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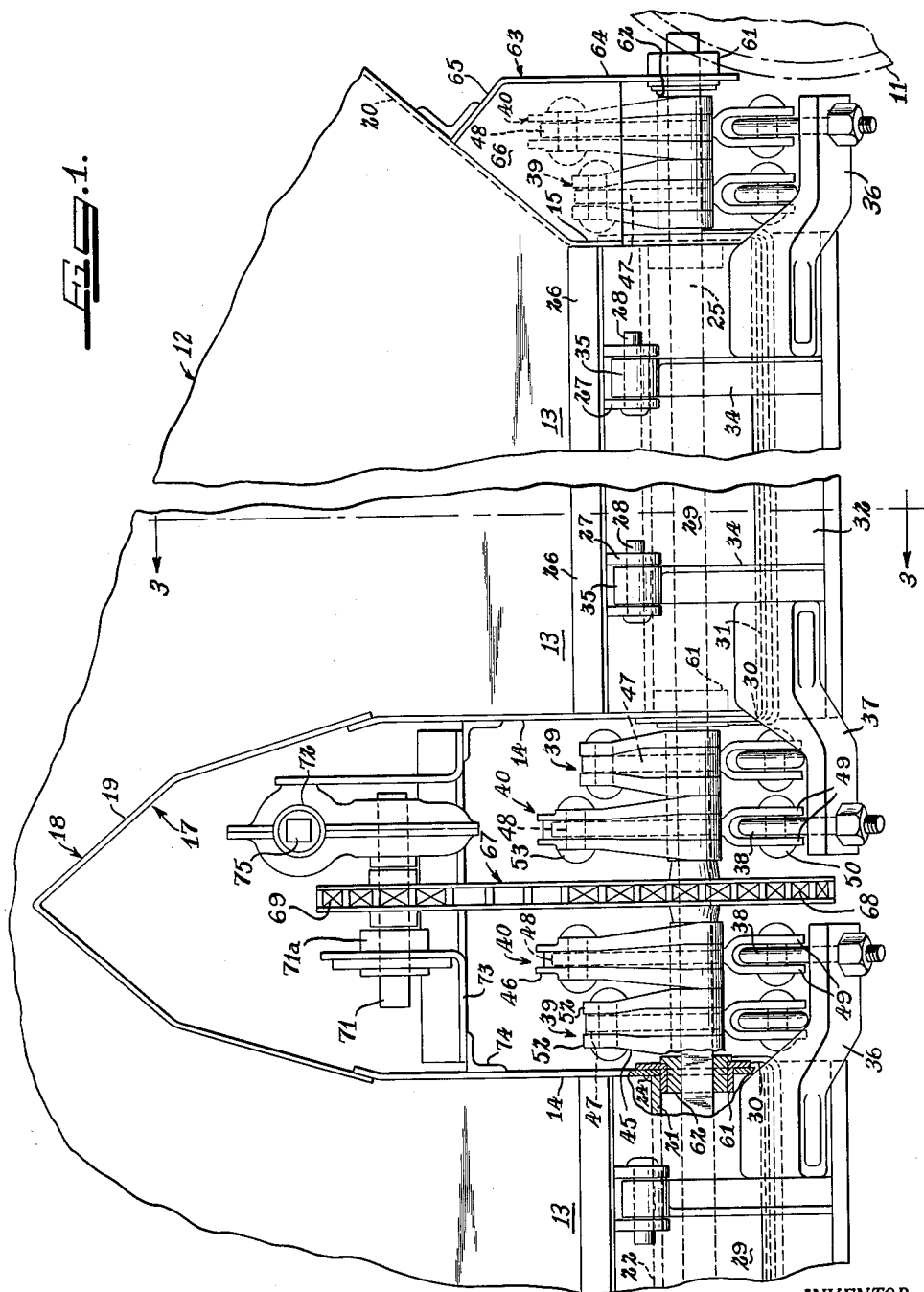
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3,262,401

