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(54) **SYSTEM FOR THE SELECTIVE COLLECTION OF FLOATING MATERIALS**

SYSTEM ZUR SELEKTIVEN SAMMLUNG VON SCHWIMMENDEM MATERIAL

SYSTÈME POUR LA COLLECTE SÉLECTIVE DE MATIÈRES FLOTTANTES

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EP 4 188 791 B1

Description

TECHNICAL FIELD

[0001] The present invention refers to a system for a selective collection of floating materials. In particular, the invention refers to a system for collecting plastic materials floating in surface water, such as a river.

BACKGROUND ART

[0002] The problem of floating waste in surface water, such as plastic, cork, bottles, wood, etc., is well known in the art. This waste material is transported by the water flow, thereby damaging aquatic flora and fauna and in particular the corresponding ecosystem, especially in rivers, coastal lakes or lagoons. In fact, floating waste tends to agglomerate in masses of natural and anthropic material, thereby creating the so called floating litter, the size of which can only be reduced when reaching the open sea due to the action of chemical degradation carried out for example by the solar light or mechanical degradation carried out for example by the wave movement.

[0003] Since the waste collection in open sea and in rivers is a complex operation due to the large areas of interest and the employment of specific naval means, the actual solutions (such as manual collection from the banks of a river or from small boats in open sea) are not very effective. On the other hand, the employment of big naval units equipped with more sophisticated collection means would strongly affect the river or marine ecosystem due for example to the water and acoustic pollution.

[0004] For this reason, fixed barrier systems are also used to collect waste in surface water. Anti-pollution barrier systems are known for collecting hydrocarbons made of semi-submerged floating longitudinal elements extending about 40-50 cm above the surface of the water and extending about 50-100 cm below the surface of the water. An example of such a barrier system is disclosed by patent document WO2019215584.

[0005] Although barrier systems allow to intercept the floating waste and conduct it to a collection area without excessively affecting the environmental ecosystem, these systems do not allow a selection of the collected waste. Furthermore, if these barriers are employed on a river bed, they could generate a dangerous "dam-effect" and a consequent overflow of the banks.

SUMMARY OF THE INVENTION

[0006] It is therefore an object of the present invention to provide a system that solves the abovementioned problems, in particular, to provide a system for the selective collection of floating material that is efficient, simple to use, not polluting and with almost zero impact on the environmental ecosystem.

[0007] This object is achieved by the system according to the independent claims. Further advantageous combinations and designs are given in the dependent claims therefrom.

[0008] The system for a selective collection of materials floating in surface water according to the present invention comprises an intercepting barrier made up of at least one longitudinal element for intercepting the materials floating and transported by the water flow and conducting the materials to a predetermined direction. The system also comprises a selecting barrier located downstream of the intercepting barrier and connected to said intercepting barrier, for selecting floating materials based on their geometry. In addition, the system comprises a collecting area located downstream of the selecting barrier and connected to said selecting barrier for collecting the materials selected by the selecting barrier.

[0009] In particular, the selecting barrier comprises a first longitudinal level staff, a second longitudinal level staff located downstream the first longitudinal level staff and two float members connecting the two level staffs. Advantageously, the first longitudinal level staff and the second longitudinal level staff are in the form of longitudinal rods and the height of the first level staff above the surface water is lower than that of the second level staff so that floating materials having a predetermined geometry are intercepted by the first longitudinal staff and are conducted to the collecting area, whereas the remaining floating materials go beyond the first longitudinal level staff and pass below the second longitudinal level staff and are conducted downstream of the collecting area.

[0010] This system is suitable to be employed for collecting floating (polluting) materials in natural and artificial water such as rivers, coastal lakes or lagoons, channels or open sea.

[0011] The different components of the system, i.e. the intercepting barrier, the selecting barrier and the collecting area, are configured in such a way to intercept the materials transported by the water flow and conducting the intercepted material to the selecting barrier and then possibly to the collecting area. For this purpose, these components are arranged in series and connected to each other by means of connecting joints. In particular, not all the intercepted material is conducted to the collecting area. In fact, the selecting barrier selects the floating material based on the geometry of this material. Specifically, materials with a limited emerged surface, such as twigs, sticks, canes, etc., are not conducted to the collecting area but are rather conducted downstream said area. On the other hand, materials with a greater emerged surface, such as plastic objects, bottles, etc., are conducted to the collecting area due to the particular configuration of the two longitudinal level staffs of the selecting barrier. The term "emerged surface" is intended here the surface of the object above the surface of water.

[0012] Specifically, the two longitudinal level staffs are two longitudinal rods parallel to each other and positioned at two different heights above the surface of the water. In particular, the first longitudinal level staff is at about 1 cm from the surface of the water and the second longi-

tudinal staff is at about 25 cm from the surface of the water.

[0013] Each longitudinal level staff has a length of about 4 m and a width of about 5 cm. Also, the two level staffs are arranged almost parallel to each other at a constant distance of about 1.3 m. In addition, each float member has a length of about 1.5 m.

[0014] It is noted that the selecting barrier comprises only two longitudinal staffs in the form of rods spaced apart on the surface of the water, wherein the distance between the two longitudinal staffs is determined by the lengths of the connecting floating members. In other words, the staffs do not form any type of grid structure and are two longitudinal rods at different height above the surface of water and the selection occurs based on the characteristics of the floating materials.

[0015] Due to the particular configuration and functioning, the present system has the advantage of not damaging the flora and/or fauna of the surrounding environment. In particular, the system according to the present invention reduces the formation of micro-plastics in open sea intervening for example upstream the river's mouth, before the micro-plastics are subjected to degradation phenomena and cannot be mechanically collected any more. In addition, the present system does not need external energy for the functioning since it takes advantage of the water flow to carry out the selection of the floating material.

[0016] In order to carry out an additional selection of the floating material, the system further comprises a deflecting barrier located upstream of the intercepting barrier. The deflecting barrier is made up of at least one longitudinal element submerged underneath the surface of the water at a predetermined depth from said surface. This barrier is configured for selecting floating or submerged materials based on their depth in water relative to the surface of the water. In this way, the intercepting barrier is configured to intercept the materials selected by the deflecting barrier.

