SHIP ELEVATOR WITH BAFFLE PLATE

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3,221,668 12/1965 Munck..............105/29
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FOREIGN PATENTS OR APPLICATIONS

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ABSTRACT

A ship elevator includes a channel, having an inclined bottom, interconnecting two bodies of water at different levels, a water wedge terminating baffle movable along the channel, and driving means moving the baffle. The water wedge engaging face of the baffle is inclined from the vertical so that the upper edge of this face is forwardly of the lower edge thereof, considered in the direction toward the water wedge. The baffle is supported from the driving means by a pair of arms which are articulated to the baffle about generally upright pivots and are articulated to the driving means about generally horizontal pivots, and a lift cable arrangement is provided for lifting the baffle from the channel to allow passage of ships therebeneath. The driving means includes driving members movable along rails on the bank of the channel and including a rack and pinion drive, with the rack teeth extending vertically.

4 Claims, 8 Drawing Figures
SHIP ELEVATOR WITH BAFFLE PLATE

BACKGROUND OF THE INVENTION

A known ship lock has an inclined floor extending from a lower level to an upper level, and the displaceable gate is movable along the lock and consists of a roll bearing uniformly on the floor of the lock over its entire width, this roll rolling along the floor. The roll is made of steel plate, with a smooth outer shell, and is reinforced in its interior. In front of each end surface of the roll, there is arranged a slider which is sealed relative to the roll by means of a leather cuff, and each slider is sealed on its end face and on its underside, relative to the wall and floor of the lock, by leather strips. The slider rests on supporting rollers on the floor of the lock, and is pushed by a carriage traveling along the bank of the lock.

The end journals of the roll extend into slots in the sliders, and carry chain wheels by means of which the roll is driven. The drive is effected from a carriage traveling on one bank of the lock on rails, and which is secured in a known manner against detachment. The drive is designed as a rack and pinion drive, with the teeth extending horizontally. In order to avoid canting of the roll during the rolling thereof, an identical carriage can be arranged on the opposite bank. For sealing the moving roll, there can be provided a smaller auxiliary roll which is arranged in front of the main roll and which also rolls along the floor of the lock. The lock channel is furthermore provided, at its bottom end where it communicates with an adjoining canal, with a depression into which the roll can move so that ships can move over the roll out of the lock and into the lock.

The design of the lock gate in the form of a roll presents some difficulties, particularly for higher water levels on the front side of the water wedge. Furthermore, this known arrangement requires a depression receiving the roll in the end position of the roll. The design of the drive of the roll in the proximity of the lower end position also presents difficulties. An arrangement of this type is disclosed, for example, in German Pat. No. 246,605.

In another known ship elevator, the ships are carried on an inclined surface, while supported in water by a wedge which is disposed by a sliding gear through the medium of a sliding lock gate mounted for vertical adjustment on the sliding gear. The connection between the sliding gear and the sliding member of the sliding lock gate includes a universal joint which is arranged at the free end of the sliding member. The universal joint insures a tight bearing of the sliding lock gate on the walls of the lock channel, even when the sliding gear is slightly displaced, for some reason, from its normal position. The sliding lock gate consists of a vertical plate which terminates the water wedge, and which has its rear surface connected to a supporting arm. The sliding lock gate bears on the bottom of the lock channel through the medium of wheels. In addition, it bears against the side walls of the lock channel through the medium of wheels mounted horizontally on the sliding lock gate. The wheels are arranged on the dry back side or face of the lock gate. On the front wet side of the lock gate, there are provided seals between the lock gate and the walls and bottom of the lock channel.

This sliding lock gate is lifted, in its lower end position, where the water level of the water wedge coincides with the water level of the lower communicating canal. Lifting is effected by means of a lifting device arranged in the sliding gear, in such a way that ships can move under the lifted sliding lock gate out of the lock or into it. A disadvantage in this arrangement is that practically the entire weight of the sliding lock gate must be borne by the wheels and transferred to the bottom of the lock channel. Furthermore, packing means must be provided in addition to the wheels. The packing means drag along the floor and side walls of the lock channel, and are subject to greater wear. An arrangement of this type is shown, for example, in German Pat. No. 1,223,316.

