REINFORCED CONCRETE PILE

INVENTOR.

HAROLD H. PELZER

BY

Edw. S. Higgins

ATTORNEY
REINFORCED CONCRETE PILE
Harold H. Pelzer, Long Island City, N.Y., assignor to
Grace L. Pelzer, Long Island City, N.Y.
Filed Sept. 15, 1965, Ser. No. 487,403
6 Claims. (Cl. 61—56)

ABSTRACT OF THE DISCLOSURE
A reinforcing concrete pile with an H-beam in the center thereof projecting slightly above the concrete body
to receive the driving impacts of a flanged driving hammer
head, and with a boot or shoe on the lower end of the
cement body for reinforcing the lower end of the
pile and concentrating the soil at and adjacent thereto.

This invention relates generally to the art of piling and more particularly to a reinforced concrete pile.

Piles are used to support or form foundations for structures such as buildings, tanks, piers, bridges, conduits,
wharves and the like by inserting them into or through surface strata far enough to obtain a solid support for the
principal structure. The present invention is concerned with pile foundations for structures in loose earth, made
earth, shell earth, said earth whether stationary or shifting and similar soft or wet soil.

In driving concrete piles if the concrete is subjected to the successive impacts of the driving tool it may shatter or fracture in the driving operation. It is accordingly a primary object of the present invention to provide a reinforced concrete pile wherein one of the metal reinforcing members projects above the top end of the concrete and absorbs the driving impacts of the driving hammer.

Another object of the invention is to provide a reinforced concrete pile with an H-beam having projecting lugs in the center of the pile serving as reinforcing agents, the top end of the H-beam adapted to receive the driving impacts of the driving hammer.

Still another object of the invention is to provide a reinforced concrete pile that is especially well adapted to withstand both tensional and compressional longitudinal forces as well as lateral stresses.

A further object is to provide the concrete pile with a boot or shoe that is capable of at the same time reinforcing the lower end of the pile and concentrating the soil at and adjacent thereto.

Yet another object is to provide a boot or shoe of maximum strength and minimum weight.

It is also an important object of the present invention according to a modification thereof to provide in a sectional pile a connecting device or coupling to be placed on the upper end of the lower of two pile sections and to receive the lower end of the upper section and hold said upper section in proper position with reference to the lower section.

With these and other objects in view as will appear hereinafter, my invention consists of certain novel features of construction, combination and arrangement of parts and portions as will be hereinafter described in detail and particularly set forth in the appended claims, reference being had to the accompanying drawing forming a material part of this disclosure, in which

FIG. 1 is a top plan view of the reinforced concrete pile embodying one form of my invention.

FIG. 2 is a vertical sectional view taken on the line
2—2 of FIG. 1, parts being omitted.

FIG. 3 is a vertical sectional view taken on the line
3—3 of FIG. 2.

FIG. 4 is a view similar to FIG. 2 showing the pile being driven into the soil, the driving hammer head being shown in operative position on the top of the H-beam reinforcing member.

FIG. 5 is a bottom plan view of the hammer head.

FIG. 6 is a top plan view of the boot or shoe.

FIG. 7 is a vertical sectional view of the bottom end of a pile embodying a modified form of the boot or shoe.

FIG. 8 is a vertical sectional view through the joint of another modified form of reinforced concrete pile.

FIG. 9 is a cross-sectional view taken on the line 9—9 of FIG. 8.

FIG. 10 is a top perspective view of the coupling device or connector used for joining the sections of FIG. 8.

FIG. 11 is a view similar to FIG. 1 of a reinforced concrete pile embodying a still further modified form of

FIG. 12 is a similar view of a reinforced concrete pile embodying yet another modified form of the invention.

FIG. 13 is a vertical sectional view similar to FIG. 8 through the joint of another modified form of reinforced concrete pile.

Referring now in detail to the various views of the drawings, in FIG. 4 a reinforced concrete pile embodying one form of the invention is shown designed generally at 10. The pile 10 is shown partly driven into the ground 12. The improved pile 10 comprises an elongated straight sided body 14 of concrete with flat top and bottom ends 16 and 16, respectively. A metal H-beam 20 is embedded in the center of the body. The H-beam extends the length of the body and protrudes slightly above and below the top and bottom ends of the concrete body as indicated at 22. The reason for this slight protrusion will be more fully described hereinafter.

In accordance with the invention, metal angle lugs 24 are welded to the web portion 26 of the H-beam and project laterally being embedded in the concrete of the body as shown most clearly in FIGS. 2, 3 and 4.

