July 24, 1956 D. H. HAYDEN 2,755,631

EROSION CONTROL APPARATUS

Filed Feb. 12, 1952

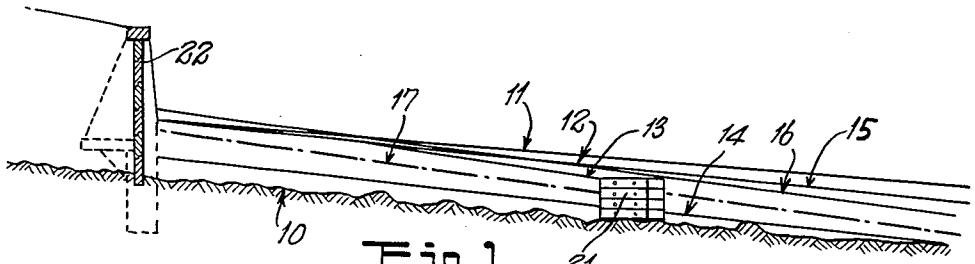


Fig. 1.

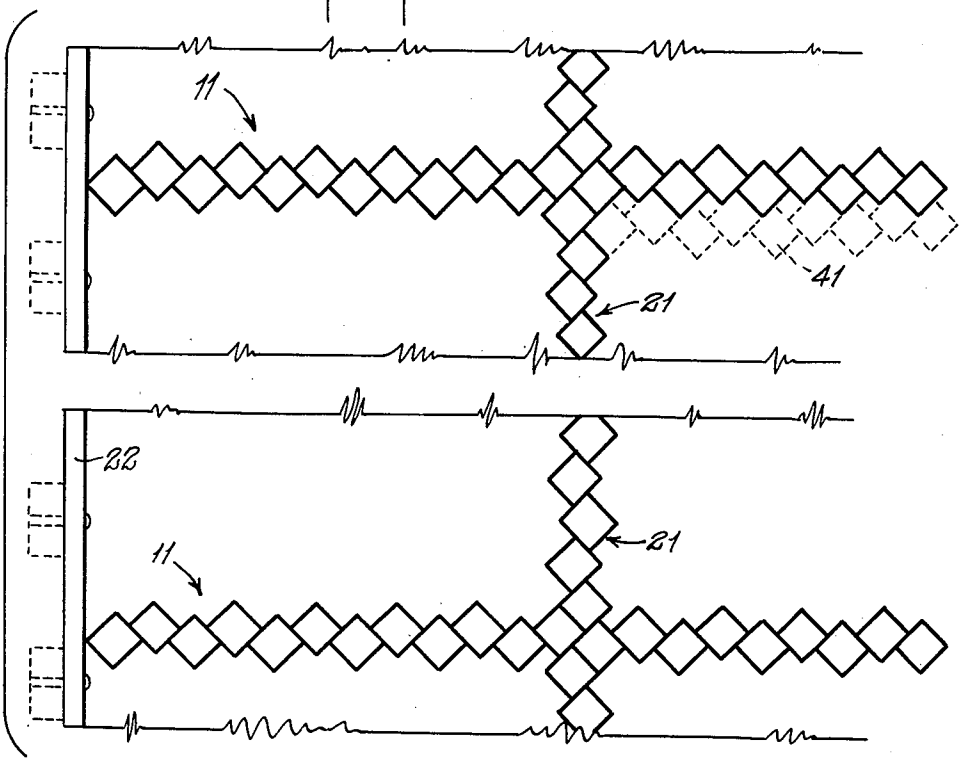


Fig. 2.

