May 13, 1958 J. O. FRERICHS ET AL 2,834,186

APPARATUS FOR LAUNCHING REVETMENT MATS AND CABLE CLAMPING MEANS THEREFOR

Filed Aug. 16, 1955 2 Sheets-Sheet 1

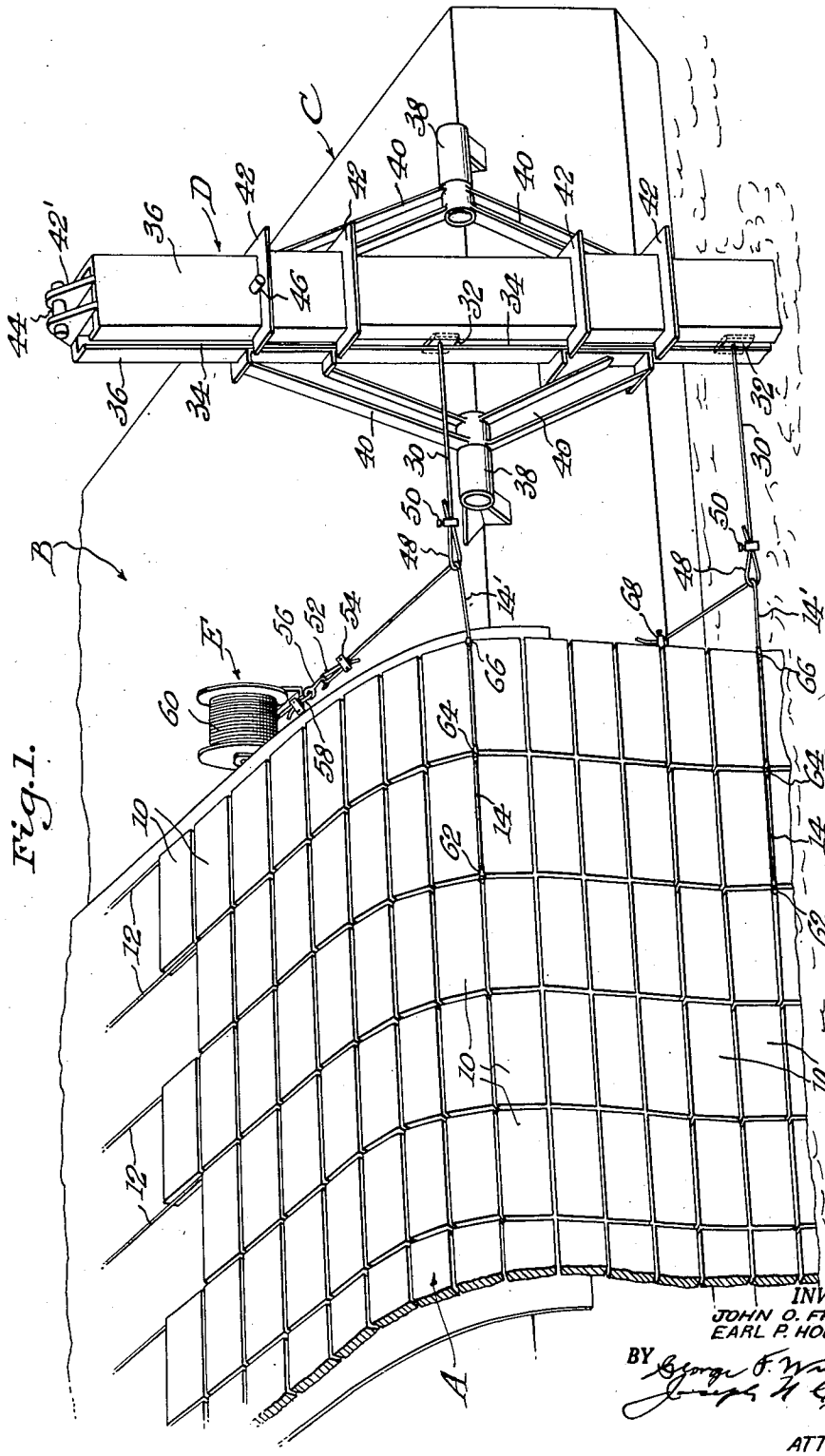


Fig. 1.

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Fig.2.

