

COUPLING DEVICE FOR A MARINE LOADING ARM

The invention relates to a coupling device for coupling a loading arm, for instance a marine loading arm, to an inlet/outlet conduit of a liquid container, comprising a cylindrical tube with a first inner diameter which is provided at a first end with a first flange which can be coupled to the loading arm and is provided at a second end with a second flange and with rapid-action coupling means for coupling the inlet/outlet conduit to the tube.

Such a coupling device is applied particularly in the loading or unloading of a tanker moored along a quayside respectively from or into an onshore liquid reservoir. The coupling device forms a connection which can be arranged rapidly between a pivotable loading arm disposed on the quay and connected to the liquid reservoir and the inlet/outlet conduit of the tanker.

Such a coupling device is known from the international patent application with publication number WO 2004/033826 A2. The rapid-action coupling means in the known coupling device are formed by four compression springs which are each coupled at an end to a respective pivotable claw which engages the end flange of an inlet/outlet conduit, and which are coupled at their other end to a rotatable disc which is driven by means of a hydraulic cylinder. The position of the one end of the springs is changed by rotating the disc. The springs are compressed by rotation of the disc in a first direction, wherein the claws hook round the end flange and the end flange is pressed onto the second flange of the coupling device, after which the end flange of the inlet/outlet conduit must be locked onto the second flange using a mechanical lock which must be placed over parts of the disc so as to thus lock the disc against rotation. The springs are extended by rotating the disc in an opposite direction, wherein the claws are released from the end flange and the end flange is no longer pressed onto the second flange of the coupling device.

The known coupling device has the drawback that it has a relatively complicated construction and is therefore relatively expensive while, as a result of an operative not paying attention, there is a risk of the end flange of the inlet/outlet conduit being pressed onto the second flange of the coupling device but not being locked thereon. This latter entails undesirable safety risks, since the liquids for loading or unloading are usually toxic or flammable. Wastage of liquids as a result of leaking conduits must moreover also be prevented for economic reasons.

A further drawback of the known coupling device is that it can only be applied to couple a loading arm and an inlet/outlet conduit which have the same diameter. Common types of loading arm have for instance a diameter of 12 or 16 inches (30.48 or 40.6 cm respectively), and with the known coupling device it is not possible to couple a loading arm with a diameter of 16 inches to an inlet/outlet conduit with a diameter of 12 inches.

It is an object of the invention to provide a coupling device using which it is possible in rapid and simple manner to couple a loading arm to the inlet/outlet conduit of a liquid container.

It is a further object to provide a coupling device which has a relatively simple construction and which provides an inherently safe coupling of a loading arm and an inlet/outlet conduit, wherein it is not necessary to arrange a mechanical locking through the intervention of an operative.

These objects are achieved, and other advantages gained, with a coupling device of the type stated in the preamble, wherein the rapid-action coupling means are adapted according to the invention to couple an inlet/outlet conduit having a second inner diameter smaller than the first inner diameter.

In an embodiment of a coupling device according to the invention the rapid-action coupling means comprise at least three clamping members which are placed along the periphery of the second flange and which are adapted to releasably

clamp onto the second flange a third flange which forms the end flange of an inlet/outlet conduit with the second inner diameter, wherein an adapter is received between the second flange and the third flange.

5 A coupling device which has clamping members which are adapted to accommodate an adapter between the second and third flange provides the option of coupling a loading arm with a determined first inner diameter to an inlet/outlet conduit with a second, smaller diameter. This is particularly
10 advantageous at locations where it is important to be able to load or unload successive tankers with inlet/outlet conduits with different inner diameters using the same loading arm.

 The clamping members each comprise for instance a clamping element displaceable in axial and radial direction
15 of the tube, and are for instance adapted to displace the respective clamping elements synchronously.

 A displacement of the clamping elements, successively in radial direction toward the central axis of the second flange and in axial direction toward the plane of the second flange,
20 results in the third flange being pressed onto the second flange, while a displacement successively in axial direction from the plane of the second flange and in radial direction from the central axis of the second flange results in the third flange being released from the second flange, and
25 sufficient space being created between the clamping elements and the third flange to enable removal of the coupling device from the inlet/outlet conduit with this third flange.

