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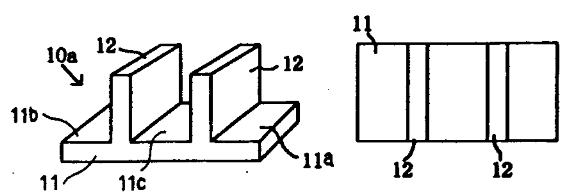
(54) **Barrage block for river construction and improvement works.**

(57) A flooded dam is constructed in a river by building up, across the river, a straight structure from a plurality of barrage blocks (10a) having a rectangular base plate (11) and a barrage wall (12) which extends substantially upright from the rectangular base plate (11) and divides the rectangular base plate (11) into at least front and rear base sections (11a,11b) between opposite ends of the rectangular base plate (11). Earth and sand, carried by the stream upstream of the straight barrage wall structure, accumulate so as to raise the water level of the stream. Another straight barrage wall structure across the river is built up, and earth and sand, carried by the stream upstream of the other straight barrage wall structure, accumulate so as to raise the water level of the stream even further. In this way, the water level of the stream is caused to rise gradually.

FIG 1A FIG 1B



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BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a barrage block used for constructing a dam in the upper reaches of a river and, more particularly, to a barrage block assembly for damming up a tributary so as to effectively store water as well as prevent earth, sand and rocks from being swept away. The assembly may also be used to reform a winding water course in a main channel so that it is straight and, therefore, to prevent floods.

2. Description of Related Art

In its upstream portion, a river tends to collect rain, which has fallen on the river basin, in tributaries and branches and lets the rainwater flow, taking its own course. In its downstream portion, the river typically is formed with banks or levees which prevent the rainwater from overflowing. The upstream portion of the river is typically formed with a V-shaped river bed, which becomes sharper and sharper with the passage of time, due to erosion of the river channel by a rapidly moving water stream. In its middle and downstream portions, the bed of the river is gradually leveled with earth, sand and rocks which accumulate in the river channel. This makes the water run gently, and changes the water flow so that it is wide and shallow in depth. The water flow, running in a river channel with banks formed or levees constructed on both sides, in order to prevent an overflow due to a rapid flooding during and/or after a torrential rainfall, moves in a "zigzag" direction. Earth, sand and rocks accumulate accordingly, causing the river bed to rise.

Typically, such a river is dammed up in its middle for the purpose of storing water and preventing floods. Earth and sand accumulate in front of dams which are built up in the middle region of the river. The earth and sand is washed out by a stream of water, or river stream, carried downstream by the stream, and deposited in front of each dam so as to gradually decrease the capacity of the dam. Such a dam needs an extensive amount of construction work to remain operational, which requires a large expense. This is true, independent of the size of the river. On the other hand, earth and sand washed out from the upstream portion of a river is carried downstream by a river stream and accumulate on a river bed near the mouth of the river, where the river stream moves slowly. The river bed, at the lower region of the river, rises gradually, due to the accumulation of earth and sand. This causes the stream to slow down even more, and causes stagnation of water. This, in turn, leads to a decrease in the quantity of water discharged into the mouth of the river and, accordingly, to floods.

In bank protection works, although bends of a river are provided with, for example, concrete blocks, concrete piles, and/or Tetra-Pots (Trade Name), the river wall is partly washed away and hollowed out by a main river stream. The river stream converges in the hollowed out portion of the wall, so as to produce a flood plain near the opposite bank. When the water level of the stream rises, the stream causes earth and sand to accumulate on the flood plain. Consequently, the stream becomes increasingly rapid along the washed out river wall. At the downstream end of the river wall, the stream turns towards the opposite river wall and washes out the opposite river wall. As the stream alternately and repeatedly washes out the river walls, an increased number of bends is formed in the river and, accordingly, the river stream moves slower and slower. This becomes one of the causes of flooding. Since the river causes water shortage and floods over the course of time, damming up the river in conventional manners is only a temporary measure for increasing the water storage capacity of the river and preventing flooding.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a barrage block and a simple method for constructing a flooded dam in the upper reaches of a river so as to expand the water storage area of the river and raise the water level of a river or water stream in the river.

It is another object of the present invention to provide a barrage block and a simple method for improving the middle course of a river with bends so as to straighten a winding steam, thereby raising the water level of the river stream in the river.

It is still another object of the present invention to provide a barrage block and a simple method for improving the lower reaches of a river so as to increase the depth of a river stream and speed up the stream, thereby increasing water discharge into the mouth of the river.

These objects of the invention are achieved by providing a barrage block, constructed as a single reinforced-concrete block, for forming a barrage wall structure for river construction and improvement works. The structure comprises a rectangular base plate and a barrage wall means extending substantially upright from the rectangular base plate. The barrage wall means divides the rectangular base plate into at least front and rear base sections between opposite ends of the rectangular base plate.

Specifically, the barrage wall means includes either a single barrage wall, extending from one side of the rectangular base plate to another so as to divide the rectangular base plate into a large front base section area and a small rear section area between opposite ends of the rectangular base plate, or a pair of barrage walls. Each of the barrage walls extends from one side of the rectangular base plate to another. The sides are arranged parallel to each other so as to divide the rectangular base plate into three base sections, substantially equal in area to one another, between opposite ends of the rectangular base plate.

For constructing a flooded dam in a river, a plurality of the barrage blocks is set up so that the blocks are located side by side. The barrage wall means of each barrage block crosses a river stream of the river so that a straight barrage wall structure is built up across the river. After earth and sand carried by the stream accumulates upstream of the straight barrage wall structure sufficiently to raise the water level of the river stream, another straight barrage wall structure is built up by setting up a plurality of the barrage blocks in the same manner. A flight of flooded dams, constructed by building up one of the straight barrage wall structures after another in the upper regions of the river, lets rainwater flowing into the river be retained, by degrees, from upstream to downstream, so as to cause the downstream rise in the water level of the river to become lower and lower. Each flooded dam expands a river stream, so as to retain a considerably increased quantity of water in the upper basin of the river as compared to the ordinary water level.

