March 25, 1958 E. T. HUNTER 2,827,769

GROIN OF VARIABLE PERMEABILITY AND A CONSTRUCTIONAL UNIT THEREFOR

Filed Oct. 18, 1954 3 Sheets-Sheet 1

Fig 1.

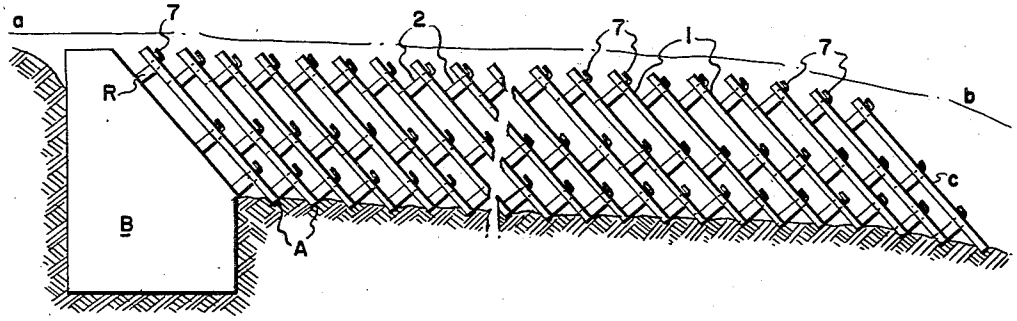
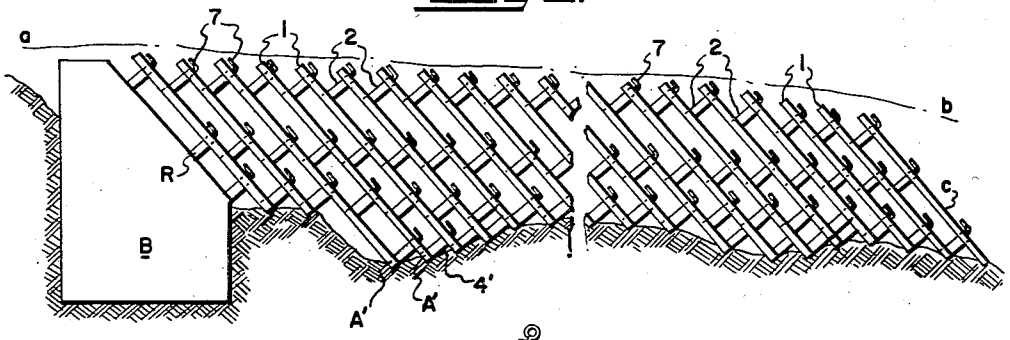


Fig 2.



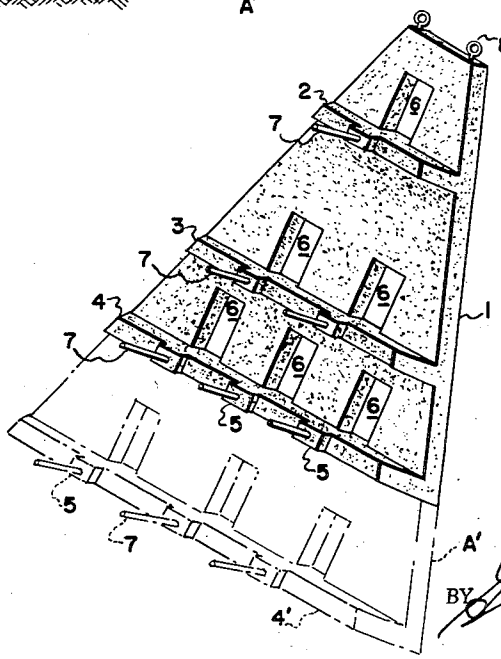


Fig 3.

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Fig 4.

