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(54) **Water control gate**

(57) An apparatus for controlling and/or closing a passage (6) in a watercourse, such as, for instance, a ditch, canal, conduit or pipe, which apparatus is provided with a plate (5) and a frame (2), the plate (5) and the frame (2) being connected with an adjusting element (16,26) which is drivable by a drive, for the purpose of adjusting the position of the plate (5) relative to the frame (2), the apparatus being further provided with at least one adjusting element (16,26) and with an aligning shaft (18) with two gear wheels (15), the distance between the gear

wheels (15) substantially corresponding to the width of the plate (5), while further gear racks or chains (12) are provided which the gear wheels (15) engage, the aligning shaft (18) and the gear racks or chains (12) being coupled to the frame (2) and the plate (5), such that a displacement of the plate (5) on the right-hand side of the plate (5) results in a corresponding displacement of the left-hand side of the plate (5) and vice versa.

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Description

[0001] The invention relates to an apparatus for controlling and/or closing a passage in a watercourse, such as, for instance, a ditch, canal, conduit or pipe, which apparatus is provided with a plate and a frame, the plate and the frame being directly or indirectly connected with an adjusting element which is drivable by a drive, for the purpose of adjusting the position of the plate relative to the frame.

[0002] Such an apparatus is known from the patent publications NL1021754 and EP-A-1 188 863 in applicant's name, which patent publications are understood to be completely incorporated into the present application by reference. In the known apparatuses, an adjusting mechanism is provided to adjust the position of the plate. To that end, the plate of the known apparatuses is driven on opposite sides by the adjusting mechanism, in order that the plate, when being lowered and raised, is loaded symmetrically. To that end, the adjusting mechanism of the known apparatus comprises two adjusting elements, each adjusting the position of the plate through at least one driving means, whether or not via a transmission. The driving means can comprise a motor, a hydraulic or pneumatic piston/cylinder assembly, a crank or like means. The above-mentioned indirect connection can have been effected, for instance, in that the frame is mounted on a wall and in that the adjusting element has an end connected to that same wall as well. The indirect connection between frame and adjusting element then proceeds via the wall.

[0003] The present invention contemplates an improvement of the apparatus mentioned in the opening paragraph hereof. In particular, the invention contemplates an apparatus that is relatively unsusceptible to trouble, wherein at least one adjusting element engages the plate and wherein jamming or skewing of the plate relative to the frame can yet be properly avoided, even when the plate has a large width.

[0004] According to the invention, to that end, the apparatus is characterized in that the apparatus is provided with at least one adjusting element and with an aligning shaft, which aligning shaft is provided with two gear wheels, the distance between the gear wheels substantially corresponding to the width of the plate, wherein further gear racks or chains are provided, engaged by the gear wheels, the aligning shaft and the gear racks or chains being coupled to the frame and the plate such that a displacement of the plate on the right-hand side of the plate results in a corresponding displacement of the left-hand side of the plate and vice versa.

[0005] The terms gear wheel and gear rack are to be taken broadly and also encompass wheels with pins or holes cooperating with tracks provided with holes or transverse pins, or pins, respectively, with the pins engaging the holes or the transverse pins. Also other form-locked transmission means having a gear wheel-like and gear rack-like appearance should be un-

derstood to fall within the terms of gear wheel and gear rack.

[0006] During use, the apparatus can control the water level of the water passage and/or for instance close the watercourse, with the plate being moved to a suitable position, for instance the clearing position, the closing position or an intermediate position. As a result of the presence of the aligning shaft with gear wheels and the cooperating gear racks or chains, it does not matter whether the adjusting element is connected to the plate centrally of the plate or adjacent one of the sides thereof. The reason is that as soon as one of the sides of the plate sustains a displacement, this displacement will be directly transmitted via the aligning shaft to the other side of the plate and there result in a corresponding displacement. As a result of the presence of the aligning shaft, no skewing can occur, not even when only one adjusting element is present. Accordingly, the aligning shaft provides much more freedom as regards the choice of the position where the adjusting element engages or the adjusting elements engage the plate.

[0007] The transmission of the displacement from one side of the plate to the other side of the plate is in itself independent of the action of the adjusting element. The adjusting element can for instance engage the plate directly to bring the plate in a desired position. The aligning shaft with the gear racks or chains then automatically provide for equal travel of the sides of the plate relative to the frame, so that jamming or skewing of the plate relative to the frame is prevented well. Of great advantage is that just one adjusting element is needed in that the aligning shaft always ensures that the plate is not out of alignment.

