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(54) Apparatus for controlling the water level in a ditch canal, river or the like

(57) Apparatus for controlling the water level in a ditch, canal, river or the like, the apparatus being provided with a box comprising a bottom wall and two side walls, while in the box a weirgate flap is mounted, connected to the box so as to be pivotable about a hinge, the apparatus being provided with an adjusting mechanism destined for adjusting the flap in different pivotal positions for controlling the water level, the adjusting mechanism comprising at least one flexible element, a first free end of the flexible element being connected to the flap, preferably near the upper edge of the flap, the flexible element being guided over a driving element, and the flexible element extending in a first groove provided in or on a side wall of the box.

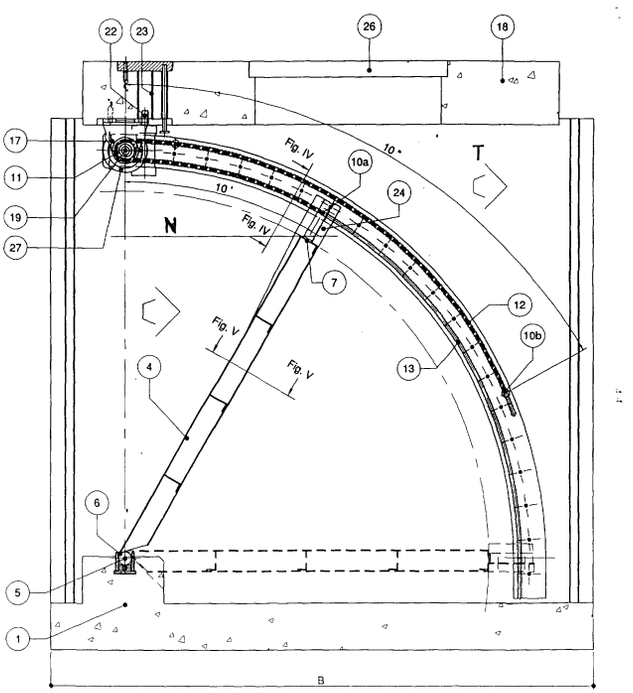

Fig. 2

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Description

[0001] The invention relates to an apparatus for controlling the water level in a ditch, canal, open canal, river or the like, the apparatus being provided with a box comprising a bottom wall and two side walls, while in the box a weir gate flap is connected to the box so as to be pivotable about a hinge, the hinge being located near the bottom of the box, the flap being provided with a lower edge and two side edges contiguous to the bottom wall and the side walls of the box, respectively, such that they form a substantially water-tight closure, the apparatus being provided with an adjusting mechanism which is intended for adjusting the flap in different pivotal positions for controlling the water level.

[0002] Such an apparatus is known from practice. Here, the adjusting mechanism is formed by a toothed rack, hinged to an upper edge of the flap. The toothed rack is driven with the aid of a gear wheel mounted on a cross beam located on the two side walls of the box. A first drawback of this known apparatus is the lack of safety. The toothed rack and the cooperating gear wheel are freely accessible to the person adjusting the flap, and therefore the danger exists that the operator of the apparatus gets a piece of clothing or a body part caught between the toothed rack and the gear wheel and thus gets injured. This is particularly undesirable when the apparatuses are situated in the middle of the countryside and hence no help is at hand for releasing the flap operator from his awkward position and giving the necessary first aid. Sometimes, the known apparatuses are remotely controllable. Then, the danger exists that a third person, not reckoning with the possibility that the adjusting mechanism comes into operation unexpectedly, is injured by the adjusting mechanism or gets caught in it. A second drawback of the fact that the adjusting mechanism is freely accessible is that it is susceptible to vandalism. Landholders are often not at all happy with the regulation or control of the water level in ditches, open canals, canals and rivers as carried out by the district water boards. Indeed, the interests of the district water board quite often do not coincide with the interests of the local landholder. In consequence, in practice, it regularly occurs that a landholder personally adjusts the flap or vandalizes the toothed rack, so that the flap is no longer adjustable. As the toothed rack is freely accessible, vandalizing it is no complicated task. A third disadvantageous aspect of the known apparatus is formed by the fact that the toothed rack projects relatively far above the ground level. Under the current environmental regulations, such projecting objects are considered to be destructive to the landscape.

