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(54) System for protecting beaches against marine erosion

(57) A system for protecting a coast against marine erosion by means of barriers arranged at a distance from the coast, wherein each barrier (1) is composed of two fixed structures (2, 3) which are installed on the sea floor, a wall (8) being arranged between the structures and being supported therein and comprising two portions (6, 7) which can move with respect to a horizontal axis (C) which is immersed at an intermediate depth of the sea, and means (9, 12) for actuating such portions (6, 7) between a barrier position, in which they lie between the sea floor (A) and the surface (B), and a position in which such portions (6, 7) are immersed in the sea and allow the circulation of water above and below them.

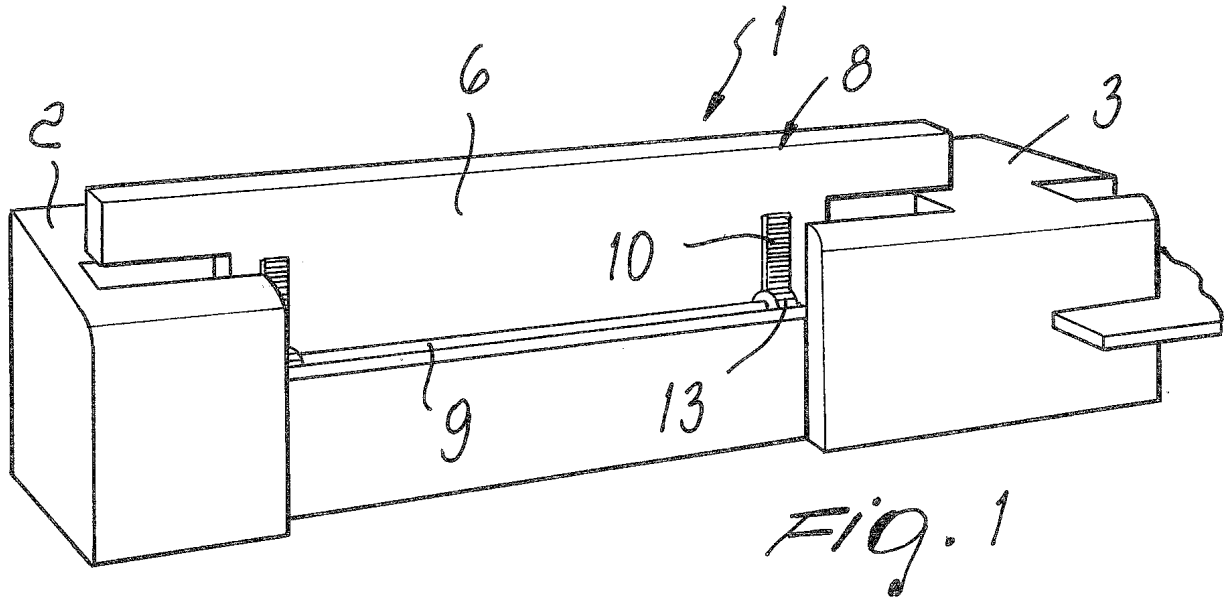

Fig. 1

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Description

[0001] The present invention relates to a system for protecting beaches against marine erosion.

[0002] The phenomenon of land subsidence which affects low lying coasts and causes the retreat of beaches in combination with the erosive action of the sea is known.

[0003] In order to protect beaches, the most widely used systems consist of reefs arranged in front of the stretch of coast to be protected and are formed by means of rocks which are piled on the sea bed and protrude above the average sea level by one or more meters.

[0004] These reefs are generally aligned parallel to the coast, so as to form an inward basin, and are mutually spaced by openings which connect the inward basin to the open sea and allow the passage of boats.

[0005] Known reefs cause a considerable accumulation of sand in the inward basin, consequently causing the sea bed to rise, but reduce significantly the recirculation of water between the inward basin and the open sea; accordingly, in particular climate conditions the water in the inward basin is degraded, with negative effects on bathing.

[0006] Another considerable drawback of reefs is the fact that they have a negative impact on the environment, in particular because they block the view of the open sea.

[0007] Barriers are known from the background art, which however have the function of controlling the flow of water in a canal or the inflow and outflow of water from basins in order to control their level, but without affecting the recirculation of the water and without affecting the formation of sand deposits on the beds of bodies of water. Barriers of this type are known, for example, from US patents no. 194,922, 3,756,032, and 4,103,497, and from German patent no. 859 129.

[0008] The aim of the present invention is to provide a system for protecting coasts which allows to obviate the shortcomings of known systems.

