No. 855,584. PATENTED JUNE 4, 1907.

D. NEALE.

ANCHOR REVETMENT FOR SHORES OR BANKS.

APPLICATION FILED FEB. 27, 1906.

2 SHEETS—SHEET 1.

Fig. 1.

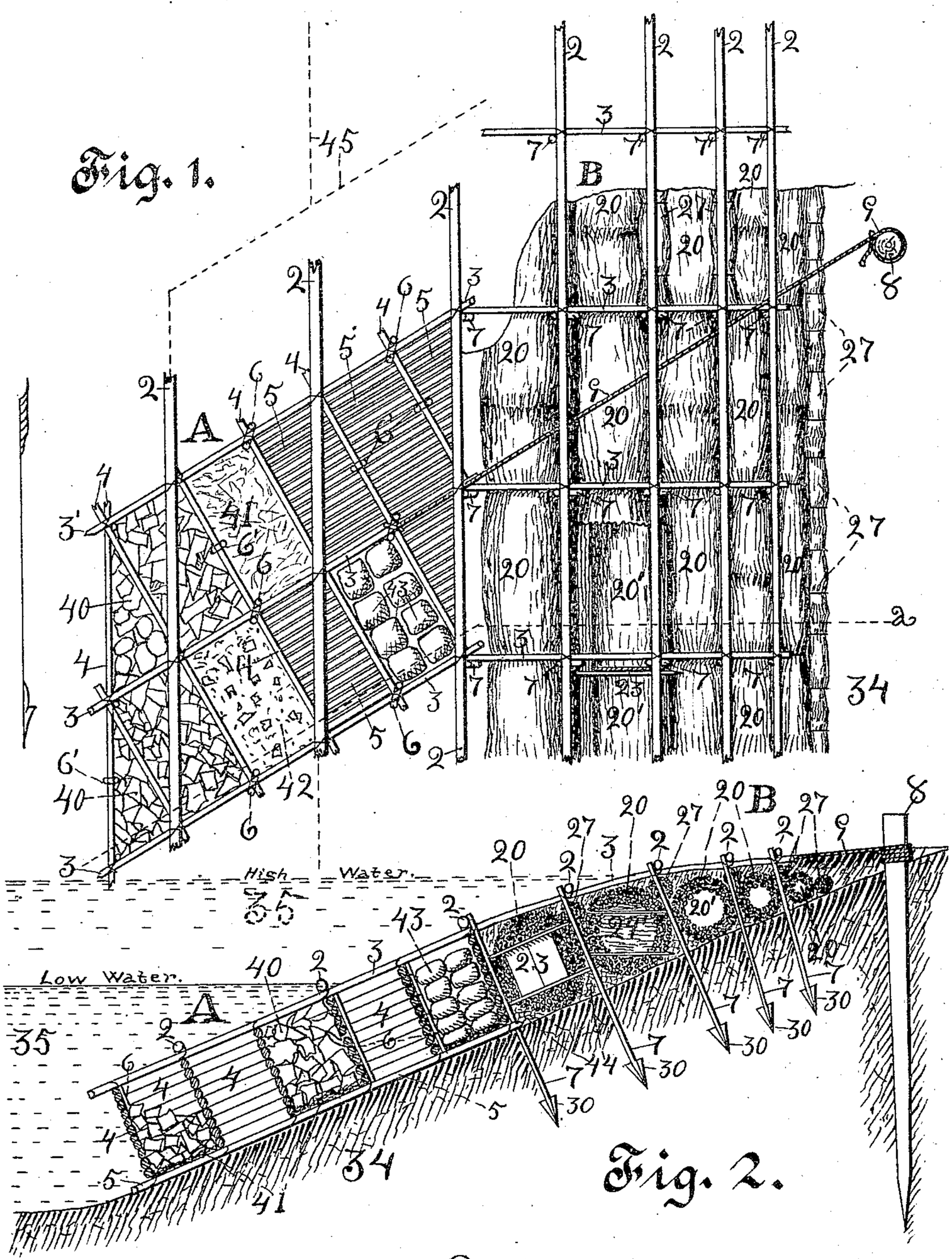

Fig. 2.

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Palmer J. Brunton

Burl Vaughan.

