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(72) Inventor: **Van Den Bergh, Luc Herman**
9120 Beveren-Waas (BE)

(74) Representative: **Donné, Eddy**
Bureau M.F.J. Bockstael nv
Arenbergstraat 13
2000 Antwerpen (BE)

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(71) Applicant: **Lumet, Naanloze Vennootschap**
9130 Beveren-Verrebroek (BE)

(54) **Device for cleaning a grate**

(57) Device for cleaning a grate (1) of the type formed by upwardly directed, parallel bars (3) provided at regular mutual interspaces, whereby such grate (1) is installed transversely in the current of a waterway or such, in order to retain pollutions, characterized in that

the device consists of a cleaning machine (7) which is equipped with a lifting basket (10) with an open wall portion (13), whereby the cleaning machine (7) is configured such that the lifting basket (10) can be moved at least over the entire height of the grate (1) along this grate (1).

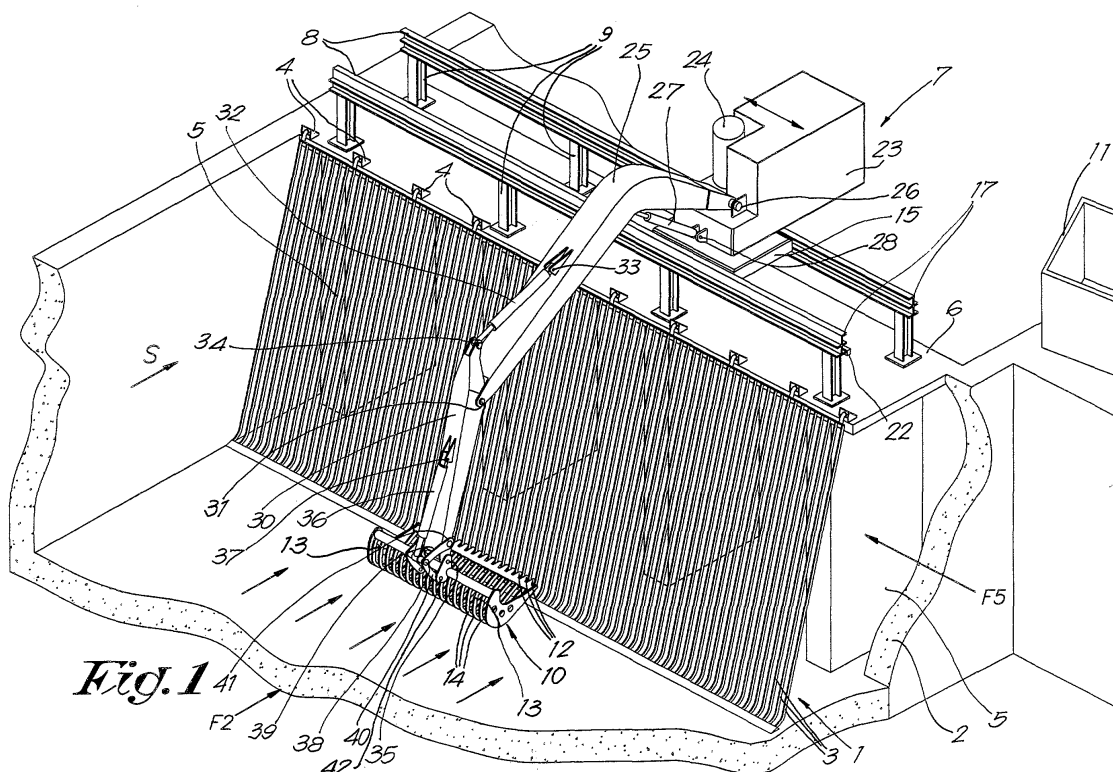


Fig. 1

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Description

[0001] The invention relates to a device for cleaning a grate.

[0002] More particularly, the invention is intended for cleaning a grate of the type which is installed transversely in the current of a creek, a river, a channel or such in order to retain waste which is carried along by the current, for example, in order to be able to remove it more easily for discharge and further treatment, or also in order to protect a downstream-situated pump installation against pollution and the like.

[0003] It is known that up to the present, for removing waste which has stacked up against such grate, use is made of machines which are equipped with a gripper, with which each time a certain amount of waste can be lifted from the water in order to be deposited in a container.

[0004] A disadvantage of such technique is that the gripper which is in the water, can not always be seen by the operator of the machine and that consequently the result of the operation is somewhat insufficient, in particular at the lower end of the grate, where often quite a lot of waste will remain after cleaning. Nor is it possible to remove with such gripper the dirt which has stacked up between the bars of the grate.

[0005] Another disadvantage is that such machines having a gripper are rather complex and expensive and that mostly, an operator is required to perform the work, as a result of which a grate cleaning action is not only little effective, but moreover also rather expensive.

[0006] Another known technique for removing the waste is that an endless chain or belt is used which is provided at its exterior with several hingeably provided shovels, whereby this belt is installed parallel to the grate, with a portion protruding into the water and another portion extending up to above a container or conveyor belt installed behind the grate, in such a manner that the shovels scrape along the grate and carry the waste along upward, where it drops into the container or onto the conveyor belt.

[0007] With this known technique, too, the result is not optimum and, moreover, the device applied is very damage-sensitive, as a result of which it is little operationally reliable and also requires a lot of maintenance, as a consequence of which the utilization costs can become high.

[0008] Moreover, another disadvantage of this known technique is that cleaning never is performed up to the bottom side of the grate.

[0009] The present invention aims at offering a remedy for the aforementioned and other disadvantages.

