

June 17, 1969

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3,450,065

POWER ACTUATED DUAL HOPPER DOOR OPERATING MECHANISM

Filed Jan. 31, 1967

Sheet 1 of 3

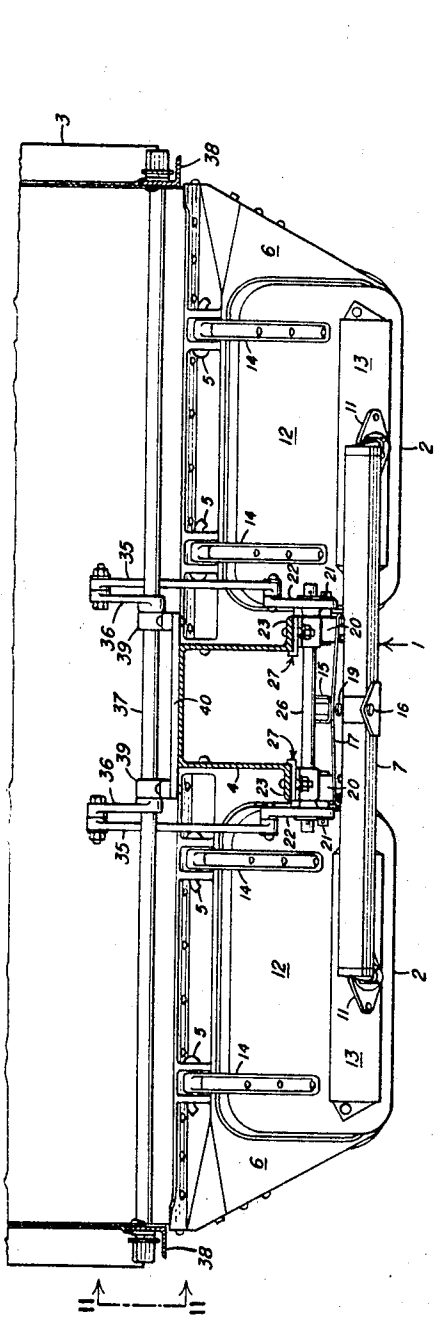


FIG. 2

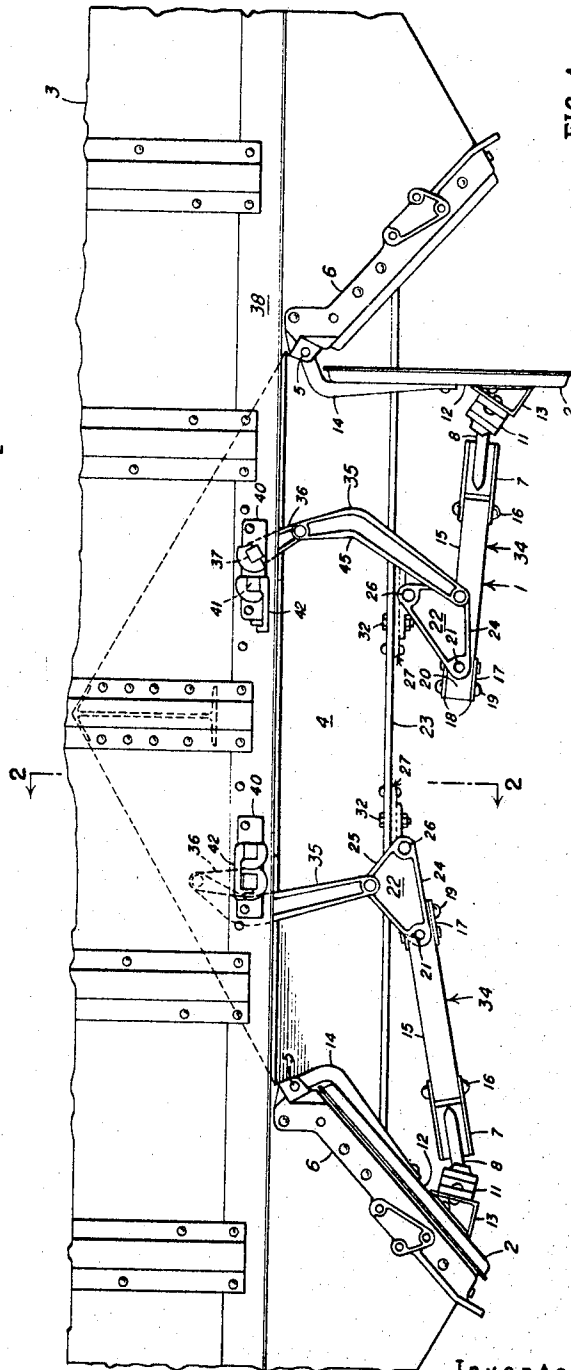


FIG. 1

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Sheet 2 of 3

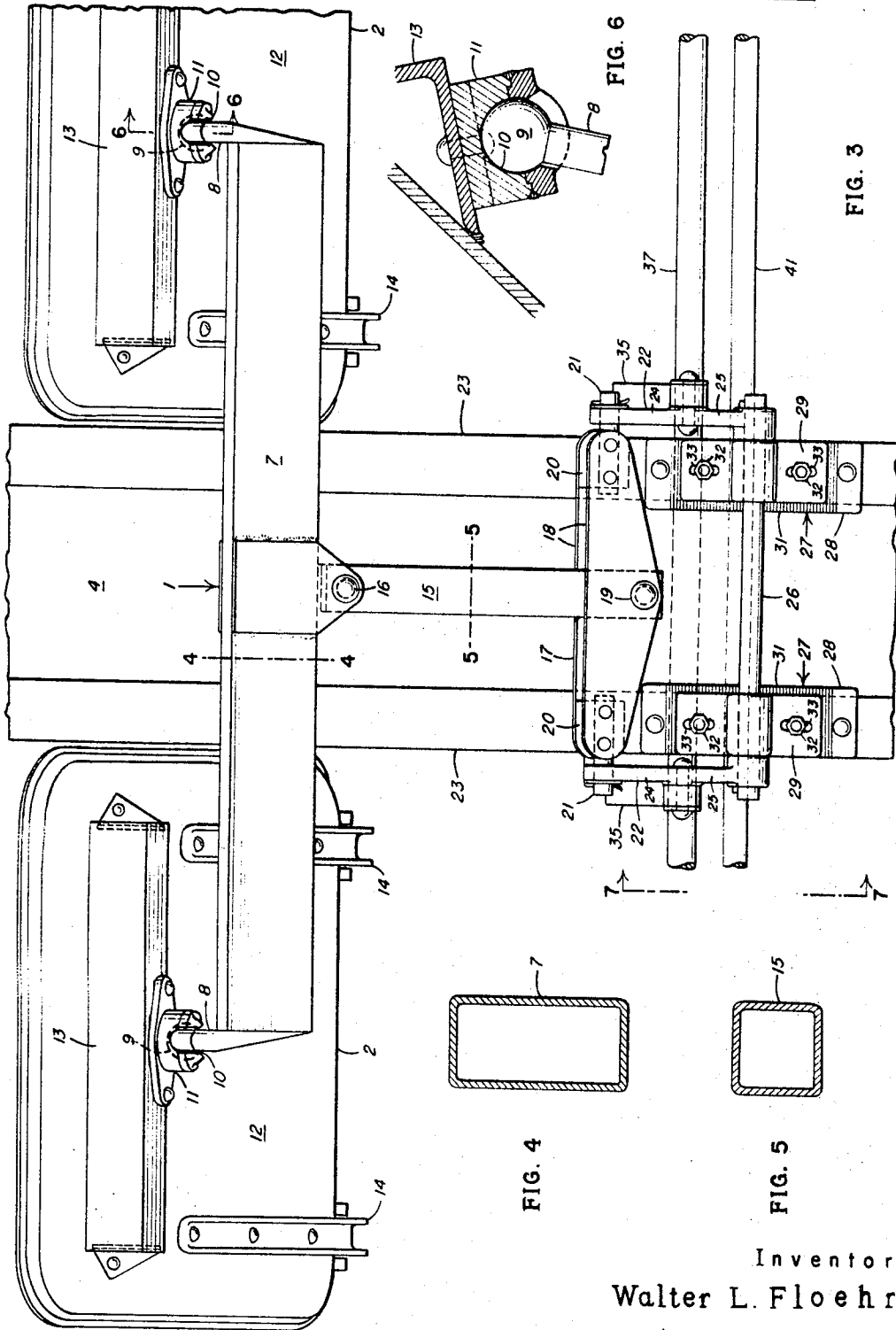


FIG. 4

FIG. 5

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Sheet 3 of 3

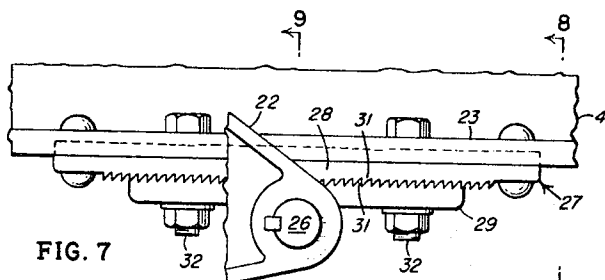


FIG. 7

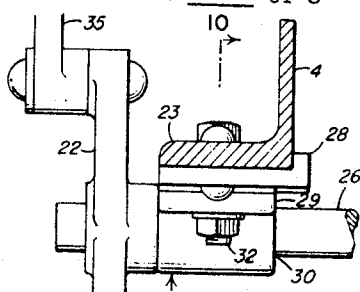


FIG. 8

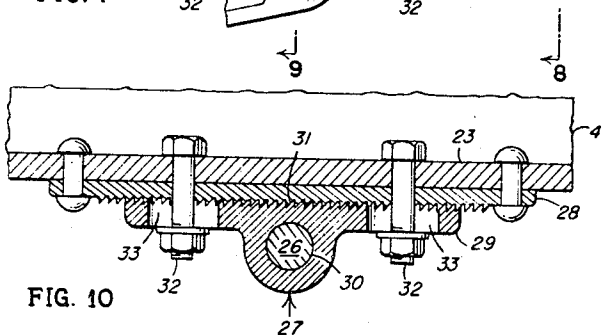


FIG. 10

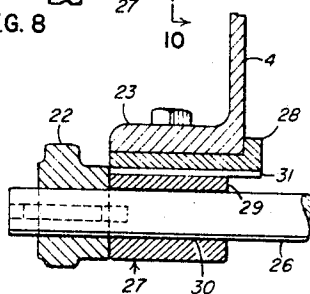


FIG. 9

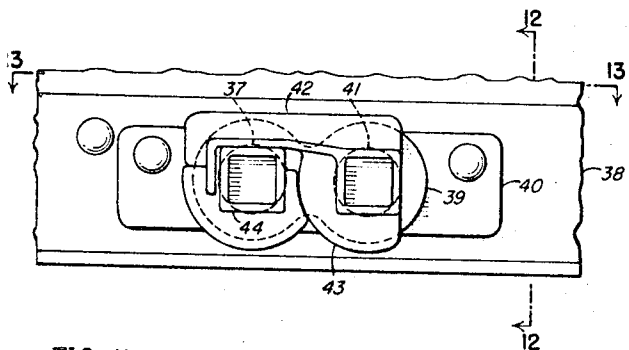


FIG. 11

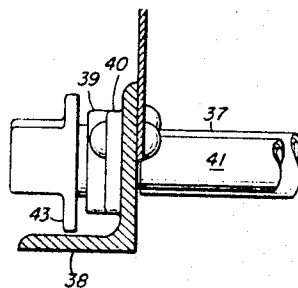


FIG. 12

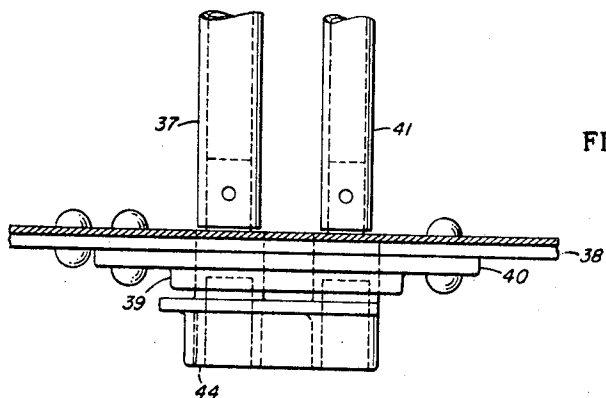


FIG. 13

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1

3,450,065

**POWER ACTUATED DUAL HOPPER DOOR
OPERATING MECHANISM**