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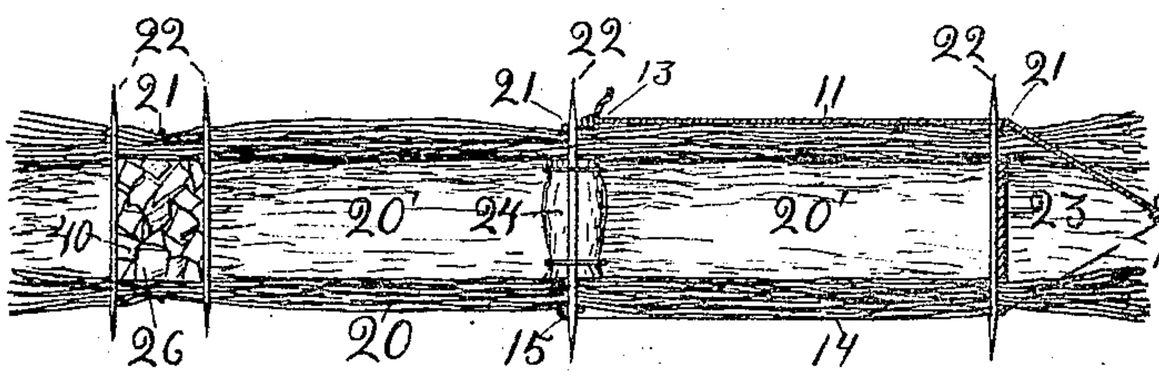

Fig. 3.

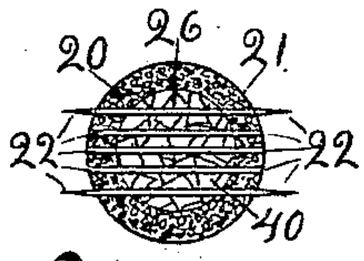

Fig. 4.

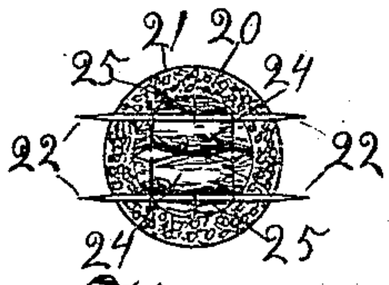

Fig. 5

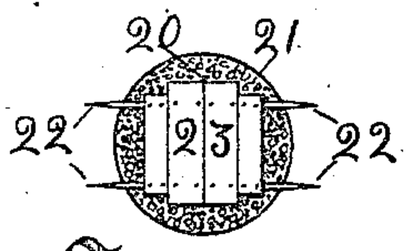

Fig. 6

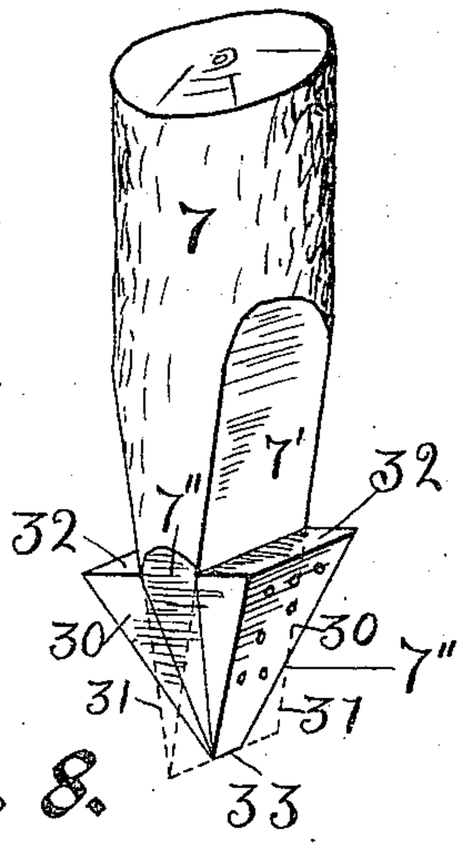

Fig. 8.

