

PATENT SPECIFICATION

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(54) IMPROVEMENTS IN JOINING PILE SECTIONS

(71) I, BOBBY ENG HEAN HO, a Malaysian Citizen of 51-L Jalan Mutiara, Singapore, 10, do hereby declare the invention, for which I pray that a patent may be granted to me and the method by which it is to be performed, to be particularly described in and by the following statement:—

When driving reinforced concrete piles it is sometimes necessary to extend a partly driven pile and to do this an additional section is coupled to it end to end. This is particularly so when a pile meets an unexpectedly low driving resistance and so has to be lengthened until it eventually reaches more solid material. Alternatively it may be known that a long pile is needed but that it may be impracticable to manufacture transport and pitch a pile of so great a length and so it is much more convenient to build it up as required from shorter sections.

In the past reinforced concrete piles have been joined in various ways, for example, by breaking away the concrete at the top of the pile, extending the reinforcement and then casting an extension onto the pile when it is in situ; by surrounding a plain butt joint between two sections of a normally reinforced or prestressed concrete pile with a tightly fitting sleeve; by casting metal plates in the top of the lower section of the pile and the bottom of the top section of the pile so that they can subsequently be welded together to join them; or by having a fitting attached to each section so that by rotating the top section relative to the lower section the two sections are locked together.

According to my invention I join two reinforced concrete pile sections together end to end by casting into the end of one section two or more projecting spigots each having a locking portion, casting into the other section corresponding sockets each having a portion to engage the locking portion of its respective spigot and placing the two pile sections end to end and in so doing sliding the spigots into the sockets.

deflection of the spigots relative to the sockets occurring as the spigots enter the sockets and the deflected parts snapping back when the spigots are fully inserted in the sockets, to cause the locking portion of the spigots to engage the sockets in a position to lock the spigots positively in the sockets.

This method has the advantage that the joint may be made quickly and conveniently, particularly in comparison with the techniques requiring a new section to be cast in situ. Also no extra skilled labour is needed to make this joint, for example welders, and further the motion needed to interlock the sections is in the same direction as that of the driving of the pile so that no additional equipment is needed to supply the coupling forces.

In accordance with another aspect of my invention, a device for carrying out the above method comprises a spigot in the form of a steel strip having at one end an anchorage for casting into, and anchoring the spigot to one pile section and a locking plate with a chamfered edge at the other end, and a steel socket having an anchorage for casting into, and anchoring the socket to, the other pile section and at one end of the socket an abutment, the arrangement being such that when two of the spigot and socket devices are cast, one into each side of the pile sections, the strips are deflected by the engagement of the chamfered edges with the sockets as the strips enter the sockets and when the locking plates reach a position adjacent the abutments the strips snap back to cause the plates to engage with the abutments to lock the spigots positively in the sockets.

The device is preferably made from mild steel which is convenient to fabricate readily available and compatible with the material used to form the piles.

An advantage of the device is that when placed adjacent the outer surfaces of the pile, openings may be provided to give access to the locking plate so that the

sections may be uncoupled if, for example, the pile meets an unexpected obstruction.

A particular example of a method and a device in accordance with the invention will now be described with reference to the accompanying drawings in which:—

Figure 1 is an exploded perspective view of two devices cast into the adjacent ends of two concrete pile sections;

Figure 2 is a section as seen in the direction of the arrows on the line 2—2 in Figure 1, but showing the sections joined together;

Figure 3 is a side elevation of the spigot part of the device; and,

Figure 4 is a side elevation of the socket part of the device.

The two devices are the same as each other and each comprises a spigot 10 and a socket 17. The spigot 10 is formed from a strip 11 of mild steel plate, the top of which is split and bent to form dove-tailed anchorages 12. Further anchorages 13, also formed from bent mild steel are welded onto the strip 11. A locking plate 14 having a chamfered leading edge 15, and a flat edge 16 is welded to the bottom of the strip 11.

Each socket 17 comprises a tube 18 of rectangular cross section, which is formed by welding flat plates together and which is arranged to receive a spigot 10. At the lower end of the tube 18 an angle 19 is welded with its foot issuing in a direction away from the tube 18. Bars 20 are welded to the external surface of the tube 18 so that when the socket is cast into a pile they will form anchorages.

To join two sections of pile together two sockets 17 are cast into opposite sides of the upper end of a lower pile section 21 and two spigots 11 are cast into corresponding sides of the lower end of an upper pile section 22. When the sockets 17 are cast into the pile section 21 temporary filler pieces are placed immediately beneath them. After the concrete has hardened these filler pieces are moved leaving recesses 23 in the sides of the pile 21. These recesses receive the lower ends of the strips 11 and the locking plates 14 when the joint is completed.

After the lower section 21 of the pile has been partly driven into the ground the upper section 22 is lowered towards it. The chamfered ends 15 of the locking plates 14 on the spigots 10 come into contact with the upper ends of the sockets 17 and as the upper section 22 of the pile is lowered further towards the lower section 21 the strips 11 are deflected away from each other. The strips 11 and the locking plates 14 move inside the tubes 18 of the sockets 17 until the top of the bottom section 21 abuts the bottom of the top section 22. At this moment the upper edges 16 of the locking plates 14 are just past the angles 19 which

form abutments at the lower ends of the tubes 18. The strips 11 then snap back to straighten themselves and the upper surfaces 16 of the locking plates 14 snap into engagement with the lower surfaces of the angles 19 so locking the two pile sections positively together.

