May 31, 1960 J. J. DOUGHERTY 2,938,355

TRANSITION SLEEVE

Filed Sept. 17, 1958 2 Sheets-Sheet 1

Fig. 2

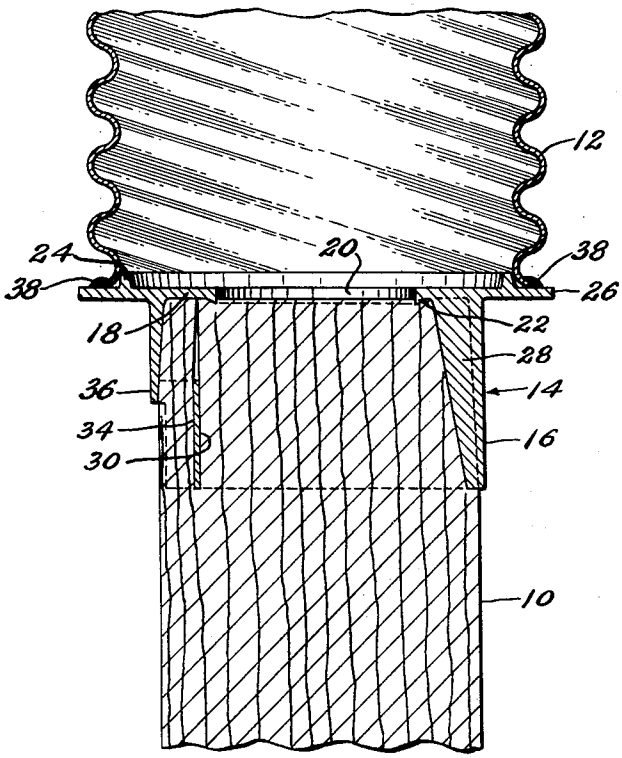


Fig. 1

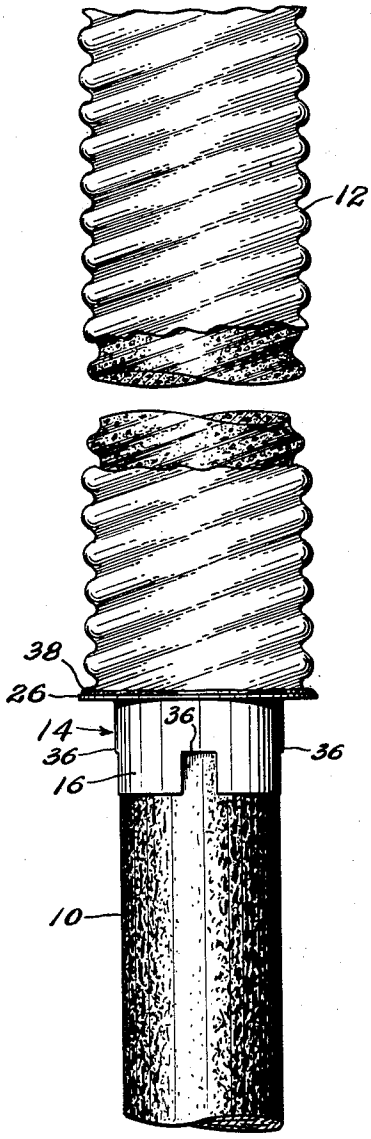
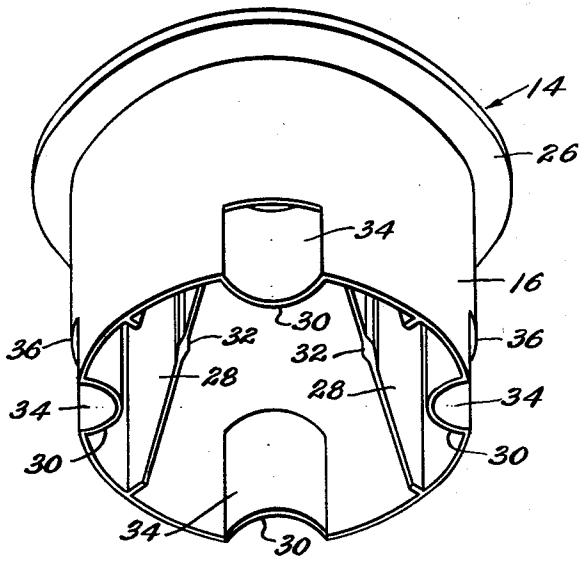