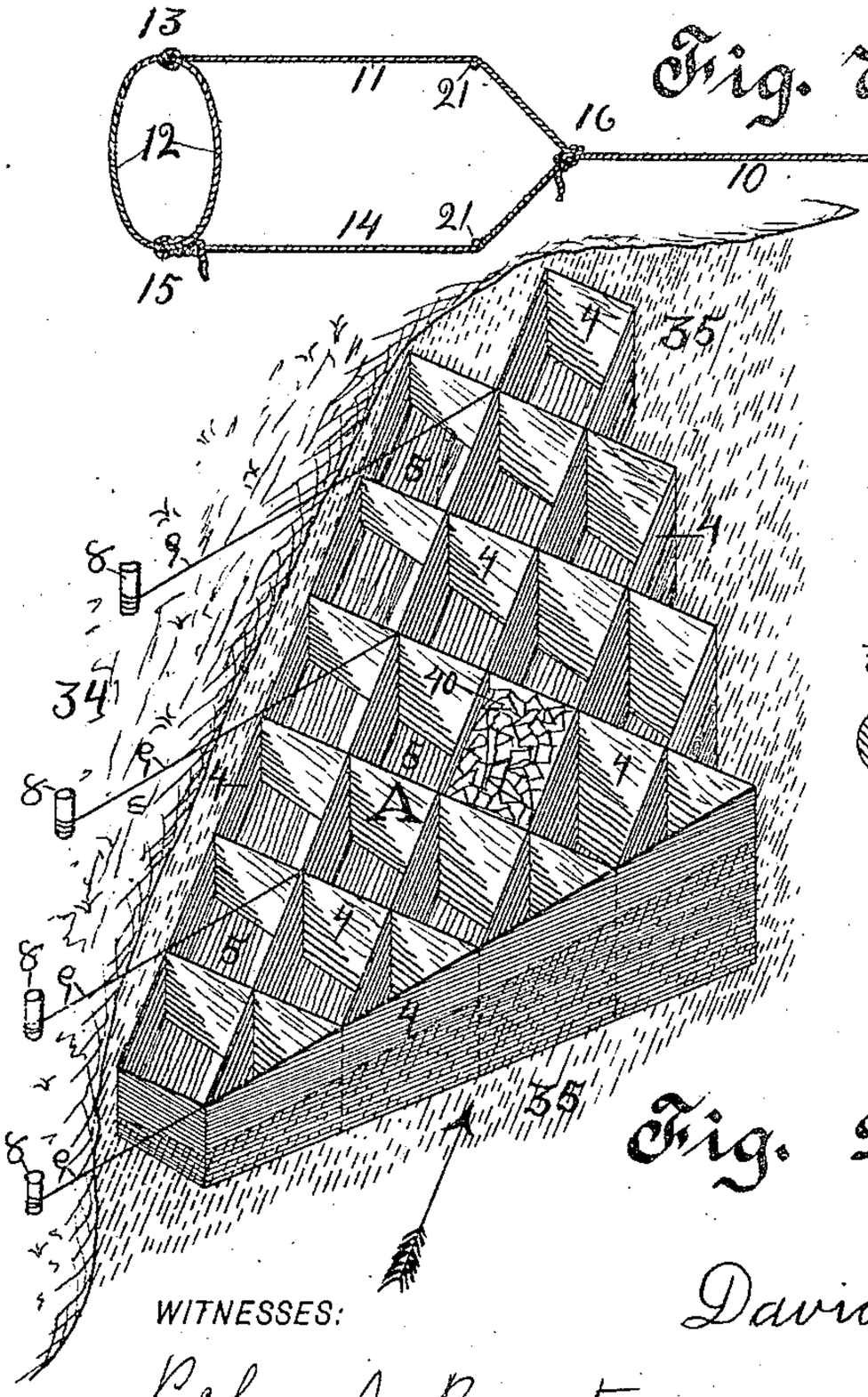

Fig. 9.

