J. M. ROHLFING.

HOPPER CAR DOOR OPERATING MECHANISM.

APPLICATION FILED APR. 10, 1917.

1,256,165.

Patented Feb. 12, 1918.

3 SHEETS—SHEET 1.

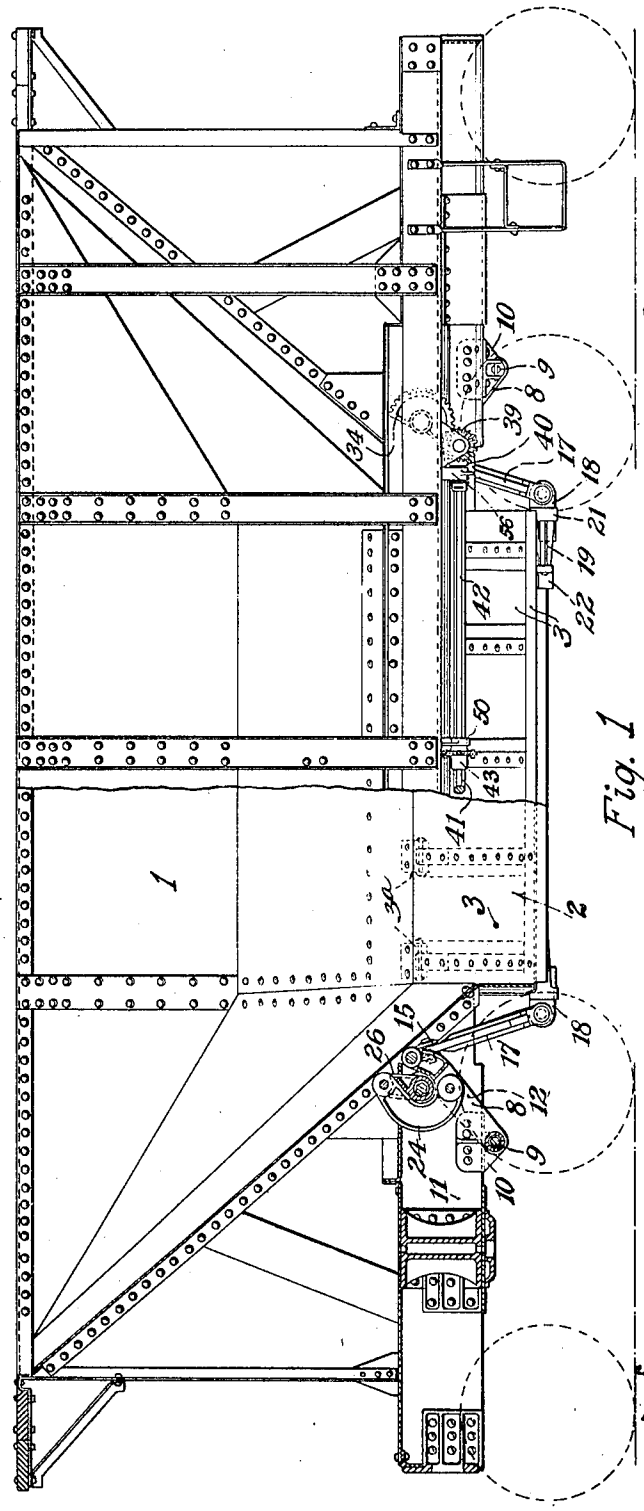

Fig. 1

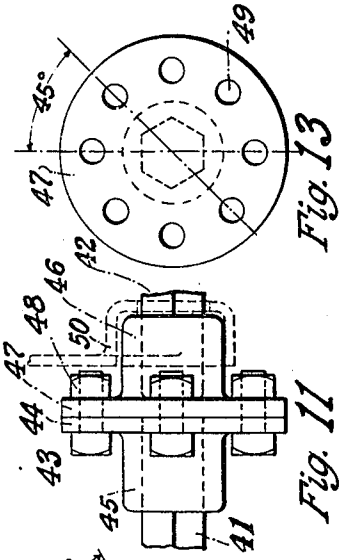

Fig. 13



Fig. 11

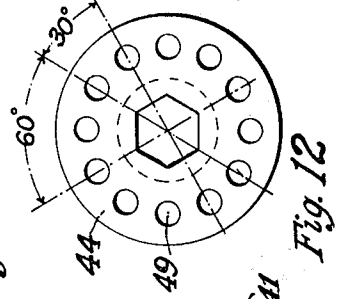