Fig. 3



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May 31, 1960 J. J. DOUGHERTY 2,938,355

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Filed Sept. 17, 1958 2 Sheets-Sheet 2

Fig. 4

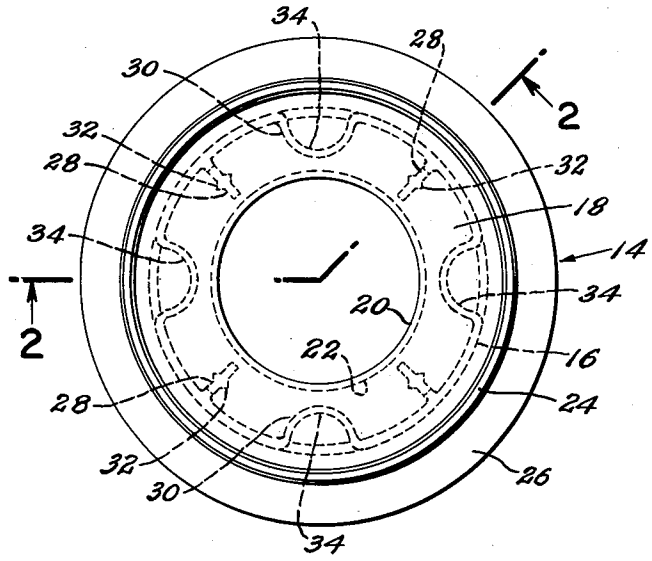


Fig. 5

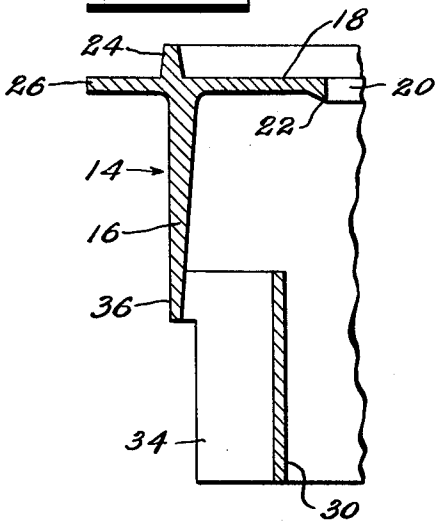
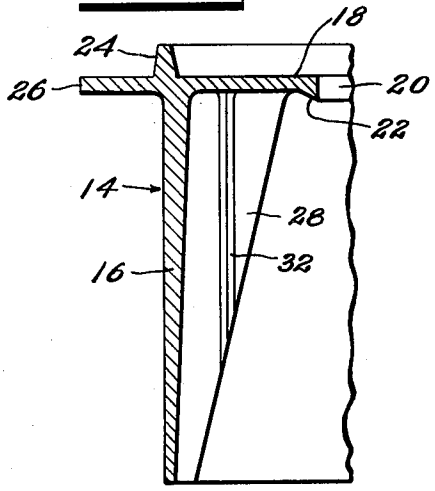


Fig. 6



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TRANSITION SLEEVE

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3 Claims. (Cl. 61—53)

This invention relates generally to piling and more particularly to an improved joint between the sheet metal shell containing the concrete and the wooden timber pile.

Piles are used to support or to form foundations for structures such as buildings, tanks, bridges, conduits, piers, wharves, etc., by inserting them into or through the yielding surface strata far enough to obtain a solid support for the principal structure. A composite wood-concrete pile structure is ordinarily used for this purpose.

One of the problems in composite piling of this type is that of providing a strong joint between the wood and concrete sections. This is important because a piling may be subjected to lateral and tension forces as well as compressional forces.

