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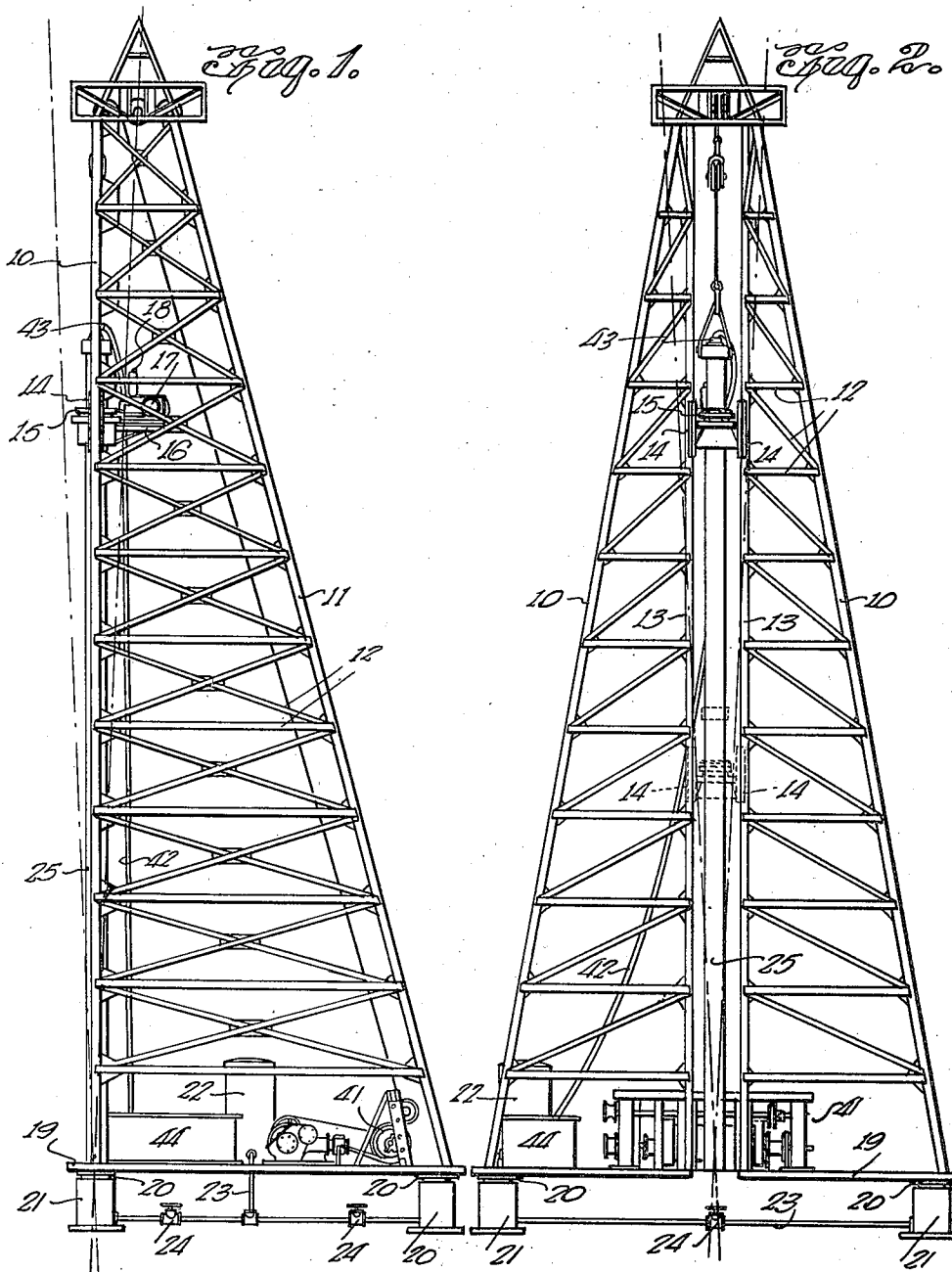
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2,373,319