For improving a river with river bends, a plurality of the barrage blocks is set up so that the blocks are disposed side by side, with the barrage wall means of each the barrage block crossing a river stream of the river so as to build up a plurality of parallel straight barrage wall structures, arranged at each bend, across the river. As earth and sand carried by the river stream accumulate upstream from each of the straight barrage wall structures, the water level of the stream gradually rises at the river bend, so as to cause the stream at the river bend to become almost straight.

Straight barrage wall structures, built up in this way at the bends of a river, may, on one hand, possibly be flooded by water and catch earth and sand carried by the stream while the water level of the stream rises. Therefore, earth and sand accumulate over time near a natural levee or bank. On the other hand, the straight barrage wall structures arrest the stream at the bends while the water level of the stream drops, letting the stream flow in a center portion of the river. As such rising and dropping of the water level is repeated, the stream gradually washes out the river bed at the center portion of the river, so as to gradually cause itself to become almost straight. Simultaneously, the straight barrage wall structure prevents the natural levees or banks at the bends from being washed out, so as to effectively reform the stream, which originally travels in a zigzag path, into a straight stream. This results in a stream which moves rapidly and in a large quantity of water being discharged into the mouth of the river. Accordingly, the barrage wall structure is effective to ease flooding.

For constructing a flooded dam in a main channel between sloped banks of a river, a plurality of barrage blocks is set up so that the blocks are located side by side, with the barrage wall means of each of the barrage blocks crossing a river stream, so as to build up a straight side barrage wall structure partly across the stream on each side of the stream at an acute angle with respect to a direction of the stream. A plurality of the barrage blocks is then set up so that the blocks are located side by side, with the barrage wall means of each barrage block crossing a river stream, so as to build up a straight center barrage wall structure perpendicularly across the stream. The straight side barrage wall structures, on the opposite sides of the stream, are located at a distance from each other in the direction of the stream. The straight center barrage wall structure is located, with a separation, downstream from both of the straight side barrage wall structures.

For constructing an alluvial bed for protecting bridge piers in a river near a mouth of the river, a plurality of barrage blocks is set up so that the blocks are located side by side, with the barrage wall means of each of the barrage blocks crossing a stream of the river so as to build up a straight barrage wall structure across the stream and downstream from a row of bridge piers.

The straight barrage wall structure retains earth and sand carried by the stream and causes the earth and sand to accumulate upstream therefrom, so as to form a stratum of earth and sand extending from upstream to downstream of the row of piers. The stratum of earth and sand prevents the river bed from being hollowed out at the basal parts of the piers, even when the stream is quite rapid. The straight barrage wall structure extending across the river also causes earth and sand to accumulate at its opposite end parts so as to strengthen the banks.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects of the present invention will be apparent to those skilled in the art from the following description of preferred embodiments thereof when considered in conjunction with the appended drawings, in which the same reference numerals have been used to denote the same or similar elements or parts throughout the drawings, and in which:

Figure 1A is a perspective view showing a double wall barrage block in accordance with a preferred embodiment of the present invention;

Figure 1B is a plan view of the structure shown in Figure 1A;

Figure 2 is a perspective view showing a double wall barrage block in accordance with another preferred embodiment of the present invention;

Figure 3 is a perspective view showing a single wall barrage block in accordance with another preferred embodiment of the present invention

Figure 4 is a view of a straight barrage wall structure which is built up from the double wall barrage blocks of Figure 1A;

Figure 5A is an illustration showing damming up of a river by the use of the straight barrage wall structures;

Figure 5B is a side view of the structure shown in Figure 5A;

Figure 6 is an illustration showing a winding river improved by the use of straight barrage wall structures;

Figure 7A is an illustration showing a river bed near the mouth of a river improved by the use of straight barrage wall structures;

Figure 7B is a side view of the structure shown in Figure 7A;

Figure 8A is an illustration showing a river bed, at a location in which a bridge is built up, which has been improved by the use of straight barrage wall structures; and

Figure 8B is a side view of the structure shown in Figure 8A.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings in detail and, in particular, to Figures 1A, 1B and 2 to 4, a barrage block, forming an integral structural component of a barrage wall structure for constructing a flooded or fill-type dam in a river according to a preferred embodiment of the present invention, is shown. As shown in Figure 1A, a barrage block 10a, which may be molded from, e.g., reinforced concrete, has a pair of barrage walls 12, extending from side to side and almost upright from a rectangular base 11. Each barrage wall 12 has the same width as that of the base 11. The barrage walls 12 are spaced apart so as to divide the base 11 into three base zones in its lengthwise direction. These three zones include an upstream base zone 11a, a downstream base zone 11c and a middle base zone 11b, between the upstream and downstream base zones 11a and 11c. The upstream and downstream base zones 11a and 11c may be substantially identical in zone area and slightly smaller than the middle base zone 11b. A plurality of the double wall blocks 10a are arranged side by side so as to form a barrage wall structure 10 which is elongated sideways, as shown in Figure 4.

The double wall block 10a may be modified in shape, as shown in Figure 2. That is, a double wall barrage block 10b, shown in Figure 2, has end sills 12a integrally formed with the base 11 along its ends, respectively, as well as the barrage walls 12. Each end sill 12a is far lower in height than the barrage walls 12 and is parallel to the barrage walls 12.

Referring to Figure 3, a single wall barrage block according to another preferred embodiment of the present invention is shown. A single wall barrage block 10c is also molded of reinforced concrete into an integral structural component of a barrage wall structure for constructing a flooded or fill-type dam in a river. The single wall barrage block 10c has a single barrage wall 12 extending from side to side and oriented almost upright from a rectangular base 11. The barrage wall 12 has the same width as the base 11. The barrage wall 12 divides the base 11 into two base zones in its lengthwise direction, namely, an upstream base zone 11d and a downstream marginal base zone 11e. A plurality of the double wall barrage blocks 10a are arranged side by side so as to form a barrage wall structure 10 which is elongated sideways.

Particular dimensions of the double wall barrage block 10a itself and the barrage wall structure 10 would, of course, depend upon the architecture of the particular river in which a flooded or fill-type dam constructed.

These barrage blocks 10a, 10b and 10c are widely used to execute a variety of river conservation and/or improvement works.

