RAILWAY CAR HOPPER DOOR OPERATING MECHANISM

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Field of Search 105/240, 250, 251, 290

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8 Claims, 4 Drawing Figures

ABSTRACT

A door opening mechanism for use in railway hopper car having pairs of interconnected longitudinally extending discharge gates. The present invention includes a door connecting mechanism which provides sequential operation of associated pairs of discharge doors. The door connecting mechanism uses a linkage which includes a spring loaded varying length floating link element which permits the outer door of each door set to close ahead of the associated inner door and permits overlapping and interlocking of the doors.
RAILWAY CAR HOPPER DOOR OPERATING MECHANISM

BACKGROUND OF THE INVENTION

1. Field of the Invention:
This invention pertains to railway hopper car discharge door operating mechanisms and in particular to discharge doors operating in pairs and interconnected by a linkage mechanism which provides for sequential opening and closing of the associated door pairs.

2. Description of the Prior Art:
Prior art door connecting mechanisms have generally included rigid fixed length members which must be accurately assembled and machined to provide the required door operation. The present invention provides a varying length link member which compensates for dimensional variations which occur during car manufacture and also to compensate for variations in the car structure which occur during car use.

SUMMARY

This invention relates to railway hopper vehicles having interconnected longitudinally extending discharge doors. The present invention is directed to a door connecting linkage arrangement which provides for sequential opening and closing of hopper doors thereby permitting one door to close ahead of the other thereby permitting locking elements on the bottom portion of each door to engage for rigidly locking the doors in position.

The operative features of the invention are produced by a spring loaded link member which interconnects each door and thereby provides a varying length link element which extends during door closing to permit the outer door to close ahead of the inner door and thus permits the inner door to overlap and support the outer door.

It is an object of the present invention to provide a door connecting linkage arrangement including a link member which may have a varying length and is spring loaded.

It is another object of the present invention to provide hopper discharge doors arranged in longitudinally extending pairs and interconnected by a linkage mechanism which permits one of the doors to close ahead of the other door and allows the other door to overlap and support the first door in the closed position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a railway hopper vehicle including the longitudinally extending pairs of discharge doors;

FIG. 2 is a removed and enlarged sectional view taken along line 2—2 of FIG. 1;

FIG. 3 is a removed and enlarged sectional view taken along line 3—3 of FIG. 1; and

FIG. 4 is a removed and enlarged sectional view taken along line 4—4 of FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1 there is illustrated a railway hopper car 10 having the usual longitudinally extending center sill member 11 and including a pair of spaced hoppers 12. The hoppers are formed between the side walls and the centrally positioned bulkhead 14 and the end slope sheets 16. These slope sheets direct lading toward the hopper discharge opening which is closed off by pairs of discharge doors, namely, an outer door 18 pivoted at 18a adjacent the car side sill and an inner door 19 pivoted adjacent the center sill 11 at 19a.

A pneumatic cylinder 20 positioned adjacent the end portions of the hopper car 11 is the force supplying source for opening and closing the hopper discharge doors. The pneumatic cylinder is operatively connected with a first lever member 22 which is spaced from the second lever member 23 and operatively connected thereby by the longitudinally extending drive member 24. A set of third levers designated by the numeral 26 are essentially link members connected to and extending through the center sill 11 and interconnected by a longitudinally extending drive member 28. Extending transversely from the levers 26 are the struts or arms 30 which are connected to the levers 26 and the inner door 19 of each door pair to a ball and socket connection such as designated at 31 and 32. The levers 26 include a pair of transversely extending strut arms 30 extending in opposite directions to thereby control the inner door of each discharge door pair, but, as illustrated in FIGS. 2 and 3, only one of these arms has been illustrated for purposes of clarity. Initial movement of the levers 26 will move the struts 30 into a past center or in line position of the strut end portions 31, 32 after which position the weight of lading and the door weight will force open the doors 18, 19.