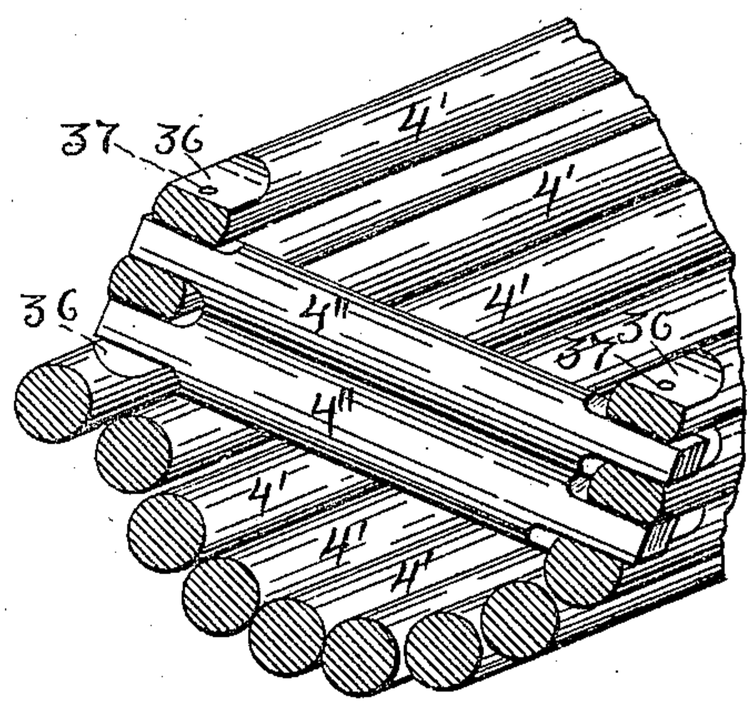

Fig. 10.

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UNITED STATES PATENT OFFICE.

DAVID NEALE, OF NEAR FORT CALHOUN, NEBRASKA

ANCHOR-REVETMENT FOR SHORES OR BANKS.

No. 855,584. Specification of Letters Patent. Patented June 4, 1907.

Application filed February 27, 1906. Serial No. 303,208.

To all whom it may concern:

Be it known that I, DAVID NEALE, a citizen of the United States, residing near Fort Calhoun, in the county of Washington and State of Nebraska, have invented a new and useful Anchor-Revetment for Shores or Banks, of which the following is a specification.

My invention particularly relates to improvements in cellulated anchor revetments having permeable walls and used for protecting the banks or shores of rivers or larger bodies of water; and the objects of my improvement are, first, to provide a revetment in which is combined an efficient, easily constructed part for the top or drier portion of the bank and an effective structure better adapted and more easily placed on the lower submerged part of the bank; second, to provide cellulated fascines and submerged cellular mattresses or cribs better adapted for use in clear water, or that bearing only a very small amount of silt or that are only periodically turbid; third, to facilitate the construction of suitable mattresses and fascines from coarser materials, as logs or poles where the finer brush are scarce; and fourth, to dispense with the old core-log and internal frame construction in building fascines and provide suitable attachment of retaining cables and anchors. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a plan or top view of a piece of such anchor revetment applied to the bank of a stream; Fig. 2 is a vertical cross-section on the broken line *a* of Fig. 1; Fig. 3 is a plan of a cellulated fascine 20, such as is shown applied at B, to form a revetment on the upper part of the bank in Figs. 1 and 2; Fig. 4 is a cross-sectional view of the fascine 20, illustrating the rock partition at 26, in Fig. 3; Fig. 5 is a cross-sectional view illustrating the brush-bundle partition at 24, in Fig. 3; Fig. 6 is a cross-sectional view showing the lumber partition at 23, in Fig. 3; Fig. 7 is a perspective view illustrating the manner of attaching the anchoring-cable 10, to the coreless cellulated fascine 20; Fig. 8, is a perspective view illustrating the manner of providing the anchor-stakes 7, 7, etc. with barbed points; Fig. 9 is a miniature perspective view of a large cellular submergible crib A, floated and anchored ready to be weighted and sunk: in this case placed before the upper part B, of the revetment; and Fig. 10, is a perspective view illustrating the manner of joining and fastening together, at the angles of the cells, the poles 4′, of which the partitions and walls 4, are built up in the cellular crib A: being applied in this view to a fascine made of poles.

Similar letters and numerals refer to like parts throughout all the views.

This anchor revetment consists primarily of two parts A and B, either of which may be placed first, depending upon the conditions to be contended with. When possible so to do I prefer to first construct and place the upper part B. Then the sinkable cellular crib A, is started on the bank above and carried to a height where it becomes sufficiently buoyant to support workmen and materials and then launched over across the upper part B, on skids placed for this purpose and then completed and sunk. In some instances large poles, even to logs, are the available material for the bottom of the crib; in which case they are formed into a raft of the desired plan and size of floor, anchored in the desired position and the superstructure of cells built up to the desired height ready to receive the required ballast to sink the structure. The fascines and cellular crib may be continued indefinitely up and down the stream the direction of which is indicated by the arrows in Figs. 1 and 9.

