

PATENT SPECIFICATION

(11)

1 479 300

1 479 300

- (21) Application No. 35111/74 (22) Filed 8 Aug. 1974
 (23) Complete Specification filed 5 Nov. 1975
 (44) Complete Specification published 13 July 1977
 (51) INT. CL.² E02B 7/42
 (52) Index at acceptance
 E1H 22A1A
 (72) Inventors MICHAEL FENWICK REAY
 GEOFFREY PHILLIP MARTIN
 KEITH ROBERT EDMONDS



(54) IMPROVEMENTS IN OR RELATING TO DOCK GATES

- (71) We, TAYLOR WOODROW INTERNATIONAL LIMITED, a British company, of Western House, Western Avenue, London, W5 1EU, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:
- 10 This invention relates to dock gates.
- According to the present invention there is provided in combination, a dock gate or dock gate section pivotable about a substantially horizontal axis from a lowered open condition to a raised closed condition and *vice versa* and provided with prop means for supporting the gate or the gate section in a closed condition; a dock sill; location means locating the base of the gate or the gate section and the prop means with respect to the sill during closing and opening movement of the gate or the gate section; and thrust bearing surfaces provided on the sill for co-operation with the gate or gate section and the prop means, and on the gate or gate section for co-operation with the prop means, to support the gate or gate section and the prop means in said closed condition of the gate or gate section, the thrust bearing surfaces being disposed to be loaded only in said closed condition of the gate or gate section and said location means being adapted to be substantially free of load in this condition of the gate or gate section.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:—

Figure 1 is a sectional side view of a first form of dock gate in position at the entrance to a dock and shown closed.

Figures 2 and 3 are diagrammatic perspective views of alternative forms of dock

gate, each shown in position and partially closed.

Figures 4A to 4D diagrammatically illustrate operation of a dock gate.

Figure 5 is a sectional side view of a second form of dock gate in position at the entrance to a dock and shown closed in full lines, and open in chain lines, and

Figures 6A, 6B and 6C are views of the details encircled at A, B and C in Figure 5, drawn to a larger scale.

Referring first to Figure 1, the dock gate 1 is mounted on a sill 2 at the entrance to a dry dock, disposed behind the apron 3 of the dock. The dock gate 1 is either a plurality of similar gate sections (Figure 2), or is one single gate (Figure 3). This gate, or each gate section, has a framework composed of a plurality of parallel beams 4 running between the edges 1A and 1B that are respectively the top and bottom edges when the gate is closed, beams 5 defining a sub-structure adjacent the edge 1A, and joists 6 secured to the beams 4 and 5 at close intervals. Plates 7 secured to this framework and stiffened by the joists 6 form a front wall and also form a first buoyancy tank 9 where they encase the beams 5. At the edge 1B the plates 7 pass around this edge to terminate, at 10, at the rear of the gate. Decking 11 is provided over the plates 7 along the edge 1A.

A second buoyancy tank 12 is supported from the gate near the edge 1B, by arms 13 extending forwardly from the front face of the gate.

Along the edge 1B, the gate is located along the sill 2 by hinges 14 spaced along the gate. Near these hinges each beam 4 has one end of a coupling arm 15 pivotally attached to it, the other end of each arm 15 being pivotally connected to a prop 16 intermediate the ends of the prop. At one end each prop 16 is located with respect to the sill 2 by a hinge 17. The

other end of the prop is disposed to move relative to the gate into abutting relationship with a bearing block 18 fixed to the rear of the gate adjacent the base of the buoyancy tank 9.

The sill 2 has embedded therein a bearing pad 19 carrying a flexible rubber sealing strip 20 on which, in the closed condition, the rear plating 7 bears near its termination 10. Also embedded in the sill 2 are bearing blocks 21 on which the lower end of each prop 16 bears when the gate is closed.

Where there is a plurality of gate sections, gate closing is effected by moving the sections one after another to the closed condition (Figure 3). Closing movement of each gate section, or of the single gate of Figure 2, is effected as follows.