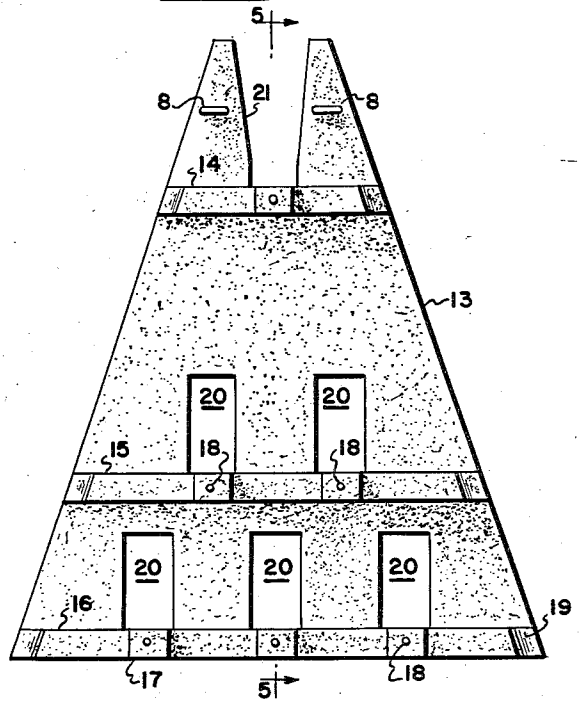


Fig 5.

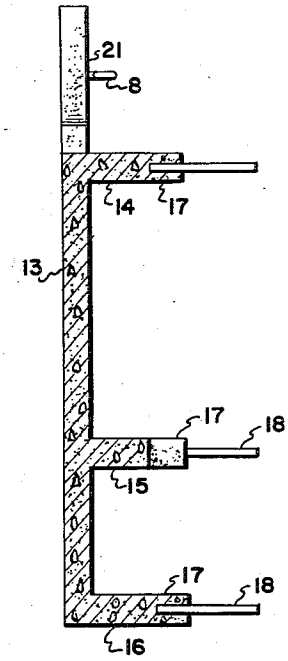


Fig 9.

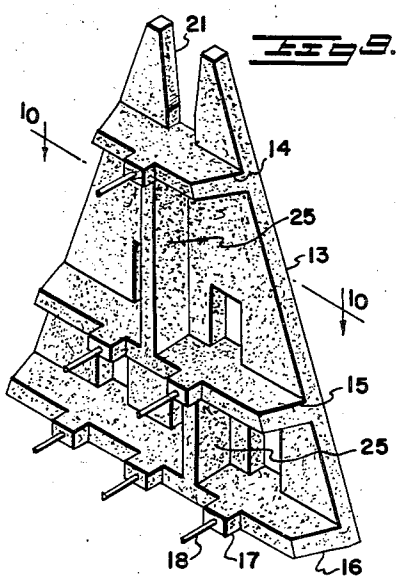
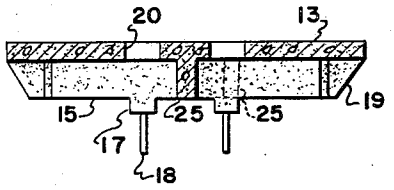


Fig 10.



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GROIN OF VARIABLE PERMEABILITY AND A CONSTRUCTIONAL UNIT THEREFOR

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Fig 8.

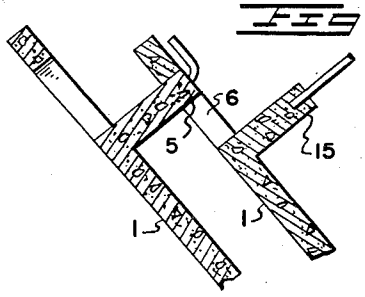
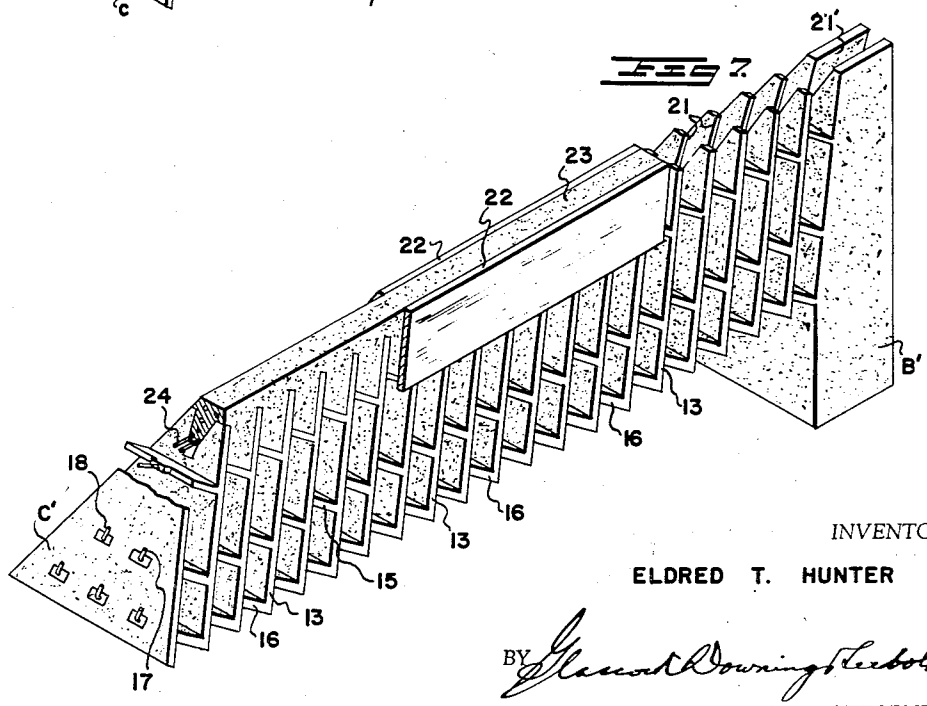


