Feb. 8, 1938. L. WATSON 2,107,556

DRILLING MECHANISM

Filed Feb. 28, 1936 2 Sheets-Sheet 1

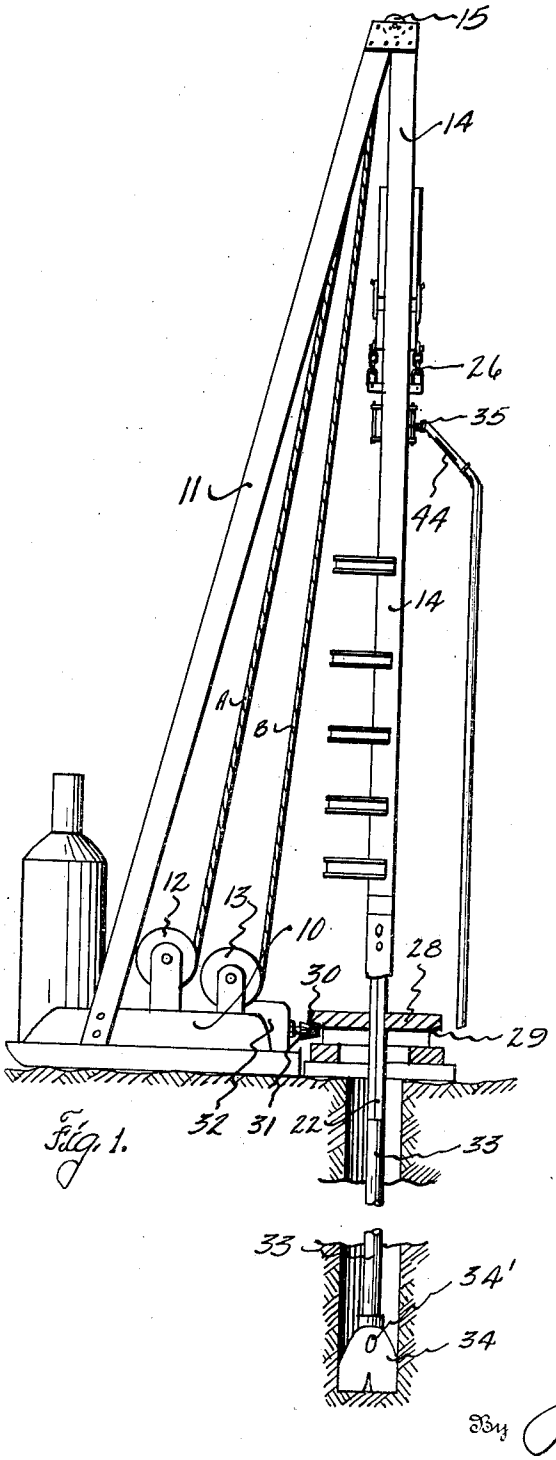


Fig. 1.

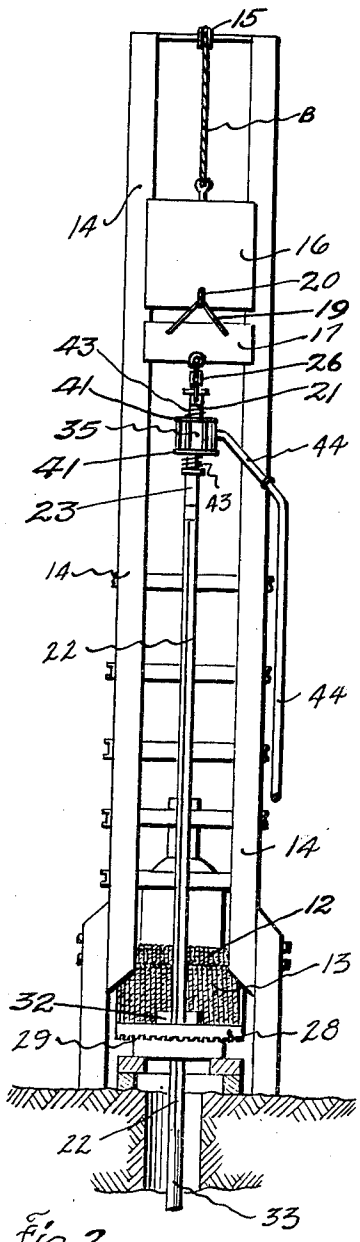


Fig. 2.

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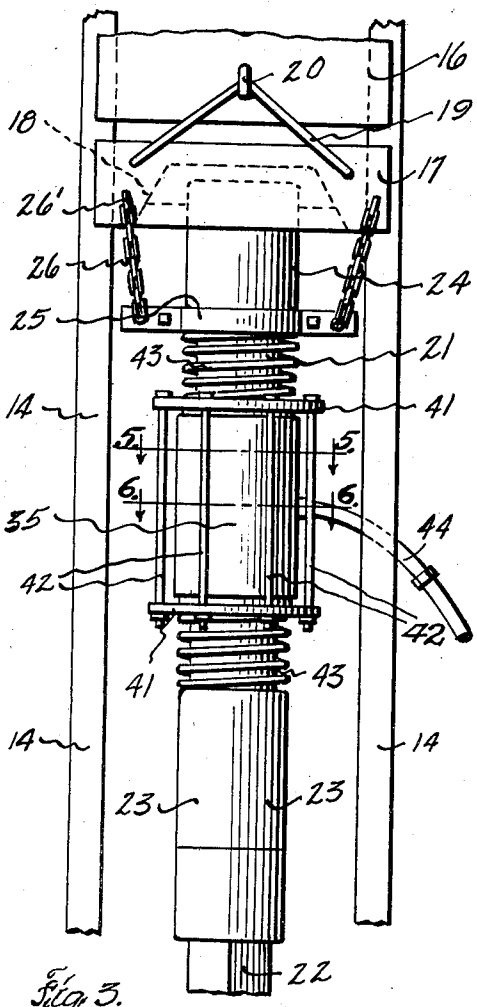


Fig. 3.