According to the invention, both ends of the concrete body 14 of the pile are formed with central H-shaped recesses 28 around the ends of the H-beam 20 and being of such dimensions so as to leave a clearance 30 on each side of the web portion 26 and a clearance 32 on the outside of each flange 34 of the H-beam as best seen in FIG. 1. The purpose of these clearances will be more fully described hereinafter.

Another important feature of the invention is a driving boot or shoe 36 that is slipped over the bottom end of the H-beam 20 covering the bottom face 18 of the pile body 14, thereby forming an extension of the body. The boot or shoe 36 is made preferably of one piece of cast steel but may be made of other suitable material such as cast iron or other alloyed metals. The boot or shoe has a solid conical shaped body 38 tapering to a point 40 and having a flat top surface 42 as viewed at the bottom of FIG. 4, with a peripheral upstanding flange 44 to protect the lower outside edge of the pile body 14 against driving action. At the center of the top surface 42, there is a pair of closely spaced perpendicular plate-like flanges 46 and closely spaced at right angles from the ends of these flanges 46 there are similarly shaped perpendicular plate-like flanges 48. The space 50 between the ends of flanges 46 and the inner faces of flanges 48 is sufficiently wide to receive the lower ends of the flanges 34 of the H-beam 20 and the space 51 between the flanges 46 is sufficiently wide to receive the web 26 of the H-beam, as best seen in FIG. 4.

The recesses 30 and 32 in the bottom end of the body of the pile are sufficiently deep, wide and long to receive the plate-like flanges 46 and 48 to avoid contact with the concrete constituting the pile body 14. On each side of the pair of flanges 46 there are recesses 54 which are provided for cost saving only.
The reinforced concrete pile 10 is adapted to be driven into the soil 12 as shown in FIG. 4, by means of a driving hammer head 56 having a circular body or base 58 with a vertically square-shaped enlargement 60 as shown in FIGS. 4 and 5, and centrally of the enlargement there is a pair of closely spaced plate-like depending flanges 62, 64. Along opposed sides of the enlargement 60, there are depending plate-like flanges 64, 66 spaced as shown at 63 from the ends of the flanges 62, 64 sufficiently to receive the top ends of the flanges 34 of the H-beam as shown in FIG. 5. The space 61 between the flanges 62, 64 is sufficient to receive the web 26 of the H-beam.

In operative position as shown in FIG. 4, the enlargement 60 of the hammer head 56 seats on the top end edges of the flanges 34 and the web 26 of the H-beam, thereby spacing the circular body 58 of the hammer head away from the top concrete surface of the body 14 of the pile, and spacing the bottom end edges of the flanges 62 and 64 away from the base of the recesses 30 and 32 shown at the top of FIG. 4. Accordingly there is a metal to metal drive from the hammer head surface 60 to the H-beam web 26 and flanges 34, and the concrete body 14 is therefore protected from damage. The boot construction affords an easy start for the driving operation of the pile and affords maximum support for the pile during driving, as well as reinforcing and protecting the lower end of the pile and preventing it from splitting or cracking. This is due to the metal to metal contact of the lower surfaces of the H-beam web 26 and flanges 34 bearing upon the top flat surface 42 of the boot in the spaces 50 and 51.

In FIG. 7 a modified form of boot or shoe 10b is shown and differs from the boot or shoe 10 of FIG. 4 in that the solid body 14b is straight along its bottom side and is formed with a curved recess 66 providing a dish-shaped body with a cutting edge 68. The recess 66 draws in and compresses the soil within this recess when the pile is driven.

FIG. 8 illustrates another modified form of reinforced concrete pile 10b which pile is sectional, two adjoining sections 70 and 72 being shown and joined by a coupling device or connector 74. The pile sections are similar in construction to the body of the pile 10 as shown in FIG. 2 and similar reference numerals are used to indicate similar parts.

The coupling device or connector 74 comprises a metal casting consisting of a circular body or base 76. Projecting from each side of the body or base, the top side and the bottom side as viewed in FIGS. 8 and 10, there is a pair of closely spaced plate-like flanges 78 disposed centrally and transversely thereof. At each end of the flanges 78 and spaced therefrom is a similarly shaped plate-like flange 80. The spacing between the lengths of the flanges 78 and that between their ends and the inner faces of flanges 80, and their lengths, widths and depths are exactly the same as for the flanges described and illustrated in FIGS. 5 and 6 in reference to the hammer head 56 and boot or shoe 36.