Fig 6.

Fig 7.



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GROIN OF VARIABLE PERMEABILITY AND A CONSTRUCTIONAL UNIT THEREFOR

Eldred Tait Hunter, Jamaica, British West Indies

Application October 18, 1954, Serial No. 462,950

20 Claims. (Cl. 61—4)

The present invention relates broadly to the art of erosion control of beaches.

More particularly this invention relates to a groin for use in stabilizing beaches by controlling erosion.

The invention is particularly directed to a groin of the permeable type.

The study of the effect of waves, and ocean currents has developed to the point where numerous attempts have been made to control erosion of beaches by intercepting the littoral drift so as to deposit materials contained in the littoral drift onto the immediate beach in a controlled manner. The groins that have been constructed before are both impermeable, that is solid structures which do not allow water to pass therethrough, or in some instances permeable, which do allow for the passage of water. Accordingly, this invention is particularly directed to the latter type or permeable groin and has for one object to provide an improved permeable groin that is economic to manufacture, readily erectible, stable in situ and one which will automatically conform itself to the profile contour from the shore outwards, and which groin is constructed of a plurality of units so inter-related and assembled as to permit lateral or vertical shifting among the units to ensure that the groin is stabilized.

It is a particular object of the invention to provide an improved groin in which the individual units are so inter-related that they can move relative to one another laterally and vertically to a sufficient degree as will ensure stabilization and compensate or cushion the effect of lateral or quartering wave shocks.

It is a specific object of this invention to provide an improved structural unit for use in assembling groins and which unit is a plate-like element having one or more apertures therein at different vertical heights and having plural spacer means projecting from one face thereof at different vertical heights and includes means embodied with the spacer means whereby when successive units are arranged adjacent to one another the last mentioned means of one unit loosely engages within the apertures of the adjacent unit. From one specific standpoint, the invention comprehends a unit of cast concrete, preferably prestressed concrete that has integral spacers projecting from one face thereof and groups of apertures extending through the structure above the respective spacers, the spacers having projections on their outer faces that are cooperable with the apertures of the succeeding unit and which projections function as guides to facilitate assembly of the units and as retaining means to limit the degree of lateral and vertical deviation of one unit relative to another.

As a further specific object the invention comprehends a variable permeable groin constructed of a plurality of plate-like units spaced from one another in the direction of the extent of the groin and each unit disposed at an angle to the shore profile. In other words the several plate-like elements are mounted in what may be termed a rearwardly inclined position and include a base spacer

extending perpendicular to the angle of incline so as to present in cross section a substantial V-shaped bottom to a vertical load which facilitates settling of the several units and provides a stable base even in shifting media such as muck.

While this invention is primarily directed to the provision of a permeable groin, it is a further specific object to provide an economically constructed impermeable groin.

Further and more specific objects will be apparent from the following description taken in connection with the accompanying drawings, in which:

Figure 1 is a sectional view through a sea beach having a gently sloping off shore profile and illustrating a groin embodying the invention after having been erected thereon,

Figure 2 is a view similar to Figure 1 but illustrating a groin constructed on a sea beach having a more irregular off shore profile.

Figure 3 is a perspective view of a unit for use in constructing the groin illustrated in Figures 1 and 2 and diagrammatically illustrating the enlargement of a unit to suit irregularities in an off shore profile,

Figure 4 is a front elevational view of a modified form of groin unit,

Figure 5 is a sectional view taken on lines 5—5 of Figure 4,

Figure 6 is a perspective view of a groin of the type embodied in Figure 1,

Figure 7 is a view similar to Figure 6 but illustrating a groin constructed of the units shown in Figure 4 and further fragmentarily illustrating the stages of applying a top cap to the groin,

Figure 8 is a fragmentary, vertical cross sectional view illustrating the top portions of the two adjacent units of the type shown in Figure 3 when embodied in a groin,

Figure 9 is a perspective view of a groin unit of the type shown in Figure 4 modified to constitute part of a groin that is substantially impermeable, and

Figure 10 is a cross sectional view taken on lines 10—10 of Figure 9.