[0008] A further advantage of the present invention is that the aligning shaft with the gear wheels as well as the gear racks or chains are relatively unsusceptible to trouble. The aligning mechanism formed by these parts consists of relatively few moving, robust parts, which increases the durability and reliability of the apparatus. Further elaborations of the invention are described in the subclaims. Presently, the invention will be clarified on the basis of an exemplary embodiment and the drawing. In the drawing:

Fig. 1 shows a perspective front view of an exemplary embodiment according to the present invention, with the plate in a clearing position;

Fig. 2 shows a front view of the exemplary embodiment represented in Fig. 1;

Fig. 3 shows a cross-sectional view along line III-III of the front view represented in Fig. 2;

Fig. 4 shows a top plan view of the exemplary embodiment represented in Fig. 1;

Fig. 5 shows a view similar to Fig. 1, with the plate of the exemplary embodiment in a closing position;

Fig. 6 shows a front view of the exemplary embodiment in the position represented in Fig. 5;

Fig. 7 shows a cross-sectional view along line VII-VII

of the front view represented in Fig. 6;

Fig. 8 shows a cross-sectional view along line VI-II-VIII of the front view represented in Fig. 6;

Fig. 9 shows a detail IX of the cross-sectional view represented in Fig. 8;

Fig. 10 shows a cross-sectional view along line X-X of the front view represented in Fig. 6; and

Fig. 11 shows a detail XI of the top plan view represented in Fig. 4.

[0009] Figures 1-11 show an apparatus 1 according to an exemplary embodiment of the present invention, whereby the chance of jamming or skewness is prevented. The present exemplary embodiment comprises a frame 2 which is provided with a lower part 3 and two opposed side parts 4. Between the side parts 4 and above the lower part 3 is a passage 6 in the watercourse. The exemplary embodiment is further provided with a plate 5 which, under the influence of one adjusting element 16, is movable between a clearing position and a closing position to clear and close the passage 6, respectively. For the present exemplary embodiment, the clearing position is indicated in the art by the term "minimum damming position" and the closing position is indicated by the term "maximum damming position". In the present exemplary embodiment, assuming intermediate positions also belongs to the possibilities. Moreover, the exemplary embodiment is provided with an aligning mechanism to cause sides of the plate 5 to travel equally relative to the side parts 4 of the frame.

[0010] The construction of this mechanism will be described in more detail hereinbelow. Figs. 1-4 show the exemplary embodiment in the clearing position of the plate 5. It is clearly visible that in this position the passage 6 is not bounded in upward direction. The closing position of the plate 5 is clearly visible in Figs. 5-9.

[0011] The exemplary embodiment is provided with guide means 7, 8 to guide the plate 5 between the clearing position and the closing position. Such guide means 7, 8 can be designed in various ways. In the present exemplary embodiment, the guide means comprise first guide profiles 7 of the frame, as well as second guide profiles 8 of the plate 5. As shown in Figs. 10 and 11, the first guide profiles 7 and second guide profiles 8 are arranged to cooperate with each other to guide the plate 5 through the passage 6 in a suitable manner. To that end, the first guide profiles 7 are provided with parallel vertical guide slots 7a. The second guide profiles 8 are provided with elongate guide flanges 8a extending into the guide slots 7a of the first guide profiles 7. However, also other guides belong to the possibilities, for instance as described in applicant's earlier, non-prepublished European application 04076491.

[0012] In the present exemplary embodiment, the adjusting element comprises a spindle drive 16, 26 which is described in more detail in a patent application filed on the same date, the content of which is considered to be inserted herein by reference. However, other drives be-

long to the possibilities, such as, for instance, a gear/rack drive, a chain drive, a hydraulically or pneumatically energized piston/cylinder assembly or the like.

[0013] The present spindle drive 16, 26 is arranged substantially outside the passage 6. To that end, the spindle drive 16, 26 extends at least along a side part 4a of the frame 2. The tubular house 26 of the spindle drive is connected with a side of the weir plate 5, while a sleeve 16 of the spindle drive, adjustable relative to the house 26, has an upper end connected with the frame 2. In the clearing position of the plate, the sleeve 16 extends outside the tubular house 26. Connected with the house 26, in the interior thereof, is a spindle 27, while a spindle nut 28 is connected with the sleeve 16. Adjustment of the sleeve 16 relative to the house 26 is effected by rotating the sleeve 16, for instance with a crank or motor which is coupled with shaft 29 which is connected with the sleeve 16 so as to be restrained from rotation.