DROP BOTTOM RAILWAY CAR

Filed July 17, 1962

5 Sheets-Sheet 1



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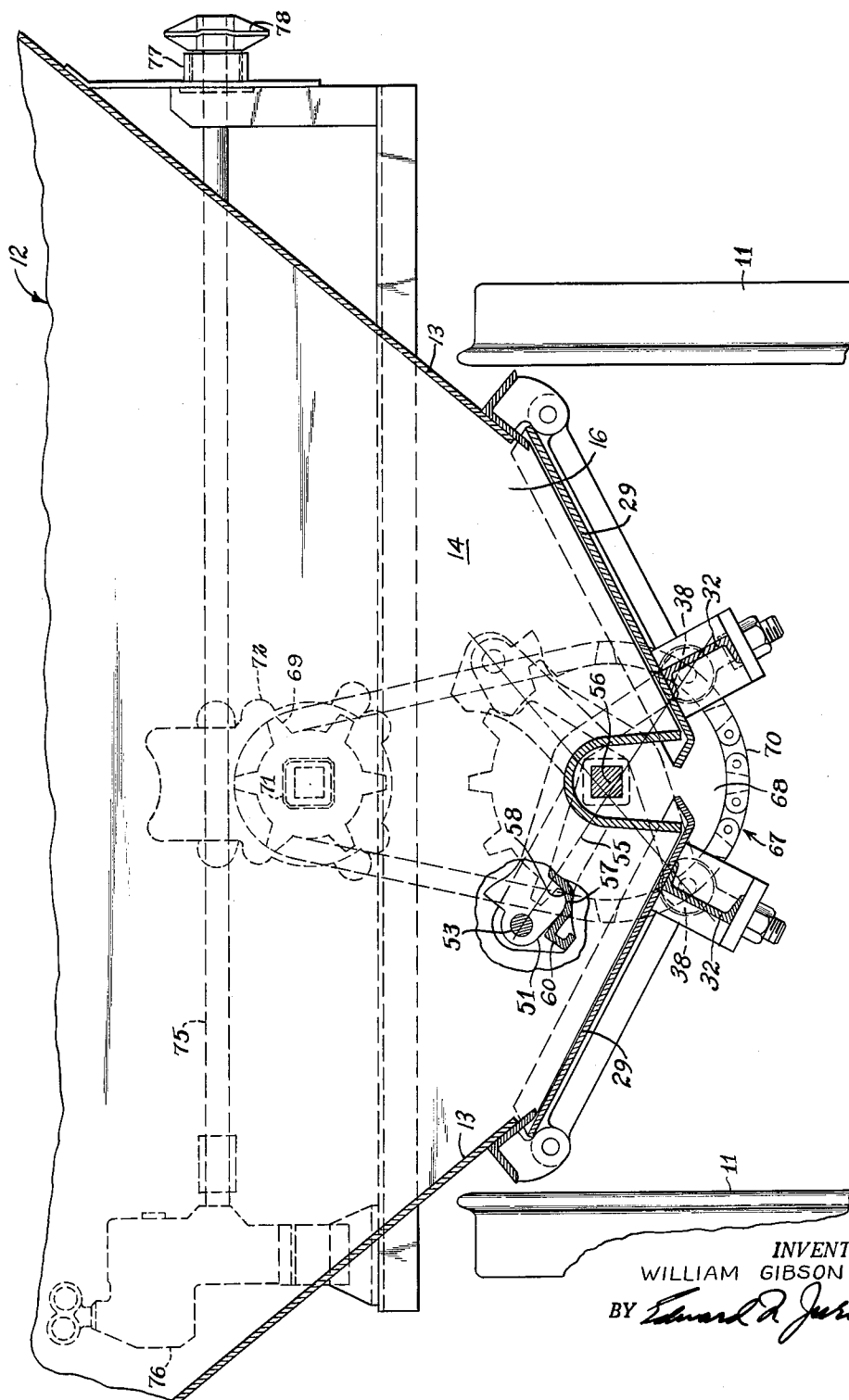


Fig. 3.