In starting the work it is best to first level the bank 34, making it true and even where the revetment is to be placed; as indicated in Fig. 2, piling any removed earth back on top of the bank for future top dressing of the revetment. Then whether or not the crib has been previously placed the first essential is to set the first row of anchor stakes 7, 7, etc., parallel with the stream and between the parts A and B. The tops of these stakes are allowed to extend above the final requirement and in case of high water they extend above the same to be finally cut down flush with the finished work.

The fascines 20, employed in the construction of the part B, are of a peculiar structure hereinafter specifically described. They are graduated in size from the largest adjacent to the crib A, to the smallest at top of the revetment, whereby the top finishing grade is eased down to the bank as shown in Fig. 2. They are also used in short lengths,—never more than 25 feet, generally less, in such streams,—so that they will readily settle into and fill any pocket that the water may subsequently cut out beneath them; and are laid

broken end joints in adjacent longitudinal tiers as indicated in Fig. 1.

If the cellular crib A, has been placed first and the water is low enough to make it possible, a curved bed 44, is formed to receive the first and larger fascine, by filling up the angle formed by the junction of the upper wall of the crib and the natural bank 34, with some fine fibrous materials as hay, straw, fine leafy brush bagasse or cotton stalks and a liberal dressing of earth incorporated therewith. This bed is particularly essential if the permeable envelops of the fascines are very coarse, as coarse leafless brush or poles. A like bed is provided for each successive fascine as soon as the preceding one is placed and a longitudinal row of anchor-stakes 7, 7, etc., set against it.

The angular spaces on top above the longitudinal joinings of the fascines 20, are partly filled by the short solid brush bundles 27; as also the easing at the top against the last fascine. They are then leveled up with a dressing of earth which the rains carry down into the fascines, the periods of high water and turbidity of the stream assisting to finally fill them up solid. The anchor-stakes 7, are also arranged in rows up and down the bank and a series of cross-poles 3, are laid up and down across the fascines on the revetment and fastened to the anchor-stakes, either by bolting, wiring or both. These poles are extended down over the cellular crib A, by splicing, and form copings on the cross-walls of the cellular cribs as shown in Figs. 1 and 2.

For streams I find it most convenient and effective to construct the cellular crib on a rhomboidal plan slanting downstream from the bank as shown in Fig. 1. However, where there is little or no current some labor and materials may be saved by building it square, in which case it will be quite as serviceable. The poles or logs 5, that form the bottom are spliced—in case of poles they are spliced under the partition walls—and the joints broken to get the required width of revetment. Each member is drift-bolted and wire-lashed to the lower members of the cell walls 4. The outside and partition walls 4, of the cellular crib are built up of superimposed poles. In order to bring them close enough together that they will retain deposits of mud in the cells, they are scored down flat to about half thickness where they interlock and cross-lap at the angles and outer corners. This cutting away is shown at 36, in Fig. 10. The drift-bolts 37, are driven down through the superimposed interlapping reduced portions. Where three walls intersect at a single corner or angle, I sometimes reduce the members to one-third thickness or cut alternate ends away entirely. For greater strength the drift-bolting is supplemented by wire lashing interlaced from bottom to top of all angles. The upright binding posts 6, 6, and 6′, 6′, etc., are set in pairs in the opposite angles of adjacent cells or at the middle of the cell walls on opposite sides all as shown in Fig. 1, and bound to the corners or walls by wire interlaced through the pole or coarse brush walls. These are most necessary when the poles so small as to be classed as very coarse brush are the available material for the walls and greater numbers of them, even to two thicknesses, are used.

The tops of the cells are left open to receive the weighting materials and for the after accumulation of mud. The walls are carried only to a height requisite to retain the required amount of stone to give the necessary thickness of revetment according to the pitch of the bank and erosive character of the stream; and the crib may, for this reason and to attain the desired extent of revetment, be composed of a single large shallow cell or many small or deep ones. Where the bank is steeper farther out into the water the walls are made higher toward the outer edge as shown in Fig. 9. Also in this figure is shown the manner of finishing the down-stream end in steps to prevent the formation of destructive eddies at this end of the work when the current of the stream is swift. The broken line 45, in Fig. 1, indicates the plan of the upstream end of the revetment when the plan of the crib is rhomboidal or oblique as shown in this figure.

