

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
8 February 2007 (08.02.2007)

PCT

(10) International Publication Number
WO 2007/015642 A2

(51) International Patent Classification:
B66D 3/00 (2006.01)

(21) International Application Number:

PCT/NL2006/050193

(22) International Filing Date: 3 August 2006 (03.08.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
05107161.1 3 August 2005 (03.08.2005) EP

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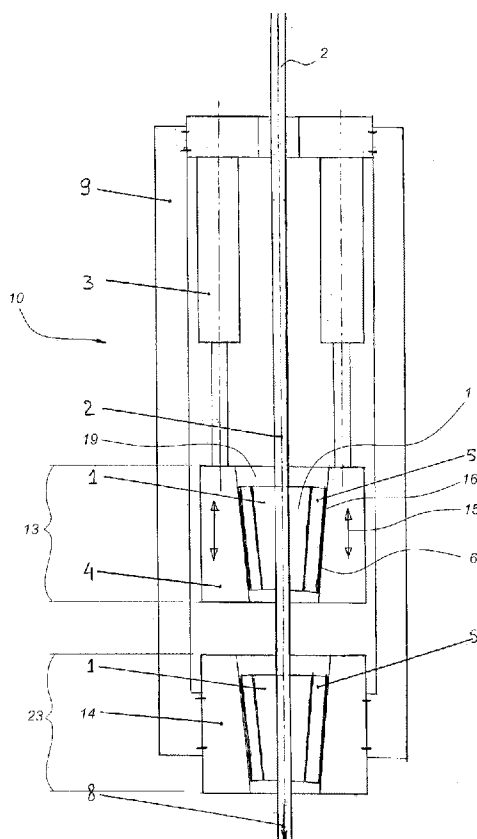
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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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(54) Title: CLAMPING SYSTEM AND PUSH/PULL SYSTEM COMPRISING SUCH A CLAMPING SYSTEM



(57) Abstract: Clamping system comprising a wedge block in which two clamping members are slidably received. The clamping members act as wedges at relative movement to the clamping block, clampingly engaging the related article to be clamped such as a cable. According to the invention between the clamping members and the clamping block a layer of rubber elastic material is provided which is fixed to the clamping members and movable relative to the clamping block. This is a service-free solution. There are many applications for the clamping system according to the invention. As an example a push/pull system is mentioned, in which the clamping system according to the invention is integrated in a structure. In such a structure a further clamping system can be provided to block the article relative to the structure during preparation of a further push/pull stroke of the first clamping system.



Published:

— without international search report and to be republished upon receipt of that report

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Clamping system and push/pull system comprising such a clamping system.

The present invention relates to a clamping system for clamping elongated articles, such as cables, pipes and so on.

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An example for such a clamping system is disclosed in US 4093042. A clamping block is provided in which clamping members can move in longitudinal direction of the article to be clamped. The clamping block is provided with an accommodation having a conical surface. During the clamping movement the clamping members will be moved
10 towards each other clampingly engaging the article to be clamped. A roller structure is provided on the clamping members which engage the conical surface of the clamping block.

Use of rollers results in a necessity of lubrication or other measures to keep the rollers
15 rotating as desired. Under hostile conditions such as under moisture conditions at open water, such as at sea, special measures have to be taken to protect the rollers from such an environment. Furthermore, regular maintenance is required.

The invention aims to provide a clamping system which can be used in all kinds of
20 environments, functions without the need of lubrication and does not require substantial maintenance.

According to the invention this is realised with a clamping system comprising two clamping members being spaced from each other and defining the clamping space in
25 between, wherein said clamping members are received in an accommodation in a clamping block, wherein the accommodation and clamping members are provided with cooperating wedge means, said wedge means comprising a wedge surface, on said accommodation/clamping block and a support surface of a support on said clamping member, wherein said support of said clamping members comprises a layer of rubber
30 elastic material being fixed to said clamping members and displaceable along said wedge surface with the support surface thereof.