Reference is now made to Figures 5A and 5B to explain an example of damming up of an upstream region of a river, which originally has a water level **S'** and a river width **W'**, with the double wall barrage blocks 10b shown in Figure 2. Each of the double wall barrage blocks 10b used has an overall size of, for instance, 2 m. length x 1 m. width x 1 m. height. As a first step in damming up the river 4, a plurality of the barrage blocks 10b is placed on a river bed, and the blocks 10b are closely arranged side by side. The barrage walls 12 are placed perpendicularly to the direction of a stream 13 so as to form a straight barrage wall structure **A** across the stream 13 in the river 4. When the straight barrage wall structure **A** blocks the river 4 almost completely across the river width

W', the water level of the stream 13 increases gradually from the original level **S'** until it is sufficiently high to flow over the straight barrage wall structure **A**. Accordingly, the structure A expands the river width **W'**.

Either after a spontaneous accumulation of earth, rocks and/or sand has become higher than the straight barrage wall structure **A** behind or upstream of the straight barrage wall structure **A** or after earth, rocks and/or sand artificially accumulates to a level higher than the straight barrage wall structure **A** behind or upstream of the straight barrage wall structure **A**, another straight barrage wall structure **B** is formed at a position or height above and upstream of the straight barrage wall structure **A** so as to cross the widened stream 13 in the river 4. As a result, the water level of the stream increases gradually from the water level which has already been raised by the straight barrage wall structure **A**. The water level increases until it is sufficiently high to flow over the straight barrage wall structure **B** and, accordingly, expands the river width even more. In the same manner, after earth, rocks and/or sand have accumulated behind or upstream of the straight barrage wall structure **B** to a level higher than the straight barrage wall structure **B**, another straight barrage wall structure **C** is formed at a height above the straight barrage wall structure **B** upstream of the straight barrage wall structure **B** so as to cross the stream 13 in the river 4, thereby widening it to a width **W** and raising the water level to a level **S**. It is to be understood that the particular numbers of such barrage blocks and straight barrage wall structures depend upon the particularly intended width and depth of the flooded dam.

Since the double wall barrage block 10b has end sills 12a formed at its lengthwise ends, it is structurally reinforced against a flow of earth and sand to a greater degree than the double wall barrage block 10a, which has no end sill. Accordingly, the double wall barrage block 10b and straight barrage wall structure of the double wall barrage blocks 10b is suitable for rapids or cataracts and water courses including a large amount of earth and sand. Compared to the double wall barrage block 10b, the double wall barrage block 10a and straight barrage wall structure of the double wall barrage blocks 10a is suitable for slow water flows, such as downstream portions of rivers. For this reason, the application of the double wall barrage blocks 10a and 10b are selected depending upon flow rates of water and quantities of earth and sand. On the other hand, although the single wall barrage block 10c is simple in structure as compared to the double wall barrage blocks 10a and 10b, it allows a large amount of earth and sand to accumulate on the base 11 over the upstream base zone 11d. The single wall barrage block 10c, therefore, is suitable for intercepting earth and sand or preventing a washout of a steep hill.

When barrage blocks are set up as a straight barrage wall structure on a river bed across a river, it is unnecessary to intercept a stream of the river or to form a distributary of the river. Also earth and sand accumulate in an upstream portion of the river immediately behind the barrage blocks. Therefore, it is quite easy to dam up rivers, and in particular, small and medium rivers, and to expand the river stream greatly between natural levees or banks 5.

Constructing a number of such flooded dams in a river from a place between mountains or hills to level land expands a river channel and, accordingly, considerably widens a river stream. By providing such dams, the river can be filled to the brim with water. This water is turned into rain in great abundance after it has evaporated. On the other hand, such water is turned into "ground water" after it has infiltrated the soil. The river water, therefore, can be used to provide water resources during dry seasons and to facilitate the active use of natural resources.

Additionally, because only straight barrage wall structures are built up, one after another, by arranging simply shaped concrete blocks in a straight line on a river bed so as to form an accumulation of earth and sand behind each straight barrage wall structure, the simply shaped barrage blocks provide a flooded dam construction method which is easier to complete than conventional dam construction methods. The flooded dam construction method of the present invention saves both construction materials and work.

Flooded dams constructed by using barrage blocks produce various effects. That is, the flooded dams let rainwater flowing into a river be retained by degrees from upstream to downstream. This brings down a downstream rise in the water level of the river, so that it gets lower and lower. Each dam expands a stream, so as to retain a larger quantity of water in the upper basin of the river than is normal. Such an abundance of water provides a reproductive or breeding place for aquatic life. Plentiful water may also be retained between mountains. This water, therefore, produces a heavy fog which can rehydrate alpine plants growing between the mountains.

A flight of flooded dams in a river performs useful functions other than the inherent function of flood prevention. For example, a flight of flooded dams helps to preserve water and marshlands. Naturally, this is important, since water and marshlands are lost when land is levelled due to urbanization. Such flooded dams are also useful in mountain sites so as to rehabilitate a destroyed natural environment, conserve animals and plants, and ensure water resources for humans. The dams also help to turn water which is harmful during flood season into water which is beneficial during a period of water shortage. In particular, in view of the recent tendency to indiscriminately develop forest resources, a flight of flooded dams can be used to control a rapid rise in water level due to large volume of rain until the middle reaches of a river.

Referring to Figure 6, which shows another application of the barrage blocks of the present invention to river improvement, such as reforming a zigzagging river, various lengths of straight barrage wall structures 16 are built up on the river bed of a river 4 in order to turn a stream 13, flowing in a zigzag line, into an almost straight stream 13'. To this end, a plurality of barrage blocks 10a are closely arranged side by side at each of bends 6 on the river bed so as to build up a straight barrage wall structure 16. The straight barrage wall structure 16 is built up so that the barrage walls 12 are placed at an acute angle with respect to a direction of the stream 13. In the same manner, other straight barrage wall structures 16 are built up. The structures 16 are different in length from but parallel to each other at each bend 6. The inner ends of the structures 16 lie along almost a straight line extending along a side of an improved stream 13'A.

