doors, thus permitting the chains to slacken or "pile up" as it were between the drum and point of connection with the locking mechanism, and consequently imparting no movement to the shafts 51, so that all danger of injury to the operator using the crank or wrench on the shaft is obviated. The operating shafts are suitably protected from the lading of the car by cross ridges 56 as shown, built in the usual manner so that the material will not bridge thereon.

Attention is directed to the manner in which the doors are wholly roller-supported, the rollers 34 acting as the pivotal points of the doors, and the latter moving over these pivots in their opening and closing movements, the upper edges of the doors following the curved dotted lines 57, minimizing and equalizing space at this point, while permitting a good rigid construction. The provision of the rollers for supporting the doors both at the top and bottom thereof, reduces the friction to a minimum and renders the doors exceedingly easy to operate, increasing their natural tendency to move to closed position when the lading is discharged. In case the chains have not been wound to the limit on their drums, it will be noted that they will offer practically no resistance to the return of the doors to closed position, but even though the chains be taut, the weight of the doors is such that they

will readily move to closed position, readily unwinding the chains and revolving the drums and shafts, the resistance offered by such parts being practically *nil* after the doors begin closing.

The tying of the middle doors together by means of the pin 42 working in the way 44 provided by the Z-bars 45 tends to unify the action of the doors, the bars acting as a guide for the doors in their movement, and the outside doors being connected with the inner doors in the manner aforesaid, positive simultaneous movement of the doors is assured.

While the toggles 40, 41 may be connected direct to the inner doors, I prefer to employ the arms 39 in connection with the toggles, since by their employment, I am enabled to shorten the upward movement of the pivoted ends of the toggles, so as not to interfere with the center sills 20. These sills in the standard hopper cars are placed quite low down at the point most desirable to receive the buffing strains and stresses on the car, and the use of the arms 39 enables me to employ the toggle lock and such sills.

It will be observed by reference to Fig. 4 (see dotted lines 58'), that the lower edges of the doors have a slight movement downward caused by the rollers being placed some distance above the lower edges of the doors; obviously, when these rollers are placed close to the bottom edges of the doors, said edges will move in a substantially straight line, the upper edges of the doors however, always following the curve of the fixed pivot.

The feature of having the doors move to open position under the weight of the lading without the pull chains operating on the shaft or shafts is considered of importance, as it eliminates all danger to the operator, and enables the wrench or crank to be applied to the shaft and turned in either direction lengthwise of the car, when the car is located in places where it may be difficult for the operator to safely operate devices which require continuous winding of an operating shaft to actuate the doors.

While I have herein shown and described the invention as embodying four doors, it will be obvious that a single pair of doors such as the inner pair herein shown and described may be employed alone, and it will be obvious also, that changes in the details of construction may be made when adapting the invention to different types of dump cars, without in any manner departing from the spirit and scope of the invention as herein disclosed.

Having fully described my invention, what I claim is:

1. In a dump car, a car body provided with a discharge opening, end-plates carried by the body at the ends of said dis-

charge opening and provided adjacent their lower ends with tracks, doors forming the bottom of said car body and provided with wheels engaging said tracks and supporting the lower edges of said doors, rollers carried by the car body for supporting the upper edges of said doors and over which rollers the doors ride in their opening and closing movements, and operating means connected to the doors for imparting initial opening movement to the doors.

2. In a dump car, a car body provided with a discharge opening, end plates carried by the car body at the ends of said discharge opening and provided adjacent their lower ends with tracks, doors forming the bottom of said car body and provided with wheels engaging said tracks and supporting the lower edges of the doors, rollers carried by the car body for supporting the upper edges of said doors and over which the doors ride in their opening and closing movements, operating means connected to the doors for imparting initial opening movement thereto, and a locking dog cooperating with the operating means to lock the doors in closed position.

3. The combination of doors adapted to control a discharge opening, tracks for the lower edges of said doors, rollers carried by the doors and traveling on said tracks for guiding the lower edges of the doors in a substantially horizontal plane, and rollers for supporting the upper edges of the doors and over which the doors freely ride in their opening and closing movements.

