

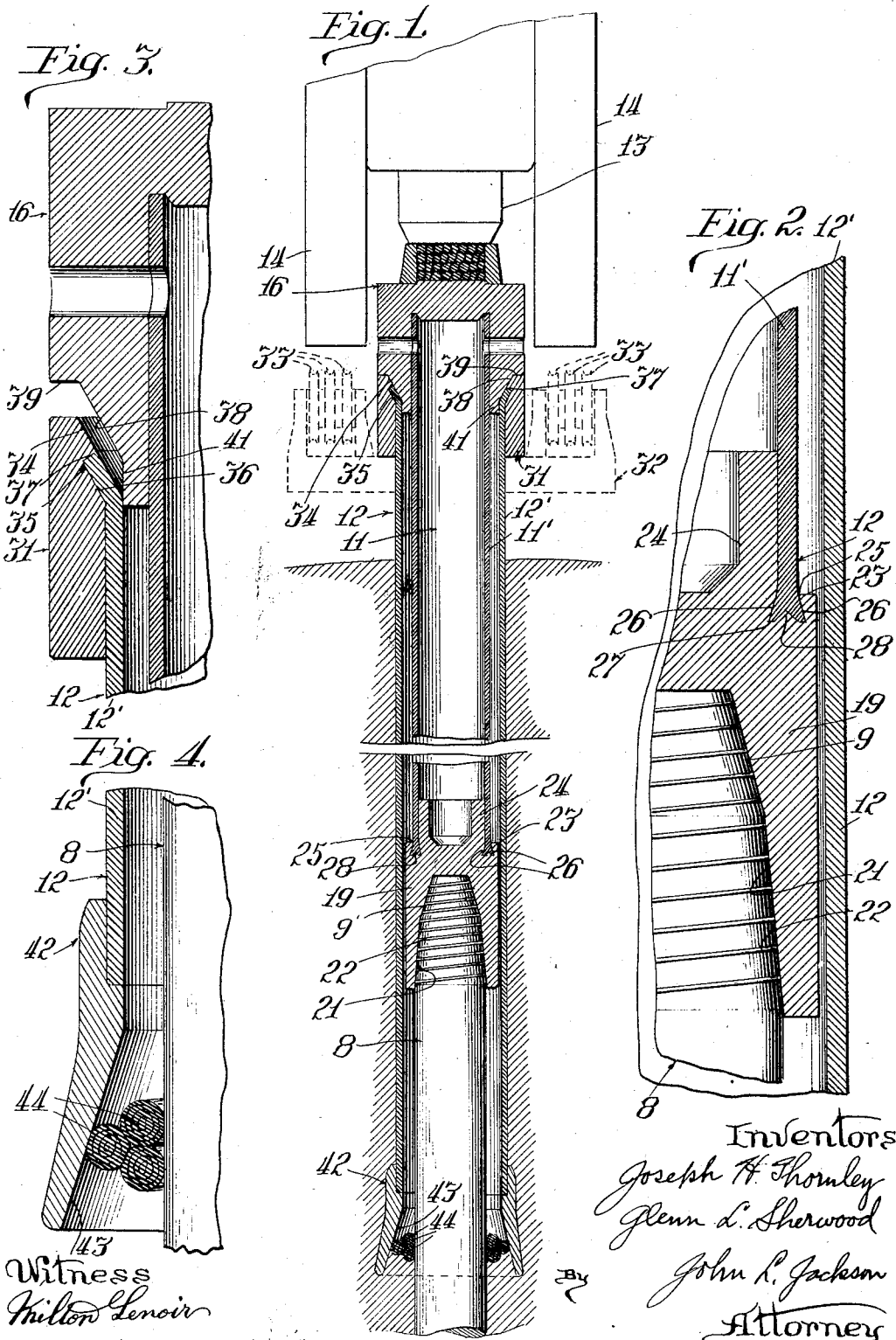
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PILE DRIVING APPARATUS

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PILE DRIVING APPARATUS

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The present invention relates primarily to pile driving apparatus of the type employed for driving wood piles below ground level, such apparatus having its principal utility in connection with the making of composite piles wherein a concrete section is joined to the upper end of a wood pile section. However, as will hereinafter appear, certain features of our invention have application to other types of apparatus employed in pile driving and forming operations, such as to the ordinary core and casing which is frequently employed for sinking the hole in which a cast-in-place pile is to be formed.