When the gate or gate section is open — see Figure 4A — the buoyancy tanks 9 and 12 are filled with water and the gate or gate section rests substantially horizontally, supported by the apron 3. The arms 15 and props 16 likewise lie substantially horizontally. The entrance to the dock is thus clear for a ship to enter or leave. Utilising pumping equipment (not shown), to expel water from the first tank 9 of the gate, or of a first gate section, the gate or this gate section can be caused to pivot about the hinges 14 — Figure 4B. As the tank 9 is further emptied and the gate or gate section approaches a vertical position, water is also expelled from the tank 12 of the gate or of this gate section. When the gate or gate section passes through the vertical position — Figure 4C — the tank 9 is empty whilst the tank 12 is still approximately half full. Thereafter, the tank 12 is further emptied of water, whilst some water is re-supplied to the tank 9.

During the pivoting movement just described the props 16 are constrained, by their connections *via* the arms 15 also to pivot, in this case about their respective hinges 17. As the gate closed condition is reached the props 16 are thus constrained automatically to come into abutting relationship with the bearing blocks 18 and 21 — Figure 4D.

In the closed condition the or each tank 12 is empty of water but the or each tank 9 is partially filled to provide, along with the water force acting on the front face of the gate a downward component of force acting on the bearing pad 19 and bearing blocks 21, and ensuring that the abutting relationship between the props 16 and their bearing blocks 18 is maintained. An appropriate angle of inclination for the dock gate in its closed condition is from 10° to 35° from the vertical. It is to be noted that in the closed condition the bearing

blocks 18 and 21 and the bearing pad 19 are loaded and act independently of the location hinges 14 and 17 to support the gate and its props, this being the only condition in which the thrust bearings comprising the blocks 18 and 21 and pad 19 are loaded. As these thrust bearings serve to support the gate in the closed condition, the pivot bearings serve to support the gate in the closed condition, the pivot bearings of the location means constituted by the hinges 14 and 17 are relieved of load in this condition. These pivot bearings are also substantially unloaded in the gate open condition.

In its closed condition the gate consists of beams disposed in vertical planes (the beams 4) that are supported at their lower ends from the sill, and by raking props 16 each at a point intermediate its ends. These beams are, of course, of sufficient strength to resist the water pressure applied to the gate. The plating 7 provided serves not only as a water-tight face and to form a buoyancy tank 9, but also imparts horizontal stiffness and terminal resistance. The raking back of the closed gate from the vertical reduces uplift forces on the sill 2.

It is to be noted that in the construction described there is no direct attachment of the free end of each prop with the gate or a gate section. Alternatively, a form of prop can be utilized which is of telescopic construction and which is hinged at one end and in a manner similar to that already described to the gate sill, and at the other end to the gate or a gate section. Such a prop can take the form of two members, one hinged to the gate sill and the other to the gate or a gate section and connected to each other *via* rollers permitting relative sliding movement of the two prop members, or two members so hinged to the gate sill and the gate or gate section with one such prop member telescopically received within the other. In all cases thrust bearings acting independently of the hinges and loaded in the gate closed condition are provided to relieve the hinges of load.

In place of the buoyancy tanks described, other equipment could be provided for raising the dock gate. For example, wire haulage against a slight preponderance created by a permanent buoyancy tank could be utilized.

Whilst the arrangements described above in which the props 16 are coupled to the gate or the gate sections so as to be constrained to move as the gate or gate sections move(s) are particularly advantageous, the props can be provided with independent actuating mechanism.

Referring next to Figures 5 and 6A, 6B

14

and 6C, the dock gate is composed of a plurality of gate sections 1. Each of these gate sections 1 carries at each end of its base a pin 22 that is engaged in a hooked seat member 23 mounted on the sill 2. The engagement of the pins 22 in the hooked seat members 3 serves to locate the bases of the gate sections 1 along the sill for the section to move about a substantially horizontal axis during closing and opening of the gate section, the pins 22 and hooked seat member 23 replacing the hinges 14 of the assembly first described.

In the assembly of Figures 5 and 6A, 6B and 6C, the major part of each gate section 1 is of substantially rectangular cross-section in side view (Figure 5), and this part is vertical in the closed condition (full lines in Figure 5). The foot of the gate section is stepped to the rear and it is the foot of this rearward step 24 that carries the pins 22, which are behind the plane of the rear face of the major part of the gate section. The upper face of the step 24 is inclined downwardly, rearwardly and carries a bearing pad 25 for co-operation with a bearing block 26 carried by a beam 27 embedded in the sill 2, the pins 22 lifting in their hooked seat members 23 with clearance such that as the gate section reaches its closed condition in operation the pins can move within the hooked seat members transversely of the axis of rotation of the gate member to permit the pads 25 to come to bear on the blocks 26 and relieve the pivot bearings 22/23 of load. In Figure 6C a condition is shown in which the pads 25 have still to come to bear on the blocks 26.