4. The combination of doors adapted to control a discharge opening, means including rollers for guiding the lower edges of the doors in substantially a horizontal plane, additional rollers upon which the doors are supported and over which the doors ride in their opening and closing movements, said additional rollers acting as the pivots for the doors, and means for imparting initial opening movement to the doors.

5. The combination with a car having an inclined bottom, of a casing therein, a pivoted door forming a portion of said bottom, rollers constituting the pivot for said door, and means for raising the upper portion of said door into said casing, said door in its movement riding over said rollers.

6. The combination with a car having an inclined bottom, of casings therein, pivoted doors forming a portion of said bottom, rollers constituting the pivots for said doors and over which the doors ride in their opening and closing movements, and means for raising the upper portions of said doors into said casings without moving the pivotal points of the doors.

7. The combination of doors adapted to control a discharge opening, tracks for guiding the lower edges of said doors in a sub-

stantially horizontal plane, and rollers supporting the upper edges of said doors, said rollers acting to guide the upper edges of said doors in curved paths while the lower edges of the doors are traveling in said substantially horizontal plane.

8. In a dump car, a car body provided with a discharge opening, doors controlling said discharge opening, and disposed with respect to the side walls of the car body as to have a normal tendency to move to closed position, toggle-links for securing said doors in closed position, and a locking-dog cooperating with said toggle links.

9. In a dump car, a car body provided with a discharge opening, doors controlling said opening, said doors so disposed with relation to the side walls of the car body as to have a normal tendency to move to closed position by gravity, toggle links for securing said doors in closed position, a locking-dog cooperating with said toggle links, and door-operating means connected to said locking-dog.

10. In a dump car, a car body provided with a discharge opening, doors controlling said opening, said doors so disposed with relation to the side walls of the car body as to have a normal tendency to move to closed position by gravity, operating mechanism for imparting initial opening movement to said doors, and locking mechanism for securing the doors against opening movement, including a locking dog connected with the door operating mechanism.

11. In a dump car, a car body provided with a discharge opening, doors controlling said opening, said doors so disposed with relation to the side walls of the car body as to have a normal tendency to move to closed position by gravity, operating mechanism for imparting initial opening movement to said doors, means for securing the doors in closed position, and means cooperating therewith to lock the doors against opening movement as they approach the closed position.

12. In a dump car, a car body provided with a discharge opening, doors for controlling said opening, and so disposed with relation to the side walls of the car body as to have a normal tendency to move to closed position, toggle links secured to the doors and acting to hold said doors in closed position, operating means for opening the toggles and imparting initial opening movement to the doors, and means cooperating with the toggles to hold the doors against opening movement as they approach the closed position.

13. In a dump car, a car body provided with a discharge opening, doors controlling said opening, said doors so disposed as to have a normal tendency to move to closed position by gravity, operating means con-

nected to said doors to impart an initial opening movement thereto, and means co-operating therewith to hold the doors against opening movement as they approach the closed position.

14. In combination with a car body having a discharge opening, and doors controlling said opening, said doors so disposed with relation to the side walls of the car body as to have a normal tendency to move to closed position by gravity, of operating means for imparting initial opening movement to the doors, and a gravity-operating locking-dog acting to hold the doors against opening movement as they approach closed position.

15. In combination with a dump car having a discharge opening, a pair of doors controlling said opening and so disposed as to have a normal tendency to move to closed position by gravity, toggle links connected to said doors, a pivoted locking-dog connected to said toggle links, and door operating means connected to said locking-dog.

16. The combination with a car body having a bottom discharge opening, of doors adapted to control said opening and disposed with respect to the walls of the car body as to have a normal tendency to move to closed position by gravity, tracks for guiding the lower edges of said doors in a substantially horizontal plane, means for supporting the upper edges of said doors, said means acting to guide the upper edges of said doors in curved paths while the lower edges of the doors are traveling in said substantially horizontal plane.