[0003] The invention contemplates an apparatus without the drawbacks described hereinabove.

[0004] To that end, according to the invention, the apparatus of the type mentioned in the preamble is characterized in that the adjusting mechanism comprises at least one flexible element, a first free end of the flexible element being connected to the flap, preferably near an upper edge of the flap, the flexible element being guided over a driving element, while a first part of the flexible element, formed by the part of the flexible element from the first free end to the driving element, extends in a first groove which is provided in or on a side wall of the box.

[0005] Such an apparatus offers the advantage that the toothed rack and the gear wheel cooperating with that toothed rack are eliminated and that all parts of the adjusting mechanism are brought outside the reach of unauthorized persons as much as possible. In fact, the or each flexible element passes in the first groove in or on a side wall of the box and is thus brought outside the direct reach of an unauthorized person. Preferably, also the or each driving element is received in a chamber in the side wall of the box, so that that part as well has been brought outside the reach of unauthorized persons as much as possible. As a result, the risk of the adjusting mechanism being destroyed by vandals is minimized and, moreover, the safety of the apparatus has been considerably increased as the adjusting mechanism is virtually no longer accessible. Further, no parts project above ground level, so that the problem of destruction of the landscape is solved as well. Still another advantage of the apparatus according to the invention is that substantially the entire upper edge of the flap remains free of parts. As a result, the passage of the apparatus according to the invention is optimally utilized. In the known apparatus, the toothed racks are connected with the upper edge of the flap. Often, straw, duckweed, reeds and such plant material gets stuck behind these toothed racks, so that, in time, the passage opening of the apparatus is considerably reduced. With the aid of the apparatus according to the invention, this problem is also eliminated.

[0006] It will be clear that preferably in each side wall of the box, a flexible element is included and extends there in a first groove.

[0007] The flexible element can be formed, for instance, by a chain, more in particular a sprocket chain of the bicycle chain type or a link chain of the ship anchor type, the driving element in that case comprising a chain wheel or a pocketed wheel.

[0008] According to an alternative further elaboration of the invention, it is also possible that the flexible element be designed as a cable. In that case, the driving element will preferably be designed as a reel on which the cable is wound or moved. With a chain, at least with a sprocket chain of the bicycle chain type, winding the chain on a reel is not recommendable. Hence, according to a further elaboration of the invention, the apparatus can be characterized in that a second part of the or each flexible element, formed by the part of the flexible element from a second end to the driving element, extends in a second groove arranged in or on the side wall of the box. When pulling the flap up with the aid of the chain, the second part of the chain is then gradually pushed into the second groove. It is noted that a sprocket chain

of the bicycle chain type, also called roller chain, is hardly compressible, so that, when lowering the flap, also a pressure force can be exerted on the flap with it.

[0009] In an alternative embodiment, the flexible element can be connected by a first end to the upstream side of the flap and the other end with the downstream side of the flap, while the flexible element is guided over a driving wheel and a return wheel. In that manner, it is possible that both when pulling up and when lowering the flap, a tensile force is exerted on the flap. It is self-evident that, to that end, also two separate flexible elements can be used, of which the first is connected by one end to the upstream side of the flap and by the other end to a driving element, while the second is connected by one end to the downstream side of the flap and by the other end to a driving element. These solutions can of course be carried out twofold, i.e. that in or near each side wall of the box such a construction is provided.

[0010] Further elaborations of the invention are described in the subclaims and will be further elucidated hereinafter on the basis of an exemplary embodiment with reference to the drawing.

Fig. 1 shows a top plan view of an apparatus according to the invention;

Fig. 2 shows a cross section along the line II-II of Fig. 1;

Fig. 3 shows a detail of the manner in which the flap is hinged to the bottom of the box;

Fig. 4 shows a detail of the manner in which the connection between the flap and the flexible element has been brought about;

Fig. 5 shows a detail of the sealing of a side edge of the flap against a side wall of the box.