Straight barrage wall structures 16, built up in this way at the bends 6, may possibly be flooded and catch earth and sand carried by the stream 13 while the water level of the stream 13 rises. Consequently, the earth and sand accumulates over time between a natural levee or bank 5 and the structures 16. On the other hand, the straight barrage wall structures 16 arrest the stream at the bends 6 while the water level of the stream 13 drops, letting the stream 13 flow in a center portion of the river 4. As such rises and drops in the water level are repeated, the stream 13 gradually erodes the river bed in the center portion of the river 4. As a result, the stream gradually becomes an almost straight stream 13'. Simultaneously, the straight barrage wall structures 16 prevents the natural levees or banks 5 at the bends 6 from being eroded. The stream 13, originally travelling in a zigzag line, is reformed into a straight stream 13'. This results in a rapidly moving stream and in a large quantity of water being delivered to a mouth of the river. Accordingly, the structures 16 are effective to ease flooding.

The number of straight barrage wall structures 16 utilized depends upon the shape of the particular bend 6, the speed of the stream 13, and the quantity of earth and sand carried by the stream 13.

Generally speaking, since bends 6 easily form in the lower and middle reaches of a river stream, in which the stream is rather slow, it is preferred to use the barrage blocks 10a to form the straight barrage wall structures 16. If the stream is rapid and carries a large quantity of earth and sand, it is preferable to use the barrage blocks 10b. It is, of course, possible to use a single straight barrage wall structure 16 if a bend in the river is small and the river stream is slow.

Referring to Figures 7A and 7B, another application of the barrage blocks of the present invention to river improvement, such as preventing earth and sand from being swept away near a mouth of a river, is illustrated. On a part of the downstream portion of a river, such as a river bed between left and right sloped banks 21 near the mouth of the river, where a plenty of earth and sand accumulate, a plurality of straight barrage wall structures are built up. Specifically, one of a pair of straight sided barrage wall structures 20a is built up in a lateral flight of double wall barrage blocks 10a at an acute angle with respect to a direction of flow of the stream 13 at one side of the main channel 22 so as to extend partly in the main channel 22. The other of the straight sided barrage wall structures 20a is built up in a lateral flight of double wall barrage blocks 10a oriented at an acute angle with respect to the direction of flow of the stream 13 at the opposite side of the main channel 22 so as to extend partly in the main channel 22. The pair of the straight sided barrage wall structures 20a are placed at an appropriate separation in the direction of flow. The remaining structure, namely, a straight center barrage wall structure 20b is built up downstream from both of the straight side barrage wall structures 20a so as to extend perpendicularly across the main channel 22.

When the water level of the stream 13 rises, the main channel 22 is expanded so that it is wider than usual and carries earth and sand. The earth and sand carried by the stream 13 is both blocked by the straight center barrage wall structure 20b and also deflected outside along the straight side barrage wall structures 20a, as indicated by a dot-chain line **ES**, so as to be prevented from being swept away by straight barrage wall structures 20a and 20b which are thus arranged.

Preventing earth and sand from being swept away during rising of a river as well as when the water level of the river is ordinary keeps the river bed at a mouth of the river flat and the depth of the mouth of the river sufficient.

Referring to Figures 8A and 8B, another application of the barrage blocks of the present invention to river improvement, such as bridge pier protection at the mouth of a river, is illustrated. In a river 30, a row of piers 31 of a bridge (not shown) extends across the river 30. The piers 31 stand at separations and extend from the river bed 35. Downstream from the row of the piers 31, a number of double walled barrage blocks 10a are arranged side by side along the row of the piers 31 so as to build up a straight barrage wall structure 32 on the river bed 35 extending across and over the river 30. If such a straight barrage wall structure 32 is not provided, the stream 13, if rapid, hollows out the river bed 35 at the basal part of each pier 31, as indicated by a dot-chain line 34 in Figure 8B. However, the straight barrage wall structure 32 retains earth and sand carried by the stream 13 and causes the earth and sand to accumulate upstream of the structure 32 so as to form a stratum of earth and sand 33 which extends from upstream to downstream of the row of the piers 31. The stratum of earth and sand 33 prevents the river bed 35 from being hollowed out at the basal parts of the piers 31, even when the stream 13 is quite rapid. The straight barrage wall structure 32, extending across and over the river 30, accumulates earth and sand at its opposite end parts so as to strengthen the banks.

It is to be noted that although preferred embodiments of the present invention have been described, various other embodiments and variants may occur to those skilled in the art. Any such other embodiments and variants which fall within the scope of the invention are intended to be covered by the following claims.

Claims

1. A barrage block for forming a barrage wall structure for river construction and improvement works, said barrage block comprising:
   a rectangular base plate; and
   barrage wall means, extending substantially upright from said rectangular base plate, for dividing said rectangular base plate into at least front and rear base sections between opposite ends of said rectangular base plate.

2. A barrage block as defined in claim 1, wherein said barrage wall means comprises a single barrage wall extending from one side to another side of said rectangular base plate so as to divide said rectangular base plate into a large front base section area and a small rear section area between opposite ends of said rectangular base plate.

3. A barrage block as defined in claim 2, wherein said rectangular base plate and said single barrage wall are made as a single reinforced concrete block.

4. A barrage block as defined in claim 1, wherein said barrage wall means comprises a pair of barrage walls, each of said barrage walls extending from one side to another side of said rectangular base plate, said barrage walls arranged parallel to each other so as to divide said rectangular base plate into three base sections, substantially equal in area to one another, between opposite ends of said rectangular base plate.

5. A barrage block as defined in claim 4, wherein said rectangular base plate and said barrage walls are made as a single reinforced concrete block.

6. A barrage block as defined in claim 4, and further comprising an end sill extending from one side to another side of said rectangular base plate at each end of said rectangular base plate.

7. A barrage block as defined in claim 6, wherein said rectangular base plate, said pairs of single barrage walls and each end sill are made as a single reinforced concrete block.