[0017] According to one embodiment, the at least one longitudinal element of the deflecting barrier has a length comprised between 5 m and 7 m and is ballasted to remain submerged at a depth comprised between 7 cm and 10 cm from the surface of the water. In this way, all the materials transported by the water flow having a submersion depth greater than 7-10 cm will be blocked by the deflecting barrier and will be deflected to a different direction and not intercepted by the intercepting barrier. This is the case of heavy and cumbersome materials, such as woods. On the other hand, plastic materials having a submersion depth lower than 7-10 cm are not blocked by the deflecting barrier and pass through said barrier and are conducted to the intercepting barrier. The term "submersion depth" is intended here as the deepest position of a floating material below the surface of water during the transportation by the water flow. It is clear that a material with a high density floats at a deepest distance from the surface of the water, thereby having a greater submersion depth compared to a material with a low density that floats very close to the surface of the water.

[0018] Advantageously, the deflecting barrier extends along a longitudinal direction forming an angle $\alpha < 90°$, preferably $10° < \alpha < 80°$, most preferably $\alpha = 45°$, with the direction of the water flow. In this way, the deflected materials can flow over the system without accumulating at the deflecting barrier.

[0019] In order to ensure a good interception of the floating material, the deflecting barrier extends along a longitudinal direction forming an angle $80° < \beta < 100°$, preferably of 90° with the longitudinal direction of the intercepting barrier. In this way, the material that is not deflected by the deflecting barrier is definitely captured by the intercepting barrier.

[0020] According to an embodiment, the deflecting barrier comprises a floating mechanism for maintaining constant the depth of the deflecting barrier from the surface of the water. In this way, even in the presence of an overflow or of high/low tide, the deflecting barrier remains always in position.

[0021] The at least one longitudinal element of the deflecting barrier and/or the at least one longitudinal element of the intercepting barrier can have a tubular form and can be made of polymeric material. For example, the material can be polyethylene, polypropylene, polyvinyl chloride, or the like.

[0022] In order to improve the capture of the floating materials, the deflecting barrier is separated from the intercepting barrier and the distance between the deflecting barrier and the intercepting barrier is two times the entire length of the intercepting barrier. In particular, the closest distance (as the crow flies) between the deflecting barrier and the intercepting barrier is two times the entire length of the intercepting barrier.

[0023] The deflecting barrier can comprise a plurality of longitudinal elements connected to each other by means of articulated joints. In this way, the deflecting barrier is not a monolithic piece but can be made longer or shorter based on the circumstances. Furthermore, the articulated joints allows the deflecting barrier to slightly adapt in shape to the different water flows.

[0024] According to an embodiment, the at least one longitudinal element of the intercepting barrier has a length comprised between 5 m and 7 m and has a tubular shape with a diameter comprised between 150 mm and 170 mm.

[0025] In order to facilitate the transport of the selected material to the collecting area, the system comprises a conveyor belt at the first longitudinal level staff of the selecting barrier. In one example, the system comprises a blade system located at the two float members to drive the conveyor belt. For its functioning, the blade system uses the force of the water flow. Therefore, no electric motors or other type of mechanical motors are required to actuate the conveyor belt. Alternatively or additionally, the conveyor belt can be driven by a different mechanism. Accordingly the system comprises a paddle wheel and

a motion transfer system. In particular, the motion transfer system can comprise one or more couple elements, for example at least a spiroidal conic couple. Also in this case, the conveyor belt functions without the need of electric motors or other type of mechanical motors since using only the force of the water flow and/or eventually of the wind.

[0026] In one embodiment, the collecting area comprises a plurality of tubular elements each having a diameter comprised between 270 mm and 290 mm and a length comprised between 5 m and 7 m.

[0027] These elements are disposed to form a fenced area, where the selected floating material is collected.

[0028] The collecting area is connected to the selecting barrier and the selecting barrier is connected to the intercepting barrier by means of articulated joints. In addition, the intercepting barrier can comprise a plurality of longitudinal elements connected to each other by means of articulated joints. In this way, the single elements of the system do not represent a monolithic pieces but can be made longer or shorter based on the circumstances. Furthermore, the articulated joints allows the intercepting barrier to slightly adapt in shape to the different water flows.

[0029] In order to avoid damages carried out by huge submerged or floating elements, the system can further comprise at least a sacrificial joint. In this way, the joint can be disengaged at any time to eventually free the system from said elements.

[0030] Preferred embodiments of a system for the selective collection of floating materials in accordance with the invention will be explained herein below in greater detail with reference to the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

[0031]

Fig. 1 illustrates the system according to an embodiment of the present invention located close to the banks of a river.

Fig. 2 illustrates a detail of the intercepting barrier and the selecting barrier according to an embodiment of the present invention.

Fig. 3 illustrates a detail of the selecting barrier and the collecting area according to an embodiment of the present invention.

Fig. 4 illustrates the selecting barrier and the collecting area of figure 3 in a top view.

Fig. 5A-5C illustrate the detail of the conveyor belt driven by a paddle wheel.

DESCRIPTION OF EMBODIMENTS

[0032] Figure 1 describes a system 1 according to an embodiment of the present invention. In particular, the figure shows a top view of the system 1 positioned in a surface water (W) close to the banks or at the coast (C) of a river. The system 1 comprises an intercepting barrier 10 connected to a selecting barrier 20 and a collecting area 30 located with respect to the water flow F of the river in order to intercept, select and eventually collect floating materials. The figure also shows the presence of a deflecting barrier 40 located upstream the intercepting barrier 10 at a distance 2D that is the double of the length D of the intercepting barrier 10. It is noted that the distance 2D is calculated between the closest points between the deflecting barrier 40 and the intercepting barrier 10. The deflecting barrier 40 is submerged at about 7-10 cm below the surface of the water and positioned obliquely with respect to the stream of the river. In particular, the longitudinal direction of the deflecting barrier 40 forms an angle α with the water flow F, wherein α is comprised between 40° and 45°.

[0033] The particular configuration of the deflecting barrier 40, i.e. the orientation of this barrier relative to the water flow F and the submersion depth of the barrier relative to the surface of the water, i.e. above the water surface, allows the barrier to deviate floating materials having a submerged part of almost 7 cm or more towards the central region of the river far away from the other components of the system 1 and particularly from the intercepting barrier 10. On the other hand, the floating materials having a limited submersion depth (i.e. lower than 7 cm) can cross the deflecting barrier 40 and reach the intercepting barrier 10 to be conducted to the selecting barrier 20 for a selection and a possible collection.