CAISSON AND METHOD OF SINKING

Filed April 17, 1944

3 Sheets-Sheet 1



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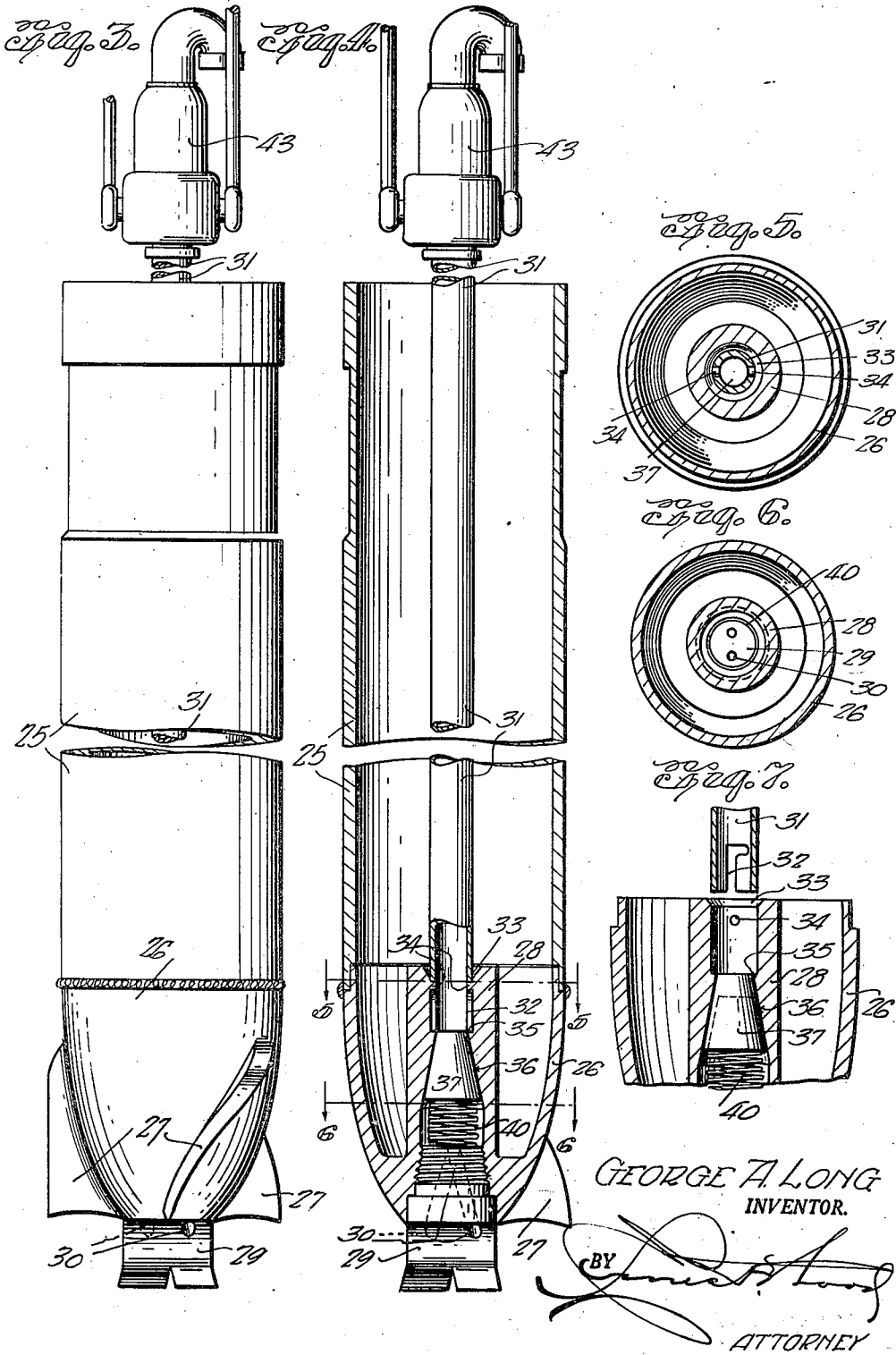
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3 Sheets-Sheet 2



