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(54) Hinge-assembly for the articulation of a pivoting sluice gates

(57) A mobile barrier (1) for temporary barrage of canals and harbour entrances essentially formed by a base (2) which extends on the bottom of the harbour entrance, and a series of sluice gates (3) of essentially rectangular shape which are hinged with one edge onto the base (2) one next to the other so as to swingingly turn about a main essentially horizontal axis of rotation (A); each

sluice gate (3) being connected to the base (2) by means of a pair of disconnectable hinges (4) which consists in a fixed portion (4a) stably anchored to the base (2), and a mobile portion (4b) which is instead stably fixed to the sluice gate (3), incorporates the articulation joint of the hinge about the main axis of rotation (A) and is finally structured so as to couple with the fixed portion (4a) in a stable yet easily releasable manner.

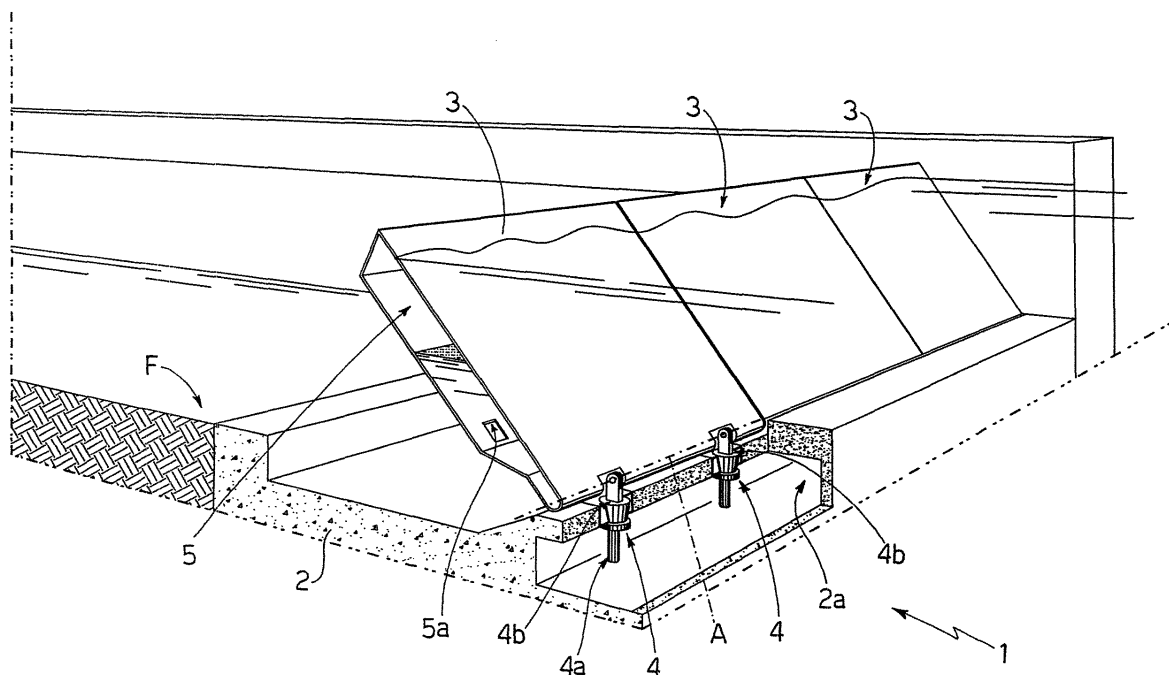


Fig.1

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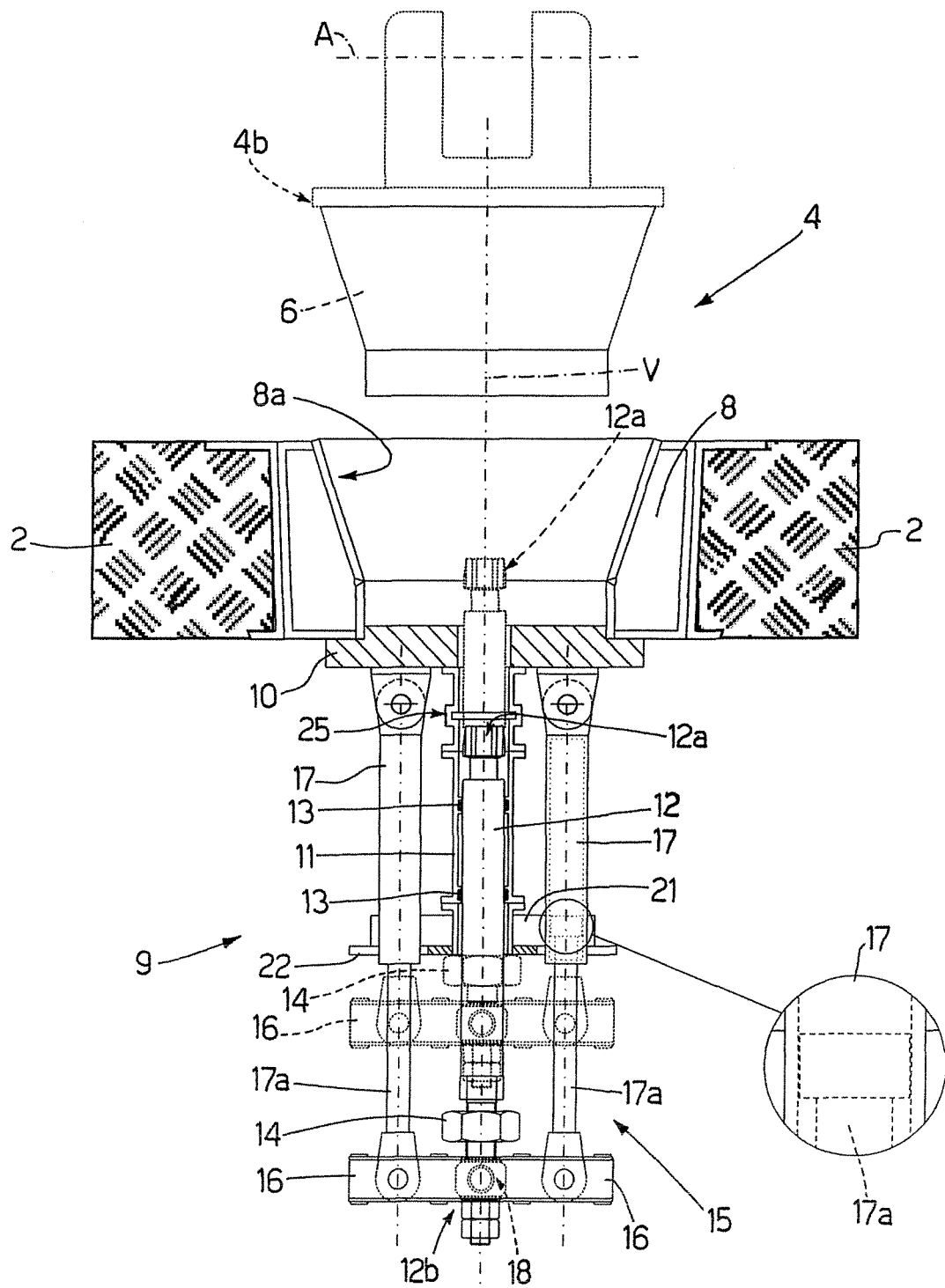