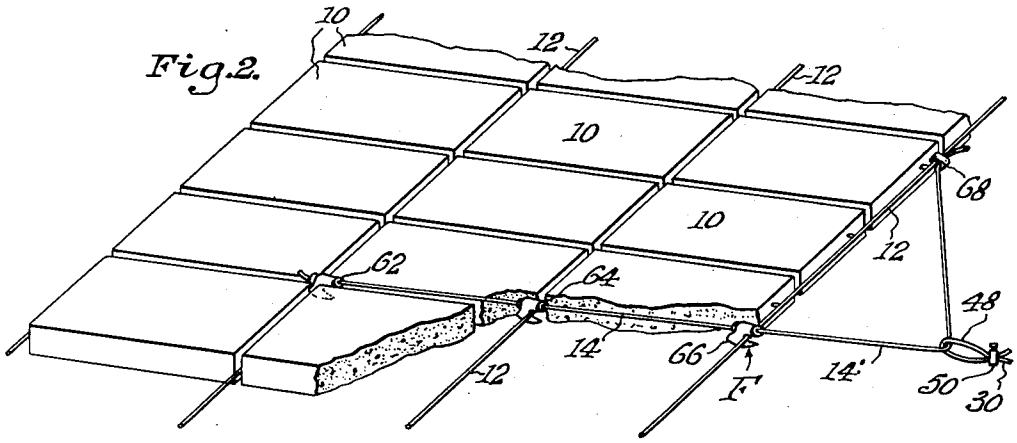


Fig.3.

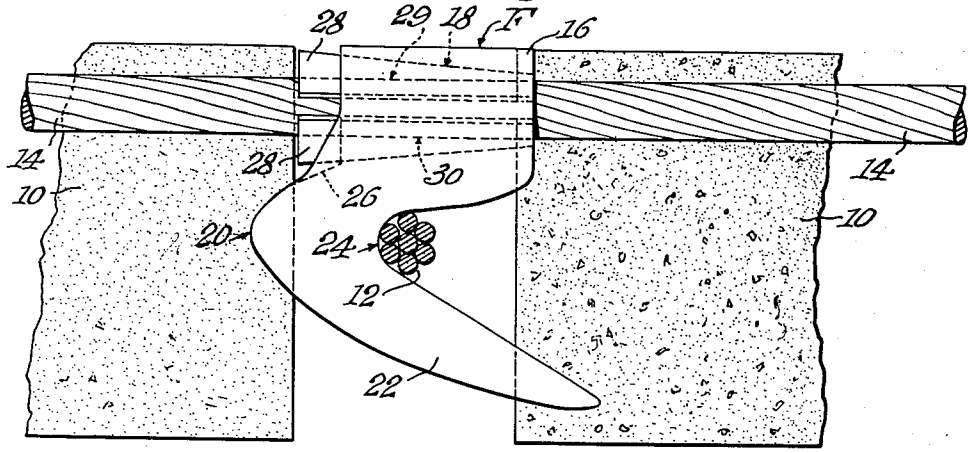
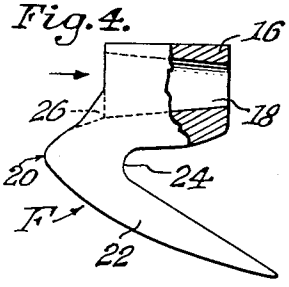


Fig.4.



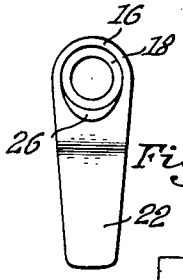


Fig.5.



Fig.6.

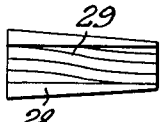
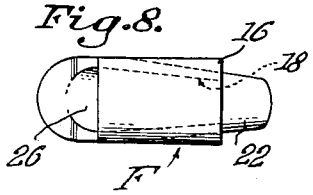


Fig.7.

Fig.8.



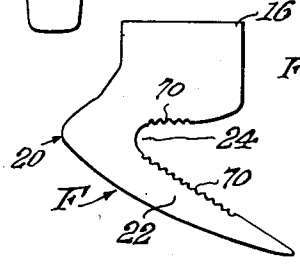


Fig.9.

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APPARATUS FOR LAUNCHING REVETMENT MATS AND CABLE CLAMPING MEANS THEREFOR

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Application August 16, 1955, Serial No. 528,855

1 Claim. (Cl. 61—38)

(Granted under Title 35, U. S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment of any royalty thereon.

