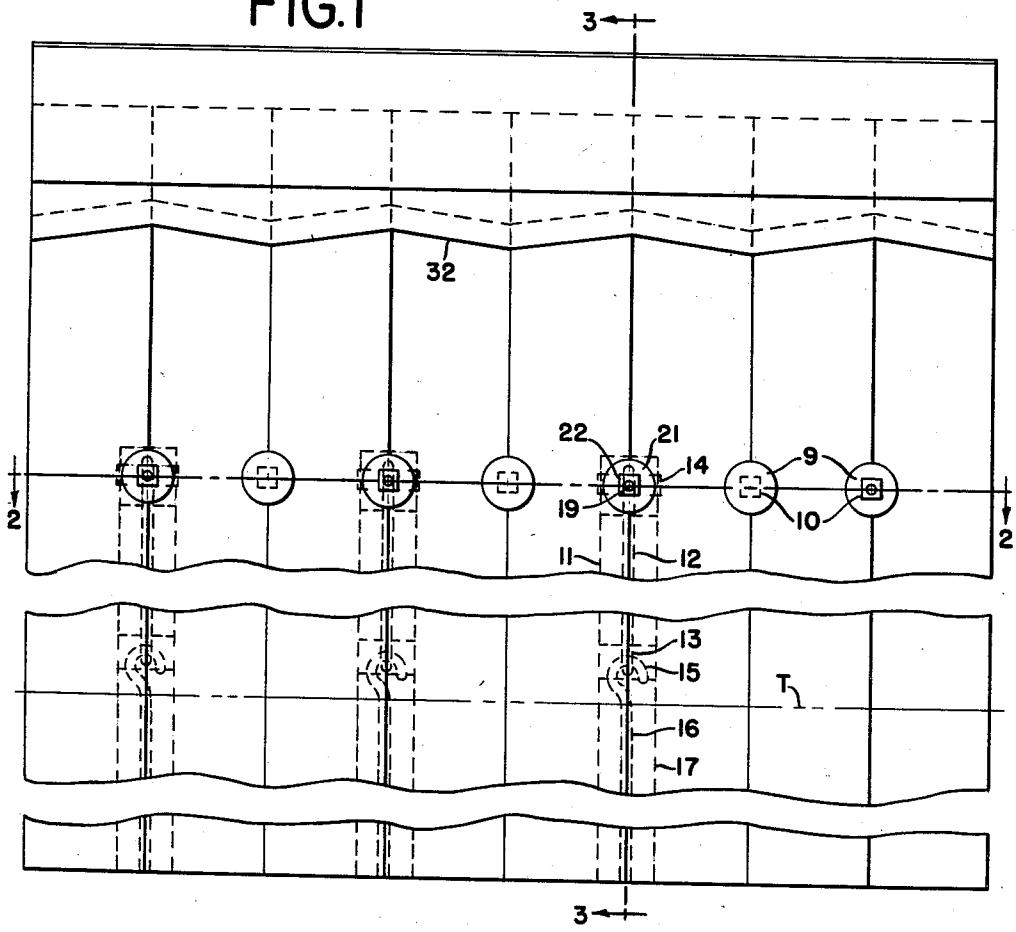
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BULKHEAD AND METHOD OF FORMING