Fig.2

Description

[0001] The present invention relates to a mobile barrier for temporary barrage of canals and harbour entrances.

[0002] More in detail, the present invention relates to a submersible mobile barrier specifically structured to be positioned at navigable harbour entrances connecting a closed lagoon to the immediately adjacent open sea, so as to block when required the flow of water from the sea towards the lagoon and vice versa obstructing only in this case the naval traffic at the aforesaid harbour entrances.

[0003] As known, sea water level is subject to periodical fluctuations (traditionally called tides) which, in combination with atmospheric events of extraordinary intensity, may flood the lagoon with a quantity of water sufficiently high to raise the level of water within the lagoon itself to such a high value which may compromise the static stability of buildings and constructions distributed in the internal coastal areas and/or facing the lagoon itself.

[0004] US patent US-3756032 proposes to solve this problem by using a submersible mobile barrier consisting of a reinforced concrete base which extends on the bottom of the harbour entrance for the entire width of the entrance itself, and by a series of flat sluice gates of rectangular shape hinged with one edge onto the reinforced concrete base one next to the other so as to seamlessly occupy the entire harbour entrance width. Such sluice gates can swingingly turn about a horizontal axis common to all sluice gates between a lowered position in which the sluice gates rest on the bottom in essentially horizontal position, and a raised position in which sluices protrudingly extend from the base in a direction essentially perpendicular to the bottom of the harbour entrance, so as to partially protrude over the water surface and to form a dam which seamlessly extends for the entire width of the harbour entrance so as to prevent the water from crossing the harbour entrance itself.

[0005] As concerns instead the raising of the sluice gates from the lowered position to the raised position and the subsequent return to the lowered position, both displacements are made by appropriately varying the buoyancy of each sluice gate.

[0006] In US patent US-3756032, each sluice gate is indeed internally provided with a trim adjustment tank which, similarly as the ballast tanks fitted in submarines, is adapted to be filled with water and/or pressurised air so as to adjust the buoyancy of the sluice gate, and the mobile barrier is provided with a pressurised air feeding system which, upon command, is capable of conveying within the trim adjustment tank of each sluice gate a quantity of air sufficient to produce a buoyancy higher than the proper weight of the sluice gate, so as to cause the slow and progressive raising of all mobile sluices from the lowered position to the raised position and the consequent formation of the dam.

[0007] In order to facilitate the installation of the single sluice gates and the subsequent maintenance opera-

tions of the barrier, US patent US-4836711 and European patent EP-0397609 envisage the connection of each sluice gate to the reinforced concrete base buried onto the bottom of the harbour entrance by means of a pair of disconnectable hinges, each of which consists of a fixed portion which is stably anchored to the reinforced concrete base immediately over an internal service compartment, and of a mobile portion which is instead stably fixed onto the side wall of the sluice gate, incorporates the articulation joint of the hinge and is finally structured so as to be coupled with the fixed portion in a stable yet easily releasable manner.

[0008] More in detail, the mobile portion of the disconnectable hinge essentially consists in a flat appendix which protrudingly extends from the side wall of the sluice gate, in an intermediate fork freely and turnably hinged on the distal end of the flat appendix by means of a transversal pin perpendicular to the laying plane of the appendix itself, and finally in an essentially truncated cone shaped fastening head rigidly fastened to the end of the intermediate fork trunk.

[0009] The fixed portion of the disconnectable hinge instead essentially consists of an anchoring platform which is embedded into the reinforced concrete wall of the base and is provided with a central seat whose shape is complementary with that of the fastening head of the mobile portion of the hinge, and of a fastening and locking member which, in sequence, is adapted to fasten the fastening head of the mobile portion of the hinge and then return the concerned head abuttingly into the central seat of the anchoring platform by exerting a predetermined traction force.