SUMMARY OF THE INVENTION

This invention relates to ship elevators and, more particularly, to a simplified ship elevator having a lighter weight of the moving parts, increased speed of movement of a sliding baffle, and reduced wear on the baffle.

The present invention is directed to a ship elevator including a baffle plate terminating a water wedge carrying the ship in a channel having an inclined bottom. In accordance with the invention, the end face of the plate directed toward the water wedge is so inclined that its upper front edge is in front of the lower front edge, considered in the direction of the water wedge. This design has the advantage that a part of the weight of the baffle plate is compensated by the water pressure, due to its inclined end face, so that the plate bears with less pressure on the bottom of the channel. Guiding of the baffle plate and sealing relative to the bottom of the channel is simplified. The bearing of the plate on the bottom of the channel, and its sealing, are achieved substantially by a single part.

In order further to reduce the wear and to simplify the sealing, the baffle plate can bear on the bottom of the channel through the medium of a supporting roll designed, at the same time, as a seal of the baffle plate relative to the bottom of the channel. The operating speed of the lock or elevator thus is increased.

In accordance with another feature of the invention, the baffle plate can be supported by two supporting arms, each of which engages the back side of the baffle plate in the proximity of a side wall of the channel. In accordance with another feature of the invention, the supporting arms can be mounted on the baffle plate, in the proximity of their engagement therewith, for rotation about upright or substantially upright axes.

In order to stabilize the four-bar linkage by which the baffle plate is secured on the sliding gear or driving means, the supporting arms can also be mounted, at their rear ends, on the driving means on horizontal or substantially horizontal pivot axes and in such a manner that the point of engagement with the sliding gear or driving means, viewed as a top plan view for the baffle plate and in an upstream direction, lies in front of the point of engagement of the lifting device on the baffle plate.

In order further to reduce the weight of the seals, sealing rolls can be provided for sealing the lateral edges of the baffle plate, and the axes of the sealing rolls are inclined relative to the channel bottom in the same
manner as the side walls of the channel and arranged in a cross sectional plane which is perpendicular to the channel bottom. The support of the sealing rolls on the side walls of the channel can be designed such that the sealing rolls can be displaced or swung toward the center of the baffle plate. This prevents abrasion of the sealing rolls at the side walls of the lock channel, when the baffle plate is lifted.

An object of the invention is to provide a simplified ship elevator.

Another object of the invention is to provide a ship elevator in which there is a lighter weight of the moving parts.

A further object of the invention is to increase the possible speed of movement of a baffle plate forming part of a ship elevator.

Another object of the invention is to provide such a ship elevator in which the wear is reduced.

A further object of the invention is to provide such a ship elevator in which a part of the weight of the baffle plate is compensated by the water pressure.

Another object of the invention is to provide such a ship elevator having an improved support and lifting arrangement for a baffle plate terminating a water wedge.

For an understanding of the principles of the invention, reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the Drawings:

FIG. 1 is a side elevation view, partly in section, of the lock gate of the lock channel;

FIG. 2 is a one-half transverse cross section looking in the direction of the arrow P1 of FIG. 1;

FIG. 3 is a side elevation view, to a larger scale, of a detail of FIG. 1;

FIG. 4 is a sectional view taken on the line A-A of FIG. 3;

FIG. 5 is an elevation view looking in the direction of the arrow P2 of FIG. 3;

FIG. 6 is an elevation view illustrating a detail of FIG. 5 to a larger scale;

FIG. 7 is a sectional view taken on the line B-B of FIG. 6; and

FIG. 8 is a transverse sectional view through the track and a rack-and-opinion drive for the sliding gear or driving means.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2 of the drawings, the lock comprises a lock channel 1 whose bottom 2 extends horizontally in the cross section of the channel. The side walls 3 of lock channel 1 are inclined toward the vertical, viewed in cross section. Between the side walls 3 and the bottom 2 there is what may be termed a bevelled part 4. The lock channel is made of concrete, and communicates at opposite ends with two connecting canals at different elevations, so that the lock channel has an inclination of several percent, as indicated by the chain line designated “Horizontal Plane”. The lock furthermore comprises a baffle plate 5 which terminates the water wedge, present in channel 1, at the bottom, and which is sealed, in a manner to be described hereinafter, relative to the channel bottom 2 and side walls 3 of lock 1.