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FIG. 1



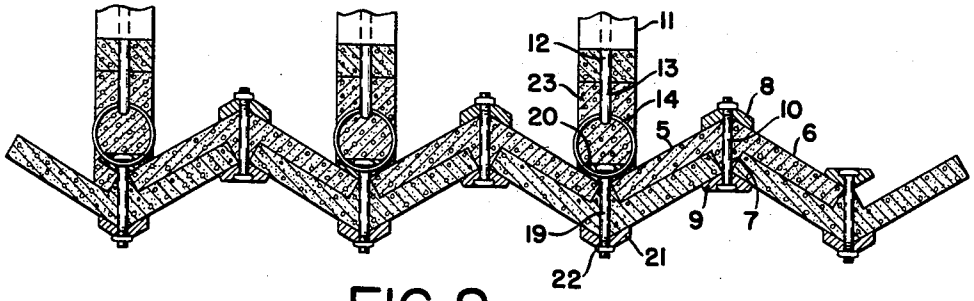


FIG. 2

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FIG. 3

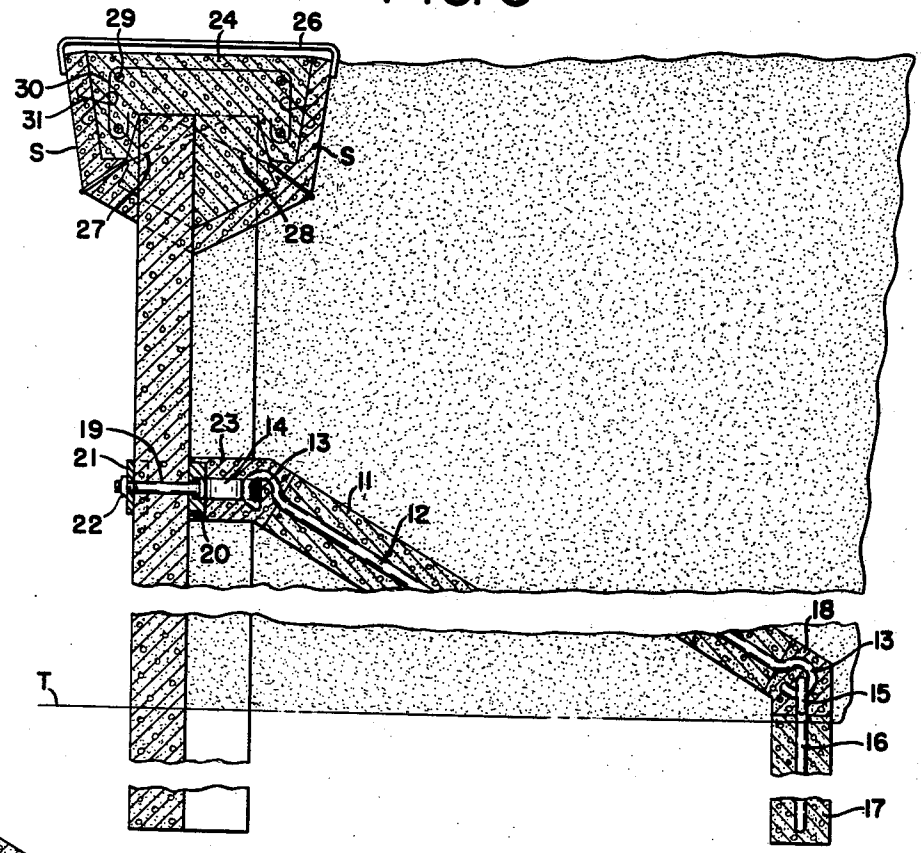


FIG. 4

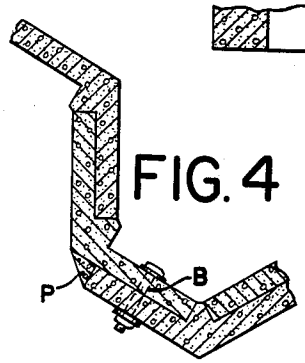
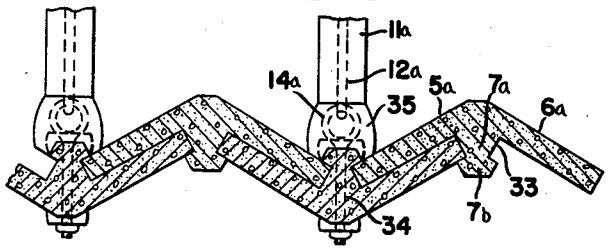


FIG. 5



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BULKHEAD AND METHOD OF FORMING

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3 Claims. (Cl. 61—49)

This invention relates to bulkheads of the type commonly employed in the construction of retaining walls for earth fills along waterways. It is of a type comprising a plurality of interlocking vertically disposed staves.