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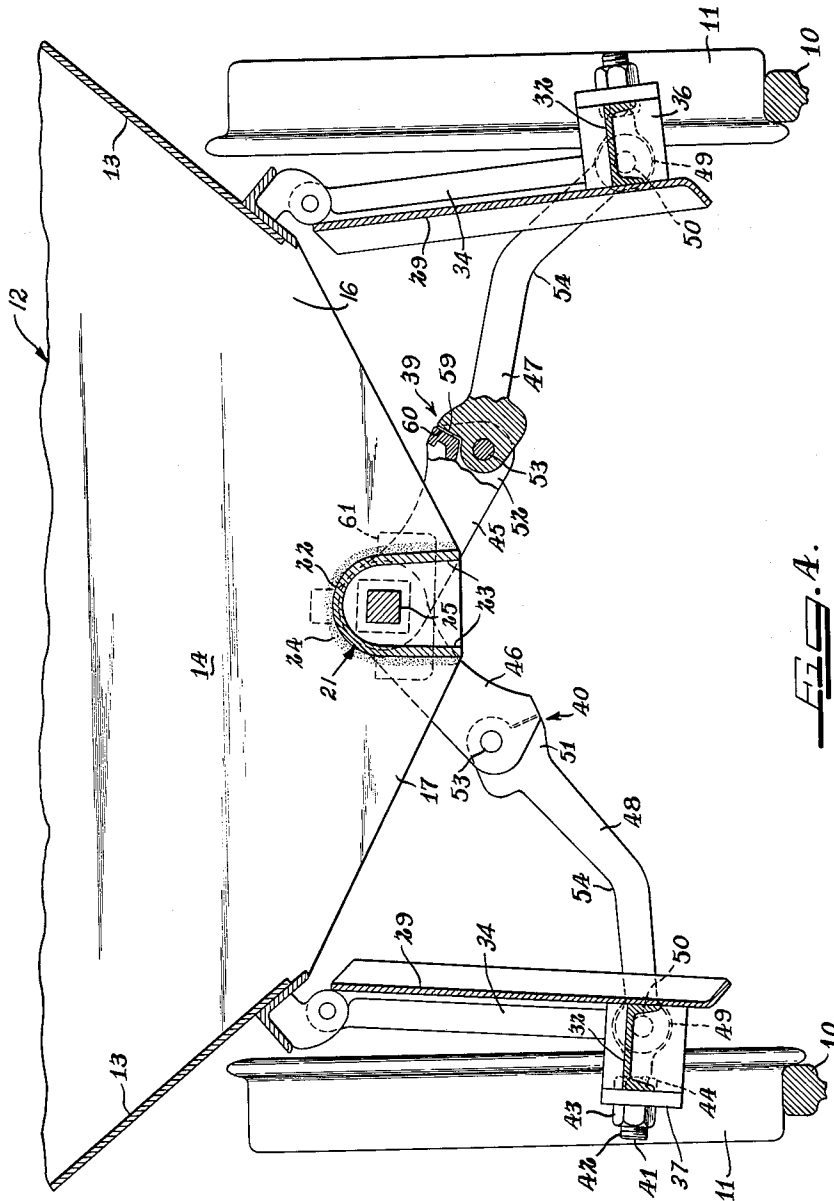
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5 Sheets-Sheet 4