Baffle plate 5 is reinforced, in a known manner, on its back side, and is articulated, in the proximity of channel side walls 3, on respective supporting arms 8 each articulated to baffle 5 by a respective pivot axis 7 extending substantially parallel to end face 6 of baffle plate 5. Each hinge connection thus has a substantially upright axis 7. The two supporting arms 8 are articulated, about horizontal axes 9, on a gantry-like sliding gear or driving means 10 which runs on both sides of lock channel 1 on tracks 11. A motor 12 serves to drive the sliding gear 10, which is mounted on tracks 11 through known link-mounted wheels 13.

For lifting baffle plate 5, there is a lifting rope or cable 14 which is trained over rollers 15 arranged on baffle plate 5. Rope or cable 14 is furthermore trained over rollers 16 which are mounted on a jib 17 which is pivotally mounted, at a lower end, on sliding gear 10 and which is held, at its upper end, by a bracing rope or cable 18. Lifting rope or cable 14 is connected to a drum hoist 19 on sliding gear or driving means 10.

The illustrated sliding gear 10 is moved to the upper end of lock 1, with the baffle plate 5 terminating, at its upper end position, the water of the adjoining upper canal at its water level. After opening the series-connected lock gate, ships are moved into the lock and the lock gate is closed. Sliding gear 10 now moves from the upper end position to the lower end position of the lock, a water wedge moving correspondingly from the top to the bottom of lock channel 1 in front of baffle plate 5. The ships float in this water wedge. When the water surface of the water edge has reached the level of the water surface of the lower connecting canal, baffle plate 5 is lifted, through the medium of cable 14, so that ships can now move out under baffle plate 5. The ships are held, during movement of the water wedge, by a fender, which has not been shown, and which is connected to the sliding gear 10 and which runs on tracks 11.

End face 6 of baffle plate 5 is inclined so that the upper front edge 20 of baffle plate 5, as viewed in the upstream direction, is in front of its lower front edge 21. The force with which the baffle plate 5 bears on the channel bottom 2 thus is reduced. On the other hand, the packing between baffle plate 5 and channel bottom 2 is less loaded.

A supporting roll 22 is provided for sealing baffle plate 5 relative to channel bottom 2, and can be formed of a steel shell with an elastic coating. This has the advantage that sealing of baffle plate 5 against the channel bottom, on the one hand, and the support of baffle plate 5 against the channel bottom 2, on the other hand, are performed by a single part.

For sealing the lateral edges of baffle plate 5 there are used sealing rollers 23 which are not arranged on the front lateral edge of baffle plate 5, but whose axes extend, in a cross sectional plane, perpendicular to channel bottom 2. Sealing rolls 23 are provided, at their opposite ends, with axle-journal bearings 24 which are engaged by axle journals 25. These axle journals are secured on swing levers 26 which, in turn, are secured on a swing column 27, mounted on baffle plate 5. In addition, the lower two-arm swing levers 26 carry, at their opposite ends, guide rollers 28.
This arrangement of the moving support of sealing rolls 23 serves to swing the lateral sealing rolls 23 out of their sealing position, shown, for example, in FIG. 4 in solid line, away from side walls 2 of lock channel 1. Sealing rolls 23 thus move into the position represented in FIG. 4 by a broken line, in which they are no longer in contact with side walls 3. This prevents sealing rolls 23 from sliding along side walls 3, and thus prevents unnecessary wear when baffle plate 5 is lifted. On the other hand, when the lateral sealing rolls 23 are lifted, the guide rollers 28 are swung from their ready position, in which they no longer bear on side walls 3, into the position shown in FIG. 4 in solid lines, and in which guide rollers 28 bear on side walls 3.

The axles 29 of guide rollers 28 extend in the direction toward the axles 9 of supporting arms 8 so that, when baffle plate 5 is lifted, guide rollers 28 can run off on side walls 3 without canting. In order to turn or angularly displace swing column 7, there is provided a drive which engages, on the one hand, swing column 27 and, on the other hand, baffle plate 5. In the represented embodiment, this drive is a hydraulic drive, although a pneumatic or other type drive may be used.

