May 9, 1961 T. C. BRUNS 2,983,104

SECTIONAL PILES

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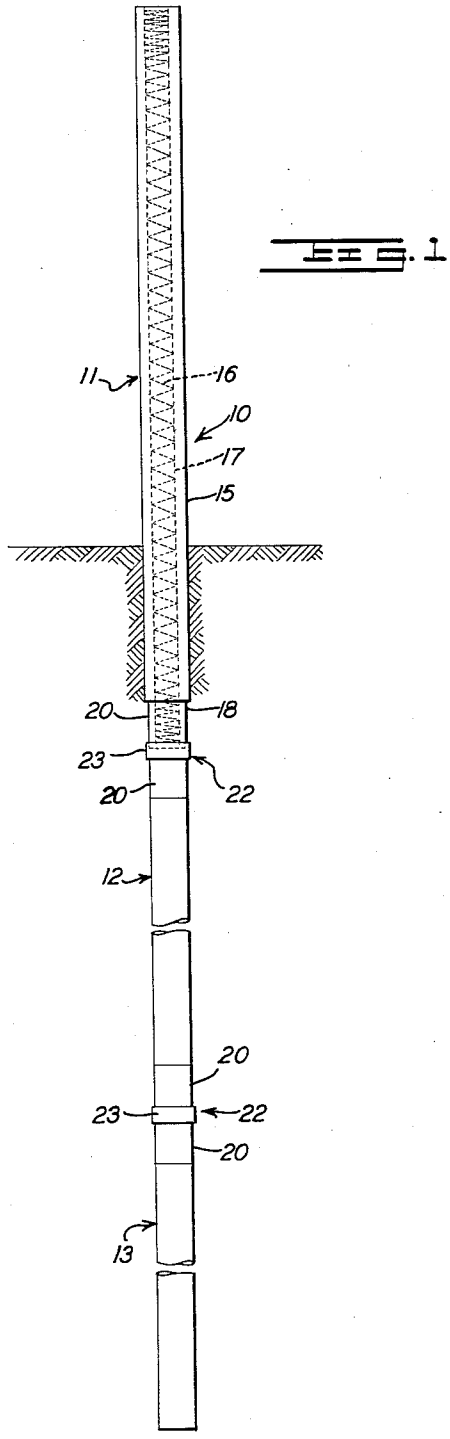


Fig. 1.

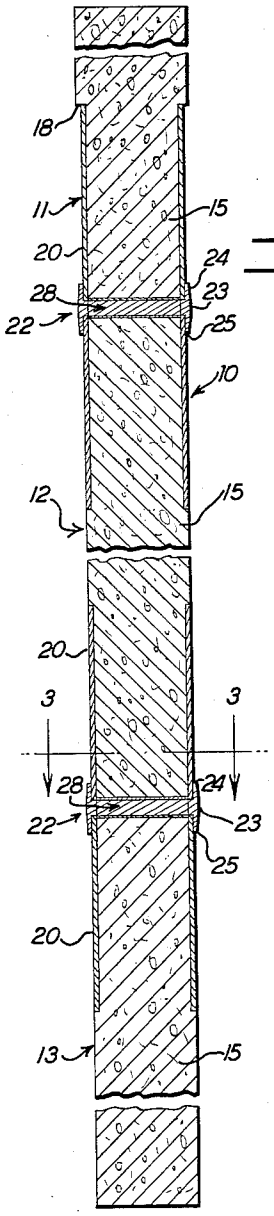


Fig. 2.

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Fig. 4.