[0014] The aligning mechanism referred to is provided with an aligning shaft 18 and two gear wheels 15 mounted thereon. The aligning shaft 18 is connected with the frame 2. On the plate 5, adjacent the sides thereof, two gear racks 12 are arranged which cooperate with the gear wheels 15. In the present exemplary embodiment, the plate 5 is provided with the gear racks 12, while the frame 2 is provided with the aligning shaft 18 with the gear wheels 15. The gear racks 12 are fixedly connected to the plate 5. Moreover, the gear racks 12 extend parallel relative to each other. In an alternative embodiment, not shown, the frame 2 is provided with the gear racks 12, while the plate 5 carries the aligning shaft 18 with the gear wheels 15. Instead of gear racks 12, also chains fixedly connected with the plate 5 or the frame 2 can be used.

[0015] Preferably, the aligning shaft 18 with gear wheels 15 and the gear racks 12 are each accommodated substantially in spaces at least partly screened from an environment, to prevent soiling. As shown in Figs. 10 and 11, in the exemplary embodiment, such spaces are formed by the guide profiles 7, 8, the plate 5 and the side parts 4 of the frame 2.

[0016] As further shown in Figs. 3 and 8, the gear racks 12 are each straight. The gear racks 12 extend along or adjacent the sides of the plate 5, spaced apart, on a rear side of the plate 5. The length of each gear rack 12 is not greater than the height of the plate 5, but in the exemplary embodiment it is actually slightly less than that height, at least measured in the direction of movement of the plate 5.

[0017] The two gear wheels 15 are mounted on the ends of the aligning shaft 18. The aligning shaft 18 is rotatably connected with the lower part 3 of the frame 2. The aligning shaft 18 extends under the passage 6. Preferably, the aligning shaft 18 is accommodated in a space closed off substantially from the watercourse. What can thus be avoided is that rotation of the aligning shaft 18 is blocked or impeded under the influence of soiling or the like coming from the watercourse.

[0018] As clearly shown in Figs. 9 and 10, the guide profiles 7, 8 are so dimensioned that each gear wheel 15 and each gear rack 12 mutually engage during the guidance provided by those profiles 7, 8. The guide profiles 7, 8 can thus guarantee in a simple manner that the racks 12 of the plate 5 remain in contact with the gear wheels 15 coupled to the frame 2.

[0019] During use, a movement of the plate 5 is kept equal on both sides of the plate 5 by the aligning shaft, to prevent the plate 5 jamming or skewing in the frame 2. The adjusting element 16 does not engage the plate 5 via the aligning shaft 18 but is connected directly with the plate 5. Accordingly, the aligning shaft 18 with the gear wheels 15 and the gear racks or chains 12 provides for the equal travel of the sides of the plate 5, without forming part of an adjusting element.

[0020] It will be clear to those skilled in the art that the invention is not limited to the exemplary embodiment described. Various modifications are possible within the framework of the invention such as it is set forth in the following claims.

[0021] Thus, the adjusting element can be designed in different ways and be arranged in various positions. The adjusting element can for instance be designed as a traditional spindle drive, a piston/cylinder assembly or a chain drive. As the adjusting element no longer needs to be arranged in the middle for the purpose of a symmetrical loading of the plate, the upper bridge hitherto needed with single-spindle products can be dispensed with.

[0022] The gear racks or chains can be formed in different ways, which depends *inter alia* on the path of movement which the aligning shaft traverses along the gear racks or chains. When the plate is, for instance, a pivoting plate capable of hinging about an axis, as described for instance in EP-A 1 188 863 in which a tilting weir gate is described, the aligning shaft can for instance be connected with the pivoting plate adjacent the free upper edge of the pivoting plate, and the gear racks can be circular segment-shaped gear racks or chains connected with the frame. It is also possible, however, that the pivoting plate is provided, adjacent the sides, with circular segment-shaped sidepieces on which a toothing is provided, and that on the wall against which the tilting weir gate is mounted or in the box in which the tilting weir gate is mounted or in the upper bridge of the frame of the tilting weir gate, an aligning shaft with gear wheels is mounted, with the gear wheels engaging the toothing of the circular segment-shaped sidepieces. It will be clear that in such a variant, instead of a toothing, also a fixed chain can be provided on the circular segments, or a hole track or transverse pin track which is suitable for cooperation with a pin wheel.

