United States Patent

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[54] **MOTOR ACTUATED HOPPER CAR DOORS**
2 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **105/240,**
105/251, 105/255, 105/290, 105/299

[51] **Int. Cl.** **B61d 7/18,**
B61d 7/06, B61d 7/28

[50] **Field of Search** 105/240,
245, 250, 251, 253, 255, 289, 290, 299, 304

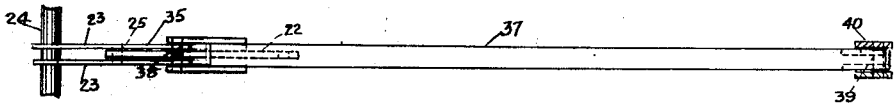
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ABSTRACT: The invention relates to a drop bottom discharge hopper car having longitudinally extending oppositely swinging doors adapted to be sequentially moved to closed position by axially movable connections. The improvement relates to mechanism for sequentially and conjointly operating oppositely swinging discharge doors which are interconnected by toggle mechanism involving linkage and radial arm means, said improvement including extending the radial arm means beyond its pivotal connection with the linkage means with provision for acting on said extension by axially movable power transmitting connecting means.



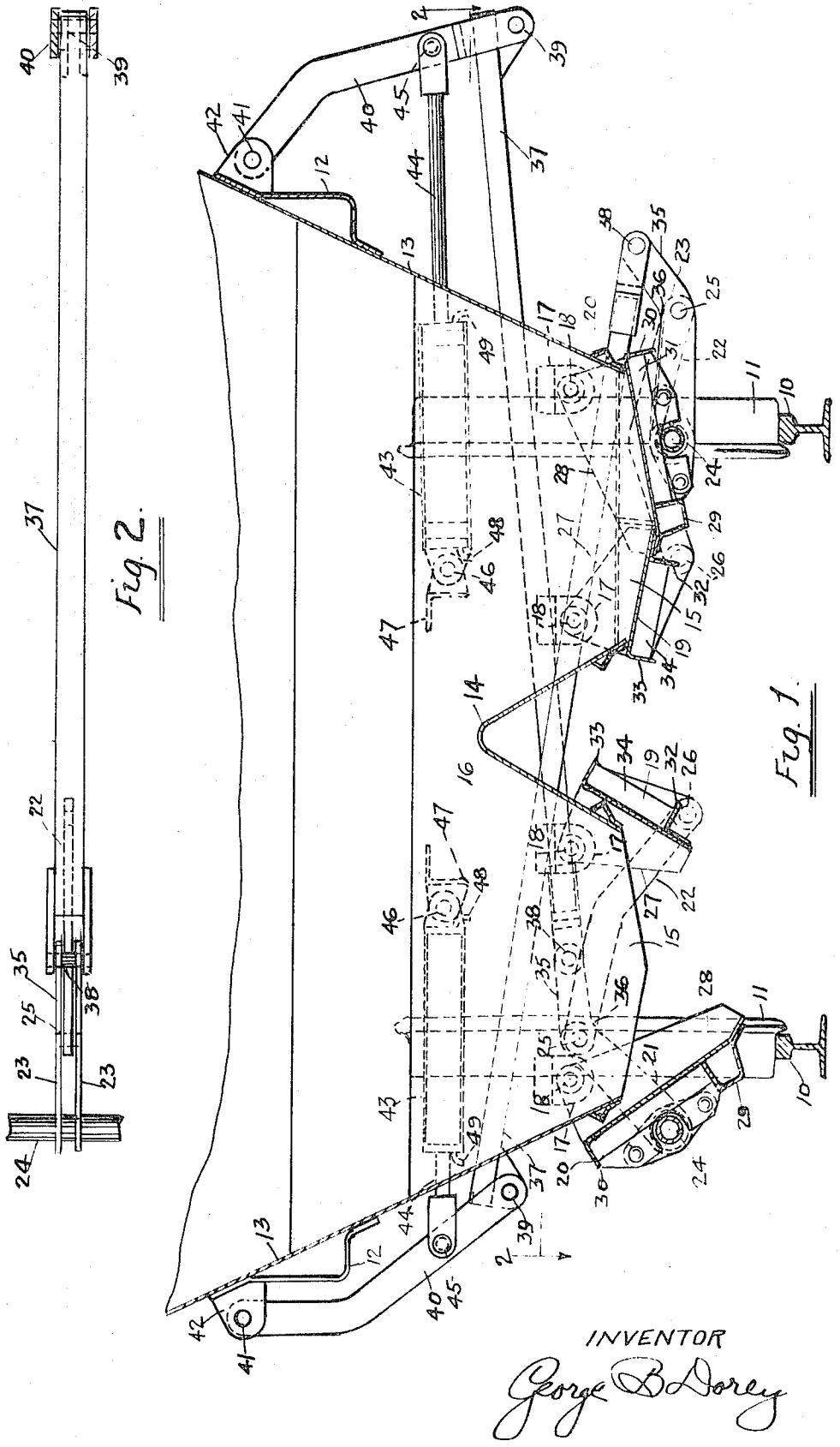


Fig. 2.

Fig. 1.

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MOTOR ACTUATED HOPPER CAR DOORS

CROSS REFERENCE TO RELATED APPLICATIONS

The toggle locking mechanism now employed is of the general type shown in my U.S. Pat. No. 3,339,500 of Sept. 15, 1967 wherein sequential and conjoining door movement is attained by rotary movement of an operating bar in prolongation of the radial arm means for applying a turning moment on said arm means beyond its pivotal connection with the linkage.

FIELD OF THE INVENTION

The improvement is of importance in the operation of discharge doors incorporated in so-called unit trains wherein opening and closing of doors is effected while the train is in motion. The stopping and starting of heavy trains to effect opening and closing of doors is an expensive and time-consuming operation which can be eliminated by slowing down the train to a speed of approximately 4 miles per hour corresponding to the speed of a walking man when it is practicable for a man to walk alongside the moving train and operate air valves or controls as required.

In carrying out automatic operation it is essential that large discharge openings with steep sloping floors be incorporated in the cars to ensure rapid and complete unloading with provision for forcing the doors open under sustained power throughout the major extent of door opening movement to cope with frozen or highly compacted lading.

