This invention relates to a beach protecting barrier, and more particularly to a bulkhead having a serrated upper grade.

One feature of this invention is that it provides a very effective protection defending a foreshore or beach from the erosive or destructive action of the waters to which it is exposed; another feature of this invention is that it enables circulation of water adjacent the beach in order to continually renew such water; yet another feature is that it is particularly designed and adapted for the protection of beaches along a substantially straight long expanse of otherwise unprotected shore; and advantages of this invention will be apparent from the following specification and drawings, in which:

Figure 1 is a side elevation of a bulkhead embodying this invention; Fig. 2 is a view along a plane transverse to that in Fig. 1 showing the general relation of the bulkhead to the beach and sea bed; Fig. 3 is a transverse view, partly in section, of the bulkhead shown in Fig. 1; Fig. 4 is a detailed top plan view of a portion of the bulkhead; Fig. 5 is a fragmentary detailed side elevation adjacent the fastening bolts; Fig. 6 is a view of a modified form of this invention; Fig. 7 is a similar view of another modification; and Fig. 8 is a detailed sectional view of the interlocking sheet metal section, along the line 8-8 of Fig. 1.

Where the beach or foreshore of a sea is substantially straight and naturally unpolluted, the action of waves, tides, and other movements scours away the foreshore material, with a resultant undesirable destruction. This is particularly true where the material of which the foreshore is composed is relatively loosely packed, as is the case with "made" ground, and especially where sand has been deposited to provide a beach. It is, of course, customary to build sea walls or bulkheads to protect such foreshores, but these have generally been of the type comprising a flat upper grade, whether the bulkhead was immediately adjacent the foreshore or out in the sea spaced a distance from it. While such a bulkhead at the water line, properly ballasted with heavy rock or the like, effectively protects the foreshore, it completely eliminates any possibility of its use as a beach. A solid bulkhead of every grade spaced from the beach, while it protects it from erosive action, traps the water between it and the shore in such manner that it becomes contaminated with continued use and renders the beach unsafe from a health standpoint.

The present invention comprises a bulkhead or barrier on the sea bed substantially parallel to but spaced from the beach, the upper grade or surface being serrated in such a manner that high and low portions alternate in regular repetition, the high portions extending to or above high water level for the sea, and the low portions being at or below low water level. There are thus at all times, regardless of water level, portions projecting above the surface to break up waves which would otherwise have an erosive effect on the beach, and yet at all times portions of the bulkhead are below water so that surface disturbance, by waves and the like, causes a continual circulation of water from one side of the bulkhead to the other with consequent renewal of the water between the bulkhead and the beach.

Referring more particularly to the embodiment of this invention illustrated herewith in Figs. 1 to 5 and 8, a beach or foreshore 10 is protected by a bulkhead or barrier 11 located on the bed 12 of the sea to which the beach is exposed. The barrier 11 is here shown as comprising a plurality of interlocking sheet metal sections 13 driven into the sea bed 12 and supported at their lower portion by a heavier ballast portion.

Referring more particularly to Figs. 3 and 4, it will be seen that a series of wooden piles 14 are driven into the sea bed on the outer side of the sheet metal sections 13, these wooden piles being connected to each other by a wale or wooden beam 15 and to an iron wale or channel beam 16 by tie rods 17. The channel wale 16 is firmly fastened to the sheet iron segments 13, some of the segments being held by the ends of the tie rods 17 and others by any other convenient means, as the bolts 18. Suitable pressure plates 19 prevent the bolts or tie rod heads from pulling through any of the members which they hold. Any convenient ballast material 20 is dumped between the piles 14 and the sheet metal sections 13, preferably being topped by heavy rocks 21.