If necessary a thin layer 24 of an epoxy resin mortar may be placed over either the top of the bottom section 21 of the bottom of the top section 22 to take up any slight irregularities on the surfaces. When this has hardened it improves the transmission of the driving force from the top pile section to the bottom pile section. The joint may be inspected at any stage of its coupling through the recesses 23, and these also provide means whereby the joint may be uncoupled by moving the strips 11 and locking plates 14 apart. This is particularly useful if the lower pile section 21 suddenly meets an unexpected obstacle after the upper pile section 22 has been attached. A further optional feature is the insertion of filler pieces into the tubes 18 after the joint has been made. These pieces are inserted between the inside faces of the tubes 18 and the strips 11 to fill the space between them so that the locking plates 14 cannot be moved apart.

More than two of these devices may be used for each joint for example when using a pile of rectangular section there may be a device adjacent each side and when a pile of hexagonal section is used either three or six of these devices may be placed around it.

WHAT I CLAIM IS:—

1. A method of joining two reinforced concrete pile sections together end to end comprising casting into the end of one section two or more projecting spigots each having a locking portion, casting into the other section corresponding sockets each having a portion to engage the locking portion of its respective spigot and placing the two pile sections end to end and in so doing sliding the spigots into their respective sockets, deflection of the spigots relative to the sockets occurring as the spigots enter the sockets and the deflected parts snapping back when the spigots are fully inserted in the sockets, to cause the locking portions of the spigots to engage the sockets in a position to lock the spigots positively in the sockets.

2. A method according to claim 1, in which a layer of epoxy resin mortar is provided in between the adjacent ends of the two pile sections before they are brought together.

3. A method according to claim 1 or claim 2, in which filler pieces are placed in the sockets after the completion of the joint to prevent disengagement of the locking portions of the spigots from the sockets.



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Figure 3 is a side elevation of the spigot part of the device; and,

Figure 4 is a side elevation of the socket part of the device.

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25 Each socket 17 comprises a tube 18 of rectangular cross section, which is formed by welding flat plates together and which is arranged to receive a spigot 10. At the lower end of the tube 18 an angle 19 is welded with its foot issuing in a direction away from the tube 18. Bars 20 are welded to the external surface of the tube 18 so that when the socket is cast into a pile they will form anchorages.

30 To join two sections of pile together two sockets 17 are cast into opposite sides of the upper end of a lower pile section 21 and two spigots 11 are cast into corresponding sides of the lower end of an upper pile section 22. When the sockets 17 are cast into the pile section 21 temporary filler pieces are placed immediately beneath them. After the concrete has hardened these filler pieces are moved leaving recesses 23 in the sides of the pile 21. These recesses receive the lower ends of the strips 11 and the locking plates 14 when the joint is completed.

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form abutments at the lower ends of the tubes 18. The strips 11 then snap back to straighten themselves and the upper surfaces 16 of the locking plates 14 snap into engagement with the lower surfaces of the angles 19 so locking the two pile sections positively together.

40 If necessary a thin layer 24 of an epoxy resin mortar may be placed over either the top of the bottom section 21 of the bottom of the top section 22 to take up any slight irregularities on the surfaces. When this has hardened it improves the transmission of the driving force from the top pile section to the bottom pile section. The joint may be inspected at any stage of its coupling through the recesses 23, and these also provide means whereby the joint may be uncoupled by moving the strips 11 and locking plates 14 apart. This is particularly useful if the lower pile section 21 suddenly meets an unexpected obstacle after the upper pile section 22 has been attached. A further optional feature is the insertion of filler pieces into the tubes 18 after the joint has been made. These pieces are inserted between the inside faces of the tubes 18 and the strips 11 to fill the space between them so that the locking plates 14 cannot be moved apart.

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WHAT I CLAIM IS:—

1. A method of joining two reinforced concrete pile sections together end to end comprising casting into the end of one section two or more projecting spigots each having a locking portion, casting into the other section corresponding sockets each having a portion to engage the locking portion of its respective spigot and placing the two pile sections end to end and in so doing sliding the spigots into their respective sockets, deflection of the spigots relative to the sockets occurring as the spigots enter the sockets and the deflected parts snapping back when the spigots are fully inserted in the sockets, to cause the locking portions of the spigots to engage the sockets in a position to lock the spigots positively in the sockets.

2. A method according to claim 1, in which a layer of epoxy resin mortar is provided in between the adjacent ends of the two pile sections before they are brought together.

3. A method according to claim 1 or claim 2, in which filler pieces are placed in the sockets after the completion of the joint to prevent disengagement of the locking portions of the spigots from the sockets.

4. A method according to any one of the preceding claims, in which a recess is formed in the side of the pile section immediately adjacent each socket to provide access to the locking portion of the spigot after the joint is completed.

5. A device for use in the method according to claim 1, the device comprising a spigot in the form of a steel strip having at one end an anchorage for casting into, and anchoring the spigot to, one pile section and a locking plate with a chamfered edge at the other end, and a steel socket having an anchorage for casting into, and anchoring the socket to, the other pile section and at one end of the socket an abutment, the arrangement being such that when two of the spigot and socket devices are cast, one into each side of the pile sections, the strips are deflected by the engagement of the chamfered edges with the sockets as the strips enter the sockets and when the locking plates reach a position adjacent the abutments, the strips snap back to cause the plate to engage with the abutments to lock the spigots positively in the sockets.

6. A device according to claim 5, in which

the socket is formed from a tube of rectangular cross section, having fixed to it at one end the abutment which is formed by a steel angle section.

7. A device according to claim 5 or claim 6, in which the steel strip is split and bent at its end remote from the locking plate to form the anchorage.

8. A method according to claim 1, carried out substantially as described with reference to the accompanying drawings.

9. A device according to claim 5, constructed substantially as described with reference to the accompanying drawings.

10. A pile formed from two sections, the two sections being joined by a method according to any one of claims 1 to 4 or claim 8.

11. A pile comprising two sections, the two sections incorporating at least two devices in accordance with any one of claims 5 to 7 or claim 9.

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