It is therefore a principal object of the present invention to provide an improved joint in the form of a fitting between the sheet metal shell containing the concrete and the timber pile that has high resistance to lateral stresses.

Another object of the invention is to provide an improved fitting of this type that is especially well adapted to withstand both tensional and compressional longitudinal forces as well as lateral stresses.

A further object of the invention is to provide an improved joint of this type in the form of a fitting that provides a watertight seal between the sheet metal shell and the transition sleeve.

A still further object of the invention is to provide an improved joint of this type in the form of a fitting that provides a watertight seal between the transition sleeve and the timber pile.

Yet another object of the invention is to provide an improved composite pile that can be readily assembled and driven and which has high structural strength.

It is also an object of the invention to provide an improvide joint of this type that is economical to manufacture, rugged in construction and highly efficient for the purpose intended.

For further comprehension of the invention and of the objects and advantages thereof reference will be had to the accompanying drawings and to the description thereof to follow.

In the accompanying drawings forming a material part of this disclosure:

Fig. 1 is an elevational view of a fragment of a composite pile having a transition sleeve embodying my invention.

Fig. 2 is an enlarged vertical sectional view through the composite pile taken substantially on the plane of the line 2—2 of Fig. 4, the concrete being omitted.

Fig. 3 is an enlarged top perspective view of the transition sleeve on the same scale as Fig. 2.

Fig. 4 is a top plan view of the transition sleeve.

Fig. 5 is an enlarged fragmentary sectional view showin a well construction.

Fig. 6 is an enlarged fragmentary sectional view showing a cleat construction.

Referring in detail to the drawings, in Fig. 1 a composite pile is shown comprising two principal parts: a wooden lower section or timber pile **10** and an upper concrete-filled casing section formed of a corrugated sheet metal shell **12** and a fitting **14** joined to and forming a continuation of the shell. The fitting will hereinafter be referred to as a "transition sleeve."

The wooden section **10** ordinarily will be generally circular in cross-section, such as a section of log. The cross-section of the wooden section is slightly smaller than the inside diameter of the transition sleeve **14**.

In accordance with the invention, the transition sleeve **14** is formed of a length of steel pipe or the like of any desired and suitable diameter and is fabricated by casting, welding or in any other suitable manner. The pipe **14** may have any desired length suitable to resist lateral forces.

Structurally the transition sleeve **14** is cast in one piece from steel and comprises a hollow cylindrical body **16**, with a tapered inner surface so that the thickness diminshes from top to bottom. A flange **18**, at the top of the body, extends inwardly a short distance providing a central opening or port **20**. The edge wall of the opening is enlarged at its bottom periphery forming a downwardly facing lip **22** which serves as a sealing ridge. An upright flange **24** extends upwardly from the juncture of the body and flange **18**. Flange **24** is circular in plan and trapezoidal in cross-section. Flange **24** acts as a centering device for the sheet metal shell **12** when it is positioned for connection to the transition sleeve **14** and acts as a backing up strip to prevent "burn through" during the welding operation, if the transition sleeve is welded to the shell. The flange **18** provides a support inside the transition sleeve for a pile-driver mandrel which is lowered into the shell and sleeve for driving the pile, and the opening or port **20** provides a clearance for a preformed portion on the end of the timber pile.

An annular flat flange **26** extends laterally outwardly from the junction of the body **16** and upright flange **24**. The flange **26** is rectangular in elevation and in cross-section, serving as a bearing to which the bottom of the shell **12** is welded.

A still tighter fit between the wooden pile **10** and the transition sleeve **14** is provided by a plurality of cleats **28** and recesses or wells **30** extending inwardly and spaced alternately around the inner periphery of the body **16**, at forty-five degree increments. The cleats are triangular in configuration and extend the length of the body. The material of each cleat is bulged out along the center thereof, on both sides thereof, forming a rib **32** on each side of the cleat extending from top to bottom thereof. The rib is triangular in cross-section.

