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(54) **SYSTEM FOR INTERCEPTING FLOATING WASTE FROM WATER COURSES**

(57) The present invention relates to a system for intercepting waste, such as in particular floating waste, from water courses (e.g. rivers, streams, channels in general, irrigation channels, regimented channels for supplying thermoelectric plants, etc.).

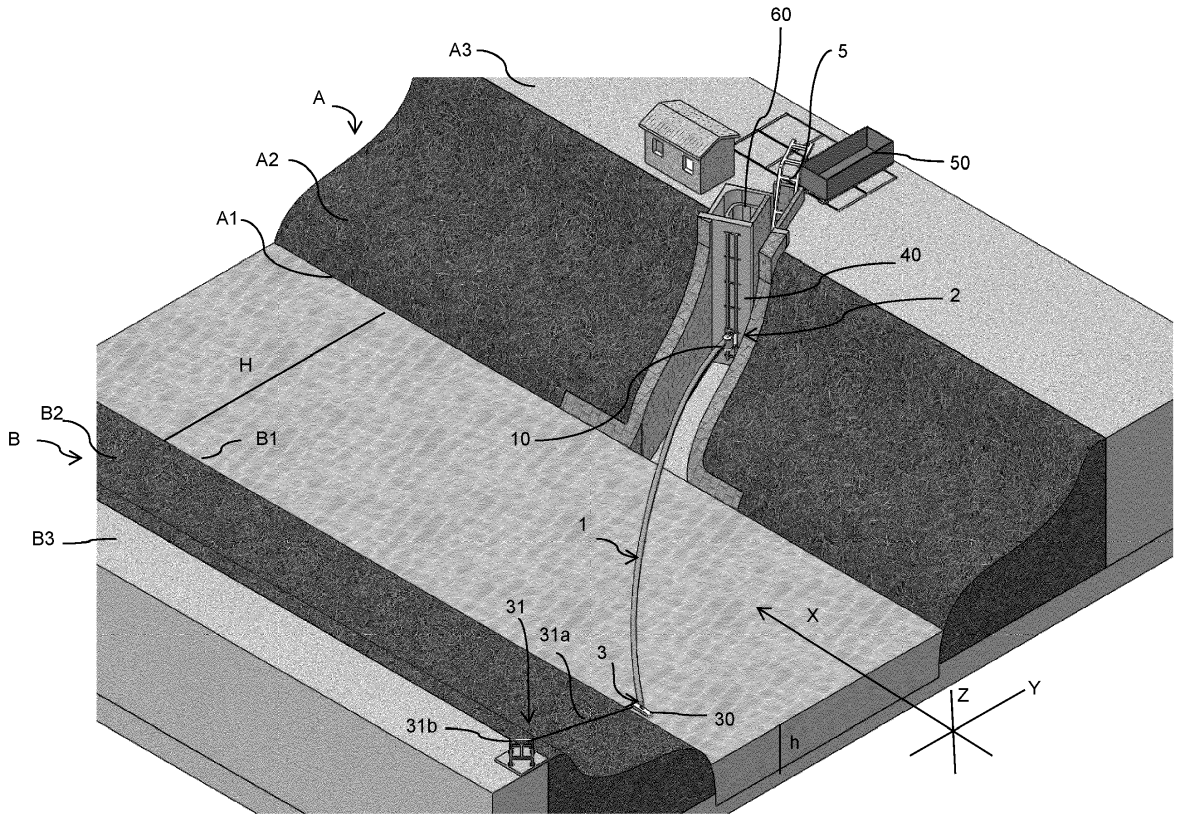

Fig.1

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Description

[0001] The present invention relates to a system for intercepting waste, such as in particular floating waste, from water courses (e.g. rivers, streams, channels in general, irrigation channels, regimented channels for supplying thermoelectric plants, etc.).

[0002] Water courses are increasingly affected by the phenomenon of pollution from solid waste, plastic or the like, which floats on the surface of the water and is carried by the current until it reaches the sea or the water basin into which the water course flows. Such floating waste is particularly hazardous as it can create obstructions and accumulations along the course of the river, reducing the local flow rate thereof and therefore representing a critical problem in the event of floods. Furthermore, the waste can compromise the fauna in the water course even as far as the water basin into which it flows. Water can in fact trap, hurt or be swallowed by animals who can therefore die either by choking or poisoning or however suffer serious damage.