SUMMARY OF THE INVENTION

The operating mechanism is shown as applied to longitudinally hinged doors arranged in two independently operable sets for discharge of lading between the rails and provides for the use of interlocking toggle mechanism for each set of doors including radial arm means and linkage. The radial arm means are extended beyond their pivotal connection with the linkage and axially movable connections act on said extensions to rotate the toggle members by linear movement. The connections are supported adjacent their distal ends by downwardly extending levers and two way acting fluid operated pressure means act on the levers for opening and closing the doors. The invention further resides in the provision of stop means between the axially movable connections and linkage for limiting the angular displacement of the arms and linkage with the doors in open position.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a vertical transverse sectional view taken through the car showing on one side of the longitudinal center line the doors in open position and showing on the right-hand side the doors in closed position.

FIG. **2** is a plan view of one of the connections and associated toggle mechanism shown in FIG. **1**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In said drawings **10–10** indicates the rails and **11** the wheels associated with the improved railway car. The body of the car includes side sill members **12–12** carrying side walls **13–13** which slope downwardly inwardly at a steep angle and intermediate said side walls a ridge structure **14** of inverted V-shape extends thereby forming spaced hoppers terminating in discharge openings **15**. Transversely extending walls **16** are disposed at the ends of the hoppers which carry hinge plates **17** for pivotally supporting as at **18** inner and outer doors indicated at **19** and **20** respectively. The respective inner and outer doors are interconnected by toggle and linkage mechanism including radially extending arm means **21** and linkage **22**.

The arm means **21** include spaced walls **23–23** which are nonrotatably mounted on shafts **24** which in turn are rotatably mounted on the doors and pivotally united with the linkages as

at **25**. The opposite end of the linkages **22** are pivotally connected with the doors **19** as at **26**. Said toggle mechanisms are adapted to fold in over center toggle locked relation for retaining the doors in closed position.