With reference to the present embodiment of our invention for driving piles, one of the particular objects of the invention is to improve upon the construction of core and casing which is usually employed for driving wood pile sections below ground level. The core, as is well known, is adapted to engage over the upper end of the pile to have the blows of the hammer transmitted therethrough to the pile, the core serving as a follower for following the upper end of the wood pile down into the ground. The casing surrounds the core and extends down and embraces the upper end of the pile, in which relation it aids to guide the pile during driving and also serves as a hollow extension within which the upper concrete portion can be anchored to the upper end of the wood pile. According to the usual practice of making these composite piles, this casing is withdrawn after the upper concrete section has been joined to the wood pile section.

The preferred practice most generally followed in making these cores is to construct the same of a long length of heavy pipe or tubular shell, to the lower end of which is secured a base casting having a socket therein adapted to engage over the upper end of the pile. This socket serves to prevent the driving blows from splitting or shattering the upper end of the wood pile. The operation of driving the pile through the interposed core generally results in the aforesaid socket seizing or becoming wedged over the upper end of the pile, necessitating the exertion of considerable lifting pressure on the

core in order to separate the latter from the head of the pile. The joint between the pipe section and the base casting of the core must be capable of withstanding these lifting stresses, and it is with the manner of forming this joint that one of the primary features of our invention is concerned. More specifically, this joint is of a swaged type which, in its initial forming, is produced by endwise compression pressure between the pipe section and the base section. By employing such form of joint, the driving blows imparted to the core in the operation of driving a pile are effective to retain the swaged form of the joint. Hence, if the lifting pressure exerted in freeing the core from one pile should have any tendency to loosen the joint, the same is immediately reformed to its previous effectiveness by the succeeding operation of driving the next pile.

Another feature of the invention is concerned with the manner of joining the upper end of the casing to the lifting collar through which the lifting forces are exerted in pulling the casing up out of the ground. The casing is subjected to earth pressure, and to the friction established between the soil and the outer sides of the casing, so that the withdrawing of the casing frequently requires the exertion of considerable lifting pressure on the collar. Here again we employ a swaged type of joint to join the collar to the casing. The driving head on the upper end of the core is arranged to cooperate with the swaged joint, such driving head having a swaging or joint-forming surface which engages with the swaged joint between the casing and the collar. The driving blows imparted to the core for driving the core and casing into the ground, are transmitted to the casing through the contact of this swaging surface with the joint. Thus in each operation of driving a pile, the driving blows transmitted to the casing are utilized to maintain the swaged joint between the casing and the collar in effective condition.

Another feature of our invention is concerned with the manner of establishing a temporary waterproof joint between the lower portion of the casing and the sides of the

wood pile. The purpose of this joint is to exclude water and soil from the lower end of the casing, so that the interior of the latter will be substantially dry for forming the concrete section of the pile upon the upper end of the wood pile section after the wood pile has been driven and the core withdrawn.

Referring to the accompanying drawings illustrating the preferred manner of carrying out our invention:

Figure 1 is a vertical sectional view showing the core and casing engaging over the upper end of a wood pile in the operation of driving the same;

Figure 2 is a fragmentary sectional view on a larger scale, showing the swaged joint which joins the lower end of the tubular core section to the base or socket member;

Figure 3 is a similar sectional view showing the swaged joint which joins the upper end of the casing to the hoisting collar; and

Figure 4 is another fragmentary sectional view showing the waterproof joint which is established between the lower end of the casing and the sides of the pile.

Referring to Figure 1, a typical wood pile is indicated at 8. When this wood pile is to be employed as the lower portion of a composite pile, the upper end of such wood pile is usually tapered as indicated at 9 so as to facilitate the forming of a joint between the wood pile section and the upper concrete section which is joined thereto.

The apparatus for driving these wood piles below ground level comprises a core 11 and casing 12, the latter surrounding the core and being of sufficiently large diameter to extend down over the upper end of the wood pile. As previously remarked, the core 11 functions as a follower through which driving blows are transmitted from the pile driving hammer 13 to the wood pile. The lower ends of the leads of a typical pile driver derrick are indicated at 14, between which leads the core and casing are guided in the driving of the pile. The core 11 comprises a length of heavy pipe or tubular shell 11' constituting a stem for the core, to the upper end of which is suitably secured a driving head 16. The blows of the hammer 13 are imparted to this driving head, and the same is provided with suitable hooks, openings or like means, represented by the openings 17, for establishing connection with hoisting rigging through which the core can be lifted from the ground.

