PATENT SPECIFICATION

Application Date: March 2, 1939. No. 6877/39. **521,681**

Complete Specification Left: Nov. 14, 1939.

Complete Specification Accepted: May 28, 1940.

PROVISIONAL SPECIFICATION

Improvements relating to the Driving of Piles

I, HARRY GORDON GEORGE GREATOREX RICHES, a British Subject, of 12, Barker Road, Singapore, Straits Settlements, do hereby declare the nature of this invention to be as follows:—

This invention consists of improvements in and modifications of the invention described in my co-pending application No. 33988/38 (Serial No. 521,644). In that application I described a method of driving concrete piles in which a tube closed by a detachable shoe is driven into the ground to the required depth and a pre-cast pile is lowered into it, after which the tube is withdrawn leaving the shoe behind. This method has the advantage that the pre-cast pile is not submitted to any stresses except those involved in actually hoisting and lowering it, in contrast to the usual case in which the pile itself is hammered or otherwise driven into the ground.

According to this invention, a quantity of fluid cement, mortar or the like is poured into the tube before and/or after the pre-cast pile is lowered into the tube, this cement hardening to form around part of the pile a coating which sets up frictional resistance with the ground after the tube is withdrawn and fills up any void spaces between the ground and the pile, especially at the base of the pile where this is most necessary.

Even when the annular space around the pile is filled up with grout, after the withdrawal of the tube, the pile is liable to be displaced out of the vertical while this grout is setting. This difficulty is especially noticeable when groups of piles are being driven, since the driving of each pile is liable to force out of the vertical the pile which was driven immediately previously, due to the displacement of the ground in the neighbourhood and to the fact that the grout surrounding the previous pile is still plastic. In order to overcome this disadvantage, one or more annular wedges of pre-cast concrete or the like may be placed round the top of the pile and forced down into the space between the ground and the pile. These annular wedges should have internal dimensions closely corresponding with the external dimensions of the pile, and the external diameter should be at the lower end slightly less than, and at the upper end somewhat greater than, the external diameter of the hole made by the tube. The effect of forcing down the wedge is to compact the liquid grout firmly round the pile and prevent the grout from being driven up during the driving of adjacent piles, and at the same time to secure the upper end of the pile firmly in position. During the driving of adjacent piles, these wedges may be held down by using the weight of the pile frame. If necessary, several of these wedges may be driven in on top of each other, preferably spaced by layers of plastic concrete or the like.

To avoid unduly straining the tube during withdrawal, especially if it is formed from sections joined together, it is preferred not to use an extracting hammer, but some apparatus affording powerful purchase.

When using the tube to make preliminary deposits of concrete into which the pile is later to be driven, as I described in my previous application, it is preferred to lower and raise the tube alternately so that the concrete which issues from below the tube can become displaced sideways in the surrounding ground.

Dated this 28th day of February, 1939.

For the Applicant:
GILL, JENNINGS & EVERY,
Chartered Patent Agents,
51/52, Chancery Lane, London, W.C.2.

COMPLETE SPECIFICATION

Improvements relating to the Driving of Piles

I, HARRY GORDON GEORGE GREATOREX RICHES, of 12, Barker Road, Singapore, Straits Settlements, a British Subject, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described

[*Price* 1/-]

and ascertained in and by the following statement:—

This invention relates to the sinking of concrete piles.

When precast piles are lowered into cavities already formed in the ground, there is a considerable risk of the pile being displaced out of the vertical or correct position while grout poured around it is setting. There is also a tendency for part of this grout to be forced out of the annular space around the pile owing to the ground closing in on the pile. According to the invention after the grout, which may take the form of liquid cement, mortar or the like, has been poured around the pile a rigid ring, preferably wedge-shaped in cross-section, is slipped over the pile and driven into the space between the pile and the wall of the cavity or socket into which it has been lowered and which also contains the grout. The ring may advantageously be precast from cement or concrete, but may be made from other materials, such as metal or wood.

The usual way of making a cavity in the ground for a pile is to drive a tube with detachable shoe and subsequently to remove the tube. When the cavity used in the present invention is formed by such a method the grout may be poured into the annular space around the pile before, during or after the tube has been removed.

