March 19, 1968 L. HORNBOSTEL, JR 3,373,568

SYSTEM FOR RECLAMATION OF LAND

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FIG. 1

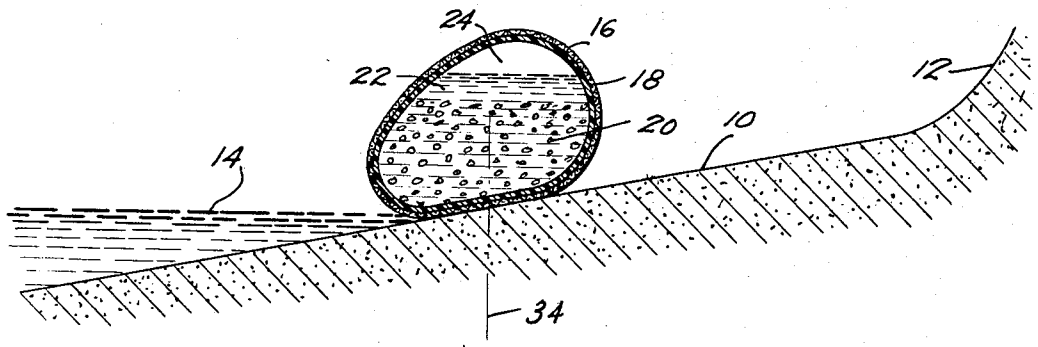

FIG. 2

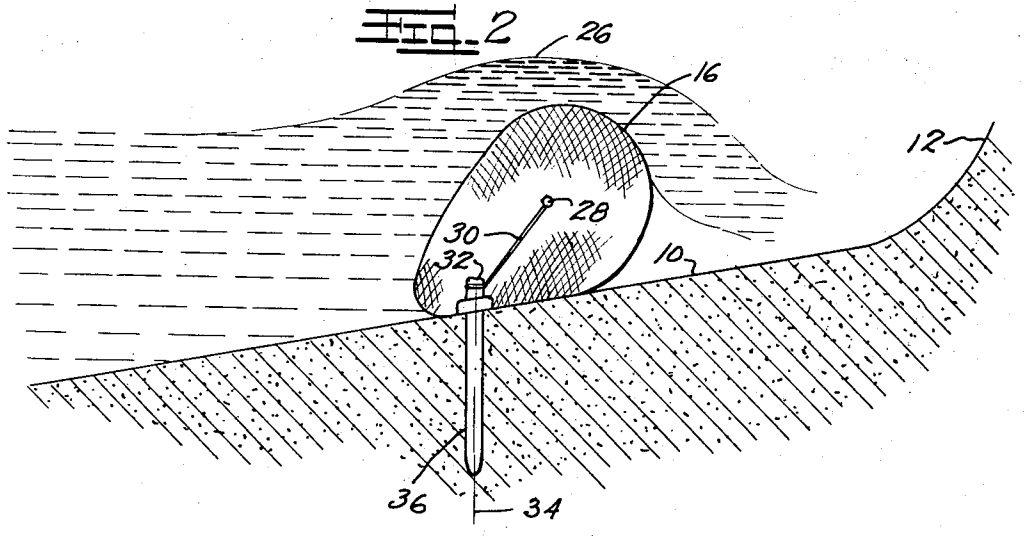