[0010] To this aim, the invention consists of a device for cleaning a grate of the type formed by upwardly directed, parallel, whether or not detachable bars which are provided at regular mutual interspaces, whereby such grate is installed transversely in the current of a waterway or such, in order to retain dirt, whereby the

device consists of a cleaning machine which is equipped with a lifting basket with an open wall portion and whereby the cleaning machine is configured such that the lifting basket can be moved at least over the entire height of the grate along this grate, as a result of which the dirt is caught between the grate and the lifting basket.

[0011] Preferably, the lifting basket will be provided with teeth which can be brought between said bars, such that waste which has accumulated between the bars, also is removed and the grate consequently is cleaned in an efficient manner.

[0012] In a preferred form of embodiment, the cleaning machine will be movably provided on rails extending parallel to the grate, as a result of which the cost price of the cleaning machine can be reduced, in consideration of the fact that in that case, no control device is necessary, and whereby one and the same machine can clean grates over an unlimited length.

[0013] When, moreover, the wheels of the cleaning machine are seated in a guide provided on the rails, the cleaning machine always can work under safe conditions, without any risk of derailing.

[0014] In the most preferred form of embodiment, the cleaning machine will be completely automatized and, to this end, will be equipped with hydraulic drive means for the movements, whereby these driving means are connected to separate control valves, which, whether or not directly, are controlled by means of a common computer.

[0015] This offers the advantage that the cleaning can be performed in a completely automatic manner, without the intermediary of an operator, and that the cleaning machine can be programmed such that the lifting basket, during cleaning, serves the entire surface of the grate, even on the non-visible locations up to the lower edge of the grate.

[0016] Another advantage thereof is that the cleaning machine can be made less expensive, considering that neither a driver's cabin nor operating elements for an operator must be provided.

[0017] Such cleaning machine can be radio-controlled from a distance.

[0018] With the intention of better showing the characteristics of the invention, hereafter, as an example without any limitative character, a preferred form of embodiment of a device according to the invention for cleaning a grate is described, with reference to the accompanying drawings, wherein:

figure 1 schematically and in perspective represents a device according to the invention;
figure 2 represents a view according to arrow F2 in figure 1;
figure 3 represents a view similar to that of figure 2, however, for another position;
figure 4 represents a top view of figure 2;
figure 5 represents a view according to arrow F5 in figure 1;

figure 6 represents a view as in figure 5, however, for another position;

figure 7 represents a simplified hydraulic scheme of the control of a device according to the invention.

[0019] In the figures, an inclined upward-standing grate 1 is represented, which is placed transverse to the current S in a U-shaped portion, which in this application is formed of concrete, of a channel 2 or such, whereby said grate 1 extends over the entire width of the channel 2 in order to retain the dirt carried along by the current S.

[0020] It is clear that such grate 1, to the same end and with the same result, can be provided in any other waterway, whether of natural origin or not.

[0021] The grate 1 is formed of parallel, upwardly directed bars 3 situated at regular mutual interspaces and rests with its lower edge on the bottom of the channel 2, whereas with the upper edge, which normally protrudes above the water level, it is anchored in points 4 in a construction formed by pillars 5, upon which a horizontal plate 6 is resting.

[0022] On the aforementioned plate 6, a device according to the invention is provided which, in first instance, consists of a cleaning machine 7, the construction of which is almost analogous to that of a classical hydraulic digger, such as it is used in civil engineering; however, which, according to the invention, is adapted in order to work fully automatic and to move on rails 8, parallel to the longitudinal direction of the grate 1.

[0023] The rails 8 are provided downstream from the grate 1 on the location 6 by means of supports 9 and are situated on a level which is situated above the upper edge of the grate 1.

[0024] The cleaning machine 7 is equipped with a lifting basket 10, with which the dirt which has accumulated against the grate 1, can be scooped out of the water, and which subsequently can be deposited in a waste container 11 situated adjacent to the device on the embankment.

[0025] The lifting basket 10 is provided with teeth 12, the interspaces of which are chosen such that those teeth can be brought between said bars 3 of the grate 1.

[0026] Preferably, the teeth 12 will be situated at equal mutual interspaces, and such that the core distance between two adjacent teeth 12 is equal to the core distance between two adjacent bars 3.

[0027] The dimensions and the interspaces of the teeth 12 may vary in function of the shape of the bars 3 and the interspaces between these bars 3.

[0028] The device can be provided with several exchangeable lifting baskets 10 which may mutually vary in respect to dimensions, content and type of teeth 12.

[0029] The lifting basket 10 has an open wall portion 13 which is formed by parallel bars 14 which are situated at a certain distance from each other, such that the water easily can flow out of the lifting basket 10 and, consequently, only the dirt is scooped up.

[0030] In this case, the cleaning machine 7 comprises

a carriage 15 which, at opposite sides, is provided with freely rotatable wheels 16 which are guided in a U-shaped portion 17 of the rails 8.

[0031] With a singlefold grate, such carriage (15), of course, will not be necessary.

[0032] The carriage 15 is provided with drive means in the form of an hydraulic motor 20 which is attached at the bottom of the carriage 15 and which is provided with a gearwheel 21 which engages into a toothed rack 22 which is provided under one of said rails 8 over its entire length.

[0033] On the carriage 15 of the cleaning machine 7, a base 23 is rotatably provided which is provided with drive means in the form of a hydraulic motor 24 and a gearwheel transmission coupled thereto and not represented in the figures, between this hydraulic motor 24 and the carriage 15.