[0011] Firstly, the device will be broadly clarified with reference to Figs. 1 and 2. The ditch, the open canal, the canal, the river or the like extends in the direction T, represented in Fig. 1 with an arrow, which arrow also represents the flow direction of the water. The exemplary embodiment shown is provided with a box comprising a bottom wall 1, two side walls 2, 3 and a lid 18. In the present exemplary embodiment, these parts are manufactured from concrete. Mostly, the side walls abut against the bank of the ditch, so that the water in the ditch can only pass the apparatus between the side walls 2, 3. Between these side walls 2, 3 extends the flap 4, which is pivotable about a hinge 5. The hinge 5 is connected to the bottom 1 or a threshold on the bottom 1 of the box. The side edges 8, 9 and the lower edge 6 and/or the hinge 5 of the flap 4 abut the respective side walls 2, 3 and the bottom wall 1 of the box, such that they substantially form a water tight closure. As a result, by setting the pivotal angle of the flap 4, a particular water level on the upstream side of the apparatus can be effected. This water level is represented with the line N in Fig. 2. It is self-evident that the water level N is determined by the position of the upper edge 7 of the flap 4. The flap 4 can also be used as a closure or for regulating the level in the low reach. The adjusting mechanism for adjusting the angular position of the flap 4 comprises two flexible elements 10. The flexible elements 10, in the present exemplary embodiment designed as chains of the bicycle chain type, are connected by a first free end 10a to the flap 4, more specifically near the two side edges 8, 9 and the upper edge 7 of the flap 4. In fact, the free end 10a of the flexible elements 10 is connected to a cross beam 24 which is connected to the upper edge 7 of the flap 4. In the present exemplary embodiment, in each side wall 2, 3, such a flexible element 10 is included in a groove 12, 13. The flexible element 10 is guided over a driving element 11, which, in the present exemplary embodiment, is formed by a gear wheel. Each side wall 2, 3 is provided with a chamber 17 in which a driving element 11 as mentioned is accommodated. As a result, the driving elements 11 are difficult to access for unauthorized persons. A first part 10' of the flexible element 10, which first part is formed by the part of the flexible element 10 from the first free end 10a to the driving element 11, extends in a first groove 13, provided in a side wall 2, 3 of the box. The first groove 13 is circular segmental, the center of the segment coinciding with the axis of the hinge 5 of the flap 4. A second part 10" of the flexible elements 10, which second part is formed by the part of the flexible element extending from the driving element 11 to the second free end 10b, extends in a second groove 12 which is also provided in the side wall 2, 3 of the box. In Fig. 2, when pulling up the flap, the chain wheel 11 rotates clockwise and thus shortens the first part 10', while, simultaneously, the second part 10" is lengthened. In that manner, essentially the chain 10 is pushed from the first groove 13 into the second groove 12 while taking along the flap 4.

[0012] Although in the present exemplary embodiment a flexible element 10 in the form of a chain of the bicycle chain type is involved, it is also possible that the flexible element 10 is formed by a cable, a link chain or the like. In those cases, if desired, the flexible element, instead of being pushed into the second groove 12, can also be wound on a reel. Such a reel can then also serve as a driving element. In that case, the second free end of the cable or link chain will be fixedly connected to the reel. Under those circumstances, the second groove 12 can of course be omitted. However, it is self-evident that also with such flexible elements, there is the possibility to use a second groove 12 in the side walls 2, 3. Then, only the design of the driving element 11 needs to be adjusted to the type of flexible element. Thus, with a cable, use should be made of a pulley with a high frictional coefficient, and, with a link chain, a chain wheel or pocketed wheel suitable for cooperation with a link chain. Such chain wheels are known per se.