The present invention provides certain improvements for launching or placement of articulated "revetment mattresses" which are employed very widely for inhibiting erosion of levees, dikes, short-lines, or banks of rivers, streams, or other localities which are subject to water-erosion through the action of water currents, waves, and other erosive and weathering forces, the preservation of which locales being important from considerations of flood control, preservation of stream contours, directional flow controls, and many other engineering adaptations. Such revetment mattresses are constructed usually of multiplicities of massive concrete blocks interconnected longitudinally and laterally by flexible cables so that when the revetments are placed in a selected locale, such as a river bank, for example, they will be self-conforming to a substantial extent to the underlying contour of the embankment.

The placement of revetments frequently is attended with considerable difficulties due to local environmental conditions, and the equipment employed for such placement necessarily is very rugged in character, due to the heavy weight of the revetment assemblies. However, notwithstanding the heavy masses thereof, launching or placement of the revetment may be increasingly troublesome by upstream edges or sides of the revetment becoming folded over main portions thereof by swift or strong water currents, thereby producing a faulty placement or launching of the revetment, thus resulting in incomplete protection of the embankment, faulty placement of the revetment, and many other attendant and subsequent difficulties, it being recalled that such revetments when once laid are intended usually to be permanent installations.

The present invention is designed to provide improved equipment for use in the launching of such revetments which enables better control to be exercised over such assemblies during the launching operations, whereby such folding over of upstream edge or side portions of the revetments and similar deformations thereof during launching or placement operations will be minimized or prevented entirely.

The present invention includes also, and more particularly, an improved cable-gripping hook which will maintain launching cables of the revetments under requisite tension under launching conditions so that the aforementioned deformations of the revetments will not occur, quite regardless of the velocity and volume of water currents and wave actions at any given location to be protected.

Further objects and advantages of the present construction will become apparent as the description proceeds, and the features of novelty will be pointed out in particularity in the appended claim.

As has been indicated above, the revetments customarily employed comprise massive concrete blocks which

are connected together longitudinally and transversely by flexible cables until a section of revetment of predetermined dimensions is formed, such section or "mattress" being interconnected longitudinally and transversely as the need may be to form a complete revetment for covering a desired area of embankment or shore-line subject to erosion for inhibiting continuance of such erosion, the flexibility of the revetment assembly enabling it to be self-accommodating to the contour and irregularities in the locale to be protected. The revetments conventionally are laid by securing or anchoring one end to the top of the locale to be protected and paying out or launching the assembly from the deck of a scow or barge positioned off-shore and provided with mechanism for controlling the launching cables interconnected with the revetment sections for controlling the launching of the revetment.

The equipment of the present invention will be understood more readily from a consideration of the accompanying drawings, wherein—

Fig. 1 is a diagrammatic view of a flexible revetment "mattress" being launched from a launching barge and controlled by the use of the improved cable-clamping hooks of the present invention;

Fig. 2 is a fragmentary view of a portion of the flexible revetment of Fig. 1, parts thereof being broken away to show details of the manner of application of the improved clamping hook construction;

Fig. 3 is an enlarged fragmentary vertical view, looking into the forward fractured portion of Fig. 2, showing in enlarged detail the disposition and utilization of one of the improved hooks of the improved construction, the illustrated embodiment of the hook being representative of the utilization and application of all of the clamping hooks embodying the structural characteristics of the present invention;

Fig. 4 is a side elevation, partly in section, of an improved cable-clamping hook of the present invention;

Fig. 5 is an end elevation of the hook of Fig. 4, looking towards the right as viewed in Fig. 4, as indicated by the arrow;

Fig. 6 is an end elevation of complemental clamping wedges used in conjunction with the improved cable-clamping hook;

Fig. 7 is a side elevation of one of the clamping wedges shown in Fig. 6, looking at the inside surface thereof;

Fig. 8 is a top plan view of the clamping hook structure shown in Fig. 4;

Fig. 9 is a side elevation, similar to Fig. 4, but showing a somewhat modified form of the hook.

Referring more particularly to the drawings which illustrate schematically launching of an articulated mattress A from deck B of a launching scow C, having an upstanding toggle beam assembly D on its front end, and there is shown as part of the launching equipment a tensioning winch E on the deck B, which winch is employed for maintaining tension on the upstream lateral blocks of the revetment. Such tension is applied as will be hereinafter described by a repetition of such tensioning winches as may be desired or required to impart adequate tension to such upstream side blocks of the revetment for preventing lifting thereof and folding of such blocks backwards with respect to the remainder of the revetment, under action of rapidly flowing stream currents.