[0034] As mentioned above, the deflecting barrier 40 is not arranged orthogonally to the water flow F, thereby forming an angle α with the flow F. In addition, the deflecting barrier 40 is arranged to form an angle β with the longitudinal direction of the intercepting barrier 10, wherein β is preferably 90°. This particular configuration allows the system to intercept only floating material having a certain density and a small submersion depth (light materials) and to deviate heavier materials with a greater submersion depth towards a different direction far away from the system 1. As a matter of fact, floating plastics, basically comprising bottles and packaging, have a limited submersion depth of about 1-2 cm.

[0035] Once the plastic material, together with other floating material having a low density (a submersion depth lower than 7 cm), i.e. canes, aquatic vegetation, woods, twigs, etc., reaches the intercepting barrier 10, it is conducted towards the selecting barrier 20 and eventually to the collecting area 30. As shown in figure 1, the deflecting barrier 40 comprises a floating mechanism defined by two opposing float members 44 for maintaining constant the depth of the deflecting barrier from the surface of the water. In this way, even in the presence of an overflow or of high/low tide, the deflecting barrier remains always in position.

[0036] Figure 2 shows a detail of the intercepting barrier 10 connected to the selecting barrier 20. In particular, the intercepting barrier 10 comprises a plurality of longitudinal elements 12 connected in series by means of

joints to form and articulated barrier. The selecting barrier 20 comprises a first level staff 22 and a second level staff 24 arranged parallel to each other and connected through two float members 26. It is noted that the first level staff 22 represent a sort of prosecution of the intercepting barrier 10, whereas the second level staff 24 is positioned behind the first level staff 22 at a predetermined distance determined by the length of the float members 26.

[0037] Figure 3 shows a detail of the selecting barrier 20 connected to the collecting area 30. The selecting barrier 20 comprises two level staffs 22, 24 in the form of longitudinal rods, preferably made of metal, for example of aluminum, that are arranged at different heights above the surface of water. The first level staff 22 is arranged very close to the surface of water and at a lower height compared to that of the second level staff 24. It is noted that the height of the level staffs 22, 24 can be varied and adjusted by means of the particular joint connections 25 of these level staff 22, 24 with the corresponding float members 26. The first level staff 22 is at 1 cm from the surface of water, whereas the second level staff 24 at about 25 cm from the surface of water. Furthermore, the joint connections 25 are at about 10 cm from the surface of water and the float members 26 at about 6 cm from the surface of water.

[0038] On the first level staff 22 is mounted a conveyor belt 28 driven for example by a blade system 35 using the water flow for its functioning. The blade system 35 basically comprises a blade (for example having an helicoidal shape) inserted in a tubular structure mechanically connected to the conveyor belt 28 for transforming the rotational movement of the blade to the translational movement of the belt 28. It is noted that other systems can advantageously be used to drive the conveyor belt 28, as shown in figures 5A-5C. The conveyor belt 28 serves to conduct floating materials having a particular geometry (great emerged surface) toward the collecting area 30. In fact, as shown in figure 3, the final extremity of the first level staff 22 directly ends into the entrance 36 of the collecting area 30. On the other hand, materials having a limited emerged surface, such as for example twigs or canes, cross and go beyond the first level staff 22, thereby reaching the second level staff 24. Since the second level staff 24 is arranged at a higher level above the surface of water compared to the first level staff 22, the floating materials not intercepted by the conveyor belt 28 cross the region between the surface of water and the second level staff 24 passing below said level staff 24, thereby exiting the system 1 and being conducted downstream the collecting area 30. In other words, the selecting barrier 20 serves to carry out a further selection of the floating materials, once intercepted by the intercepting barrier 10.

[0039] Figure 4 shows a detail of the collecting area 30 connected to the selecting barrier 20. In particular, the collecting area comprises at least four tubular elements 32 having a length of about 6 m and a diameter of about 280 mm. The tubular elements 32 are arranged to form a closed structure with a single entrance 36 in order to contain the intercepted and selected material. It is noted that the entrance 36 of the collecting area 30 is defined by one of the float members 26 of the selecting barrier and by a second additional float member 34. Also, the tubular elements 32 are arranged in pairs opposite to each other and are connected by a connection rod 38 representing end of the collecting area 30. The floating material present in the collecting area 30 can be retrieved using terrestrial means or suitable boats comprising metallic containers located on the prow. Thereafter, the retrieved material can be transferred to suitable container, i.e. big bags of 1 meter cubed, and placed in storage areas for the delivery to authorized operators.

[0040] The system 1 according to the present invention represents a preventive approach to the problem of plastic present in open sea. In fact, the floating litter is intercepted before it reaches the open sea, thereby strongly reducing the employment of determined resources dedicated to the emergency of huge quantity of floating litter in open sea.

[0041] The system 1 is also configured to reduce the maintenance service and can be adaptable to different types of rivers having different dimensions and quantity of transported water.

[0042] The figures 5A to 5C show in detail the functioning of the conveyor belt 28 according to an example. The conveyor belt 28 is located at the first longitudinal level staff 22 in order to facilitate the conduction of the collected material, in particular floating material having a particular geometry (great emerged surface), towards the entrance 36 and then towards the collecting area 30. The conveyor belt 28 is driven by a paddle wheel 21 located laterally on the barrier 20. In particular, the paddle wheel 21 is fixed to a frame supported by one of the floating member 26 of the barrier 20 and by a second additional floating member 23. In particular, the paddle wheel 21 is fixed at a certain height relative to the surface of the water so that it can freely rotate due to the water flow hitting and pushing the paddles. Through a motion transfer system 27, located between the paddle wheel 21 and the conveyor belt 28, the paddle wheel 21 can drive the movement of the belt 28. The motion transfer system 27 is illustrated in more detail in figures 5B and 5C according to two different perspective views. As shown in these figures, the motion transfer system 27 comprises three spiroidal conic couples 29 formed by toothed elements and longitudinal rods that transfer the rotational movement of the paddle wheel 21 (through a rotational rod 31 extending from the center of the wheel 21) to the translational movement of the conveyor belt 28 (through a dedicated toothed wheel). It is noted that the paddle wheel 21 can transfer the motion to the conveyor belt 28 using only the force of the water flow and/or of the wind.

[0043] Specifically, the system 1 is configured to intercept, select, and collect materials floating in the water of a river so that the collected materials are ready to be

transported to a dedicated recycling or waste disposal plant.