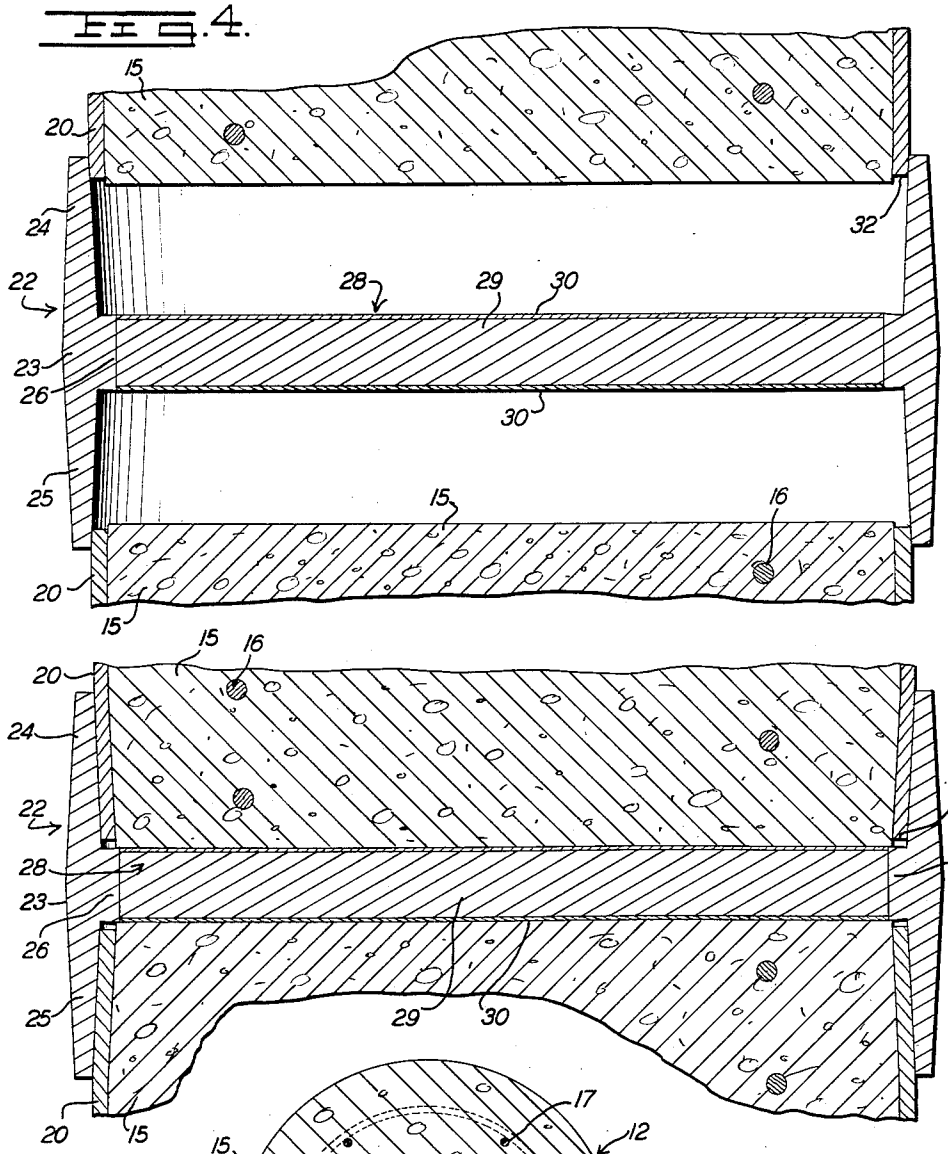


Fig. 5.

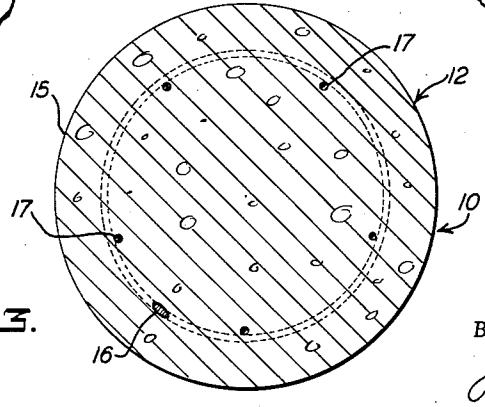


Fig. 3.

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SECTIONAL PILES

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4 Claims. (Cl. 61—56)

This invention relates to improvements in sectional piles.

The invention more particularly relates to a novel type of sectional preferably reinforced concrete piles. In some parts of the country, it is necessary to drive piles of a length up to one hundred feet, and it is the common practice at present to cast such piles in single units. This is highly disadvantageous for several reasons. In the first place, the length of the piles is so great as to make it highly impracticable to cast the piles at the site, and the transporting of piles made away from the site is extremely difficult and expensive. Moreover, driving of a pile of such length requires special and extremely expensive pile driving apparatus.