The permeable groin of the present invention is constructed so that the degree of permeability is increased from bottom to top as desired. The constructional arrangement however includes a disposition of weight with respect to the vertical dimensions of each unit such that the center of gravity is below the median center line resulting in the units having a tendency to fall over backwards if deviated slightly from the vertical in the direction away from the side from which the spacers project. Essentially the unit has a cross section of a ribbed slab. Preferably the plan of each unit is of truncated formation, that is, it is much wider at the base than at the top. It is not absolutely essential that the tops be flat since a triangular shape in plan is effective. The shape essentials comprise upwardly converging sides. This shape has proven effective and dispite the absence of piling or other supports or base structures, a groin constructed in accordance with the invention adequately resists wave shock directed to the sides of the groin that is the effect of lateral or quartering waves.

The units of the groin may have different heights which is governed by the slope of the bottom or off shore profile. For a gently sloping profile as in Figure 1 the units would all be of substantially the same height and the top line of the groin would slope more or less parallel to the line of slope of the bottom. The fact that the groin is permeable provides a variable control as regards interception of littoral drift.

It is further to be pointed out that in the majority of instances the present invention is utilized to construct a groin field, that is, there will be a plurality of groins

projecting out into the water generally in parallelism with one another. This of course is the desirable aspect of a beach erosion control system on a large scale and comprehensive project. However, the present invention provides for a low cost readily manipulatable unit construction ideally suited for purchase by individuals owning beach property and purchase by beach control boards in municipalities and the like, to answer immediate beach erosion problems.

The groin of the present invention comprises a series of units A positioned in sequence to extend seaward. In Figure 1 the off shore profile is of a gently sloping bottom so that the units A have substantially the same height. The desired bottom to be built up is indicated by the line *a—b*. In constructing the groin a base block is embedded in the bank or in the beach and is suitably anchored above the high water mark and the base structure preferably is a cast block B of prestressed concrete, however it is possible to assemble the groin units A in extension of a rock formation. The base block provides a suitable initial abutment and the several units are then positioned in sequence to extend seaward from the base block. When the groin has extended seaward a distance sufficient to intercept the littoral drift, an end block or cap is put in place. This end block C is similar in plan to the plan of the units A. Each unit incorporates means cooperable with succeeding units to restrain the unit from outward movement. The units and groins illustrated in the drawings are constructed of prestressed concrete, however the invention is not to be limited to the structural material used since any material suitable for the purpose can be employed. The groins of Figures 1 and 2 are constructed of units shown in Figure 3. The unit includes a plate-like base portion 1 that is provided with three transversely extending spacer ribs 2, 3 and 4. The rib 4 constitutes a foot for the base portion. The spacer ribs extend from one face only of the base 1 and are provided with projections 5 that extend outwardly of the ribs. Further the base 1 is provided with a plurality of apertures 6 that extend therethrough. The apertures have greater cross sectional area than the projection 5 so that when the successive units are assembled in the manner shown in Figures 1 and 2 the projections fit loosely within the apertures whereby one unit can move vertically and laterally relative to the adjacent units and this freedom of movement is such that a slight swinging movement of one unit relative to another is permitted. Figure 3 diagrammatically illustrates an enlargement of the unit utilized to provide the units A' of Figure 2 in instances where the off shore profile is irregular. The larger size unit will have one or more ribs 4' in addition to the previous ribs 2, 3 and 4.