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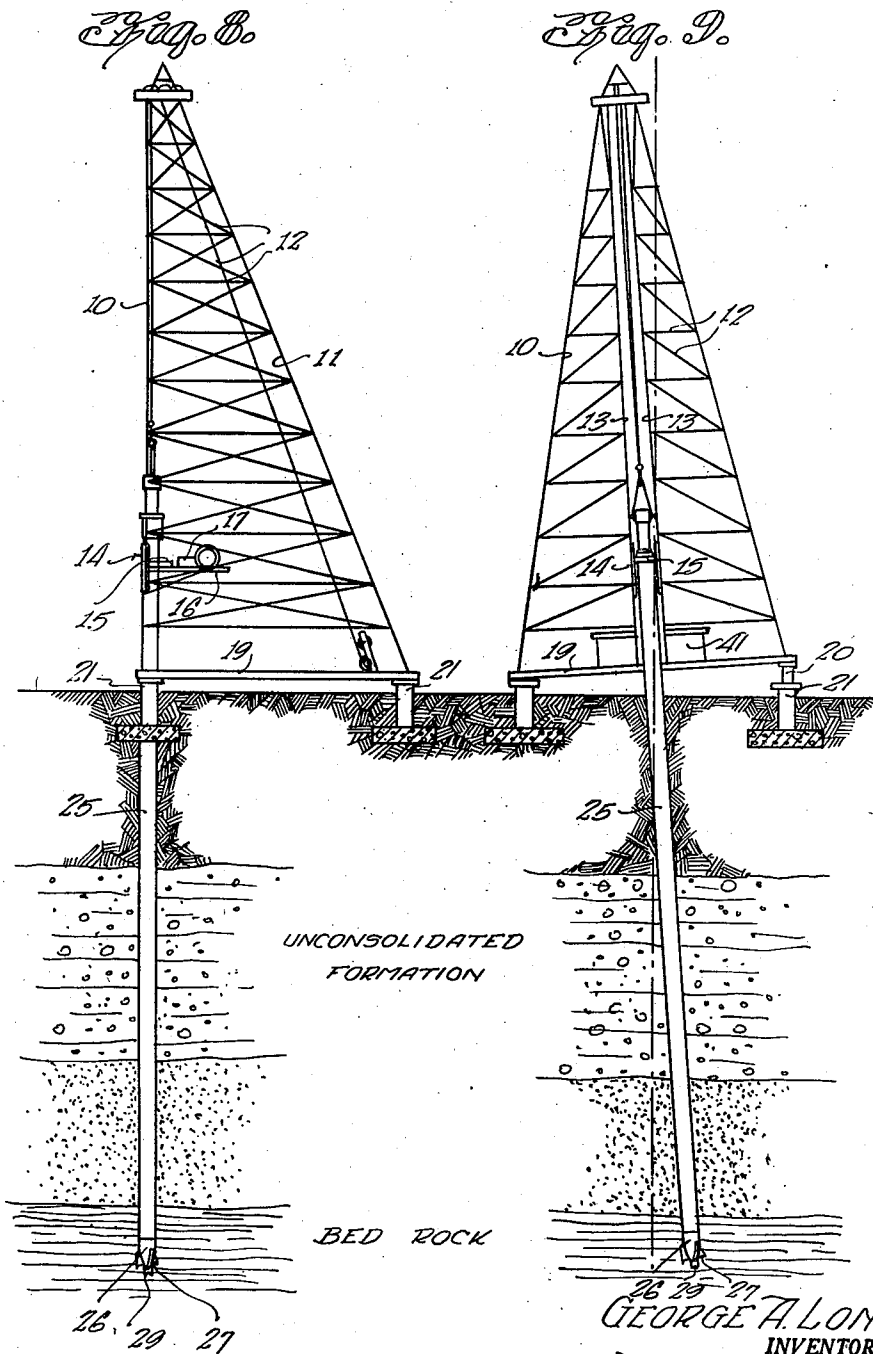
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CAISSON AND METHOD OF SINKING