 In an embodiment of such clamping members the clamping elements are each received displaceably in guides which are
30 coupled to the second flange and which extend in axial and radial direction of the tube.

 For this purpose the clamping members for instance each comprise a screw spindle for displacing the respective clamping element, and are for instance each provided with a
35 hydromotor for driving the respective screw spindle.

 In an extremely advantageous embodiment of a coupling device with clamping members which each comprise a clamping

element displaceable in axial and radial direction of the tube, each of the clamping elements is assembled from a permanent part and an exchangeable part which can be coupled thereto, wherein the exchangeable part is provided with at least one contact surface co-acting with the third flange at the end of the inlet/outlet conduit.

The exchangeable part is chosen in each case such that the at least one contact surface corresponds with the end flange of the inlet/outlet conduit for coupling.

In order to facilitate the coupling of a loading arm, a coupling device according to the invention comprises at least three fixing and guide members placed along the periphery of the second flange for the purpose of fixing an adapter placed on the second flange and guiding the third flange at the end of the inlet/outlet conduit to a position suitable for coupling.

The invention will be elucidated hereinbelow on the basis of an exemplary embodiment, with reference to the drawings.

In the drawings

Fig. 1 shows a perspective view of an embodiment of a coupling device according to the invention,

Fig. 2 is a perspective view of an adapter for a coupling device as shown in fig. 1,

Fig. 3 is an exploded view of a clamping element assembled from two parts for a coupling device as shown in fig. 1, and

Fig. 4 is a perspective view of a guide member for a coupling device as shown in fig. 1.

Corresponding components are designated in the figures with the same reference numerals.

Fig. 1 shows a coupling device 10 assembled from a tube 5 with a first end flange 1 for coupling of a marine loading arm (not shown), and a second end flange 2 for coupling of end flange 3 of an inlet/outlet conduit 4 (partly shown) of a liquid tank on a tanker (not shown). Arranged along the periphery of second flange 2 are five clamping members (6, 7,

8), which are each assembled from a housing with cheeks 7, a hydromotor 6 which drives a screw spindle (not shown) and a clamping element 8 coupled to the screw spindle. In the shown example the inner diameter of tube 5 is greater than the inner diameter of inlet/outlet conduit 4, and an adapter 9 (shown in fig. 2) with flange 17 is received between second flange 2 and end flange 3 of inlet/outlet conduit 4. The assembly of hydromotor 6, screw spindle and clamping element 8 is arranged between cheeks 7 for pivoting about a shaft 11 extending transversely relative to tube 5. Guide slots 13 for guiding cams 12, which extend laterally from clamping elements 8, in axial and radial direction of tube 5 are arranged in cheeks 7. In the shown situation end flange 3 of inlet/outlet conduit 4 is held liquid-tightly on flange 17 of the adapter by clamping elements 8, this flange in turn being held liquid-tightly on second flange 2 of tube 5, wherein the screw spindles are retracted as far as possible. Slots 13 in cheeks 7 are formed such that clamping elements 8 are displaced from the shown situation successively in axial direction from the plane of second flange 2 and in radial direction from the central axis of second flange 2 by unscrewing the screw spindles (toward clamping elements 8), which results in end flange 3 of inlet/outlet conduit 4 being released from second flange 2 and sufficient space being created between clamping elements 8 and end flange 3 in order to enable removal of coupling device 10 from inlet/outlet conduit 4 with this end flange 3. The respective hydromotors 6 are connected in parallel with their liquid conduits 14, 15 (partly shown) and are provided with pressure-compensated flow control valves 26, as a result of which the respective screw spindles and clamping elements 8 coupled thereto are driven synchronously. The figure further shows five fixing and guide members 16 placed along the periphery of second flange 2 for the purpose of fixing an adapter placed on second flange 2 in the absence of a coupled inlet/outlet conduit 4 and for guiding an end flange 3 of an inlet/outlet conduit 4 to the position suitable for coupling prior to

coupling of this end flange 3. Guide members 16 are hooked with hooks 32 into eyes 27 on the side of second flange 2.