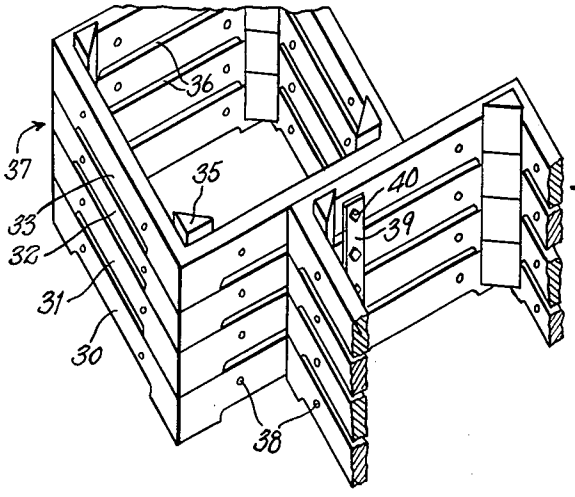


Fig. 3.

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EROSION CONTROL APPARATUS

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5 Claims. (Cl. 61—4)

The present invention relates to an apparatus and method for controlling the erosion of beaches caused by waves, and refers more particularly to a combination of groins and seawall, and the best method of constructing the same.

The effort to protect the land from the erosive action of waves has a history of the greatest antiquity. If any general statement can be made concerning seawalls, breakwaters, and the like as they are now constructed, it is that they are so massive as to withstand the highest waves and the fiercest storms, by reason of their great mass rather than particular features of construction. A corollary of their massive construction is that their cost is prohibitive except where a government chooses to spend the money in order to protect a particularly valuable piece of land.

My United States Patent No. 2,525,547 for a retaining wall includes the results of my early experiments in controlling erosion of shores and beaches by a less massive construction, which by costing less, becomes available for a wider variety of shore and beach. In the years since the application for that patent was filed, as a result of building installations along shore lines which had been eroded at the rate of one hundred feet in the immediate previous ten years, I have discovered what I believe to be the ideal combination of protective elements for an erosion control system, and the best method of installing the same.

As already suggested, the principal object of the present invention is to reduce drastically the cost of an installation for the control of erosion of beaches.

A further object of the invention is to provide means for rebuilding the beach by actually reversing the process of erosion.

Still another object is that the installation of the system may be accomplished by the services of two or more able bodied men, avoiding the necessity for use of power equipment.

Other objects will appear as the description proceeds.

In accomplishing the objects of the present invention, I have found that maximum results are obtained, to the extent not only of stopping erosion but of building up the beach again, by constructing two or more seawardly extending groins, then constructing a parallel groin extending substantially parallel to the beach and connecting the first two groins, and finally connecting the landward ends of the seaward extending groins by a wall extending along the beach.

Experience has shown that all of the above groins may be constructed without piling, by laying a comparatively shallow and light construction unit, such as a pre-cast concrete shape, upon the sand at low tide, and superposing similar units thereon to the desired height, the superposed units being retained in such relation by internal flanges and the box constituted by one series of superposed units being loosely bolted to the adjacent box to produce a flexible but permanent groin assembly.

My experience has also shown that there is a necessary

sequence of building the above described system. The seaward extending groins are built first, and rapidly cause a deposit of sand between each pair of adjacent groins. The parallel groin, which is next laid down, substantially parallel with the beach and approximately midway the length of the seaward groins, and connecting adjacent seaward groins, may thus be started on newly deposited sand. A further new deposit of sand then builds up on the landward side of the parallel groin, and on the beach as then constituted the shore wall is built, connecting the landward ends of the seaward groins.

Other objects of this invention will in part be obvious and in part hereinafter be pointed out. The invention accordingly consists in the features of constructing combinations of elements and arrangements of parts which will be exemplified in the constructions and methods hereinafter described. In the accompanying drawing, in which is shown one of the various possible illustrative embodiments of this invention:

Figure 1 is a sectional profile view of an eroded beach, showing also my system of groins and wall and the various levels of beach which develop as the installation progresses.

Figure 2 is a plan view of the system installed.

Figure 3 is a perspective view of a fragment of a groin, showing the construction thereof.

Referring now in detail to the drawings, **10** is the profile of the eroded beach. **11** is the top line of the seaward groin. **12** is the line of the beach adjacent the seaward groins built up from wave action as the results of the installation of said seaward groins. **13** is the line of the same beach midway between adjacent groins. **14** is the probable beach profile, corresponding to line **12**, after a storm and in the absence of the parallel groins to be described hereafter. Line **15** is the beach line adjacent the seaward groins after the installation of the parallel groin, and line **16** is the beach line midway between the seaward groins after the parallel groin has been installed. **17** is the beach profile during a hard storm after the parallel groins have been installed.