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3 Sheets-Sheet 3



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CAISSON AND METHOD OF SINKING

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7 Claims. (Cl. 61—57)

This invention relates to the sinking of caissons, pile tubes and the like and it has particular reference to an improved apparatus for and method of accomplishment.

The principal object of the invention is to reduce, by means of a minimum number of steps, the excessive labor and costs in constructing foundation piles. Construction of this character has, in the past, been carried out in a number of different ways, first by manually digging the caisson holes or pits and later by drilling the holes in a manner similar to that employed in drilling wells. The present invention is similar in some respects to the latter method in that the pile casing follows the boring tool into the earth but unlike ordinary well drilling practices, drilling is continuous without interruption and the drilling lubricant is excluded from the casing, with the result that the latter is "dry" when the required depth is reached. Obviously then, the step of filling the caisson with concrete may be pursued without requiring the removal of mud from the casing which is the expensive and time consuming step necessary in some other caisson sinking methods.

Another object of the invention is to include in the method of constructing caissons, the steps consisting of sinking an elongated casing by an uninterrupted drilling operation, in impregnating the formation immediately surrounding the casing at bed rock with grout and subsequently removing the concentric tube through which is pumped the drilling mud and later, the grout, preparatory to the introduction of concrete.

Still another object of the invention is to provide a caisson sinking apparatus consisting of a special derrick having provisions for hydraulically tilting the same for battering the pile casings; a special rotary and hoist equipment and an elongated casing or shell in a single piece provided in its lower end with a back pressure valve of special design to resist bottom hole pressure tending to move counter to pump pressure through the concentric tube in the casing.

With the foregoing objects as paramount, the invention has further reference to certain features of accomplishment illustrated in the accompanying drawings and to the novel steps of the method to be presently described.

Figure 1 is a side elevational view of a derrick constructed according to the present invention.

Figure 2 is a front elevational view thereof.

Figure 3 is a side elevational view of the casing and drill of the invention.

Figure 4 is a vertical sectional view thereof.

Figure 5 is a transverse sectional view taken on line 5—5 on Figure 4.

Figure 6 is a transverse sectional view taken on line 6—6 on Figure 4.

Figure 7 is a fragmentary view in vertical section of the boring tool and valve.

Figure 8 is a schematic side elevational view of the derrick showing the casing partly in the earth, and

Figure 9 is a similar view but showing the derrick from the front and tilted slightly to batter the casing in sinking.

Continuing with a more detailed description of the drawings, reference is primarily made to Figures 1 and 2 wherein numeral 10 denotes the foremost legs of the derrick which converge at their tops but are normally disposed in a plane perpendicular to the earth except when tilted for battering in a manner to be presently described. The rearmost legs 11 converge towards each other and to the front legs at their tops and suitable struts and braces 12 are appropriately arranged on the legs in the conventional manner to assume and distribute strains and stresses to which the structure may be subjected.

Intermediate the foremost legs 10 of the derrick there is provided relatively parallel and perpendicular guides 13, supported by suitable braces from the legs 10. These guides serve as tracks for the oppositely disposed, elongated shoes 14 which serve as a mounting for a rotary table 15 and its associated elements.

Supported also by the vertically movable shoes 14 is a platform 16 on which is mounted the associated elements of the rotary, including the motor 17 and controls 18. This platform likewise provides a station for the operators of the rotary and attendant elements.