FIG. 3

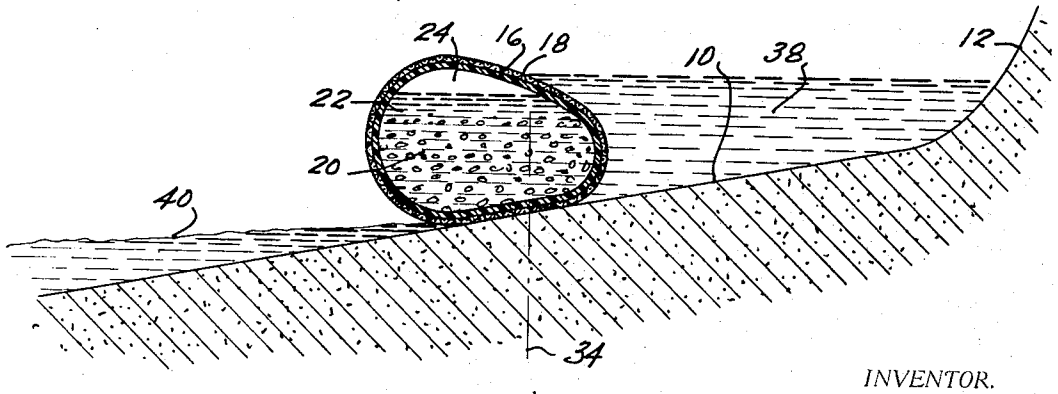

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FIG. 4

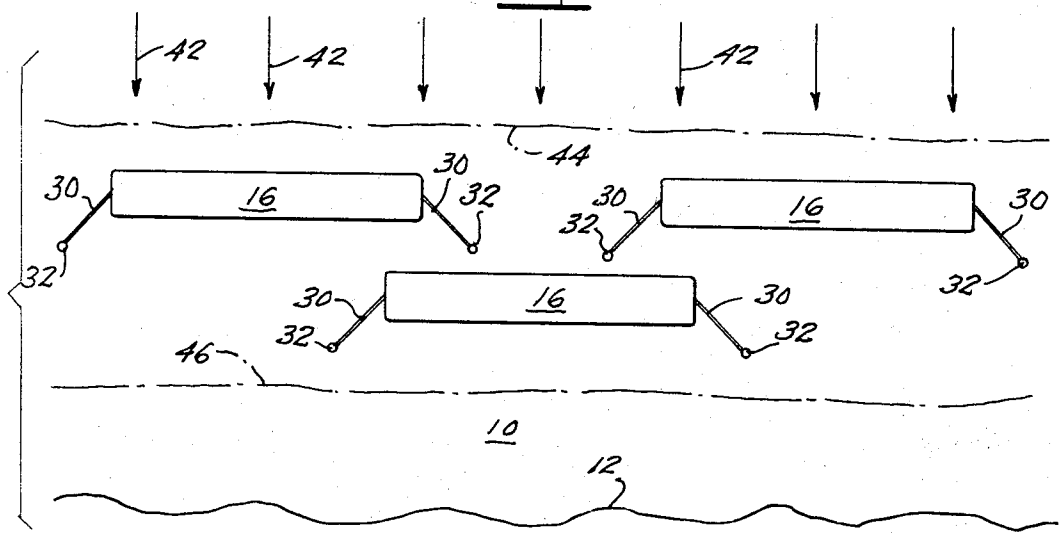
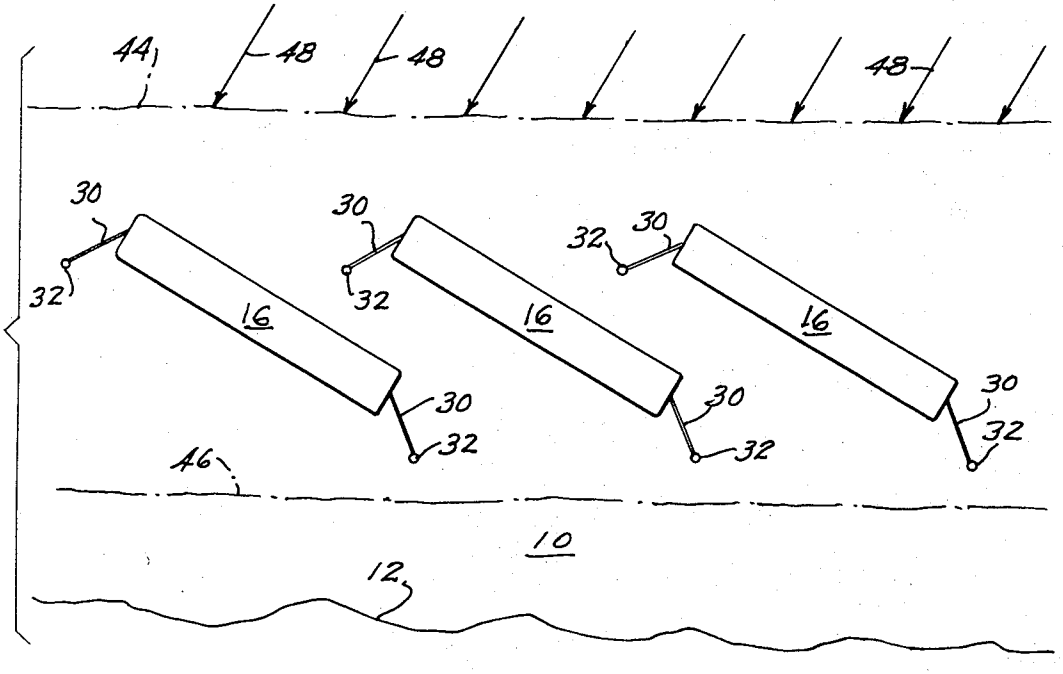