The props 16 in this form are located with respect to the sill 2 by arms 28 pivotably coupled at 29 to the props 16 near the lower (gate closed condition) ends of the props and at hinges 30 to the sill. At their upper (gate closed condition) ends the props 16 carry rollers 31 that run in tracks 32 extending down the rear faces of the gate section. As in the form first described the ends of the props 16 are disposed for moving into abutting relationship with bearing blocks 18 and 21 carried by the gate member sections and the sill respectively. To this end the props 16 carry bearing pads 33 at their ends which abut on bearing surfaces 18A and 21A of the blocks 18 and 21.

In the gate as illustrated in Figures 5 and 6A, 6B and 6C, a gate section is raised by utilizing wire haulage operating against a slight preponderance created by permanent buoyancy tanks, the relative motion of the gate sections 1 and the props 16 being substantially as already described with reference to Figures 1 to 3 and 4A to 4D. During closing and opening

movement of the gate the gate sections 1 and the prop 16 are located with respect to the sill 2 by the pivot bearings 22/23 and 29 and 30. When the gate sections reach their closed condition load is relieved from the pivot bearings 22/23 and 29 and 30 and transferred to the thrust bearing surfaces 25/26, 33/18A and 33-21A.

Thus in the forms of dock gate described the pivot bearings provided are only loaded to any substantial extent during opening or closing movement of the gate these bearings being substantially unloaded in both the gate open and gate closed conditions, that is, for the major part of time that the assembly is in an operational environment.

WHAT WE CLAIM IS:—

1. In combination, a dock gate or dock gate section pivotable about a substantially horizontal axis from a lowered open condition to a raised closed condition and *vice versa* and provided with prop means for supporting the gate or the gate section in a closed condition; a dock sill; location means locating the base of the gate or the gate section and the prop means with respect to the sill during closing and opening movement of the gate or the gate section; and thrust bearing surfaces provided on the sill for co-operation with the gate or gate section and the prop means, and on the gate or gate section for co-operation with the prop means, to support the gate or gate section and the prop means in said closed condition of the gate or gate section, the thrust bearing surfaces being disposed to be loaded only in said closed condition of the gate or gate section and said location means being adapted to be substantially free of load in this condition of the gate or gate section.

2. A combination as claimed in claim 1, wherein for locating the base of the gate or the gate section with respect to the sill said location means comprise pins located in seat members with clearance such that as the gate or gate section reaches its gate closed condition in operation the pins move within the seat members transversely of the axis of rotation of the gate or gate section to permit the gate or gate section to bear on the thrust bearing surfaces provided for the gate or gate section on the sill, thereby relieving of load the pivot bearings constituted by these pins and their seat members.

3. A combination as claimed in claim 2, wherein said pivot axis is to the rear of the rear face of the gate or gate section, and wherein a thrust face of the gate or gate section and the bearing surface that it co-operates with on the sill are disposed above said pivot axis to the rear of the gate or gate section, this face and this sur-

14

and 6C, the dock gate is composed of a plurality of gate sections 1. Each of these gate sections 1 carries at each end of its base a pin 22 that is engaged in a hooked seat member 23 mounted on the sill 2. The engagement of the pins 22 in the hooked seat members 3 serves to locate the bases of the gate sections 1 along the sill for the section to move about a substantially horizontal axis during closing and opening of the gate section, the pins 22 and hooked seat member 23 replacing the hinges 14 of the assembly first described.

In the assembly of Figures 5 and 6A, 6B and 6C, the major part of each gate section 1 is of substantially rectangular cross-section in side view (Figure 5), and this part is vertical in the closed condition (full lines in Figure 5). The foot of the gate section is stepped to the rear and it is the foot of this rearward step 24 that carries the pins 22, which are behind the plane of the rear face of the major part of the gate section. The upper face of the step 24 is inclined downwardly, rearwardly and carries a bearing pad 25 for co-operation with a bearing block 26 carried by a beam 27 embedded in the sill 2, the pins 22 lifting in their hooked seat members 23 with clearance such that as the gate section reaches its closed condition in operation the pins can move within the hooked seat members transversely of the axis of rotation of the gate member to permit the pads 25 to come to bear on the blocks 26 and relieve the pivot bearings 22/23 of load. In Figure 6C a condition is shown in which the pads 25 have still to come to bear on the blocks 26.