[0003] Therefore there is an increasing need to intercept this type of waste already in the water course, so as to prevent its accumulation along the embankment and prevent it spilling into the water basin or the sea where it would be more complex and therefore expensive to collect.

[0004] Known systems include those that exploit elements for intercepting floating waste stretched between two or more boats. On board the boats there may also be water filtering systems for collecting waste trapped in the interception elements. Similarly, combined systems exist that envisage boats for collecting waste inside drainage nets for waste stretched between the banks or buried in portions of the water course.

[0005] However, these systems have various drawbacks. In the first place they are expensive as they constantly envisage the use of boats therefore require large numbers of support staff and also constitute a significant obstruction in the water course.

[0006] Another known system is the one described in CN207193929U which makes use of a conveyor belt placed between the two banks of a water course, moved by two pulleys. Such belt comprises filtering elements floating in a bucket that collect and transport waste towards a collection container placed in proximity to one of the pulleys. However, this system is "rigid" in the sense that it cannot be used in the event of floods or more generally it is unable to be effective when the water level varies therefore it is only suitable for artificial water courses or for natural water courses whose variation in flow rate over time is minimal.

[0007] A functionally similar system having the same critical issues as the previous one is described in KR20030007256. This system also has little possibility of adjusting the barrier, in particular only in height, with respect to a Z axis, therefore it is not a system capable of dynamically and actively responding to changes in current, flow rate and water level.

[0008] US3779385 describes a floating barrier designed to intercept floating waste towards a side channel where a dam is installed. This barrier is adjustable only in height, with respect to a Z axis. Furthermore, this regulation is passive, based exclusively on floating systems and therefore linked to the flow of the river. This system therefore presents the same regulation problems as the previously mentioned document. Still, the waste extraction system requires an accumulation basin and therefore on the whole it is very difficult to install in waterways that flow in inaccessible areas or without spacious embankments.

[0009] US4229119 also describes a barrier system suitable for being installed in a watercourse which however has drawbacks linked to the fact that the barrier is immersed and therefore constitutes an obstacle to the hydraulic flow.

[0010] The aim of the present invention is that of providing a system for collecting floating waste in water courses adapted to be used in water courses of any type, even non-regimented ones.

[0011] Yet another aim of the floating waste collection system according to the invention is that of being functionally independent or however requiring the minimal presence of operators/management personnel.

[0012] A further object of the present invention is that of providing a system for collecting floating waste in water courses that automatically operates the movement of waste from the collection point to bank height in order to collect it for transport to the waste dump.

[0013] Such aims are reached with the system for collecting floating waste in water courses, the essential characteristics of which are defined by the first appended claim. Other important additional characteristics are the subject matter of the dependent claims.

[0014] The characteristics and advantages of the system for intercepting and collecting floating waste in water courses will appear more clearly from the following description of an embodiment thereof, provided by way of non-limiting example with reference to the appended drawings wherein:

- Figure 1 shows the system for collecting floating waste according to the invention contextualised in a water course;
- Figure 2 shows a view from above of a portion of such model depicting the inlet of waste accumulation;
- Figure 3 schematically depicts the bypass arm of the derivation channel.

[0015] With reference to the figures, the system for intercepting and collecting floating waste in water courses operates at a portion of the water course (for example but not limited to a river or an irrigation channel or for a hydroelectric power station) comprised between two banks A and B. The banks can be made of earth or re-

inforced concrete, vertical or oblique, of an artificial channel or, in the example of this description, the banks of a natural water course or artificially limited natural water course. With respect to each of the two embankments it is possible to identify a shore A1, B1, the area of the embankment lapped by the water course, a bank A2, B2, the decline area of the embankment and a top A3, B3 of the embankment, normally (i.e. except in the case of catastrophic events) not affected by the water. Again, the water course defines a direction X that is the flow direction, i.e. of the main current. The river then has a width H, defined along the direction Y, perpendicular to the direction X. Again, the height or depth of the river h is evaluated according to the direction Z, which defines with X and Y a Cartesian tern.

