

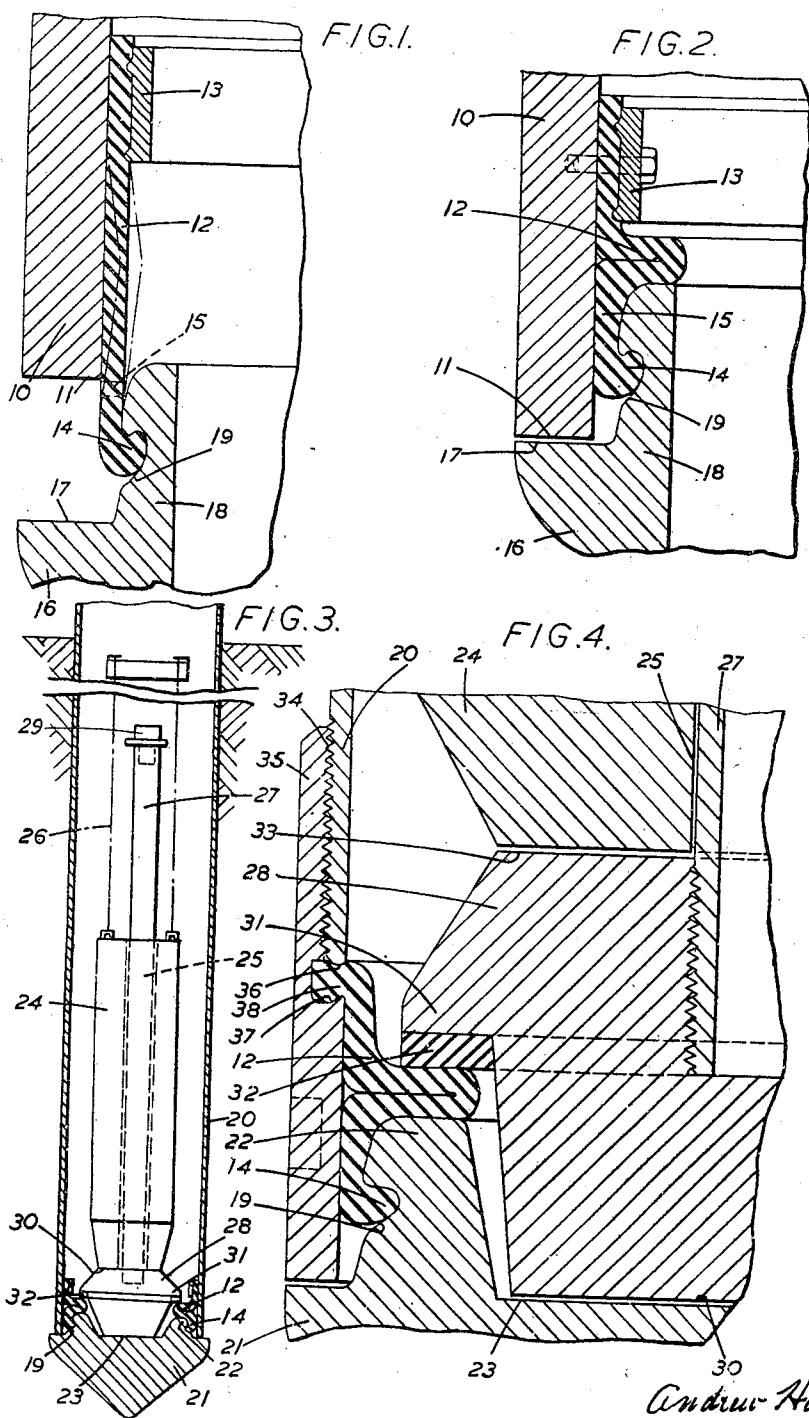
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PILE CASING

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PILE CASING

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This invention is for improvements in or relating to the manufacture of in situ concrete piles, walls, coffer-dams and the like and has for an object to provide means whereby in situ concrete piles, walls, coffer-dams or the like can be constructed through water-logged ground or through an appreciable depth of water.

Hitherto the formation of such in situ concrete structures through water of any appreciable depth has never been successfully attempted for want of some means to enable the steel casing, together with its shoe closure to be lowered through water and driven into the ground, providing an effective automatic seal against the ingress of water under considerable external head pressures and at the same time eliminating the natural buoyancy of a hollow closed vessel, for example a closed piling tube.