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Int. Cl. B61d 7/26

U.S. Cl. 105—290

7 Claims

ABSTRACT OF THE DISCLOSURE

A mechanism for operating in unison a laterally aligned pair of longitudinally opening doors of a railway hopper car which in closing distributes equally between the doors by a flexible spreader an adjustable preloading to compensate for the weight of the lading.

BACKGROUND OF THE INVENTION

Mechanisms have heretofore been developed for operating in unison a laterally aligned pair of longitudinally opening doors of a railway hopper car and, as disclosed in Murphy Patent No. 1,877,423, issued Sept. 13, 1932, some such mechanisms employ a spreader pivotally connected to the doors for substantially equally distributing the applied forces therebetween.

SUMMARY OF THE INVENTION

The hopper door mechanism of the present invention improves upon prior mechanisms of the spreader type by using as its spreader a flexible beam which by being flexed within its elastic limit on closing of the doors, enables the doors to be preloaded to compensate for the weight of the lading and also acts to absorb the shocks on doors when the lading is introduced into the car. Preferably operable from either side of the car, the improved mechanism further improves upon prior mechanisms by being mounted on and reacting against the car's center sill, transmitting force from an operating shaft to the spreader through counterpart levers fulcrumed on opposite sides of the sill and acting through an equalizer, and enabling the lever fulcrum to be shifted longitudinally as necessary to suit particular installations.

With the foregoing its main objectives, other objects and advantages of the invention will appear hereinafter in the detailed description, be particularly in the appended claims and be illustrated in the accompanying drawings, in which:

FIGURE DESCRIPTION

FIGURE 1 is a fragmentary side elevational view of a railway hopper car in which oppositely opening pairs of longitudinally opening doors are each operated by a preferred embodiment of the improved operating mechanism of the present invention;

FIGURE 2 is a fragmentary vertical sectional view taken along lines 2—2 of FIG. 1;

FIGURE 3 is a fragmentary bottom plan view on an enlarged scale of the structure of FIG. 2;

FIGURE 4 is a fragmentary vertical sectional view on an enlarged scale taken along lines 4—4 of FIG. 3;

FIGURE 5 is a fragmentary vertical sectional view on the scale of FIG. 4 taken along lines 5—5 of FIG. 3;

FIGURE 6 is a fragmentary vertical sectional view on the scale of FIG. 4 taken along lines 6—6 of FIG. 3;

FIGURE 7 is a fragmentary side elevational view on the scale of FIG. 4 taken along lines 7—7 of FIG. 3;

FIGURE 8 is fragmentary vertical sectional view taken along lines 8—8 of FIG. 7;

2

FIGURE 9 is a fragmentary vertical sectional view taken along lines 9—9 of FIG. 7;