The units illustrated indicate the essential features of the invention, however they are not drawn to the precise proportions since the size of the spacing means and projection and the over-all size and thickness of the plate units can be varied in accordance with conditions. In the practical embodiment constructed of prestressed concrete, the base member is nine feet from top to bottom, has its sides upwardly converging from a base width of eight feet, and the ribs 2, 3 and 4 extend outward from one face of the base a distance approximately twelve inches. These ribs are approximately nine inches thick and the projections 5 will thus have approximately nine-inch vertical dimensions and are six inches wide. The apertures 6 through the base are approximately twenty-seven inches in vertical dimension and nine inches wide. There is an aperture 6 through the base for each projection extending from the ribs and the apertures are vertically aligned with the projections so that when one unit is placed against the next the apertures of the said one unit fit loosely over the projections on the preceding unit. The difference in dimensions between the projections and apertures result in an arrangement in which one unit can slide eighteen inches vertically relative to the other and shift laterally by three inches. The bottom of the unit or base presents a surface that is eight feet wide. Where the base is constructed to be approximately three inches thick, a bearing foot at the bottom of the unit having approximately a fifteen-inch width will result. The total weight of the unit is approximately 3,000 pounds and the foot dimensions of eight feet by fifteen inches provides approximately ten square feet of base area for bearing against the bottom. A unit weighing 3,000 pounds having a ten-square-foot base area can be supported by a 300-pound per square foot underlying base material. Thus units of this type can be supported in muck. Since the groin of Figures 1 and 2 is permeable the material in the littoral drift in passing through the groin will be deposited hydraulically so that the strength of the bottom or underlying base material will be increased.

It is further to be pointed out that the sliding movement of the units relative to one another facilitates their adjusting themselves to the slope of the off shore profile and irregularities in the shore and underwater base materials.

As indicated the invention contemplates construction of different size units insofar as the vertical and base width dimensions are concerned; However the angle of slope of the sides will be the same. Thus in certain conditions as shown in Figure 2, a groin will require a certain number of small size units A and then if the off shore profile has an abrupt dip therein it will be necessary to insert several larger units A' in place. The length of the units to be used is determined by the length of the groin, the angle of slope of the off shore profile and the desired angle of slope to be built up by use of the groin. The length of the groin must be such that it will intercept the littoral drift, it being understood that the littoral drift flows off shore and parallel to the shore.

As stated, Figure 1 illustrates an embodiment in which the off shore profile can be termed gently sloping and all of the groin units A are identical. The groin is built up from the base block B which will be constructed of concrete in a stabilized area of the beach. The outer face of the block B is sloped at an angle of approximately 50° and during the formation of the block, spacer means such as ribs R are formed that extend across the face of the block. Projections similar to the projections 5 are molded as outward extensions of the spacer ribs and in each projection both on the block B and units A are embedded one or more tie bolts or steel rods that extend outwardly about one foot for use as described hereinafter.

As denoted previously, the rib 4 is at the bottom of the vertical height of the plate 1 and flush with the bottom edge so as to increase the base area and stability. The ribs 3 are located more adjacent the bottom edge of the base plate 1 than the top so that the center of gravity is low whereby the groins have a normal tendency to fall backwards if deviated from the vertical in the direction away from the spacer ribs. Knowing the angle of slope of the off shore profile, the groin in Figure 1 after the base block B has been constructed in situ is readily assembled by the use of a mobile crane. The individual groin units weigh approximately 3,000 pounds when constructed of prestressed concrete. Suitable lifting hooks such as at 8 are provided for lifting up each unit. The unit is swung out, lowered in place adjacent the bottom of the sloped portion of the base block and then is lowered back at the angle of the base block. Since the openings in the first unit are longer in the vertical dimension than the vertical length of the projections on the base block, the first unit can slide downwards until its base is stabilized. After the first unit is placed against the base block, the projecting bars or rods 7 are bent over such as upwardly or laterally, so as to prevent back wash action of the water or waves from moving the unit seaward of the base block. The second and subsequent units are similarly lowered in place with the bars 7 being bent over to prevent outward movement of the units relative to one

another. As indicated previously the larger area of the apertures 6 when compared with the cross sectional area of the projections 5 permits each unit to have movement relative to the adjacent unit both vertically and laterally to a certain extent until the units adjust themselves and are stabilized. This mobility of units relative to one another is further important to minimize the shock of quartering waves.

After the number of units have been assembled in place so as to extend the groin seaward the required distance, an end cap C is lowered in place. The end cap is flat on boht faces, has the same plan shape as the other units and has apertures 9 therein that are made with reasonable close tolerance as compared with the cross sectional shape of the projections 5. The steel bolts or rods 7 are deformed to hold the cap in position. The cap presents an inclined face to head-on waves. As is clear from Figure 1, the permeability of the grain increases variably from bottom to top and in the course of time the material accompanying the littoral drift and the material of the sea bottom will fill the spaces within the groin and deposit material on both sides thereof.