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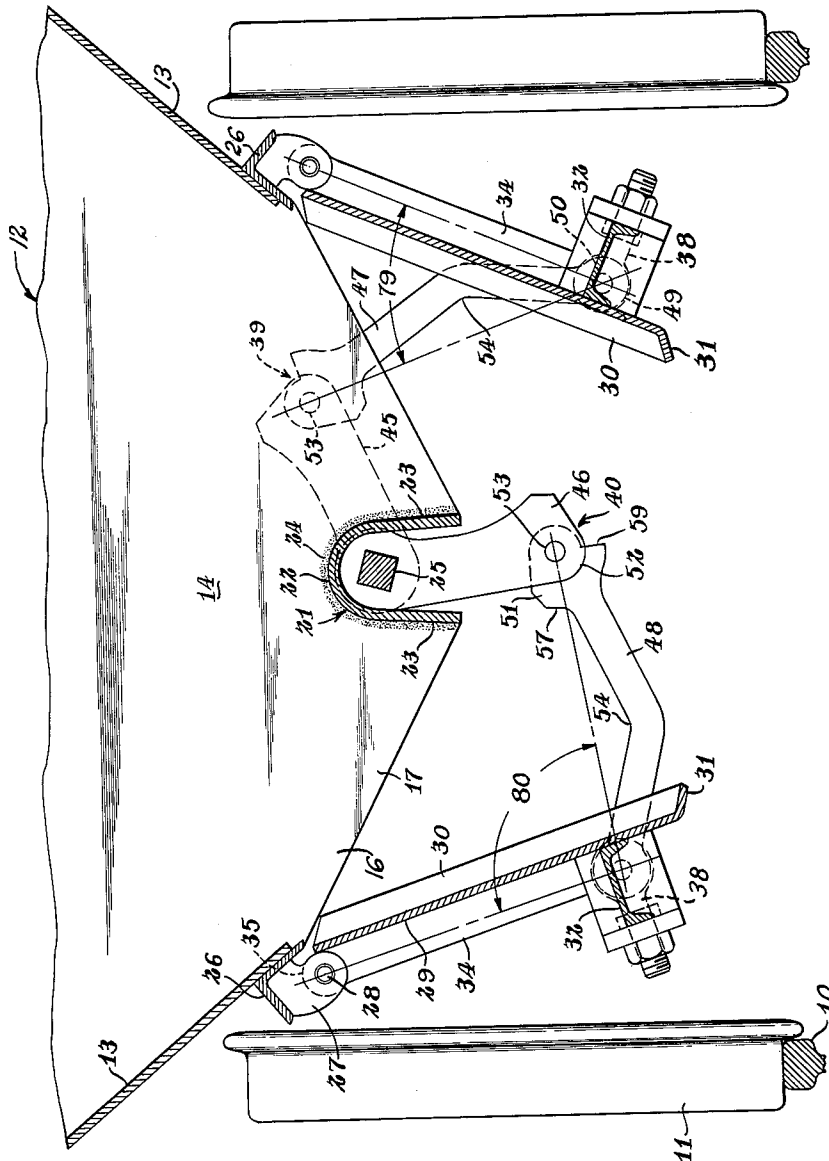


Fig. 5.

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3,262,401

DROP BOTTOM RAILWAY CAR

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1 Claim. (Cl. 105—250)

The invention relates to an improved Drop Bottom Railway Car having oppositely swinging doors movable towards each other to an inclined closed position and swingable to an open pendant position for rapid and complete discharge of lading.

The invention is particularly concerned with an arrangement of doors and door operating and locking mechanism therefore to meet the exacting requirements of automation.

The improvement contemplates the provision of door raising and supporting mechanisms for a pair of oppositely downwardly inclined facing doors which in addition to providing direct support for the doors in closed position also operate as an interlock to restrict outward spreading movement of the doors and door supporting floors. To this end the improved structure provides for a pair of jackknife folding mechanisms at each end of the doors which when in folded position extend between the doors and between an operating shaft at a minor acute angle to the doors.

The improvement is shown in connection with a hopper structure of the type shown in A. E. Zimmer United States Patent No. 2,741,193 issued April 10, 1956, and is by way of an improvement thereon. In said Zimmer structure the respective inclined doors are interlocked against outward separation by means of jackknife locking mechanism operable by a shaft carried by one of the doors and said shaft is operable by a secondary shaft carried by the car body proper and connected therewith by a chain belt drive.

The weight of the shaft carried by the door and the absence of direct support for the swinging end of the doors are disadvantageous factors in adapting the Zimmer structure to unattended or automatic operation inasmuch as light weight of the doors is a prime consideration for ensuring complete closure of the doors with limited operating power.

The present improvement overcomes the limitations of the Zimmer structure by providing door locking mechanisms of the jackknife type which operate from a fixed location on the car and provide the dual advantages of direct support for the swinging ends of the doors and still retain interlocking action between the inclined doors and the supporting floors to restrict outward spreading of the doors and also restricting outward spreading of the members to which the doors are hingedly connected.

Other objects of the invention are to provide for extending a shaft through a hopper compartment to project beyond the end walls thereof and carry door operating mechanisms on the projecting ends of the shaft out of the path of the discharging load and further to protect said shaft from the lading; to provide a hopper structure suitable for receiving and housing an operating shaft between the doors without restricting free flow of lading; to provide a housing for the shaft having walls for sealing co-operation with the doors; to provide doors having upwardly extending flanges adapted to embrace the walls of a longitudinally extending hood member; to provide an arrangement of door mechanisms and doors with the parts so arranged as to provide for conjoint operation of a pair of doors and restricting one of the doors to a pendulate movement when the companion door is being lifted at an unfavorable angle of lift (as will be described hereinafter); and to provide for conjointly operating the

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doors of longitudinally spaced hoppers through the medium of a transversely extending shaft located midway between the hoppers.