Fig. 12

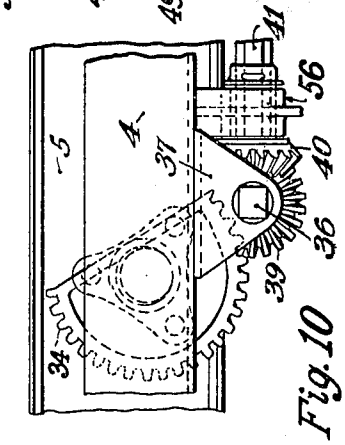

Fig. 10

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3 SHEETS—SHEET 2.

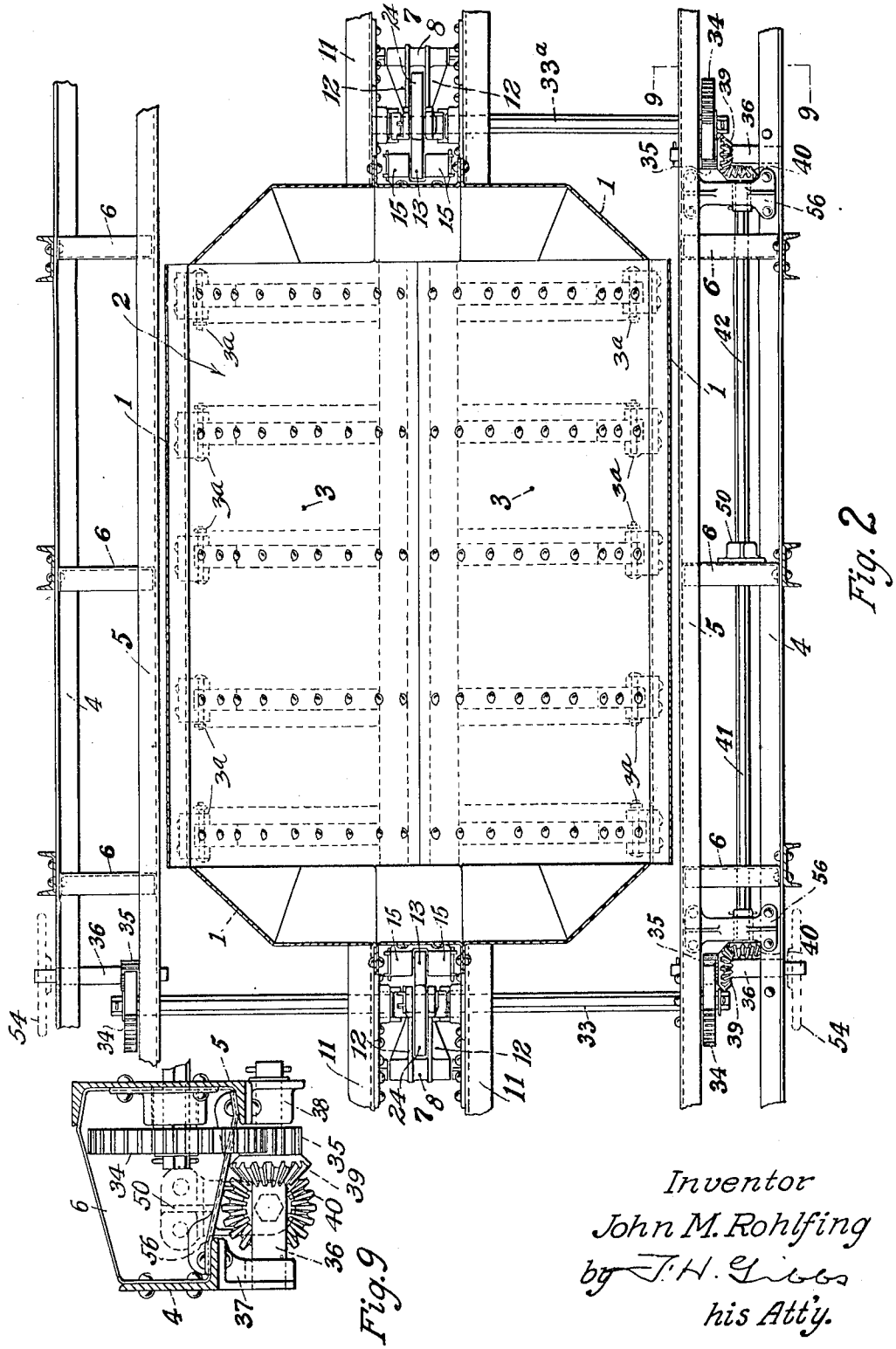

Fig. 2



Fig. 9

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3 SHEETS—SHEET 3.