Claims

1. An apparatus for controlling and/or closing a pas-

sage (6) in a watercourse, such as, for instance, a ditch, canal, conduit or pipe, which apparatus is provided with a plate (5) and a frame (2), wherein the plate (5) and the frame (2) are directly or indirectly connected with an adjusting element (16, 26) which is drivable by a drive, for the purpose of adjusting the position of the plate (5) relative to the frame (2), **characterized in that** the apparatus is provided with at least one adjusting element (16, 26) and with an aligning shaft (18), which aligning shaft (18) is provided with two gear wheels (15), the distance between the gear wheels (15) substantially corresponding to the width of the plate (5), wherein further gear racks or chains (12) are provided, which the gear wheels (15) engage, wherein the aligning shaft (18) and the gear racks or chains (12) are coupled to the frame (2) and the plate (5), such that a displacement of the plate (5) on the right-hand side of the plate (5) results in a corresponding displacement of the left-hand side of the plate (5) and vice versa.

2. An apparatus according to claim 1, wherein the plate (5) is provided with the gear racks or chains (12), while the frame (2) is provided with the aligning shaft (18) with the gear wheels (15), said gear racks or chains (12) preferably extending substantially along-side or near sides of the plate (5).
3. An apparatus according to claim 1, wherein the frame (2) is provided with the gear racks or chains (12), while the plate (5) is provided with the aligning shaft (18) with the gear wheels (15).
4. An apparatus according to any one of the preceding claims, wherein the aligning shaft (18) extends substantially under said passage (6), in a lower part (3) of the frame (2).
5. An apparatus according to any one of the preceding claims, wherein the aligning shaft (18) extends substantially perpendicularly relative to the gear racks (12).
6. An apparatus according to any one of the preceding claims, wherein the passage (6) is unbounded in upward direction in the clearing position of the plate (5), while the adjusting element (16, 26) is situated substantially outside the passage (6).
7. An apparatus according to any one of the preceding claims, wherein the adjusting element (16, 26) comprises just one spindle drive (16, 26), which spindle drive (16, 26) preferably extends along a said side part (4) of the frame (2).
8. An apparatus according to any one of the preceding claims, provided with guide means (7, 8) to guide the plate (5) between said clearing position and clos-

ing position, at least during operation of said adjusting element (16), wherein the guide means (7, 8) are arranged to guide the plate (5) such that each gear wheel (15) and each associated gear rack or chain (12) engage each other.

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9. An apparatus according to claim 8, wherein said guide means comprise first guide profiles (7) of said frame (2) and second guide profiles (8) of said plate (5), the first guide profiles being provided with parallel guide slots (7a), and the second guide profiles (8) being provided with guide flanges (8a) extending into the guide slots (7a) of the first guide profiles (7).
10. An apparatus according to any one of the preceding claims, wherein said adjusting element (16) engages the plate (5) directly.

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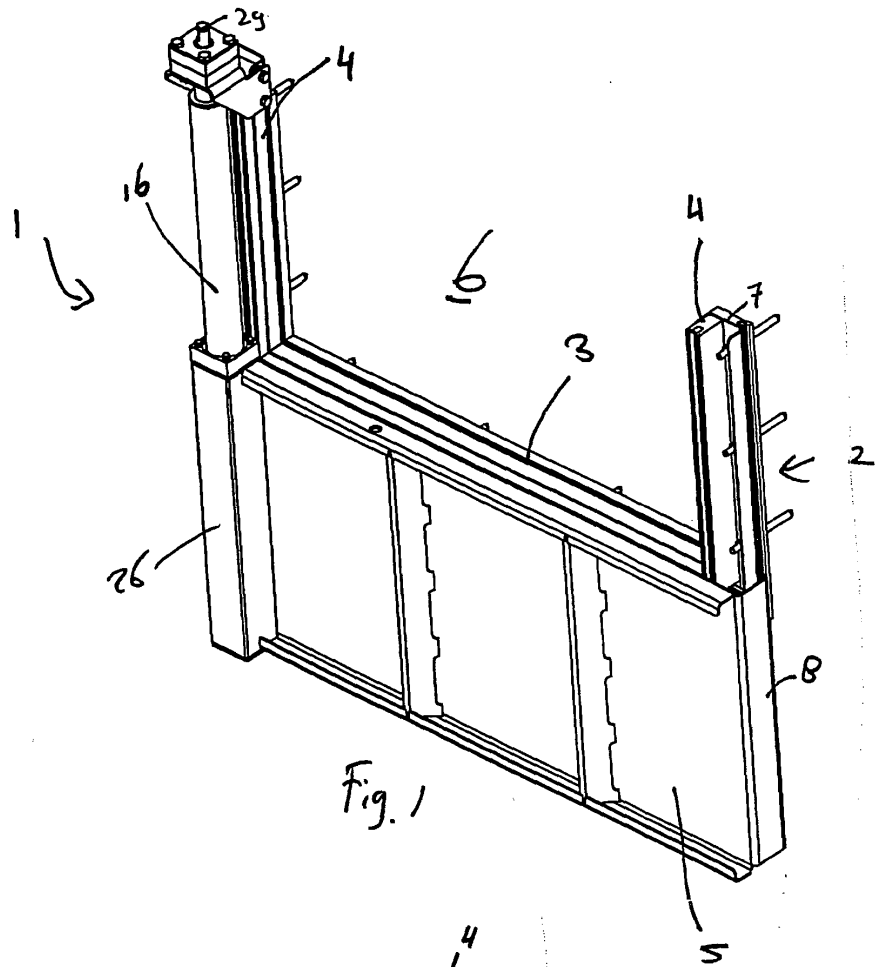


