

May 17, 1949.

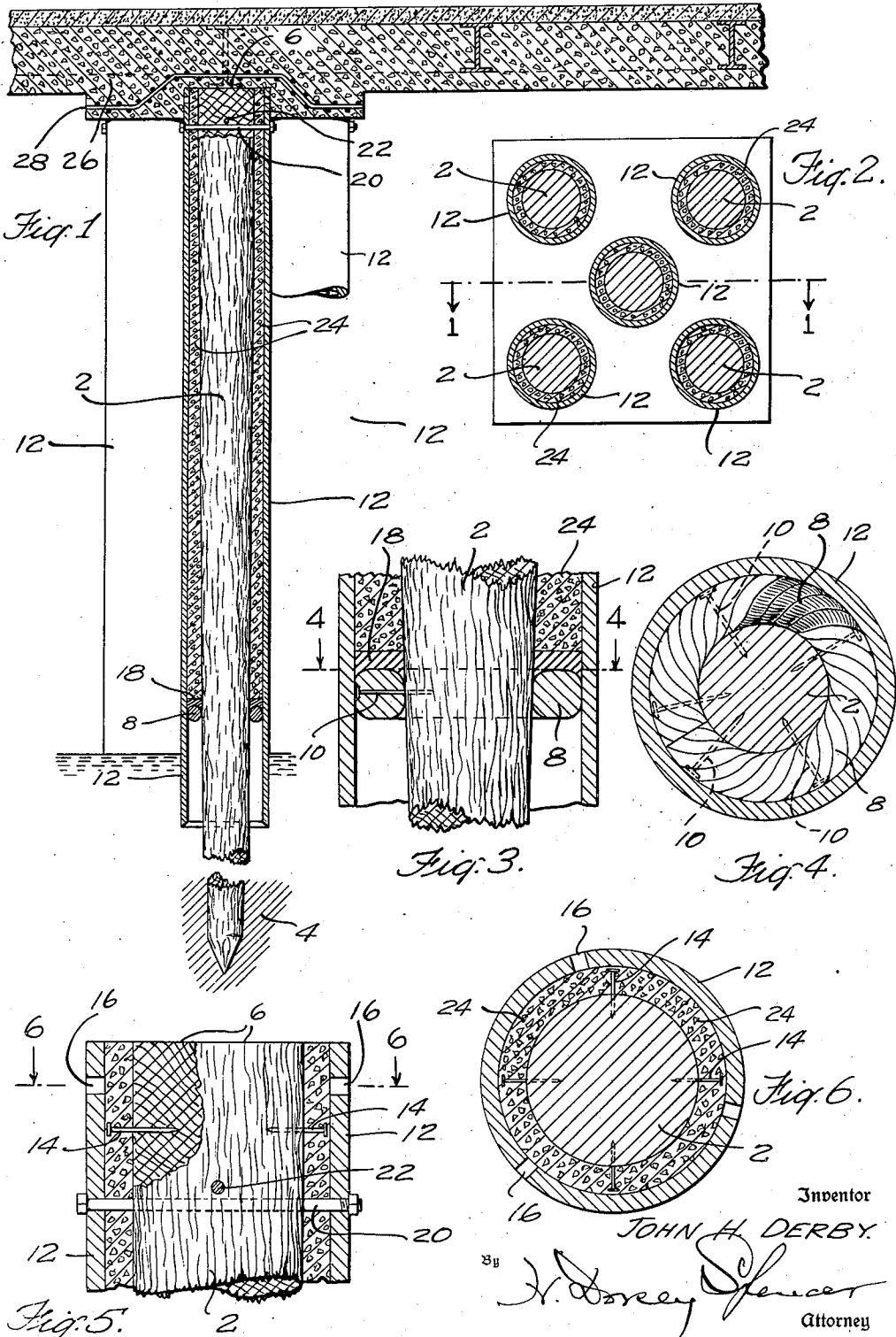
J. H. DERBY

2,470,149

PILE

Filed Jan. 16, 1948

2 Sheets-Sheet 1



Inventor

JOHN H. DERBY

By

J. H. Derby Spencer
Attorney

May 17, 1949.

