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CONCRETE PILE AND JOINT

Robertson L. Belden, P.O. Box 607, Metairie, La. 70004

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10 Claims

ABSTRACT OF THE DISCLOSURE

The structure relates to a prestressed concrete pile having a joint sealing means between adjacent piles comprising a plastic member interlocked between piles and being formed of material having stress and corrosion characteristics so as to resist movement between adjacent piles yet maintain a tight seal if some limited movement occurs and having configuration and composition characteristics which facilitate easy installation of the piling yet virtually unaffected by and resistant to deterioration by the surrounding conditions in which used.

This invention is directed to the formation of piling and to a joint for sealing adjacent piles one to the other. In particular, the invention is concerned with concrete piles and with the problem of securing adequate sealing between adjacent piles.

The prior art is replete with suggestions of the use of concrete for forming piles particularly where such piling is installed as a bulkhead along a shore line to retain earth and/or to prevent erosion of land by the washing action of waves and/or tides against the shore. In one area of the country, particularly the South, the problem of proper bulkheading is quite acute because of the extensive use of water transportation via canals which flows from the geographic nature of the area. In various parts of Texas and Louisiana, for example, it is common practice to develop canal and linking waterway systems far inland of the Gulf of Mexico, the Mississippi River and other navigable bodies of water. These canals are traversed daily by tons of shipping ranging from small canal boats to large seagoing vessels. The topographical characteristics of the land make it economically feasible to construct such waterways by dredging or other means. The fact that the canals are, in many cases, open to deep draft vessels makes it essential that the depth of the water be maintained constant and that, once completed, such waterways will not require extensive repeat dredging in years to come. However, the wash created by continual movement of the water due to wave and tide action and the wake of passing vessels erodes the banks with the result that the waterways eventually become silt-laden and shallow, thus they must be repeatedly dredged and cleared of such silt.

Various solutions to the problem, notably bulkheading the shore lines, have been tried but with varying degrees of success. First of all, particularly in the areas mentioned, the water and soil are extremely corrosive hence steel bulkheads formed of interlocking, sheet steel pile are subject to replacement at relatively short intervals. Secondly, while it has been proposed to substitute concrete pile of various configurations for sheet pile, since concrete is a relatively inert non-corrosive material, difficulties have been experienced in both installing such piling and, to a large measure in affecting a seal between adjacent piles, to prevent the passage of silt between piles. Another aspect of major consideration is the affectation of a seal which is completely durable and can be maintained during the life of the pile itself despite any

movement between piles due to settling and the like and despite the corrosive nature of the surrounding environment in which the piles are installed.

The present invention therefore, has for its object the production of a joint for concrete pile.

Another object of the invention is to provide a joint for concrete pile which is completely corrosion resistant and compatible with the material from which the pile is formed.

Still a further object of the invention is to produce a concrete pile construction wherein the piles are easily driven and easily joined together.

An additional object of the invention is to produce a bulkhead from concrete pile having a joint which will maintain the structural integrity of the assembly for long periods of time.

These and other objects of the invention not specifically set forth but inherent therein may be accomplished by providing a pile of rectangular, plank-like configuration formed of concrete, the longer, narrow edges of the pile being provided with tongue and groove configurations for interfitting engagement of one such pile with a next adjacent pile; a sealing member integrally molded within and coextensive with the longer length of the pile, one longer edge of the sealing member extending outwardly of the tongue of the concrete plank and defining a bulbous locking element, the other edge of the sealing members defining an elongated generally cylindrical pocket having an opening directed outwardly away from the pile, the opening being coextensive with the bottom of the groove edge of the concrete body whereby the pocket and opening may be interlocked with the bulbous locking element of an adjacent pile. The seal member is fabricated from a plastic material having self-lubricating surfaces and properties of chemical inertness and a minimum ultimate strength of 900 p.s.i., an example of which is black linear non-filled polyethylene.

In addition the edges of the opening along the socket edge of the seal may include outwardly extending lips of a further inert material having the properties of deforming under pressure so as to seal against the sides of the sealing member behind the bulbous locking element of an adjacent sealing member, while the extreme outer edge of said bulbous locking element may be provided with an insert of similar deformable material to affect a further sealing action within the elongated pocket defining the locking element of an adjacent pile.

Having thus described the invention in broad terms, same will now be described in detail reference being made to the drawings, wherein

FIGURE 1 is a side elevational view of two piles comprising the invention, shown in their interengaged relationship as when forming a bulkhead,

FIGURE 2 is an enlarged sectional view taken along the line 2—2 of FIG. 1, and

FIGURE 3 is a still further enlarged view of the joint configuration within the area bounded by the dashed line circle of FIG. 2.

FIG. 4 is a view similar to FIG. 3, but showing the lip elements formed of a stress deformable material.