FIGURE 10 is a fragmentary vertical sectional view taken along lines 10—10 of FIG. 8;

5 FIGURE 11 is a fragmentary side elevational view on the scale of FIG. 4 taken along lines 11—11 of FIG. 2;

FIGURE 12 is a fragmentary vertical sectional view taken along lines 12—12 of FIG. 11; and

10 FIGURE 13 is a fragmentary horizontal sectional view taken along lines 13—13 of FIG. 11.

DETAILED DESCRIPTION

Referring now in detail to the drawings in which like referenced characters designate like parts, the improved operating mechanism of the present invention, designated as 1, is designed to operate in unison a pair of longitudinally opening, laterally aligned doors 2 of a railway hopper car 3, such as the so-called "sawtooth" hopper car. The doors of the pair are mounted on opposite sides of the car's center sill 4 and, as indicated in FIG. 1, the car may be equipped with a plurality of such pairs. The doors 2 of the exemplary application of the mechanism 1 are conventional top hinged, drop bottom or bottom opening doors, which in the closed position shown at the left in FIG. 1, slope downwardly and inwardly from their hinges 5 and seat against frames 6 and are adapted to swing between that position and a substantially vertical open position such as shown at the right in FIG. 1.

In the improved mechanism 1, the laterally aligned doors 2 of each pair are operated in unison by a horizontally disposed spreader 7 extending laterally of the car 3 across the center sill 4 and partly across the doors and pivotally or, preferably, universally connected at opposite ends to the doors substantially midway between their sides on their lateral midlines. For the preferred universal connection, the spreader 7 may have at or fixed to its opposite ends a pair of legs 8 each instanding toward and centered laterally on one of the doors 2 and carrying or having on its inner end a ball or spherical foot 9 releasably received or seated and rotatable or swivelable in a correspondingly spherical socket 10 in a bracket 11 fixed to and centered laterally on the door's confronting or outer face 12. To prevent buckling of the doors, each of the brackets 11 is fixed directly to and backed by an angle iron or other suitable horizontally disposed stiffener or backing member 13 which extends laterally substantially across and is fixed at its ends to the door's face 12. To clear the door hinge butts 14, the preferred stiffeners 13 are on the lower parts of the doors.

The spreader 7 is connected substantially midway of its ends or at its longitudinal center to a link 15 for relative pivoting in the generally horizontal plane of itself and the link about a generally vertical axis perpendicular or normal to that plane. Contrary to the conventional rigid spreader, the spreader 7 is elastic and flexible or bendable within limits over which it retains its elasticity and, although the extent will usually be slight, is designed to be bowed, flexed or bent inwardly at the center toward the doors and longitudinally of the car in the doors' closed position. For such limited longitudinal flexing or bending, the preferred spreader is a box or box-shaped beam of rectangular and most suitably oblong cross-section with its long cross-axis disposed generally horizontally normal to the pivotal axis of its pivotal connections 16 so that its flexing longitudinally is along that cross-axis. Mainly for strength rather than flexibility, the link 15 too preferably is a box beam of rectangular and most suitably square cross-section. Pivotally connected at its outer end to the spreader 7,

the link 15 is so connected at its opposite or inner end for relative pivoting about an axis parallel to that of the pivotal connection or pivot 16 to an equalizer or cross-head or member 17. Below and extending laterally or transversely across the center sill 4 and conveniently formed of spaced plates 18 sandwiching or embracing the link 15, the equalizer 17 is connected centrally or midway of its ends to the adjoining end of the link by a pivot pin 19 and has at its ends, between and fixed to the plates, spacer blocks 20 mounting axially aligned trunnions 21 extending oppositely at right angles to the pivot pin.