The object of the invention is to provide an improved structure of this character composed of interlocking staves of concavo-convex form in horizontal section and so constructed as to present a wall or bulkhead of zig-zag formation. The invention provides a bulkhead that will be impervious to sand leaks and highly resistant to the impact of advancing waves. The invention further contemplates the provision of staves of such configuration that the same mold that makes such staves may be utilized to form molds for a very strong and unshakable cap sill. The invention further contemplates means for bracing the bulkhead in a manner to prevent it from being either pushed forward by the earth fill or pushed back by wave action.

Further advantages of the invention will be best understood and appreciated after a consideration of the accompanying drawings, forming a part of this application and wherein:

Figure 1 is a front or face view of a bulkhead constructed in accordance with the invention, the staves shown therein being constructed of concrete.

Figure 2 is a horizontal sectional view taken on line 2—2 of Figure 1,

Figure 3 is a vertical sectional view illustrating the use of some of the staves of the bulkhead proper as a form in the formation of the cap sill,

Figure 4 is a horizontal section illustrating the manner in which the staves are so disposed as to facilitate the creation of a turn at a corner of a bulkhead and,

Figure 5 is a horizontal sectional view illustrating a slightly modified form of stave.

By referring to the drawings and particularly to Figures 1 and 2, it will be seen that the bulkhead is composed of a plurality of vertically disposed staves of somewhat V-shape in horizontal section each comprising integral wings 5 and 6 and an inwardly directed rib 7 shaped to lie between and make snug contact with the confronting ends of the wings of the adjacent wings of the two staves upon each side thereof, when the staves are disposed to constitute a bulkhead of zig-zag formation as shown in Figure 2. The inner faces of the wings constituting the concave sides of the staves lie flat against each other and in conjunction with the ribs 7 provide a wall that will be impervious to sand leaks. Washers 8 and 9 are drawn toward each other by bolts 10 which pass through the apices of the V-shaped staves and bind the staves securely to each other.

These interlocking staves are useful in the formation of medium or high bulkheads. A medium bulkhead is one in which the staves are from eight to ten feet in length and extend to approximately five feet above the mean tide level. The line T in Figure 1 indicates the approximate ground level and in placing the staves in position their lower ends are driven into the soil to the desired depth. Where roots are encountered, these must be cut away.

High bulkheads are those in which the staves are from twelve to twenty feet in length and extend from eight to sixteen feet above the mean tide line. Where the bulkhead extends for any substantial distance above the ground line, it is desirable to provide bracing means to resist the tendency of the earth fill back of the bulkhead to push the bulkhead forward and also to resist the tendency of the wave action to force the bulkhead inwardly. Such a bracing means is illustrated in Figures 2 and 3 and where used they comprise concrete sills or beams 11 having rods 12 extending therethrough. Hooks 13 upon the ends of these rods engage at their outer ends with rings 14 and at their inner ends with eyes 15 of rods 16. The eyes 15 project upwardly from precast anchor posts 17 that are embedded in the ground. Concrete sealing and filling pieces 18 are cast on the job around the eyes 15 and the hooks 13 of the rods 12. The rings 14 are held in place by bolts 19 similar to bolts 10, which pass through washers 20 and 21. After the structure has been erected and the nuts 22 upon bolts 19 have been tightened, a filling block 23 of concrete is cast about the eye 13, ring 14 and washer 20 as illustrated in Figures 2 and 3.

Referring to Figure 3, it will be seen that staves cast in the shape of those previously described may be utilized as forms in the casting of a concrete cap or sill 24.