[0013] Preferably, the or each first groove 13 and the or each optional second groove 12 are formed in a material with a low frictional coefficient, such as, for in-

stance, plastic. As is clearly visible in Fig. 4, in the concrete side wall 3 a plastic lining is incorporated, manufactured from a suitable plastic such as, for instance, HDPE (high density polyethene). Fig. 4 also clarifies the manner in which the free end 10a of the chain 10 is connected to the flap 4 via pin 25. Fig. 5 shows a cross-sectional view along line V-V of Fig. 2 adjacent the side wall 3. From this Figure, it is clear that with the side edge 9 of the flap 4, a sealing profile 15 is connected which has flexibility and which abuts the side wall 3 of the box. Thus, at that location, a substantially water tight closure is created. Such a watertight closure is also created near the hinge 5 of the flap 4, see Fig. 3. There, in the threshold on the bottom 1 of the box, a U-shaped mount 26 is cast-in, in which the hinge 5 is pivotally received. The hinge 5 rests on a flexible sealing profile 16, so that a substantially water tight closure is created there as well.

[0014] In the present exemplary embodiment, a cover plate 18 rests on the side walls 2, 3. In the cover plate 18, a grid 26 is received, so that the flap 4 can be inspected from above. Connected to the lower side of the cover plate 18 is a driving shaft 19 which, near the two side walls 2, 3 of the box, is provided with a worm wheel 20 (see Fig. 1). The worm wheel 20 cooperates with a worm shaft 21. The worm shaft 21 is provided with an engaging stub 22 (see Fig. 2) to be engaged with a handle, motor or such operating element. It is self-evident that to this end a driving motor can also be used which can optionally be integrated in the cover plate 18. The driving shaft 19 also carries, on the ends, the driving elements 11, in the present exemplary embodiment the chain wheels 11. The worm wheel 20 and the worm shaft 21 are accommodated in a housing 27 which also serves as a bearing for the driving shaft 19, which housing 27 is connected to the bottom side of the cover plate 18. The engaging stub 22 extends in a bore 23 which extends completely through the cover plate 18. Through this bore 23, the engaging stub 22 can be engaged with the aid of an operating element such as, for instance, a handle, for adjusting the flap 4.

[0015] It will be clear that the invention is not limited to the exemplary embodiment described, but that various modifications within the framework of the invention are possible. Thus, the box, instead of being manufactured from concrete, can also be manufactured from a different material and the flap, instead of being manufactured from stainless steel, can be manufactured from a different material.

Claims

1. An apparatus for controlling the water level in a ditch, canal, river or the like, the apparatus being provided with a box comprising a bottom wall (1) and two side walls (2, 3), while in the box a weirgate flap (4) is mounted which is connected to the box so as to be pivotable about a hinge (5), the hinge (5) being located near the bottom wall (1) of the box, the flap (4) being provided with a lower edge (6) and two side edges (8, 9) abutting the bottom wall (1) and the side walls (2, 3), respectively, of the box, such that they form a substantially water-tight closure, the apparatus being provided with an adjusting mechanism intended for adjusting the flap in different pivotal positions for controlling the water level, **characterized in that** the adjusting mechanism comprises at least one flexible element (10), a first free end (10a) of the flexible element (10) being connected to the flap (4), preferably near an upper edge (7) of the flap, the flexible element (10) being guided over a driving element (11), while a first part (10') of the flexible element (10), formed by the part of the flexible element (10) from the first free end (10a) to the driving element (11), extends in a first groove (13) provided in or on a side wall (2, 3) of the box.

2. An apparatus according to claim 1, **characterized in that** the adjusting mechanism is provided with two flexible elements, such a flexible element (10) extending in each side wall (2, 3) of the box in a said first groove (13).

3. An apparatus according to claim 1 or 2, **characterized in that** the or each first groove (13) is circular segmental, the imaginary center of the circular segmental groove coinciding with the central axis of the hinge (5).

4. An apparatus according to any one of the preceding claims, **characterized in that** a second part (10") of the or each flexible element (10), formed by the part of the flexible element (10) from a second free end (10b) to the driving element (11), extends in a second groove (12) provided in the side wall (2, 3) of the box.