The invention is particularly applicable in soft or swampy ground, where the cement grout greatly increases the frictional resistance between the pile and the ground and increases its bearing capacity. In such ground, however, the grout would be largely forced out of the space if it were not for the provision of the ring. This is partly due to the natural pressure of the earth which tends to return to its previous position, but when a number of piles are driven simultaneously or at short intervals of time a more important factor comes into play. The impacts set up by the driving of neighbouring piles build up pressure waves which are transmitted to a very considerable distance. When a pile is being driven within this distance of a pile which is surrounded by unset grout, the latter is forced upwards and would be almost completely ejected from the space were it not for the presence of the ring, which in effect seals the space. The ring also serves the purpose of fixing the position of the head of the pile in the soft ground and ensuring that the pile remains vertical and in its correct position.

The inner surface of the ring need not fit the pile exactly. For example, the ring may be a true frustum of a cone and the pile may be polygonal. It is to be understood that the ring may be polygonal, and that the word " ring " includes any shape that is essentially annular.

In certain circumstances it may be desirable to use more than one ring, these being driven in on top of each other, principally for the purpose of increasing the frictional value of the pile by successive ramming and consolidation of the wet concrete, or for the purpose of building up a greater bearing surface at the head of the pile.

In order that the invention may be clearly understood and readily carried into effect, one method of driving piles in accordance with the invention will now be described by way of example and with reference to the accompanying drawings, in Figure 1 of which a pile is shown in position, surrounded by grout which is held down by a ring, which is shown in Figure 2.

A steel tube closed by a detachable cast iron shoe is first driven in until firm ground is reached. A precast pile, which may be a composite pile built up from units in the manner described in the co-pending application No. 28453/39 (Serial No. 521,683) is then lowered onto the shoe. If desired, a small amount of cement or mortar may be poured onto the shoe before the pile is lowered, so that the latter is firmly secured to the shoe. Liquid cement grout is then poured into the annular space between the tube and the pile, after which the tube is extracted. A further quantity of grout is then poured down to fill up the space left by the tube, and an annular wedge is slipped over the head of the pile and into the space vacated by the tube. If neighbouring piles are being driven, the wedge may be held down by using the weight of the pile frame.

The drawing shows the pile after it has been driven. The pile 1 is octagonal in section, although the tube used to drive the hole was circular in section so that the irregular hole left in the ground is substantially circular in section. Cement grout 33 is shown filling the space between the pile and the wall of the hole. When this grout sets, the irregular form of its outer surface will greatly increase the frictional forces between the pile and the ground. The grout is held down and the head of the pile is kept in position by an annular wedge 30. The inner surface of this wedge is polygonal in section and of such a size that the upper end fits closely round the pile 1. The outer surface of the wedge is conical and circular in section so that it can be driven to fit tightly into the hole left after extraction of the tube.

The piles used in the invention may be hollow, though they are preferably solid.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A method of sinking concrete piles by lowering precast piles into cavities already formed in the ground, in which grout is poured into the space around the pile and a rigid ring is slipped over the pile and driven into the space between the pile and the wall of the cavity.

2. A method of sinking concrete piles, in which a tube is driven into the ground to form a socket, a precast pile is lowered into the tube, liquid cement grout is poured into the annular space around the pile before, during and/or after the tube is extracted and a precast cement or concrete ring is slipped over the pile and driven into the space between the upper part of the pile and the ground so as to fix the position of the head of the pile and to hold down the liquid grout.

3. A method according to claim 1 or claim 2, in which the ring is wedge-shaped in cross-section.

4. A method according to any of the preceding claims, in which several rings are driven in on top of one another.

5. A precast cement or concrete annular wedge suitable for use in a method according to claim 3.

6. A method of sinking concrete piles substantially as described herein with reference to the accompanying drawings.

Dated this 14th day of November, 1939.

For the Applicant:
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Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1940.

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Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A method of sinking concrete piles by lowering precast piles into cavities already formed in the ground, in which grout is poured into the space around the pile and a rigid ring is slipped over the pile and driven into the space between the pile and the wall of the cavity.

2. A method of sinking concrete piles, in which a tube is driven into the ground to form a socket, a precast pile is lowered into the tube, liquid cement grout is poured into the annular space around the pile before, during and/or after the tube is extracted and a precast cement or concrete ring is slipped over the pile and driven into the space between the upper part of the pile and the ground so as to fix the position of the head of the pile and to hold down the liquid grout.

3. A method according to claim 1 or claim 2, in which the ring is wedge-shaped in cross-section.

4. A method according to any of the preceding claims, in which several rings are driven in on top of one another.

5. A precast cement or concrete annular wedge suitable for use in a method according to claim 3.

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