

[54] **HOPPER CAR DOOR ACTUATING MECHANISM**

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 [58] **Field of Search** ..... 105/240, 250, 251, 290, 105/304

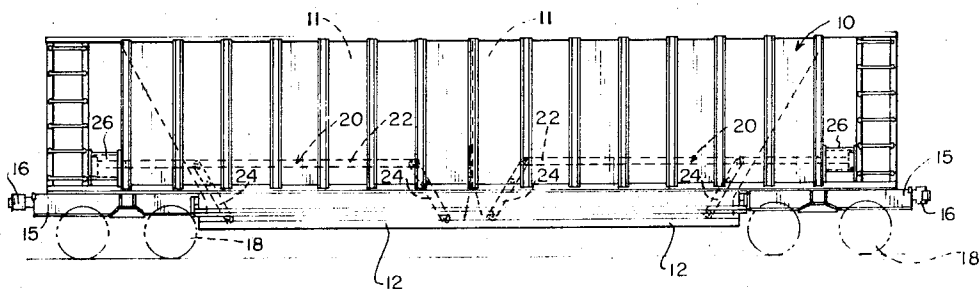
[57] **ABSTRACT**

A railway hopper car having longitudinally extending discharge doors arranged in pairs and operable in response to fluid motor actuation of a lever system. A four bar linkage mechanism interconnects each pair of associated doors in such a manner as to provide sequential opening and closing of the hopper doors and the door connecting link members are positioned to provide an over-center locking feature to the doors when rotated into the closed position. One door of each pair includes a lip portion which overlaps the associated door to provide support and improved sealing when the doors are in a closed position.

[56] **References Cited**  
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**5 Claims, 3 Drawing Figures**







**HOPPER CAR DOOR ACTUATING MECHANISM****BACKGROUND OF THE INVENTION****1. Field of the Invention:**

This invention pertains to door operating mechanisms embodied in railway hopper cars having longitudinally extending pairs of doors.

**2. Description of the Prior Art:**

Longitudinally extending hopper doors which expose a large portion of the bottom of the hopper car for rapid discharge of lading while permitting the car to be unloaded rapidly have an inherent lengthy unsupported portion between the supported ends of the doors. The weight of the lading tends to bend the central portion of the hopper doors between the two supported end portions. This bending could present an undesirable leakage problem if not controlled. To overcome this tendency to deflect under lading forces various methods of reinforcing the lower portions of the doors or providing some means of central support to these door members have been devised.

**SUMMARY**

This invention relates to a hopper door operating mechanism for use in railway hopper cars. A linkage arrangement connects the inner and outer doors of a longitudinally extending pair of hopper doors. This linkage is arranged in such a manner as to provide for sequential opening and closing of each door and also permits the inner door to overlap the outer door in a closed position and permits it to engage the lower portion of the outer door in a supportive manner.

It is therefore an object of the present invention to provide a linkage arrangement between pairs of pivoted hopper doors to thereby permit sequential opening and closing of the hopper doors.

It is another object of the present invention to provide a pair of hopper doors operatively connected to each other with one door having an overlapping lip portion for supporting the associated door when both doors are in a closed position.

It is yet another object of the present invention to provide a pair of sequentially operated hopper discharge doors operatively connected by a linkage and an over-center locking feature which insures that the doors remain closed when the hoppers are filled with lading.

These and other objects of the invention will become apparent from reference to the following description, attached drawings and appended claims.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a side elevational view of a railway hopper car;

FIG. 2 is an end view of the end portion of a hopper and the associated linkage mechanism used in operating the discharge doors; and

FIG. 3 is a view similar to that illustrated in FIG. 2 showing the doors in the fully open position.

**DESCRIPTION OF THE PREFERRED EMBODIMENT**

FIG. 1 illustrates the general arrangement of a typical hopper car having a pair of hopper members 11 having lower discharge portions which permit removal of lading carried within the hoppers. The doors are spaced

longitudinally and arranged in pairs and comprise an outer door 12 and an inner door 13. The center sill 14 which runs along the center portion of the car 10 forms a dividing line between the symmetrically placed discharge doors which are on each side of the center sill 14. The center sill 14 has draft sill portions 15 at each end and these draft sills 15 contain the couplers 16. The car is supported and carried by the spaced truck and wheel members which are designated schematically and indicated by the numeral 18.

A door operating lever assembly 20 includes a longitudinally extending drive rod 22 which is pivotally connected to the door operating levers 24 to transmit opening and closing forces from the pneumatic cylinders 26. The door levers 24 are pivotally attached to the center sill 14 as best indicated in FIGS. 2 and 3, and include the adjustable strut assemblies 28 which form ball and socket connections between the lower portions of the door levers 24 and an associated inner door 13.

The discharge openings, through which lading is removed, are indicated in FIGS. 2 and 3 generally by the numeral 30 and is the open portion which is closed off by the discharge doors 12, 13. The discharge opening 30 is rectangular as defined by the end slope sheets 31 and the side slope sheets 32. The end wall members 33 which form a seal with the pivoted discharge doors contain angled portions which conform to the closed position of the hopper doors.