17. In combination with a dump car having a bottom discharge opening, end plates carried by the car body at the ends of said discharge opening, a pair of doors controlling said discharge opening and so disposed as to have a normal tendency to move to closed position by gravity, tracks carried by the end plates, rollers carried by the doors and traveling on said tracks for supporting the lower edges of said doors, rollers carried by the car for supporting the upper edges of the doors and over which the doors ride in their opening and closing movements, toggle links connecting the doors and acting to secure the doors in closed position, headed pins to which the toggle links are connected, and guides carried by the end plates in which the heads of said pins ride during the movement of the doors.

18. In combination in a dump car, a car body having a bottom discharge opening, end plates carried by the car body at the ends of said discharge opening, doors for controlling said discharge opening, tracks arranged to support and guide the lower edges of said doors during their opening and closing movements, toggle-links connecting

said doors, headed pins to which said toggle-links are connected, and guides carried by the end plates in which the heads of said pins engage and in which said heads travel during the opening and closing movements of the doors.

19. In combination in a dump car, a car body having a discharge opening, end plates carried by the car body at the ends of said opening and provided with tracks, doors for controlling said opening having rollers engaging said tracks, rollers for supporting the upper edges of the car doors and over which said doors ride in their opening and closing movements, toggle-links connected to the doors for securing them in closed position, pins connecting the toggle-links together, and guides carried by the end plates in which said pins engage and ride during the opening and closing movements of the doors.

20. In combination in a dump car, a car body having a discharge opening beneath the center sills of the car, doors for controlling said opening and so disposed with relation to the side walls of the car as to have a normal tendency to move to closed position by gravity, means for supporting the lower edges of said doors and guiding them in a substantially horizontal plane during their opening and closing movements, and rollers carried by the center sills of the car for supporting the upper edges of the doors and over which rollers the doors ride in their opening and closing movements.

21. In combination in a dump car, a car body having a discharge opening beneath the center sills of the car, doors for controlling said opening, means for supporting the lower edges of said doors and guiding them in a substantially horizontal plane during their opening and closing movements, and rollers carried by the center sills of the car for supporting the upper edges of said doors and over which rollers the doors ride in their opening and closing movements.

22. In combination in a dump car, a car body having a bottom discharge opening, end plates carried by the car body at the ends of said discharge opening, doors for controlling said opening, tracks for supporting and guiding the lower edges of said doors during the opening and closing movements thereof, toggle-links pivoted together and connecting said doors for securing the doors in closed position, vertically-disposed guides on the end plates at the ends of the doors, and means at the ends of the doors engaging in said guides to insure uniform travel of the doors in their opening and closing movements.

23. In combination in a dump car, a car body having a discharge opening, end plates carried by the car body at the ends of said discharge opening, doors for control-

ling said opening and so disposed with relation to the car body as to have a normal tendency to move to closed position by gravity, tracks for supporting and guiding the lower edges of said doors during the opening and closing movements thereof, toggle-links pivoted together and connected to said doors for securing the doors in closed position, and guides on the end plates co-acting with the pivots of the toggle-links for insuring uniform travel of the doors in their opening and closing movements.

24. In combination in a dump car, a car body having a discharge opening, end plates carried by the car body at the ends of said discharge opening, doors for controlling said opening so disposed with relation to the side walls of the car body as to have a normal tendency to move to closed position, tracks for supporting and guiding the lower edges of said doors during the opening and closing

movements thereof, toggle-links connected to said doors, a pin to which said links are pivoted, vertical guides on one of the end plates receiving said pin, and a locking dog carried by said pin.

25. In a dump car, a car body, and a plurality of doors forming the bottom of said body, said doors arranged in pairs and shiftable to open and closed positions, tie rods connecting alternate doors together, and guiding means at the ends of the doors co-operating with the tie rods to insure uniform movement of the doors in their opening and closing movements.

In testimony whereof I affix my signature in the presence of two witnesses.

PATRICK JOSEPH HARRIGAN.

Witnesses:

PETER LANGSDORF,
JOHN LANGSDORF.