May 9, 1944. L. A. WELLS 2,348,508

BREAKWATER

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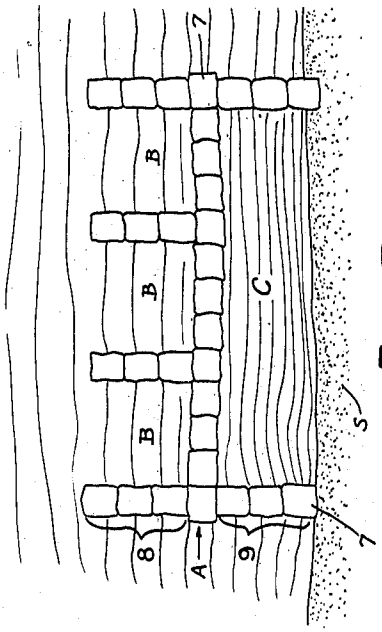


FIG. 3.

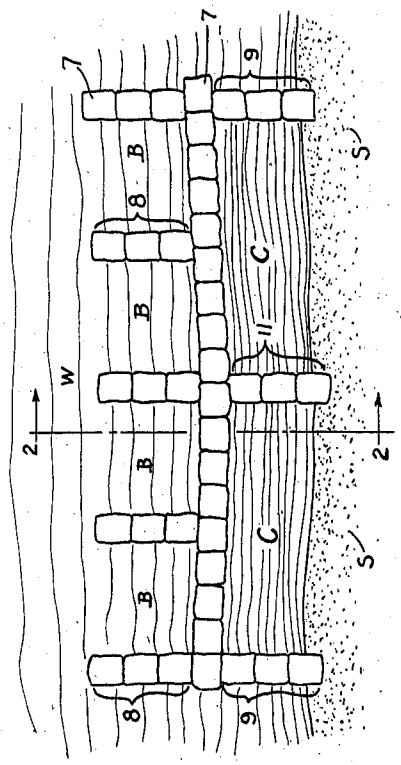


FIG. 1.

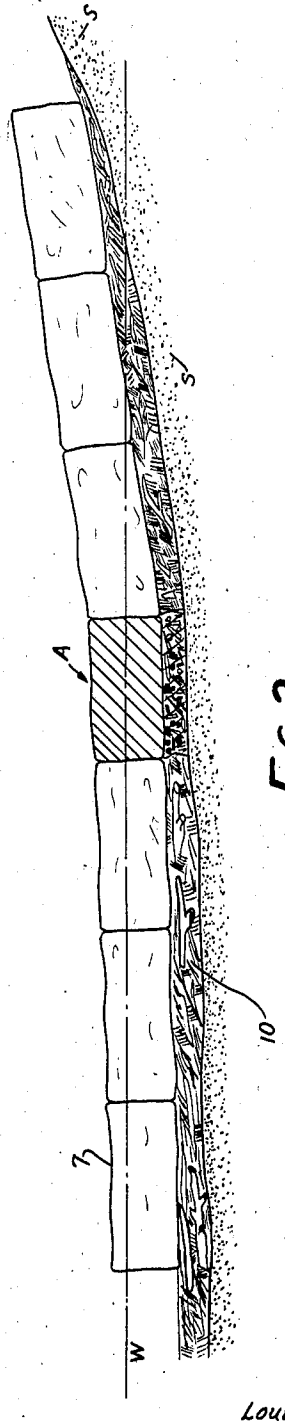


FIG. 2.

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BREAKWATER

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3 Claims. (Cl. 61—4)

This invention relates to improvements in lake shore breakwaters and is more particularly directed to that type of breakwater concerned primarily with bank protection and beach building.

One object of the invention is to provide a breakwater structure that will afford protection to the shore, not only from the undertow erosion of direct waves, but also from a lateral scouring caused by lateral currents and angular waves. Besides this protective function, my invention makes use of the force of such waves, and the dispersion of solid particles in the same, to effect the constructive result of beach building.

Another object of my invention is to provide a breakwater adapted to furnish such protective and constructive functions, and yet have a simple and inexpensive construction, and one particularly durable because of the scientific placement of the unattached individual components of the breakwater's structure.

These and other objects of my invention will be apparent from the following structural description and operative analysis.

In the annexed drawing—

Fig. 1 is a top plan view of a breakwater built according to the invention;

Fig. 2 is a sectional view on a somewhat larger scale taken on lines 2—2 of Fig. 1; and

Fig. 3 is a top plan view of a modified form of the breakwater.

In all figures the letter W represents the extension of the breakwater into the lake, and S the shore to which the breakwater is attached.

My breakwater includes in its design, as is clearly shown in Fig. 1, the interrelation of three distinct sections coordinated to provide an integral and effective structure. These sections are all composed of a plurality of heavy, unattached, individual blocks 7, disposed to form substantially continuous walls.

One section of blocks designated as A extends in front of and separated from the shore line substantially parallel with the general contour thereof. Jetties 8, likewise made up of unattached individual blocks, project from the shore parallel section A perpendicularly into the water to form in conjunction with the latter a series of open three-sided squares, or bays B, the second salient section of my breakwater. The third section is formed by other jetties 9, similarly composed, which project perpendicularly from the shore parallel section A toward the bank.