The inner door 19 includes a smooth door sheet 34 and the door is reinforced by longitudinally extending channel member 34a and a series of transversely extending stiffeners 35 to thereby produce a rigid door member which will not bulge from the weight of the supported lading. The outer door 18 likewise includes a door sheet 36 and the longitudinally extending reinforcing channel 36a as well as the transversely extending stiffeners 35. The outer door 18 includes a plurality of downwardly extending locking bolts 37 fixedly attached to the reinforcing channel member 36a into the door 18 and has a depending lip portion 37a which is receivable in the associated locking latch 38 which is securely attached to the inner door 19. Thus in the door closed position the locking bolt 37 will cooperate with the locking latch 38 in an overlapped inserted configuration to provide a mating door structure which is interlocked by virtue of the cooperation between the locking bolt 37 and the latch 38.

The doors 18 and 19 are interconnected for simultaneous and sequential opening and closing by a four bar linkage which includes a fixed link assembly 40 which is securely and rigidly attached to the inner door 19 and includes a pivot 41 as does the outer door 18 which includes a pivot 42 and extending between these pivots is the floating link member 43 which pivotally interconnects the outer door 18 with the inner door 19. Thus, for determining the operational features of the interconnected doors, a first link is defined between the inner door pivot 19a and the pivot 41, and a second link exists between the outer door pivot 18a and the pivot 42. The floating link 43 is also the third link of the mechanism. By definition in linkage mechanisms, the fourth link of the four bar mechanism which interconnects the doors 18, 19 is a stationary link existing between door pivot 18a and door pivot 19a.

The floating link 43 is a spring loaded flexible member having a varying length between the pivots 41 and
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42. The floating link 43 also includes spring loaded member having a cannister 44 rigidly attached to the pivot 41 and enclosed at one end by the end cover plate 45. A rod 46 extends from the pivot point 42 through the end cover plate 45 and terminates with an end cap 47. A compression spring 48 is positioned between the end cap 47 and the cover plate 45 to confine the spring and provide a biasing force when the distance between the end cover plate 45 and the end cap of the rod 47 come together.

THE OPERATION

As the pneumatic cylinder 20 is operated by air pressure moving its piston rod horizontally and longitudinally of the vehicle to actuate the lever members 22, 23 and 26 the strut arms 30 will move to a passed center position at which time the toggle effect design of the levers 26 and the connected inner doors 19 will force the doors and the levers past the over-center position due to the weight of the doors and the weight of lading within the hoppers. In the opening movement the inner door 19 will move from the solid line to the dotted line position illustrated in FIG. 3 and pivot about the pivot point 19a in a counterclockwise direction. This downward pivoting movement will force the floating link 43 in an essentially downwardly and outwardly direction away from the fixed link assembly 40 in a translatory movement which is essentially a clockwise rotational movement plus a horizontal and vertical displacement of the link 43. In such movement the link 43 will push the associated outer door 18 in a clockwise pivoting movement to open the discharge area of the hoppers. It will also be noticed that the initial rotational movement of the inner door member 19 allows the locking latch 38 which is attached to the underside of the inner door 19 to clear the associated locking bolt 37 which is a part of the outer door 18. During this initial opening movement when the inner door clears the outer door the floating link 43 will be shortened as the pivot 41 moves toward the pivot 42. During this shortening of the floating link 43 the distance between the end cap 47 on the rod 46 and the end cover plate 45 of the cannister 44 will be increased thereby decompressing the coil spring 48. It is contemplated by the design that as clearance occurs between the locking members 37, 38 the outer door 18 will then rotate into the open position. Likewise, on closing of the hopper doors, the pneumatic cylinder will operate the levers in a reverse direction and the strut arms 30 will be compressed as the door 19 is rotated toward the closed position. It is understood that because the compression spring 48 has become decompressed during the opening movement of the doors the distance between the pivot 41 and 42 has been shortened, therefore during the closing the outer door will move into the closed position ahead of the inner door and it is contemplated by the design that as the outer door reaches a completely closed position the floating link 43 will begin to expand or increase in length and thereby compress the spring member 48. During this lengthening of the floating link 43 and the associated contracting of the spring 48 the inner door 19 will continue to rotate toward a fully closed position. Thus this sequential closing of the doors which permits the outer door 18 to close ahead of the inner door 19 permits the locking latch 38 to receive the lip portion 37a of the locking bolt 37. Thus it is noticed in FIG. 3 that when the doors are in a completely closed position the compression spring 48 will have been compressed by the increase in length between the link pivots 41 and 42 and place the doors in the overlapping interlocked position. But any weight of lading which is being carried by the doors and tending to force the doors to pivot open will be restrained by the interlocking of the block bolt 37 and the locking latch 38.