[0034] On the base 23, an arm 25 is provided pivotably around a horizontal axis 26. Between the base 23 and the arm 25, drive means are provided in the form of a jack 27 which, at each extremity, is hingeably connected to the base 23, on one hand, and the arm 25, on the other hand, by means of an axis 28, 29, respectively.

[0035] At the other extremity of the arm 25, a second arm 30 is hingeably provided around a horizontal axis 31 which is bearing-mounted between the extremities of this arm 30. The arm 30 is provided with drive means in the form of a jack 32, which is provided between the top side of the arm 25 and one extremity of the arm 30, whereby this jack 32, at each extremity, is hingeable on an axis 33, 34, respectively.

[0036] At the other extremity of the arm 30, said lifting basket 10 is hingeably provided around an axis 35.

[0037] The lifting basket 10 is controlled by drive means in the form of a jack 36, which, with one extremity, is hingeably attached to an axis 37 at the top side of the arm 30 and which, with its other extremity, by means of an axis 38, is hingeably connected to a lever mechanism consisting of two pairs of rods, 39 and 40, respectively, whereby each of these aforementioned rods is provided with one extremity on the aforementioned axis 38.

[0038] With their other extremity, the rods 39 are provided on a common axis 41 provided through the arm 30, whereas the rods 40, with their other extremity, are hingeably connected to the wall portion 13 of the lifting basket 10, by means of an axis 42.

[0039] It is clear that, by controlling the aforementioned drive means, more particularly, the hydraulic motors 20 and 24, which respectively provide for the movement of the cleaning machine 7 along the rails 8, and for swinging the base 23 around a vertical axis, and the jacks 27, 32 and 36 which operate the arm 25, the arm 30 and the lifting basket 10, respectively, the lifting basket 10 can be put into a variety of positions.

[0040] The drive means, 20, 24, 27, 32 and 36, respectively, are taken up into a hydraulic circuit, as, for example, represented in figure 7 in a very schematic manner.

[0041] This circuit comprises a hydraulic power source 43 in the form of a 43A driving a pump 43B which is fed with liquid from a reservoir 44, whereby the outlet of the pump 43B is connected to a manifold block 45 with several independent control valves 46, which each

[0042] Each control valve 46 is provided with a coil 47 which, under the impulse of an electric current, can move an internal bar, which is not represented in the figures, in order to let hydraulic oil pass towards the respective hydraulic component, in such a manner that the delivered flow rate is parallel to the supplied electric control signal.

[0043] The coils 47 are electrically coupled, directly or indirectly, by means of relays or such, to a computer 48, in which a certain program is loaded for performing synchronized movements of the driven parts of the cleaning machine 7, to wit the carriage 15; the base 23; the arm 25; the arm 30, and the lifting basket 10, respectively, in order to obtain an automatized working of the device.

[0044] Preferably, for the control of the cleaning machine 7, a servo control will be used, whereby the computer 48, at any moment, takes into account the actual position and location of the lifting basket 10 in respect to the grate 1, by calculating this position starting from the position signals which it receives from measuring sensors 49, which, for clarity's sake, only are represented in figure 7, and which transmit the absolute or mutual position of said driven parts 15, 23, 25, 30 and 10 and/or of the drive means 20, 24, 27, 32 and 36 which operate these parts.

[0045] If necessary, an operator control panel 50, represented in dashed line, can be connected to the computer 48 in order to allow the loading of another performance program or to adapt the existing performance program, when, for example, the lifting basket 10 is replaced by a lifting basket 10 of, for example, larger or smaller dimensions and content.

[0046] Once the computer 48 is set and adjusted, the device works completely autonomous.

[0047] The computer 48 is programmed such, that the hydraulic drive means, 20, 24, 27, 32 and 36, respectively, are controlled in a synchronized manner, such that the cleaning machine 7 automatically positions itself successively at several pre-determined locations along the grate and that, at each of these locations, the lifting basket 10 is moved such that it moves with its teeth 12 between the bars 3 of the grate 1 upward, starting from the lowermost edge of the grate 1, as represented in figure 5, up to the uppermost edge of this grate 1, as represented in figure 6, such that waste which has stacked up against the grate 1 or between the bars 3 of the grate 1, is taken up by the lifting basket 10 and lifted in order to empty the content of the lifting basket 10 in a waste container 11.

[0048] Afterwards, the cleaning machine 7 moves to

a subsequent position along the grate 1 in order to there again lift the waste, according to the same procedure, out of the water and to deposit it into the waste container 11. The successive positions of the cleaning machine 7 are chosen such that the successively cleaned zones of the grate 1 overlap each other.

[0049] The succession of automatic operations can continue until the waste container 11 is full, after which the device, whether or not automatically, is shut down until the full waste container 11 is replaced by an empty waste container 11.

[0050] The working of the device can be continuous or can also be controlled by the computer 48 in such a manner that the device only is operating during limited, preprogrammed periods of time.

[0051] It is clear that other forms of control by the computer are possible, for example, by the intermediary of a separate hydraulic control circuit, operated by electrovalves or similar.

[0052] According to a not-represented embodiment variant, the whole cleaning process also can be performed manually by an operator which controls the afore-discussed operations manually from a driver's cabin which is provided with operating elements for manually controlling each of said hydraulic drive means, 20, 24, 27, 32 and 36, respectively.

[0053] The present invention is in no way limited to the form of embodiment described as an example and represented in the figures; on the contrary, a device according to the invention may be realized in various forms and dimensions, without leaving the scope of the invention.