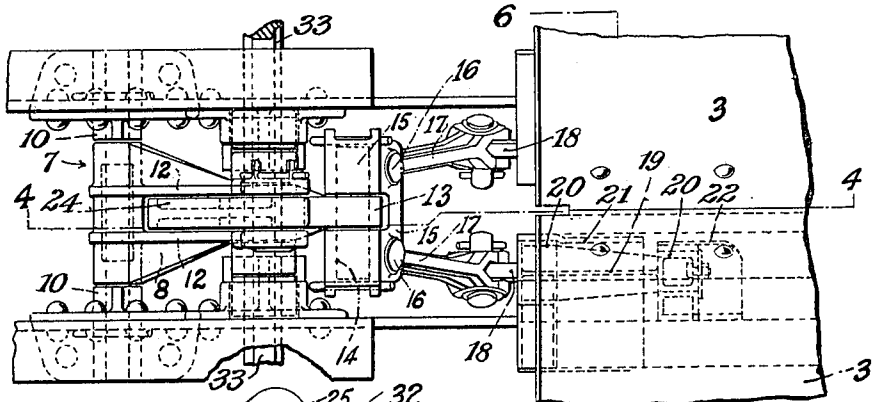

Fig. 3

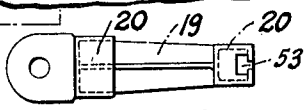

Fig. 7

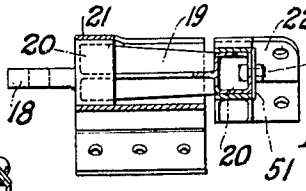

Fig. 8

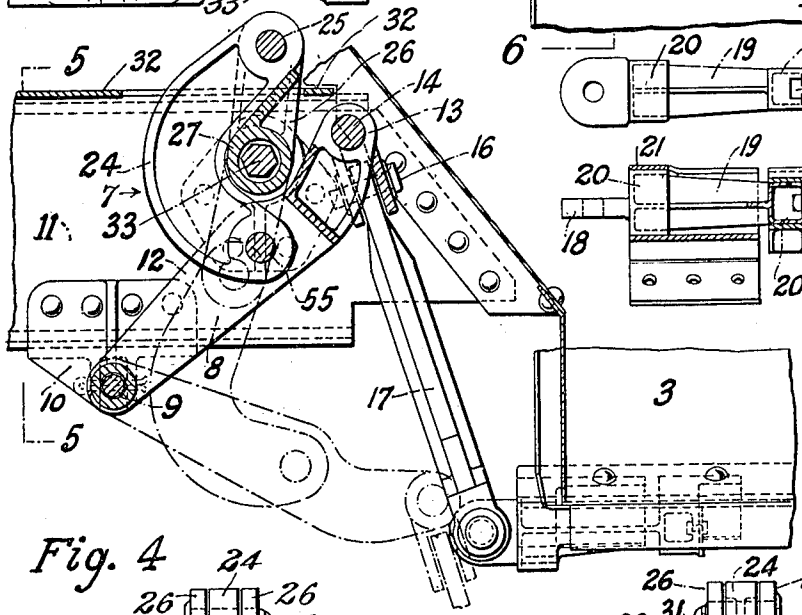

Fig. 4

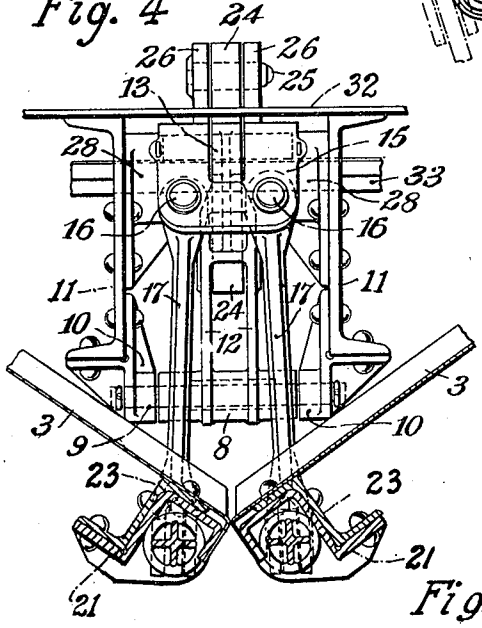

Fig. 6

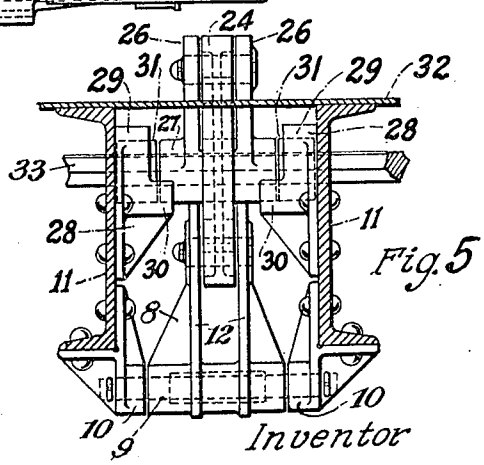

Fig. 5

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# UNITED STATES PATENT OFFICE.

JOHN M. ROHLFING, OF ST. LOUIS, MISSOURI, ASSIGNOR TO AMERICAN CAR AND FOUNDRY COMPANY, OF ST. LOUIS, MISSOURI, A CORPORATION OF NEW JERSEY.

## HOPPER-CAR-DOOR-OPERATING MECHANISM.

1,256,165. Specification of Letters Patent. **Patented Feb. 12, 1918.**

Application filed April 10, 1917. Serial No. 160,952.

*To all whom it may concern:*

Be it known that I, JOHN M. ROHLFING, residing at St. Louis, Missouri, and being a citizen of the United States, have invented certain new and useful Improvements in Hopper-Car-Door-Operating Mechanism, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and to use the same, reference being had to the accompanying drawings, which illustrate the preferred form of the invention, though it is to be understood that the invention is not limited to the exact details of construction shown and described, as it is obvious that various modifications thereof within the scope of the claims will occur to persons skilled in the art.

In said drawings:

Figure 1 is a composite view showing a side elevation on the right of a hopper car with my door operating mechanism applied thereto, and on the left being a vertical longitudinal section illustrating other parts of the mechanism;

Fig. 2 is a partial plan view of the car shown in Fig. 1, the hopper being in such horizontal section as to reveal parts of the car door operating mechanism in plan;