If the crib A, is constructed and placed first as shown in Fig. 9, the anchoring cables 9, are raised one or two at a time and the part B, placed in sections when the cable is again brought over and made fast to the pile 8, as shown in Fig. 1. The cribs may be placed a part at a time or the whole length of the revetment at once.

To facilitate the retention of silt in the cells, a quantity of fine fibrous material as shown at 41,—see Fig. 1,—is placed in the bottom of each cell and the weighting may then be done with stone 40, sacks of sand 43, or heavy building rubbish 42, from constructive works in the adjacent cities or towns. Before the crib is entirely sunk and after the cross-binding poles 3, have been placed and wired down to make them fast to the top of the walls, the fender-logs or poles 2, are placed and fastened. These fenders are ranged parallel with the stream and are securely bolted and lashed down with wire being spliced out in length and made continuous throughout the length of the revetment. The upper part B, is also supplied with these fenders 2, one to each longitudinal row of anchor-stakes 7, to which they are attached as well as to the cross-poles 3. These fenders serve to preserve the revetment against the destructive action of floating ice and driftwood; also add strength to the cellular crib. Weighting materials are finally de-

posited in the cells filling them all evenly and sufficiently to retain the bottom of the crib in close contact with the bank, where it and the fascine work above finally become filled with mud and form a strong permanent revetment.

The hollow fascines 20, employed in this construction, and for use in other ripraping on streams of the character herein noted, encompass these further improvements:—The old continuous hollow fascine with a core-log and an unbroken cell, will often in streams of only periodic turbidity, during a period of clear running water, have the core or filling of mud washed out. This occurs by the formation of a small rivulet within the fascine at its down-stream end and extending up through until it has a small way the entire length of the fascine and the clear current then rapidly carries away the whole filling of mud. To obviate this and cheapen the construction of these fascines I omit the core-log and open frame partitions and use instead the construction illustrated in Figs. 1 to 7, inclusive and Fig. 10. For the revetment B, I usually construct the fascine with the partition 23, shown in Figs. 1, 2, 3 and 6: Two stakes or cross-bars 22 and 22, little longer than the diameter of the fascine have their ends sharpened and the planks 23, nailed across them as shown in Fig. 6. The permeable envelop of brush 20, with joints broken often, is formed around this and secured by the binding wire 21, as shown. But in a period of high water the first longitudinal tier of fascines adjacent to the cellular crib A,—and perhaps the second and third tiers,—will necessarily be constructed as illustrated in Fig. 4, and at 26, in Fig. 3. This is by a double cross-tier of bars 22, with their ends built into the walls of the fascine and the space 26, between the two tiers filled with stones 40, or other heavy materials to sink the fascine. Where lumber is scarce or brush cheaper the partitions are formed as shown at Fig. 5, and at 24, in Fig. 3. Here the short brush bundles 24, and the shorter ones 25, with the bars 22, are all bound together and the ends of the bundles cut and trimmed to the required circular shape so that the ends of the bars project through and the brush bundles support the envelop of the fascine. These partitions divide the chamber of the fascine into a longitudinal row of cells 20′, 20′, etc.,—see Figs. 1 and 3,—from which the deposit of mud cannot be washed out.

It is often expedient to build the fascines of poles 4′ as shown in Fig. 10. In such cases partitions of stone, lumber or brush are held in position by as many cross-bars 4″ and 4″, as may be required, framed across and fastened in the manner shown and described.

The manner of fastening the anchoring cable 10, to the coreless fascine is illustrated in Figs. 3 and 7: An end portion of the cable 10, is appropriated for one of the binding-wires of the fascine and in work of the character herein described, this is generally disposed at the second partition from the end. The end of the cable is formed into the binding loop 12, fastened at 13. It is then continued along as the leg at 11, to the end binder 21, which may encompass it with the brush envelop and to which it may be wired. A shorter cable 14, is attached to the loop 12, at 15, opposite to the tie 13, and then carried forward like the leg 11, of the main cable and the two brought together and fastened at 16. This gives the anchor cable a secure fastening on the fascine and a straight central point of draft. These cables are used on the fascines at the upstream end of the revetment, and where there is difficulty in holding the fascines until the other anchors are placed.