The revetment A is composed of flexibly interconnected concrete blocks 10, which are interconnected both longitudinally and transversely by flexible reinforcing cables or "fabric" (not shown), the revetment A being provided with longitudinally extending flexible launching cables 12 which are disposed at suitably spaced intervals between longitudinally extending courses of such blocks. Such launching cables 12 are payed out from reels (not

shown) which carry the reeled-up revetment sections or "mattresses," and which are secured either to the deck of the launching barge or to the shore, the launching barge or scow C being moored or anchored transversely of the stream currents. These launching cables 12 are intersected by transverse flexible tensioning cables 14 which are spaced at suitable equal intervals.

Any tendency of lateral or marginal upstream blocks 10 to become lifted by rapidly flowing water currents is overcome in the present construction by maintaining the transversely-extending cables 14 and the launching cables 12 under sufficient tension to overcome any such lifting or buckling forces exerted by the currents on the upstream blocks. In practice, the launching cables and transverse tensioning cables are approximately 7/16 inch in diameter and are composed of seven strands of spirally-wound strands of flexible wire, these dimensions and structure being noted for purposes of illustration only.

The improvements of the present invention include an improved type of cable clamping hook for interconnecting the aforesaid launching cables and transverse tensioning cables. Reference at this point may be made to the structure of this improved clamping hook shown in Figs. 4 through 9, which is adapted to be applied to the aforesaid cables which are disposed at right angles to each other.

Each of the improved cable-clamping hooks, which is indicated generally at F, is an integral structure including a clamping eye 16 having a conically tapered hole 18 extending therethrough and a clamping hook portion 20, the hook element 22 diverging from the eye portion 16 in the direction of convergence of conical hole 18, thereby forming a clamping recess 24 between the hook (clamping jaw) element 22 and the lower part of cylindrical clamping eye 16. The hooks F are recessed at 26 to form a tapered guide recess for guiding insertion of cable 14 into the clamping hole 18 in the clamping eye portion 16 of the integral clamping hook F.

For clamping the eye portion 16 of the integral clamping hook structure F onto the cable 14, there are provided a pair of complemental clamping wedges 28 which are identical in construction, and which are tapered exteriorly to correspond to the interior taper of the clamping hole 18 into which the wedges 28 are adapted to be inserted, as shown in Fig. 3, each of the wedges 28 having a corresponding corrugated channel 29 extending therethrough, the corrugations in each channel being spirally disposed to correspond to the spiral winding of the strands of the launching and tensioning cables of the revetment, the wedges 28 when inserted in the clamping opening 18 through eye portions 16 of the clamping hooks between cables 14 and the inner periphery or surface of clamping holes 18 being pulled increasingly tightly against the cables 14 as the cables are tensioned towards the right as viewed in Figs. 1, 2, and 3.

For application of current-resisting tension to the launching cables 12 and the transversely-extending tensioning cables 14, a series of toggle cables 30 is provided, each of the toggle cables 30 being anchored in vertical toggle-beam assembly D by means of a washer 32 secured to an inner end of each cable 30 which extends to such washer 32 through slot 34 extending vertically between complemental channels 36 of the vertical toggle-beam assembly.

As will be seen from Fig. 1, this vertical toggle-beam assembly is mounted on the outer end of launching scow C by means of mounting brackets 38 from which extend bracing arms 40, which are connected to flange or collar elements 42 into which are received the complemental channels 36 of the toggle-beam assembly, the flanges 42 enclosing the channels 36 except for slot 34 which is open at both its top and bottom ends and which continues uninterruptedly throughout its length which corresponds to the height of the channels 36, these latter being provided with lifting brackets 42' interconnected by a lifting pin 44 adapted to be engaged by a lifting hook on the end of a lifting boom or the like (not shown). The channels 36 are held in position by means of stop pins 46 that extend laterally from the channels 36 and engage against the top flange elements 42.

The outer, or free, end of each toggle cable 30 is formed into an eye-loop 48, the end of which is clamped against its toggle cable by means of a conventional cable clamp 50.

It will be seen that each transverse tensioning cable 14 is extended substantially beyond the upstream side of the revetment to form a free end portion 14' which is sufficiently long to be formed into a free end loop 52, clamped by a conventional cable clamp 54 for receiving a hook 56 carried by the free end loop 58 of winch-cable 60. Each of the transverse cables 14 is sufficiently long to extend across a desired number of launching cables 12, for example, three thereof, counting from the outside launching cable extending along the upstream side of the revetment mattress, there being provided a clamping hook of the present improved type for each intersection of the launching cables and the tensioning cables.