The driving action forces of this sectional pile, FIG. 8, will be delivered to the top end of the H-beam flanges 34 and web 26 of the section 70 by a hammer head 56 in the same manner as illustrated in FIG. 4 and described in reference to FIG. 4. This driving force downwardly of the H-beam in section 70 is exerted upon the top surface of the coupling or connector 74 in the same manner that the H-beam shown in FIG. 4 exerts upon the flat top surface 40 of the boot or shoe 36. These driving forces are then delivered from the boot or shoe 36 to the H-beam in the lower section 72 and through to the lower end to drive the boot and shoe 36, shown in FIG. 4, into the ground. It is hereby readily seen that the driving forces required to force or drive a multiple sectional pile as illustrated in FIG. 8, whether two or more sections, into bearing position are accomplished by metal-to-metal forces without disturbing or fracturing the pile's concrete body formation.

In operation, the lower pile section 72 when driven into the earth has the coupling device 74 placed on the upper end of the section with the flanges 80 outside the flanges 34 of the H-beam and with the flanges 78 on the inside of said flanges 34 and on opposed sides of the web 26. Then the upper section 70 is lowered with the flanges 34 of the H-beam placed between the flanges 80 and 78 of the coupling device or connector taking the position as shown in FIG. 8 thereby aligning the H-beam flanges and webs of both pile sections 70 and 72.

It will be evident that the coupling device or connector 74 serves to provide a strong and effective connection between the adjacent ends of the pile sections 70 and 72.

The modified form of reinforced concrete pile 10c shown in FIG. 11 differs from the concrete pile 10 of FIG. 1 merely in that reinforcing rods 82 are provided in the body 14c of the pile 10c.

The modified form of reinforced concrete pile 10d shown in FIG. 12 is similar to the pile 10 except that the body 14d of the pile 10d is multi-sided.

Referring to FIG. 13, another modified form of concrete pile is illustrated. In this form, a modified coupling or connector 75 provides a column with two or more sections and all the features and construction of the coupling or connector 74 of FIG. 10 including its circular body or base 76a with the exception that at the periphery of the circular body or base 76a there are upward and downward extending flanges 84 and 86, respectively. These flanges are provided to create more stability and rigidity between the pile sections 70a and 72a and protect their lower and upper concrete edges. With this modified form of coupling or connector, the driving forces for the assembled pile are delivered from the upper pile section 70 through the H-beam to the lower section 72a by means of the circular body or base 76a as already described above in view of the coupling or connector 74, FIG. 10.

All features and construction of pile sections 70a and 72a are exactly the same as those shown and described in reference to FIGS. 1, 2 and 6, and similar reference numerals are used to indicate similar parts. The driving forces will be delivered in like manner to force the pile into the ground to its required depth without distraction or damage to the main concrete body 14 of the pile structure.

In this pile construction, the very slight protrusion of the H-beam reinforcement as shown, and the slight clearance between the lower surface 18 of the pile and the flat surface 42 of the boot or shoe 36, FIG. 4, and the very slight clearance 45 shown between the two top and bottom sections of a multiple sectional pile, FIGS. 8 and 13, and the connector 74 or 74a will be reduced to a minimum due to the driving pressures directed upon the surfaces of the flanges and webs of the H-beam 20 reinforcement of the pile structure. It must be realized that some amount of swedging action of the H-beam end surfaces area, the web and flanges, will take place due to the driving force of the hammer head 56 at the head of the pile, and at its base where it is in contact with the boot or shoe 36 as illustrated in FIG. 4. The same swedging action will take place between the lower and upper ends of the H-beam in the upper and lower sections 70 and 72, 70b and 72b as shown in FIGS. 8, and 13, respectively. This swedging action will cause the lower end 18 of the concrete body 14 of the reinforced concrete pile sections to recede to within close contact of its end surfaces to its next preceding unit or member without cracking the lower edges or surfaces of the concrete body 14 of the pile or pile sections in no manner what sequence they may be used, singu-
larily or in the plural to form a complete pile for support purposes. The clearance 45, FIG. 4, between the bottom surface 18 and the flat top surface 42 of the boot or shoe 36 will be eliminated due to the driving forces upon the H-beam, and in view of FIGS. 8 and 13, the driving force sweding action upon the surfaces of the H-beam 20 ends will also close up the space 45. This sweding action due to the beam forces upon the pile or connected pile sections will bring the ends thereof closely into contact with the concrete body of the pile into contact with each other. While I have illustrated and described the preferred embodiments of my invention, it will be understood that other modifications might be made and changes in details made without departing from the principles of the invention and I desire therefore to be limited only by the state of the prior art and the appended claims.