The anchor-stakes 7, are made effective by providing them with barbed points as shown in Fig. 8. The point of the stake is first sharpened to a wedge-shape 7′, as indicated by the broken lines 31. Then the wedge-shaped blocks 30 and 30, are spiked to opposite sides the sharp edges of all the wedges brought together at 33. The opposite edges are then cut away to form the inclines 7″ and 7″, and give the stake a point 33. The tops of the wedges 30, form shoulders or barbs 32 and 32, to prevent the withdrawal of the stakes. For repairing breaches in old fascine work that has been undermined by the water and settled down and must be covered with new, I make a modification of this stake point which is triangular in plan, having three barbs spaced equally around so that whatever way it is turned some of the barbs will catch in the brush below and hold the stake.

I claim:

1. A revetment consisting of an upper field of anchored fascines and a lower field of weighted cribs.

2. A revetment consisting of a covering of anchored fascines and a weighted crib along its lower edge.

3. A revetment of anchored cellulated fascines having a submerged cellular weighted crib along its lower edge.

4. A revetment having in combination a cellulated fascine with a permeable envelop and a cellular weighted crib having permeable walls.

5. A revetment consisting of a field of anchored fascines having attached to its lower edge a submerged crib of upwardly open cells.

6. A revetment formed of fascines ranged longitudinally along the water edge and an adjoined submerged crib to form the lower edge of the revetment.

7. A revetment consisting of a course of

longitudinal tiers of fascines, a bed of loose fibrous materials interposed between said fascines and the bank to be protected, anchor-stakes disposed between said tiers of fascines and anchored in said bank beneath, and poles disposed across said fascines and fastened to said anchor-stakes.

8. A revetment having in combination adjoining tiers of fascines ranged end to end in each tier, anchor-stakes seated in the bank beneath the fascines, binding-poles fastened to the tops of the anchor-stakes, and fenders crossing the binding-poles and fastened thereto and to said anchor-stakes.

9. A revetment composed of a field of coreless fascines each having a permeable envelop and a central longitudinal chamber cross-partitioned into cells; said fascines disposed in lateral and longitudinal contact with each other throughout said field.

10. A revetment consisting of coreless fascines, each fascine having a central longitudinal chamber cross-partitioned into cells within a permeable envelop; said fascines arranged in longitudinal lateral contact with each other to form the field of revetment; anchor-stakes driven between the fascines and into the bank beneath and binding poles disposed across said fascines and fastened to the tops of said anchor-stakes.

11. A revetment composed of fascines each having a permeable envelop and a longitudinal chamber divided into cells by weighted cross-partitions.

12. A revetment composed of separate fascines ranged parallelly with and against each other, each fascine having a permeable envelop and a longitudinal chamber divided into cells by weighted cross-partitions.

13. A revetment consisting of a covering of permeable cellulated fascines, anchor-stakes driven into the bank beneath, binding-poles disposed across said fascines and fastened to the tops of said anchor-stakes, and fender-poles disposed across the binding-poles and fastened thereto and to the tops of said anchor-stakes.

14. A revetment comprising a crib of open-topped cells, having a permeable floor, a layer of fibrous material in the bottom of the cells, and coarser weighting material on the fibrous layer.

15. A revetment consisting of an open-topped cellular crib having longitudinal fenders disposed and fastened along its open top and weighting material in its cells.

16. A submerged revetment consisting of a crib divided into open-topped cells, an anchor-cable attached to the crib and to a pile driven into the bank, and the cells weighted with rock on a layer of fibrous material in the bottom of said cells.

17. An open-topped cellular crib for revetment consisting of a substructure of poles laid to form a floor under the cells; a superstructure of outside and partition walls composed of superimposed poles flattened and interlapped and cross-lapped at the junctions of said walls and said walls fastened at their bases to said substructure; vertical stakes set in diagonally opposed angles at said junctions and secured by wire lashing interlaced through said walls and around said vertical stakes.

18. An entirely open-topped cellular crib for revetment consisting of a substructure of poles laid to form a floor under the cells; a superstructure of outside and partition walls composed of superimposed poles flattened and interlapped and cross-lapped at the junctions of said walls and said walls fastened at their bases to said substructure; vertical stakes set in diagonally opposed angles at said junctions and secured by wire lashing interlaced through said walls and around said vertical stakes; intermediate supports to walls consisting of uprights secured thereto by wire lashing interlaced through said walls and around said intermediate uprights; and copings of heavier poles or logs fastened on the tops of said walls.