Fig. 3 is a fragmentary plan view illustrating portions of a pair of doors and the operating means therefor at one side thereof;

Fig. 4 is a vertical section taken on the line 4—4 of Fig. 3;

Fig. 5 is a transverse section through the draft or center sills, being taken on line 5—5 of Fig. 4, and illustrating parts of the door operating means in end elevation;

Fig. 6 is another transverse section taken substantially on the line 6—6 of Fig. 3;

Fig. 7 is an elevational view of one of the trunnions adapted for mounting on the doors;

Fig. 8 illustrates the same trunnion mounted in bearings secured to the door, parts of the trunnions being broken away for clearness;

Fig. 9 is a transverse view illustrating the mounting of the gearing at one end of the transmission means, being taken on line 9—9 of Fig. 2;

Fig. 10 is a side elevation of similar gearing at the other end of the transmission means;

Fig. 11 is an elevational view of a plural-part coupling for connecting sections of the transmission shaft;

Fig. 12 is an end elevation of the flanged end of one of the coupling parts illustrating the number and disposition of bolt holes therethrough; and

Fig. 13 is an elevation of the flanged end of the other coupling half illustrating the different bolt-hole arrangement and showing the imperforate portion opposite the shaft end.

This invention concerns door-operating mechanism, being well adapted for use in operating and controlling the doors that normally close the discharge opening or openings of dump cars. The operating mechanism is capable of such coöperation with the doors that one door may be adapted to close against another, and both of those doors be oppositely opening, the operating mechanism accommodating itself to each door with full effectiveness at all times irrespective of the positions of the doors.