FIG. 5



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SYSTEM FOR RECLAMATION OF LAND

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ABSTRACT OF THE DISCLOSURE

System for the reclamation of land by placing spaced elongated flexible sealed bags filled with a mixture of aggregate and water along the shore line in overlapping relationship. The bags are made from a plastic material and may be covered by a nylon netting and have anchors at their opposite ends for the attachment of anchoring cables, anchoring the bags to the shore to extend with their longest dimensions parallel to the short line. The bags may be anchored in staggered relation with respect to each other with two advance bags lapped at the ends thereof by a trailing bag spaced from the two advanced bags to take care of an on-shore wash. The bags also may be angularly disposed with respect to the shore line and extending in spaced parallel staggered relationship with respect to each other in positions orthogonally with respect to the direction of the wash, where the wash is a long-shore wash.

This invention relates generally to a system for the reclamation of land and more particularly to a novel method and apparatus for protecting a shore line and removing suspended sediment in the water adjacent a shore line and depositing such sediment on the shore. The present invention accomplishes the several novel results by absorbing energy from a wave front and trapping the water of the wave front from the receding water of the remaining portion of the wave which allows suspended sediment therein to be deposited on the shore. The instant invention exemplified herein has particular application in those shore line areas where tidal action occurs. However, it is to be understood that the present invention may be employed in other shore line areas and is not dependent upon tidal action for satisfactory achievement of the several novel results thereof.

Damage to shore line areas and to beaches is commonly caused by the erosion effect of waves attacking the shore line and carrying away earth and sand. This problem is particularly acute in those areas which have been developed for commercial use. Such development is commonly practiced in those shore line areas which have very little or no sand available for forming suitable beaches for commercial use. When sand is deposited in such areas for improving the commercial use of the land, erosion effects of the waves will eventually carry all of the deposited sand away from the area.

In addition, many of the natural sand beaches are being constantly changed as the sand is shifted by the action of the water in the form of waves and tidal currents. Since the development of man made beaches is expensive, primarily due to the cost of transporting sand and other materials, and, since the maintenance of existing natural beaches is a serious problem, a need exists for structures which will eliminate damage to a shore line and which will further reclaim a portion of the sediment suspended in the water adjacent a shore line. Such structures, therefore, not only will protect existing beaches from the erosion effects of the water, but will provide a means for enlarging the beach area and maintaining a proper amount of sand on and adjacent the beach area.

In the past, shore lines have been protected by seawalls and pylons driven into the earth covered by water and

spaced a short distance from the beach. The primary difficulty which such prior structures is that of the expense inuvolved in having such structures erected and maintained. Furthermore, sea walls, breakwater walls, and pylons being permanent type structures present a hazard to navigation and mar the beauty of a beach employed for commercial purposes. Furthermore, it is well known that pylons attract sharks and other dangerous fish which may present a safety hazard to swimmers in the beach area.

Although removable breakwater structures have been employed for protecting recreational areas adjacent a shore line from waves, such prior art structures are not well suited for the protection of the beach nor for the reclamation of land in the form of sediment in the water. For instance, flexible buoyant materials have been placed in the water adjacent a shore line to dampen the effect of waves on a recreational area or the like immediately adjacent a beach. Also, flexible barriers have been employed in the water, usually below the surface thereof, for dampening the energy of the incoming waves. However, these latter prior art structures, although satisfactory for the intended purpose of protecting a recreational water area, are not intended for use and are not satisfactory for reclaiming land in the form of suspended sediment in the water. Furthermore, many of these prior art structures are not completely satisfactory as energy absorbers, since they are disposed below the surface of the water and the energy of the wave passing thereover is substantially not affected.

Summary and objects of the invention

Therefore, it is an object of the present invention to provide a method of and apparatus for protecting a shore line from the effects of tidal currents and waves.

It is another object of the present invention to provide a method of and apparatus for absorbing energy from water waves and tidal currents adjacent a shore line.

Still another object of the present invention is to provide a method of and apparatus for removing suspended sediment in water adjacent a shore line and depositing such sediment on the shore or beach.

Another object of the present invention is to provide a system for the protection of a shore line and for reclaiming land in the form of suspended sediment in water adjacent a shore line and depositing such land or sediment on the shore.