It will be observed that the four corners of the derrick foundation 19 are supported upon hydraulic rams 20, operated in cylinders 21. These cylinders have communication between each other and with a compressor tank 22 (Figs. 1 and 2) through the medium of a system of pipes 23, pressure to selected ones of the cylinders 21 being controlled by valves 24. Thus, it may be seen that by actuating the valves 24, one side of the derrick may be raised, as suggested by the inclined lines in Figures 1, 2 and 9 in order to batter the casing 25 of the caisson as suggested in Figure 9 particularly.

Referring now to Figures 3 to 7, inclusive; the caisson casing 25 is shown as consisting of one continuous tubular body, probably made up of welded sections, considering that it often exceeds

100 feet in length. In this, among other things, the actual process of sinking the caisson tube differs from the conventional drilling process wherein the pipe is set up as drilling proceeds.

Welded or otherwise suitably secured to the lower end of the casing 25 is a drilling head 26, equipped with blades 27. This head has an integrally formed, concentric sleeve 28 therein, to which further reference will be made presently.

The drilling head 26 is truncated and a pilot bit 29 is threaded into an interiorly threaded cavity in the end of the head which communicates with the passage through the sleeve 28. The pilot bit 29 is of conventional fishtail design and therefore has fluid passages 30 therein.

Extending axially through the casing 25 is a tube 31 whose lower end is provided with oppositely disposed, inverted L-shaped slots 32. This tube is adapted to be withdrawn from and replaced in the casing 25 as occasion requires and when it is set down into the sleeve 28 of the drilling head, provision is made in the form of a beveled recess 33 in the sleeve for guiding the lower end of the tube into the socket provided by the sleeve. The slots 32 of the tube receive oppositely disposed pins 34 in the walls of the socket and in this manner interlocked relationship of the tube and sleeve is effected.

Interiorly of the sleeve 28 and intermediate the ends thereof is a shoulder 35 on which rests the lower end of the tube 31. Starting at this shoulder and terminating at a point spaced from the lower end of the passage through the sleeve 28 is an inverted coniform cavity 36 to accommodate a conformably shaped valve body 37, preferably constructed from wood. Below the valve body 37 is a coil spring 40 whose lower end rests upon the pin of the pilot bit 29 and is effective to hold the valve body 37 in closed position except when fluid pressure is imposed thereon in operation.

In operation, the derrick 10 is oriented with respect to point of operations and the casing 25, equipped with the drilling head 26 is elevated through the medium of the line drum assembly and draw works 41, much in the customary manner of drilling. The tube 31 is run into the casing and interlocked with the sleeve 28, as explained. The rotary 15 is set into operation and drilling begins, the cuttings from the bit 29 and drilling head 26 being elevated in the hole around the casing by fluid forced by pump pressure through the hose 42, swivel 43 and tube 31 and past the valve body 37 which has been displaced by pressure, and into the hole through the fluid passages 30 in the pilot bit 29.

It is important to note that as drilling progresses, the inside of the casing 25 remains dry and unlike other and conventional drilling methods or processes, the mud does not at any time enter the casing. This makes for speedier work and reduces materially the cost of sinking piles and caissons because it obviates the final operation of removing mud from the hole as by pumping, bailing and by other means. This is an expensive and time consuming operation and is not entirely satisfactory even when expertly accomplished. When the desired depth is reached by the present process, the operation is complete with the exception of introducing grout, since the casing 25 is left in the hole as the form for the concrete which is subsequently deposited therein.

When the casing 25 has been sunk to a predetermined depth the pipe 31 is flushed out with water and grout from a suitable reservoir such as suggested at 44 (Figs. 1 and 2) is pumped into the

bottom of the hole and up around the lower end of the casing. Pump pressure may be maintained thereon until the grout attains a mechanical set but this is usually unnecessary due to the presence of the valve 37 whose peculiar construction and function is such that it will resist heavy bottom hole pressure.