Considering now the drawings, particularly FIGS. 1 and 2, it will be seen that the main volume or body of pile members 10 and 20 is comprised of elongated concrete planks 11 and 21 respectively, having relatively wide working faces 22 and 24 and narrow terminal faces or edges 26 and 28. The planks are of any convenient length, depending on the depth to which they may be driven or set into the ground and the amount of above ground exposure required for a given installation. The main body is comprised essentially of concrete molded in forms by conventional techniques. As is old in the art,

the longer edges 26 and 28 of the respective planks or main body of each pile 10 and 20 are configured so that one edge forms a tongue 13 and 23, respectively, formed integrally with the main body. The opposite edge of each plank is formed with a recess or groove 16 (only one shown) in plank 10 which is configured to receive tongue 23 of pile 20. Thus a number of similarly shaped piles may be driven side by side to form a bulkhead, with the tongue of one pile received in the groove of a next adjacent pile to mitigate against relative lateral motion, i.e. motion laterally of the plane of the longer, wider faces 24 and 26 of the individual piles.

The concrete body 11 and 21 of each pile 10 and 20 has embedded therein, during the manufacturing process, steel reinforcing bars 17 and 27 respectively. As shown, for simplicity, these bars are spaced apart along the major axis of the planks or main body in parallel relation and are staple or U-shaped in plan configuration. The main length of the members lies on one side of the vertical axis of the concrete body while the ends traverse across a plane in which this axis lies. Preferably the bars are positioned alternatively down the length of the pile with the aforesaid major length disposed to first one side then the other of the central plane, not bars 15 and 25 of FIG. 2.

The same pattern of reinforcement may be repeated vertically of the concrete body, but is not shown to avoid confusion in the drawings.

Also embedded within each pile 10 and 20 is a joint sealing member 30. Since each member 30 is identical a description of one such member will suffice for the purposes herein. Each sealing member, then, is comprised of a flat sheet 33 of plastic material having a length which may be coextensive with that of each pile and positioned in a vertical plane disposed along the longitudinal axis of each pile, as is obvious from an inspection of FIG. 2. Suitable apertures 31 are provided through the sheet to accommodate the ends of reinforcement bars 15 and 17.

The sealing member 30 is provided at its longer edges, that is the edges paralleling the tongue and groove edges of the concrete body of each pile, with interconnection means whereby a tight seal may be affected at the tongue and groove connections between adjacent, co-terminal pilings when they are installed side by side to form a bulkhead.

As shown in the enlarged view of FIG. 3, one edge of seal member 30 is comprised of an enlarged bulbous terminal portion 35 of generally heart-shaped configuration formed integrally with the sheet. Preferably, but not necessarily, the extreme terminal edge end of this bulbous edge portion may be recessed to receive therein a plastic insert 37 of a material having different characteristics than that of the sheet member 33 as will be explained.

The opposite edge of each sheet 33 includes a recess 29 defined by outwardly bulged walls 41, 43. The bulged walls in turn merge into a pair of spaced apart lip members 45, 47 which are co-extensive and spaced apart by a width approximately equal to the width of the plate 33. The volume of space embraced by the bulged walls 41, 43 corresponds approximately to the volume of material defining the opposite bulbous terminal edge 35 of plate 33. While the lip members 45, 47 are shown as being formed integral with and of the same material as the remainder of the sealing member, it should be understood that they may be formed of a different material and attached to the members 41, 43 as by extrusion joining or adhesive bonding.

It will be noted that seal members 30 are positioned within the concrete body or plank such that (see FIG. 2) the bulbous edge 35 projects outwardly beyond tongue 13 thereof. Also the socket edge of seal member 30 is so positioned as to be completely within the plank but with the slot formed between lips 45, 47 opening into

the bottom of the tongue 13 of plank 20. Thus when the piles are installed in co-terminal adjacent relation to form a bulkhead, the interlock between cooperating sealing members is displaced laterally as viewed in FIG. 2, with respect to the interlocking tongue and groove edges of the concrete body or plank members. This arrangement, coupled with the particular seal interlock, aids in preventing seepage of water and silt material between adjacent piles.

As has been stated, the sealing members are formed of a plastic material. One essential characteristic of such material is that it must be chemically inert and highly corrosion resistant. It must, as well, be compatible with the concrete mass defining the plank or main body of the individual piles.

Secondly, the material must have a property of surface "oiliness" or self-lubricating properties. This is important having in mind that the pilings are installed one at a time by vertical movement of one pile into interlocking engagement with a previously installed pile. Due to this characteristic the plastic sealing members can be interengaged and moved relative to one another in a longitudinal movement without the danger of tearing the seal members. This would not be the case otherwise.

Third, the seal members should have strength properties such as to resist stresses across the interlocked joint yet have some degree of flexibility coupled with structural integrity so that when integrated into the body of the pile during molding, the lips 45, 47 will remain separated yet when the joint is formed the interlocked parts will somewhat conform to each other to form a tight seal at the joint.