Referring more particularly to Fig. 1, it will be seen that the upper grade of the bulkhead 11, comprising the sheet metal pilings sections extending above the ballasted lower portion, is serrated in form. That is, the upper edge or grade is of varying height having portions extending above high water level for the particular sea in which the bulkhead is located, and intermediate portions below the low water level.
The word serrated, as used herein, contemplates an upper surface of irregular height comprising substantially regular repeating sections, whether the form of such variation is jagged, undulated, step by step, or otherwise. Fig. 1 illustrates the preferred embodiment in sheet metal sections, where the rise and fall in grade is in steps; Fig. 6 shows an embodiment where the change in grade from the low portions to the high portions is abrupt; and Fig. 7 shows a modification wherein the change in grade is smooth and gradual, approximating a sine wave, adapted to be constructed of concrete or similar materials. Regardless of the form, such bulkheads are intended to comprise extended portions at or above high water level and lower portions at or below low water level, the low portions being intermediate the high ones and both being regularly repeated at frequent intervals, so that the high portions are sufficiently adjacent each other to insure no long wave sections going through between even at high water.

The water body is principally submerged, as may be readily seen in Fig. 2, and it is preferable to have it form the outer edge of the "made" beach or foreshore, so that the inner level of such fore-shore is above the bed of the sea. The lower or ballasted portion should rise a substantial height above the sea bed in order that it may block sub-surface currents and water movement.

While the barrier is described as being used in connection with the foreshore or beach on a sea, it is to be understood this term means an ocean, lake or in fact any large expanse of water having waves or other surface disturbances strong enough to have substantial erosive effect, and wherein there is a periodic rise and fall of average or still water level. The invention described herein achieves its full advantages over an ordinary bulkhead only where there is such a rise and fall or water level. Where the water level is constant a barrier with a flat upper surface can be located a foot below the water level, for example, and achieve to a certain extent the desirable results of the barriers illustrated herein; but where there is a considerable rise and fall of level such a flat surface barrier is valueless, since part of the time it would be completely above water and block any circulation, while at other times it would be so many feet below the surface that erosive action of the water would be unimpeded.

In the form of this invention illustrated here-with using the angular interlocking sheet metal sections, the segments illustrated in Fig. 1, are about a foot and a half wide and rise about a foot at each junction. Thus only a foot of any one pile is unsupported by its neighboring sections, and throughout the majority of their height above the water 16 the right angle portions of the adjacent piles form sufficiently firm reinforcement to withstand any buffeting normally encountered. At a datum or normal water level only even with the third step or pile section there would be openings for circulation at least four and one-half feet wide, and two feet in depth at the center. At high water there would still be projecting portions seven and one-half feet wide and only sixteen and one-half feet apart to break up rollers and waves. Even at the lowest water level encountered the embodiment shown would provide an opening a foot and a half wide located every twenty-four feet for some circulation. This is in connection with still water level, but in practice surface variation and waves would be spaced water to break over the two adjacent sections of sheet piling, only a few inches above the surface and thus insure good circulation even at low water.

While I have described and claimed certain embodiments of my invention it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims in which is any invention to claim all novelty inherent in my invention as broadly as permissible in view of the prior art.

I claim: 1. A protecting bulkhead of the character described adapted to be located on the bed of a sea spaced from a beach, comprising a wall with a plurality of portions extending to or above high water level and a plurality of intermediate portions at or below low water.

2. A protecting bulkhead of the character described adapted to be located on the bed of a sea having a periodically varying wave, and waves spaced from a beach exposed to the erosive effects of said waves, comprising a principally submerged wall having portions of different height, the highest portions extending at least to high water level and the lowest portions being at or below low water level and intermediate said highest portions.

3. A protecting bulkhead of the character described adapted to be located substantially parallel to but spaced from a beach, comprising a wall with a relatively heavy base portion, and a lighter portion thereof above having a serrated upper grade, the highest portions of said grade being always above water and the lowest portions being always below water during periodic variations in the level of such water.

4. A protecting bulkhead of the character described adapted to be located on the bed of a sea having a periodically varying water level, substantially parallel to but spaced from a beach exposed to the erosive effects of said water, comprising a principally submerged wall having a relatively heavy base portion and a lighter portion thereof above having a serrated upper grade, the highest portions of said grade extending at least to high water level and the lowest portions being at or below low water level and intermediate said highest portions.

5. A protecting bulkhead of the character claimed in claim 4, wherein said lighter portion comprises interlocking sheet metal piling sections.

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