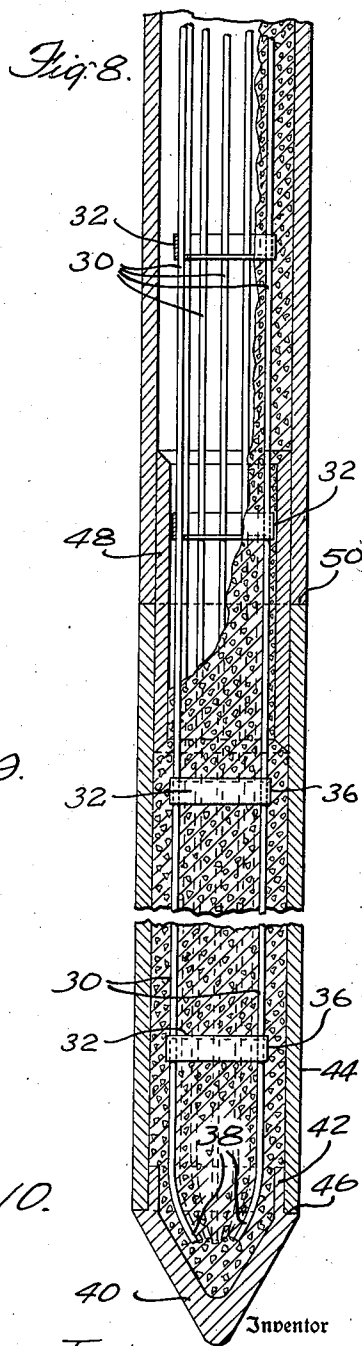
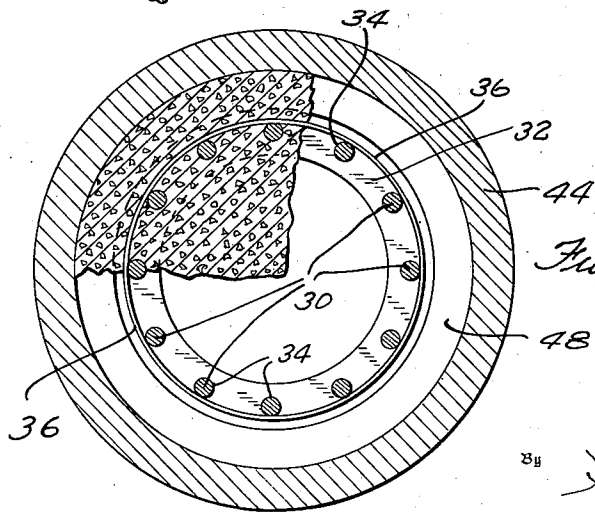
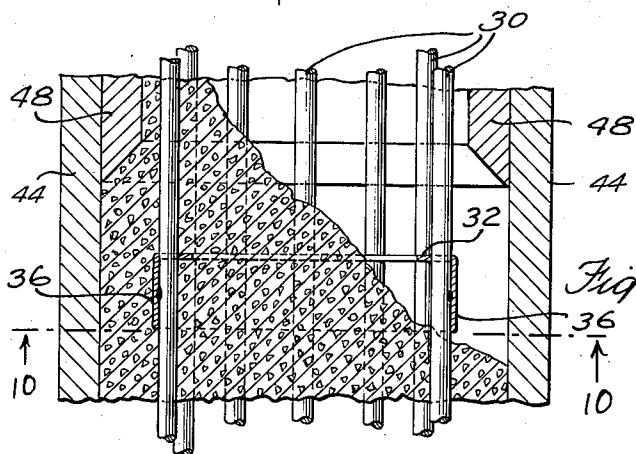
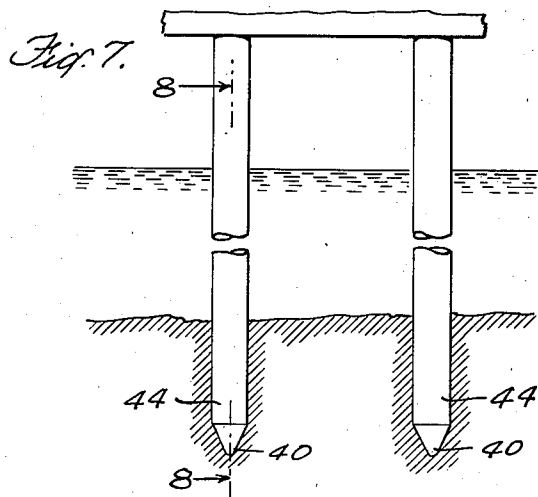
J. H. DERBY

2,470,149

PILE

Filed Jan. 16, 1948

2 Sheets-Sheet 2



Inventor
JOHN H. DERBY
By *J. Dorey Spencer*
Attorney

UNITED STATES PATENT OFFICE

2,470,149

PILE

John H. Derby, Scarsdale, N. Y.