Claims

1. System (1) for a selective collection of materials floating in surface water (W), the system (1) comprising:

   an intercepting barrier (10) made up of at least one longitudinal element (12) for intercepting the materials floating and transported by the water flow (F) and conducting the intercepted materials to a predetermined direction,
   a selecting barrier (20) located downstream of the intercepting barrier (10) and connected to said intercepting barrier (10), for selecting floating materials based on their geometry, and
   a collecting area (30) located downstream of the selecting barrier (20) and connected to said selecting barrier (20) for collecting the materials selected by the selecting barrier (20),
   wherein the selecting barrier (20) comprises a first longitudinal level staff (22), a second longitudinal level staff (24) located downstream the first longitudinal level staff (22) and two float members (26) connecting the two level staffs (22, 24),
   characterized in that
   the first longitudinal level staff (22) and the second longitudinal level staff (24) are in the form of longitudinal rods and the height of the first level staff (22) above the surface water is lower than that of the second level staff (24) so that floating materials having a predetermined geometry are intercepted by the first longitudinal staff (22) and are conducted to the collecting area (30), whereas the remaining floating materials go beyond the first longitudinal level staff (22) and pass below the second longitudinal level staff (24) and are conducted downstream of the collecting area (30).

2. The system (1) of claim 1, further comprising a deflecting barrier (40) located upstream of the intercepting barrier (10) and made up of at least one longitudinal element (42) submerged underneath the surface of the water at a predetermined depth from said surface for selecting floating or submerged materials based on their depth in water relative to the surface of the water, wherein the intercepting barrier (10) is configured to intercept the materials selected by the deflecting barrier (40).

3. The system (1) of claim 2, wherein the at least one longitudinal element (42) of the deflecting barrier (40) has a length comprised between 5 m and 7 m and is ballasted to remain submerged at a depth comprised between 7 cm and 10 cm from the surface of the water.

4. The system (1) of any one of claims 2 to 3, wherein the deflecting barrier (40) extends along a longitudinal direction forming an angle $\alpha < 90°$, preferably $10° < \alpha < 80°$, most preferably $\alpha = 45°$, with the direction of the water flow (F) .

5. The system (1) of any one of claims 2 to 4, wherein the deflecting barrier (40) extends along a longitudinal direction forming an angle $80° < \beta < 100°$ with the longitudinal direction of the intercepting barrier (10).

6. The system (1) of any one of claims 2 to 5, wherein the deflecting barrier (40) comprises a floating mechanism (44) for maintaining constant the depth of the deflecting barrier (40) from the surface of the water.

7. The system (1) of any one of claims 2 to 6, wherein the at least one longitudinal element (42) of the deflecting barrier (40) and/or the at least one longitudinal element (12) of the intercepting barrier (10) is made of polymeric material.

8. The system (1) of any one of claims 2 to 7, wherein the deflecting barrier (40) is separated from the intercepting barrier (10) and the distance between the deflecting barrier (40) and the intercepting barrier (10) is two times the entire length of the intercepting barrier (10).

9. The system (1) of any one of claims 2 to 8, wherein the deflecting barrier (40) comprises a plurality of longitudinal elements (42) connected to each other by means of articulated joints.

10. The system (1) of any one of the preceding claims, wherein the least one longitudinal element (12) of the intercepting barrier (10) has a length comprised between 5 m and 7 m and has a tubular shape with a diameter comprised between 150 mm and 170 mm.

11. The system (1) of any one of the preceding claims, further comprising a conveyor belt (28) at the first longitudinal level staff (22) to facilitate the transport of the materials towards the collecting area (30).

12. The system (1) of claim 11, further comprising:

    a. a paddle wheel (21) and a motion transfer system (27) to drive the conveyor belt (28), wherein in particular the motion transfer system (27) comprises at least a spiroidal conic couple (29); and/or

b. a blade system (35) located at the two float members (26) to drive the conveyor belt (28).

13. The system (1) of any one of the preceding claims, wherein the collecting area (30) comprises a plurality of tubular elements (32) each having a diameter comprised between 270 mm and 290 mm and a length comprised between 5 m and 7 m.

14. The system (1) of any one of the preceding claims, wherein the collecting area (30) is connected to the selecting barrier (20) and the selecting barrier (20) is connected to the intercepting barrier (10) by means of articulated joints.

15. The system (1) of any one of the preceding claims, wherein

a. the intercepting barrier (10) comprises a plurality of longitudinal elements (12) connected to each other by means of articulated joints; and/or
b. the system (1) further comprises at least a sacrificial joint.

Patentansprüche

1. System (1) zur selektiven Sammlung von Materialien, die in Oberflächenwasser (W) schwimmen, wobei das System (1) umfasst:

eine Abfangbarriere (10), die aus mindestens einem länglichen Element (12) besteht, zum Abfangen der Materialien, die durch den Wasserstrom (F) schwimmen und transportiert werden, und Leiten der abgefangenen Materialien in eine vorbestimmte Richtung,
eine Auswahlbarriere (20), die sich stromabwärts der Abfangbarriere (10) befindet und mit der Abfangbarriere (10) verbunden ist, zum Auswählen von schwimmenden Materialien basierend auf ihrer Geometrie, und
einen Sammelbereich (30), der sich stromabwärts der Auswahlbarriere (20) befindet und mit der Auswahlbarriere (20) verbunden ist, zum Sammeln der Materialien, die von der Auswahlbarriere (20) ausgewählt wurden,
wobei die Auswahlbarriere (20) einen ersten länglichen Pegelstab (22), einen zweiten länglichen Pegelstab (24), der sich stromabwärts des ersten länglichen Pegelstabs (22) befindet, und zwei Schwimmelemente (26) umfasst, die die zwei Pegelstäbe (22, 24) verbinden,
dadurch gekennzeichnet, dass
der erste längliche Pegelstab (22) und der zweite längliche Pegelstab (24) die Form von länglichen Stangen haben und die Höhe des ersten Pegelstabs (22) über dem Oberflächenwasser niedriger ist als die des zweiten Pegelstabs (24), so dass schwimmende Materialien mit einer vorbestimmten Geometrie von dem ersten länglichen Stab (22) abgefangen und zu dem Sammelbereich (30) geleitet werden, während die übrigen schwimmenden Materialien über den ersten länglichen Pegelstab (22) hinausgehen und unter dem zweiten länglichen Pegelstab (24) hindurchgehen und stromabwärts des Sammelbereichs (30) geleitet werden.

2. System (1) nach Anspruch 1, ferner umfassend eine Ablenkbarriere (40), die sich stromaufwärts der Abfangbarriere (10) befindet und aus mindestens einem länglichen Element (42) besteht, das unter die Oberfläche des Wassers in einer vorbestimmten Tiefe von der Oberfläche eingetaucht ist, zum Auswählen schwimmender oder eingetauchter Materialien basierend auf ihrer Tiefe im Wasser relativ zu der Oberfläche des Wassers, wobei die Abfangbarriere (10) eingerichtet ist, um die Materialien abzufangen, die durch die Ablenkbarriere (40) ausgewählt wurden.