Between the respective end faces of each sealing roll 23 and the adjacent supporting roll 22, there is arranged, on baffle plate 5, a slider 31 which has a triangular profile in cross section and which forms the seal between baffle plate 5 and bevelled part 4. Supporting roll 22 is mounted in sliders 31 through the medium of axle journals 32. Sliders 31 are provided with sealing profiles 33 of elastic material, which extend over the entire width of the part 4 and which are held, on the back side, by bars 34 pressed outwardly by compression springs 35.

In order to drive sliding gear 10, there is provided a rack 36 which is arranged laterally at the foot 41 of each rail 11. The teeth of rack 36 extend vertically, and are engaged by a pinion 38. In order to assure pinion 38 providing proper driving forces, pressure rollers 39 are provided, and are mounted on vertical axes on sliding gear 10. These pressure rollers 39 bear on that side of each rail 11 opposite to the side having the rack 36.

In the arrangement of the lifting device shown in FIG. 1, lifting cable 14 engages baffle plate 5 at a point which, seen in a top view and in the upward direction, lies behind the point of engagement of lifting cable 14 on sliding gear 10. In other words, the rollers 16 on the jib 17 are in front of the rollers 15 on baffle plate 5, again seen in a top view and in an upward direction. Lifting rope 14 thus is stabilized for baffle plate 5, which is mounted in a supporting rectangle opposite sliding gear 10.

Clearing plates 40 can be arranged at the lower end of baffle plate 5 on one or both sides of roller 22, and these push any objects that have dropped on the channel bottom 2 in front of them, to prevent damage to the packing.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. In a ship elevator including a channel having an inclined bottom, a water wedge terminating baffle movable along the channel, and driving means moving the baffle, the improvement comprising, in combination, a baffle having a water wedge engaging face inclined from the vertical so that the upper edge of said face is forwardly of the lower edge thereof, considered in the direction toward the water wedge; two supporting arms connecting said baffle to said driving means, each supporting arm engaging the back side of said baffle in the proximity of a respective side wall of said channel; articulating means connecting said supporting arms to said baffle for pivoting about a substantially vertical axis; articulating means connecting the opposite ends of said supporting arms to said driving means for pivoting about substantially horizontal axes; and a baffle lifting device connected to said baffle and to said driving mechanism; the connection of said baffle lifting device to said driving means being forwardly of the connection of said baffle lifting device to said baffle, as viewed from the top and in an upstream direction.

2. In a ship elevator including a channel having an inclined bottom, a water wedge terminating baffle movable along the channel, and driving means moving the baffle, the improvement comprising, in combination, a baffle having a water wedge engaging face inclined from the vertical so that the upper edge of said face is forwardly of the lower edge thereof, considered in the direction toward the water wedge; sealing rolls at the lateral edges of said baffle for sealing said baffle relative to the side walls of said channel; the axes of said sealing rolls being inclined at the same angle as the side walls of said channel, and the axes of said sealing rolls extending perpendicularly to the channel bottom in a cross sectional plane; means mounting said sealing rolls for displacement toward the center of said baffle; said mounting means comprising axle journals at opposite ends of each sealing roll; a respective swing lever engaged with each axle journal; a respective swing column supporting the swing levers for each sealing roll; guide rollers on each swing column bearing on the channel side walls when said sealing rolls are lifted; a pair of supporting arms connected to the back side of said baffle in the proximity of respective side walls of said channel and connected to said driving means; first articulating means connecting said supporting arms to said baffle for rotation about substantially vertical axes; and second articulating means connecting said supporting arms to said driving means for rotation about substantially horizontal axes; the axes of rotation of said guide rolls intersecting said horizontal axes.

3. In a ship elevator including a channel having an inclined bottom, a water wedge terminating baffle movable along the channel, and driving means moving the baffle, the improvement comprising, in combination, a baffle having a water wedge engaging face inclined from the vertical, toward the water wedge so that the upper edge of said face is forwardly of the lower edge thereof, considered in the direction toward the water wedge; said driving means including a rack and pinion drive having racks extending along the bank of said channel and having teeth extending in a vertical direction.
4. In a ship elevator, the improvement claimed in claim 3, including rails extending along the bank of said channel and supporting said driving means; said racks each extending along a respective side of a rail; and pressure rollers engaging the opposite side of each rail at the rail head.