[0016] The system for intercepting and collecting waste comprises a floating barrier 1 placed, in operation, in a substantially transversal arrangement to the water course and in general to the direction X of the current.

[0017] Such barrier 1 is adapted to intercept waste R floating on the surface of the water course or partially immersed such as bottles or plastic bags and other waste materials that have ended up in the water course dragged by the current.

[0018] The barrier is materialised for example by a tube made of plastic material, such as PVC, polyurethane or the like. The tube may possibly be reinforced with metal cables, such as steel cables.

[0019] The barrier is stretched between two attachment points including a first attachment point 2 proximal to the waste discharge point on the embankment A, in the example depicted, and a second distal attachment point 3 i.e. positioned on the embankment B opposite the waste discharge point.

[0020] Going into more detail, the proximal attachment point 2 is made at the bottom 40 of a derivation channel 4 obtained in the embankment A of the river. The derivation channel 4 is arranged in a substantially transverse position with respect to the river and in more detail it has an inclination with respect to the direction X which is comprised, by way of non-limiting example, between 10° and 60° as a function of the conditions of the water course, the erosion currents and the spaces available on the embankment for creating the channel.

[0021] Being anchored at the bottom 40, a part of the floating barrier is internal to the derivation channel, therefore extending from the course of the river within it.

[0022] A derivation current, indicated in Figure 2 by the arrows, with direction X1 is determined within the derivation channel. Such derivation channel extends from the main water course within the channel and therefore has the aim of directing the waste stacked on the barrier towards the inside of the derivation channel and in particular towards the bottom. A means 5 for picking up the intercepted waste operates at such point. More detail will be provided on this below.

[0023] The derivation current is generated by the current generation means 6 such as, for example, a pump or a bypass arm 6 which opens downstream of the barrier and at a lower geodetic height. Possibly, to exploit the geodetic height, an electric turbine 60 can be arranged on the bypass arm. Again in the case of the embodiment of the bypass arm, a water flow adjustment means is provided (not shown in the figures). For example, such adjustment means may be materialised by a bulkhead actuated by an electric motor. The bulkhead is adjusted to open according to the flow rate of water that is to access the turbine or as a function of the bypass current to be generated.

[0024] The proximal attachment 2 obtains a movement of the floating barrier 1, i.e. of an end 10 thereof, at least in the vertical direction Z and therefore the height of the barrier to be varied with respect to the alveolus of the river. Possibly the proximal attachment 2 is configured so as also to determine a length variation of the barrier.

[0025] In more detail, the proximal attachment 2 is materialised by a guide means 20 adapted to determine the movement of the end 10 in direction Z. Such guide means comprises for example a prismatic guide 20a on which a carriage 20b engages in a sliding manner integrally with the proximal end 10 of the floating barrier and actuated by first actuator means controlled, as will be seen better below, automatically by a control and management system.

[0026] In a preferred embodiment the attachment of the proximal end 10 to the carriage 20b is obtained by engagement on a spool 20c, integral with the carriage, which, through a rotation on its own axis in the Z direction, performs the winding or unwinding of the floating barrier in direction Y. The spool 20c is also moved by its own actuator means controlled by the aforementioned automatic control and management system.

[0027] The distal attachment point 3 is made in proximity to the opposite bank B of the river. In this case, a distal end 11 of the barrier is anchored to a floating element 30 that is movable in all directions X, Y and Z. The variation of the position of the floating element 30 is controlled by a own second actuator means that is substantially placed on the proximal embankment B3. Such own actuator means 31 comprises, in a preferred embodiment, one or more cables 31 a (shown in the figures in a sketch way), that extend in a variable way between the floating element 30 and an attachment point integral with the embankment at which it is engaged for example with a winch 31b or other winding/unwinding means of one or more cables.

[0028] By modifying the length of the at least one cable, it is possible to modify the position of the floating element 30 in the river and consequently also the inclination of the barrier with respect to the direction of the current X and the tension of the barrier. The distal attachment point 3 is preferably placed upstream with respect to the attachment point 2 at a proportional distance to the maximum width of the alveolus of the water course and the maximum length of the floating barrier.