The props 16 in this form are located with respect to the sill 2 by arms 28 pivotably coupled at 29 to the props 16 near the lower (gate closed condition) ends of the props and at hinges 30 to the sill. At their upper (gate closed condition) ends the props 16 carry rollers 31 that run in tracks 32 extending down the rear faces of the gate section. As in the form first described the ends of the props 16 are disposed for moving into abutting relationship with bearing blocks 18 and 21 carried by the gate member sections and the sill respectively. To this end the props 16 carry bearing pads 33 at their ends which abut on bearing surfaces 18A and 21A of the blocks 18 and 21.

In the gate as illustrated in Figures 5 and 6A, 6B and 6C, a gate section is raised by utilizing wire haulage operating against a slight preponderance created by permanent buoyancy tanks, the relative motion of the gate sections 1 and the props 16 being substantially as already described with reference to Figures 1 to 3 and 4A to 4D. During closing and opening

movement of the gate the gate sections 1 and the prop 16 are located with respect to the sill 2 by the pivot bearings 22/23 and 29 and 30. When the gate sections reach their closed condition load is relieved from the pivot bearings 22/23 and 29 and 30 and transferred to the thrust bearing surfaces 25/26, 33/18A and 33-21A.

Thus in the forms of dock gate described the pivot bearings provided are only loaded to any substantial extent during opening or closing movement of the gate these bearings being substantially unloaded in both the gate open and gate closed conditions, that is, for the major part of time that the assembly is in an operational environment.

WHAT WE CLAIM IS:—

1. In combination, a dock gate or dock gate section pivotable about a substantially horizontal axis from a lowered open condition to a raised closed condition and *vice versa* and provided with prop means for supporting the gate or the gate section in a closed condition; a dock sill; location means locating the base of the gate or the gate section and the prop means with respect to the sill during closing and opening movement of the gate or the gate section; and thrust bearing surfaces provided on the sill for co-operation with the gate or gate section and the prop means, and on the gate or gate section for co-operation with the prop means, to support the gate or gate section and the prop means in said closed condition of the gate or gate section, the thrust bearing surfaces being disposed to be loaded only in said closed condition of the gate or gate section and said location means being adapted to be substantially free of load in this condition of the gate or gate section.

2. A combination as claimed in claim 1, wherein for locating the base of the gate or the gate section with respect to the sill said location means comprise pins located in seat members with clearance such that as the gate or gate section reaches its gate closed condition in operation the pins move within the seat members transversely of the axis of rotation of the gate or gate section to permit the gate or gate section to bear on the thrust bearing surfaces provided for the gate or gate section on the sill, thereby relieving of load the pivot bearings constituted by these pins and their seat members.

3. A combination as claimed in claim 2, wherein said pivot axis is to the rear of the rear face of the gate or gate section, and wherein a thrust face of the gate or gate section and the bearing surface that it co-operates with on the sill are disposed above said pivot axis to the rear of the gate or gate section, this face and this sur-



* C L N S *

face being inclined downwardly rearwardly.

4. A combination as claimed in claim 1, 2 or 3, wherein for locating the prop means with respect to the sill said location means comprise pivot bearings disposed intermediate the ends of props of the prop means, the ends of these props being constrained by movement of the gate or associated gate section into its closed condition to come to bear on said thrust bearing surfaces provided therefor on the sill and on the gate or gate section, thereby to relieve the last-mentioned locations means pivot bearings of load.
5. In combination, a dock gate or dock

gate section, a dock sill, location means and thrust bearing surfaces, substantially as hereinbefore described with reference to Figures 1 to 3 and for 4A to 4D; or Figures 5 and 6A, 6B and 6C, of the accompanying drawings.

HASELTINE LAKE & CO.

Chartered Patent Agents

28, Southampton Buildings

Chancery Lane

London WC2A 1AT

— and —

Temple Gate House, Temple Gate

Bristol BS1 6PT

9 Park Square, Leeds LS1 2LH

Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1977.
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