Fig. 2 shows an adapter 9 with a flange 17 and a raised edge 18 which widens conically on its inner side and which must be directed toward tube 5. The smallest inner diameter of edge 18 corresponds to the inner diameter of an inlet/outlet conduit 4 for coupling, the largest inner diameter corresponds with the inner diameter of tube 5, whereby adapter 9 thus provides a continuous transition between inlet/outlet conduit 4 and tube 5 of coupling device 10.

Fig. 3 shows a steel clamping element assembled from parts 8a and 8b, wherein an opening 19 for receiving the screw spindle is present in fixed part 8a and the exchangeable part 8b comprises a contact surface 20 to be placed against third flange 3. In assembled position the exchangeable part 8b is received with a rigid shaft 21 and a tongue (not shown) in respectively a corresponding groove 22 and a channel 23 in fixed part 8a, and parts 8a, 8b are locked by a pin extending through a first transverse bore 24 in fixed part 8a and the tongue of exchangeable part 8b. The figure further shows a second transverse bore 25 in fixed part 8a for receiving side cams 12 with which the assembled clamping element 8a, b is guided through slots 13 in cheeks 7.

Fig. 4 shows a guide member 16 with a guide plate 29 which is fixed to a base plate 30 with which the guide member is placed on second flange 2. Base plate 30 is provided on its underside with pins 31 which fit precisely into free bores in second flange 2. In order to lock guide member 16 on second flange 2 member 16 is provided with a tensioning clamp 28, a hook 32 of which (shown in fig. 1) engages just behind an eye 27 on second flange 2.

CLAIMS

1. Coupling device (10) for coupling a loading arm, for instance a marine loading arm, to an inlet/outlet conduit (4) of a liquid container, comprising a cylindrical tube (5) with a first inner diameter which is provided at a first end with a first flange (1) which can be coupled to the loading arm and is provided at a second end with a second flange (2) and with rapid-action coupling means (6, 7, 8) for coupling the inlet/outlet conduit (4) to the tube (5), characterized in that the rapid-action coupling means (6, 7, 8) are adapted to couple an inlet/outlet conduit (4) having a second inner diameter smaller than the first inner diameter.

2. Coupling device (10) as claimed in claim 1, characterized in that the rapid-action coupling means comprise at least three clamping members (6, 7, 8) placed along the periphery of the second flange (2) for releasably clamping onto the second flange (2) a third flange (3) which forms the end flange of an inlet/outlet conduit (4) with the second inner diameter, wherein an adapter (9) is received between the second flange (2) and the third flange (3).

3. Coupling device (10) as claimed in claim 2, characterized in that the clamping members (6, 7, 8) each comprise a clamping element (8) displaceable in axial and radial direction of the tube (5).

4. Coupling device (10) as claimed in claim 3, characterized in that the clamping members (6, 7, 8) are adapted to displace the respective clamping elements (8) synchronously.

5. Coupling device (10) as claimed in any of the claims 3-4, characterized in that the clamping elements (8) are received displaceably in respective guides (13) which are coupled to the second flange (2) and which extend in axial and radial direction of the tube (5).

6. Coupling device (10) as claimed in any of the claims 3-5, characterized in that the clamping members (6, 7, 8)

each comprise a screw spindle for displacing the respective clamping element (8).

7. Coupling device (10) as claimed in any of the claims 3-6, characterized in that the clamping members (6, 7, 8) are
5 each provided with a hydromotor (6) for displacing the respective clamping element (8).

8. Coupling device (10) as claimed in any of the claims 3-7, characterized in that each of the clamping elements (8)
10 is assembled from a permanent part (8a) and an exchangeable part (8b) which can be coupled thereto, wherein the exchangeable part (8b) is provided with at least one contact surface (20) co-acting with the end flange (3) of the inlet/outlet conduit (4).

9. Coupling device (10) as claimed in any of the claims 15 3-8, characterized in that it comprises at least three fixing and guide members (16) placed along the periphery of the second flange (2) for the purpose of fixing an adapter (9) placed on the second flange (2) and guiding the end flange (3) of the inlet/outlet conduit (4) to a position suitable
20 for coupling.