The seaward groins **11** extend seaward from the beach, and in most cases will be perpendicular thereto. Such groins already constructed vary in length from 100 to 150 feet, however their length, as well as the distance between adjacent groins, will be dictated by local conditions. The parallel groins **21** connect adjacent seaward groins about midway the length of the latter, and extend substantially parallel with the shore line. The wall **22** extends along the beach, connecting the landward ends of the seaward groins **11**. Wall **22** must contact the groins **11** substantially throughout the height of the latter for reasons to be explained hereafter. Wall **22** is preferably constructed according to the principles set forth in my above identified patent.

Groins **11**, **21** may be formed of cribs or frames such as are more fully described and claimed in my copending application, Serial No. 745,850, filed May 3, 1947, now Patent 2,652,692 dated September 22, 1953. They may also be constructed by laying a structural unit **30**, Figure 3 herein, upon the sand at low tide. The unit **30** is in the form of a hollow polygonal or circular frame. It is shallow, has thin side walls, is completely open at bottom and top, is constructed of pre-cast concrete, is light enough to be carried to its place, and set in place by two able bodied men. Unit **30** has no piles or other anchoring means associated therewith. Units **31**, **32**, **33**, identical to **30**, are then successively superposed thereon to the desired height of groins and all the units are interlocked in register, for instance by internal flanges or studs **35** integrally comprised by each unit **30**, **31**, etc. and extending above each unit into a recess in the superposed unit. The undersurface of each unit **30**, **31**, etc. may be

recessed intermediate the corners so as to provide openings 36 which render the groins permeable to water and sand suspended in the water, and the motion of the water inside the groins being slower, some of the suspended sand settles out before the water passes through, thus rapidly filling the groins with sand and the entrapped sand anchoring the groin in place.

A stack 37 is constituted by each series of superposed units 30, 31, etc. and the adjacent stacks 37 loosely connected together collectively constitute the groins 11, 21. The height of a groin may be increased from time to time as described by superposing additional units 30, 31, etc. thereon.

The units 30, 31, etc., are formed with holes 38 through their walls, and strips 39 of metal or wood are formed with corresponding holes, and bolts 40 pass through the strips 39 and holes 38 of the units 30, thus tying the stacks 37 flexibly together to form the groins 11, 21 and also tying together the superposed units of each stack. In Figure 2, a series 41 of additional stacks 37 has been added to the groin 11 to give it additional width at a spot subjected to particularly vigorous wave action, the extra width causing additional turbulence in the wave, thus diminishing the power of the wave.

In the installation of the system, the seaward extending groins 11 are installed first, being built as described above. As seen from Figure 1, the installation of the seaward groins 11 immediately causes a considerable deposit of sand and shingle between adjacent seaward groins 11. By reference to line 14 of Figure 1, it is also obvious that a storm will remove almost all of the newly built up beach between seaward groins 11 if they are not combined with further elements of the within invention. In Figure 1 the parallel groin 21 has been build on the line 14 left by a storm. If a storm had not intervened, the parallel groin 21 could have been built from the line 13. As the groin 21 builds up sand on its landward side, the level of the beach is again raised and the high water line advances seaward on the beach. The wall 22 is built at the calm weather high water line.

The function of both groins 11, 21 is to flatten out the waves by causing turbulence in them. The seaward groins 11 having produced a beneficial building of the beach, the parallel groin 21 is necessary because the receding water confined between adjacent seaward groins 11 still has a powerful erosive effect sufficient to pull the beach down to the line 14 during a storm. Parallel groin 21 retards the rate of flow of the receding water, thus building up sand on its landward side.