Together, the right angularly related pivot pin 19 and trunnions 21 form a crosspin universal connection between the link 15 and a pair of levers 22 mounted on opposite sides of the center sill 4, each on the underside of one of the sill's bottom flanges 23. Suitably bellcranks formed for strength as triangular plates with web-reinforced legs, the levers 22 journal or pivotally receive or seat the trunnions 21 in their outer corners or outer ends of their force-transmitting legs or sides 24 and fulcrum or pivot at their inner corners at the intersection or joint between their force-transmitting legs and force-receiving legs or sides 25 on a common fulcrum rod 26.

Projecting or extending laterally or transversely across the center sill 4 below and beyond the bottom flanges 23 and mounting the levers 22 on its outer end beyond those flanges, the fulcrum rod 26 is mounted on, anchored to or suspended from the sill flanges by a pair of laterally spaced and aligned mounting brackets 27 each mounted on and extending or elongated longitudinally of the underside of one of the flanges. Each bracket 27 preferably is formed of upper and lower plates 28 and 29, respectively, the former fixed or secured as by riveting to the adjoining or related bottom flange 23 and the latter carrying or mounting the fulcrum rod 26 in an integral or rigid, downstanding or depending eye or boss 30. The plates 28 and 29 of each bracket 27 have laterally or transversely serrated, grooved or toothed, consequently interlocking or interfitting confronting faces 31 and these and the releasable mounting of each bottom plate by a pair of bolts 32 extending through the bottom flange and top plate and received in longitudinally elongated slots 33 in the bottom plate at opposite sides of the eye 30, enable the bottom plates of both brackets to be shifted together longitudinally of the center sill and selectively fixed or secured thereto in any of a plurality of longitudinally spaced positions, with corresponding adjustable shifting of the common fulcrum of the levers 22.

Swingable vertically and longitudinally of the car, the levers 22 form with the link 15 an in part double toggle 34 having as its knee the trunnions 21 and breaking or folding downward at that knee on opening of the doors 2. Conversely, when the doors are closed, the toggle 34 is extended and the link 15 forming its outer leg is substantially aligned with its fulcrum 26. For extending and collapsing the toggle 34, each of the counterpart triangular bellcrank levers 22 has pivotally connected to its intermediate corner at the outer end of its force-receiving leg 25 a lower end of one of a pair of counter parts, preferably bent links 35, the upper ends of which are each connected to one of a pair of counterpart cranks 36. Positioned with their links 35 on opposite sides of the center sill 4, the cranks 36 are keyed or otherwise non-rotatively mounted on an operating shaft 37 extending laterally across the car with its opposite ends projecting through the side sills 38 and its intermediate portion between the cranks rotatably mounted in bushings 39 fixed at opposite sides of the center sill 4 to a support plate 40 mounted on top thereof.

The mechanism 1 preferably also includes a locking or locked operating shaft 40 extending across the car through the side sills 38, parallel to but spaced from the operating shaft 37. Each of the shafts 37 and 40 is socketed or otherwise fitted at each end for turning from either side

of the car by a suitable turning tool (not shown). In addition, as fully explained in my copending application Ser. No. 460,028, filed June 1, 1965, the preferred locking shaft 40 has at each end a radially extending arm 41 and radial flange 42 which, in the door-locked position of the operating shaft 37, are adapted respectively to fit over and be received in a side of a head 43 on the adjoining end of the operating shaft 37 for positively locking the latter against turning. This interlock between the shafts must be disturbed when the doors 2 are to be opened by first turning the locking shaft 40 from either end in an unlocking direction. Thus released or disengaged from the locking shaft, the operating shaft thereafter is turned in an opening direction for opening the doors.

As in the operating mechanism disclosed in application Ser. No. 460,028, in the closed position of the doors 2 each of the cranks 36 upstands substantially vertically from the operating shaft 37 and the shaft, by engaging the links 35 in their concave crooks or bends 44, acts as a limit stop for preventing further turning of the operating shaft in a closing direction. At the same time the substantial longitudinal alignment of the link 15 of the toggle 34 with the latter's fulcrum 26 practically eliminates any resultant force from the weight of the doors 2 and any lading tending to unlock the mechanism and, if desired, any such tendency can be removed completely and the engagement of the operating shaft 37 and links 35 used as a positive lock against unlocking by so adjusting the position of the fulcrum as to have a slight upward break in the toggle 34 when the doors are closed.