[0010] More in detail, in US patent US-4836711, the fastening and locking member is a tubular rod mounted in vertical position and axially sliding under the central seat of the anchoring platform and has the upper end shaped so as to couple with the fastening head of the mobile portion of the hinge by means of a bayonet coupling, and by a hydraulic type apparatus which, once coupled to the lower end of the rod, can both turning the rod by a predetermined angle about its longitudinal axis, and axially displacing the aforesaid rod between a first operative position in which the upper end of the rod protrudes within the central seat, and a second operative position in which the upper end of the rod is positioned immediately under the seat itself.

[0011] European patent EP-0397609, filed some years later, instead specifies that the hydraulic type apparatus which displaces the tubular axis consists of two double-acting hydraulic cylinders which are respectively responsible for the angular rotation and the axial displacement of the rod, and that the tubular rod consists of a mobile stem of the double-acting hydraulic cylinder which axially displaces the rod.

[0012] Although being very advantageous in principle, the solution described in European patent EP-0397609 has shown on the field a series of drawbacks which make it unsuitable for continuous use in non-experimental in-

stallations.

[0013] Experimental tests have indeed indicated that, due to the particularly aggressive environment of use and to the long periods of inactivity between activations, the double-acting hydraulic cylinders which displace the tubular rod are subject to particularly accentuated structural decay which may be contrasted only by periodical preventive maintenance operations. In the case of the vertical hydraulic cylinder which superintends axial displacement of the tubular rod, these maintenance operations are extremely complicated and costly. The mobile stem of the concerned hydraulic cylinder indeed forms the entire tubular rod of the fastening and locking member of the hinge and therefore is very heavy and large, thus making handling extremely difficult.

[0014] In addition to the above, the fixed portion of the disconnectable hinge described in European patent EP-0397609 has considerable dimensions, particularly along the vertical actuating axis of the tubular rod, and therefore the reinforced concrete base buried on the bottom of the harbour entrance must be provided with service compartments and tunnels of large cross-section, with all the drawbacks that this entails.

[0015] It is therefore the object of the present invention to make a mobile barrier for temporary barrage of canals and harbour entrances provided with hydraulic apparatuses for axially displacing the tubular rod whose maintenance is simpler and more cost-effective.

[0016] According to the present invention, it is achieved a mobile barrier for temporary barrage of canals and harbour entrances as explained in claim 1 and preferably, but not necessarily, in any of the dependent claims.

[0017] The present invention will now be described with reference to the accompanying drawings illustrating a non-limitative embodiment example thereof, in which:

- figure 1 shows a perspective view of a mobile barrier for temporary barrage of canals and harbour entrances made according to the dictates of the present invention;
- figure 2 is a frontal view of one of the disconnectable hinges used in the mobile barrier shown in figure 1, with parts in section and parts removed for clarity;
- figure 3 is a side view of a detail of the disconnectable hinge shown in figure 2 with parts in section and parts removed for clarity; while
- figure 4 is a view of the fixed part of the disconnectable hinge shown in figure 3 taken along line IV-IV.

[0018] With reference to figure 1, number 1 shows as a whole a mobile barrier for the temporary barrage of canals and harbour entrances specifically structured to be positioned on the bottom F of a navigable harbour entrance connecting a closed lagoon to the immediately adjacent open sea.

[0019] The mobile barrier 1 essentially comprises a reinforced concrete base 2 or the like, which extends on

the bottom F of the harbour entrance for the entire width of the same, and a series of flat, essentially rectangular sluice gates 3 which are hinged with one edge onto the base 2 one next to the other so as to seamlessly occupy the entire width of the harbour entrance and to swingingly turn about a horizontal axis A common to all sluice gates 3.

[0020] More in detail, such sluice gates 3 can swingingly turn about a horizontal axis A common to all sluice gates 3 between a lowered position (not shown) in which the sluice gates 3 rest on the bottom F of the harbour entrance in an essentially horizontal position, and a raised position (see figure 1) in which the sluice gates 3 protrudingly extend from the base 2 in a direction essentially perpendicular to the bottom F of the harbour entrance, so as to partially protrude over the water surface and form a dam which seamlessly extends for the entire width of the harbour entrance so as to prevent the water from crossing the harbour entrance itself.

[0021] With reference to figure 1, each sluice gate 3, in particular, is connected to the base 2 by means of at least one pair of disconnectable hinges 4 (only two of which are shown in figure 1) which are positioned on the side wall of the sluice gate 3 so as to allow the swinging rotation of the sluice gate 3 about axis A, and has a boxed structure so as to form within at least one trim adjusting tank 5 adapted to be filled with water and/or pressurised air so as to adjust the buoyancy of the sluice gate 3.

[0022] More in detail, in the example shown, the tank 5 of each sluice gate 3 is connected with the outside by means of a series of water loading and unloading openings 5a through which the sea water can freely flow within the tank 5, and the mobile barrier 1 is provided with a pressurised air supply system (not shown) which, upon command, can pump within the tank 5 of each sluice gate 3 a quantity of pressurised air sufficient to at least partially empty the tank 5 from the water which fills it, so as to generate a buoyancy higher than the proper weight of the sluice gate 3. This buoyancy is able of causing the progressive raising of all the sluice gates 3 from the lowered position to the raised position and the consequent constitution of the aforesaid dam.