The lower end of the pipe section 11' carries a core base 19 having a tapered socket 21 in its lower end, adapted to engage over the tapered upper end 9 of the wood pile. By driving the pile through this tapered socket, the upper end of the pile is prevented from splitting or shattering. In most instances, the tapered end 9 of the pile will have a coil of heavy wire 22 wound thereon and stapled thereto, which wire affords a multiplicity of

shoulders for interlocking in the concrete section which is subsequently formed on the upper end of the wood pile. The socket 21 is proportioned to engage over such wire coil 22.

The base 19 is formed with a shoulder 23, see Fig. 2, from which rises an annular flange or neck portion 24. The pipe section 11' fits down over the neck 24 and enters an annular groove or recess 25 formed in the shoulder 23 at the base of the neck 24. The swaged joint which couples the pipe section 11' to the base section 19 is formed in this recess. It will be noted that the two sides walls 26 of such recess diverge outwardly and downwardly, so that the recess is wedge shaped in profile. The force of the driving blows imparted to the upper end of the core is borne by the lower edge of the pipe section bearing against the bottom wall 27 of the recess. This results in the lower edge of the pipe section being swaged or expanded outwardly into pressure engagement with the diverging side walls 26 of the recess. To augment this swaging operation, a wedge shaped ridge 28 may be extended up from the center of the bottom wall 27 to act as a splitting or dividing member for spreading the opposite side surfaces of the pipe section outwardly into pressure engagement with the divergent side walls 26 of the recess. It will be observed that the present construction provides a swaged or expanded joint between the stem portion 11' and base portion 19, through which joint the driving blows are transmitted to the pile, with the result that the force of the driving blows serves to maintain the joint in tightly swaged engagement. Hence, if the lifting pressure necessary to separate the socket 21 from the tapered head 9 of one of the piles should tend to loosen this joint, the same is immediately reformed to its previous tightly swaged engagement by the operation of driving the next succeeding pile.

The casing 12 is constructed of a length of heavy pipe or tubular shell 12', of sufficiently large diameter to pass down over the core base 19 and around the upper end of the wood pile 8. This casing is adapted to follow the core 11 down into the ground, with its lower end embracing the upper portion of the wood pile. Secured to the upper end of the casing section 12' is a lifting collar 31. When it is desired to pull the casing out of the ground, a hoisting yoke or similar member, indicated in dotted lines at 32, is engaged under the lower shoulder of the collar 31, and lifting forces are applied to this yoke through tackle rigging which passes through the sheave blocks 33 carried by the yoke. The collar 31 is secured to the upper end of the casing section 12' by a swaged joint, which is also arranged to be reformed or retained in tightly swaged engagement by the driving blows of the hammer. In making this joint, the upper portion of the collar 31 is provided

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with a beveled or sloped inner surface 34 (Fig. 3) in which is formed a recess or groove 35 having an outwardly sloping wedge surface 36. The upper end of the casing section 12' is swaged or expanded outwardly into this groove, thereby providing a swaged joint through which the casing is lifted when the hoisting yoke 32 is engaged under the collar 31. A shoulder 37 at the upper end of the groove or recess 35 engages the upper edge of the casing 12' and prevents the collar from being driven downwardly along the casing. In driving the core down into the ground, the casing is compelled to follow the core downwardly through the transmission of driving forces from the upper end of the core to the upper end of the casing, and these driving forces are utilized to maintain the swaged joint. To this end, the driving head 16 of the core is formed with a wedge shaped neck portion 38 which extends downwardly from a transverse shoulder 39 adjacent to the lower end of the driving head. A cylindrical guiding portion 41 extends downwardly from the lower end of the sloping surface 38. In the operation of driving a pile, the sloping surface 38 bears against the sloping inner surface of the swaged joint, thereby transmitting the driving forces of the core to the casing through this joint. Hence it will be seen that the surface 38 functions as a joint-forming surface, and if there is any tendency for the swaged joint to loosen in the operation of lifting the casing from the ground, the joint is immediately reformed to its previous condition in the next pile driving operation. The cylindrical end portion 41 of the driving head engages within the cylindrical end of the casing and serves to center the upper end of the casing with respect to the core. The upper ends of the core and casing receive the guiding influence of the derrick leads 14 either through direct engagement of the core head 16 therewith, or by virtue of the engagement of the core head with the base of the hammer 13.