Figure 6 illustrates in perspective, a suitable groin and indicates the action of quartering waves as regards the shape of the groin. As noted, each groin panel unit A has an inclined side 10, thus a quartering wave moving in the direction of the arrow W will strike the edge of each panel as at 11 so that the water flow is split to pass across the face of each panel and rearwardly thereof to strike the face of the adjacent panel where again the flow is split from flowing through the groin. This action minimizes the shock effect of a quartering wave. Further since the base panel when made of prestressed concrete has a certain amount of flexibility, it can deflect under shock to a limited degree and still return to normal shape without cracking and exposing the embedded steel components. Utilizing prestressed or high strength concrete in constructing the panel units minimizes the abrasive effect resulting from wave action.

The units utilized in constructing the groin of Figure 6 are shown in Figure 3. In plan, the truncated arrangement includes sloping sides and projecting from the outer exposed face are the spacer ribs 2, 3 and 4 with the projection 5 thereon. The apertures 6 are so arranged in each unit that the projections of the adjacent unit loosely fit therein. In this form the unit is closed on its top and subjacent the top edge is a single aperture. The figure further illustrates diagrammatically and in dotted lines an enlarged unit insofar as vertical and base dimensions are concerned. The angle of slope of the sides is the same and the outward projection of the spacer ribs and projections remains the same although the ribs are of course wider due to the increased base width at the bottom of the unit. It is further noted that the center of gravity of an enlarged unit remains below the transverse median line of the unit so that the unit is very stable and would have a normal tendency when tipped to stay in that position resting on the sloped face.

Figure 7 illustrates in perspective, a groin constructed from the modified form of panel unit shown in Figures 4 and 5. In these latter figures, the unit includes the base plate 13 of suitable thickness as regards strength. Projecting from one face of this plate are spacer ribs 14, 15 and 16. Each spacer rib has one or more projections 17 extending therefrom and steel bars or rods 18 project outwardly from the face of the projections. The side edges of at least the top spacer ribs are sloped as at 19 and rows of apertures 20 are provided in the base plate for cooperation with the projections on the ribs 14 and 15 of the preceding base plate. At the top of the base plate in this modification, there is an elongated notch having inclined sides 21. This notch as shown in Figure 7 is utilized when the groin is to have a concrete top cap. In Figure 7, the units nearest adjacent the base block B' present an appearance in which the notches 21 of the succeeding units are in alignment. To construct the top cap, wooden forms 22 are fastened to the sides of the groin, it being understood that these forms extend from end to end of the groin and the area between the wooden forms 22 is filled with concrete as at 23. If desired, suitable reinforcing rods as at 24 can be laid in the notches. The top cap when set provides an arrangement in which each panel unit in effect fits in a slot in the concrete of the top cap which means that the plates are restrained but not firmly fixed whereby settling and slight lateral movement is still possible. The inclination of the walls of the notch facilitates this slight lateral movement. The incline 19 on each side edge of each top spacer permits laying the form boards 22 flush against the sides of succeeding spacers. In placing the form boards 22, a cover is placed under the notches 21 so as to prevent the concrete flowing down into the space underlying the top spacer 14.

It is believed that the construction of a groin utilizing the present invention is clear from the drawings, in that with the formation of the base block the individual units are positioned in place, the bars or rods as at 18 are deformed between the positioning of succeeding units and an end cap as at C' is placed on the end. The concrete top cap is formed after the groin has been built to the length required.

The wooden forms 22 are so arranged that the concrete 23 of the top cap does not extend below the top spacer 14. The base block B' is provided with a notch as at 21' so as to securely anchor the inner end of the concrete top cap. The end plate C' as stated previously, is flat and has apertures formed therein to closely conform to the dimensions of the projection 17.

Figure 8 illustrates in cross section the relation of the vertically elongated apertures 6 to the projections 5. As shown, the apertures both in the forms of Figures 3 and 4 extend from just above the level of the respective spacer ribs upwardly and in number corresponding to the number of projections. Only one restraining bar or rod respectively at 7 or 18 has been illustrated as extending from each projection. Obviously two or more such rods can be bent over in the manner as shown in the drawings to restrain the respective units against outward movement.

It is to be specifically pointed out that the invention is not to be limited to an arrangement where all of the spacing means constitute ribs extending completely across one face of the panel. It is necessary that the bottom spacing means as at 4 and 16 extend completely across the face of the panel so that in cross section the bottom portion of the panel is L-shaped and provides the required base or foot area. However, the intermediate spacing means such as at 2 and 3 do not have to be complete ribs. Ribs are desirable but the invention contemplates an arrangement in which individual projections extend from one face of the panel in the intermediate areas at least which are shouldered to provide the reduced area necessary for the projections 5 that engage in the apertures 6. Where a top cap is to be used, the top spacing means is a rib extending transversely across the face of the panel.