[0023] As concerns the disconnectable hinges 4, with reference to figures 1, 2 and 3, each consists in a fixed portion 4a which is stably anchored onto the base 2 immediately over a service compartment 2a, and in a mobile portion 4b (sketched in figures 1 and 2) which is instead stably fixed onto the side wall of the sluice gate 3, incorporates the articulation joint of the hinge about axis A and is finally structured so as to be coupled with the fixed portion 4a in a stable yet easily releasable manner.

[0024] More in detail, with reference to figures 1 and 2 the mobile portion 4b of the disconnectable hinge 4 is provided with a terminal fastening head 6 which is essentially shaped as a funnel and is adapted to engage in the fixed portion 4a of the disconnectable hinge 4 in a stable yet easily releasable manner, thus contextually forming a fluid-tight coupling.

[0025] With reference to figures 1, 2 and 3, the fixed portion 4a of the disconnectable hinge 4 comprises instead an anchoring platform 8 which is stably fixed to the base 2 and is provided with a central seat 8a shaped so as to accommodate the terminal head 6 of the mobile portion 4b, and a fastening and locking member 9 which, in sequence, is adapted to fasten the terminal head 6 of the mobile portion 4b and then withhold the concerned head abutting in the central seat 8a exerting a predetermined traction force.

[0026] More in detail, the anchoring platform 8 is embedded in the horizontal wall of the base 2 which separates the service compartment 2a from the mass of water above so that its upper face is skimmed by the water, while the central seat 8a is a blank seat which is made on the upper face of the anchoring platform 8 and extends towards the inside of the anchoring platform 8 maintaining itself coaxial with a longitudinal reference axis V which is preferably, but not necessarily, perpendicular to the laying plane of the platform and, therefore, essentially vertical.

[0027] In the example shown, in particular, the anchoring platform 8 consists in a metallic box structure which is provided with a central through hole 8a which is essentially shaped as a funnel so as to accommodate the terminal head 6 of the mobile portion 4b, and in a flat closing plate 10 which is fastened to the boxed structure so as to fluid-tightly close the lower end of the central through hole 8a. The longitudinal axis V is instead essentially coplanar and essentially orthogonal to axis A.

[0028] With reference to figures 1 and 2, the fastening and locking member 9 is instead fixed to the anchoring platform 8 on the opposite part of the central seat 8a, and comprises a cylindrical tubular sleeve 11 which protrudingly extends from the anchoring platform 8 from the opposite side of the central seat 8a maintaining itself coaxial or however parallel to the longitudinal axis V, and a fastening and tensioning rod or tie-rod 12 which is inserted within the cylindrical tubular sleeve 11 in an essentially slidingly and angularly turnable manner, has the upper end 12a shaped so as to fasten itself on the terminal head 6 of the mobile portion 4b with a bayonet coupling of the known type, and is finally capable of overhangingly protruding within the central seat 8a engaging in an axially sliding manner a specific through hole made in the body on the anchoring platform 8.

[0029] More in detail, in the example shown, the cylindrical tubular sleeve 11 is fixed onto the flat plate 10 of the anchoring platform 8 aligned with a specific through hole which allows the upper end 12a of the rod 12 to penetrate within the central seat 8a, and extends within the service compartment 2a maintaining itself coaxial to the longitudinal axis V, whereas the rod 12 is cylindrical, has axial length higher than that of the cylindrical tubular sleeve 11, and is mounted in an axially sliding manner within the cylindrical tubular sleeve 11 by interposition of specific ring seals 13 capable of preventing the leakage of water into the service compartment 2a.

[0030] In addition to the above, the fastening and locking member 9 is provided also with a lock nut 14 which is adjustably fastened onto a terminal segment of the rod 12 overhangingly protruding from the lower end of the cylindrical tubular sleeve 11, and with an actuating device 15 of the rod which, upon command, can turn the rod 12 by an predetermined angle α about the longitudinal axis V, and axially displace the rod itself 12 between a completely extracted position (shown by a dotted line in figure 2) in which the upper end 12a of the rod 12 protrudes within the central seat 8a and is positioned at the maximum distance from the bottom of the seat itself, and a retracted position (see figure 2) in which the upper end 12a of the rod 12 is positioned within the cylindrical tubular sleeve 11, i.e. outside the central seat 8a.

[0031] With reference to figures 2 and 3, in particular, the actuating device 15 comprises a connecting crossbar 16 rockingly hinged to the lower end 12b of the rod 12 so as to form a reversed T configuration, and a pair of single- or double-acting hydraulic cylinders 17, which extend parallelly to the longitudinal axis V, on opposite sides of the cylindrical tubular sleeve 11, are coplanar to the crossbar 16 and have the two terminal ends which are abuttingly arranged one on the anchoring platform 8, or on a structural element rigidly connected to the latest, and the other on a corresponding arm of crossbar 16.

[0032] More in detail, the crossbar 16 is centrally hinged on the lower end 12b of the rod 12 by means of a cardan joint 18 of a known type, whereas each hydraulic cylinder 17 is oriented with the mobile stem 17a facing downwards, i.e. towards the crossbar 16, and has the bottom of the external casing hinged onto the flat plate 10, while the terminal end of the mobile stem 17a is hinged onto the arm of the crossbar 16.

[0033] The two hydraulic cylinders 17 are also hydraulically coupled so as to work in parallel, while the lock nut 14 is positioned immediately over the cardan joint 18 and is adapted to be abuttingly arranged on the lower end of the cylindrical tubular sleeve 11 so as to keep the rod 12 in tension also in the absence of the downward thrust exerted by the two hydraulic cylinders 17 of the actuating device 15.

