A swinging hopper discharge gate suspended by a pair of rotating link members and operatively connected with a crank and link actuating arrangement. The crank and link device includes an over center locking feature and is operatively connected to a slide bolt which locks the discharge gate in a closed position during final rotation of the operating crank. In opening the discharge gate, initial movement of the crank and link operating arms initially disengages the lock bolt and is followed by the swinging opening movement of the discharge gate.

3 Claims, 7 Drawing Figures
LINK SWINGING HOPPER DISCHARGE GATE ACTUATING MECHANISM

BACKGROUND OF THE INVENTION

1. Field of the Invention: This invention pertains to rail- way hopper cars and in particular to the discharge gate arrangement which comprises a swinging discharge gate having a linkage actuated locking bolt arrangement.

2. Description of the Prior Art: Prior art locking arrangements used on the swinging discharge gate have generally required an independent unlocking operating lock device prior to opening of the discharge gate. To decrease the time and effort involved in unlocking and opening a discharge gate it is desirable to provide a lock which is disengaged upon actuation of the gate operating mechanism.

SUMMARY

This invention pertains to a locking device used to maintain a swinging hopper discharge gate in the closed position. In operation the gate utilizes a sliding bolt which engages the gate support structure and is operatively connected to the gate operating mechanism through a lost motion connection which permits unlocking of the gate during initial movement of the door opening mechanism.

It is therefore an object of the present invention to provide a hopper discharge gate having an automatic unlocking lock bolt member which is easily and rapidly disengaged from the locked position during initial operation of the discharge gate actuating mechanism.

It is another object of the present invention to provide a swinging hopper discharge gate supported on a pair of link members and operatively connected with an over center crank and link operating mechanism which is operatively connected to the locking slide bolt by a link member which provides a lost motion connection between the crank and link operating mechanism and the slide gate bolt.

It is yet another object of the present invention to provide a hopper discharge gate having a locking bolt arrangement operatively connected to the door operating linkage mechanism through a lost motion connection and having the lost motion connection including a biasing spring which permits complete closing of the hopper discharge opening prior to the engagement of the locking bolt with the hopper gate support structure.

It is still another object of the present invention to provide an unlocking capstan unit adjacent the crank and link operating mechanism and including a cam member operatively adjacent said operating mechanism and including a locking hook portion engageable with the crank member to prevent undesirable, inadvertent gate actuation or operating of the gate opening mechanism.

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 the discharge portion of a hopper and including the hopper gate and locking unit of the present invention;

FIG. 2 is a view taken along line 2-2 of FIG. 1 with portions removed;

FIG. 3 is a view taken along line 3-3 of FIG. 1;

FIG. 4 is a sectional view taken along line 4-4 of FIG. 3;

FIG. 5 is a sectional view taken along line 5-5 of FIG. 3;

FIG. 6 is a sectional view taken generally along line 6-6 of FIG. 3, but showing the discharge gate in the fully open position; and

FIG. 7 is a cross sectional view, with portions removed, of the discharge gate operating linkage and lock bolt of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings and particularly to FIG. 1, a hopper 10 is illustrated having usual discharge portion 12 which includes the usual slope sheets 14 inclined to define the discharge portion 12. A gate 16 is positioned at the opening defined at the bottom terminal ends of the slope sheets 14 and is utilized in the usual manner to open and close the discharge portion of the hopper 10. The gate 16 includes the usual horizontally extending sheet portion 17 which is fastened and reinforced by the angle elements 18. The door or gate 16 is suspended from an associated slope sheet 14 at the pivot points 20, 21 which are the usual pin type pivotal connections fixedly supported on the angle mounting member 22 which is welded to the slope sheet 14.

Door support links 23 and 24 are pivotally attached to the associated pivot points 20, 21 respectively and have at their opposite ends second pivotal connections 25, 26 which connect the links to the gate 16, Gusset reinforcing plates 25a are positioned at the link-to-door pivot points to reinforce the connection. Thus it is noticed that the discharge gate 16 is a rigid heavy duty reinforced member which is pivotally and rotatably supported for opening and closing of the discharge portion 12 of the hopper 10.

The operating linkage which actuates the discharge gate 16 is referred to as a crank and link type of mechanism and includes a crank member 28 and an associated link 30. The crank 28 and the link 30 are pivotally connected at 31. Crank 28 is non-rotatably fastened to an associated operating shaft 31a having a slotted head portion 31b for rotation by suitable power means. An unlocking capstan 32, as best illustrated in FIGS. 1 and 3, is fixedly attached to the rotatable shaft 33 and positioned adjacent the crank member 28. The operating and unlocking capstan 32 and its associated shaft 33 have a locking and operating member 33a fixedly attached thereto and positioned adjacent the crank member 28. The unlocking and operating member 33a includes a cam or crank engaging portion 34 and a hook locking portion 35 which is associated with the locking pin 36 which is part of the crank member 28 (see FIG. 4).