3. System (1) nach Anspruch 2, wobei das mindestens eine längliche Element (42) der Ablenkbarriere (40) eine Länge zwischen 5 m und 7 m umfasst und beschwert ist, um in einer Tiefe zwischen 7 cm und 10 cm von der Oberfläche des Wassers eingetaucht zu bleiben.

4. System (1) nach einem der Ansprüche 2 bis 3, wobei sich die Ablenkbarriere (40) entlang einer Längsrichtung erstreckt, die einen Winkel $\alpha < 90°$, vorzugsweise $10° < \alpha < 80°$, am meisten bevorzugt $\alpha = 45°$, mit der Richtung des Wasserstroms (F) bildet.

5. System (1) nach einem der Ansprüche 2 bis 4, wobei sich die Ablenkbarriere (40) entlang einer Längsrichtung erstreckt, die einen Winkel $80° < \beta < 100°$ mit der Längsrichtung der Abfangbarriere (10) bildet.

6. System (1) nach einem der Ansprüche 2 bis 5, wobei die Ablenkbarriere (40) einen Schwimmmechanismus (44) umfasst, um die Tiefe der Ablenkbarriere (40) von der Oberfläche des Wassers konstant zu halten.

7. System (1) nach einem der Ansprüche 2 bis 6, wobei das mindestens eine längliche Element (42) der Ablenkbarriere (40) und/oder das mindestens eine längliche Element (12) der Abfangbarriere (10) aus polymerem Material hergestellt ist.

8. System (1) nach einem der Ansprüche 2 bis 7, wobei die Ablenkbarriere (40) von der Abfangbarriere (10) getrennt ist und der Abstand zwischen der Ablenkbarriere (40) und der Abfangbarriere (10) das Zwei-

fache der Gesamtlänge der Abfangbarriere (10) beträgt.

9. System (1) nach einem der Ansprüche 2 bis 8, wobei die Ablenkbarriere (40) mehrere längliche Elemente (42) umfasst, die mittels gelenkiger Verbindungen miteinander verbunden sind.

10. System (1) nach einem der vorhergehenden Ansprüche, wobei das mindestens eine längliche Element (12) der Abfangbarriere (10) eine Länge zwischen 5 m und 7 m umfasst und eine röhrenförmige Form mit einem Durchmesser zwischen 150 mm und 170 mm aufweist.

11. System (1) nach einem der vorhergehenden Ansprüche, ferner umfassend ein Förderband (28) an dem ersten länglichen Pegelstab (22), um den Transport der Materialien hin zu dem Sammelbereich (30) zu ermöglichen.

12. System (1) nach Anspruch 11, ferner umfassend:

a. ein Paddelrad (21) und ein Bewegungsübertragungssystem (27), um das Förderband (28) anzutreiben, wobei das Bewegungsübertragungssystem (27) insbesondere mindestens ein spiroidales konisches Paar (29) umfasst; und/oder
b. ein Schaufelsystem (35), das sich an den zwei Schwimmelementen (26) befindet, um das Förderband (28) anzutreiben.

13. System (1) nach einem der vorhergehenden Ansprüche, wobei der Sammelbereich (30) mehrere röhrenförmige Elemente (32) umfasst, die jeweils einen Durchmesser zwischen 270 mm und 290 mm und eine Länge zwischen 5 m und 7 m aufweisen.

14. System (1) nach einem der vorhergehenden Ansprüche, wobei der Sammelbereich (30) mit der Auswahlbarriere (20) verbunden ist und die Auswahlbarriere (20) mit der Abfangbarriere (10) mittels gelenkiger Verbindungen verbunden ist.

15. System (1) nach einem der vorhergehenden Ansprüche, wobei

a. die Abfangbarriere (10) mehrere längliche Elemente (12) umfasst, die mittels gelenkiger Verbindungen miteinander verbunden sind; und/oder
b. das System (1) ferner mindestens eine Opferverbindung umfasst.

Revendications

1. Système (1) de collecte sélective de matières flottantes dans de l'eau de surface (W), ce système (1) comprenant :

une barrière d'interception (10) constituée d'au moins un élément longitudinal (12) pour intercepter les matières flottantes et transportées par le flux d'eau (F) et conduisant les matières interceptées dans un sens prédéterminé,
une barrière de sélection (20) située en aval de la barrière d'interception (10) et connectée à ladite barrière d'interception (10), pour sélectionner les matières flottantes en se basant sur leur géométrie, et une zone de collecte (30) située en aval de la barrière d'interception (20) et connectée à ladite barrière de sélection (20) pour collecter les matières sélectionnées par la barrière de sélection (20),
la barrière de sélection (20) comprenant une première tige de niveau longitudinale (22), une seconde tige de niveau longitudinale (24) située en aval de la première tige de niveau longitudinale (22) et deux éléments de flottaison (26) connectant les deux tiges de niveau (22, 24),
caractérisé en ce que
la première tige de niveau longitudinale (22) et la seconde tige de niveau longitudinale (24) ont la forme de barres longitudinales et la hauteur de la première tige de niveau (22) au-dessus de l'eau de surface est inférieure à celle de la seconde tige de niveau (24), de sorte que les matières flottantes ayant une géométrie prédéterminée sont interceptées par la première tige de niveau longitudinale (22) et sont conduites vers la zone de collecte (30), tandis que les matières flottantes restantes vont au-delà de la première tige de niveau longitudinale (22) et passent en dessous de la seconde tige de niveau longitudinale (24) et sont conduites en aval de la zone de collecte (30).

2. Système (1) selon la revendication 1, comprenant en outre une barrière de déflexion (40) située en amont de la barrière d'interception (10) et constituée d'au moins un élément longitudinal (42) submergé en dessous de la surface de l'eau à une profondeur prédéterminée de ladite surface pour sélectionner les matières flottantes ou submergées en se basant sur leur profondeur dans l'eau par rapport à la surface de l'eau, la barrière d'interception (10) étant configurée pour intercepter les matières sélectionnées par la barrière de déflexion (40).

3. Système (1) selon la revendication 2, dans lequel l'au moins un élément longitudinal (42) de la barrière de déflexion (40) a une longueur comprise entre 5

m et 7 m et est lesté pour rester submergé à une profondeur comprise entre 7 cm et 10 cm de la surface de l'eau.