[0009] This aim is achieved with a system for protecting a coast against marine erosion by means of barriers arranged at a distance from the coast, characterized in that each barrier is composed of two fixed structures which are installed on the sea floor, a wall being arranged between said structures and being supported therein and comprising two portions which can move with respect to a horizontal axis which is immersed at an intermediate depth of the sea, and means for actuating said portions between a barrier position, in which they lie between the sea floor and the surface, and a position in which said portions are immersed in the sea and allow the circulation of water above and below them.

[0010] Further characteristics and advantages of the invention will become better apparent from the following detailed description of two exemplary embodiments thereof, illustrated in the accompanying drawing, wherein:

Figure 1 is a schematic perspective view of a barrier according to the invention;
Figures 2 and 3 are views of the barrier of Figure 1 in two operating conditions;
Figures 4 and 5 are views of a barrier according to a different embodiment of the invention in two operating conditions.

[0011] With reference to Figures 1 to 3, the reference numeral 1 generally designates a barrier according to the invention. The barrier 1 is composed of two structures 2 and 3, which are installed and anchored at a preset distance on the sea floor A. The height of the structures is lower than the depth H of the sea in the point where they are installed, so that they are immersed below the level B of the surface of the sea.

[0012] Each one of the two structures 2 and 3 is provided with vertical guides 4 and 5, in which the opposite ends of two portions 6 and 7 which form a barrier wall, generally designated by the reference numeral 8, can slide.

[0013] Between the portions 6 and 7 there is a gap, in which a horizontal shaft 9 is present which has an axis C which is supported, by means of its opposite ends, so that it can rotate within the structures 2 and 3. The shaft 9 is actuated by motor elements, which are installed in chambers provided in the structures 2 and 3, and is provided with pinions 13, which mesh with vertical racks 10 and 11, which are rigidly coupled to the opposite faces of the portions 6 and 7. Therefore, by actuating the shaft 9 in one direction or the other it is possible to lower the portion 6 and at the same time lift the portion 7, and vice versa.

[0014] Conveniently, the shaft 9 is arranged at an intermediate level, which is half of the depth H, and the height of the portions 6 and 7 is chosen so that by lifting the portion 6 and lowering the portion 7 the upper edge of the portion 6 is arranged at the level of the surface B of the sea or slightly above it, while the lower edge of the portion 7 rests on the sea floor A. In this manner, the portions 6 and 7 integrate each other, forming a barrier which, during heavy seas, prevents the water of the sea from overflowing into the inward basin and causing the erosion of the coast.

[0015] When the sea is calm, instead, the portion 6 is lowered, while the portion 7 is raised, so as to reduce the overall height of the wall 8 and allow the recirculation of water above and below it.

[0016] In particular, it should be noted that with the portions 6 and 7 in the water recirculation position it is possible to prevent and reduce the deposition of sand in the internal basin. Moreover, by adjusting the lowering and lifting of the portions 6 and 7 to intermediate values or by varying the position of the portions among the successive barriers it is possible to achieve, if necessary, nourishment of the floor of the inward basin and of the beach.

[0017] The invention is susceptible of numerous modifications and variations, all of which are within the scope of the

appended claims.

[0018] Figures 4 and 5 illustrate a different embodiment in which the barrier wall 8 is constituted by two portions 6 and 7, which are rigidly coupled along a plane which is substantially diametrical with respect to the shaft 9, so that they can pass from a barrier position to the recirculation position by means of the rotation of the shaft 9.

[0019] The portion 7 comprises a chamber 12, which is connected to the atmosphere by means of a duct and is suitable to be flooded, by means of suitable valve systems, with seawater and emptied with the aid of a pump. The wall 8 is kept in the barrier position by differentiating the weight of the portions 6 and 7 in order to create a moment which keeps the portion 7 rested on the sea floor. The chamber 12 is sized so that expelling the water contained therein produces buoyancy adapted to create a moment sufficient to rotate the wall 8 from the barrier position to the horizontal recirculation position.

[0020] In another embodiment, there are valve systems which are suitable to close hermetically the chamber 12 after filling and allow its emptying by pumping compressed air therein.

[0021] The same concept of buoyancy, shown for the embodiments of Figures 4 and 5, can be applied to the embodiment of Figures 1-3, by forming in the portions 6 and 7 chambers which are alternately flooded with water or emptied by introducing air therein, so that when the wall 8 must assume the barrier position, the portion 7 is flooded and the portion 6 is emptied, and vice versa when the wall must assume the recirculation position.

[0022] The disclosures in Italian Patent Application No. RN2005A000008 from which this application claims priority are incorporated herein by reference.