[0034] As concerns instead the rotation of the axis 12 about the longitudinal axis V, with reference to figures 2, 3 and 4, the actuating device 15 comprises a protruding appendix or toe 20 which protrudingly and radially extends from the body of the rod 12, and a transversal hydraulic actuator 21 which can engage the protruding appendix 20 when the rod 12 is arranged in the fully extracted position, and then turn the entire rod 12 by a predetermined angle α about the longitudinal axis V pushing the protruding appendix 20 in a direction locally tangent to the cylindrical surface of the aforesaid rod 12.

[0035] In the example shown, in particular, the protruding appendix 20 is arranged on the rod 12 in a position so as to be arranged at the lower end of the cylindrical tubular sleeve 11 when the rod 12 is arranged in the fully extracted position and the hydraulic actuator 21 is fixed

at the aforesaid lower end.

[0036] More in detail, the actuating device 15 is provided with a flat supporting plate 22 which is rigidly fixed to the lower end of the cylindrical tubular sleeve 11 in position perpendicular to the longitudinal axis V, i.e. in an essentially horizontal position, and the hydraulic actuator 21 is fixed onto said plate.

[0037] In the example shown, in particular, the hydraulic actuator 21 is formed by two single- or double-acting hydraulic cylinders 23 which are fixed to the flat plate 22 aligned and reciprocally counterpoised, and by a central carriage 24 which is arranged between the two hydraulic cylinders 23 and structured so as to be engaged by the protruding appendix 20 when the rod 12 is in the fully extracted position. The central carriage 24 is positioned by the side of the rod 12, while the two hydraulic cylinders 23 are aligned along a longitudinal axis essentially tangent to the rod 12 and are capable of moving the central carriage 24 by reciprocating straight motion facing the rod 12, i.e. tangential to the latter.

[0038] With reference to figures 2, 3 and 4, the actuating device 15 is finally provided with guiding means adapted to prevent any accidental rotation of the crossbar 16 about the longitudinal axis V with consequent misalignment of the two hydraulic cylinders 17. In the example shown, in particular, the guiding means are integrated in the flat supporting plate 22 which, in order to achieve the aim, has an elongated rectangular shape and presents, at the two smaller side edges of the plate, two containment grooves 22a each of which is adapted to be thoroughly engaged by a respective hydraulic cylinder 17.

[0039] Finally, with reference to figures 2 and 3, the fastening and locking member 9 is preferably, but not necessarily, provided also with a shut-off valve 25 of the shutter type or the like which is positioned along the cylindrical tubular sleeve 11, immediately under the anchoring platform 8, so as to prevent the passage of water to the service compartment 2a when the rod 12 is not inserted in the cylindrical tubular sleeve 11.

[0040] More in detail, with reference to figure 2, the shut-off valve 25 is positioned in the upper segment of the cylindrical tubular sleeve 11 which is not engaged by the rod 12 when this is in retracted position.

[0041] The operation of the mobile barrier 1 is identical to the mobile barriers for temporary barrage of canals and harbour entrances described in US patent US-4836711 and in European patent EP-0397609, and therefore no further explanations are required.

[0042] As concerns instead the operation of the fastening and locking member 9 which equips the fixed portion 4a of the disconnectable hinge 4, the connection crossbar 16 rockingly hinged to the lower end 12b of the rod 12 allows to compensate for possible differential displacements between the stems of the two hydraulic cylinders 17, thus allowing to use two smaller and lighter hydraulic cylinders instead of a larger single cylinder.

[0043] The use of such a fastening and locking mem-

ber 9 offers significant advantages: firstly, the fixed portion 4a of the disconnectable hinge 4 is much smaller than the disconnectable hinges used until now, and may therefore be placed in smaller service compartments 2a, thus considerably simplifying the structure of the base 2.

[0044] Additionally, the fastening and locking member 9 has a structure which allows the assembly and disassembly of the hydraulic cylinders 17 and 23 and of hydraulic actuator 21, enormously simplifying the maintenance operations within the service compartment 2a.

[0045] Actually, the fastening and locking member 9 thus obtained makes it possible to remove all the single- and double-acting hydraulic cylinders present in the actuating device 15 at the end of each fastening operation between the fixed portion 4a and the mobile portion of the disconnectable hinge 4, with all the advantages that this entails. Above all, the possibility of sharing the hydraulic cylinders of the actuating device 15 between several disconnectable hinges 4.

[0046] Finally, with reference to figure 2, the displacement of the fastening and tensioning rod 12 from the fully extracted position to the retracted position and, therefore, the tensioning of the rod 12 when the terminal head 6 is fastened to the upper end 12a of the rod 12, are obtained by pumping pressurised oil into the "bottom-side" chamber of the hydraulic cylinders 17, i.e. into the chamber not engaged by the mobile stem 17a, thus exploiting all the thrust that the hydraulic cylinder 17 can output.

[0047] It is finally apparent that changes and variants can be made to the mobile barrier 1 described and shown herein without departing from the scope of the present invention.

[0048] For example, according to an embodiment not shown, the connection crossbar 16 may be fixed directly to the lower end 12b of the fastening and tensioning rod 12, without the interposition of the cardan joint 18, so as to make a reversed T configuration of the rigid type.

[0049] More in detail, the connecting crossbar 16 may be provided with a central through hole within which is adapted to be inserted and locked the lower end 12b of the rod 12, for example by means of a lock nut fastened directly onto the same lower end 12b immediately under the crossbar 16.