In order to function properly, the groins 11, 21 should have their top line at about the high water mark in calm weather, though additional height will not be detrimental. During a storm, though the crests of the waves are higher than in calm weather, the troughs between waves are lower, so that a large portion of the wave is subjected to the groin action. As the wave action is more violent during a storm, the turbulence created by the groins is also greater, and the waves are thus flattened out.

Wall 22 has a dual function. It is not a conventional seawall receiving the full action of the waves, said action having been minimized by both groins 11, 21. Flattened waves reaching the shore during a storm still have a cutting effect upon the bank. Wall 22 prevents this cutting action, and returns the spent wave seaward, where it crests with an incoming wave about midway between the wall and the parallel groin.

Prevention of cutting of the bank being the first function of the wall, the second function is to confine the receding wave between the same two seaward groins as those between which it arrived at the shore. For this purpose it is necessary that the wall actually contact the seaward groins 11 substantially throughout the height of the latter as clearly shown in Figure 1. Presuming that there were only two seaward groins 11, a wave arriving at an oblique angle would not only cut the bank in the absence of wall 22, but in case wall 22 did not contact the groins 11, the wave would escape around the end of one or the other groin 11 and recede along a beach not protected by any groins, causing just as bad erosion as if no installation had been made. Such action would undermine the groins 11.

It is therefore clear that seaward groins 11, parallel groins 21 and the shore wall 22 are all necessary for erosion control, and that the above described relation between them is also necessary.

I believe that my method of building these groins from comparatively light, shallow units placed on the sand at low tide, an operation within the reach of most property owners from an economic point of view, is of utmost importance. The conventional jetty or groin is out of the reach of most property owners because of its great cost.

It is also remarkable that my experience has shown that the groins 11 need only be between 100 and 150 feet long. After a complete system as described herein has been in operation for some time, the groins are completely covered with sand and the beach is far extended seaward. At this point the property owner may either count on a fairly static condition in which a bad storm will uncover the groins and they will fill up again in calm weather, or he may build another complete installation further seaward, in order to build up more beach. Conventional jetties of massive construction usually run 250 feet or more in length, so that they cost not only many, many times more per unit of length to construct, but are also necessarily longer so that their disparity in cost increases again.

It will thus be seen that there is provided a device in which the several objects of this invention are achieved, and which is well adapted to meet the conditions of practical use. As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiments above set forth, it is to be understood that all matter herein set forth or shown in the accompanying drawing is to be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A groin and wall system for controlling erosion of beaches by waves, comprising the combination of a plurality of groins extending seaward, a parallel groin extending substantially parallel to the beach and connecting two of said first mentioned groins, and a wall extending along the beach and connecting the landward ends of said two first mentioned groins all of said groins being constituted by a plurality of side by side substantially vertically extending stacks of closed polygonal cross section, said stacks being formed with openings in their side walls so as to be water permeable.

2. In a system according to claim 1, each of said stacks being constituted of a plurality of substantially identical frames superposed in register, said frame being completely open at bottom and top and said groins resting on the beach and being fixed thereto by sand entrapped in said stacks.

3. A groin and wall combination comprising a plurality of groins extending outward from a wall connecting said groins at their inner ends, each groin being comprised of connected stacks of superposed similar precast frames, each frame having a closed perimeter, largely open at its top and bottom, of a height and weight whereby it may be laid in position on a beach without any piles or other anchoring foundation, at least some of the frames being provided with a guide projection for engagement within a contiguous alined frame in a stack, each frame being provided with lateral openings rendering the stack permeable to water whereby suspended sand may be precipitated from slower moving water within a stack to anchor the stacked frames in

place, and means for connecting contiguous portions of adjacent stacks and frames.

4. A combination according to claim 3 in which a groin generally parallel to the wall, of less height than said wall, connects adjacent outwardly extending groins intermediate their ends, said parallel groin being also of stacks of frames according to those called for.

5. A combination according to claim 4 in which said parallel groin is of a height to impede a substantial portion of an incoming wave, said parallel groin being spaced from said wall a distance to allow the top portion of an incoming wave to abut said wall, be reflected

and have the reflected wave meet a succeeding incoming wave between said parallel groin and wall.

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