[0023] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A system for protecting a coast against marine erosion by means of barriers arranged at a distance from the coast, **characterized in that** each barrier (1) is composed of two fixed structures (2, 3) which are installed on the sea floor, a wall (8) being arranged between said structures and being supported therein and comprising two portions (6, 7) which can move with respect to a horizontal axis (C) which is immersed at an intermediate depth of the sea, and means (9, 12) for actuating said portions (6, 7) between a barrier position, in which they lie between the sea floor (A) and the surface (B), and a position in which said portions (6, 7) are immersed in the sea and allow the circulation of water above and below them.

2. The system according to claim 1, **characterized in that** each one of the two structures (2, 3) is provided with vertical guides (4, 5) in which the opposite ends of said portions (6, 7) which form said barrier wall (8) can slide, a horizontal shaft (9) being arranged between said portions (6, 7), its opposite ends being supported rotatably within said structures (2, 3), said shaft being controlled by actuation elements which are installed in chambers provided in said structures (2, 3).

3. The system according to claim 2, **characterized in that** said shaft (9) is provided with pinions (13) which mesh with vertical racks (10, 11) which are rigidly coupled to the opposite faces of said portions (5, 6) so that by actuating said shaft (9) said portions are moved in mutually opposite directions.

4. The system according to claim 1, **characterized in that** said two portions (6, 7) are rigidly coupled along a substantially diametrical plane to a horizontal shaft (9), which is supported rotatably in said structures (2, 3) and is controlled by actuation means which actuate said portions between a barrier position and a water recirculation position.

5. The system according to claim 4, **characterized in that** one (7) of said portions (6, 7) comprises a chamber (12) which is connected to the atmosphere by means of a duct and is adapted to be flooded, by way of valve means, with seawater and emptied with the aid of a pump so that expelling the water contained therein produces enough buoyancy to turn the wall (8) from the barrier position to the horizontal recirculation position.

6. The system according to claim 4, **characterized in that** one (7) of said portions (6, 7) comprises a chamber (12), which is connected by way of valve means to the atmosphere and to means for pumping compressed air, said chamber (12) being sized so that expelling the water contained therein produces enough buoyancy to turn said wall (8) from the barrier position to the horizontal recirculation position.

7. The system according to one of claims 2 and 3, **characterized in that** said portions (6, 7) comprise respective chambers, which are connected to the atmosphere by way of respective ducts and are adapted to be filled alternately, by way of valve means, with seawater and emptied with the aid of a pump, so that expelling the water contained in one chamber and filling with water the other chamber produces the buoyancy of one portion and the sinking of the other portion such as to cause the wall (8) to move from the barrier position to the horizontal recirculation position and vice versa.