More specifically the invention is directed to the attainment of a hopper car having doors and mechanisms therefore adapted for unattended operation or by remote control and to this end embodies features rendering the car entirely self-cleaning thereby dispensing with the necessity of scraping the doors for removal of residual lading.

For further comprehension of the invention reference may be had to the accompanying drawings wherein:

FIG. 1 is a partial elevational view of the lower portion of a hopper car embodying the improvement, said view showing as much of the car as necessary to illustrate one hopper door and its associated parts. Certain parts are shown broken away to better illustrate the construction.

FIG. 2 is a vertical end view of the structure shown in FIG. 1.

FIG. 3 is a vertical sectional view taken on a line 3—3 of FIG. 1.

FIG. 4 is a view similar to FIG. 3 except that the doors are shown in open position with certain parts of the mechanisms omitted and the others broken away to better illustrate the construction.

FIG. 5 is still another view similar to FIG. 3 except that the doors are shown in partially closed position, with one of the doors being actually lifted at an unfavorable angle of lift and the companion door being swung in a pendulate movement (as will be described hereinafter).

The improvements are shown as embodied in a railway hopper car arranged for discharge of lading between the rails indicated at 10—10, the trucks being indicated by the wheels 11—11 and the body of the car at 12.

The body 12 of the car preferably includes two hopper compartments each having a lower section defined in part by downwardly inwardly sloping side floors 13—13 meeting with transversely extending vertical wall sections 14 and 15 respectively located at the opposite ends of each hopper compartment, the said walls 13, 14 and 15 being spaced from each other to provide a load discharge area 16. The walls 14 of the respective compartments are located midway of the car body length and are spaced lengthwise from each other to form the lower portion of a transversely extending housing structure 17 which serves as a strengthening member and also accommodates door operating and supporting mechanisms as will be described hereafter.

The walls 14—14 are surmounted by an inverted V-shaped cap 18 which presents oppositely sloping walls 19—19 for directing lading to the adjacent hopper compartments.

The vertical wall sections 15 which are located adjacent the ends of the car merge into the inclined end floors 20 of the car body.

Extending longitudinally of the hoppers between the vertical end wall sections 14 and 15 of each hopper compartment is a centrally located hollow hood member 21 having an upper arcuate-shaped roof 22 and side walls 23—23. The said hood members are welded at 24 to the end wall sections 14 and 15 and act as longitudinal tie members between the respective end wall sections in addition to serving as protective housings for door operating shaft 25.

The lower marginal portions of the inwardly sloping side floors 13—13 are reinforced by angle-shaped members 26 and said members in turn carry a series of hinge brackets 27. The hinge brackets are apertured for the purpose of receiving pintles 28 whereby a pair of doors 29—29 are hingedly mounted on the car body. The doors 29—29 are preferably formed of steel plates each

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flanged upwardly at the sides as seen at 30—30 and at the outer end as at 31 to form a three-sided pan-shaped member. Each door 29 on its under side is longitudinally reinforced by a beam member 32 extending adjacent the swinging end of the door and extending transversely of said beam member 32 are a series of hinge beams 34 which are apertured at 35 for accommodating the hinge pintles 28 whereby the doors are pivotally mounted on the hinge brackets 27.

The doors in closed position (FIGS. 1 and 3) slope downwardly from the pivotal ends towards each other and are swingable downwardly therefrom to assume a substantially pendant open position as seen by reference to FIG. 4. In said open position the doors are preferably swung to extend outwardly beyond a normal pendant position in order to shed by gravity such residual lading as might rest on the flanges 31.

The respective ends of the beam members 32 are fitted with brackets 36 and 37 to which eye bolts 38 are attached for connection with door operating and supporting jackknife-type mechanism assemblies 39 and 40 as will be later described.

The eye bolts 38 have shank portions 41 which are screwthreaded at 42 for receiving complementary screwthreaded nuts 43 and 44 whereby the eye bolts are adjustably mounted on their associated brackets to allow for wear and possible variations in manufacture.