Fig. 1

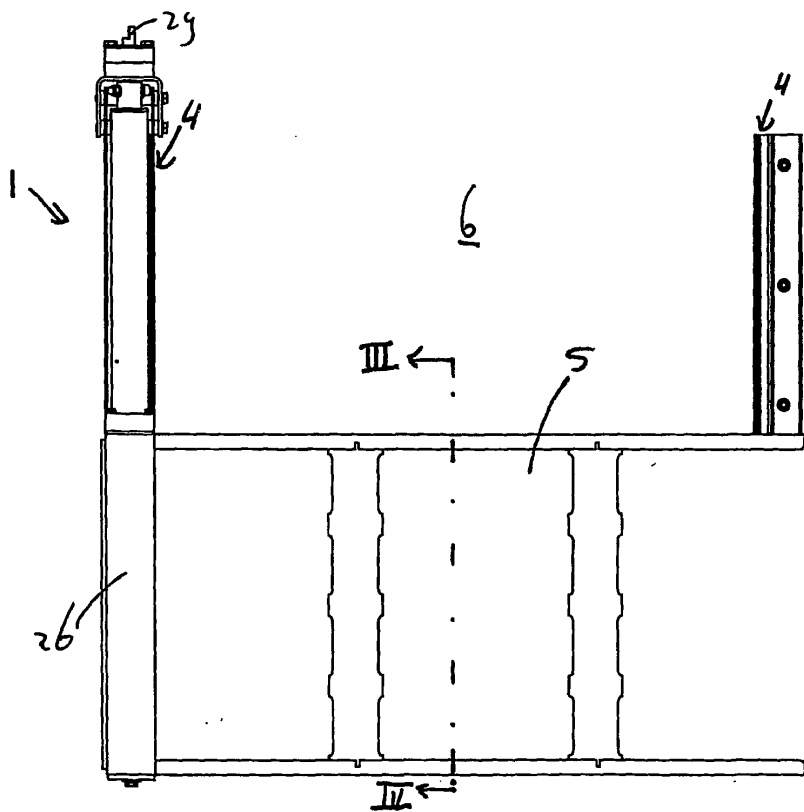


Fig. 2

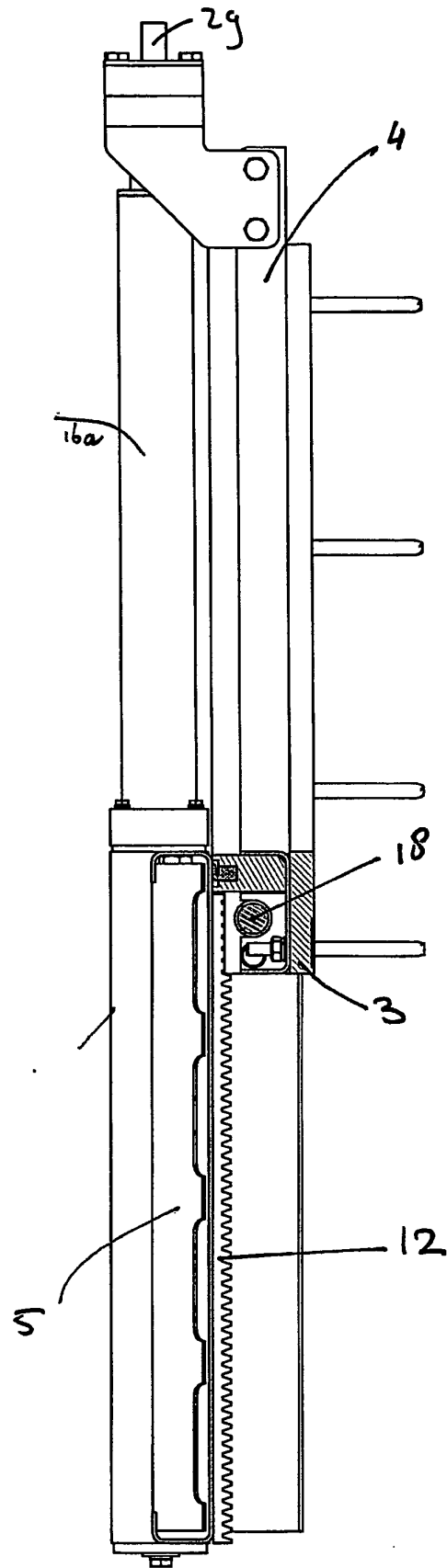