According to the present invention there are provided means, adapted to be driven into the ground to permit construction of in situ concrete piles, walls, coffer-dams and the like in the presence of water, comprising a hollow open-ended casing, a closure member for one end thereof and a connecting member, comprising rubber or like resilient material, releasably engaging with said closure member and/or said casing to seal the casing against ingress of water. Said connecting member may be secured to the interior of said casing by means of bolts or the like or it may be gripped between the edge of said casing and a screw-threaded collar engaging with a corresponding screw-thread formed on the said casing.

The preceding constructions are eminently suitable for the formation of the in situ concrete structures referred to, in water-logged ground; they provide a simple and convenient means for preventing the ingress of water into the casing during the operation of driving into the ground and at the same time permit of a ready withdrawal of the casing when the concrete has been poured into the casing.

A feature of the invention consists in that said connecting member is formed with a hole or holes therethrough permitting ingress of water into said casing and is resiliently deformable by pressure of said casing upon said closure member to close said hole or holes. By means of this construction the casing can be lowered into contact with the ground through a considerable depth of water. The provision of the holes in the connecting member permits water to flow into the interior of the casing and thereby overcomes the difficulty of buoyancy and enables the casing to

be lowered without difficulty into the desired position. The construction is such that when the closure member has made contact with the ground and the casing is lowered on to it, the connecting member is resiliently deformed in such a manner as to close the holes, thereby preventing further ingress of water into the casing and thus permitting the casing to be de-watered either before or after it is driven into the ground, but in any event before the concrete is poured into the casing to form the desired structure.

The attachment of the shoe to the casing in accordance with the present invention makes it possible to make an important and valuable alteration in the method of driving the casing into the ground; ordinarily, the casing is fitted with a driving helmet and a piling hammer is caused to strike the said helmet and the driving effort is then transmitted through the length of the casing to the shoe which is thereby driven into the ground. This causes considerable vibration during the driving operation and moreover necessitates the use of a casing which is stronger and heavier than is required for its primary function, namely, forming a cavity into which the fluid concrete can be poured. Furthermore, a very strong piling frame is required in order to support the casing and guide it throughout the driving operation and to support the piling hammer at a considerable height above ground.

According to a further important feature of the invention there is provided a method of driving a casing, as hereinbefore set forth, which comprises lowering the piling hammer inside the casing and causing it to strike the closure member at the foot of the casing and to engage with the connecting member whereby the closure member is driven into the ground and the casing is simultaneously pulled down. Preferably the closure member (i. e., the shoe) is formed with a flat surface, for engagement with a driving surface associated with the piling hammer, surrounded by an upstanding flange between which and a part of the said driving surface, the connecting member is "nipped" during a driving stroke of the piling hammer.

The advantage of the foregoing method of driving the casing into the ground is that the casing can be constructed of thinner gauge metal than would otherwise be necessary as it does not have to transmit the driving effort, that vibration during driving is minimized and that the piling frame can be less substantially built than is customary.

In the accompanying drawing,

Figure 1 is a section of a part of a piling tube casing at the point at which the shoe is secured thereto,

Figure 2 is similar to Figure 1 with the connecting rubber sleeve deformed,

Figure 3 is a vertical section of a piling tube casing showing the arrangement of parts for driving by direct blows upon the shoe and

Figure 4 is an enlarged sectional view of a part of the arrangement of Figure 3 illustrating an alternative method of fixing the rubber sleeve to the casing.

The following is a description with reference to Figures 1 and 2 of an embodiment of the invention for use in the formation of an in situ concrete pile under a considerable depth of water.

In Figure 1 is shown a piling tube casing 10, which is of any ordinary type of construction, has attached to the interior thereof, adjacent the lowermost end 11, a rubber sleeve 12 which projects below the lowermost end of the casing to the extent of an inch to $1\frac{1}{2}$ inches. The rubber sleeve 12 is secured fast to the interior of the casing 10 by means of a metal ring 13, attached to the casing by means of studs or bolts not shown, firmly clamping the rubber sleeve between it and the casing.

The lowermost edge of the rubber sleeve 12 is formed with a rim 14 similar to the bead edge on a pneumatic tyre.

Around the periphery of the rubber sleeve 12 and at a point just below the lowermost edge 11 of the casing, a number of perforations 15 are formed which, as later described, permit the passage of water into the interior of the casing.

The shoe 16, which is made of cast iron, is in the conventional form, i. e., it has a driving shoulder 17, and, extending upwardly from that shoulder, a flange 18 arranged to fit inside the casing. Around the periphery of the upstanding flange 18 there is formed a groove 19 of such a shape as to engage the bead-like rim 14 formed at the lowermost edge of the rubber sleeve 12. The rubber sleeve 12 which is of about $\frac{1}{4}$ inch in thickness is sufficiently strong to secure the shoe 16 to the casing 10 when the casing is suspended so that the casing and shoe can be lowered into position without the shoe becoming detached from the casing.