Aside from its action when the doors 2 are closed, the mechanism 1, because of the pivot connection of the spreader 7 to the doors and the link 15, will continue to close the doors until both are fully seated against their respective frames 6, thus compensating for warping or other irregularities in the doors and the frame. While similar in this respect to prior door operating mechanisms of the pivoted spreader type, the improved mechanism 1, as a result of the elasticity or resilience and limited flexibility of the spreader 7, has the unique capability of preloading or prestressing the doors in closing both to compensate for the weight of lading subsequently introduced or loaded into the car and to absorb resiliently the impacts of the lading upon the doors during such loading. Not only is this capability inherent in the mechanism but its presence in any installation is ensured by the selective shiftability or positionability of the toggle fulcrum 26 longitudinally of the center sill 4 and thus toward or away from the doors 2 to suit a particular installation. Furthermore, the anchoring or backing of the mechanism by the center sill and transmission of a closing force from the operating shaft 37 to the link 15 through the duplicate cranks 36, links 35 and levers 22, ensures that the doors can be preloaded without requiring corresponding strength in any members of the power train to the spreader 7, other than the operating shaft, equalizer 17 and link 15. Too, in an opening operation an operator need only turn the operating shaft 37 to the point at which the toggle 34 has begun to break downwardly, whereupon the force of gravity upon the doors and any lading will take over and quickly swing the doors by gravity to open position.

From the above detailed description it will be apparent that there has been provided an improved operating mechanism for a pair of laterally aligned drop bottom hopper doors which can compensate not only for irregularities in the doors and their frames but also for the weight and impacts on the doors of subsequently introduced lading. It should be understood that the described and disclosed embodiment is merely exemplary of the invention and that all modifications are intended to be included that do not depart from the spirit of the invention and the appended

5

Having now described my invention, I claim:

1. An operating mechanism for a railway hopper car for operating in unison a pair of longitudinally opening drop-bottom doors laterally aligned on opposite sides of the car's center sill, comprising spreader means pivotally connected to and connecting the doors below the center sill, and power means for opening and closing the doors, said power means including a pair of levers fulcrummed on a common fulcrum axis on opposite bottom flanges of the center sill, and link means common to and connecting said levers to said spreader means substantially midway of the pivotal connections thereof to the doors.

2. Operating mechanism according to claim 1, wherein the fulcrum axis is stationary during operation of the mechanism, and including means for selectively shifting longitudinally of the car the position of the fulcrum axis.

3. Mechanism according to claim 1, wherein the link means is pivotally connected to the spreader means and universally connected to the lever means.

4. Mechanism according to claim 3, wherein the spreader and link means are each a box beam of rectangular cross-section.

5. Mechanism according to claim 3, wherein the power means includes an operating shaft extending across operable from opposite sides of the car, cranks non-rotatably

6

mounted on said shaft on opposing side of the sill, and links each connecting one of the cranks to the lever at a corresponding side of the sill.

6. Mechanism according to claim 5, wherein the link means is a link centered laterally on the center sill, the connection of the link means to the levers includes an equalizer pivotally connected at ends thereof to the levers and substantially midway therebetween to the link, and the pivotal connections of the equalizer to the levers and the link are right angularly related.

7. Mechanism according to claim 6, including means operable from opposite sides of the car for locking the operating shaft and therethrough the doors in closed position.

References Cited

UNITED STATES PATENTS

1,284,111	11/1918	Kestler	-----	105—290	XR
1,859,339	5/1932	Murphy	-----	105—280	

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U.S. Cl. X.R.

105—280, 296, 299, 304; 298—30