The doors are generally of scoop shape with end walls as shown at **27** for doors **19** and at **28** for doors **20** and are reinforced on their underside longitudinally and transversely, the door **20** being provided with a boxlike beam **29** adjacent its swinging end and reinforced at its opposite end by a downwardly extending flange **30**, and transverse beams **31** extend between the said longitudinal members. The door **19** is reinforced adjacent its swinging end by an angle shaped member **32** and at the opposite end by a downwardly extending flange **33** and transverse beams **34** extend between said longitudinal members.

The doors are movable to closed position with the swinging end of door **20** extending beneath the end of the door **19** and in consequence it is necessary that the doors be moved to close in a given sequence with the overlapping door lagging behind the overlapped door.

To insure the required sequential closing movement of the doors it is necessary that the shaft rotating means act thereon to exert turning movement beyond the pivotal connection **25** of the radial arms with the linkage and to this end certain of the arms are formed with extensions **35** which are preferably inclined to the main body of the arms in bell crank relation as indicated at **36**, it being understood that each door system if fitted with a plurality of radial arms and associated linkages.

Axially movable connections **37** are pivotally connected with the extensions **35** by means of pintles **38** and the said connections **37** extend transversely of the car and adjacent their distal ends are pivotally connected at **39** with levers **40**. The levers **40** are preferably pivotally mounted at **41** on brackets **42** carried by the side sill members **12**.

Movement of the levers is preferably carried out by double acting fluid operated pressure applying means preferably in the form of air pressure operated cylinders **43** acting on connecting rods **44** which in turn pivotally connect at **45** with the levers at a locations intermediate the distal pivots.

The cylinders **43** are preferably pivotally mounted at **46** on brackets **47** carried by the car structure and provided with air apertures at opposite ends as seen at **48** and **49** for connection with a conventional arrangement of air piping and controls (not shown).

Angular opening movement of the radial arms and linkages is limited by the pintles **38** which are arranged to make contact with the links when the doors are fully opened and thus position the extensions **35** for receiving direct axial pressure from the axially movable connections **37**.

The operation of the mechanisms is as follows: Assuming the doors in closed position as viewed in the right hand part of FIG. **1**, it will be seen that admission of air in aperture **48** of the cylinder **43** will force operating rod **44** outwardly to swing the lever **40** along with the axially movable connection **37** and by reason of the turning moment **50** on the shaft release the toggle lock and force the doors open. The extent of lever movement is preferably of sufficient extent to act on the doors throughout the entire range of door movement thus assuring complete opening of the doors even with frozen or heavily compacted lading.

Although the extent of door opening shown in the left hand half of FIG. **1** is the expected condition which prevails under the influence of discharging lading it is to be understood that the balanced mounting of the doors tends to return them towards closed position therefore upon reverse movement of the connections to close the doors it will be appreciated that the initial closing movement will be assisted by the gravitational swing of the doors towards closed position.

The force exerted on the bell crank extensions **35** operates to first close the inner doors **19** to abut the marginal edge of the end walls **15** whereupon the outer door **20** is toggled to closed position with the swinging end underlying the other door as seen in the right hand part of FIG. **1**.

I claim:

1. In a hopper car having an opening for discharge of lading and pivotally mounted oppositely swingable doors for the opening a movable to closed position in mating relation, in combination:

a. overcenter toggle locking mechanism for moving the doors and retaining said doors in closed position comprising:

1. a rotatable shaft carried by one of the doors,

2. radial arm means nonrotatably carried by the shaft,

3. linkage pivotally connected at one end to the radial arm means and at the opposite end pivotally connected to the companion door,

4. said linkage and arm means being foldable to an overcenter toggle locked position to assume a substantially horizontal position,

5. said radial arm means with the mechanism in over center toggle locked position presenting an upwardly and outwardly projecting extension forming with the radial arm means a bell crank lever,

6. power transmitting means acting on said bell crank lever extension of the arm means for imparting a movement of rotation to the arm means comprising:

a. a depending lever pivotally mounted on the car above the level of the bell crank lever and distally therefrom and

b. connecting means between the depending lever and the bell crank extension and

c. a double acting fluid actuated pressure transmitting means mounted on the car and acting on said depending lever for moving the said lever in directions to open or close the doors by rotation of the radial arm means.

2. The invention set forth in claim 1 wherein the pivotal connection between the bell crank and connecting means acts on the linkage to limit angular movement of the toggle members when the doors are in open position.