After the grout has been introduced as described, the complement being determined by pump gauge pressure, the tube 31 is rotated slightly to disconnect it from the pins 34 and it is withdrawn from the casing 25. The casing 25 is then filled with concrete and whether or not reinforcing steel is prearranged in the casing would depend upon the specification requirements of the engineers in charge of the particular project under construction, such as casing wall thickness, nature of the surrounding formation and the like.

It is obvious from the foregoing that even though the casing, drilling head and its attendant parts are left in the hole, the time saved by the process described herein materially offsets the value of these elements and beyond this, the caisson, having the benefit of the reinforcing supplied by the casing, possesses greater strength and endurance than piles similarly set up but wherein the casing is removed.

One outstanding characteristic which the present process possesses over other types of caisson sinking methods is the fact that the drilling operation is continuous from beginning to end. Should there be any interruptions in the course of drilling, especially in quick sand, the sand would set up and further drilling would be rendered difficult if not impossible to again start the caisson.

Manifestly, the construction and process as shown and described is capable of some modification and such modification as may be construed to fall within the scope and meaning of the appended claims is also considered to be within the spirit and intent of the invention.

What is claimed is:

1. The hereindescribed method of sinking caissons, characterized by continuously drilling into the earth a closed ended casing, in continuously introducing drilling fluid through a restricted passageway in said casing to the drilling end of said casing, in flushing said passageway at bedrock, in introducing grout through said passageway into the formation immediately surrounding said casing, in removing said passageway from said casing and finally in filling said casing with concrete.

2. The hereindescribed method of sinking caissons which consists in continuously rotating an elongated, hollow tubular body to effect penetration of the earth thereby to a predetermined depth, in continuously supplying the drilling end of said body with fluid, in maintaining the drilling end of said body closed except for the downward passage of fluid, in ceasing the introduction of fluid at bedrock and substituting grout therefor and finally in filling said body with concrete.

3. The hereindescribed method of sinking caissons, piles and the like, the steps consisting in penetrating the earth to a predetermined depth by uninterrupted rotating a hollow, tubular body, in continuously wetting the formation in advance of said body to remove loosened earth, in suspending the wetting operation at bedrock, in introducing grout into the formation through said body and finally in filling said body with concrete.

4. A method of constructing caissons, the steps consisting in uninterruptedly boring into the earth with an elongated and hollow tubular body and in continuously washing the cuttings from the bore with fluid passed restrictedly through the body, in suspending the passage of fluid through the body at a predetermined depth and in substituting the fluid with grout and finally in filling the hollow body with concrete.

5. The method of constructing caissons, the steps consisting in sinking a hollow, tubular body through unconsolidated formation to bedrock by uninterruptedly rotating the body and in washing cuttings from around said body as the latter penetrates the earth, in impregnating the surrounding formation with grout and finally in filling the hollow body with concrete.

6. Apparatus for constructing caissons including an elongated, hollow casing having a truncated drilling head closing one end thereof, an integral and concentrically related sleeve in said drilling head whose passageway is straight walled at its upper end and threaded at its lower end and provided intermediate said ends with an inverted coniform chamber, a correspondingly shaped non-metallic valve body disposed in said

chamber, a pilot bit disposed in the threaded end of said passageway, a coiled spring interposed between the shank of said bit and said valve body to urge the latter to closed position in said chamber, a fluid transporting tube extending axially through said casing and entering the upper end of said passageway and means carried jointly by said tube and passageway for releasably holding said tube.

7. Apparatus for sinking caissons and piles comprising an elongated and tubular hollow casing having a trunco-coniform drilling head on one end, a pilot bit carried by said drilling head, means removably connected to said drilling head interiorly of said casing for introducing drilling fluid and grout into the formation through said casing and said pilot bit, a sleeve rising axially in said drilling head whose passage is beveled at its top to receive the lower end of said removable means and is further provided with a valve chamber intermediate its ends; valve means in said chamber for closing said passage against bottom hole pressure and spring means between said bit and valve means for urging the latter to closed position in said chamber.

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