In Figure 3, two of the staves S are shown as being disposed upon opposite sides of a vertical bulkhead. They are held in place temporarily by a clamping bar 26 and by wires 27 and 28. Reinforcing rods 29 and wires 30 are disposed in position to reinforce the mass of concrete which, when poured between the outwardly flaring wings of the cap form, provided by staves S, constitutes the cap sill, when said mass hardens. If desired, wires 31 may be cast in the elements S which constitute the form, to engage about the wires 30 during the casting operation. Since the outside face of the vertical bulkhead is of zig-zag form, the lower edges of the staves which constitute the cap forms in Figure 3, may be cast to accommodate this zig-zag formation as illustrated at 32 in Figure 1. This may be easily accomplished by placing board like piece of notched wood in the form in which the form staves S, are cast. The structure shown in Figure 4 is substantially the same as in Figure 3 except that in this figure the positions of the staves have been reversed in such manner that the inner face of one stave contacts with the outer face of its companion stave, with the result that the staves are caused to assume such modified direction that the bulkhead may be carried around corners. The overlapping wings may be tied together by bolts B and a sealing rib of cement plaster P may be applied on the job.

In the modification illustrated in Figure 5, the staves have the general V-shape previously described. That is to say, they comprise the wings 5*a* and 6*a* but the central rib at the inner side of the junction of the wings is somewhat enlarged as at 7*a* and terminates in a flaring head 7*b*. This head preferably extends the full length of the staves and its presence results in the formation of channels or recesses 33 within which the ends of the wings of the adjacent staves engage. Where it is desired to brace the structure illustrated in Figure 5 in the manner suggested with respect to Figure 3 the reinforcing beam 11*a* corresponding to beam 11 may be employed and a tie rod 12*a* embedded therein may engage with the ring 14*a* of an eye bolt 34. The protuberant head 35 may be cast in place on the job and the ring 14*a* may be embedded therein, in the manner shown with respect to the ring 14 as shown in Figure 3.

A bulkhead constructed as described presents a very strong and rigid structure, as stated. It is impervious to sand leaks and its zig-zag shape sets up such counter currents and such return waves as tend to check the impact of oncoming waves against the bulkhead. It will be seen that the staves are of such configuration as to make it possible to mold them of concrete without difficulty.

It is to be understood, that the invention is not limited to the exact construction shown, but that it includes within its purview whatever changes fairly fall within either the terms or the spirit of the appended claims.

We claim:

1. A bulkhead comprising a plurality of inter-engaging vertically disposed concrete staves each of said staves being of shallow V-shape in horizontal section to thereby form a pair of flat wings disposed at an angle with respect to each other whereby the staves have a convex side and a concave side, the concave faces of said wings adapted to closely conform to the concave faces of alternate staves, the staves being alternately reversely facing, means for binding said alternately facing sections together to constitute a zig-zag bulkhead, said staves being in overlapping relation in a manner whereby each alternate stave is disposed with its concave side forwardly while the adjacent alternate staves have their concave sides rearwardly facing, and means supporting others of said staves in a substantial horizontal plane along the upper ends of said bulkhead to thereby constitute an outwardly flaring form defining a receptacle for the reception of a mass of concrete of a nature which, when set, constitutes a cap for the retaining wall.

2. A bulkhead of the character described comprising a plurality of interlocking and vertically disposed staves, each stave being of hollow V-form in horizontal section to present a pair of wings angularly disposed with respect to each other, the alternating staves being in a reverse direction, the staves each presenting a concave side and a convex side, the inner faces of the wings being flat and lying in closely contacting relation with correspondingly formed flat inner faces of the adjacent staves upon each side thereof, said staves along the apex of the concave sides being provided with outwardly directed ribs of V-shape and with the ribs extending for the full length of the staves, the side faces of the ribs conforming to and making close contact with edges of the wings of adjacent staves, and binding means located at the apex portions of the several staves and extending through the staves and the ribs of alternate staves adjacent to the confronting edges of adjacent staves.

3. The structure as recited in claim 2 wherein the faces of the staves are formed flat and with the staves having overlapping contacting engagement alternately with adjacent staves for the full width of the wings and whereby the edges of the wings of alternate staves engage the opposite sides of the ribs, the said binding means comprising threaded screws that extend through the apex of alternate staves and through the said ribs to project rearwardly of the ribs, the said screws having a head portion at one end and a nut threaded upon the opposite end whereby to bind the contacting faces of reversely facing staves in firm engagement with each other.

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