Each well **30** is formed by an indented or depressed portion **34** of the wall of the body **16** projecting inwardly of the body. The indented portion **34** is spaced and overlapped by the adjacent portion **36** of the wall of the body extending from the respective springing lines or points of contact between the individual curves. The overlapping portion **36** of the body extends only approximately a third of the distance measured from the top.

The shell **12** is joined to the transition sleeve **14** in any suitable or well known manner. Preferably, as shown in the drawings, the shell is welded as at **38** to the outer flange **26**. The shell preferably is corrugated in helical or spiral turns. Helical corrugations are preferred as they contribute to the lateral rigidity of the joint.

In assembling and placing the composite pile, the wooden section **10** first is driven with a pile driver in the usual way until its upper end is just above the surface of the soil or water, as the case may be. The assembled shell **12** and transition sleeve **14** are then placed in posi-

tion on top of the partially driven wooden section **10** and a suitable mandrel is lowered into the joined shell and transition sleeve until it rests on the inner flange **18**. The pile driver is then used to drive the transition sleeve **14** down over the upper portion of the wooden section thereby fitting the transition sleeve **14** snugly onto the wood.

During this driving operation, the wells **30** penetrate and cut away material of the timber pile, but the flow of cut material is controlled assuring the proper formation and compression of that portion of the timber pile required to seal the void left by the penetration of the wells. The wells displace a volume equal to their own when driven into the timber pile to augment the compressive stress within the wall of body **16** for greater frictional bond. As the lower edge of each well **30** penetrates and compresses the fibers of the timber pile and progresses to its final location on the pile butt, there is a void left in its path between the upper edge of the well and the lower face of the flange **18**. This void has the configuration of the well that produced it. The stress within the fibers of the timber pile tends to relieve causing the compressed fibers to expand to refill the void forming a lock to permanently bond the transition sleeve **14** and the timber pile. It will require as much force to withdraw the well from its final position as was required to drive it thereto.

Furthermore, the cleats **28** compress and distort the fibers of the timber pile during this driving operation. The stress pattern produced by the wells and cleats is increasingly greater toward the upper end or butt end of the timber pile to produce the greatest sealing or water proofing and to produce the greatest frictional bond in the strongest part of the transition sleeve **14**. The ribs **32** on the cleats also displace and compress the fibers of the timber pile thereby increasing the frictional bond and watertight seal. The rib acts as a seal at the point where the cleat and the inner flange **18** contact one another. The rib also acts as a stiffener and as an aid to proper seating during the driving that causes the junction of the transition sleeve and timber pile.

During the driving operation, the taper of the inner surface of the wall of the body **16** of the transition sleeve **14** compresses the fibers of the timber pile to produce a seal that is watertight between the timber pile and the transition sleeve. The stress pattern, within the compressed fibers, is annular, toward the center. Since for every action there is an equal and opposite reaction, the pressure of the compressed fibers within the timber pile will press outwardly with equal force against the inner face of the transition sleeve.

It is to be noted that the entire strain of the driving operation is transferred by the inner flange **18** to the transition sleeve **14** so that the shell **12** simply is drawn down with the sleeve as the latter is driven over the wood. The comparatively thick walled sleeve **14** is fully capable of withstanding the impact force imparted by the pile driver to the follower, so that no potentially damaging forces are applied to the relatively weaker and more readily collapsible corrugated shell.

The compression of the wood fibers of the timber pile by the body **16**, cleats **28** and wells **30** forms a seal between the transition sleeve **14** and the timber pile **10**. The joint so created can be caulked, covered with a mastic or plastic material or rendered watertight by the application of a gasket or gaskets. The joint so created will be watertight under considerable hydrostatic head to provide a dry interior in the sheet metal shell **12**.

The lip **22** also forms a positive seal between the inner flange **18** and the butt end of the timber pile **10** against the entrance of ground water under hydrostatic pressure.