It is an object that, when the operating mechanism has been manipulated to close the doors, it shall automatically lock them against possible accidental opening, being, however, immediately and readily responsive to intended actuation for opening the doors.

The invention extends to the use of a plurality of door-operating and controlling means located at different positions in the car and to transmission means connecting the individual operating means, the mechanism being operable, if desired, simultaneously and from either side of the car.

Ruggedness, simplicity, rapidity of action, unvarying efficiency and safety to the operator characterizes the door-operating mechanism herein disclosed, the various features of which are presented in what follows:

Referring to the drawings, and particularly to Figs. 1 and 2, 1 represents the hopper of the car, which, at its lower end, forms a discharge opening 2 adapted to be closed by doors 3. Said doors are shown as having edges adapted, when closed, to meet substantially at the longitudinal center line of the car and the doors being hung from hinges $3^a$ and being adapted to swing downwardly and outwardly toward the sides of the car. On opposite sides of the hopper 1 are shown

a plurality of sills, the outer sill 4 at each side of the car being a side sill and there being an intermediate sill 5 spaced inwardly therefrom, said sills being connected at suitable intervals by pressings or other connectors 6.

Spaced longitudinally of the car at the transverse center thereof are individual door-operating and controlling means indicated generally at 7, both of which are similar, and the one at the left in Fig. 2 being shown in plan and vertical section in Figs. 3 and 4, respectively.

As seen in said figures, each individual door-operating means is provided with a lever 8, the lower end of which is pivoted by a pin 9 to bearing brackets 10, each of which is secured to one of the spaced draft sills 11, which draft sills may, if desired, be center sills. Lever 8, as shown in Fig. 3, is provided with a pair of spaced lever arms 12 which merge with a single portion 13 at the free end of the lever. A pin 14 passes through the free end 13 of lever 8 and extends through upper extensions of a bifurcated yoke 15. From spaced pivot pins 16 passing through different portions of yoke 15, are suspended a pair of door-controlling links 17, the lower ends of which are bifurcated or jaw-shaped, as shown in Fig. 3.

Extending into the lower jaws of links 17 and pivoted thereto are extensions 18 of trunnions 19, each of which is provided with spaced journals 20. Trunnions 19 extend longitudinally of the meeting edges of the doors 3 and have their journals 20 seated and revoluble in bearing castings 21 and 22. Said bearing castings are secured to stiffeners 23 that extend along the meeting edges of opposing doors, said stiffeners 23 being illustrated in Fig. 6 as being commercial Z-bars.

It will thus be seen that the lever 8 of each operating device is adapted to oscillate up or down and through the links 17 to correspondingly move the doors 3. In so doing, the links 17, which are individually pivoted at different places to the yoke 15, spread apart transversely of the car as they travel downwardly with the doors and move together when they are drawn upwardly by lever 8 to close the doors.

During their movements actuating the doors, links 17 oscillate the trunnions 19 in their bearings 21 and 22. The links 17 swing about their upper pivot pins 16 in a direction transversely of the car with entire freedom and, by reason of their connection to the trunnions, make such transverse accommodation to the doors as is necessary without the slightest tendency of binding in any direction.

Intermediate its pivoted and free ends, lever 8 has pivoted to it a curved locking link 24, the lower end of which link projects between the spaced arms 12 of lever 8 and the upper end of which link is pivotally connected by pin 25 to the free ends of the spaced arms of crank 26.

Crank 26 is provided with a hub 27 that extends between and rests in bearing castings 28, one of each of these castings being secured to the inner side of one of the spaced draft sills 11. The bearing castings 28 are positioned considerably above and rearwardly of the bearing castings 10 for lever 8, and each has an annular portion 29 converted as it progresses inwardly into a merely circular bottom portion 30, in which portions 30 the hub 27 of crank 26 is seated. Within the circumscribing annular portions 29 of bearing castings 28 are located bushings 31 which receive end thrusts from crank hub 27 and also serve to center crank 26.

The draft or center sills 11 are connected by a top cover plate 32 provided with an opening therein through which crank 26 may pass to have its hub seated in the portions 30 of bearing castings 28, thus permitting the positioning of crank 26 without disturbing the draft sills and their top cover plate when the parts are being assembled.