5. An apparatus according to claims 1 - 3, **characterized in that** the or each flexible element, when the flap is being closed, is wound around the driving element.

6. An apparatus according to claim 5, **characterized in that** the or each driving element comprises a reel and the or each flexible element comprises a link chain or cable.

7. An apparatus according to claim 4, **characterized in that** the or each flexible element comprises a chain (10), while the or each driving element (11) comprises a chain wheel or pocketed wheel.

8. An apparatus according to any one of the preceding claims, **characterized in that** the or each first groove (13) and the or each possible second groove

(12) are formed in a material (14) with a low frictional coefficient, such as, for instance, plastic.

9. An apparatus according to any one of the preceding claims, **characterized in that** the side edges (8, 9) of the flap (4) are provided with flexible sealing profiles (15).

10. An apparatus according to any one of the preceding claims, **characterized in that** at the location of the lower edge (6) of the flap (4), the apparatus is provided with a flexible sealing profile (16).

11. An apparatus according to any one of the preceding claims, **characterized in that** the or each driving element (11) is received in a chamber (17) in a side wall (2, 3) of the box.

12. An apparatus according to any one of the preceding claims, **characterized in that** the box is provided with a cover plate (18).

13. An apparatus according to any one of the preceding claims, **characterized in that** the or each driving element (11) is mounted on a joint driving shaft (19), which further has mounted thereon a worm wheel (20) which cooperates with a worm shaft (21), which worm shaft (21) is provided with an engaging stub (22) for engagement with a handle or like operating element.

14. An apparatus according to claims 12 and 13, **characterized in that** the driving shaft (19) extends under the cover plate (18), while the worm wheel (20) and the worm shaft (21) are located under the cover plate (18), and in the cover plate (18) a bore (23) is provided which gives access to the engaging stub (22).