The outer door 12 is pivoted at 35 by a customary pin and lug type of pivotal connection. Likewise, the inner door 13 is pivoted at 36 adjacent the center sill 14. In the door closed position the edge 38 of the outer door 12 is received by and in contact with the lip portion 40 of the inner door 13. This overlapping permits a seal to be effected with the two doors and also provides a supporting feature by having the inner door support the outer door as lading within the hopper tends to press down on the doors. The doors 12, 13 are interconnected by a four bar type of linkage mechanism which includes a first link 42 and the reinforcing linkage strut portions 42a and a second link 44 having a reinforcing portion 44a. A floating third link 48 is connected to the strut portions of each door to form the connecting link which permits interaction and sequential opening and closing of each door member. A rotating pivotal connection is provided at 49, and 50, between the floating link 48 and the outer door 12 and the inner door 13, respectively. Thus the four bar mechanism is provided with a first link 42 existing between pivots 36 and 50, a second link 44 existing between pivots 35 and 49, the third link provided by the floating link 48, and the fourth link provided by the stationary link which exists by definition between the fixed pivots 35 and 36.

**THE OPERATION**

Upon actuation of the pneumatic cylinders 26 at each end of the hopper car, the drive rods 22 of the door operating lever assembly will move longitudinally towards each other and towards the center of the car. This longitudinal movement of the drive rods 22 will move the struts 28 and the hopper discharge doors 12, 13 from the position illustrated in FIG. 2 to the open position illustrated in FIG. 3. Referring to FIG. 2, it will be noticed as the discharge doors are opened, and the struts 28 tend to fold under the center sill 14, the inner door 13 will move in a counterclockwise direction

about its associated pivot 36. In such opening rotational movement the floating link to strut pivotal connection designated by the numeral 50 will be moved from a slightly over-center position with respect to a straight line drawn between the inner door pivot 36 and the floating lever pivot 49. This initial movement from the over-center self-locked position during initial opening rotation of the inner door 13 will not be reflected in any initial rotation of the outer door 12. This lack of rotation in the outer door 12 permits the supporting lip 40 of the inner door 13 to clear the lower edge portion 38 of the outer door 12. Thus as the strut to floating lever pivotal connection 50 moves over center and the doors are clear of each other, the weight of the lading along with the force provided by the door opening mechanism will force open the doors 12, 13.

In closing the hopper doors a reverse of the door opening operation occurs as the struts 28 unfold from under the center sill 14 and extend transversely outward towards their respective doors. The sequential operation in door closing occurs as the door connecting mechanism causes the outer door 12 to reach a fully closed position ahead of the inner door 13 as shown in FIG. 2 which indicates in phantom the position of the inner door 13 when the outer door 12 has been completely closed. Sequential closing permits the lip 40 of the inner door 13 to overlap the bottom edge 38 of the outer door 12 when the inner door 13 has finally moved into a fully closed position. In the fully closed position the door connecting linkage will have moved from the phantom line position illustrated in FIG. 2 which is shown to designate the center line or turning point positioning of the linkage elements. Movement of the door 13 to the fully closed position naturally moves this linkage which connects these two doors to an over-center position whereby force of the lading which tends to open the doors 12 and 13 will be utilized to more fully lock the doors and insure that the doors are not accidentally opened during car movement by impact or transport forces.

The invention is not to be limited to the specific embodiment disclosed here because modification of linkage lengths and positions could be made to permit the inner door 13 to close ahead of the outer door 12. Reversal of the sequential operating sequence would also involve placing the lip 40 on the outer door 12 to thereby support the inner door 13. Such reversal in operating sequence is contemplated and would not depart from the scope of the invention.

The foregoing description and drawings merely explain and illustrate the invention and the invention is not limited thereto, except insofar as the appended claims are so limited, as those skilled in the art who have the disclosure before them will be able to make modifications and variations therein without departing from the scope of the invention.

What is claimed is:

1. A railway hopper car having first and second longitudinally extending discharge doors arranged in operatively connected pairs and operable in response to actuation by a door connected actuating mechanism, and the improvement comprising:

said first and second discharge doors pivotally attached to said railway hopper car and having overlapping portions;

said first door including a first door pivot for providing pivotal rotation to said first door;

a second door pivot transversely spaced from the first door pivot to provide for rotational opening and closing of said second door;

a first link means having portions fixedly attached to said first door and including a link member extending from said first door pivot;

a second link means operatively connected with said second door and including a link portion extending from said second door pivot;

said first and said second link means having end portions spaced from the associated first and second pivot;

a floating link operatively interconnecting the end portions of both the first link and the second link means to thereby form a generally straight line over-center connection from the end portions of the link member and the link means and extending to one of said door pivots.

2. The invention according to claim 1, and:

said overlapping portions of both the first and the second door including a lip portion and an associated edge portion forming the lower edges of the first and the second door whereby the lip portion is positioned in abutting and supporting relation with the edge portion of the associated door when the doors are in the closed position with the door connecting mechanism in the locked over-center configuration.

3. The invention according to claim 1, and:

said railway vehicle including a continuous center sill and providing a mounting member for attachment of a door connecting lever means including generally vertically disposed operating levers pivotally attached to said center sill and including transversely extending door connecting struts operatively attached with said first discharge door;

said link member of the first link means combining with said floating link to form said over-center locking connection.

4. The invention according to claim 1, and:

said discharge doors arranged in pairs and including said first discharge door adjacent said center sill and connected with said second discharge door and spaced about a longitudinally extending center sill thereby providing said hopper car with four transversely arranged and transversely aligned discharge doors disposed along the bottom margin of said railway vehicle for discharge of lading contained therein.

5. The invention according to claim 1, and:

said first link means including a support strut member having portions fixedly attached to said first door and spaced from the first pivot and having connecting portions supportingly attached to said link member;

said second link means including a link support means extending from the second door and having portions extending to said link portion and fixedly attached thereto.

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