The individual blocks 7 of the breakwater may be stone or other heavy, durable material. The size of these blocks may vary considerably depending upon the shelf angle of the lake bottom, but I prefer to use blocks having a length and width of about five feet with a vertical depth of about 30 inches. The shore-parallel blocks in section A are placed at a distance from the shore line that will permit them to have approximately half of their vertical extension above the normal water level. The blocks are laid side by side without attaching binder, and are kept in relative position and alignment by inherent weight.

Under the blocks, as shown in Fig. 2, a foundation layer of brush mat 10 or the like is advantageously used. Generally, a mat having an initial thickness of about a foot is sufficient. Under the weight of the blocks compression to about a third of the initial thickness takes place. This foundation mat tends to keep the blocks from settling into the sand too much due to constant undertow erosion.

Lake shores are usually subjected to water attack, by direct wave action directed either perpendicularly or obliquely to the shore line, by currents flowing parallel to the shore, and by combinations of these two actions.

When waves sweep in to the shore the turbulence of the water raises sand and other solid material from the shore bottom which becomes entrained in or suspended throughout the entire wave mass and is carried in with the water. When the wave breaks upon the beach the sand is dropped. In the recession of the water from the shore, sand is again picked up and swept outward into the lake by the swiftly flowing current of water, known as the undertow, which sweeps outwardly along the lake bottom, undermining the water mass of the incoming waves. The ultimate effect of this type of wave action upon the shore depends upon which influence predominates in moving the sand. If more sand is deposited by the waves than is swept out by the undertow, the beach of course builds up, and vice versa.

Parallel currents tend to scour the shore and may be much more rapid in their destructive action than direct wave action, since the current is usually effective only in carrying material away from the scoured shore. However, sand deposits tend to form down-current from the scoured shore at a point where the energy of the current is dissipated or diminished. More generally combinations of these two water actions are bound to be at work.

The above described breakwater construction is designed not only to protect the shore from the destructive action of the lake but also to promote

the building of the beach by modifying or redirecting these otherwise destructive water actions as is hereafter explained.

In calm weather, as waves flow over the breakwater into the pool C with their burden of entrained solids, most of their force is spent before they reach the beach, so that the pools C act as large settling basins in which the solid content of the waves is dropped. In rough weather, as waves sweep in toward shore, they flow over the breakwall with their burden of entrained or suspended material and break upon the shore, thereupon depositing the suspended material. However, the undertow which runs outwardly along the bottom is interrupted by the shore parallel breakwall A and dispersed within the pool C. Most of the sand which is usually carried out into the lake by the undertow is now deposited and retained within the pools C. Thus continued wave action will build up a beach within the pool C, even though the unprotected shore was subject to erosion. If the unprotected shore was being built by wave action, this breakwater will accelerate the building process.

The jetties 9 protect the shoe and the pools C within which beach building occurs from the scouring effect of lateral currents and oblique waves. When the shore line to be protected is so long that the construction of Fig. 3 would result in a pool C too large for best results, the jetty 11 is used to divide the pool within the breakwater as shown in Fig. 1. Jetty 11 prevents the development within the breakwater of waves or currents of a magnitude sufficient to cause a maldistribution of the deposited material. This feature of the construction contributes not only to the building of a higher beach, but also insures its retention.

The jetties B have the dual function of protecting the shore-parallel section A from destructive wave forces, and of assisting the beach building process by causing the deposition of solids within the bays B, particularly when waves or lateral currents cause the water to approach the breakwater obliquely. These jetties 9 also insure the permanency of the section A by protecting its off-shore side from the scouring effects of strong lateral currents, which might so deeply erode the bottom parallel to A that the slabs of A would be undermined and displaced despite the brush mat foundation 10.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the structure herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:

1. A breakwater comprising a wall made up of substantially contiguous blocks of masonry positioned off-shore and extending generally parallel to the shore line; a plurality of jetties similarly constituted, extending from adjacent the shore line out to said wall, forming therewith and the shore at least one substantially enclosed bay; and a second set of jetties adjoining said wall on the off-shore side thereof, extending outwardly into the water to define a plurality of open-sided bays; the masonry blocks comprising said wall and jetties being disposed upon means to prevent undercutting and substantial settling of said blocks into the bottom by action of the water.

2. An erosion-preventing and beach-building breakwater comprising a plurality of jetties composed of blocks of masonry extending in generally parallel relation from the shore-line outwardly toward deep water; a wall extending athwart said jetties intermediate their length so as to be positioned off-shore generally parallel to the shore line; and a water-pervious mat underlying said jetties and wall to afford subjacent support therefor.

3. A breakwater construction comprising a succession of massive masonry blocks layed contiguously to each other along the shore line so that they rest upon the bottom with not less than one-half of their height submerged beneath the water; a plurality of similarly constituted elements extending generally transversely to said contiguous blocks between the latter and the shore and beyond the contiguous blocks into deeper water; and means for supporting all of said blocks upon the bottom to prevent erosion of the subjacent support of said blocks.

LOUIS A. WELLS.