4. Système (1) selon l'une quelconque des revendications 2 à 3, dans lequel la barrière de déflexion (40) s'étend dans un sens longitudinal en formant un angle (α) < 90°, de préférence 10° < α < 80°, le plus préférentiellement α = 45°, avec le sens du flux d'eau (F) .

5. Système (1) selon l'une quelconque des revendications 2 à 4, dans lequel la barrière de déflexion (40) s'étend dans un sens longitudinal en formant un angle 80° < β < 100° avec le sens longitudinal de la barrière d'interception (10).

6. Système (1) selon l'une quelconque des revendications 2 à 5, dans lequel la barrière de déflexion (40) comprend un mécanisme de flottaison (44) pour maintenir constante la profondeur de la barrière de déflexion par (40) par rapport à la surface de l'eau.

7. Système (1) selon l'une quelconque des revendications 2 à 6, dans lequel l'au moins un élément longitudinal (42) de la barrière de déflexion (40) et/ou l'au moins un élément longitudinal (12) de la barrière d'interception (10) est composé de matériau polymérique.

8. Système (1) selon l'une quelconque des revendications 2 à 7, dans lequel la barrière de déflexion (40) est séparée de la barrière d'interception (10) et la distance entre la barrière de déflexion (40) et la barrière d'interception (10) représente deux fois la totalité de la longueur de la barrière d'interception (10) .

9. Système (1) selon l'une quelconque des revendications 2 à 8, dans lequel la barrière de déflexion (40) comprend une pluralité d'éléments longitudinaux (42) connectés les uns aux autres au moyen de joints articulés.

10. Système (1) selon l'une quelconque des revendications précédentes, dans lequel l'au moins un élément longitudinal (12) de la barrière d'interception (10) a une longueur comprise entre 5 m et 7 m et a une forme tubulaire ayant un diamètre compris entre 150 mm et 170 mm.

11. Système (1) selon l'une quelconque des revendications précédentes, comprenant en outre une bande transporteuse (28) au niveau de la première tige de niveau longitudinale (22) pour faciliter le transport des matières vers la zone de collecte (30).

12. Système (1) selon la revendication 11, comprenant en outre :

a. une roue à aubes (21) et un système de transfert de mouvement (27) pour entraîner la bande transporteuse (28), le système de transfert de mouvement (27) comprenant en particulier au moins un couple conique spiroïde (29) ; et/ou
b. un système de pales (35) situé au niveau des deux éléments de flottaison (26) pour entraîner la bande transporteuse (28).

13. Système (1) selon l'une quelconque des revendications précédentes, dans lequel la zone de collecte (30) comprend une pluralité d'éléments tubulaires (32) ayant chacun un diamètre compris entre 270 mm et 290 mm et une longueur comprise entre 5 m et 7 m.

14. Système (1) selon l'une quelconque des revendications précédentes, dans lequel la zone de collecte (30) est connectée à la barrière de sélection (20) et la barrière de sélection (20) est connectée à la barrière d'interception (10) au moyen de joints articulés.

15. Système (1) selon l'une quelconque des revendications précédentes, dans lequel

a. la barrière d'interception (10) comprend une pluralité d'éléments longitudinaux (12) connectés les uns aux autres au moyen de joints articulés ;
et/ou
b. le système (1) comprend en outre au moins un joint sacrificiel.