An important object of the present invention is to provide a novel type of sectional pile of such nature as to facilitate the casting of the piles at the site with a much higher degree of practicability than is possible where single long piles are cast.

A further object is to provide a pile construction formed of sections of such length as to facilitate loading them on trucks when the sections are made at a casting yard away from the building site.

A further object is to provide such a pile structure which facilitates and makes practical the hauling of piles on trucks of conventional type, there being no need for special and very expensive trucks such as are required for transporting longer piles.

A further object is to provide a sectional pile structure of the character referred to which eliminates the very heavy and expensive reinforcing rods which are required for piles even of intermediate lengths such as fifty feet, since reinforcing rods for such piles and longer ones must be very large and numerous to prevent the pile from breaking when being handled in a horizontal position before it is up-ended to the vertical position for driving the piles.

A further object is to provide a sectional pile which, where a one hundred foot pile, for example, is desired, could be cast in two, three or more sections and associated with each other in end-to-end relation at the driving site by means of a novel connecting element between the pile sections.

A further object is to provide such a sectional pile structure wherein the connecting member between the pile sections is relatively cheap to make and is wholly practicable in use with wide manufacturing tolerances, and wherein the driving forces are transmitted from an upper to a lower pile section through such connecting means in a novel manner.

A further object is to provide sectional piling of this character wherein the connecting member is formed wholly separate from the pile sections and efficiently performs its function without being welded or otherwise positively connected to the adjacent pile sections.

A further object is to provide piling of this character wherein the connecting member has associated therewith

a novel impact plate between adjacent ends of the pile sections and through which most of the driving forces are transmitted and to so form the body of the connecting member as to effect a tight fit thereof with the adjacent pile sections and to transmit part of the driving forces therethrough, thus relieving the impact plate from some of such forces and minimizing the danger of cracking the concrete bodies of the piles.

A further object is to provide such a construction wherein the body of the connecting member is provided with upper and lower coaxial annular flanges engageable with the adjacent ends of the adjacent pile sections to clamp inwardly thereagainst to effectively confine such adjacent ends of the pile sections to minimize any danger of the cracking of the concrete of the pile sections and to assist in transmitting driving forces from each pile section to the next adjacent lower pile section.

Other objects and advantages of the invention will become apparent during the course of the following description.

In the drawings I have shown one embodiment of the invention. In this showing:

Figure 1 is a side elevation of a complete pile unit of the preferred type, shown partially driven into the ground;

Figure 2 is an enlarged fragmentary axial sectional view through three of the pile sections, parts being broken away;

Figure 3 is an enlarged transverse section on line 3—3 of Figure 2;

Figure 4 is a substantially enlarged fragmentary axial sectional view showing the relation of two adjacent pile sections with the connecting means, upon the initial assembling thereof; and

Figure 5 is a similar view with the parts driven completely together in driving relationship and in the relationship which the parts will retain throughout the driving operation.

Referring to the drawings, numeral **10** designates a pile unit as a whole shown in the present instance as comprising an upper pile section **11**, an intermediate pile section **12**, and a lower pile section **13**. While the pile unit is shown in the present instance as comprising three sections, it will be obvious that the invention is applicable for use with two sections or more than three sections, if desired.

Each pile section comprises a concrete body **15** of the usual cement mixture. Each body **15** is preferably provided with spiraled reinforcing **16**, the turns of which are fixed with respect to each other by longitudinally extending reinforcing rods **17**. The reinforcing elements **16** are preferably more closely spiraled toward the ends of each pile section, as indicated in Figure 1, to increase the ability of each section to absorb driving shocks, as will be apparent. The particular reinforcing means employed forms no part per se of the present invention. The upper end portion of the upper body **15** may be of greater diameter than the lower end of such section, as shown in Figures 1 and 2, the lower end of the larger portion of the section being shouldered as at **18**.

The adjacent ends of the pile sections are provided with steel jackets **20** which are in position in the molds when the bodies **15** are cast, as will be apparent, and the diameter of the pile sections **12** and **13** may be uniform from end to end, if desired, as shown in Figures 1 and 2.