According to the invention rollers or other structures engaging the conical surface of the clamping block are replaced by a layer of rubber elastic material. This layer is fixedly connected to the clamping members or clamping jaws and is displaceable along the conical surface of the clamping block. According to the invention the rubber elastic layer will deform during use in the direction of clamping or in the opposite direction. This means that a part of the movement between the clamping members or clamping jaws and the clamping block is taken up by internal deformation of the rubber layer reducing sliding movement between the outer surface of the rubber elastic layer and the clamping block.

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According to a preferred embodiment of the invention the layer of rubber elastic material comprises a number of sub layers of rubber elastic material and a substrate such as a steel plate to which for example rubbery material is adhered for example is vulcanised. In this way a layer is obtained which is substantially ridged in a direction perpendicular to the separation surface between said rubbery layers and is yielding in a direction parallel to such separation.

The surface of engagement with the clamping block can either be a rubbery material or such a separation such as a metallic plate and more particular a steel plate.

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If a rubbery material outer surface is used no lubrication is required between the rubber elastic material and the clamping block. If a metallic outer surface is present minor lubrication might be desirable. Furthermore in both cases no maintenance is necessary. It has been found that wear of the outer layer is neglectible.

25

According to a preferred embodiment of the invention actuating means are provided to displace the clamping members or clamping jaws relative to the clamping block to bring the clamping members in or out engagement with the conical surface of the clamping block. More particular, these actuating means engage on the layer of rubber elastic material. According to a preferred embodiment of the invention, the actuating means engage on or near the outer layer of the rubber elastic material which will contact the conical surface of the clamping block. The actuating means can comprise any actuating means known in the art such as hydraulic, pneumatic or electric rams or

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other means to displace the clamping members relative to the clamping block. By using such actuators the clamping system according to the invention can be used in any position to clamp the article to be clamped as desired.

- 5 The invention also relates to a push/pull system comprising any structure imaginable, wherein the clamping system according to the invention is incorporated. According to the invention this clamping system is movably relative to the structure such that the article to be clamped can be moved relative to the structure. Such a push/pull system can, for example, comprise a linear winch but other applications will immediately be
- 10 clear for the person skilled in the art after reading the specification. Examples are movement of structures along pipes or movement of pipes along structures.

- The means for displacing the clamping system relative to the structure can comprise any means known in the art such as a winch, but preferably comprise a ram and more
- 15 particular a hydraulic ram.

- In order to be able to effect a number of strokes of the structure relative to the article in the same direction according to a preferred embodiment of the invention, such a structure comprises a further clamping system. This further clamping system is
- 20 preferably fixed to the structure. However, it should be understood that this can also be movable relative to the structure. In all cases, after the first clamping system has effected the related stroke, engagement of the clamping system and the article is released whilst the structure is connected to the article through the further clamping system. In that way it is possible that the first clamping system makes a return
- 25 movement engaging the article on a further place and taking over engagement of the article relative to the structure, which means that the further clamping system is made ineffective.

- The invention also relates to a method for operating a clamping system as well as a
- 30 method for operating a push or pull system.

The invention will be further elucidated referring to a preferred embodiment thereof. In the drawings:

Fig. 1 shows a push/pull system according to the invention and,

Fig. 2.1-2.3 shows several positions of a part of the clamping member relative to the
5 clamping block and the article to be engaged. (Only one side is shown).

In fig. 1 as an example a pull system according to the invention is shown and generally referred to by 10. This comprises a structure 9 and a cable 2. According to the invention displacement of the cable 2 relative to the structure is required. I.e. the structure 9 acts as a linear winch. To provide such a relative movement a clamping system 13 is provided comprising a clamping block 4 having an accommodation 19 in which two clamping members or clamping jaws 1 are received. It should be understood that more than two clamping jaws can be present. The accommodation 19 has a conical surface 9. The outer surface of the clamping jaws 1 is provided with a rubber layer 5 of
15 which the outer surface or support surface 16 is tapering in the direction corresponding to the tapering of conical surface 6. This means that if the clamping jaw 1 is moved in downward direction in fig. 1, the cable 2 will be clamped between opposed clamping jaws. Rubber layer 5 comprises a number of parallel rubber sub layers between which an adhesive surface such as a metallic grid or metallic plate is provided. Such a metallic
20 plate as well as the rubber layers extend in the direction of the conical surface 6. Such a rubber layer can for example have a total thickness of 10-20 cm whilst each sub layer has for example a thickness of 1-5 cm.