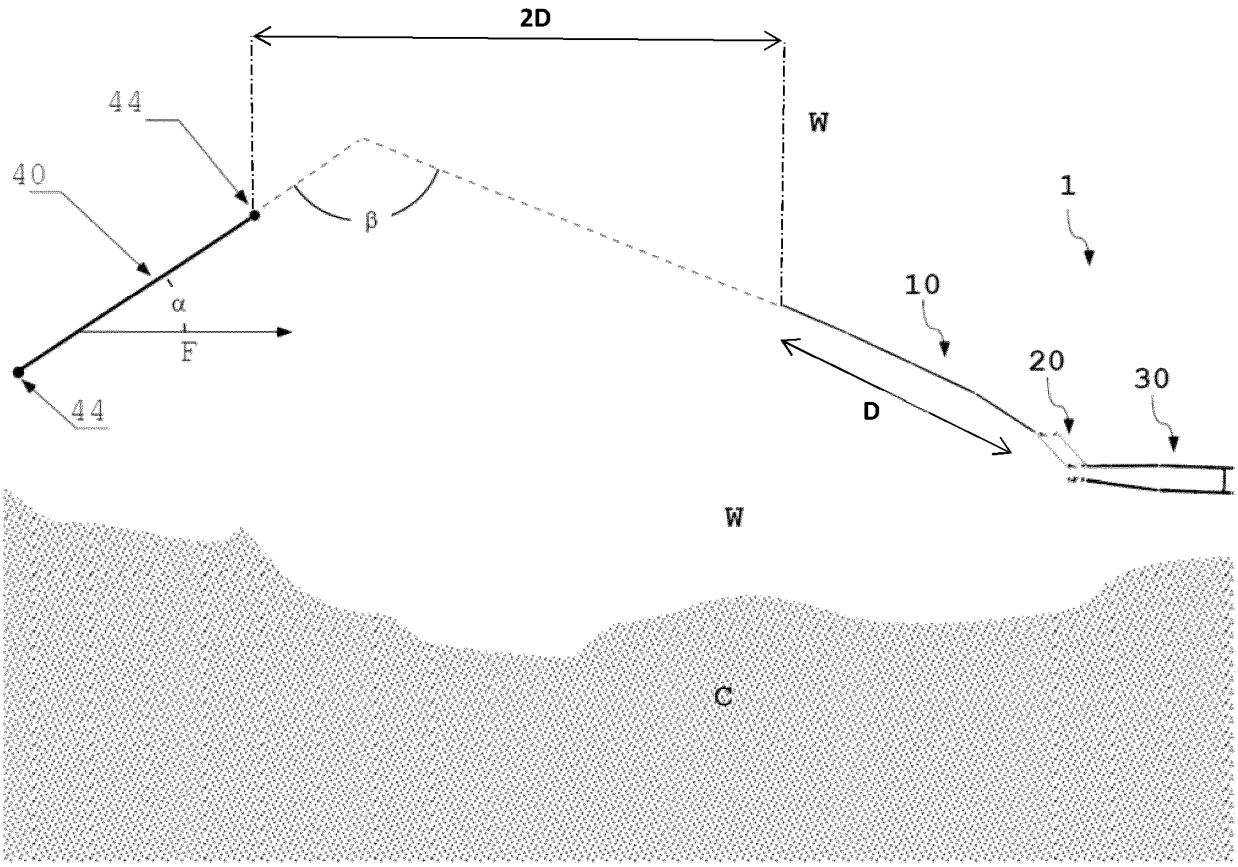

FIG. 1

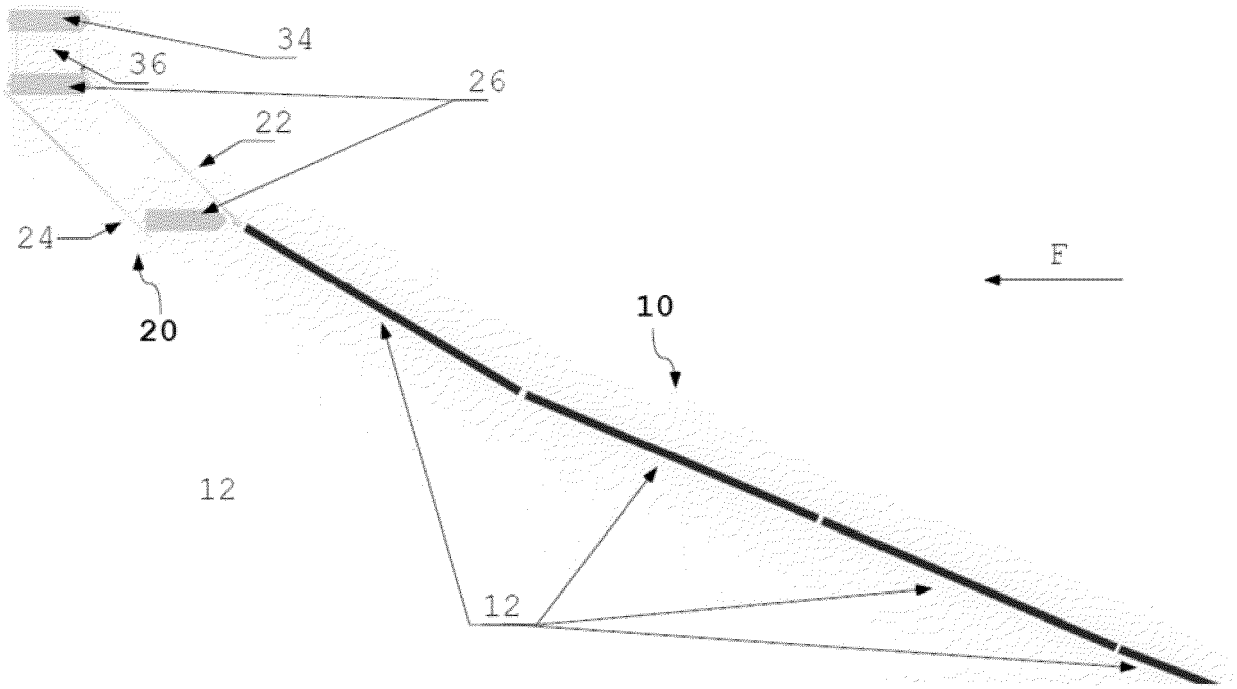

FIG. 2

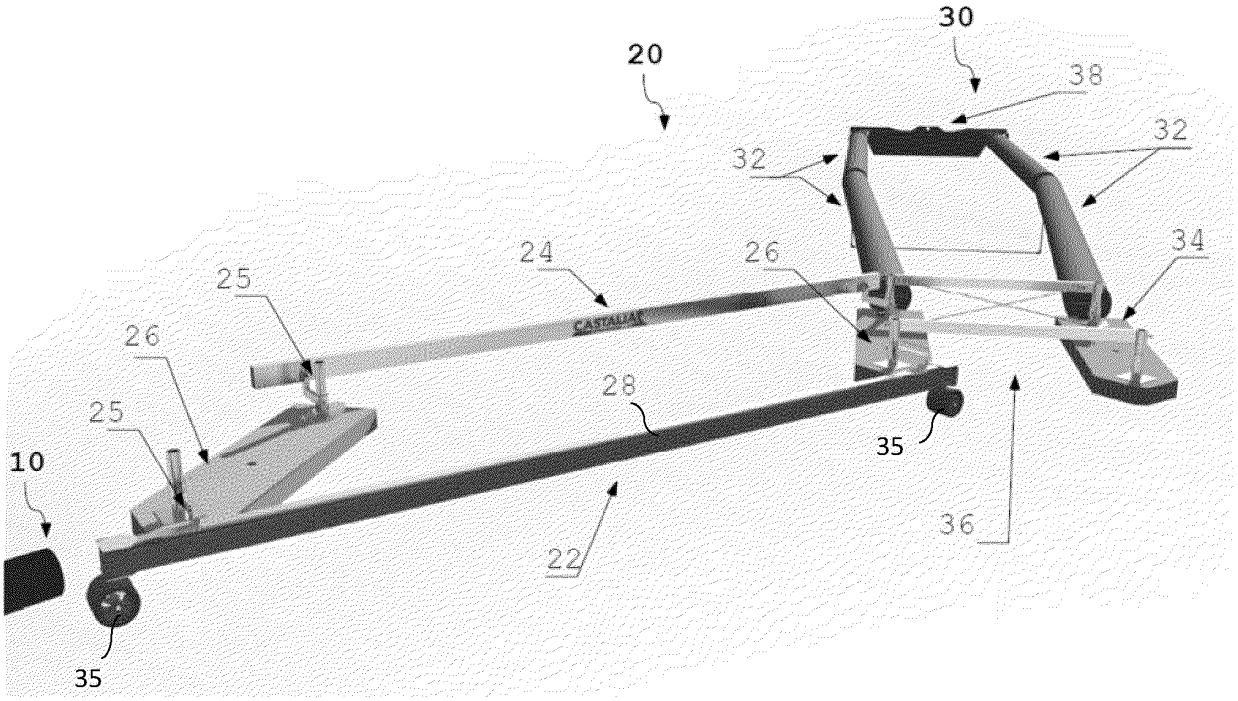

FIG. 3

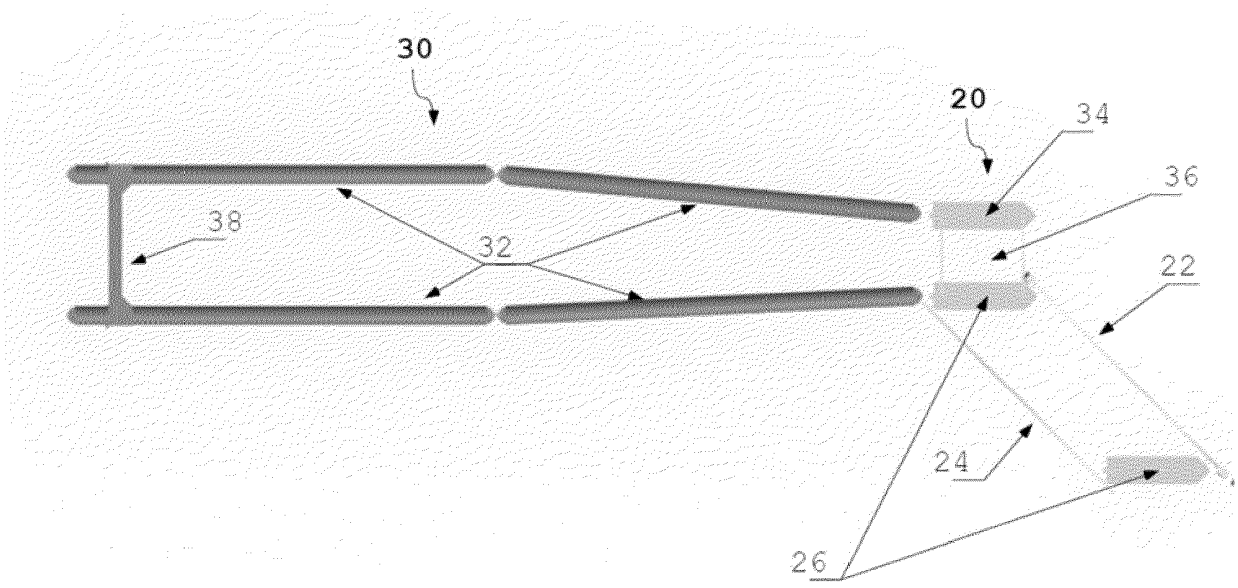

FIG. 4

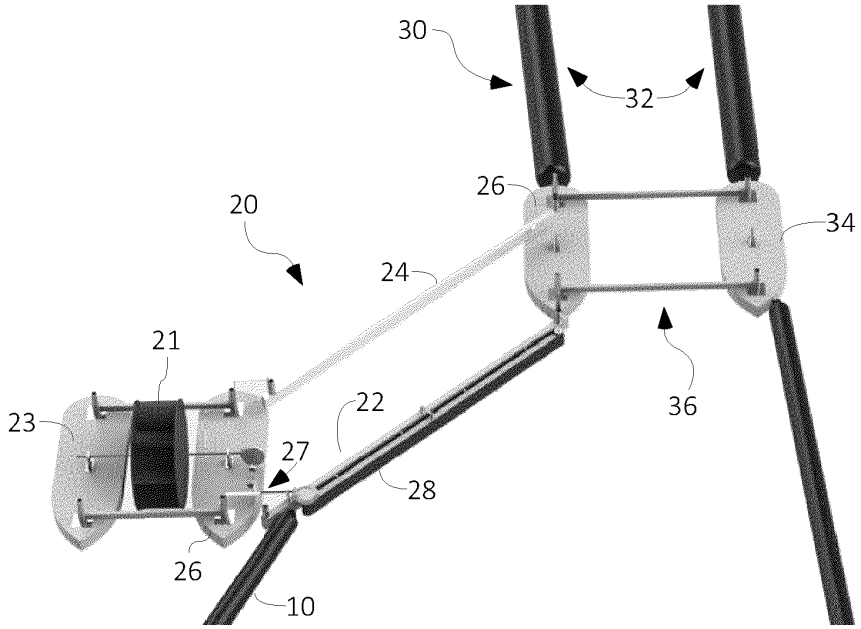