Claims

1. Device for cleaning a grate (1) of the type formed by upwardly directed, parallel bars (3) provided at regular mutual interspaces, whereby such grate (1) is installed transversely in the current of a waterway or such, in order to retain pollutions, **characterized in that** the device consists of a cleaning machine (7) which is equipped with a lifting basket (10) with an open wall portion (13), whereby the cleaning machine (7) is configured such that the lifting basket (10) can be moved at least over the entire height of the grate (1) along this grate (1).
2. Device according to claim 1, **characterized in that** the cleaning machine (7) consists of a base (23) rotatably provided around a vertical axis; a first arm (25) hingeably provided on the base (23) by means of a horizontal axis (26); a second arm (30), which, by means of a horizontal axis (31), is hingeably provided on the first arm (25), whereby said lifting basket (10) is hingeably provided on this second arm by means of a horizontal axis (35); drive means (20-21-22) for moving the carriage (15) on the rails

(8); drive means (24) for pivoting the base (23); drive means, (27) and (32), respectively, for pivoting the arms (25) and (30); and finally drive means (36-39-40) for tilting the collecting basket (10).

3. Device according to claim 2, **characterized in that** the base (23) is provided on a carriage (15), the wheels (16) of which are guided in rails (8).

4. Device according to claim 2, **characterized in that** the rails (8) are parallel to the longitudinal direction of the grate (1).

5. Device according to claim 3, **characterized in that** the rails (8) are situated upstream from the grate (1) and on a level situated above the top edge of the grate (1).

6. Device according to claim 2, **characterized in that** said drive means consist of a motor (20) which is mounted on the carriage (15) and which is provided with a gearwheel (21) cooperating with a fixed toothed rack (22); a motor (24) which is provided on the base (23) and a gearwheel transmission between this motor (24) and the carriage (15); a jack (27) which is provided between the base (23) and the first arm (25); a jack (32) connecting the first arm (25) to the second arm (30); and finally a jack (36) which is provided on the second arm (30) and which, by means of a lever mechanism (39-40), is connected to the lifting basket (10).

7. Device according to claim 5, **characterized in that** said lever mechanism (39-40) consists of rods, (39) and (40), respectively, which each are hingeably connected to said jack (36), whereby the rods (39) are hingeably provided on the second arm (30) and the rods (40), by means of an axis (42), are hingeably connected to the lifting basket (10).

8. Device according to any of the preceding claims, **characterized in that** the open wall portion (13) of the lifting basket (10) is formed by parallel bars (14).

9. Device according to any of the preceding claims, **characterized in that** the lifting basket (10) is provided with teeth (12) which can be brought between the bars (3) of the grate (1).

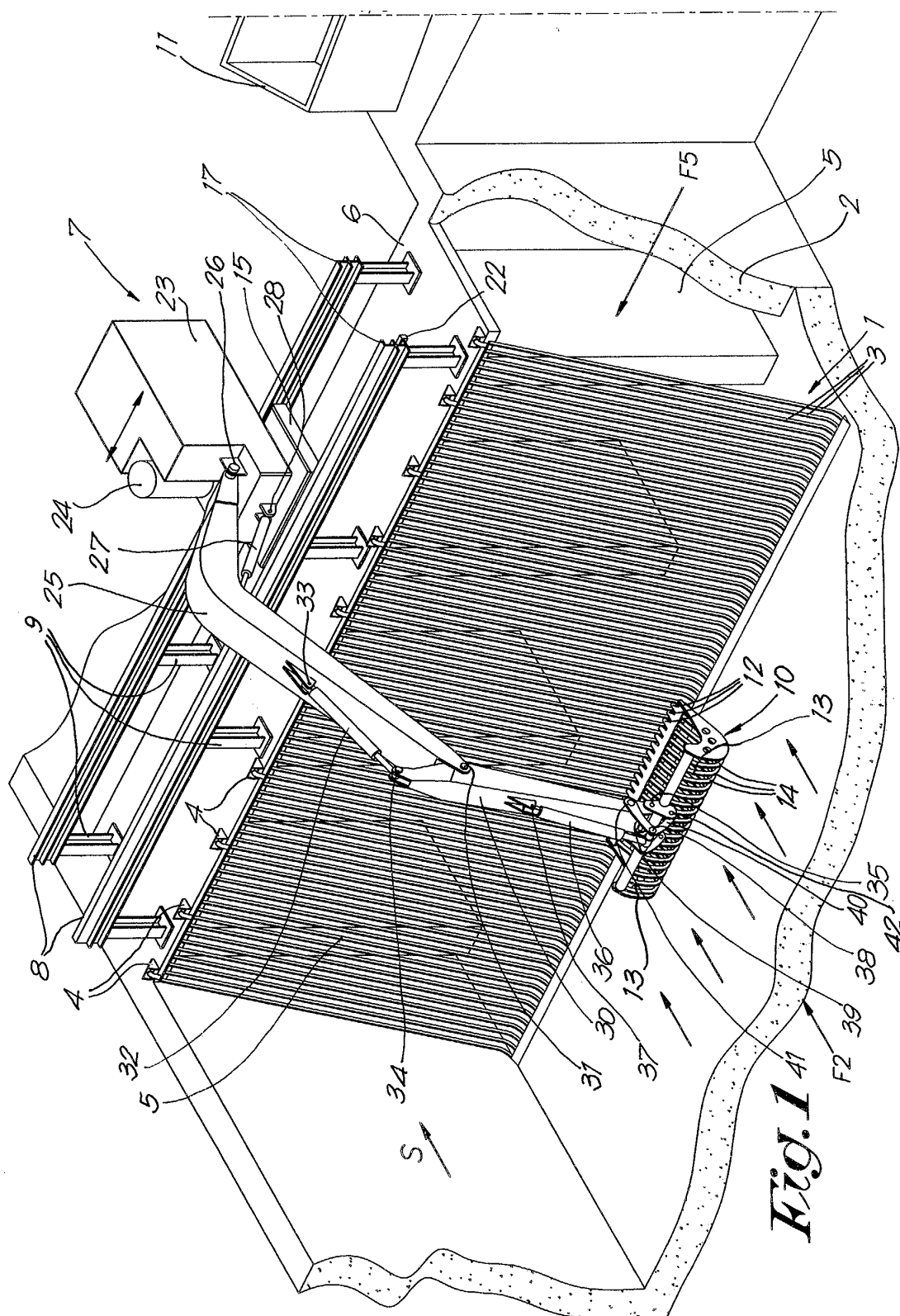
10. Device according to claim 8, **characterized in that** the teeth (12) are situated at equal mutual interspaces and that the core distance between two adjacent teeth (12) is equal to the core distance between two adjacent bars (3) of the grate (1).