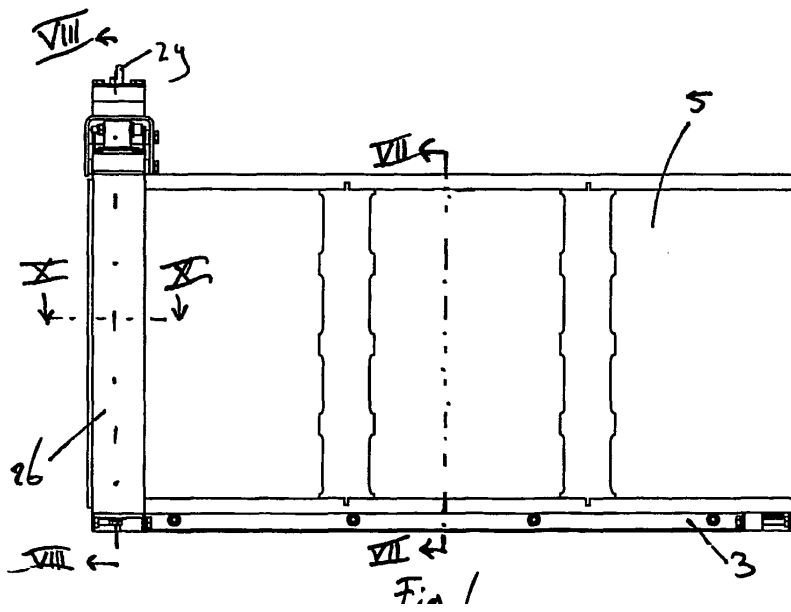
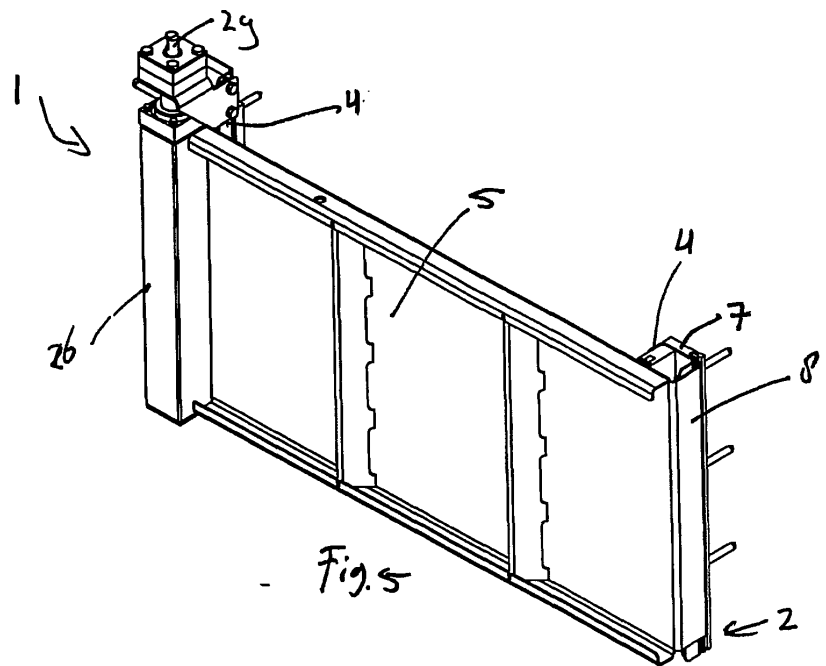
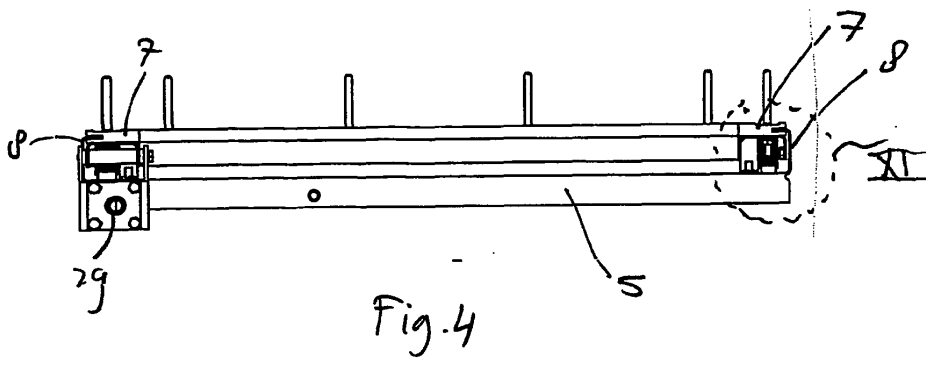