[0029] It therefore appears clear from the above that

the barrier can be moved at least until it is always on the surface of the water. Furthermore, by operating on the distal attachment point (in the embodiment shown this translates into leaving the at least one cable more or less taut) the barrier assumes a more or less inclined position with respect to the direction of the current X and more or less taut, therefore a variable length.

[0030] Now returning to the subject of the automatic control and management system, it performs the movement of the barrier as explained above, i.e. it controls the actuator means of the distant attachment points, commanding it so that the barrier is always on the free surface of the water.

[0031] To obtain this result, the control and management system makes use of a sensor means such as, in particular, fluid speed sensors, flow rate sensors, level sensors, etc.

[0032] The control and management system can also detect the presence of a draught beyond a limit threshold on the distal attachment point, in order to control the emergency release of the barrier. For this purpose the barrier is sensorised with load cells that detect the state of tension on the barrier itself. The information provided by the load cells on the tension of the barrier are further used by the control and management system also to evaluate the inclination and extension movement thereof (hence acting regulating the position of the distal and proximal attachment points).

[0033] The control and management system further controls the bulkhead for adjusting the value of the bypass current.

[0034] In a further embodiment of the invention the barrier occupies only a part of the water course so as to maintain the navigability thereof. The attachment point 30 is therefore moved within the water course, while still remaining connected to the embankment by means of the means 31.

[0035] Returning to the picking means, it is materialised, in the example illustrated in the figures, by a conveyor belt 5 that operates at the bottom 40 of the channel. The conveyor belt operates frontally with respect to the mouth of the bypass channel and generally with respect to the generation point of the derivation current, so that the waste is taken by it towards the belt. The conveyor belt 5 transports waste towards a raised collection point. Advantageously, such point can be placed on the top of the embankment so as to be reachable with a transport means for picking up the waste and transporting it to the dump. The management and control system can in that case be programmed to detect, through relevant sensors, the filling level of the provisional waste collection bins 50 and therefore, in the event that such filling level exceeds a predefined threshold value, contact the control centre of the waste for picking up.

[0036] It is obvious from the previous description that the embankment A of the water course and all the structures comprised therein can be specularly placed on the left bank of the water course and, at the same time, the embankment B and the structures comprised thereon can be placed on the right bank.

[0037] The system for intercepting and collecting floating waste from water courses described has the advantage of providing a system for collecting floating waste from water courses, that can operate independently without the use of personnel, adapted to be used in non-regimented water courses, such as in the alveolus of a river.

[0038] The system obtains this advantage also thanks to the control system that allows the floating barrier to assume different occupation configurations of the alveolus of the water course.

[0039] Furthermore, thanks to the fact that the floating barrier is movable and adapts, at least according to the direction Z, to the height of the water, the system can also be positioned in non-regimented water courses, which therefore undergo water level variations over the course of the year.

[0040] The barrier can also advantageously adapt to flood conditions of the water course by extending, in response therefore to the situation in which the river alveolus, due to flooding, extends onto the banks. In any case, the variable extension of the barrier has a positive effect regardless, because it can be used to vary the arrangement thereof with respect to the main sliding direction X.

[0041] Thanks to the derivation current the waste is easily conveyed within the derivation channel, downwards, without it accumulating along the shores; therefore the system is particularly effective for the removal of waste from the water course.

[0042] Being a structured and fixed system, it allows the interception and collection of the waste in the water course in a continuous cycle.

[0043] The system allows the phenomenon of pollution due to plastic in the sea and at relatively contained costs.

[0044] Again, if it is provided with a turbine, the system is self powered in the sense that it can produce energy. This can therefore be used for self powering the system or be released onto the public grid.

[0045] The distal attachment point can be arranged closer to the centre of the water course in applications in which a navigable passage must be left next to the floating barrier.

[0046] The present invention has been described herein with reference to preferred embodiments thereof. It is to be understood that there may be other embodiments that relate to the same inventive nucleus, all falling within the scope of protection of the claims provided below.