Between the adjacent ends of each adjacent pair of pile sections is arranged a connecting unit **22**. Such connecting unit comprises an annular member **23** having integral upwardly and downwardly extending annular flanges **24** and **25** into which the adjacent ends of the

pile sections are adapted to be initially inserted as shown in Figure 4. Each body **23** is further provided intermediate its ends with an internal annular flange **26**, the internal diameter of which is approximately equal to the internal diameter of the adjacent sleeves **20**.

Each driving unit **23** further comprises a plate **28** which may be integral and formed of such deformable material as friction board, and the plate is shown in the present instance as being formed of an interior relatively thick body **29** and veneer layers **30**. If such plate is employed, the body **29** may be formed of a steel plate with the veneers **30** formed of sheet lead or felt, or the same material may be applied against both sides of a concrete disk forming the body **29**.

The body **23** may be formed in any desired manner, for example as a forging, and the inner surfaces of the flanges **24** and **25** converge toward each other as shown in somewhat exaggerated form in Figures 4 and 5. The internal diameters of the remote ends of the flanges **24** and **25** are preferably approximately equal to or very slightly greater than the external diameter of the ends of the sleeves **20** so that, when these elements are initially brought together, they will occupy the relative positions shown in Figure 4, with the adjacent ends of adjacent pile sections positioned near the extremities of the flanges **24** and **25**. It also will be noted that the adjacent ends of the sleeves **20** of adjacent pile sections are offset slightly away from the bodies **15** of the pile sections, as indicated in Figures 4 and 5 by the numeral **32**. The purpose of this arrangement will be described below.

Operation

A standard pile driving rig may be employed for driving the pile sections due to the limited lengths thereof, it being unnecessary to use highly expensive special rigs for this purpose. For example, for a long pile unit, the individual sections may be approximately 33 feet in length, and accordingly each individual section can be accommodated beneath the hammer of a standard driving rig.

The lower section **13** is first placed in position at the desired point, and obviously this section is free to be driven directly against the top thereof since no connecting unit **22** is employed at such time. The lower section **13** is driven into the ground until the upper end of such section is only slightly above the surface of the ground. One of the units **22** is then placed in position on the upper end of the section **13**, which may be assumed to be the lower pile section in Figure 4. It merely is necessary to engage the lower extremity of the flange **25** of such unit **23** around the upper extremity of the sleeve **20** of the lower pile section. The pile section **12** is hoisted into position above the previously placed connecting unit **22** and lowered into position as shown in Figure 4. The lower extremity of the sleeve **20** of such pile section will enter slightly within the flange **24**.

The pile driving rig is now operated to drive the pile section **12** downwardly, it being understood that the upper end of such section is open and free so that the driving forces are directly delivered to the upper end of the body **15** of such section. The driving of the second section causes the lower end of the second section to be driven into the flange **24** while the flange **25** will be driven downwardly over the sleeve **20** of the lowermost section, and the parts are driven until they assume the final positions shown in Figure 5. The lower and intermediate pile sections then become a unit to be driven downwardly until the upper end of the second section **12** projects only slightly above the surface of the ground. The previous operation is then repeated, the upper pile section **11** being hoisted into position above the upper end of the intermediate pile section **12**, whereupon the parts are brought into the relationship shown in Figure 4 and the third driving operation performed. The completed pile unit may be driven downwardly as far as desired.

Particular attention is invited to the fact that the connecting units **22** are formed wholly separate from the pile sections and are never positively connected thereto by welding or any other means. With the parts formed as shown, manufacturing tolerances are not particularly important and, accordingly, economy in the manufacture of the parts is accomplished. With the parts in the positions shown in Figure 5, impact forces are delivered through the impact plate **28** to the next lower pile sections. The deformability of the plates **28** or the veneers thereon permits such deformable surfaces to be deformed to accommodate themselves to irregularities in the ends of the pile sections to secure a uniform distribution of forces from each upper pile section to the next lower pile section, thus minimizing chances of cracking the concrete of the pile sections.

Particular attention is also invited to the fact that the driving together of the pile sections from the relative positions of the parts in Figure 4 to the positions in Figure 5 causes the sleeves **20** of adjacent pile sections to become tightly wedged in the flanges **24** and **25**, thus very effectively confining the adjacent ends of the pile sections radially thereof to further minimize cracking.