Yet another object of the present invention is to provide a method of and apparatus for protecting and developing a shore line which is less expensive than the heretofore known methods and apparatus.

It is still another object of the present invention to provide a method of and apparatus for protecting and developing a shore line which is easily removable and portable so as not to reduce the commercial use of the shore line nor mar the beauty thereof.

These and other objects, features and advantages of the present invention will be more fully realized and understood from the following detailed description when taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a side view in transverse section of the apparatus of the present invention illustrated in relation to the water level;

FIGURE 2 is a side elevational view of the apparatus of the present invention and illustrating its relative position during the passage of a water wave thereover;

FIGURE 3 is a side elevational view in transverse section of the apparatus of the present invention illustrating its relative position after a wave has passed thereover and is receding from the beach;

FIGURE 4 is a top view illustrating a system employing the apparatus of the present invention for an onshore wash; and

FIGURE 5 is a top view illustrating a system of the present invention for a longshore wash.

Like reference numerals throughout the various views of the drawings are intended to designate the same or similar structures.

As shown on the drawings:

With reference to the drawings and in particular to FIGURE 1, there is shown the preferred form of the present invention positioned along a shore line which includes a beach **10** and a beachhead **12**. The average or nominal level of the water is indicated by the line **14**. The novel apparatus of the present invention includes a flexible bag **16** in the shape of a cylinder and of the type commonly used to barge liquids under water. The bag **16** is preferably formed of reinforced polypropylene which is self-sealing. In the preferred form of the present invention, the bag **16** was formed of a polypropylene dunnage bage in the shape of a cylinder eight feet in length and thirty-six inches in diameter. The bag **16** is covered with a nylon netting **18**.

The bag **16** is filled with a clean grade of gravel **20** having a uniform stone-size diameter in the preferred form of the present invention of one-fourth inch. It is to be understood, however, that larger aggregate may be employed and the size of the aggregate will vary with the size of the bag **16**. The bag **16** is filled from between 50% to 90% by volume with the gravel **20**. The amount of gravel or aggregate **20** employed in the bag **16** controls the ballast thereof. In the preferred form of the present invention, the bag **16** was 70% filled with the gravel **20**.

Water, indicated with the reference numeral **22**, is placed in the bag **16** over and through the gravel **20** to provide lubricating qualities to the gravel to allow the gravel to move as a semi-fluid mass. The remaining volume of the bag **16** which may vary from 10% to 50% is filled with air such that the bag **16** assumes the cross-sectional shape illustrated in FIGURE 1. The water **22** may be added to the gravel **20** until it attains a level equal to that of the gravel **20**, or it may be filled to provide a small layer of water over the gravel **20** as illustrated in FIGURE 1. An air pocket **24**, which is the space remaining in the bag **16** after the gravel **20** and water **22** are added, allows the upper portion of the bag **16** to be relatively more pliable than the lower portion thereof surrounding the gravel **20**. Therefore, the bag **16** and its contents including the gravel **20**, the water **22**, and the air define a resilient barrier having greater flexibility at the upper portions theerof and decreasing in flexibility toward the bottom portions thereof. It is to be understood, however, that the air pocket **24** is not sufficiently large to allow the bag **16** to float in water. Because of the relative distribution of the aggregate **20**, the water **22**, and the air in the air pocket **24**, a large surface area of the bag **16** remains in contact with the beach **10** to prevent channeling.

FIGURE 2 illustrates the bag **16** during maximum impact position thereof when the crest of a wave **26** is passing thereover. As shown, the bag **16** conforms to the energy profile of the wave **26**, absorbing energy therefrom and allowing excess water to spill over the top of the bag **16**. The bag **16** is provided with an anchor pin **28** centered at each end thereof which is secured by means of a cord **30** or other suitable means to a pylon **32**. A centerline **34** of the pylon **32**, as illustrated in FIGURES 1 and 2, provides an indication of the relative movement of the bag **16** during impact of a wave thereon. That is, when the wave **26** strikes the bag **16**, the bag **16** rolls up the beach **10** toward the beachhead **12** as illustrated in FIGURE 2. However, the aggregate **20** remains in the bottom portion of the bag **16** to maintain the stability of the bag **16** and further to maintain a large surface area of the bag **16** in contact with the beach **10**. As illustrated in FIGURE 2, the bag **16** is normally positioned such that the highest point at which the water will reach is lower than the top portion of the bag **16**. Therefore, the crest of the wave **26** must flow upwardly over the top of the bag **16** and spill over behind it. Because the bag **16** is allowed to move with impact of the wave **26** thereon, energy in the wave **26** is absorbed by the bag **16** and destructive effects of the wave **26** are substantially eliminated.