Application January 16, 1948, Serial No. 2,762

7 Claims: (Cl. 61-54)

1

This invention relates to piles and particularly to piles intended for use in the construction of piers, wharves, docks, slips, etc.

Piles employed in the construction of piers have been, for the most part, ordinary wooden piles because of the difficulty of making and driving other types of piles and also because of their lack of durability. One of the great drawbacks to the use of wooden piles, particularly since the general use of oil as a fuel in steam and Diesel engine propelled vessels, is that, when a pier fire occurs, the piles, which have usually become coated with oil from the oil seum on the water, get afire and it is almost impossible to get at them to extinguish the fire. Some of the greatest pier fire disasters have resulted from this inability to extinguish the fire in the piling beneath the piers.

Various attempts have heretofore been made to cover wooden piles in such manner as to preserve and protect them but substantially all such attempts have involved the use of concrete coatings or sheaths, directly exposed to the action of the water, with the result that the action of the salt water soon causes disintegration of the concrete and eventual destruction of the protective covering. In some cases glazed tile has been tried as a substitute for concrete for the protective outer sheath but this has the objection that it is brittle and fragile and cannot flex with the pile structure, as a whole, and therefore is apt to become broken and thus expose the inner corrodible contents of the pile cover to the action of the salt water.

The present invention aims to overcome the difficulties heretofore encountered in the protection of wooden piles and in the construction of reinforced concrete piles by providing a protective cover therefor that will resist the action of the salt water, thus making possible the provision of piling, suitable for use in the construction of piers, wharves and slips, which not only will withstand the action of the water and other conditions to which such piling is subjected, but will also be fireproof, thus eliminating one of the principal difficulties in subduing pier fires short of complete destruction of the pier.

I have discovered that if a wooden pile be covered with an outer sheath of semi-flexible asbestos-cement tubing, uniformly spaced from the pile, and if the space between the outer sheath and the pile be filled with a relatively light concrete, such as might be made with cement mixed with slag, pumice, stone, mica, etc., not only will such a pile resist indefinitely the action of the

2

salt water thereon and of any other corrosive substances that may be carried to the piling by the water, but, by reason of the semi-flexible nature of the outer sheathing and of the relatively light concrete filling, such piling will withstand the shocks to which piling is subjected in piers, slips, wharves, etc. Not only have I found that such an outer sheathing, with its relatively light concrete filling between the wooden core and the sheathing, provides an improved wood pile construction for the uses aforementioned, but I have also found that, if a core of other elastic material, such as may be formed by providing a cage of metal reinforcing rods concentric with the asbestos cement outer sheath, be substituted for the wood pile core and the whole interior of the sheath be then filled with the relatively light concrete, there will be provided an improved reinforced concrete pile construction that will withstand not only the action of the water but also the impact of the pile driver and the considerable rough treatment to which piling for such uses is subjected after installation.

An important feature of the invention is the permanent sealing of the concrete filling of the piles against possible action of the salt and other corrosive elements in the water to which they are exposed.

Another important feature of the invention is the locking of the protective sheath against movement relative to the core, particularly in those piles that have wooden cores.

Other important features, advantages and objects of the invention, to which reference has not hereinabove specifically been made, will appear hereinafter when the following description and claims are considered in connection with the accompanying drawings, in which—

Figure 1 shows the invention incorporated in a pile construction having a wood pile core, this view being a vertical section of one of the piles shown in transverse section in Figure 2 and being taken on the line 1-1 of Figure 2;

Figure 2 is a transverse section through a group of piles constituting a part of the supporting piling of a pier;

Figure 3 is an enlarged sectional detail showing the combined dam and seal near the lower end of the protective sheath;

Figure 4 is a section on the line 4-4 of Figure 3;

Figure 5 is a vertical sectional detail near the upper end of the pile;

Figure 6 is a transverse section on the line 6-6 of Figure 5;

3

Figure 7 is a side elevation, partly broken away, of piles, embodying the present invention, which have reinforced concrete cores instead of wood cores;

Figure 8 is a vertical section, on the line 3—3, of one of the piles shown in Figure 7;

Figure 9 is an enlarged vertical sectional detail showing particularly the construction of the cage of metal reinforcing rods; and

Figure 10 is a transverse section on the line 10—10 of Figure 9.