There are several materials which meet these requirements, as for example certain compositions identified by the general name of nylon, also the material known as "Teflon" manufactured by the Du Pont Company of Wilmington, Del. However, for reasons of economy, availability and other factors the material selected for commercial use is high density, .93 to .95, black non-filled linear polyethylene having a maximum ultimate strength in the oriented direction of not less than 900 p.s.i. in tension. This material can be readily obtained, is readily formed into shape by extrusion and possesses all of the desirable properties spelled out above. A typical sealing member formed of this material would be $\frac{3}{16}$ inch thick, have an edge-to-edge dimension of about $6\frac{1}{8}$ inches. The bulbous edge would be defined as about $\frac{3}{4}$ inch in width while the space between the sealing lips would be about $\frac{1}{4}$ inch before the members are molded in place in the concrete body of a pile.

As has been stated, it may prove to be desirable to provide a different material in the area of lips 45a, 47a and the extreme edge 37 of the bulbous portion 35 of the seal members 30. Such a material would also have the properties of surface oiliness but would be less resistant to deformation under pressure than the remainder of the sealing member. One such satisfactory material is again polyethylene, but not necessarily linear polyethylene and certainly having less density than .95. With such material it will be seen that as adjacent piles are installed and become seated, after some period of time, this deformable material will tend to conform tightly against the surfaces with which it is in contact to further increase the effectiveness of the sealing members 30. The use of the described piles is believed obvious where a river or canal bank is to be bulkheaded, a first pile is driven at the proper location by any conventional pile driving means. A second pile is then lifted vertically and a proper edge guided into position with respect to the mating edge, be it tongue or groove, of the previously driven pile. The seal members are interengaged by lowering the pile after which the second pile may be driven into place. This process is continued until a wall or bulkhead of proper length is formed of a series of interlocked sealed piles.

5

Having thus described the invention in detail, it will be apparent that various modifications and changes will occur to those skilled in the art and all falling within the spirit and scope of the inventive concept which is limited only as defined in the claims following.

What is claimed is:

1. A pile member for forming bulkheads and the like including a concrete body defining a plank having terminal edges one of which defines a tongue and the other of which defines a groove adapted to receive the tongue edge of a next adjacent plank; seal members incorporated in said body, each of said seal members comprising a flat sheet disposed in a central plane passing through the terminal edges of said body, one edge of each of said seal members being defined by a bulbous locking element, the other edge of each of said seal members being defined by a pocket having parallel, spaced lips extending outwardly therefrom, the spacing between said lips being such as to closely approximate the thickness of the flat sheet; one seal member being embedded within the concrete body with the bulbous locking element extending outwardly beyond the terminal edge of the body defining a tongue, the other of said seal members being embedded within the body such that the spaced lips open outwardly to the terminal edge of the body defining the groove; each of said seal members being formed of a high strength plastic material having the characteristics of surface oiliness whereby the tongue edge of the body and the associated bulbous edge of the one seal member in one pile may be interlocked in tight sealing engagement with the grooved edge and associated pocket and spaced lips of a seal member in a next adjacent pile member.

2. A pile member as defined in claim 1 wherein the seal member is formed of .93 to .95 linear polyethylene having a maximum ultimate strength from edge to edge of 900 p.s.i.

3. A pile member as defined in claim 1 wherein the bulbous locking element is generally heart shaped in cross sectional configuration with the greatest width thereof disposed adjacent the sheet portion of the seal member and said bulged walls of the opposite edge are configured so as to receive said bulbous locking element.

4. A pile member as defined in claim 1 wherein said lip elements are formed of a second material having stress flow characteristics and are attached to the bulbous walls.

6

5. A pile member as defined in claim 1 wherein reinforcing bars are integrated into the concrete body.

6. A pile member as defined in claim 3 wherein the narrow portion of the heart shaped bulbous locking element is provided with an insert comprised of a material having stress flow characteristics.

7. A bulkhead comprised of interlocking pile members in accordance with claim 1.

8. A seal member for concrete pile comprising an elongated thin sheet of plastic material having parallel long edges, one of which edges is defined by a coextensive bulbous locking element, the other of which edges is comprised of an elongated pocket defined by a pair of spaced bulged walls and generally parallel lip elements extending outwardly from said bulged walls to define a slot-like opening along said edge, the member being comprised of a plastic material having the property of surface oiliness, whereby when the bulbous locking edge of one seal member may be inserted within and moved longitudinally in the pocket defining the edge of a second seal member without tearing of the material.

9. A seal member as defined in claim 8 wherein the member is formed of .93 to .95 density linear polyethylene having a minimum ultimate tensile strength of 900 p.s.i.

10. A seal member as defined in claim 9 wherein the space between the parallel lip elements is approximately $\frac{1}{4}$ inch and the thickness of the thin sheet is $\frac{3}{16}$ inch whereby the lip elements will tightly engage the opposite faces of a sheet element of a second seal member.

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JACOB SHAPIRO, Primary Examiner

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