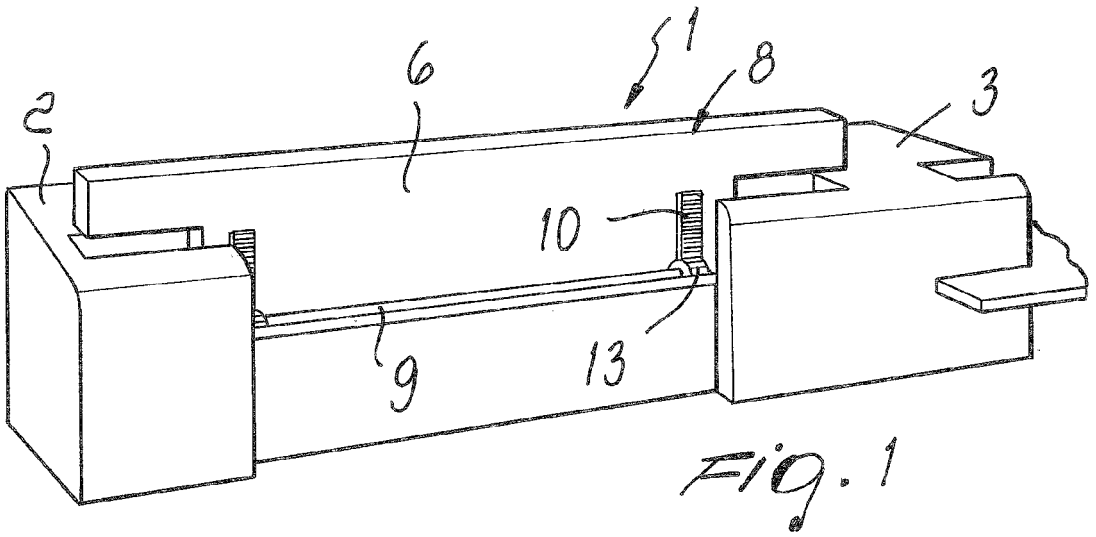

Fig. 1

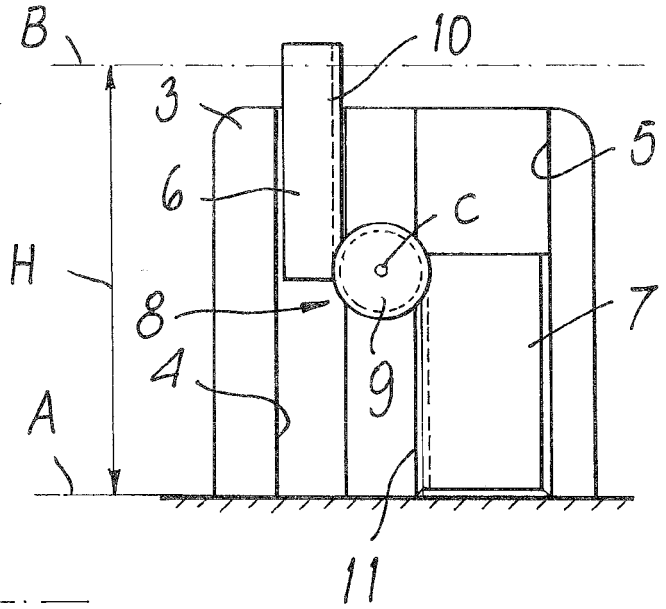

Fig. 2

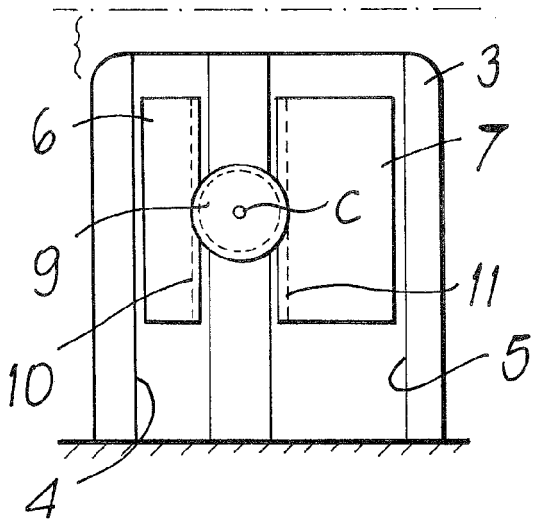

Fig. 3

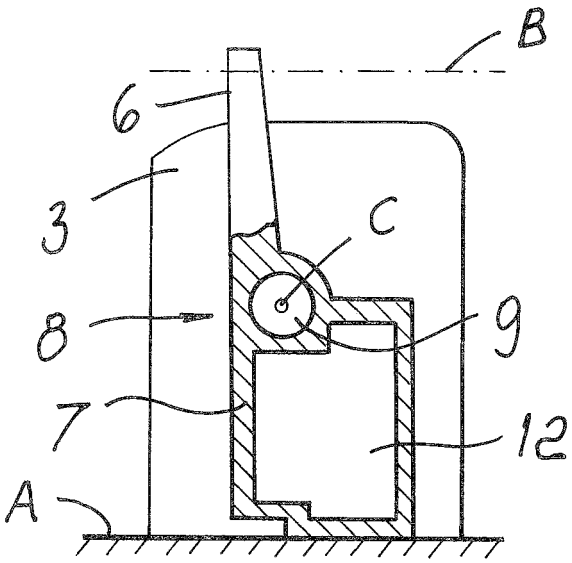

Fig. 4

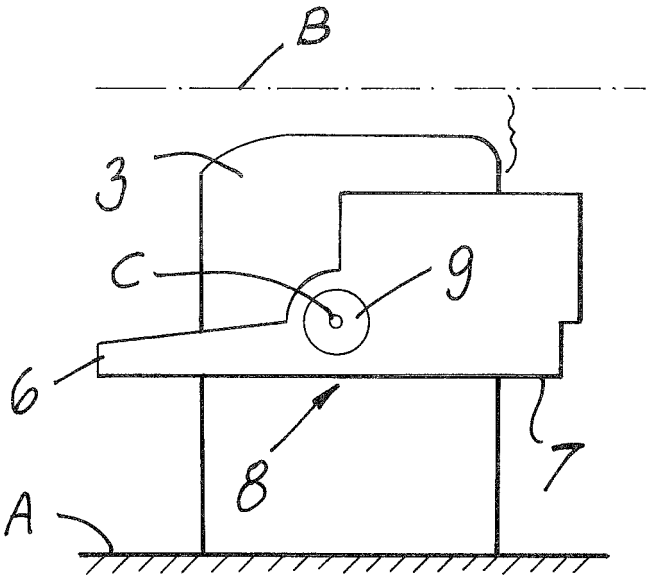

Fig. 5