As shown in Figures 1 to 6 inclusive, when a novel pile of the present invention is to be provided with a wood core the wooden pile 2 is driven in the usual manner into the harbor bottom 4, at the point where the pier, wharf or slip is to be constructed, to the desired depth and the top of the pile is then cut off at 6 at the desired height. There is then applied to the pile at low tide, and preferably just above the low tide line, a dam formed by wrapping a piece of rope 8 about the pile and securing it thereto by nails 10. The rope 8 is of such a thickness that the sheath 12, to be more fully described hereinafter, can be slipped over the rope, the rope serving to center the sheath on the pile 2.

To insure centering of the sheath 12 on the pile 2, at both its upper and its lower ends, centering means may also be provided near the upper end of the pile, such, for example, as nails or spikes 14 driven into the pile at 90° spacings and allowed to project therefrom at such equal distances that, while the sheath 12 will easily slip over them, at the same time the nails or spikes 14 will serve to keep the sheath substantially centered in respect to the pile 2.

The construction of the sheath 12, particularly its composition, is, as hereinabove suggested, an important feature of the present invention, since it is important that this sheath both be of such a composition that it will prevent the entry of the salt water into the space that is to be filled with concrete and that it be sufficiently flexible to permit its taking part in the flexings to which most pilings used in the construction of piers, wharves, etc. is subjected, without liability to rupture of the sheath. I have discovered that if the sheath 12 be formed of an asbestos cement tubing, such, for example, as that sold under the trade name "Transite" and extensively used for water mains, particularly in soils where ordinary iron pipe would corrode, the problem of providing a sheath answering the foregoing specifications of flexibility and resistance to corrosion is effectively solved. The sheath 12 employed in the pile construction illustrated in Figures 1 to 6 inclusive consists preferably, therefore, of semi-flexible tubing of asbestos-cement composition, such tubing being formed by dispersing a mixture of asbestos fibers and cement in water to form a paper-making stock, picking up a thin layer of this mixture, say 1/100ths of an inch thick, on an endless felt, sucking out the water therefrom in the usual paper-making procedure and building up a tube from this thin sheet on a polished rotating mandrel to the desired thickness, heavy hydraulic pressure rolls being pressed against the mandrel while the pipe is being formed. It will be seen that a tube having this construction will necessarily have both inherent strength and considerably flexibility and that it will be waterproof when the cement has fully set.

The sheath 12 shown in Figures 1 to 6 of the drawings is, in this form of the invention, to be

4

placed in protective relation to the wooden core 2, as above stated, after the core 2 has been driven in position and cut off and, therefore, the asbestos-cement tube is preferably provided near its upper end with three openings 16 there-through to receive a three prong grapple by which the sheath or tube 12 can be lifted and lowered over the upper end 6 of the wood pile 2 which is to constitute the core of the novel pile construction shown in Figures 1 to 6. When the sheath 12 has been placed in the position shown in Figure 1, with its lower end centered on the pile 2 by means of the rope dam 8 and its upper end centered by means of the nails or spikes 14, the lower end of the pile 2 will preferably project about two feet below the water level at the lowest tide, which will usually mean that it will project at least two feet below the rope dam 8. Before the concrete filling is placed between the inner face of the sheath 12 and the outer face of the pile 2, a water-tight seal is provided at the rope dam 8 by pouring down on the inside of the sheath 12 a suitable sealing material 18, such as tar or asphalt or other waterproof material.

After the waterproofing 18 has been placed in position and after the bolts 20 and 22 have been passed through opposed openings therefor provided near the upper end of the sheath 12 and through registering openings bored in the pile 2, to prevent relative longitudinal movement of the pile 2 and sheath 12, the concrete mixture 24 may then be poured into the space between the sheath 12 and pile 2 until it completely fills this space up to the top of the sheath and top of the pile. As hereinabove suggested, the concrete 24 is, preferably, a relatively light concrete such as may be made by substituting for the usual gravel or broken stone some of the lighter grout ingredients such, for example, as crushed pumice stone, crushed slag, mica, etc. A very satisfactory concrete for this purpose is one made from a mixture of Portland cement, 1 part, sand, 1 1/4 parts, and the gravel substitute sold under the trade name of "Waylite," 2 1/2 parts.

After the piles for a pier have been driven and protected in above-described manner, the pier floor 26 may be formed thereon in any suitable manner as, for example, by providing forms supported by the piling and reinforcing rods 28 and then pouring any suitable concrete mixture for the floor construction into the forms. The reinforcing rods 28 may be bent over the upper ends of the piles, as shown in Figure 1, to permit the concrete of the floor 26 to form a cap, integral with the floor, extending down a ways over the upper end of the pile.