Claims

1. A system for intercepting floating waste from a water course defining a main flow direction (X) and delimited between a first (A) and a second (B) embankment and for collecting said waste on said first embankment (A) comprising:

- a floating barrier (1) stretched between two attachment points, a first attachment point (2) proximal to said first embankment and a second attachment point (3) distal from said first embankment (A), the floating barrier being arranged in a substantially transverse position with respect to main flow direction (X) of the water in order to intercept and block said floating wastes and prevent their further flow along the water course;
- means (5) for picking up the intercepted waste, said means being placed in correspondence of said proximal attachment point (2) on said first embankment (A) such as to pick up said intercepted waste and move it towards a storage point for final removal;
- a deviation channel (4) arranged substantially transverse to said flow direction (X) and made within said first bank (A), said deviation channel (4) providing a bottom (40) at which it is arranged said proximal attachment point (2) and operate said picking means (5);

characterized in that:

- said deviation channel (4) is affected by a by-pass current flowing from the water course into said channel (4) towards said bottom according to a main by-pass current flowing direction (X1) in such a way as to promote the flow of said intercepted waste along said barrier towards said bottom itself;
- wherein said floating barrier is supported in a movable manner between said attachment points (2, 3) at least with respect to a direction (Z) vertical and perpendicular to said water flow direction (X) so as to result in a water's free surface position;
- automatic control and management means, adapted to regulate the position of said attachment points (2, 3) in order to move said floating barrier at least with respect to said direction (Z) in response to a detected variation of the water level (h) of the watercourse,

wherein said distal attachment point (3) is located on a floating element (30) movable in each direction (X, Y, Z) and anchored by actuator means (31) to said second embankment, said actuator means being operable to adjust the position of said floating element (30) according to said sliding (X) and vertical (Z) directions and according to a horizontal (Y) direction perpendicular to said (X) and (Z) directions.

2. System according to claim 1, wherein said by-pass current is generated by the circulation of the water of the water course within a bypass arm running from said bottom (40) of said deviation channel to a downstream position with respect to said system for the interception of waste.

3. System according to claim 2, wherein said bypass arm has a mouth opened on said bottom (40) said mouth can be intercepted in a controlled manner by a bulkhead controlled by said control and management means in order to adjust said by pass current.

4. System according to claim 3, wherein said proximal attachment point (2) comprises a prismatic guide (20a) on which a carriage (20b) engages in a sliding manner according to the direction (Z) to move a first end (10) of said barrier along the (Z) direction

5. System according to claim 4, wherein said carriage (20b) supports a spool (20c) rotatable about its own axis aligned according to the direction (Z) on which said first end (10) of the barrier is fixed, whereby the rotation of said spool corresponds to a winding or unwinding of the barrier according to a horizontal direction (Y) perpendicular to the sliding direction (X) and vertical (Z).

6. System according to any one of the previous claims, wherein said means (5) for picking up the intercepted waste comprise a conveyor belt a first end of which is placed in correspondent of said bottom (40) of said deviation channel and a second end other end discharges said collected wastes on a storage point on said first embankment.

7. System according to any one of the preceding claims, in which said control and management means also detects the state of tension of said floating barrier and commands the release thereof from at least one of the two attachment points (2, 3) in case this state of tension exceeds a certain threshold value.

8. System according to any one of the preceding claims, in which said control and management means detect the level of filling of said storage point and sends a signal to request its emptying.