The casing and shoe are then lowered through the water at the selected position and when the shoe 16 makes contact with the ground the casing will continue to descend until its lowermost edge 11 makes contact with the driving shoulder 17 on the shoe 16.

During the descent of the casing and shoe through the water, water has penetrated into the interior of the casing 10 through the perforations 15 so that the interior becomes filled with water and has no undesirable buoyancy.

During the relative movement between the casing and the shoe the rubber sleeve 12 becomes deformed and collapses inwardly thereby compressing the portion in which the perforations 15 are formed and thus sealing them whilst the casing 10, sliding over the rubber sleeve 12 also seals against the lowermost rim 14 of the rubber sleeve and effects a further sealing against the ingress of water as best seen in Figure 2. The casing can now be driven into the ground into the required depth and can then be de-watered; it will be appreciated of course that the casing could be de-watered as soon as the rubber sleeve has

been deformed sufficiently to close the perforations.

When the casing has been driven into the ground to the desired depth by means of blows upon a driving helmet fitted to the upper end of the casing in conventional manner, a steel cage reinforcement (not shown) can if desired be lowered into the casing and if desired a liner (not shown), also of steel tubing, can also be lowered into position and can be retained suspended inside the main casing.

The concrete is now poured into the casing 10 (when a liner is employed the concrete is introduced into the liner only) and the casing can then be extracted in conventional manner by reversing the action of the piling hammer (when the concrete has set sufficiently to be self-supporting) and during the process of extraction the bead-like rim 14 on the lowermost edge of the rubber sleeve 12 is withdrawn from the groove 19 in the upstanding flange 18 of the shoe 16 leaving the shoe in position in the ground at the foot of the concrete column and permitting the casing to be withdrawn.

In the case where a liner is used the casing can be withdrawn as soon as the required amount of concrete has been poured into the liner, the liner being left in position either permanently as a support and protection for the concrete pile or, alternatively, the liner (which may conveniently be made in sections as is conventional) may be withdrawn when the concrete column has become self-supporting.

It will be appreciated that the perforations 15 in the rubber sleeve 12 can be omitted when the casing and shoe assembly does not have to be lowered through any considerable depth of water; it is only where the depth of water is such that the buoyancy of the empty casing presents considerable difficulties in the control thereof whilst being lowered into position that the function of the perforations attains its full degree of importance.

The following is a description, with reference to Figures 3 and 4 of the way in which the casing and shoe are modified from what is described above and of the means and method used for driving the casing and shoe into the ground.

The casing 20 is formed of sheet metal, or otherwise as required, of the thickness necessary to withstand the stresses imposed upon it by the lateral pressure of the ground and concrete filling, e. g., $\frac{3}{8}$ " to $\frac{1}{2}$ " thickness and has secured thereto, near to the lowermost end, a rubber sleeve 22 as above described. The rubber sleeve is attached to the shoe 21 by means of a bead 24 engaging with a groove 23 in the upstanding flange 22 on the shoe 21 also as above described.

The shoe 21 is formed with a flat surface 23 lying within the said upstanding flange 22 to receive the driving effort of the blows from the piling hammer.

Into the casing there is lowered the piling hammer and associated parts which are constructed as follows: the piling hammer 24, which is a cylindrical mass weighing say two-and-a-half tons, is formed with a hole 25 along the longitudinal axis and is attached by cable 26 or the like to the operating means in conventional manner. Passing through said hole 25 is a rod 27 which at its lowermost end is secured to an anvil 28 (hereinafter described) and at its uppermost end is formed with a cap or boss 29 so that when the piling hammer 24 is raised it will abut against the cap or boss 29 so that the extent of the drop is regulated. The rod 27, which acts as a guide

for the piling hammer, may also have holes (not shown) formed transversely through it into which pins or the like may be placed to vary the amount by which the piling hammer 24 is raised at each stroke whereby the driving effort can be regulated.

The anvil 28 is a block of metal having a flat undersurface 30, which is to engage with the flat surface 23 of the shoe above referred to, and a transverse flange 31 extending sideways to such an extent as to overlap the upstanding flange 22 on the shoe, the said transverse flange 31 being disposed at a distance above the flat surface 30 such that it rests upon the rubber sleeve 12 where the latter is folded over and upon the upstanding flange 22; the transverse flange 31 is preferably provided with a rubber or other soft facing 32 (best seen in Figure 4) for engaging with the rubber sleeve 12. The anvil 28 may be arranged to rest with its flange 31 upon the rubber sleeve 12 and to be brought into contact with the shoe 21 only during the driving stroke; it is provided with a flat upper surface 33 for engagement with the piling hammer 24.