The mechanism assemblies 39 and 40 each include radially extending arms 45 and 46 nonrotatably mounted on the shaft 25 and said respective arms 45 and 46 are radially spaced as will best be seen by reference to FIGS. 2 and 3. The said arms 45 and 46 respectively connect with the eye bolts 38 through the medium of linkages 47 and 48. The arms 45 and 46 with their associated linkages 47 and 48 are of identical construction and are arranged to operate in jackknife fashion to fold over the shaft upon closing operation of the doors (FIG. 3) and unfold to a straightened position for maintaining the doors in opened position (FIG. 4).

The mechanism assemblies 39 and 40 while of similar construction differ in that link 47 associated with arm 45 to form assembly 39 has an overhead movement to the shaft 25 when in folded position whereas link 48 associated with arm 46 underlies the shaft 25 when folded. Inasmuch as the assemblies 39 and 40 are of identical construction, the detail description will be confined to only one of said assemblies.

Referring to assembly 39, it will be seen that link 47 is formed at its lower end with a forked end presenting spaced jaws 49—49 which straddle the associated eye bolt 38 and is pivotally connected therewith by a pivot 50 and at its upper end the link includes a head 51 which is sandwiched between spaced jaws 52—52 of arm 45 and connected therewith by pivot 53. The link is concaved at 54 to allow over center locking action between the link and arm as indicated in FIG. 3 where a line 55 extending through the axis of pivots 50 and 53 is shown as having by-passed the axis 56 of the shaft and thereby attained a toggle locked-over center position.

It will be noted by reference to FIG. 3 that the line 55 extends at a minor acute angle to the door and operates to mitigate the outward spreading tendency on the doors and inclined supporting floors resulting from the weight of lading on the inclined planes.

The head 51 is provided with an arcuately-shaped seat 57 concentrically related to the axis of pivot 53 and adapted to register with a complementary-shaped concave seat 58 of the arm 45 to relieve the pivot 53 of excessive strain when the mechanism assembly is in folded relation (FIG. 3). A shoulder 59 extends radially from the link 47 to engage with an abutment 60 formed on the arm 45 for the purpose of limiting opening movement of the mechanism assembly to a substantially straightened position when the doors are in full open position (FIG. 4).

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There are two hopper compartments each having its pair of oppositely facing doors 29—29 and each pair of doors having mechanism assemblies at the respective ends, one door being fitted with assemblies 39 and the facing companion door with assemblies 40.

The doors of the respective hopper compartments are preferably operated conjointly and towards this result the shaft 25 extends continuously beyond the two compartments and the various mechanisms are nonrotatably mounted thereon.

The shaft 25 is rotatably supported in a series of bearings 61 which are axially spaced on the shaft to support the latter on opposite sides of the mechanism assemblies. Inasmuch as the shaft employed is of non-circular section a circular bearing sleeve 62 is inserted over the shaft at each bearing. The bearings 61 are carried by the vertical walls 14 and 15 of the hopper and the overhanging ends of the shaft are further supported by a housing structure 63.

The housing structure is formed in part by a wall member 64 spaced from the end wall 15 and deflected to provide an inclined upper wall 65 constituting the roof of the housing. The said wall 65 is welded or otherwise secured to the end sloping floor 20 and side walls 66 as best seen in FIG. 3, are located at each side of the housing and welded to the said hopper end wall 15 and to the walls 64 and 65. The outer wall 64 then forms a rigid support for supporting that portion of the shaft which projects beyond the end wall 15 through the medium of bearing 61 which as will be seen by reference to FIG. 1 is mounted on the said wall 64.

Rotation of the shaft 25 is effected through the medium of a sprocket and chain drive generally indicated by the reference 67 and includes a driven sprocket wheel 68 nonrotatably carried by the shaft 25 and a driving sprocket pinion 69 interconnected with the driven sprocket wheel 68 by an endless link belt chain 70.

The driving sprocket pinion 69 is nonrotatably mounted on a short shaft 71 which is rotated by a worm gear transmission enclosed in a housing 72. The gear housing as will be understood forms the support for one end of the shaft 71 and the opposite end of said shaft is rotatably supported in a bearing 71a which in turn is carried by a framework consisting of an angle-shaped bracket 73 which in turn is secured to an angle-shaped stiffening member 74.