Claims

1. A mobile barrier (1) for temporary barrage of canals and harbour entrances comprises a base (2) extending on the bottom of the harbour entrance, and a series of essentially rectangular shaped sluice gates (3) hinged with one edge onto the base (2) one next to the other so as to swingingly turn about an essentially horizontal main axis of rotation (A) between a lowered position in which the sluice gates (3) rest on the bottom of the harbour entrance in an essentially horizontal position, and a raised position in which the sluice gates (3) protrudingly extend from the base

(2) in a direction essentially perpendicular to the bottom so as to partially protrude over the water surface and form a dam adapted to prevent the passage of water through said harbour entrance; each sluice gate (3) being connected to the base (2) by means of a plurality of disconnectable hinges (4) which consist of a fixed portion (4a) stably anchored to the base (2), and a mobile portion (4b) which is instead stably fixed to the sluice gate (3), incorporates the articulation joint of the hinge about said main axis of rotation (A) and is finally structured so as to couple with the fixed portion (4a) in a stable yet easily releasable manner; the fixed portion (4a) of said disconnectable hinge (4) comprising an anchoring platform (8) which is fastened to the base (2) and is provided with a central seat (8a) shaped so as to accommodate a terminal fastening head (6) of the mobile portion (4b), and a fastening and locking member (9) which, upon command, is adapted to fasten and then withhold said terminal head (6) abuttingly in the central seat (8a); said fastening and locking member (9) being fixed to the anchoring platform (8) on the opposite side of said central seat (8a), and being provided with a tubular sleeve (11) which protrudingly extends from the anchoring platform (8), from the opposite side of said central seat (8a), maintaining itself coaxial to a longitudinal reference axis (V) essentially perpendicular to the laying plane of the anchoring platform (8), and with a fastening and tensioning rod (12) which is inserted within said tubular sleeve (11) in an axially sliding and angularly turning manner, and has an upper end (12a) shaped so as to be fastened onto the terminal head (6) of the mobile portion (4b); said fastening and locking member (9) being also provided with an actuating device (15) which, upon command, is capable of both turning said rod (12) by a predetermined angle (α) about said longitudinal reference axis (V), and axially displacing the same rod (12) between an essentially extracted position in which the upper end (12a) of the rod (12) protrudes within said central seat (8a), and a retracted position in which the upper end (12a) of the rod (12) is positioned outside the central seat (8a) and within said tubular sleeve (11); said mobile barrier (1) for temporary barrage of canals and harbour entrances being **characterised in that** said actuating device (15) comprises a connection crossbar (16) fixed to the lower end (12b) of said rod (12) so as to form a reversed T configuration, and a pair of first hydraulic cylinders (17) which are arranged on opposite sides of the tubular sleeve (11) parallelly to the latter, and have two terminal ends abutting one on the anchoring platform (8) and the other on a corresponding arm of said connection crossbar (16).

2. A mobile barrier according to claim 1, **characterised in that** said connection crossbar (16) is rockingly

hinged on the lower end (12b) of said rod (12).

3. A mobile barrier according to claim 2, **characterised in that** said connection crossbar (16) is hinged to the lower end (12b) of said rod (12) by means of a cardan joint (18).
4. A mobile barrier according to any of the preceding claims, **characterised in that** each said first hydraulic cylinder (17) is oriented with the mobile stem (17a) facing towards said connection crossbar (16).
5. A mobile barrier according to claim 4, **characterised in that** each external casing of said first hydraulic cylinder (17) is hinged onto said anchoring platform (8) and the terminal end of the mobile stem (17a) is hinged to a corresponding arm of said connection crossbar (16).
6. A mobile barrier according to any of the preceding claims, **characterised in that** said first hydraulic cylinders are hydraulically coupled so as to work in parallel.
7. A mobile barrier according to any one of the preceding claims, **characterised in that** said actuating device (15) further comprises a protruding appendix (20) which overhangingly protrudes from said fastening and tensioning rod (12) and a hydraulic transversal actuator (21) which, upon command, is capable of engaging said protruding appendix (20) when the rod (12) itself is arranged in the fully extracted position, and then of turning the entire rod (12) by a predetermined angle (α) about said longitudinal reference axis (V).
8. A mobile barrier according to any of the preceding claims, **characterised in that** said actuating device (15) further comprises guiding means (22) adapted to prevent any accidental rotation of the connection crossbar (16) about said longitudinal reference axis (V).
9. A mobile barrier according to any of the preceding claims, **characterised in that** said fastening and locking member (9) further comprises a stop nut (14) which is adjustably screwed to a terminal section of said rod (12) which overhangingly protrudes from the distal end of said tubular sleeve (11).
10. A mobile barrier according to any of the preceding claims, **characterised in that** said longitudinal reference axis (V) is vertically oriented.