Thus, where the tensioning cables 14 extend across three launching cables, there will be provided for each of the resulting three intersections, one of the improved clamping hooks, the inmost or first of which clamping hooks is clamped to both tensioning cable and its intersecting launching cable by threading the tensioning cable 14 through clamping hole 18 and inserting clamping wedges 28 intermediate the tensioning cable and the inner surface of the clamping hole 18, and the launching cable is received in the clamping recess 24 of the clamping hook. The tensioning cable is threaded through the clamping hole 18 of each of the successive clamping hooks, which, however, are left loose for the time being.

The clamped hook is inserted into its crack of the articulated revetment mattress, as designated at 62, the free end of the cable 14 being passed through loop 48 of toggle cable 30, end loop 52 being formed at the free end of the cable 14 and secured over hook 56 on winch cable 60, the winch E then being operated to tension the cable 14. The remaining clamp hooks are clamped on the remaining launching cables 12 and tightened on the transverse cable 14 after being pressed into the said crack of the articulated mattress, as indicated at 64 and 66, and are clamped on the cable 14 as has been described above. This tensioned cable 14 then is pressed against the leading or upstream launching cable and secured thereto by one or more of conventional type of clamps 68. When the tensioned cable 14 is secure, the winch E is slacked off, and excess length of cable 14 is trimmed.

The eye loop 48 is on the downstream end of toggle cable 30, which is a preassembled length of toggle cable, the upstream end of which has been anchored in a washer 32 and inserted into the toggle-beam assembly D through the open top thereof with the end of the toggle cable adjacent to the washer passing through slot 34. The washer 32 is substantially wider than the slot 34, so that it cannot be pulled out of the slot. The said slot runs the entire length of the toggle-beam assembly D, and is open at both its top and bottom ends.

As the articulated revetment mattress A is launched from the scow C, the transverse tensioning cables 14 and toggle cables 30 attached thereto move with the mattress as the latter is deposited from the barge or scow C, the movement causing the successive washers 32 to slide down to the bottom of the slot 34, eventually falling free onto the bottom of the stream. After each of the tensioning cables 14 has been tensioned by winch E and the sections 14' have been clamped to the leading launching cable as shown and the section 14' then severed from the winch E, the applied tension in the cables 14 is maintained and augmented by the pressure of the current against the revetment mattress, thereby holding the toggle cables 30 in

place and taut until they are released at the bottom of the toggle-beam assembly D.

It will be understood that the tensioning cables **14** may be applied to the mattress in any number and at any spacing as may be required to withstand the velocity and turbulence of the stream at whatever the particular location the revetment is being applied.

The modified construction of the clamping hook shown in Fig. 9 shows the hook structure **22** optionally serrated along its cable-engaging and clamping surface, as is indicated at **70** for increasing the clamping action of the hook against the launching cables **12**.

Having thus described our invention, what we claim as new and wish to secure by Letters Patent is:

A launching system for controllably launching transversely of a stream current articulated revetment mats having a plurality of spaced longitudinally extending launching cables from a launching platform while preventing lifting and backward folding of upstream courses of the mats under action of water currents in streams in which the mats are being placed for inhibiting erosion of embankments subject to water current action, which comprises, in combination, a launching platform, a plurality of spaced transverse cables adapted to interconnect the said spaced longitudinally extending launching cables, means for applying tension to said launching cables, said tensioning means including a vertically disposed toggle-beam mounted on the launching platform adjacent to launching stations thereon, said toggle-beam having a vertical longitudinal slot extending through the beam from top to bottom thereof, toggle cable means extending through said slot in said beam and connected successively to a pair of transverse cables next to submerge, anchoring means cooperating with said slot for the toggle cable means in the toggle beam, means connecting said toggle

cable means to the pair of successive transverse cables next to submerge, the toggle cable means and anchoring means being movable downwardly through the slot in the toggle-beam responsively to launching movement of the revetment mat, a winch mounted on said launching platform for launching the revetment mats, means releasably interconnecting each upper cable of the pair of transverse cables next to submerge to said winch for tensioning such upper cable through the connecting means between the top toggle cable means and said transverse cable to apply tension to such transverse cable longitudinally thereof and in opposition to direction of stream flow, and clamping means adapted to permanently interconnect each lower cable of the pair of transverse cables next to submerge to the leading launching cable through the connecting means between the toggle cable means and the said lower transverse cable, thereby continuously maintaining the tension applied by the tensioning means to each upper cable of the pair of transverse cables next to submerge.

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