During the driving operation, the outer flange **26** on the body **16** of the transition sleeve produces a hole in the soil by displacement of the soil. Through this hole the sheet metal shell **12** is drawn to its final position as the mandrel pushes the transition sleeve **14**. The hole reduces the drag on the sheet metal shell since some such forms will stretch and stretching is undesirable. The size of the diameter of the hole in the soil can be controlled by the size of the outer edge of the flange **26**.

It will also be noted that the transition sleeve **14** has the additional useful function of protecting the upper end of the timber pile **10** against splitting, "dubbing over" or otherwise being damaged by the severe driving impacts.

While I have illustrated and described the preferred embodiment of my invention, it will be understood that changes in details of construction might be made without departing from the principle of the invention and I desire to be limited only by the state of the prior art and the appended claims.

I claim:

1. A composite pile comprising a lower wooden section, a substantially cylindrical casing comprising a tubular shall and a transition sleeve joined to said shell to form a continuation thereof, said sleeve having a cross section slightly larger than the cross section of the wooden section, a flange at the top of said sleeve extending inwardly thereof at right angles to the axis of the casing, said flange presenting a continuous support for a driving member lowered into said sleeve, a plurality of cleats on the inner surface of said sleeve joined to said flange, said flange and cleats serving to transfer driving impact force from a pile driver member lowered into said casing to the wall of the sleeve, said cleats being located at points substantially equidistant from and relatively close to the juncture of the shell and said sleeve, a plurality of recessed wells in the wall of said sleeve projecting inwardy from the inner surface of the sleeve spaced below said inner flange and extending to the bottom of the sleeve in alternate arrangement with the cleats, said sleeve extending around the upper portion of said wooden section to the depth of said wells and having a snug driving fit over said wooden section with said wells embedded in said wooden section and a filling of concrete in said casing above said wooden section, said recessed wells extending upwardly above the lower edge of the sleeve and being open at the top.

2. A composite pile comprising a lower wooden section, a substantially cylindrical casing comprising a tubular shell and a transition sleeve joined to said shell to form a continuation thereof, said sleeve having a cross section slightly larger than the cross section of the wooden section, a flange at the top of said sleeve extending inwardly thereof at right angles to the axis of the casing, said flange presenting a continuous support for a driving member lowered into said sleeve, a plurality of cleats on the inner surface of said sleeve joined to said flange, and extending to the bottom of the sleeve, said cleats tapering from top to bottom with the widest portion at the top, a longitudinal rib on each cleat extending centrally thereof and bulging from both surfaces thereof, said flange and cleats serving to transfer driving impact force from a pile driver member lowered into said casing to the wall of the sleeve, said cleats being located at points substantially equidistant from and relatively close to the juncture of the shell and said sleeve, a plurality of recessed wells in the wall of said sleeve projecting inwardly from the inner surface of the sleeve spaced below said inner flange and extending to the bottom of the sleeve in alternate arrangement with the cleats, said sleeve extending around the upper portion of said wooden section to the depth of said wells and having a snug driving fit over said wooden section with said wells embedded in said wooden section and a filling of concrete in said casing above said wooden section, the top ends of the wells being overlapped by the sleeve.

3. A composite pile comprising a lower wooden section, a substantially cylindrical upper casing, said casing comprising a helically corrugated shell and a smooth-walled sleeve welded thereto, a flange at the top of the sleeve extending inwardly thereof, a flange at the top of

the sleeve and extending upwardly thereof, an annular flange at the top of the sleeve and extending outwardly thereof, a plurality of cleats on the inner surface of said sleeve joined to said inwardly extending flange, said inwardly extending flange and cleats serving to transfer driving impact force from a pile driver member lowered into said casing to the wall of the sleeve, a plurality of recessed wells in the wall of said sleeve projecting inwardly from the inner surface of the sleeve spaced below said inner flange and extending to the bottom of the sleeve at uniformly spaced points about the inner surface in alternate arrangement with the cleats, said sleeve extending around the upper portion of said wooden section to the depth of said wells and having a snug driving fit over said wooden section with said wells embedded in said

wooden section, and a filling of concrete in said casing above said wooden section, said recessed wells extending upwardly above the lower edge of the sleeve and being open at the top.

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