A lost motion connecting link 37 is attached to the link 30 by a pin type connection designated by the numeral 39. Laterally spaced from the link 37 are a pair of lock actuating lost motion links 38 which are fixedly attached to shaft 38a as shown in FIG. 3. Extending from the links 37 is a locking drive link 40 which extends generally under the gate 16. As noticed in FIG. 7, a torsional biasing spring 42 is positioned about the shaft 38a and provides a rotational biasing force to the
link member 38. The locking link 40 is pivotally connected at 43 to the slide bolt 44. The slide bolt 44 is receivable in the locking flange portion 46 of the door supporting structure which forms the periphery of the hopper discharge portion 12 and is best illustrated in FIG. 3.

THE OPERATION

The operative features of the present invention will be described with reference to the initial opening and followed by a description of the closing movement of the gate 16. Referring to FIG. 1 which discloses the gate in the fully closed and locked position, it is noticed that the slide bolt 44 is extended into the locking flange opening 46 as shown in FIG. 7. Opening of the gate commences with engagement of the capstan 32 by a suitable operating wrench resulting in a rotation of the shaft 33 and engagement of the cam member 34 with the crank member 28 which is shown in FIG. 7. Initial rotation of the crank 28 is produced by the rotating force of the cam member 34 on crank 28. As the crank 28 rotates into an over-center position the self locking feature of the crank and link mechanism will be eliminated and the weight of the lading within the hopper will force the door 16 into the open position. During the initial rotation of the crank member 28 past the over-center position the link 30 will be moved upwardly and generally to the right as illustrated in FIGS. 1 and 3 and there will be an associated rotation of the connecting links 38. Because the locking link member 40 is pivotally connected to the associated rotating connecting link 38 there will be produced a slider crank effect causing a reciprocating lateral movement of the locking bolt 44 into and from the locking flange 46. Once the locking bolt clears the flange 46 the weight of lading within the hopper 10 will force the discharge gate 16 into an open position such as is illustrated in FIG. 6.

To close the discharge gate 16 from the open position which is illustrated in FIG. 6, a clockwise rotational force is applied to the capstan 31b which in turn rotates the associated shaft 31a which is fixedly attached to the crank member 28, producing a likewise clockwise rotation of the crank 28. Rotation of crank 28 results in a pushing or compressive force being transferred through the link member 30 which is applied to the connecting link 37 which is pivotally attached to the link 30 at pivot 39. Closing forces initially applied to the connecting links 38 do not produce a rotation of link 38 because of the resisting force applied by the torsional biasing spring 42. This spring is so designed as to prevent rotation of the connecting link 38 until the gate 16 is positioned in the fully closed position at which time the gate is no longer rotating and the closing forces will increase and overcome the resisting effect of the torsion spring 42 thereby permitting the connecting links 38 to rotate and providing a sliding transverse movement of the slide bolt 44 into the locking flange cutout 46. Thus it is noticed that by designing the spring 42 to prevent rotation of the associated link 30 and thereby prevent sliding movement of the slide bolt 44 until the gate 16 is flush with the discharge opening, the slide bolt is thereby maintained in an out-of-the-way position under the gate sheet 17 and will not interfere with complete closing of the gate 16. Once the gate 16 is in the fully closed position additional closing forces are applied which will overcome the resisting spring force and result in insertion of the slide bolt 44 into the locking flange 46 as the crank and link members move into the over-center self locked position. When this occurs the locking and operating member 33a may be rotated to engage the locking pin 36 on the crank 28 by the hook lock portion 35.

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 discharge arrangement for use on a railway hopper car having slope sheets for directing lading towards a hopper discharge opening having a locking flange portion and the improvement comprising:
   a gate member suspended by spaced pairs of support link members and said support link members pivotally connected to an associated slope sheet and to the gate;
   a door actuating mechanism comprising a crank member rotatably mounted on said hopper car and comprising a link member pivotally attached to said crank member;
   a door locking means mounted on said discharge gate and including a locking link and a horizontally movable slide bolt being moveable to and from locking engagement with said locking flange portion of the discharge opening;
   lost motion means being pivotally attached to said gate member and connecting the locking link and said link member of the door actuating mechanism to thereby provide for unlocking movement of the door locking member during initial opening rotation of the door actuating mechanism;
   said lost motion means comprising a lost motion link pivotally attached to said gate member and a biasing means operatively and restrainingly engaging the door locking means to thereby provide for unlocking movement of the slide bolt prior to gate opening and to provide for gate closing prior to locking sliding movement of the slide bolt.

2. The invention according to claim 1, and:
   a locking and operating member rotatably positioned adjacent said crank member of the door operating mechanism and having a locking hook portion to lock the crank member and also having a crank engaging cam portion for providing initial gate unlocking rotation to the crank member.

3. The invention according to claim 1, and:
   a transversely disposed crank operating shaft extending the width of said hopper car and being operatively connected with said rotatable crank member for providing opening and closing rotational movement to said discharge gate.