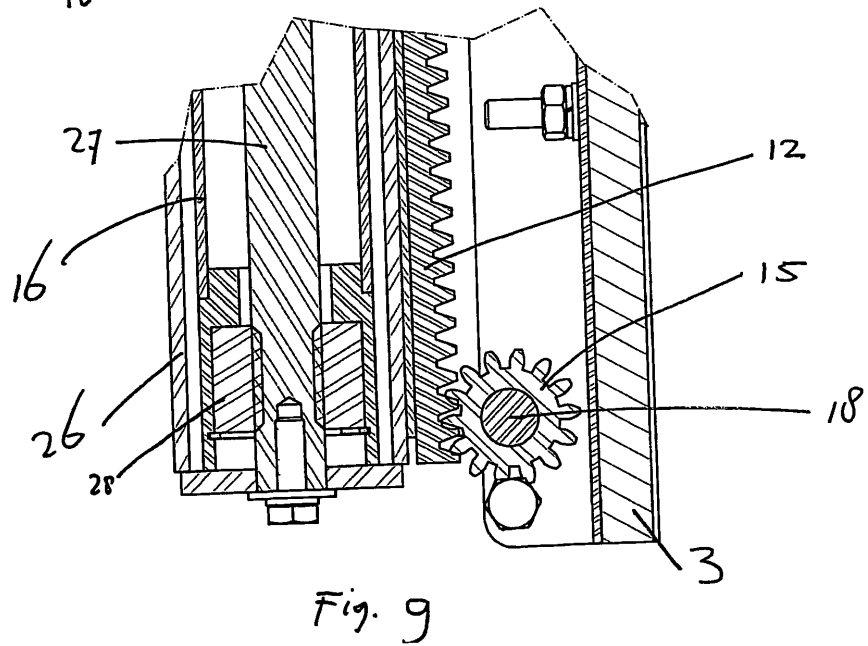
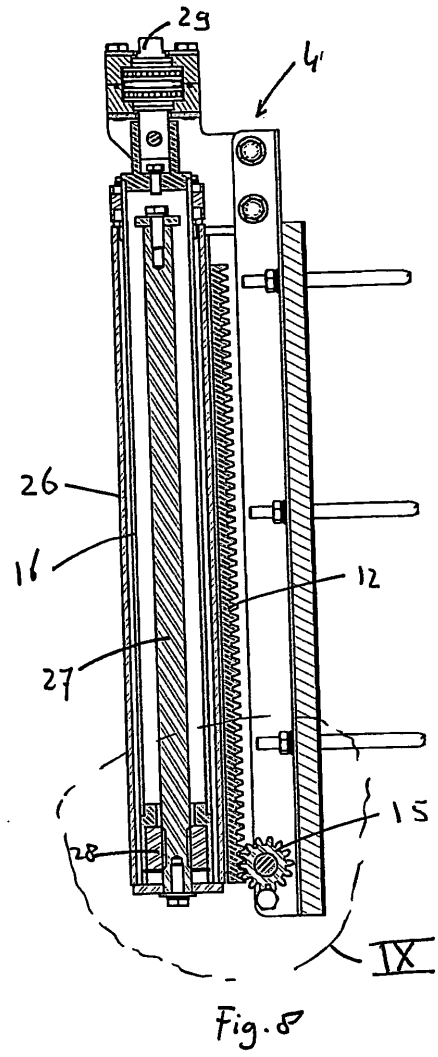
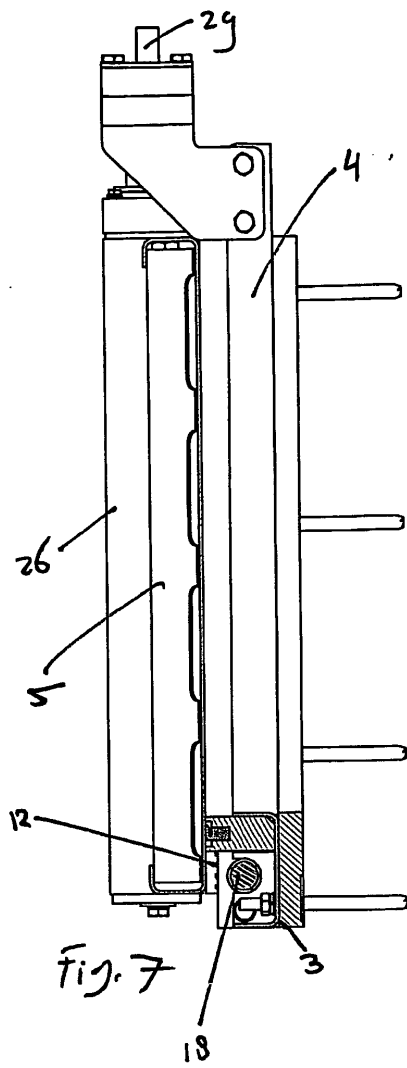