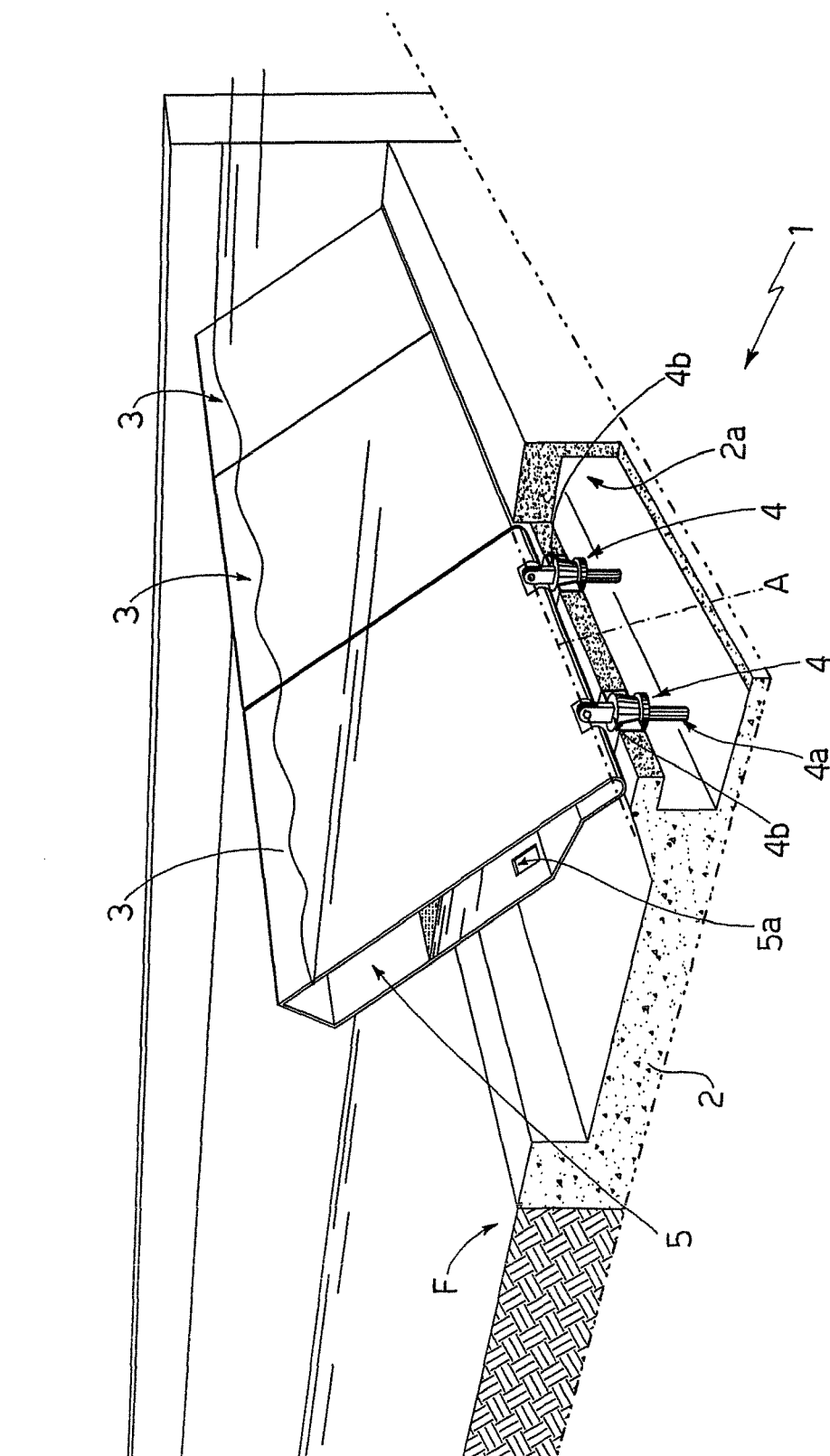


Fig.1

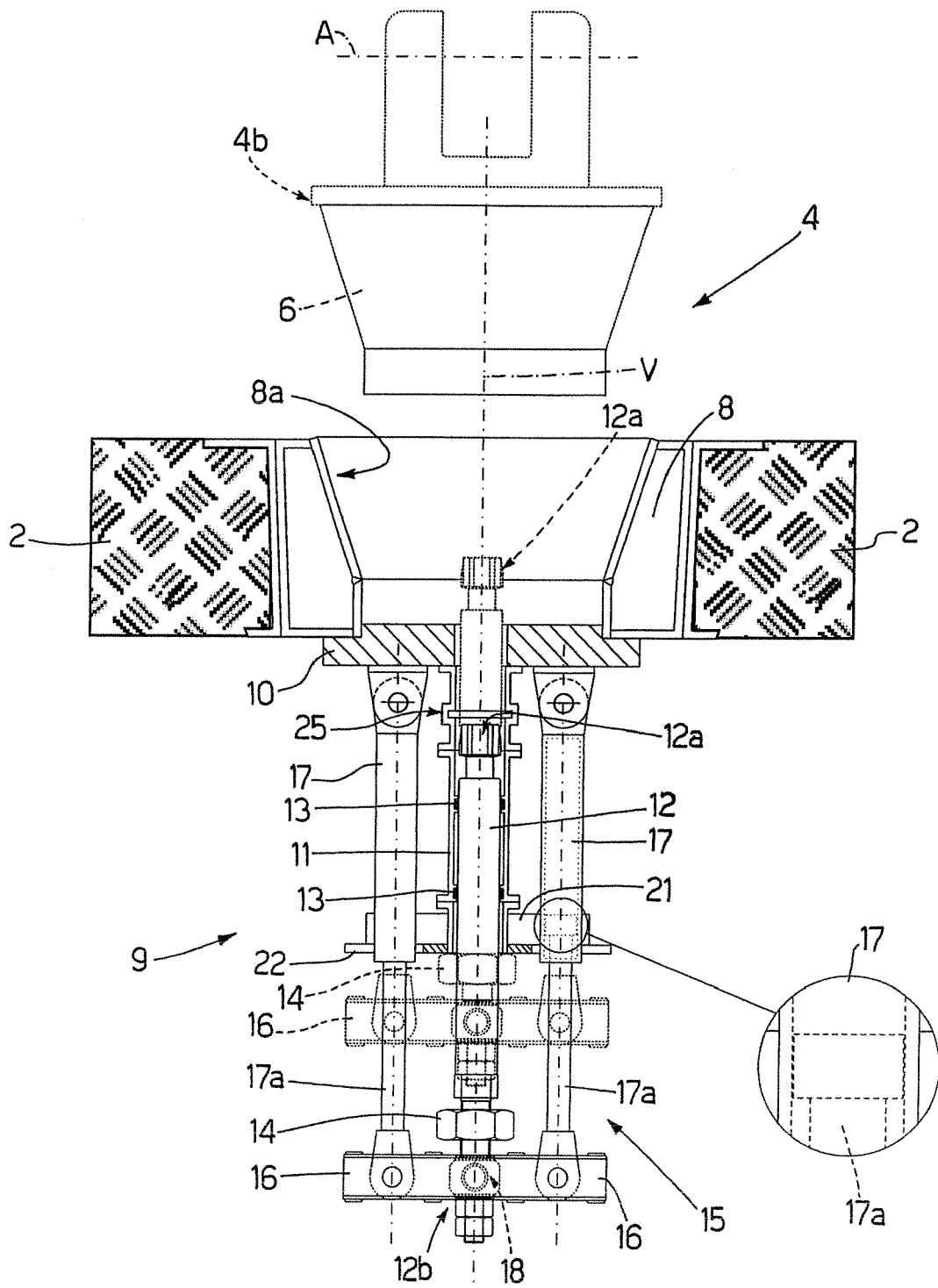
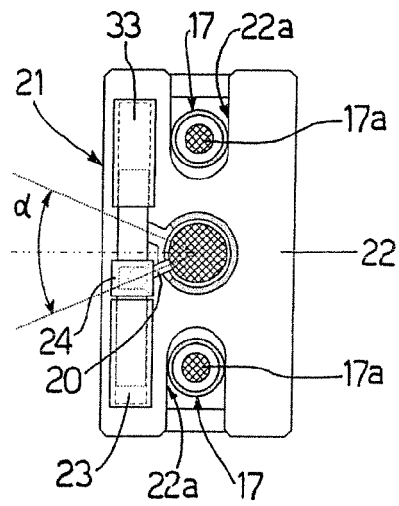