Further the units utilized in constructing the groins in Figures 6 and 7 readily lend themselves to modification to construct a groin that is substantially impermeable. Figures 9 and 10 illustrate such a modified groin unit. The unit is the same as that shown in Figures 4 and 5 with the exception of the vertical ribs 25 that extend between the bottom spacing rib 16 and intermediate rib 15 and also between the top of rib 15 and the undersurface of rib 14. One vertical rib is in the upper portion of the unit and the vertical rib 25 between spacing ribs 15 and 16 can be positioned between either two of the three apertures. A groin constructed of a unit illustrated in Figure 9 is still able to move the required amount vertically and laterally to ensure proper stabilization but

is substantially impermeable since the vertical ribs 25 block unimpeded passage of water through the spaces between adjacent units in the lateral direction.

The invention provides a wide range of constructional methods. The vertical height of groin units will of course be determined by the off shore sea bottom conditions. The groin is constructed of standardized units of any suitable structural material such as prestressed concrete, reinforced concrete, steel or timber. The complete groin panel unit including spacers and projections can be molded in a single operation from concrete materials or if desired, the spacers with their projections can be made separately and either bolted to preformed back panels or embedded therein while the back panels are being cast. Obviously the various components when made of timber will be bolted together and reinforced as necessary. The panels of the invention can be constructed of steel if desired. In other words, this invention is not to be limited to the use of any particular structural material being borne in mind that regardless of the structural material utilized the individual units have the same characteristics, namely, a plate-like base panel having apertures therein at different levels in the vertical dimension and between the apertures a plurality of transversely extending spacer ribs having projections extending therefrom of a size smaller than the size of the apertures whereby panels can be successively placed one upon the other with the apertures of one panel loosely fitting over the projection on the preceding panel and the back face of the one panel engaging the spacers of the preceding panel. Means are provided to restrain outward movement of the said one panel relative to the preceding panel.

The invention is not to be limited to a truncated shape but the outer margins of each panel are preferably inclined toward the top. In other words, the panels are of diminishing width toward the top. It is of course possible to construct the panels with curved edges. In other words, the groin as constructed presents a receding face in the path of movement of waves from any direction.

It is to be further borne in mind that the panels can be fabricated in situ where the groin is to be constructed or made up in a factory in units and transported to the site. Therefore the present invention provides a groin constructed of panels which preferably are truncated triangular sloped, with variably fixed and spaced spacers and apertures so that when erected, a non rigid solidly based articulated prism is provided having slopes to decrease incoming wave forces and with the panels tied to resist outgoing wave forces to thereby constitute a variably permeable groin to control the deposit of solids carried in the littoral drift and thus assist formation of beaches and preserve beaches along shore lines.

As pointed out previously, the individual panels have movement relative to one another so that the groin can adjust itself within limits to the underlying base material and changes in slope of the shore profile.

In keeping with the design of permeable groins the space between the top two spacer ribs is greater than that between the underlying ribs so that permeability variably decreases toward the bottom of the panel of the groin to provide a great interference to littoral drift at the bottom and as shore material builds up the increased permeability at the top allows free distribution of solids on both sides of the groin.

It is to be further pointed out that change in off shore profile slope can be counteracted by increasing or decreasing the outward extent of the spacers proportionately from top to bottom, in other words, support one panel further away from the preceding panel at the top than at the bottom so that the said one panel has a more stable angle. As previously indicated, for large changes in profile slope the size of the panel is increased proportionately and meets the slope conditions. If conditions require greater or less permeability in the groin the spacer ribs can be increased or decreased in height and/or width respectively as desired.

It is to be specifically pointed out that a groin constructed in accordance with the present invention does not require the use of piling or any other under-pinning. Consequently the time required to erect a groin is reduced to a minimum so that installation cost is materially reduced. Where the groins are constructed of panel units of prestressed concrete or high stressed concrete which is resistant to abrasion, the life of the groin is materially increased and maintenance costs are reduced to a minimum.

What is claimed is:

1. A groin comprising a series of contiguous members each having a lateral foot, upwardly converging sides and spacer means at different levels above the foot, said members being positioned to extend seaward in rearwardly inclined sequential, parallel spaced relation with at least portions of the spacer means and said foot of one unit engaging the succeeding unit.