By reference to Fig. 2, it will be seen that a through, preferably non-circular, operating shaft passes through the hub 27 of crank 26, extending away from the door-operating device in opposite directions to pass through the intermediate sills 5. At the right in Fig. 2, a similar operating shaft 33ª passes through the hub 27 of crank 26, but extends to and through the intermediate sill 5 at one side of the car only. Upon each end of operating shaft 33 and the outer end of operating shaft 33ª, is mounted a gear sector 34, each of which meshes with a pinion 35 mounted upon a jack shaft 36, three such jack shafts being illustrated in Fig. 2. As best shown in Fig. 9, each jack shaft 36 is journaled in bearing castings 37 and 38 mounted on the under sides of side sill 4 and intermediate sill 5.

Fig. 2 also discloses that there is one jack shaft on one side of the car and a pair of widely spaced jack shafts on the other side. Upon each of the widely spaced jack shafts 36 at one side of the car, is also mounted a bevel gear 39, each of which meshes with another bevel gear 40 on the adjacent end of a transmission shaft comprising sections 41 and 42. Such transmission shaft extends from the gearing interposed between one of its ends and one operating shaft to the gearing interposed between its opposite end and the end of the operating shaft adjacent thereto and lies between and parallel with side sill 4 and intermediate sill 5.

Intermediate the length of the transmission shaft, its sections 41 and 42 are connected by a coupling 43, as best seen in Figs. 1 and 11. Coupling 43, as best seen in Fig.

11, comprises two somewhat dissimilar parts, the left hand coupling part 45 having a non-circular hole for receiving the adjacent end of transmission shaft section 41, and also an annular flange 44. The right hand part 46 of coupling 43 has a similar cylindrical portion having a non-circular socket for receiving the adjacent end of transmission shaft section 42, and is also provided with a flange 47 corresponding to flange 44 of the other coupling part.

From Figs. 11 and 13, it will be seen that the socket in coupling part 46 is closed at the end adjacent coupling part 45, the disk-like end which forms flange 47 not being centrally perforated. The flanges 44 and 47 of parts 45 and 46, respectively, are connected by bolts 48 and when so connected the metal of the disk-like end which is interposed between the ends of shaft sections 41 and 42 prevents the coupling as a whole from creeping in either direction upon the transmission shaft.

Referring to Figs. 12 and 13, it will be noted that the apertures 49 in the flange 44 of part 45 are more numerous than those in the flange 47 of coupling part 46.

As illustrated, bolt-holes 49 in flange 44 are spaced approximately 30 degrees apart while bolt-holes 49 in flange 47 are substantially 45 degrees apart. In consequence of this, there may be a relative opposite rotation of coupling parts 45 and 46 that will allow a step-by-step relatively rotary adjustment of coupling parts 45 and 46 amounting to 15 degrees. This gives a finer relatively rotary adjustment between the coupling parts than could be accomplished by uniform spacing of the bolt-holes in the flanges, and such adjustment is useful in taking up slack between the ends of the transmission shaft and the gearing thereat.

Inasmuch as the transmission shaft is comparatively long, it has bearing brackets 56 near its ends secured to side sill 4 and intermediate sill 5, and it may derive an intermediate support by means of a bracket 50, shown in Figs. 1 and 11, which receives and forms a bearing for the cylindrical portion of coupling part 46, said bracket 50 being secured to the web of the adjacent pressing 6 that connects side sill 4 and intermediate sill 5, as shown in Fig. 2. Further details of the mechanism include the squaring of the ends of the jack shafts 36 that are affiliated with the through operating shaft 33, and it is to be noted that the trunnions 19, mounted upon the under sides of the doors 3, are held from material longitudinal movement in their pairs of bearings 21 and 22, as may be appreciated from inspection of Fig. 8. The lower end of the link 17 that is connected to the trunnion extension 18, will prevent undue inward movement of trunnion 19, while said trunnions are prevented from moving outwardly by means of a washer 51 secured by a bolt 52 to the inner end face of the smaller inner bearing 20. Said bolt may be positioned by passing it through the T-shaped opening 53 illustrated in the smaller inner bearing 20 in Fig. 7, until it occupies a central position, whereupon its nut is tightened to secure washer 51 in place.