It also will be noted that the sleeve sections **20** are slightly shortened as at **32**. This arrangement eliminates any direct transmission of driving forces from an upper section body **15** through its sleeve **20**, through the flange **26**, and thence through the upper end of the next lower sleeve **20** and to the next lower body **15**. Such direct transmission of forces would prevent the use of the entire areas of the adjacent ends of the pile sections for the transmission of driving forces from an upper pile section to a lower pile section. With the arrangement shown, most of the forces are directly transmitted through the impact plates **28**. Some forces will be transmitted from each upper sleeve **20** and through the associated flanges **24** and **25** to the next lower sleeve **20** and thus to the next lower pile section body **15**. This frictional transmission of forces merely reduces somewhat the direct positive transmission of driving forces through the plates **28**, thus further minimizing the danger of cracking the pile section bodies, but such forces are not sufficient to break loose any of the sleeves **20** from their associated bodies **15**.

In practice, therefore, it has been found that the present pile structure is of such nature that the relatively short sections readily may be cast at the site, thus eliminating expensive and difficult transportation of single long pile units. It also will be apparent that each pile section is directly driven by engaging the pile driver hammer against the top thereof and that the driving forces are effectively transmitted from each pile section to the next lower pile section with no danger of cracking the concrete bodies of the pile sections. Particular attention is again directed to the fact that the connecting units **22** are conveniently formed wholly separately from the pile sections, it being entirely unnecessary to weld or otherwise fix either of the connecting units to any pile section. The adjacent ends of the pile sections are effectively radially confined to prevent cracking, and the assembling of the parts in final relation as shown in Figure 5 is accomplished merely by the delivering of the usual pile driving forces to the upper end of the uppermost pile section. The parts automatically assume the proper positions through the delivering of the driving forces, and as stated, the driving forces are safely and efficiently delivered from each upper pile section to the next lower pile section. The end result is a pile unit which is just as effective as a single unit, and the cost of making and driving the pile sections and associated parts is very much reduced from what is involved in the making and driving of single long pile units.

It is to be understood that the form of the invention shown and described is to be taken as a preferred example

of the same and that various changes in the shape, size, and arrangement of the parts may be made as do not depart from the spirit of the invention or the scope of the appended claims.

I claim:

1. A pile unit comprising a pair of pre-formed concrete pile sections adapted to be arranged in end-to-end relation and having metallic sleeve portions surrounding adjacent ends of such sections, and a connecting unit separate from said sections and arranged therebetween, said connecting unit comprising a body having an axial opening therethrough substantially equal in diameter to the diameter of the adjacent ends of said pile sections, said connecting unit having coaxial flanges surrounding adjacent ends of said sleeve portions, each flange throughout its length and the adjacent end of the adjacent sleeve portion slightly diverging from the extremity of the latter, whereby said sleeve portions are driven into said flanges by the application of driving force to the upper of said sections, and an impact plate separate from said connecting unit arranged between said pile sections and substantially equal in diameter to said axial opening and having at least the upper and lower surface portions thereof deformable to accommodate them to irregularities in the adjacent end surfaces of said pile sections.

2. A pile unit according to claim 1 wherein said body of said connecting unit is provided with an internal flange centrally of the length thereof having an internal diameter approximately equal to the diameter of the adjacent ends of said pile sections within said sleeves, said impact plate being arranged within said internal flange.

3. A pile unit according to claim 1 wherein said sleeve portions are substantially cylindrical and said coaxial flanges have internal conical surfaces into which said sleeve portions are adapted to be wedged, said body of said connecting unit having an internal flange centrally of the length thereof having an internal diameter approximately equal to the diameter of the adjacent ends of the concrete portions of said pile sections within said sleeve portions, said impact plate being arranged within said internal flange and the adjacent ends of said sleeve portions terminating in spaced relation to said internal flange when the concrete portions of the adjacent ends of said pile sections are engaged with said impact plate.

4. A pile unit according to claim 3 wherein the smaller ends of said conical surfaces adjacent said internal flange are slightly smaller in diameter than said sleeve portions whereby, when said sleeve portions are initially inserted in said coaxial flanges, they will engage thereagainst with the adjacent ends of said pile sections in spaced relation to said impact plate.

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