In order to form an effective joint or splice between the upper end of the wood pile section and the superposed concrete section, it is desirable that water and soil be excluded from the lower end of the casing so that the concrete can surround the tapered upper end 9 of the pile in direct contact therewith. To this end, we have provided means which affords a substantially waterproof joint between the lower end of the casing and the sides of the pile, which joint is maintained during the driving operation and after the removal of the core. Referring to Figure 4, the lower end of the casing has a ring or sleeve 42 secured thereto, within which is formed a flared or sloping sealing surface 43. This sealing surface is adapted to have wedging engagement over a heavy sealing ring 44 which is secured to the pile. Preferably, such

sealing ring consists of a length of tarred rope which is wound around the pile and nailed or stapled thereto. The rope is preferably wound with two or more closely spaced turns, and one or more outer turns which are wound over and between the inner turns, thereby providing a sealing ring which is of considerable radial depth and which has extensive surface engagement along the pile. The sloped sealing surface 43 is adapted to move down into wedging engagement over this rope grommet or sealing ring. As will be noted from Figure 1, the casing 12 is made considerably longer than the core 11 so that the lower end of the casing extends down over a considerable length of the pile. The rope grommet or sealing ring 44 is secured to the pile a measured distance down from the upper end thereof, so that the driving blows transmitted from the core head to the upper end of the casing will first force the tapered sealing surface 43 down into tight compression engagement over the rope grommet, before the core base 19 engages with the head of the pile. Thus the driving blows of the hammer are utilized to compress the rope grommet between the surface of the pile and the sloped sealing surface 43, whereby a tight joint is created between the casing and pile which will effectively exclude water and soil from the interior of the casing. It will also be noted that the pressure engagement between the rope grommet and the sealing surface 43 affords a lower point of guiding support between the pile and casing which aids the casing in maintaining guiding restraint on the pile.

After the wood pile has been driven to the desired depth the core is pulled up out of the casing, such being performed by suitably connecting the tackle rigging to the driving head 16. Thereupon the upper concrete section of the pile is formed within the casing 12, the tapered upper end 9 of the pile being imbedded in this concrete section. In forming such concrete section a light shell may be lowered within the outer casing to engage over the upper end of the wood pile, and the concrete and any reinforcement placed within this light shell. Any other preferred practice of forming the upper concrete section may be followed, the present invention not being concerned with the details thereof. After the concrete section has been completed, the outer casing 12 is pulled up out of the ground in the manner above described.

While the pile driving apparatus hereinbefore described constitutes the preferred embodiment of our invention, it will be understood that the swaged joint illustrated in Figure 2 may be employed for uniting the tubular stem and base portion of a core designed for sinking holes in the ground; and similarly the swaged joint illustrated in Fig. 3 may be employed for uniting the hoisting

collar to the upper end of the casing which is usually employed in conjunction with such core, this combination of core and casing for sinking holes being well known.

5 What we claim as our invention and desire to secure by Letters Patent, is—

1. A pile driving apparatus for driving a wooden pile comprising the combination of a core having driving and guiding engagement
10 with the upper end of said pile, a tubular shell operatively connected to said core and having a driving head on the upper end thereof, a casing extending down over the core and the upper end of the pile and having
15 a collar on the upper end thereof for engagement with the driving head, a conically flared portion at the lower end of the casing and a grommet on the pile engaging with the flared portion of the casing to form a water-tight
20 seal when driving force is applied to the driving head.

2. A pile driving apparatus for driving a wooden pile comprising the combination of a core having driving and guiding engagement
25 ment with the upper end of said pile, said core comprising a stem portion having a driving head on the upper end thereof, a casing extending down over the core and the upper end of the pile and having a collar on the
30 upper end thereof for engagement with the driving head, a conically flared portion at the lower end of the casing and a grommet on the pile engaging with the flared portion of the casing to form a water-tight seal when
35 driving force is applied to the driving head.

3. A pile driving apparatus for driving wooden piles comprising the combination of a core having a socket therein adapted to fit over the upper end of the pile for driving
40 and guiding engagement with the pile, said core comprising an upwardly extending stem portion having a driving head on the upper end thereof, a casing extending down over the core and the upper end of the pile, a shoulder
45 on said casing, a cooperating shoulder on said core adapted to seat upon the shoulder on said casing for transmitting driving blows from said core to said casing, a conically flared portion at the lower end of said casing,
50 and a grommet on the pile spaced downwardly from the upper end thereof and engaging with the flared portion of said casing to form a water-tight seal when driving force is applied to the driving head.

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