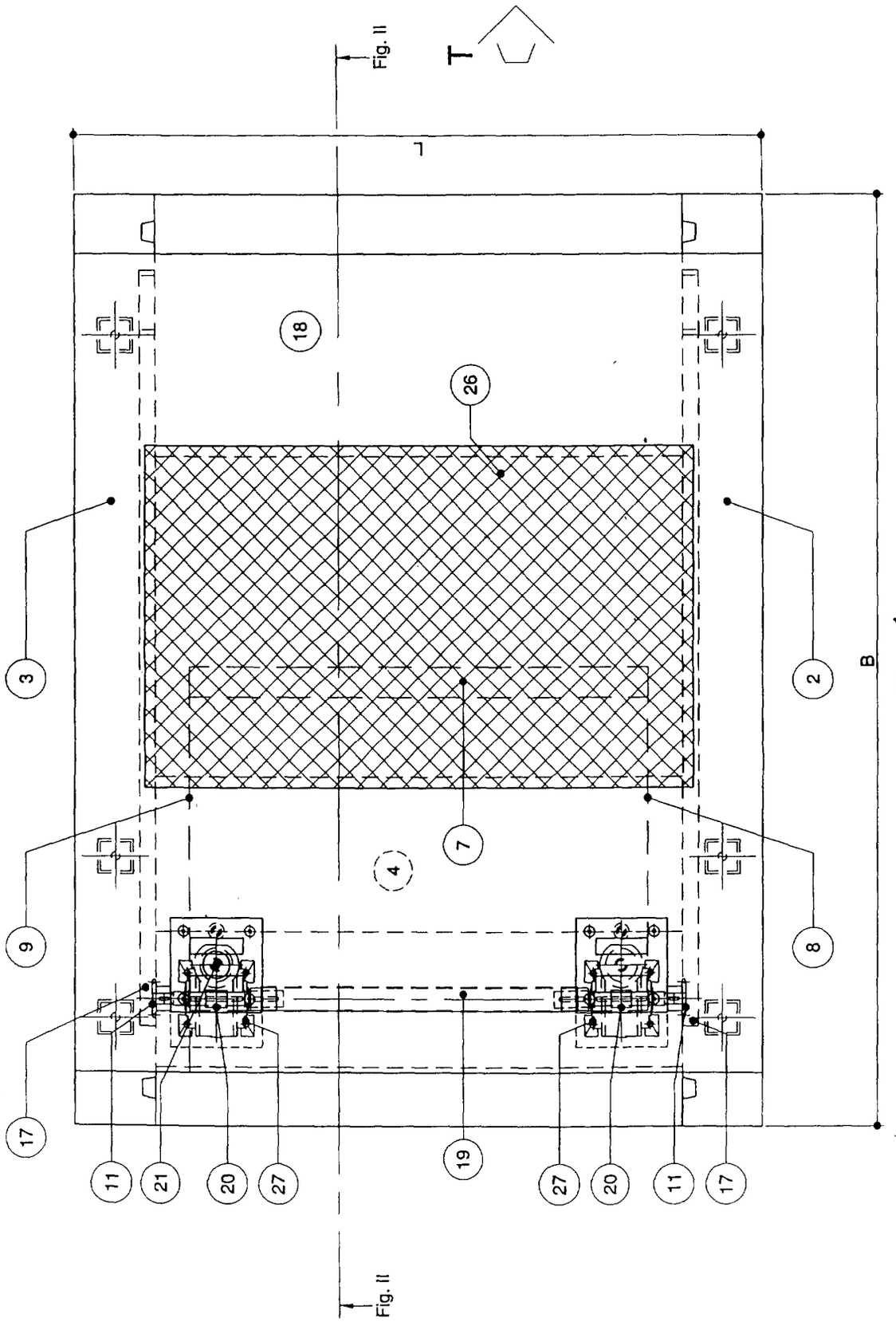

Fig. 1

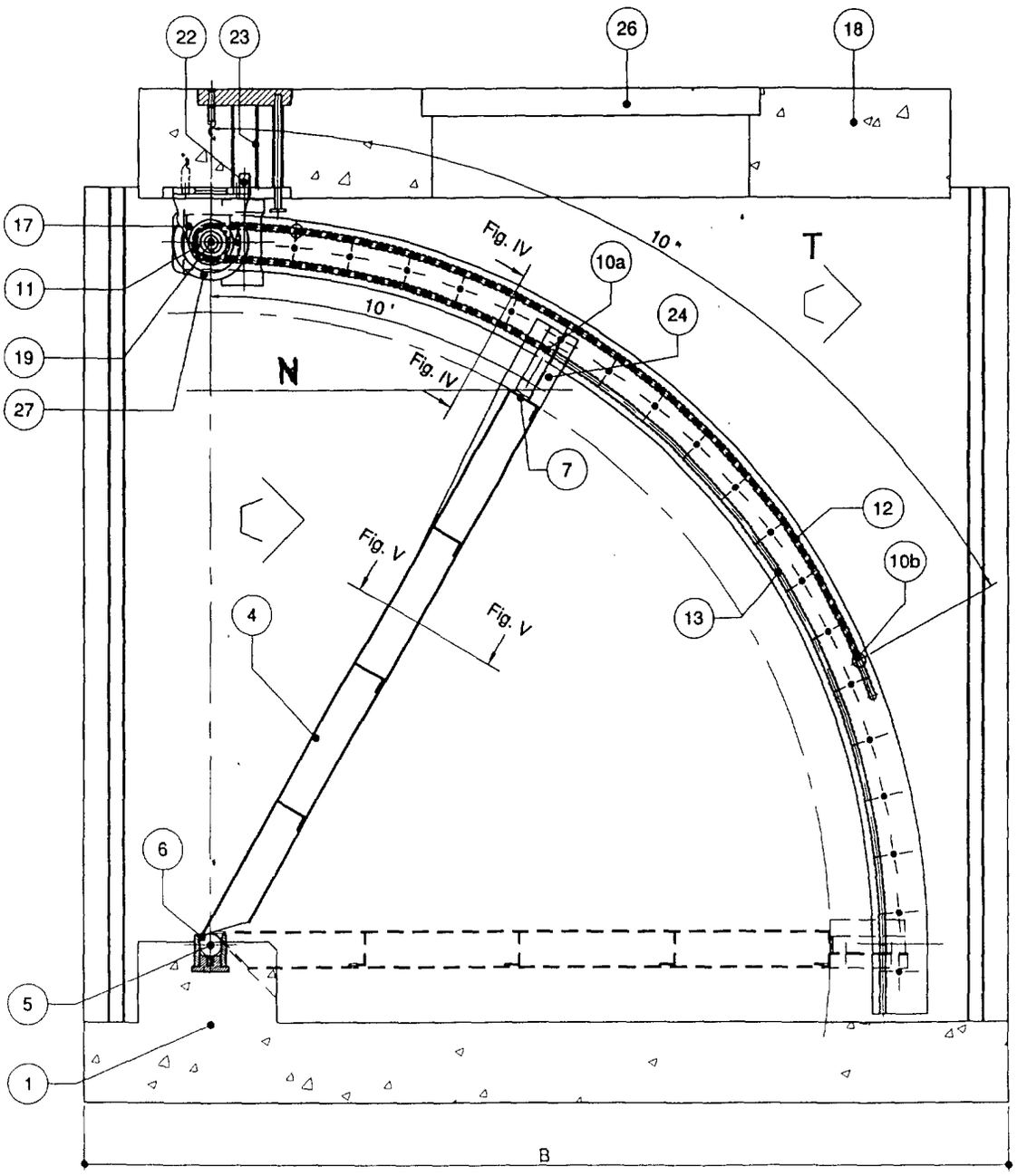
22
23
26
18
17
11
19
27
Fig. IV
10a
10'
24
N
Fig. IV
7
12
10b
Fig. V
Fig. V
4
13
6
5
1
B

