

## 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  
5 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  
10 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  
15 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  
20 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  
25 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  
30 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  
35 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.

US 3 661 408 A shows a power-actuated pipe coupler for quickly, securely, and releasably coupling together two flanged conduits, such as a marine loading arm and an oil tanker's manifold, in fluid-tight coaxial relationship. The coupler includes a plurality of clamp assemblies mounted on and spaced circumferentially around the end flange of the arm, and power supplied by a hydraulic, pneumatic or electric motor is transmitted through a belt, chain or gear drive unit, a screw shaft, and a toggle link assembly to open and close hook-shaped clamp arms about the manifold flange.

This known coupling device is to be applied to couple a loading arm and an inlet/outlet conduit which have the same diameter.

US 4 202 567 A relates to a pipe coupling comprising a tubular member to be coupled to a flange, an de ring slidable on the tubular member carrying pivotable hooks which cooperate with cams on the tubular member to engage behind the flange as the ring is moved to the tubular member. A second ring is provided for locking the first ring in position after

coupling of the pipes has taken place.

This known coupling device is to be applied to couple a loading arm and an inlet/outlet conduit which have the same diameter.

5 GB 1 395 928 A discloses a pipe coupling apparatus for attachment to a pipe which is to be coupled in liquid-tight fashion to another pipe end.

In the device disclosed, an adapter ring for coupling pipes having a different diameter, comprises an annulus  
10 furnished on one side with lugs for engagement in the tubular body of the coupling and in its other side with lugs for location around the perimeter of a ship's flange. The adaptor ring is provided with two radially extending L-shaped ears formed with recesses for receiving bolts pivotally mounted on  
15 the terminal flange of a coupling.

The adaptor ring in this known device has to be mounted with bolts, and is not adjusted to be clamped in one single movement together with the flanges to be coupled.

US 2007/057507 A1 discloses a coupler which is adapted  
20 to be connected to a complementary device for the transfer of a fluid between the coupler to the complementary device, comprising a body through which the fluid is allowed to flow, at least one seal for providing a fluid-tight seal between the coupler and the complementary device, and a protecting  
25 device for the seal.

This known coupling device is to be applied to couple a loading arm and an inlet/outlet conduit which have the same diameter.

It is an object of the invention to provide a coupling  
30 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  
35 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.

It is another object to provide a coupling device which can be applied to couple a loading arm and an inlet/outlet conduit which having a different diameter.

5        These objects are achieved, and other advantages gained, with a coupling device according to claim 1.

      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  
10       with a determined first inner diameter to an inlet/outlet conduit with a second, smaller diameter. This is particularly advantageous at locations where it is important to be able to load or unload successive tankers with inlet/outlet conduit with different inner diameters using the same loading arm.

15       The clamping members 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.

      The clamping elements are each received displaceably in guides which are coupled to the second flange and which  
30       extend in axial and radial direction of the tube.

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

35       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), wherein 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, wherein 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), wherein the clamping members (6, 7, 8) each are assembled from a hydromotor (6) which drives a screw spindle and a clamping element (8) coupled to the screw spindle, characterized in that the clamping members further include a housing with cheeks (7), wherein the assembly of hydromotor (6), screw spindle and clamping element (8) is arranged between the cheeks (7) for pivoting about a shaft (11) extending transversely relative to the tube (5), and guide slots (13) for guiding cams (12), which extend laterally from clamping elements (8), in axial and radial direction of the tube (5) are arranged in the cheeks (7).

2. Coupling device (10) as claimed in claim 1, characterized in that the clamping element (8) is assembled from parts (8a, 8b), wherein an opening (19) for receiving the screw spindle is present in a fixed part (8a) and an exchangeable part (8b) comprises a contact surface (20) to be

placed against the third flange (3), wherein in assembled position the exchangeable part (8b) is received with a rigid shaft (21) and a tongue in respectively a corresponding groove (22) and a channel (23) in the fixed part (8a), and  
5 the 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).

3. Coupling device (10) as claimed in either of the claims 1-2, characterized in that the guide member (16)  
10 comprises a guide plate (29) which is fixed to a base plate (30) with which the guide member (16) is placed on the second flange (2).

4. Coupling device (10) as claimed in claim 3, characterized in that the plate (30) is provided on its  
15 underside with pins (31) for fitting into free bores in the second flange (2).

5. Coupling device (10) as claimed in either of the claims 3-4, characterized in that the guide member (16) is provided with a tensioning clamp (28) having a hook (32) for  
20 engaging just behind an eye (27) on the second flange (2) for locking the guide member (16) on the second flange (2).

6. Coupling device (10) as claimed in any of the claims 1-5, characterized in that this coupling device (10) comprises at least three fixing and guide members (16) placed  
25 along the periphery of the second flange (2) for both the purpose of fixing an adapter (9) placed on the second flange (2) in the absence of a coupled inlet/outlet conduit (4), and for guiding the end flange (3) of the inlet/outlet conduit (4) to a position suitable for coupling of this end flange  
30 (3).

7. Coupling device (10) as claimed in any of the claims 1-6, characterized in that the clamping members (6, 7, 8) are adapted to displace the respective clamping elements (8) synchronously.