Fig. 3





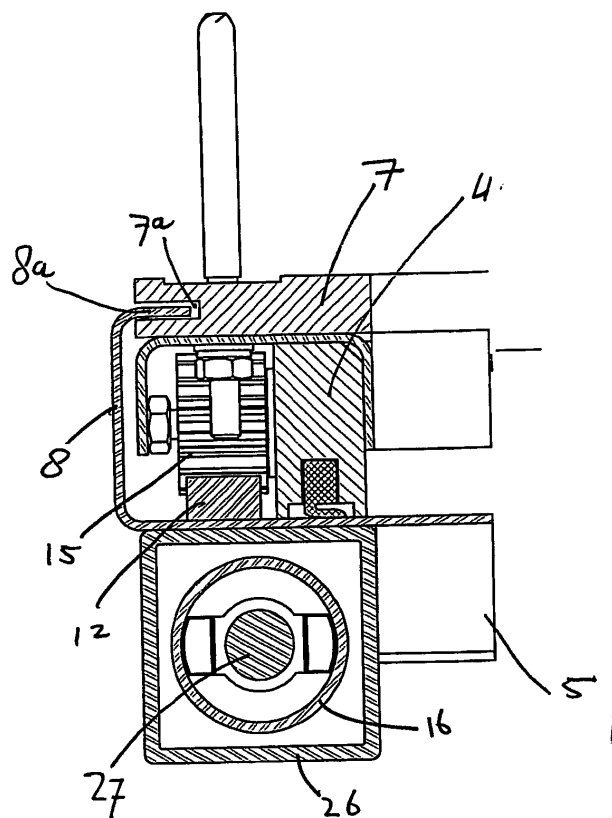


Fig. 10

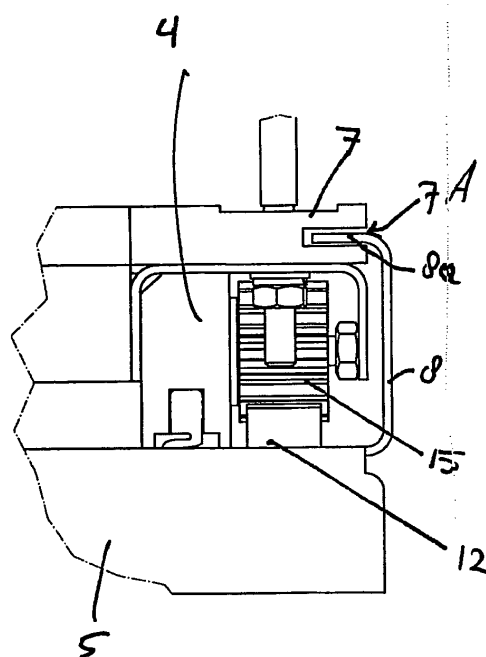


Fig. 11



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 04 07 7295

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 12 January 2005	Examiner Isailovski, M
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EPO FORM 1503 03/82 (P04/C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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