Fig. 2

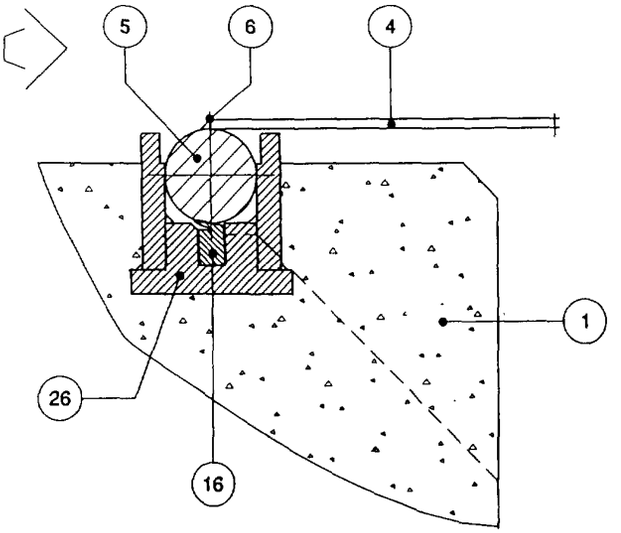

Fig. 3

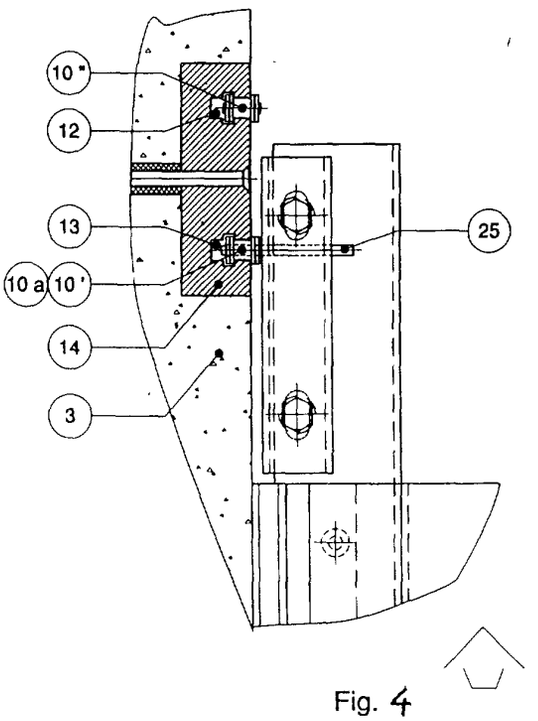

Fig. 4

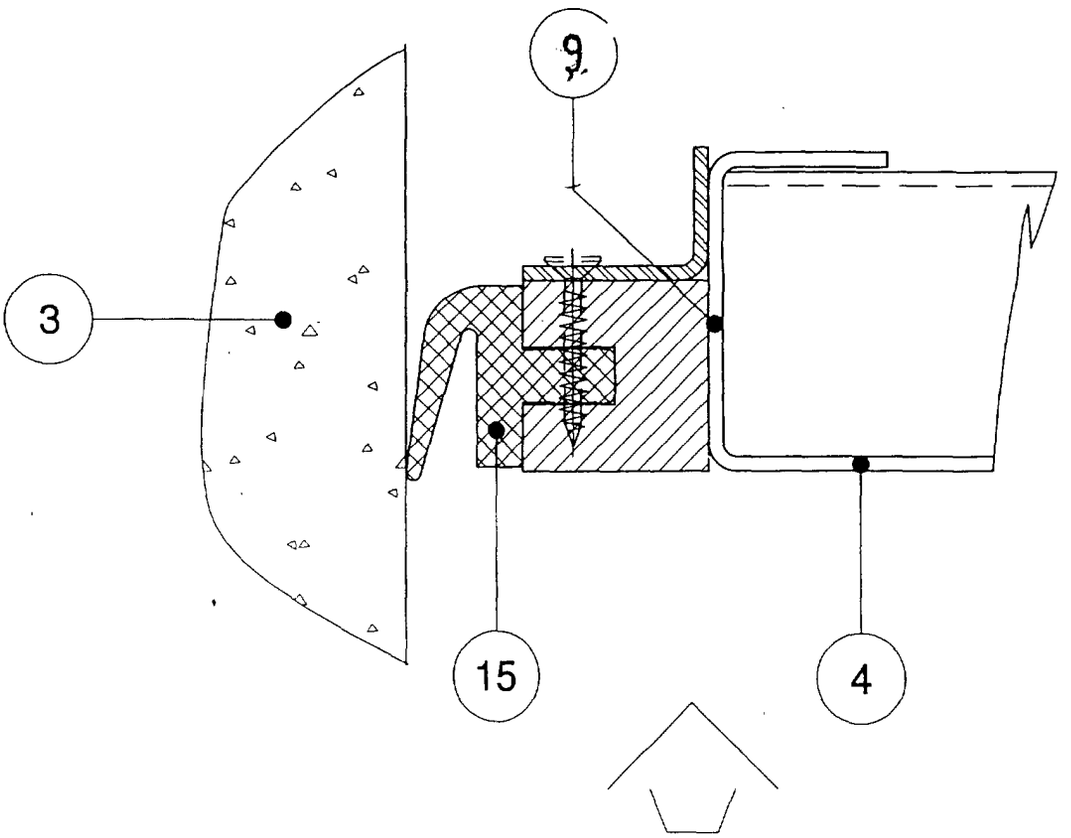

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 01 20 3491

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	CH 119 408 A (JONNERET FILS AINE) 1 August 1927 (1927-08-01) * column 2, line 1 - column 4, line 14 * * figures *	1,2,6-8, 13	E02B7/44
A	US 4 549 837 A (HEBERT CAMILE J) 29 October 1985 (1985-10-29) * column 6, line 33 - line 45 * * column 7, line 33 - line 68 * * figures 1,3-5 *	1,3,8-10	
A	CH 188 255 A (LUTZ ALOIS VIKTOR) 31 December 1936 (1936-12-31) * column 3, line 3 - line 31 * * figures 1,2 *	11	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

E02B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10 December 2001	Urbahn, S

CATEGORY OF CITED DOCUMENTS

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10-12-2001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US 4549837 A	29-10-1985	NONE	
CH 188255 A	31-12-1936	NONE	

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