8. A method of constructing a flooded dam in a river comprising the steps of:
   providing barrage blocks, each having a rectangular base plate and barrage wall means, extending substantially upright from said rectangular base plate, for dividing said rectangular base plate into at least front and rear base sections between opposite ends of said rectangular base plate;
   setting a plurality of said barrage blocks side by side with said barrage wall means of each barrage block crossing a stream of said river so as to build up a straight barrage wall structure across the river;
   accumulating earth and sand, carried by said stream, upstream of said straight barrage wall structure so as to raise a water level of said stream;
   setting a plurality of said barrage blocks side by side with said barrage wall means of each barrage block crossing a stream of the river so as to build up another straight barrage wall structure across the river; and
   accumulating earth and sand, carried by said stream, upstream of the other straight barrage wall structure so as to raise the water level of said stream, thereby gradually raising the water level of said stream.

9. A method as defined in claim 8, wherein said barrage wall means comprises a single bar-

rage wall extending from one side of said rectangular base plate to another so as to divide said rectangular base plate into a large front base section area and a small rear section area between opposite ends of said rectangular base plate.

10. A method as defined in claim 9, wherein said rectangular base plate and said single barrage wall are made as a single reinforced concrete block.

11. A method as defined in claim 8, wherein said barrage wall means comprises a pair of barrage walls, each barrage wall extending from one side of said rectangular base plate to another, said barrage walls being arranged parallel to each other so as to divide said rectangular base plate into three base sections substantially equal in area to one another between opposite ends of said rectangular base plate.

12. A method as defined in claim 11, wherein said rectangular base plate and said barrage walls are made as a single reinforced concrete block.

13. A method as defined in claim 11, wherein an end sill extends from one side of said rectangular base plate to another side at each end of said rectangular base plate.

14. A method as defined in claim 13, wherein said rectangular base plate, said pair of barrage walls and each end sill are made as a single reinforced concrete block.

15. A method of constructing a flooded dam in a river at a river bend comprising the steps of:

providing barrage blocks, each having a rectangular base plate and barrage wall means, extending substantially upright from said rectangular base plate, for dividing said rectangular base plate into at least front and rear base sections between opposite ends of said rectangular base plate;

setting a plurality of said barrage blocks side by side with said barrage wall means of each barrage block crossing a stream of said river so as to build up a plurality of straight barrage wall structures arranged at said river bend, in parallel, across said river; and

accumulating earth and sand carried by said stream upstream of each straight barrage wall structure so as to raise a water level of said stream at said river bend, thereby causing said stream at said river bend to become almost straight.

16. A method as defined in claim 15, wherein said barrage wall means comprises a single barrage wall extending from one side of said rectangular base plate to another so as to divide said rectangular base plate into a large front base section area and a small rear section area between opposite ends of said rectangular base plate.

17. A method as defined in claim 16, wherein said rectangular base plate and said single barrage wall are made as a single reinforced concrete block.

18. A method as defined in claim 16, wherein said barrage wall means comprises a pair of barrage walls, each barrage wall extending from one side of said rectangular base plate to another, said barrage walls being arranged parallel to each other so as to divide said rectangular base plate into three base sections substantially equal in area to one another between opposite ends of said rectangular base plate.

19. A method as defined in claim 18, wherein said rectangular base plate and said barrage walls are made as a single reinforced concrete block.

20. A method as defined in claim 18, wherein an end sill extends from one side of said rectangular base plate to another side at each end of said rectangular base plate.

21. A method as defined in claim 20, wherein said rectangular base plate, said pair of barrage walls and each end sill are made as a single reinforced concrete block.

22. A method of constructing a flooded dam in a river comprising the steps of:

providing barrage blocks, each having a rectangular base plate and barrage wall means, extending substantially upright from said rectangular base plate, for dividing said rectangular base plate into at least front and rear base sections between opposite ends of said rectangular base plate;

setting a first plurality of said barrage blocks side by side with said barrage wall means of each barrage block crossing a stream of said river so as to build up a straight side barrage wall structure partly across the stream on one side of the stream at an acute angle with respect to a direction in which the stream travels;

setting a second plurality of said barrage blocks side by side with said barrage wall means of each barrage block crossing a stream of the river so as to build up, at a separation downstream from said straight side barrage wall structure, another straight side barrage wall structure partly across the stream on another side of the stream at an acute angle with respect to a direction in which the stream travels; and

setting a third plurality of said barrage blocks side by side with said barrage wall means of each barrage block crossing a stream of the river so as to build up, at a separation downstream from said straight side barrage wall structures, a straight center barrage wall structure perpendicularly across the stream.

23. A method as defined in claim 22, wherein said barrage wall means comprises a single barrage wall extending from one side of said rectangular base plate to another so as to divide said rectangular base plate into a large front base section area and a small rear section area between opposite ends of said rectangular base plate.

24. A method as defined in claim 23, wherein said rectangular base plate and said single barrage wall are made as a single reinforced concrete block.

25. A method as defined in claim 23, wherein said barrage wall means comprises a pair of barrage walls, each barrage wall extending from one side of said rectangular base plate to another, said barrage walls being arranged parallel to each other so as to divide said rectangular base plate into three base sections substantially equal in area to one another between opposite ends of said rectangular base plate.

26. A method as defined in claim 25, wherein said rectangular base plate and said barrage walls are made as a single reinforced concrete block.

27. A method as defined in claim 25, wherein an end sill extends from one side of said rectangular base plate to another at each end of said rectangular base plate.

28. A method as defined in claim 27, wherein said rectangular base plate, said pair of barrage walls and each end sill are made as a single reinforced concrete block.

29. A method of constructing an alluvial bed for protecting bridge pairs in a river near a mouth of the river comprising the steps of:

providing barrage blocks, each having a rectangular base plate and barrage wall means, extending substantially upright from said rectangular base plate, for dividing said rectangular base plate into at least front and rear base sections between opposite ends of said rectangular base plate;

setting a plurality of said barrage blocks side by side with said barrage wall means of each barrage block crossing a stream of said river so as to build up a straight barrage wall structure across the stream downstream from a row of bridge piers; and

accumulating earth and sand carried by the stream upstream of said straight barrage wall structure.

30. A method as defined in claim 29, wherein said barrage wall means comprises a single barrage wall extending from one side of said rectangular base plate to another so as to divide said rectangular base plate into a large front base section area and a small rear section area between opposite ends of said rectangular base plate.

31. A method as defined in claim 30, wherein said rectangular base plate and said single barrage wall are made as a single reinforced concrete block.