The actual rotation of the shaft 71 through the agency of the worm and gear transmission is effected by a cross shaft 75 which extends through the worm to rotate therewith and is connected at one end with a power operated prime mover here indicated conventionally at 76 as a fluid operated motor. The opposite end of the shaft 75 is extended towards the opposite car side wall and rotatably mounted in a bearing 77.

To permit manual operation of the door mechanisms there is provided on the outer end of the shaft beyond the bearing 77, an operating head 78 of conventional type.

The angular relation of the radially extending operating arms and links and the relation of the operating shaft and associated parts to the doors are factors of importance in providing for a smooth and even lifting response to the operating power imparted on the shaft.

In the lifting operation of the doors under automatic or unattended operation, it is essential that temporary peak loads on the mechanism be avoided and that resistance to lift be substantially uniform throughout the major extent of the door raising operation.

On account of the unidirectional rotation of the radial arms and the overhead movement of the link 47 connected with one of the doors it will be observed by reference to FIG. 5 that there is a critical stage in the lifting of this door where the direction of lift is at an unfavorable acute angle as indicated at 79. The acute angle 79 is the smallest angle determined between the door 29 and the link 47 of the assembly 39 during the closing

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movement of the door 29 with the component of the closing force being applied normally to the door at this point being at its minimum value.

In order to avoid the necessity of providing such additional lifting power as necessary for overcoming resistance necessitated by surge loading provision is made for easing the lifting resistance of the facing companion door of the pair.

The problem of easing the lifting resistance of the companion facing door referred to is brought about by arranging for a swinging pendulate-like movement of said facing door by having the operating radial arm of such a length and the pivotal linkage so located as to exert a pull on the door in a direction substantially normal to its swinging movement as indicated at 80 in FIG. 5.

It will be observed by reference to FIG. 1 that the car is divided by the transversely extending ridge structure 17 into two separate hopper compartments of similar construction, each with its own pair of doors and operating mechanisms at the ends of the doors. The pair of doors for the separate hopper compartments are conjointly operated by extending the shaft 25 continuously from end of the car and disposing the driven sprocket 68 intermediate the mechanisms of the respective adjoining doors and interconnecting the same with the driving sprocket pinion 69 by means of the cross-shaft 75 operating through the worm and gear transmission indicated by the housing 72.

While I have shown and described what I consider to be a preferred embodiment of my present invention, it will be understood that various modifications and rearrangements may be made therein without departing from the spirit and scope of my invention.

I claim:

In combination, a railway hopper car having adjoining hopper compartments spaced from each other lengthwise of the car, including:

- (a) a transversely extending hollow housing separating the hopper compartments and having transversely extending walls spaced lengthwise of the car from each other,
- (b) each said hopper compartment being defined in part by transversely spaced longitudinally extending walls meeting with one of the walls of the housing and with another end wall spaced from said first named transverse wall to present a discharge area,
- (c) a pair of longitudinally extending doors for each hopper pivotally mounted at their upper edges along the lower edges of the longitudinally extending side walls of the hopper and extending at an inclined slope towards each other when in closed position to close the discharge area,

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(d) means for moving the doors and supporting them in closed position, including:

(e) a rotatable shaft projecting through said housing and both of the adjoining hopper compartments with the ends of said shaft extending through and terminating externally of said other end walls of said compartments,

(f) jackknife-type folding mechanisms carried by the portions of the shaft disposed externally of both of the end walls of each of the hopper compartments, a different pair of said mechanisms being connected with the opposite ends of each door,

(g) means for conjointly operating the doors of adjoining hoppers by rotation of the shaft with said means being disposed in the transversely extending housing between said compartments, and including:

(h) a driven sprocket wheel fast on the operating shaft approximately midway between said transverse walls of said transversely extending housing,

(i) a driving sprocket pinion rotatably mounted at an appreciable distance from the driven sprocket wheel and disposed in alignment therewith,

(j) a link belt connection interconnecting the the sprocket wheel and its associated pinion,

(k) a worm wheel fast with the driving sprocket,

(l) a worm interengaging the worm wheel for driving the latter,

(m) a shaft nonrotatably connected with the worm and extending transversely of the car, and

(n) means for rotating said transversely extending shaft.

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