From fig. 1 it is clear that the clamping block 4 can move in upward and downward
25 direction as indicated by arrows 15 through actuation of hydraulic rams 3.

On the structure or housing 9 a further clamping block 14 is provided which is part of a further clamping system 23, which is substantially identical to the clamping system 13 with the difference that the clamping block 14 is fixed to structure 9.

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From fig. 2.1 it is clear that an actuator, which can be a ram 7 is present, which engages on the outer surface or support surface 16 of the layer 5 of rubber elastic material. From fig. 2.1 it is clear that because of that the support surface 16 is elastically deformed

relative to the adhesion surface 17 of the layer of rubber elastic material 5 to the clamping jaw 1. The rubber elastic material according to the invention is a material which is able to be subjected to such an elastic deformation.

- 5 At operation of actuator 7 in the right hand direction in fig. 2.1 not only deformation of the support layer 16 will occur but the clamping jaw 1 will also slide relative to the clamping block 4 over cable 2. After releasing the force on actuator 7 return movement of the support surface 16 in leftward direction (arrow 12) is not possible or only possible over a limited extent. Return movement is restricted because the increase in
10 thickness of layer 5 resulting therefrom cannot be taken up by this system because the clamping jaw 1 is already pushed against the cable 2.

Starting from the extended position of ram 3 as shown in fig. 1 and with the engagement of clamping jaw 1 as shown in fig. 2.1 hydraulic pressure is entered in ram
15 3 to effect an upward movement (as shown in fig. 1) of ram 3. During such a movement the clamping jaws 1 will clampingly engage the cable 2 which means a slide movement relative to the clamping block. In contrast to the prior art this movement does not result in a sliding or rolling displacement of the clamping jaw outer surface 16 relative to the surface 6 of the accommodation. This movement is substantially compensated for by
20 removing of the previous deformation of the rubber layer 5. This is shown in fig. 2.2. This means that with the device according to the invention, basically there is only relative displacement at the two surfaces 6, 16 in the non-clamped condition. At further tightening the cable 2, finally the condition as shown in fig. 2.3 is obtained. After that the actuation of the ram 3 results in movement of the cable 2 relative to the structure.

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If the clamping block 4 approaches the cylinders of ram 3, movement of ram 3 is reversed. This will result in reverse movement of the deformation of layer 5. Starting from the condition shown in fig. 2.3 the position of fig. 2.1 will be obtained. It is noted that during this transition there is no sliding movement of support surface 16 relative to
30 the conical surface 6. In the condition shown in fig. 2.1 the block 4 can move freely along the cable 2 in downward direction.

In the meantime, the cable 2 is fixed relative to the structure through the presence of the further clamping system 23, which acts in a way analogous to clamping system 13.

5 After the clamping block 4 has reached the extended position of ram 3, a further stroke can be effected. Because a pulling force is exerted on the cable 2, the clamping system 23 will become ineffective allowing the cable 2 to pass there through. Only if force acts on cable 2 in downward direction, the clamping system 23 becomes effective.

10 From the above it is clear that in a simple way winching or other movement of an article 2 relative to a structure is possible. If the rubber layer is correctly chosen with regard to the composition and thickness thereof during such repeated movement, there is no sliding (and/or rolling) contact between the clamping jaws 1 and the related clamping block.

15 Under other conditions it might well be possible that there is a sliding movement between the support surface 16 of the rubber layer and the conical surface. However, also in these conditions because of the material, additional lubrication is not necessary whilst the system according to the invention is particularly resistant to external effects, such as hostile environments.

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After the above, for the persons skilled in the art, immediately further embodiments are clear, which are within the range of the appended claims. Furthermore, it is emphasized that not only rights are claimed for the sub claims in combination with claim 1 but also for the sub claims as such.