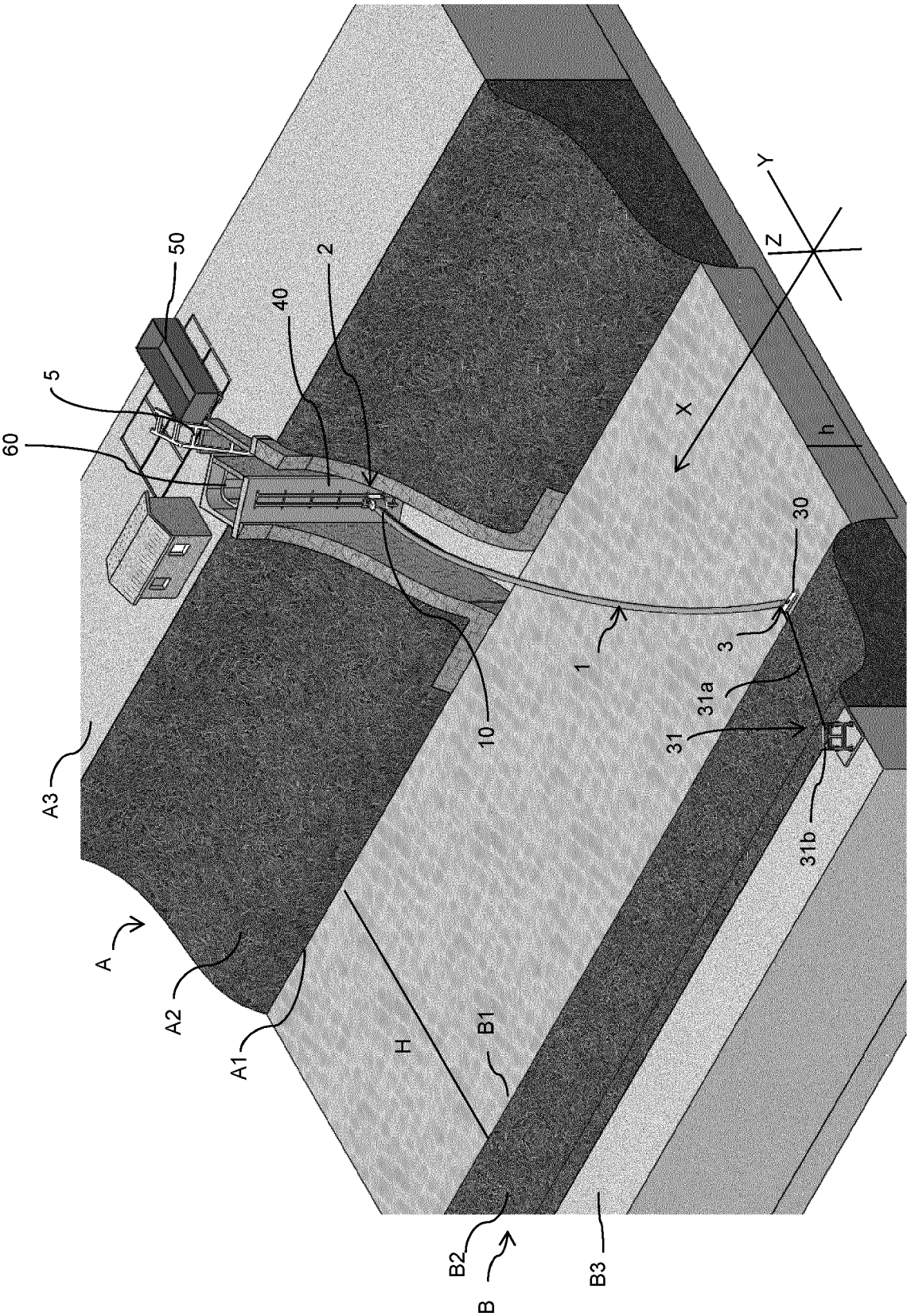

Fig.1

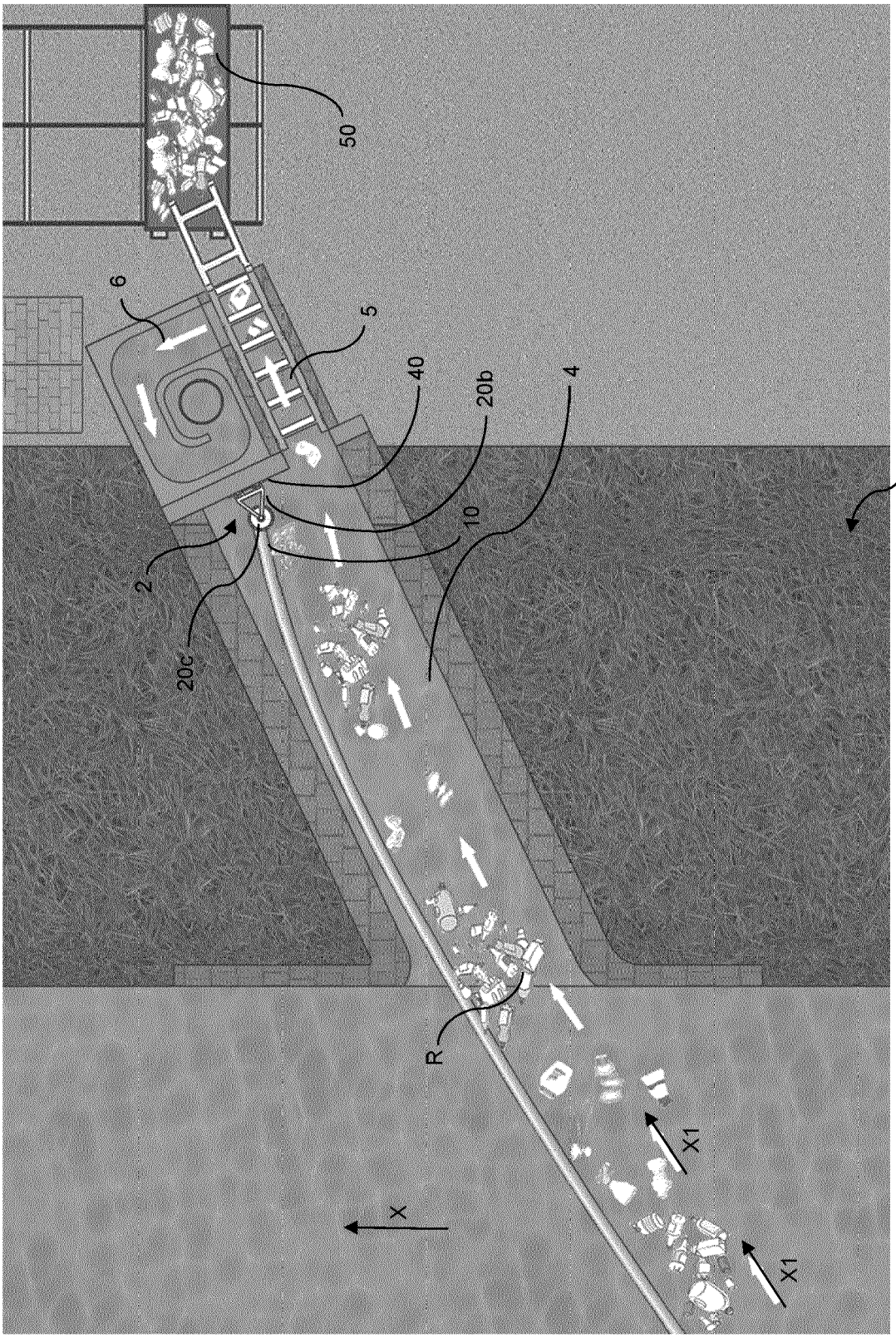

Fig.2

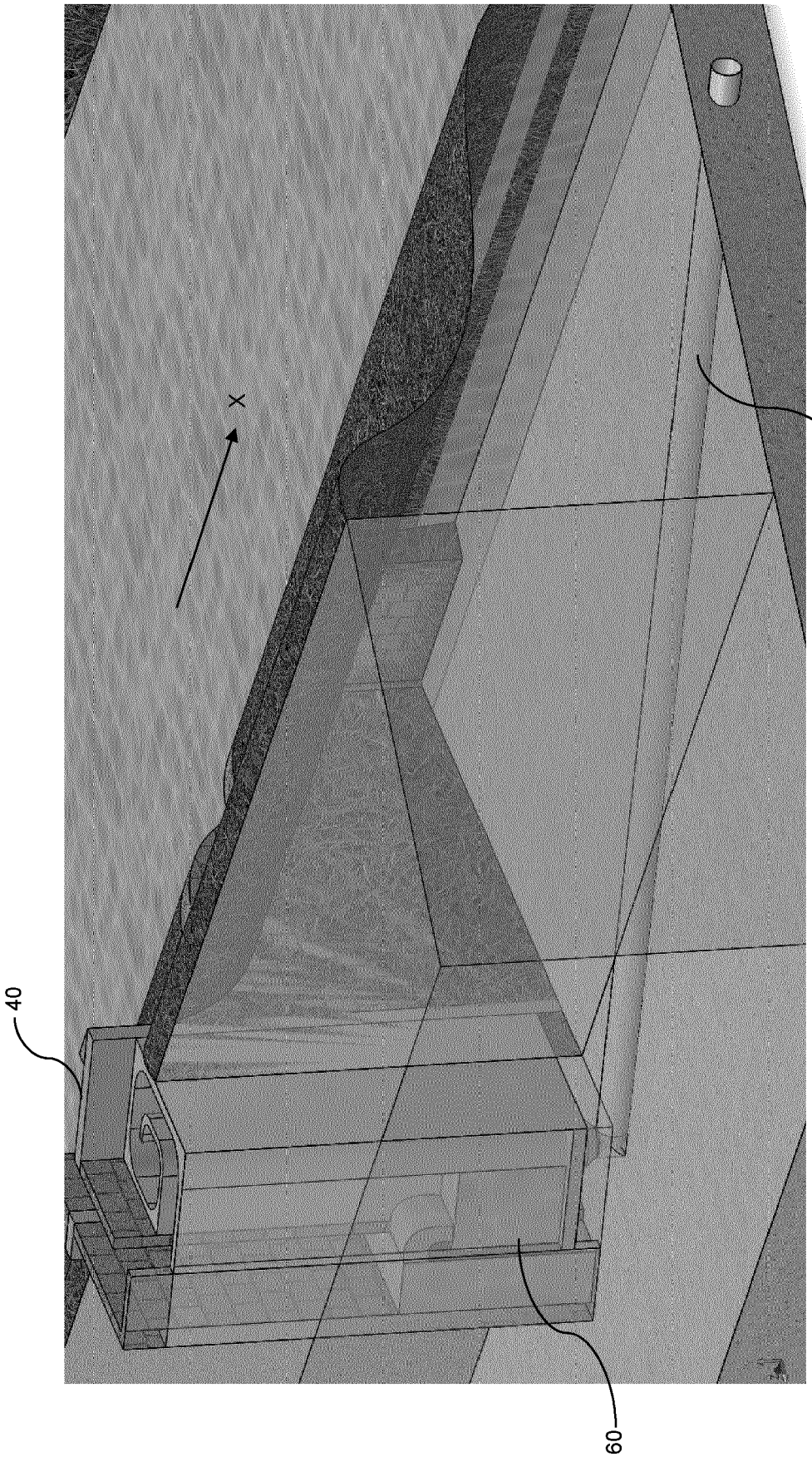

Fig.3

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EUROPEAN SEARCH REPORT

Application Number
EP 20 15 6991

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y,D	US 3 779 385 A (STROHECKER J) 18 December 1973 (1973-12-18) * the whole document *	1-8	INV. E02B15/04
A,D	US 4 229 119 A (BORCA BRUNO ET AL) 21 October 1980 (1980-10-21) * column 3, line 39 - column 5, line 5; figures *	1,7	
A,D	KR 2003 0007256 A (BYUN HWA WON [KR]) 23 January 2003 (2003-01-23) * the whole document *	1,6,8	
Y	BR PI0 801 947 A2 (DT ENGENHARIA DE EMPREENDIMENTOS LTDA [BR]) 12 January 2010 (2010-01-12) * claims; figures 5-9 *	1-8	

TECHNICAL FIELDS SEARCHED (IPC)

E02B
E02C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	30 June 2020	Fordham, Alan

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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30-06-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3779385 A	18-12-1973	NONE	
US 4229119 A	21-10-1980	AU 4994679 A	19-02-1981
		BE 867654 A	18-09-1978
		CA 1086084 A	23-09-1980
		DE 2823874 A1	14-12-1978
		FR 2393112 A1	29-12-1978
		GB 1594528 A	30-07-1981
		IT 1115663 B	03-02-1986
		NL 7804435 A	04-12-1978
		US 4229119 A	21-10-1980
KR 20030007256 A	23-01-2003	NONE	
BR PI0801947 A2	12-01-2010	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 207193929 U **[0006]**
- KR 20030007256 **[0007]**
- US 3779385 A **[0008]**
- US 4229119 A **[0009]**