The operation of the car door-operating mechanism is as follows:

The doors being in the closed positions shown in the drawings, and it being desired to open them, a crank, ratchet lever or hand wheel, symbolically indicated at 54, is attached to the squared outwardly projecting end of either jack shaft 36 that is affiliated with the through operating shaft 33. Such jack shaft is turned so that its pinion 35 drives gear sector 34 to rotate through operating shaft 33 in the counterclockwise direction, thereby turning crank 26 of the left hand door-operating device in the same direction. Curved locking link 24 responding to the movement of crank 26, as shown in Fig. 4, moves to the left and downwardly. The weight of the doors 3 pulling on links 17, swings link 8 downwardly as soon as the center of crank pin 25 passes beyond the dead center of crank 26, whereupon the doors fall by gravity to their open positions, the links, lever 8, locking link 24 and crank 26 assuming the positions shown in dot and dash lines in Fig. 4.

When the jack shaft 36 was rotated to drive through operating shaft 33, bevel gear 39 rotated bevel gear 40, which meshes with it and is secured to the adjacent end of the transmission shaft, revolving such shaft. Bevel gear 40, at the opposite end of the transmission shaft, simultaneously drove bevel gear 39 that is mounted on the adjacent jack shaft 36, pinion 35 of that jack shaft driving gear sector 34 carried upon the outer end of the shorter operating shaft $33^a$, said operating shaft $33^a$ thereupon actuated the door-operating means at the right hand side of the doors 3 in Fig. 2 in quite the same manner as has been described in connection with the left hand door-operating means. Therefore, the doors were simultaneously released at their opposite sides.

Having discharged the lading and wishing to again close the doors, a reversal of the operation just described takes place, the parts returning to the positions indicated in Fig. 4. In resuming their positions the centers of crank pin 25 and pivot pin 55 pass beyond the dead center of crank 26, *i. e.*, the axis of through operating shaft 33, and the parts, and consequently the doors, are locked in door-closing position.

It is to be noted that in returning to the position shown in Fig. 4, locking link 24 engages the hub 27 of crank 26 preventing

excessive movement in a closing direction. It is also apparent that the free end 13 of lever 8 moves toward crank hub 27 and with the locking link 24 embraces the hub of crank 26, all tendency of the parts to accidentally unlock being prohibited by a movement thereof in an incorrect direction for the opening of the doors, and in a direction tending to lock the parts against further movement. While the parts are safely locked against movement permitting unintentional opening of the doors, it is quite apparent that when the jack shaft 36 is operated they freely respond to the influence thereof.

It will further be observed that the parts of each door-operating device are compactly arranged, the links 17, when holding the doors closed being nearly vertical and therefore better adapted to sustain weight without injury to themselves.

What I claim is:

1. In combination in a dump car, a door, and door-operating mechanism comprising a coöperatively connected crank and lever each pivoted to a rigid structure of the car, a link pivotally connected to said lever and said door and operating means for said crank, said lever being drawn into close proximity to said crank when said door is closed.

2. In combination in a dump car, doors, and door-operating mechanism comprising a crank and a lever each having a pivotal connection to rigid car structure, a locking link connecting said crank and lever, other links connecting said lever to different doors and crank-operating means operable to collectively arrange a portion of said lever, said locking link and crank about the pivotal axis of the latter and to cause said locking link to lock said mechanism in door-closing position.

3. In combination in a dump car, a door, and operating mechanism therefor comprising a crank and a lever pivoted at fixed positions to rotate in reverse directions throughout the movement of said door in one direction, a link causing simultaneous movement of said crank and lever, another link pivotally connected to said lever and adjustably to said door, and operating means for said crank.

4. In combination in a dump car, a door, and operating mechanism therefor comprising a crank and a lever pivoted at different fixed places, said lever extending to and beyond the vertical plane that contains the pivotal axis of said crank, a locking link pivotally connected to said crank and lever, means responsively connecting said door to said lever and operating means for said crank, the points of pivotal connection of said link to said crank and lever being adapted to be carried beyond the dead center of said crank thereby locking said mechanism in door-closing position.

5. In combination in a dump car, oppositely opening doors, operating mechanism therefor comprising a crank projecting downwardly when said doors are open and a lever both having fixedly positioned fulcrums, a link connecting said crank and lever, a plurality of other and oppositely movable links connecting said doors to said lever and crank-operating means, said mechanism being adapted to lock said doors in closed position.