25

Claims

1. Clamping system (13) comprising two clamping members (1) being spaced from each other and defining the clamping space in between, wherein said clamping
5 members are received in an accommodation (19) in a clamping block (4) wherein the accommodation and clamping members are provided with cooperating wedge means, said wedge means comprising a wedge surface (6), on said accommodation/clamping block and a support surface (16) of a support on said clamping member, characterized in that, said support of said clamping members comprises a layer (5) of rubber elastic
10 material being fixed to said clamping members and displaceable along said wedge surface (6) with the support surface (16) thereof.
2. Clamping system according to claim 1, comprising actuating means (7) acting between said clamping block and said layer (5) of rubber elastic material to bring the
15 support surface (16) in or out engagement with said wedge surface (6).
3. Clamping system according to claim 2, wherein said actuating means (7) engage on said layer (5) of rubber elastic material near the support surface (16) thereof.
- 20 4. Clamping system according to one of the preceding claims, wherein said layer of rubber elastic material comprises a number of layers of rubber elastic material between which a support is provided.
5. Push/pull system (10) comprising an elongated member (2) and a structure (9)
25 supporting said elongated member or being supported by said elongated member, wherein said structure is provided with a clamping system (13) according to one of the preceding claims and drive means (3) for displacing said clamping system relative to said structure.
- 30 6. Push/pull system according to claim 5, wherein said drive means comprise a ram (3).
7. Push/pull system according to claim 5/6, wherein said elongated member is a cable (2).

8. Push/pull system according to one of the claims 5-7, wherein a further clamping system (23) being fixed to said structure.

- 5 9. Method for operating a push/pull system according to one of the claims 5-8, wherein in a first step the clamping members of said clamping system are clampingly positioned between the article to be clamped and said wedge surface by displacing said support surface of said rubber elastic material in the direction of wedging and executing a push/pull stroke.

10

10. Method according to claim 9, wherein after execution of said push/pull stroke of the clamp article relative to the structure, the clamping system executes a return movement relative to said structure after which a further push/pull stroke is effected without further additional clamping of said clamping member against said wedge surface.

15

11. Method according to claim 10 in combination with claim 7, wherein after executing a push/pull stroke, said article to be clamped is kept in fixed position relative to said structure by said further clamping system.