19. A continuous open-topped cellular crib for revetment comprising walls of superimposed poles, wall copings of larger poles fastened to the tops of the walls, and fender-logs or poles fastened across the tops of the wall copings.

20. A bank revetment having in combination an upper field of fascines, anchor-stakes driven into the bank beneath said fascines, a cellular crib anchored against the lower edge of the upper field of fascines, poles fastened to the anchor-stakes to bind across the fascines, said poles continued across and fastened to form copings on the tops of the walls of the cellular crib.

21. A bank revetment comprising an upper field of fascines, a lower field of cellular cribs, binding-poles fastened across the fascines and continued across to form copings on the walls of the cellular cribs, and fenders of poles or logs fastened across the binding and coping poles.

22. A revetment consisting of a bed of loose fibrous materials deposited upon the bank to be protected and then covered with a corse of loosely laid hollow fascines having permeable envelops.

23. A revetment consisting of a course of closely laid hollow fascines having permeable envelops; each fascine laid in a bed of loose fibrous materials incorporated with earth and shaped on top to fit the underside of said fascine.

24. A revetment consisting of a finishing course of closely laid hollow fascines having permeable envelops; a bed of loose fibrous materials interposed between said fascines

and the bank to be protected; and anchor-stakes disposed between said fascines and into the bank beneath.

25. A revetment consisting of a finishing course of closely laid hollow fascines having permeable envelops, loose fibrous materials incorporated with earth and disposed to fill the angles between said fascines and the bank to be protected, anchor-stakes driven between said fascines into said bank and poles disposed across said fascines and fastened to said anchor-stakes.

26. A revetment consisting of a single course of closely laid hollow fascines having permeable envelops, loose fibrous materials in the angles between said hollow fascines and the bank beneath, small fascines disposed in the angles on top between said hollow fascines and the top leveled up with a dressing of earth.

27. A cellulated fascine consisting of a permeable envelop inclosing a central longitudinal chamber divided into cells by cross partitions which also support said envelop.

28. A coreless fascine consisting of a permeable envelop inclosing a central longitudinal chamber and cross-partitions to support said envelop and divide said chamber into an axial tier of cells.

29. A cellulated fascine having a permeable envelop to inclose a longitudinal chamber and impermeable cross-partitions to divide said chamber into cells and support said envelop.

30. A coreless cellulated fascine having a permeable envelop to inclose a central longitudinal chamber and impermeable cross-partitions to support said envelop and to divide said chamber into an axial tier of cells.

31. A coreless cellulated fascine having a permeable envelop inclosing a central longitudinal chamber and cross-partitions to support said envelop; said cross-partitions disposed in pairs to form small cells; weighting materials in said small cells; and said small cells disposed to cross-divide said central longitudinal chamber into other cells.

32. A cellulated fascine having a permeable envelop inclosing a chamber; cross-partitions to support said envelop and disposed in pairs to form small cells adapted to receive weighting materials; said small cells disposed to divide said chamber into other cells.

33. A cross-partition to support the envelop of a cellulated fascine, consisting of bars to span the chamber of the fascine with their ends disposed in the envelop, and bundles of fibrous material, as brush, shaped to fit the inner walls of the chamber and fastened to said cross-bars.

34. An impermeable cross-partition to divide the chamber and support the envelop of a hollow coreless fascine, consisting of planking having its edges shaped to fit the inner walls of the chamber and cross-battened by bars having their ends projecting beyond the planking to engage the envelop.

35. A fastening to attach an anchor-cable to a fascine comprising an end portion of the main cable looped around the fascine and tied, a supplemental cable having one end fastened into the loop opposite to its tie, the two cables carried along opposite sides of the fascine to its end and then bent toward each other and fastened together.

36. A combined binding and cable attachment for fascines comprising an end of the cable looped and applied by tying as the second binder from the anchored end of the fascine, a supplemental cable having one end fastened to said binder on the side opposite to said tie, the two cables carried along opposite sides of the fascine to its end binding and fastened thereto, then bent toward each other and fastened together.

DAVID NEALE.

Witnesses:
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WM. E. KAUFMAN.