As the shoe 21 is moved deeper into the ground at each blow of the piling hammer 24, the casing 20 is caused to follow it by reason of the pull exerted on it by the rubber sleeve 12; the rubber sleeve 12, being nipped between the flange 31 of the anvil 28 and the flange 22 of the shoe, transmits the movement of the shoe 21 to the casing 20 which consequently does not need to be driven.

When the casing and shoe have been driven into the ground to the required distance, the anvil and piling hammer are withdrawn and the finishing of the concrete pile effected as described in relation to Figures 1 and 2.

In addition to showing, on a larger scale, part of Figure 3, Figure 4 also shows an alternative method of securing the rubber sleeve 12 to the casing 20. In this arrangement, a screw-thread 34 is formed on the outside of the casing 20 and a correspondingly screw-threaded collar 35 is secured thereto. The collar 35 is formed with a recess 37 which cooperates with the end 36 of the casing 20 to form a groove in which the beaded upper edge 38 of the rubber sleeve 12 is nipped.

This method of securing the rubber sleeve to the casing is possibly more convenient than that shown in Figures 1, 2 and 3 and although it is illustrated in connection with the embodiment of the invention described with reference to Figure 3, it is to be understood that it is not limited thereto and can be applied to the embodiment shown in Figures 1 and 2, i. e., where the casing is driven by the blows of a piling hammer upon the conventional driving helmet fitted to the top of the casing.

What I claim is:

1. Means for use in the formation of in situ concrete piles, walls, coffer dams and the like in the presence of water, and adapted to be driven into the ground comprising a hollow open-ended casing, a closure member for one end thereof and a connecting member of flexible, water-imperious material, releasably engaging with said closure member and said casing to seal the casing against ingress of water.

2. Means according to claim 1, including means in the form of bolts for releasably securing said connecting member to the interior of said casing.

3. Means according to claim 1, including a metal ring between which and the interior of said

casing said connecting member is gripped, and means in the form of bolts for releasably securing said ring and connecting member to said casing.

4. Means according to claim 1, said casing terminating at its lower end in a screw threaded portion, a screw threaded collar threadedly mounted on said screw threaded portion, and one end of said connecting member being gripped between the edge of said casing and said screw threaded collar.

5. Means according to claim 1, said connecting member being provided with means for the passage therethrough of water into said casing, and being resiliently deformable by pressure of said casing upon said closure member to close said last-named means.

6. Means according to claim 1, said connecting member being provided at its lower end with a bead, and said closure member being provided with a cooperating groove for the releasable reception of said bead.

7. Means for use in the formation of in situ concrete piles, walls, coffer dams and the like in the presence of water, and adapted to be driven into the ground comprising a hollow open-ended casing, a closure member for one end thereof and a connecting member, of flexible rubber material, releasably engaging with said closure member and said casing to seal the casing against ingress of water, said closure member being formed with a flat surface surrounded by an upstanding flange arranged to fit within said casing, said flange being so disposed and dimensioned that, when the casing is pressed upon said closure member, the said connecting member is deformed so as to overlap the edge thereof and is nipped between said flange and driving means engaging with said flat surface during driving of said casing and closure means into the ground.

8. Means according to claim 7, said driving means comprising an anvil, provided with a circumferential flange extending outwards to overlap said upstanding flange and with a flat surface for engagement with the flat surface of said closure member, a guide member secured to said anvil, a drop-hammer fitting around said guide-member, a stop on said guide member for limiting the upward movement of said drop-hammer and operating means for raising and dropping said drop-hammer.

9. Means according to claim 7, said driving means comprising an anvil, provided with a circumferential flange extending outwards to overlap said upstanding flange and with a flat surface for engagement with the flat surface of said closure member, a guide member secured to said anvil, a drop-hammer fitting around said guide-member, a stop on said guide member for limiting the upward movement of said drop-hammer and operating means for raising and dropping said drop-hammer, wherein the lower face of said circumferential flange on the anvil being faced with soft or resilient material and is disposed at such a distance from the flat surface of said anvil that said flat surface is held out of contact with the flat surface of the closure member except during a driving stroke when said connecting member is nipped between the upstanding and circumferential flanges and causes the casing to move down with the closure member.

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