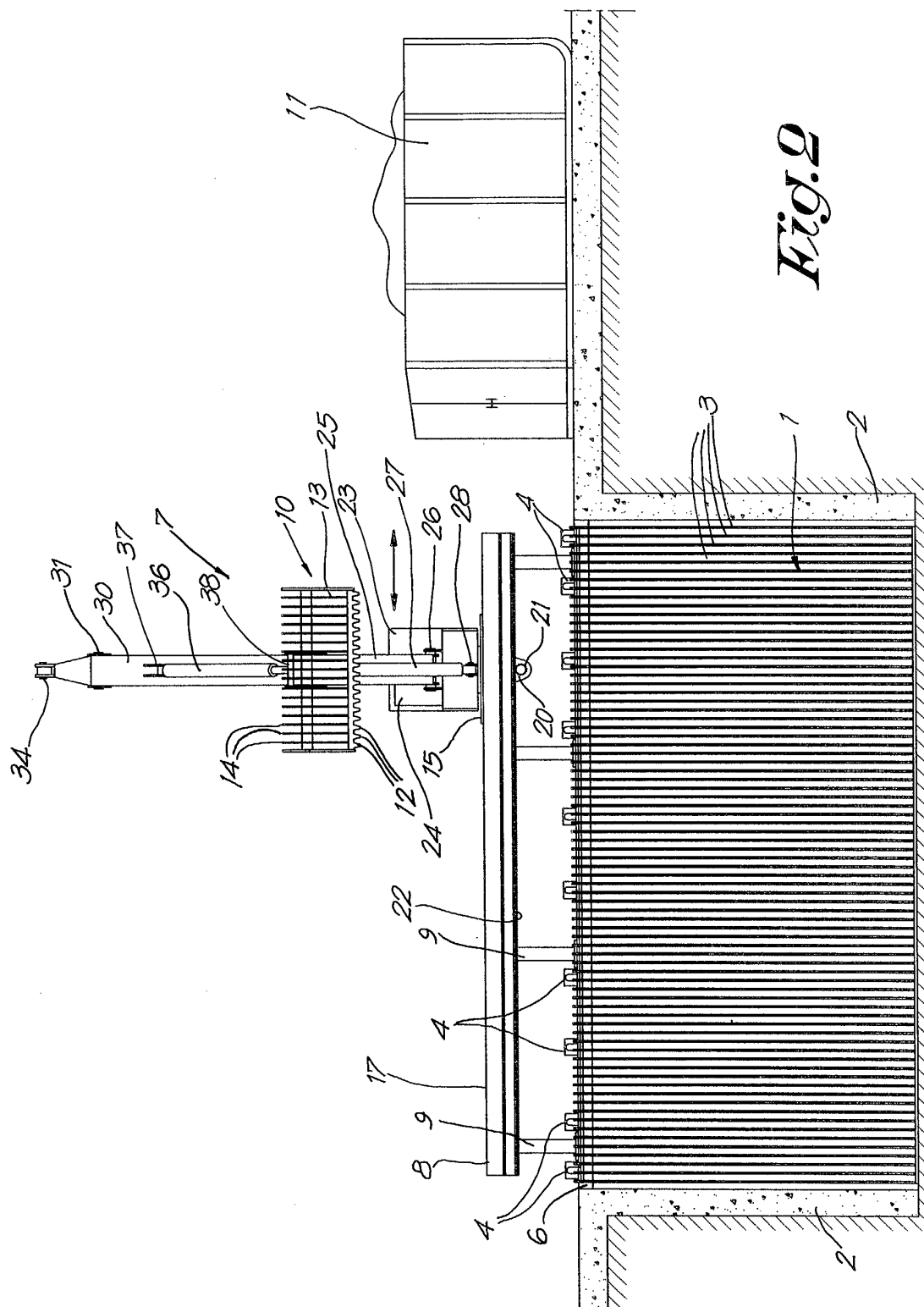
11. Device according to any of the preceding claims, **characterized in that** the cleaning machine (7) is completely automatized.

12. Device according to claim 10, **characterized in that** said drive means (20-24-27-32-36) are connected to separate control valves (46) which, whether directly or not, are controlled by means of a common computer (48).

13. Device according to claim 11, **characterized in that** the computer control is a servo control.

14. Device according to claim 12, **characterized in that** the computer is coupled to measuring sensors (49) measuring the position of the drive means (20-24-27-32-36) and/or of the driven parts (10-15-23-25-30).