1/2

Fig 1

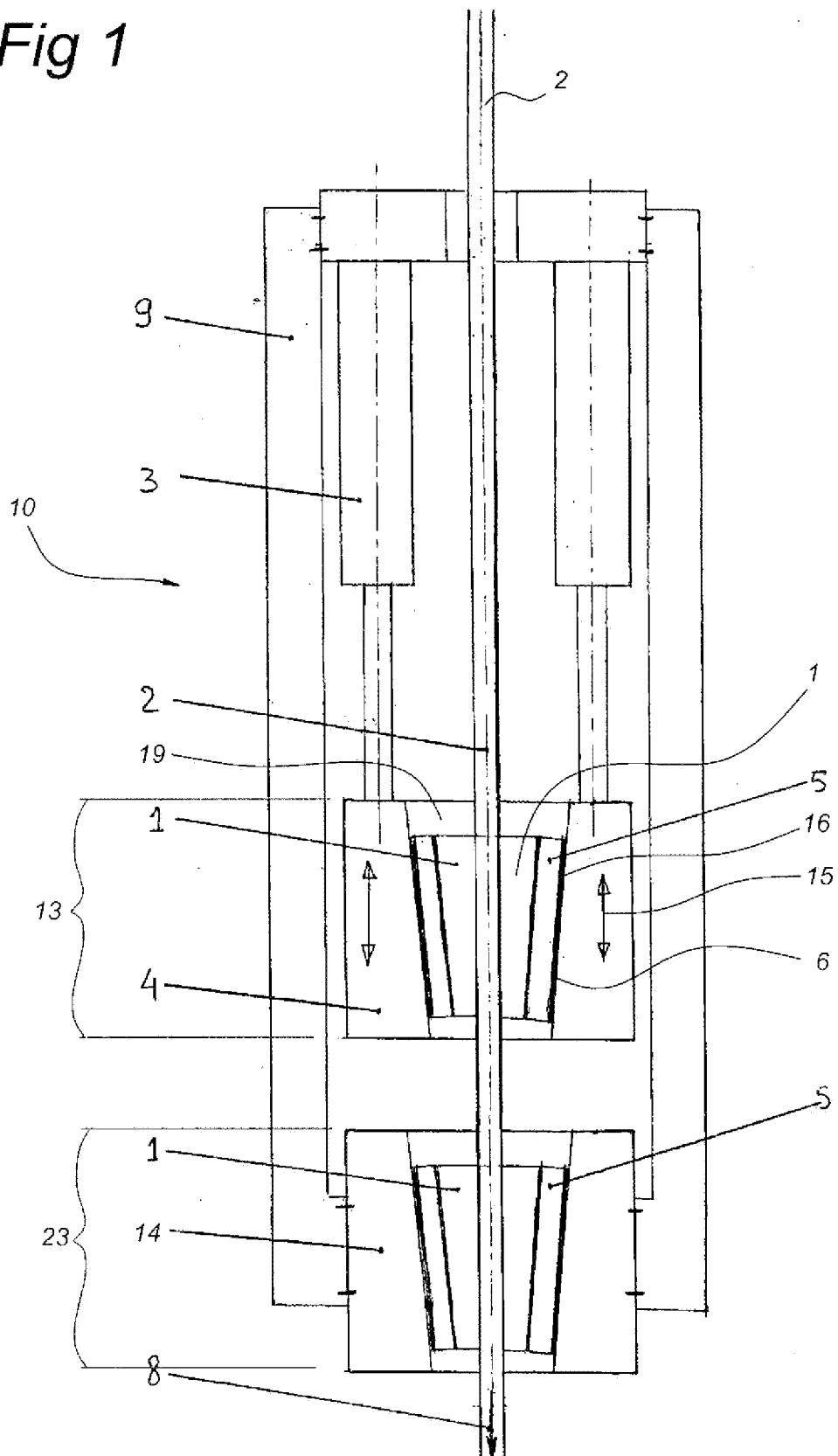
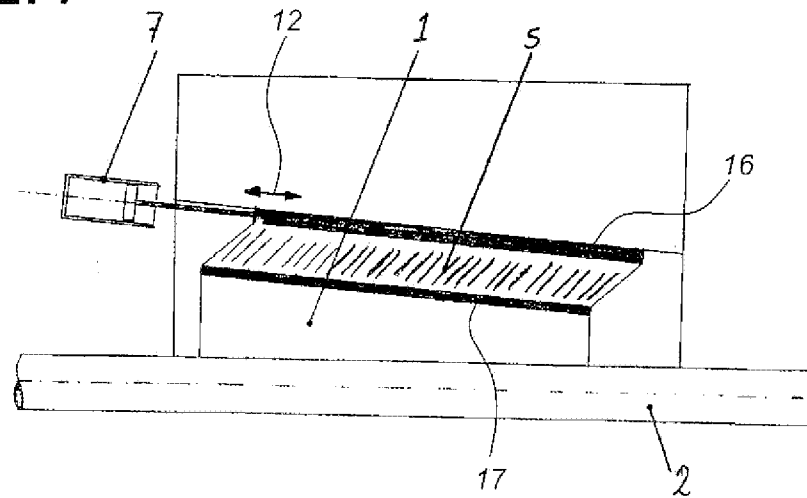
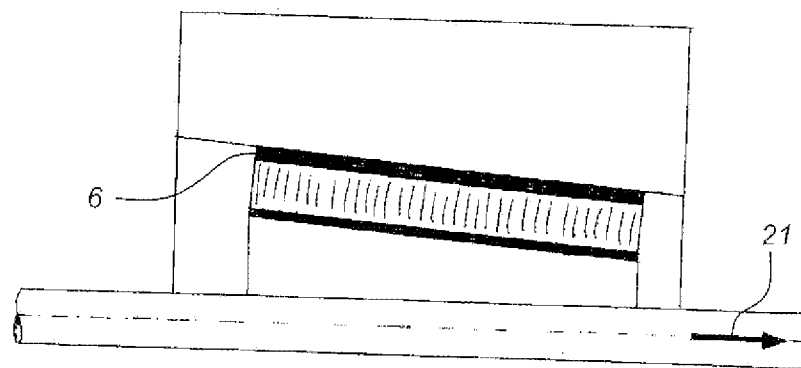


Fig 2.1*Fig 2.2**Fig 2.3*