6. In combination in a dump car, a door and operating mechanism therefor comprising a crank with a hub and a lever both having separate fixedly positioned fulcrums, a link connecting said crank and lever, said link and lever being shaped to embrace the crank hub when said mechanism is in door-closing position, means connecting said door and lever, and crank-operating means.

7. In combination in a dump car, a door and operating mechanism therefor comprising a pivoted lever, a crank pivoted higher than the lever pivot, a link pivoted to said crank and to said lever intermediate its end portions, said pivotal connections of said link being directly over and under the crank pivot when said door is closed, means connected elsewhere to said lever responsively connecting said door thereto, and crank-operating means.

8. In combination in a dump car, doors and operating means therefor comprising a lever, door-actuating connections between said lever and doors, and means adapted to swing said lever to open or close said doors including a link connected with said lever and having its opposite ends simultaneously movable upwardly or downwardly, and means to reversely move the link and to carry it into a locking position.

9. In combination in a dump car, door-operating mechanism comprising a plurality of pivotally connected alternating pivoted arms and links, said arms having individual fulcrums, each arm having a portion subsequently movable into space that is previously occupied by a portion of another of said arms, doors operably connected with some of said links, and operating means for said mechanism.

10. In combination in a dump car, a door and operating mechanism therefor comprising alternated individually pivoted arms and links, one arm extending into proximity to another and beyond the pivotal axis thereof, and a door connected to one of said links.

11. In combination in a railway car, arms having individual fulcrums, a link connecting said arms, a door connected with and operable by one of said arms and operating means adapted to actuate the other arm and to move said link and the arm connected

with the door to a door-locking position wherein they embrace the operated arm.

12. In combination in a car, arms having individual fulcrums, a link connecting said arms, a door operably connected with one of said arms and operating means for actuating the other arm, the latter arm preventing undue relative movement of said door-connected arm and link when the door is in a closed position.

13. In combination in a car, a door, a bearing carried thereby, a revoluble trunnion mounted in said bearing, and door-operating means including a link connected with said trunnion to operate the same.

14. In combination in a dump car, a door, a stiffener therefor, bearings carried by said stiffeners, a trunnion mounted in said bearings and door-operating means including a member engaging said trunnion so as to turn the same when said operating means is acting.

15. In combination in a dump car, a pair of doors and operating means therefor comprising a link adapted to swing connected to each door, a yoke having different portions each bifurcated angularly to the other portion, said links being pivoted at different places to the bifurcations of one portion, a lever having a fixed pivotal axis and being oscillatory in a plane angularly disposed to that in which said links swing and connected to said other bifurcated yoke portion, and lever-operating means.

16. In combination in a dump car, a pair of doors, bearings carried thereby, revoluble trunnions mounted in said bearings, and door-operating mechanism including links, a yoke to which said links are pivoted at spaced locations and means for raising and lowering said yoke connected therewith intermediate the locations of link-connection, said links being connected to said trunnions to turn the same and being adapted to spread and move together in operating said doors.

17. In combination in a dump car having a discharge opening, doors for closing the opening, door-operating means on opposite sides the discharge opening each including an operating shaft, and suitably supported transmission means comprising spaced jack-shafts geared to each other and each geared to one of said operating shafts.

18. In combination in a dump car having a discharge opening, doors for closing the opening, door-operating mechanism operable from either side of the car and comprising different door-operating means on opposite sides of the discharge opening and transmission means, said different door-operating means each having an operating shaft and said transmission means comprising differently arranged shafts and gearing therebetween and between some of its shafts and said operating shafts.

19. In combination in a dump car, doors, separated operating means therefor on opposite sides thereof and transmission means causing the separated door-operating means to act in unison and comprising shaft sections and a coupling comprising connected portions each related to one of said shaft sections to turn it and a portion interlocking with the ends of adjacent shaft sections to prevent creepage of said coupling on said shaft.

20. In combination in a dump car, separated door-operating means each including an operating shaft, a sectional transmission shaft geared with said operating shafts, a coupling having flanged parts each mounted for rotation with one of the transmission shaft sections, there being a plurality of apertures in the flange of each part and in excess in the flange of one part over that of the other, permitting a finer relatively rotative adjustment between both coupling parts than the distance between the most closely spaced apertures, and means passable through the apertures of both flanges securing the coupling parts together.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

JOHN M. ROHLFING.

Witnesses:

EDW. J. LONERGAN,

BLASDEL SHAPLEIGH.