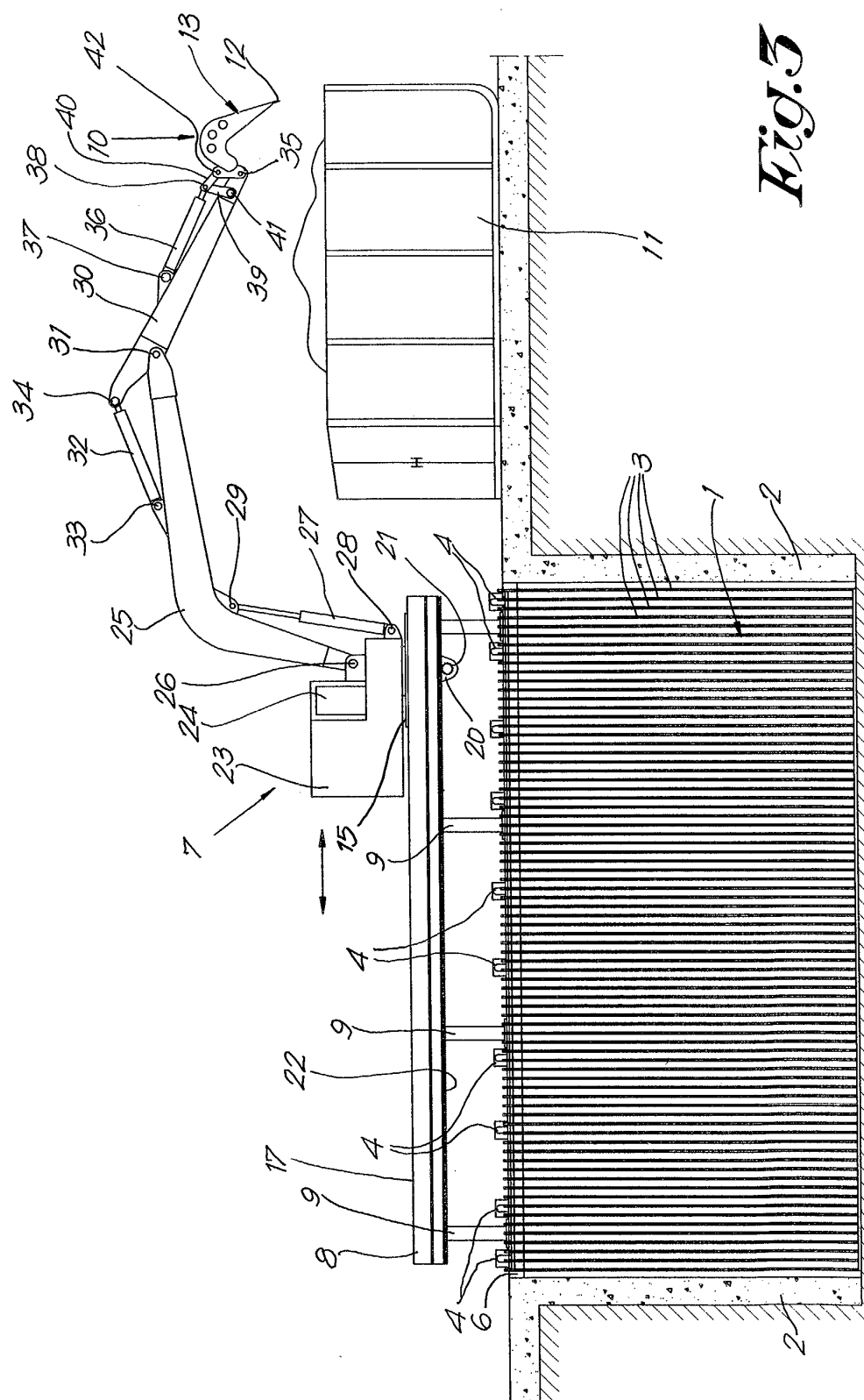
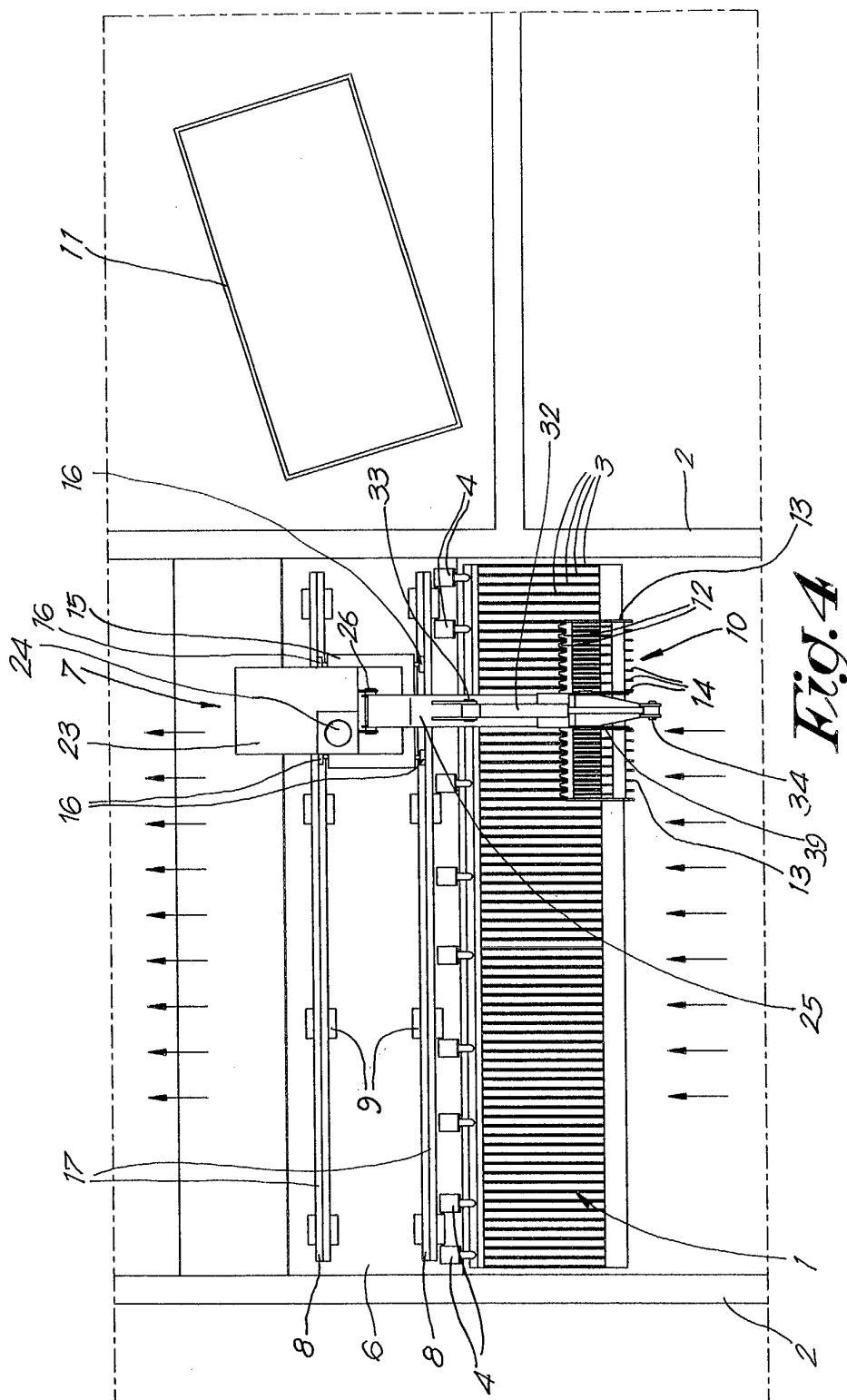
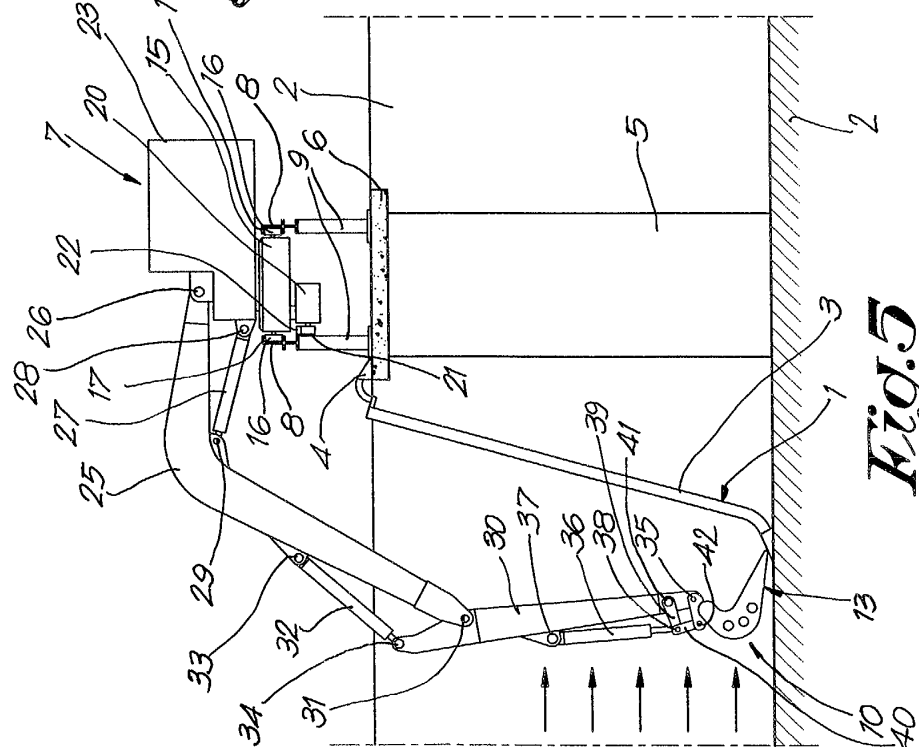
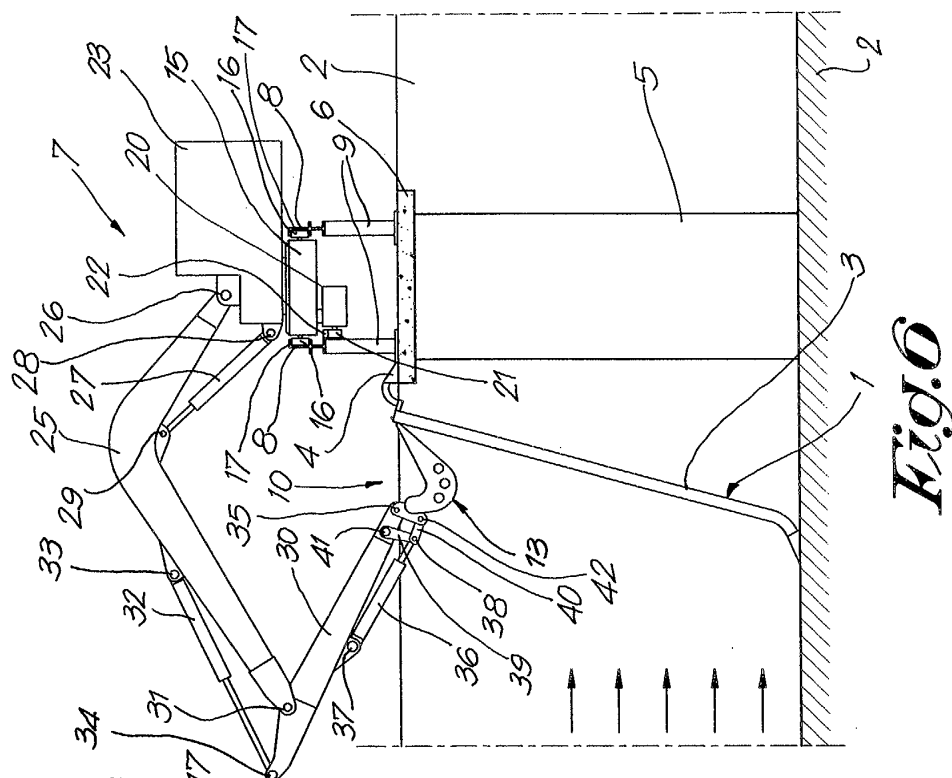
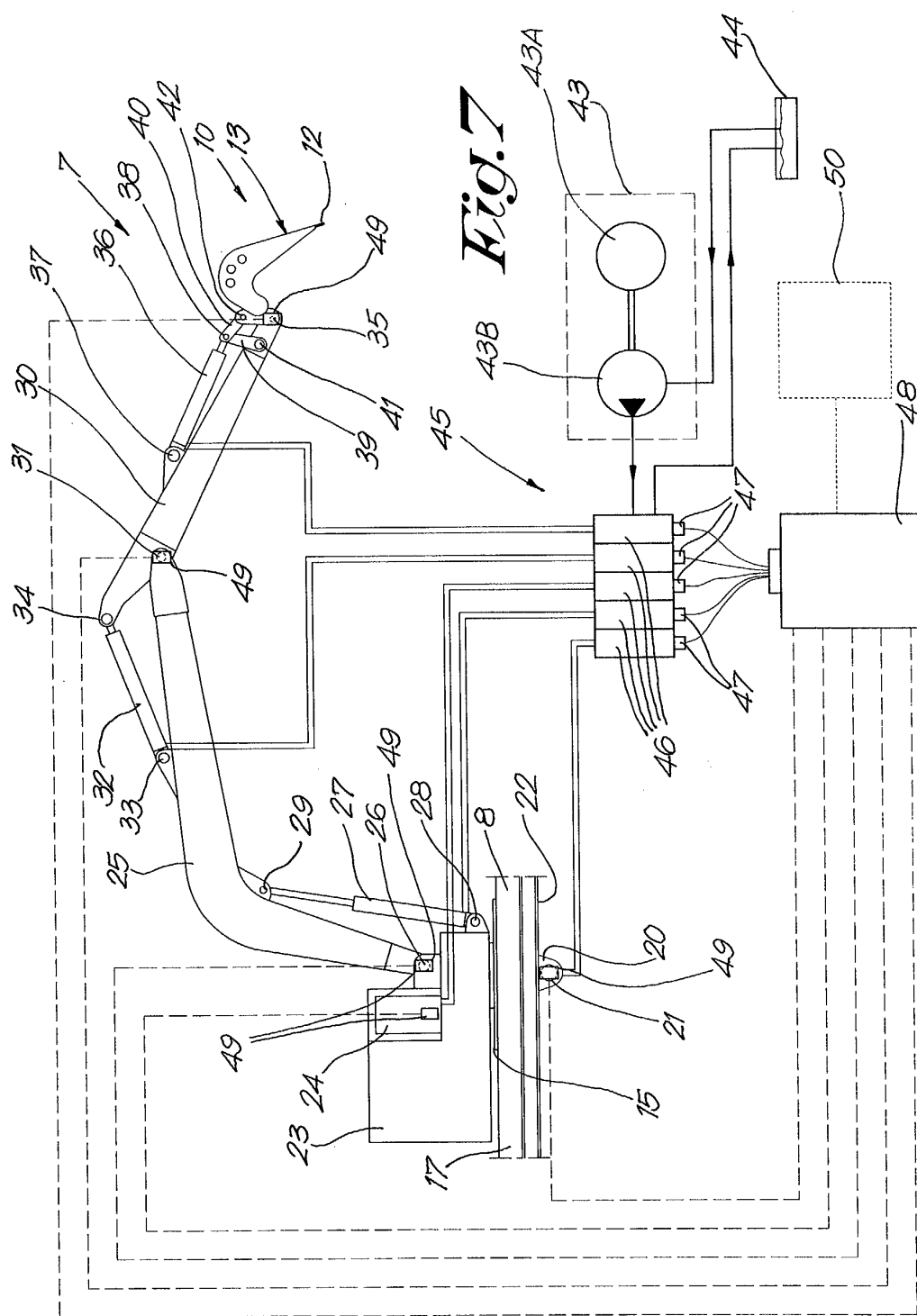


Fig. 3









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EUROPEAN SEARCH REPORT

Application Number
EP 02 08 0556

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)
X	DE 35 36 587 A (KAHL HUGO) 23 April 1987 (1987-04-23) * column 4, line 27 - column 7, line 6; figure *	1,8-11	E02B8/02
Y	---	2-7, 12-14	
Y	US 5 571 406 A (MENSCHING HERMAN E) 5 November 1996 (1996-11-05) * column 3, line 48 - column 4, line 5 * * column 5, line 44 - column 6, line 53; figures 1,7-9 * -----	2-7, 12-14	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			E02B B01D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 28 April 2003	Examiner De Coene, P
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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