FIG. 5A

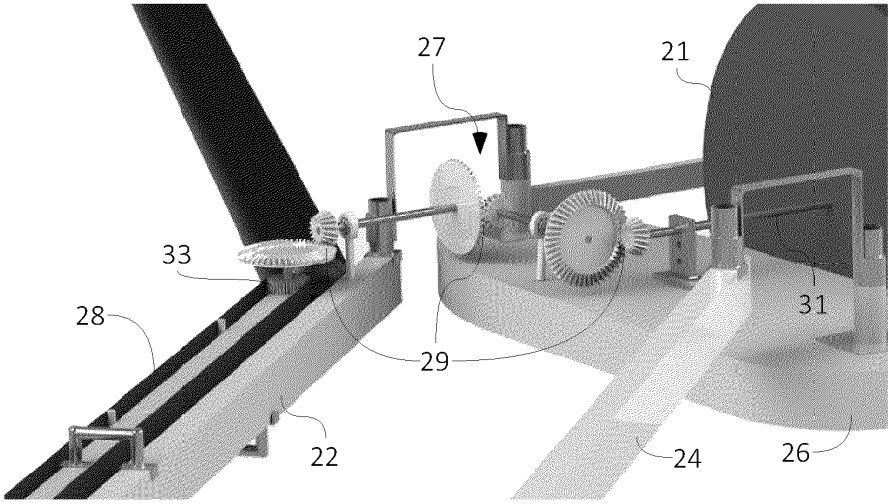

FIG. 5B

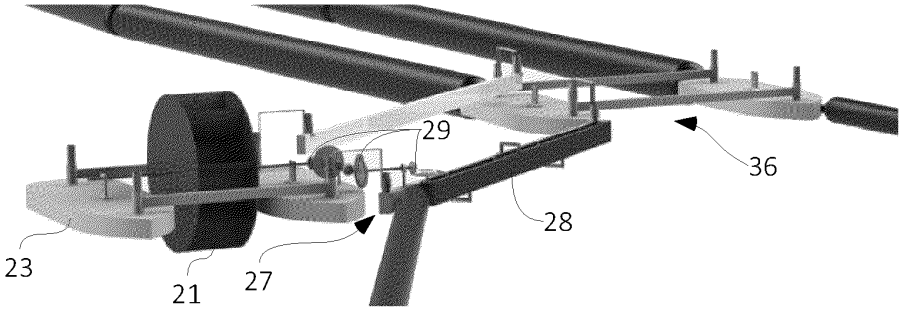

FIG. 5C

REFERENCES CITED IN THE DESCRIPTION

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