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 a center sill and longitudinally extending pairs of discharge doors comprising an inner door and an outer door spaced about said center sill, said hopper car also including door operating members associated with the center sill and operatively connected to an operating air cylinder and connected to door connecting struts for opening and closing the pairs of discharge doors, said doors interconnected by a door linkage mechanism comprising:
   a first link member rigidly attached to the inner discharge door;
   a second link member rigidly attached to the outer discharge door;
   a third floating link pivotally attached to the first link and to the second link;
   said floating link having end portions and having a resilient means connecting said end portions biasing said end portions toward each other to shorten said floating link to thereby permit relative movement between the end link portions as the resilient member is deflected.

2. The invention according to claim 1, and:
   said third floating link having telescoping members including a rod with an end portion and a cannister member having an end cover plate through which said rod extends;
   a resilient biasing member surrounding said rod and operatively positioned between the rod end portion and the cannister cover plate.

3. The invention according to claim 2, and:
   said third floating link comprising members having end portions and said floating link having a spring member biasing apart said end portions of the members.

4. The invention according to claim 1, and:
   said outer door having a locking bolt portion extending downwardly and outwardly therefrom;
   said inner door having a locking lip operatively attached thereto;
   said inner door and said outer door having spaced pivot points and positioned for opening and closingrotating movement, and said first, second and third links interconnecting the doors to thereby permit sequential opening and closing of said doors with said outer door closing ahead of said inner door and said locking lip receiving said locking bolt when the doors are closed.

5. The invention according to claim 4, and:
   said first link having portions extending upwardly of the inner door pivot;
said second link having means extending downwardly of the outer door pivot; said third floating link connecting said first and said second link to thereby extend the floating link and compress said resilient means as the doors are being closed.

6. A hopper device having converging slope sheets and defining a discharge opening, and a pair of pivotally attached doors including a first door and a second door positioned for rotating movement to open and close off the discharge opening and being operatively connected to a door actuating arrangement for powered operation of said doors, and a discharge mechanism interconnecting said doors and comprising: a first link attached to said first door and a second link attached to said second door; a floating third link pivotally connecting both the first link and the second link and the associated first and second doors and thereby defining a four bar mechanism providing sequential opening and closing of both the first and the second doors and said doors having overlapping portions; said floating third link having portions extending from the first link to said second link thereby disposed to place a tensile load on said floating third link during operation of said doors; said floating third link having intermediate end portions connected by resilient biasing means thereby providing the third link with a length which is variable in response to tensile loading of the third link.

7. The invention according to claim 6, and: said intermediate end portions of the third link including telescoping members including a rod and end cap portion and a cannister member having an end cover plate through which said rod extends; said resilient biasing means having portions surrounding said rod and compressively positioned between the rod end portion and the end cover plate of said cannister.

8. The invention according to claim 6, and: said overlapping portions of both the first door and the second door including a locking lip portion and an associated locking bolt portion; said first door and said second door having spaced pivot points and positioned for opening and closing rotating movement and said first, second and third links interconnecting the doors to thereby permit sequential opening and closing of said doors with said second door closing ahead of said first door and said locking lip receiving said locking bolt when the doors are closed.

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