The pylons **32** may be supported in sockets **36** sunk into the beach **10** such that the pylons **32** and the bag **16** may be removed during their non-use. Caps may be provided for the sockets **36** during their non-use to eliminate sand and other sediment from accumulating therein.

That portion of the water which passes over the bag **16** accumulates between the bag **16** and the beachhead **12**, as indicated by the reference numeral **38** in FIGURE 3. The remaining portion of the wave recedes from the beach **10** as indicated by the reference numeral **40**. The force of the ponded water **38** forces the bag **16** to roll down the beach **10**, as illustrated in FIGURE 3. The large surface contact of the bag **16** with the beach **10** eliminates underwash of the water **38** thereunder. The ponded water **38** returns to the lower water **40** by sinking into the sand and by end wash around the ends of the bag **16**. Any silt or sediment is retained behind the bag **16** and is deposited on the beach **10**. This sediment which was retained in the water by movement and currents in the water settles behind the bag **16** when the water **38** is brought to substantially a standstill by the bag **16**.

FIGURE 4 illustrates an arrangement of the bags **16** as energy absorbers for an onshore wash, as indicated by the arrows **42**. The nominal or average water level at low tide is indicated on the beach **10** by the line **44** and the nominal level of the water during high tide is indicated by the line **46**. The forwardly placed bags **16** are positioned the same distance from the low tide line **44** as the rearwardly placed bags **16** are positioned with respect to the high tide line **46**. As illustrated in FIGURE 4, the bags **16** overlap with respect to one another to prevent end wash therearound.

FIGURE 5 illustrates an arrangement of the bags **16** for a longshore wash as indicated by the arrows **48**. As illustrated in FIGURES 4 and 5, the bags **16** are positioned orthogonally with respect to the direction of the wash, as indicated by the arrows **42**, **48**. The arrangement illustrated in FIGURE 5 also provides for a staggered relationship between the bags **16** in end-to-end overlapping relationship. The bags **16** in each of the arrangements illustrated in FIGURES 4 and 5 should move a total of their contact face width along the beach **10**. However, the bags **16** should not come into contact with one another.

The principles of the invention explained in connection with the specific exemplifications thereon will suggest many other applications and modifications of the same. It is accordingly desired that in construing the breadth of the appended claims they shall not be limited to the specific details shown and described in connection with the exemplifications thereof.

I claim as my invention:

1. A system for protection of a shore line and reclamation of suspended sediment in water adjacent a shore line comprising

(a) a plurality of wave energy absorbers each including

(1) a sealed bag of impervious flexible material, and

(2) a mixture of aggregate and water in said bag for weighting said bag, said aggregate being solid independent shapes denser than said water and being supportingly disposed as a mass against the bottom and lower sides of said bag, said mass filling substantially no less than the lower half portion of the bag and having a free upper surface with the shapes capable of moving relative

to each other when the bag flexes, said water filling the voids between said shapes to a depth substantially at the level of the free surface of said mass, and

(b) means for securing each of said absorbers to the shore line in parallel relation to a wave front, and in an overlapping relation with one another.

2. A system for protection of a shore line in accordance with claim 1, wherein the mixture of aggregate and water within the bags fills 50% to 90% of the volume of the bags.

3. A system for protection of a shore line in accordance with claim 1, wherein a mixture of aggregate and water fills 70% of the volume of the bags.

4. A system for protection of a shore line in accordance with claim 2, wherein the sealed bags are elongated and have anchoring means at their opposite ends, anchoring the bags to the shore line orthogonally with respect to the direction of wash of the waves.

5. A system for protection of a shore line in accordance with claim 4 wherein nylon nettings enclose the bags.

References Cited

UNITED STATES PATENTS

919,788	4/1909	Smith	61—4
1,004,718	10/1911	Wieland	61—5
2,655,790	10/1953	Daley	61—3
2,967,398	1/1961	Smith	61—5
3,067,712	12/1962	Doerpinghaus.	
3,191,386	6/1965	Wiegel et al.	61—5

OTHER REFERENCES

Civil Engineering, pp. 31, 32 and 33; January 1963.

EARL J. WITMER, *Primary Examiner.*