In the embodiment of the invention shown in Figures 7 to 10 inclusive there has been substituted for the wood core 2 of the pile shown in Figure 1 a reinforced concrete core and the entire pile structure is formed before it is driven. In this embodiment of the invention a cage of reinforcing metal rods 30 is first formed by the use of annular spacers 32 having punched therein, at uniform angular distances about their centers, holes 34 to receive the rods 30 and hold them in uniformly spaced relation to each other, these annular spacers 32 preferably having flanges 36 against which the sides of the rods may abut. To hold the spacers 32 in their proper longitudinal relations to the rods 30 they may be spot-welded to the rods either at the points where the rods

pass through the openings 34, or where the flanges 36 touch the rods.

These spacers 32 will be located at such distances along the rods, as shown, as will serve to maintain the rods uniformly spaced throughout their lengths, the rods being of lengths substantially coextensive with the length of the pile and being substantially straight throughout their lengths except at their lower ends where they are incurved, as shown at 38, to bring them into the tapered hollow on the inside of a steel head or driving point 40 at the lower end of the assembled pile.

The steel head or point 40 of the pile has a conical end as shown and, integral with this, a cylindrical part 42 for receiving the sheath or outer shell 44 of the pile, the end of which rests on a shoulder 46 at the upper end of the conical part of the steel head. The sheath or outer shell 44 of the pile is preferably of the same composition as the sheath 12 of the pile construction shown in Figures 1 to 6 inclusive, that is, it is an asbestos-cement tube which preferably fits tightly over the cylindrical part 42 of the head and, when in position, is preferably concentric with the cage of reinforcing rods hereinabove described. If the pile to be driven is of considerable length, say in the neighborhood of 40 feet, the sheath 44 will usually be formed of several sections held together by inner sleeves 48 which are of sufficient length to overlap the joint 50 between successive sections a considerable distance on each side of the joint and which have a forced fit upon the inside of the two sections so as to provide a water-tight seal.

In forming a 40 foot pile, for example of an outer diameter of approximately 20 inches, I may use three 13 foot sections of a 16" asbestos cement pressure pipe of the type sold under the trade name, "Transite," and capable of withstanding a pressure of 200 pounds per square inch, such pipe having a wall thickness of approximately 1.65 inches. In such a pile the cage of metal reinforcement rods may be made up of twelve $\frac{3}{4}$ " steel rods spaced approximately 3 inches apart in the spacer 32, thus making a cage of approximately 12 inches in diameter and leaving a space between the cage and the inner wall of the tube of approximately $2\frac{1}{4}$ ". The sleeves 48 in such a construction would preferably overlap the joints 50 at least 18 inches on each side thereof and

these sleeves 48 would help center the cage of reinforcing rods, the parts being in the position shown in Figures 8, 9 and 10. The entire interior of the assembled structure would then be filled with concrete, preferably a relatively light concrete such as may be made by the illustrative mixture hereinabove given in connection with the concrete filling of the pile construction illustrated in Figures 1 to 6 inclusive. The pile thus constructed can safely be driven when a steel driving cap is placed over its upper end and, when driven, the concrete filling and the reinforcing are obviously completely protected from the salt water surrounding the piles.

What is claimed as new is:

1. A non-rigid fireproof pile structure for piers and the like having, in combination, a core of elastic material, a prefabricated, semi-flexible, tubular asbestos-cement sheath, substantially uniformly spaced from said core, and a filling of relatively light concrete between said elastic core and said sheath.

2. A pile according to claim 1 in which the elastic core is of wood.

3. A pile according to claim 1 in which the elastic core is of wood and a waterproof seal is located between said sheath and said core at the lower end of said concrete filling.

4. A pile according to claim 1 in which the elastic core is of wood and in which metal spacers insure maintenance of the substantially uniform spacing between the core and the sheath.

5. A pile according to claim 1 in which the elastic core comprises a cage of metal reinforcing rods concentric with the sheathing and extending lengthwise thereof.

6. A pile according to claim 1 in which the elastic core comprises a cage of metal reinforcing rods concentric with the sheathing and extending lengthwise thereof and a steel driving point extending from the lower end of the sheath.

7. A pile according to claim 1 in which the elastic core comprises a cage of metal reinforcing rods concentric with the sheathing and extending lengthwise thereof, a steel driving point extending from the lower end of the sheath and in which the concrete filling extends across the interior of the sheath.

JOHN H. DERBY.

No references cited.