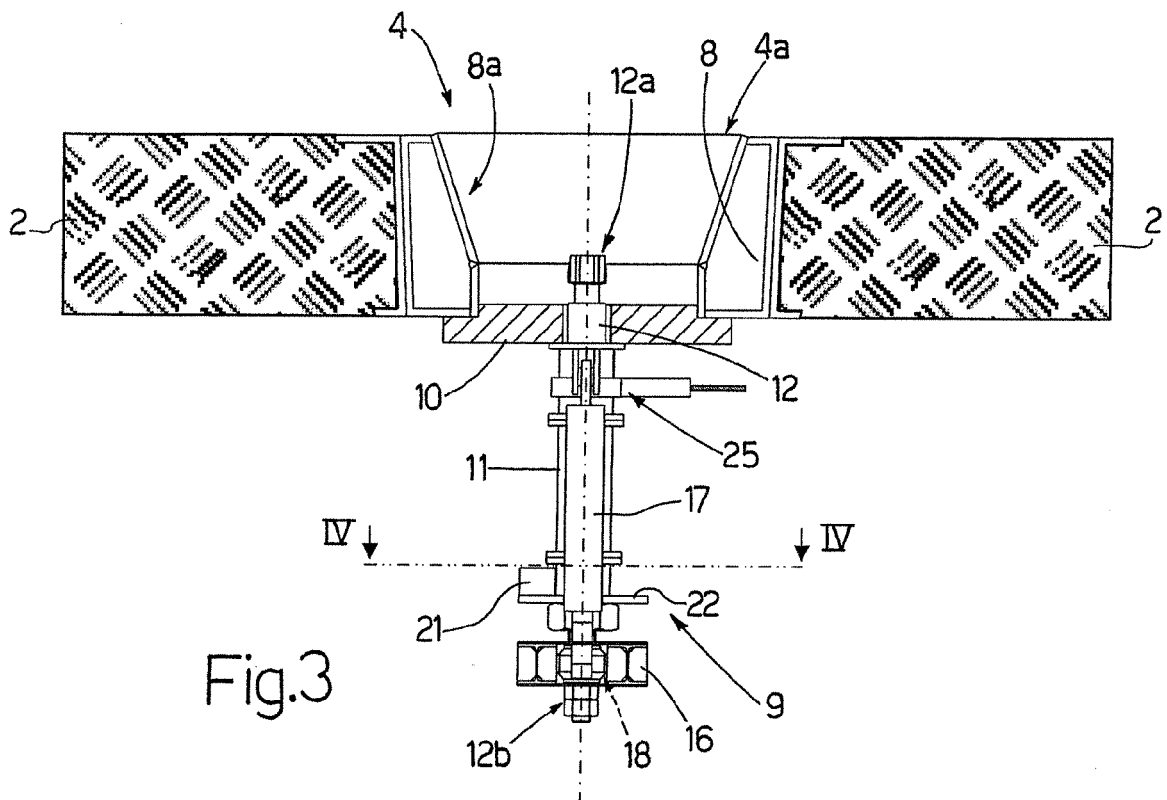


Fig.2



REFERENCES CITED IN THE DESCRIPTION

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