I claim:

1. In combination with a hammer head having a circular body with depending pairs of spaced plate-like flanges, a reinforced concrete pile, a cylindrical solid body of concrete, a metal H-beam in the center thereof extending from end to end thereof serving as a reinforcement, one end of said H-beam extending beyond one end of said pile, the other end being in alignment with the concrete, said solid body having H-shaped recesses in the ends thereof, an H-beam extending through the center of the body from end to end thereof, said beam extending into the recesses, one end of each H-beam extending beyond one end of its pile section, the other end being in alignment with the concrete, a connecting device between said closely spaced ends, said device having an upstanding pair of closely spaced flanges in the center and an upstanding remotely spaced pair of flanges perpendicularly arranged relative to the ends of the closely spaced flanges, said flanges extending into the end recess of the section above the flat body of the device and disposed alongside of and in interlocking relation with the web and flanges of the H-beam; said device having a downwardly extending pair of closely spaced flanges in the center and a downwardly extending remotely spaced pair of flanges perpendicularly arranged relative to the ends of the closely spaced flanges, said flanges extending into the end recess of the section above the flat body of the device and disposed alongside of and in interlocking relation with the web and flanges of the H-beam.

2. In combination with a hammer head having a circular body with depending pairs of spaced plate-like flanges, a reinforced concrete pile having an elongated circular body in cross-section of concrete, a metal H-beam in the center thereof, extending from end to end thereof serving as a reinforcement, said solid body having H-shaped recesses in the ends thereof centrally of the body, the ends of the flanges and web of the H-beam extending outwardly into and through said recesses and slightly above the body, the web at one end fitted between one pair of depending flanges on the hammer head, the ends of the flanges disposed outwardly of another pair of depending flanges on the hammer head, said ends of the web and flanges supporting the hammer head which is adapted to receive hammer blows of a hammer, and a pointed driving boot interlocked with said H-beam underneath the concrete body.

3. In combination with a hammer head having a circular body with depending spaced plate-like flanges, a reinforced concrete pile having an elongated circular body in cross-section of concrete, a metal H-beam in the center thereof, extending from end to end thereof serving as a reinforcement, one end of said H-beam extending beyond one end of said pile, the other end being in alignment with the concrete, said solid body having H-shaped recesses in the ends thereof centrally of the body, the ends of the flanges and web of the H-beam extending outwardly into and through said recesses with a clearance therebetween, the end of the web at one end of said H-beam fitted between one pair of depending flanges on the hammer head, the ends of the flanges disposed outwardly of another pair of depending flanges on the hammer head, said ends supporting the hammer head which is adapted to receive hammer blows of a hammer, spaced legs extending radially from both sides of the web of the H-beam into the concrete body serving as reinforcing elements, and a pointed driving booth interlocked with the outstanding ends of the flanges and the web at the other end of the H-beam.

4. A multiple section reinforced concrete pile, each section having an elongated cylindrical solid concrete body, with H-shaped recesses at both ends thereof, an H-beam extending through the center of the body from end to end thereof, one end of said H-beam extending beyond one end of said pile, the other end being in alignment with the concrete, the ends of the flanges and web of said H-beam extending through the recesses in the ends of the body with clearance therearound, the sections being in end to end alignment closely spaced from each other, a metal connector device interposed in the space between adjacent ends of the sections, said device having a pair of closely spaced upstanding flanges extending into the recess in the adjacent body interlocking with the web of the H-beam in the clearance therearound; said device having a pair of remotely spaced upstanding flanges perpendicularly arranged relative to the closely spaced flanges and extending into the same recess interlocking with the flanges of the H-beam in the recess in the clearances therearound; said connector device having pairs of upwardly and downwardly extending flanges on the opposed sides of the periphery of the flat body, said flanges engaging the outer surface of the concrete body on both sides of the junction between the sections to add rigidity and stability to the sections and to protect the peripheral edges of the bodies of the sections.

(References on following page)
<table>
<thead>
<tr>
<th>References Cited</th>
<th>7 References Cited</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNITED STATES PATENTS</td>
<td></td>
</tr>
<tr>
<td>1,759,786 5/1930</td>
<td>Hardin --------------</td>
</tr>
<tr>
<td>1,858,918 5/1932</td>
<td>De Vou --------------</td>
</tr>
<tr>
<td>1,954,070 4/1934</td>
<td>Cook --------------</td>
</tr>
<tr>
<td>2,141,107 12/1938</td>
<td>Greulich --------------</td>
</tr>
<tr>
<td>2,211,375 8/1940</td>
<td>Greulich --------------</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>8 References Cited</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOREIGN PATENTS</td>
</tr>
<tr>
<td>2,562,860 7/1951 Cobi ---</td>
</tr>
<tr>
<td>2,731,824 1/1956 Hadley ---</td>
</tr>
</tbody>
</table>

| 5 373 | 1907 Great Britain. |
| 3,730 | 1908 Great Britain. |