32. A method as defined in claim 30, wherein said barrage wall means comprises a pair of barrage walls, each barrage wall extending from one side of said rectangular base plate to another, the barrage walls being arranged parallel to each other so as to divide said rectangular base plate into three base sections substantially equal in area to one another between opposite ends of said rectangular base plate.

33. A method as defined in claim 32, wherein said rectangular base plate and said barrage walls are made as a single reinforced concrete block.

34. A method as defined in claim 32, and further comprising an end sill extending from one side of said rectangular base plate to another at each end of said rectangular base plate.

35. A method as defined in claim 34, wherein said rectangular base plate, said pair of barrage walls and said end sills are made as a single reinforced concrete block.

FIG 1A

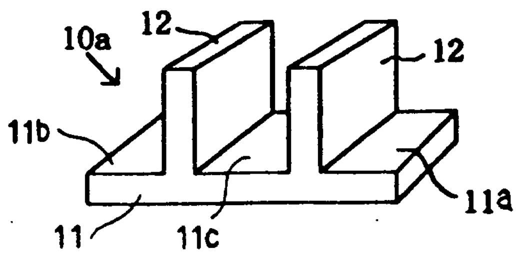


FIG 1B

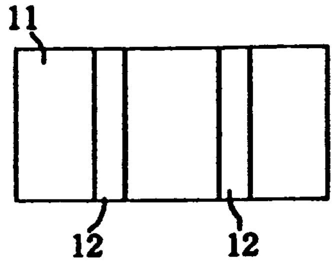


FIG 2

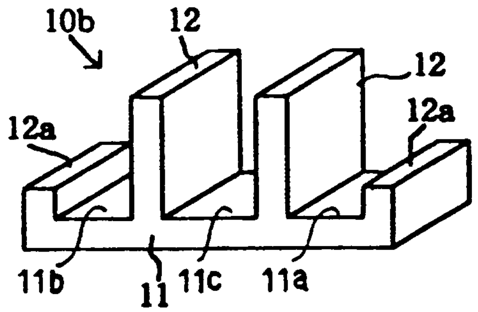


FIG 3

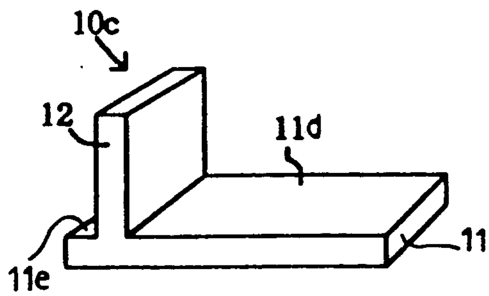


FIG 4

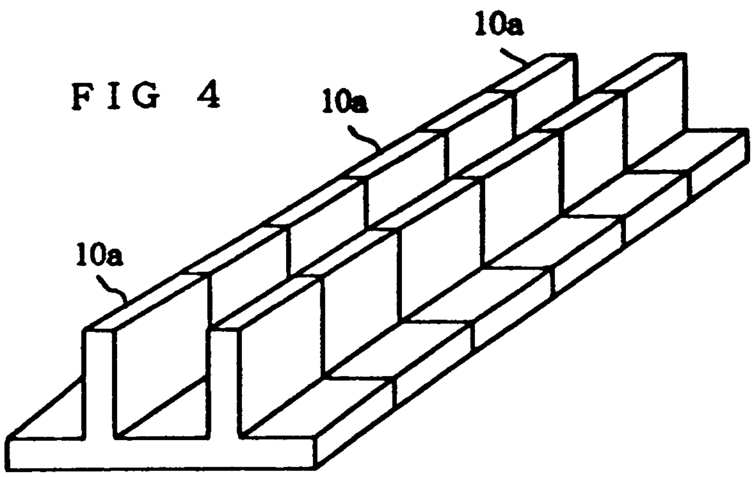


FIG 5A

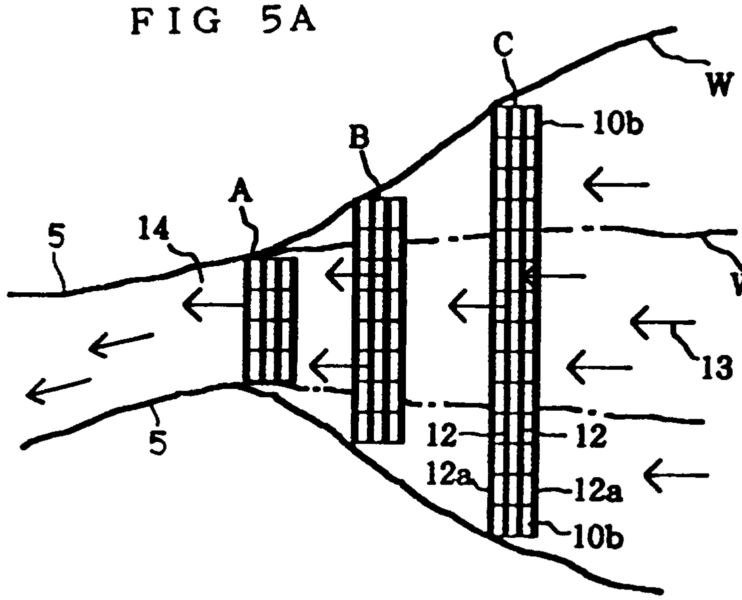


FIG 5B

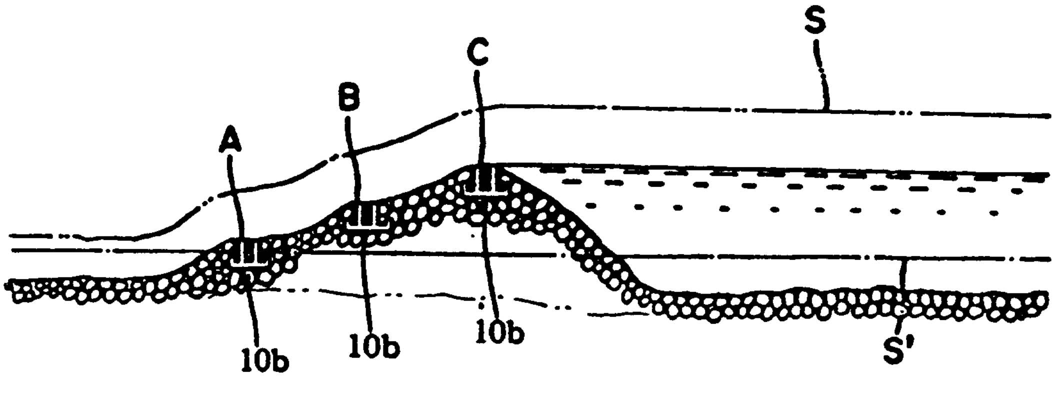


FIG 6

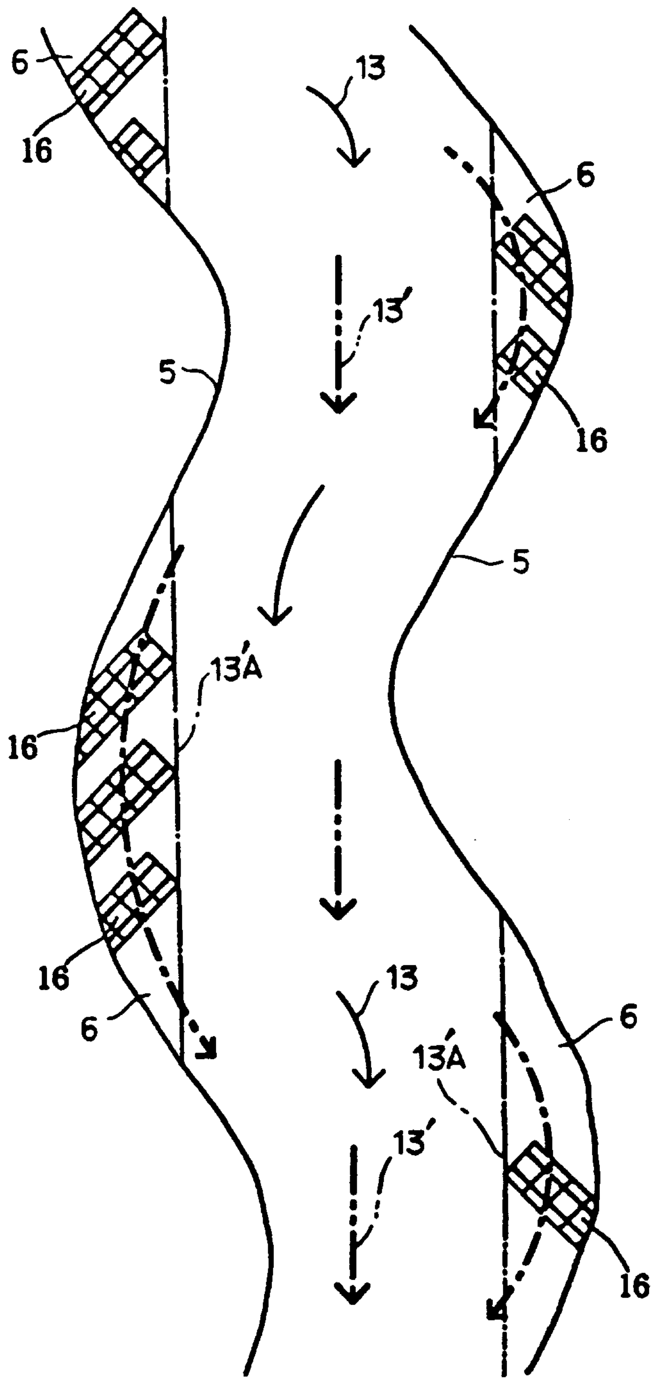


FIG 7A

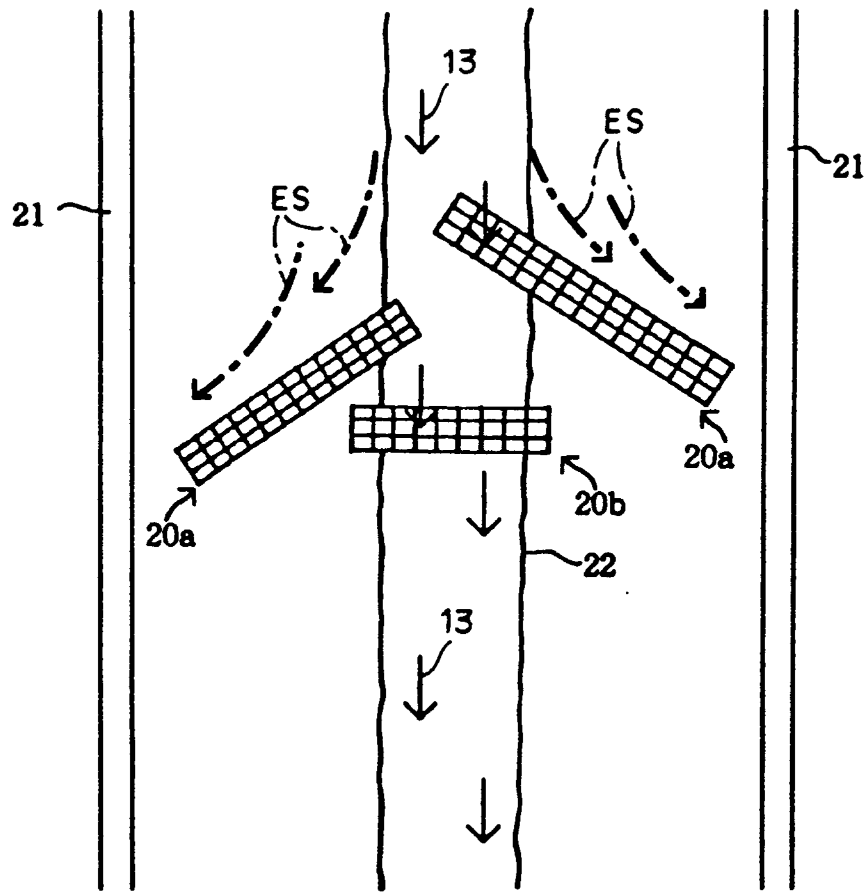


FIG 7B

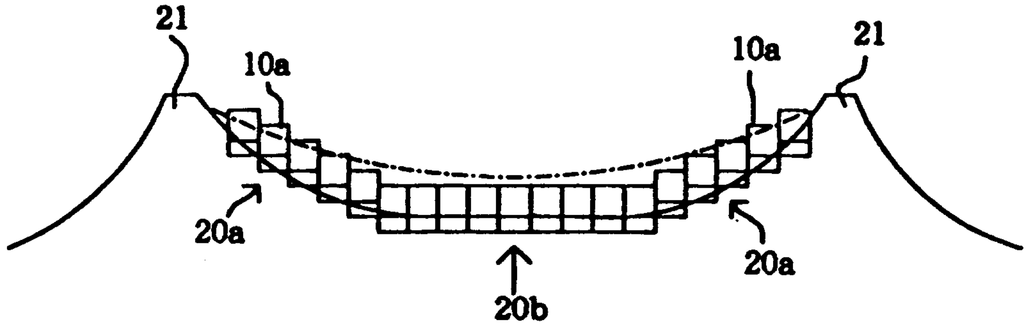


FIG 8A

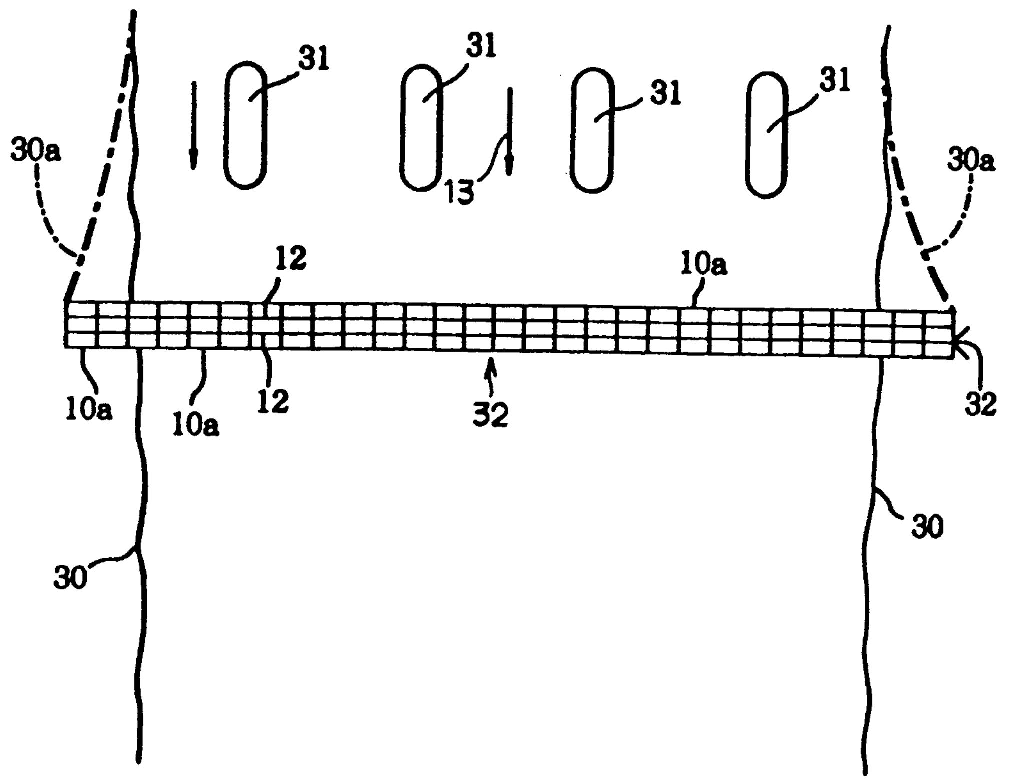
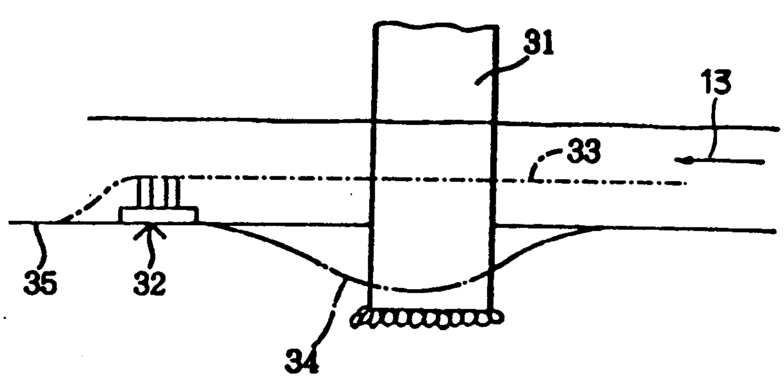


FIG 8B



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EUROPEAN SEARCH REPORT

Application Number

EP 92 11 0486

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.5)
X Y	CH-A-635 639 (P. BOLLER) * column 2, line 23 - line 30; figure 1 *	1,4,5 2,3,8, 11,12, 15,18,19	E02B3/04
Y	FR-A-630 804 (NAAMLOOZE VENNOOTSCHAP RIJNLANDSCHE BETONBOUW) * page 1, line 52 - page 2, line 15; figure *	2,3	
A	FR-A-2 419 362 (L. MALIE) * claim 1; figure 3 *	6,7	
Y	EP-A-0 147 311 (HYDRO-ORGUE) * page 12, line 23 - page 14; figures 6-8 *	8,11,12	
Y	PATENT ABSTRACTS OF JAPAN vol. 8, no. 94 (M-293)(1531) 28 April 1984 & JP-A-59 8 815 (SHIGEROU KANEKO) 18 January 1984 * abstract *	15,18,19	**TECHNICAL FIELDS SEARCHED (Int. Cl.5)**
A	FR-A-2 219 671 (G. BERRIOLO) * figures 1,4 *	22	E02B E02D
A	DE-C-3 705 425 (DYCKERHOFF & WIDMANN)	-	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	15 FEBRUARY 1993	KRIEKOUKIS S.

CATEGORY OF CITED DOCUMENTS

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