2. A groin comprising a plurality of units positioned in rearwardly inclined sequential relation, each unit including spacing means projecting from one face only, said spacing means including shoulders extending substantially parallel to the plane of said face and projections extending outwardly of the shoulders, each unit further having apertures therein and the projections of one unit being disposed in the apertures of a succeeding unit and the shoulders engaging with the opposite face of a succeeding unit to space the units in substantial parallelism whereby the groin is permeable and means preventing the units from outward disassociation relative to one another.

3. A groin as claimed in claim 2, including upwardly converging sides and the shoulders including a rib projecting from the base of each unit and extending transversely across the same to constitute a lateral foot at the bottom of each unit and said projections including plural projections extending outwardly of said rib.

4. A groin as claimed in claim 3 in which the apertures correspond in number to the number of projections and are larger in two directions at right angles to one another than the projections thereby permitting lateral and vertical movement of one unit relative to another.

5. A groin comprising a series of units positioned in sequence to extend seaward, each unit comprising a base plate having upwardly converging sides, a plurality of spaced ribs extending across one face only of the plate including a rib at the bottom of each unit, projections extending outwardly of the ribs and the base plate having apertures therethrough in number corresponding to the projections and offset vertically therefrom whereby the apertures of succeeding units fit over the projections of the preceding units with each unit being upwardly and rearwardly inclined and having its rear face spaced from the base plate of the preceding unit.

6. A groin as claimed in claim 5 in which the apertures have greater dimensions in two directions at right angles to one another than the corresponding dimensions of the projections whereby the units can be displaced laterally and vertically relative to one another.

7. A groin as claimed in claim 6 in which the apertures are elongated vertically to permit substantial vertical movement of one unit relative to another.

8. A groin as claimed in claim 5 and a concrete cap poured over the tops of the units.

9. A groin as claimed in claim 5 in which the groin is impermeable and includes vertical ribs on each base plate extending between the transverse ribs.

10. A groin unit for use in assembling a groin to extend seaward, said unit comprising a body portion having a bottom and upwardly converging side edges, spacing means embodied with the front of the body portion at different levels including a foot portion extending transversely across the body at the bottom thereof, said spac-

ing means further including projections at different levels above the foot portion, said unit further having apertures therein corresponding in number to the number of projections so that a plurality of units may be positioned in rearwardly inclined spaced relation with the projections of one unit within the apertures in a succeeding unit.

11. A groin unit as claimed in claim 10 and securing means carried by the projections and adapted to cooperate with a succeeding unit in assembling a groin.

12. A groin unit comprising a base plate having a plurality of spaced ribs extending transversely across one face only thereof, projections extending outwardly of the ribs and the base plate having apertures therethrough in number corresponding to the number of projections and which apertures are offset vertically from the ribs and vertically aligned with the projections.

13. A groin unit as claimed in claim 12 and deformable securing means carried by each projection for cooperation with a succeeding unit in assembling a groin.

14. A groin as claimed in claim 5 and said apertures including an elongated notch extending inwardly from the top of the plate to the level of the upper rib.

15. A groin as claimed in claim 5 in which the opposite ends of each rib extend at angles inwardly toward one another.

16. A groin as claimed in claim 5 in which the space between the uppermost ribs is greater than that between the other ribs.

17. A groin unit comprising a base plate element having opposite faces, greater transverse dimensions than thickness and major and minor axes, plural spacer means extending outwardly from one face only and including free projecting ends and shoulders constituting supporting surfaces extending transversely of the plate and disposed between said face and said free ends, said spacer means being arranged at spaced areas along the major axis and said base plate having apertures therethrough corresponding in number to the number of projecting ends with the apertures offset from and in alignment with the projecting ends in the direction of the major axis whereby the apertures of a succeeding unit can fit over said projecting ends with the face of a succeeding unit engaging the supporting surfaces.

18. A groin unit as claimed in claim 17 in which the spacer means comprise ribs extending transversely across the plate in the direction of its minor axis and said projections extending outwardly from the ribs.

19. A groin as claimed in claim 18 in which one of said ribs extends across said plate along the bottom edge thereof when the plate is viewed from vertical position.

20. A groin unit as claimed in claim 17 in which said spacer means comprise ribs extending transversely across said plates at different levels in the direction of the minor axis, said projections extending outwardly of said ribs and additional ribs extending parallel to the minor axis and between the transversely extending ribs at areas of the base plate displaced laterally from the apertures.

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