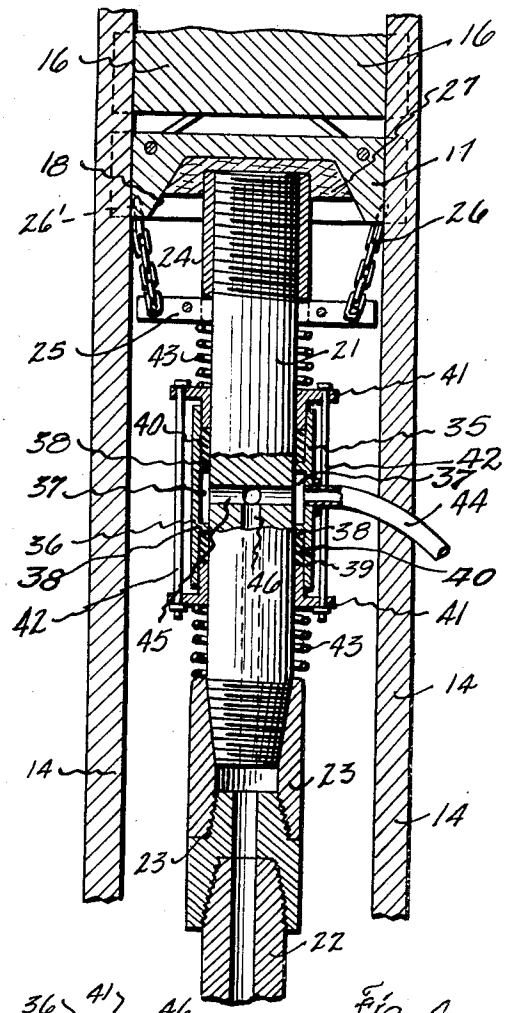


Fig. 4.

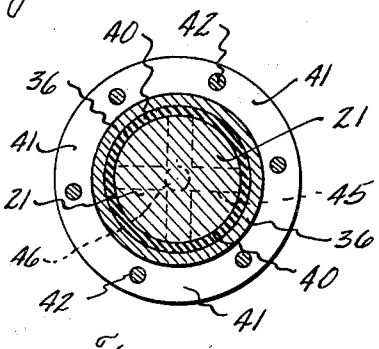


Fig. 5.

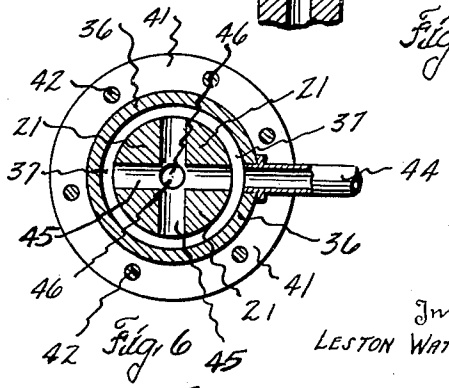


Fig. 6

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DRILLING MECHANISM

Leston Watson, Ardmore, Okla.

Application February 28, 1936, Serial No. 66,199

9 Claims. (Cl. 255—19)

This invention relates to new and useful improvements in drilling mechanism.

One object of the invention is to provide an improved means for drilling which may be readily attached to or detached from the usual pile driving mechanism, whereby when necessary, holes may be drilled for receiving piles in hard formations in which the piles cannot be driven.

An important object of the invention is to provide improved drilling mechanism which may be readily attached to the hammer leads of a pile driver and which is so constructed that the weight of the hammer of said driver may be utilized to force the drill stem downwardly, whereby the necessity of setting up a drilling rig and spudding the stem into the hole is eliminated, which greatly reduces the cost and also results in a saving of time and labor.

A further object of the invention is to provide an improved drilling mechanism which is arranged to be suspended from the hammer of a pile driver, whereby the usual control cable for the hammer may be utilized for raising and lowering the equipment, which obviates providing separate cables, or suspensions for the equipment.

Another object of the invention is to provide an improved means for drilling adapted to be readily mounted on an ordinary pile driver without making any changes in said driver, said means including a drill stem mounted below the hammer of the driver so that said hammer may be utilized to drive the stem downwardly when the penetration into the formation of the bit at the lower end of the stem is insufficient; there being a connection for conveying water to the stem, the connection being such that driving of the stem will not affect said connection.

A construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, in which an example of the invention is shown, and wherein:

Figure 1 is a side elevation of a pile driver having the drilling equipment, constructed in accordance with the invention, attached thereto,

Figure 2 is a front elevation of the same,

Figure 3 is an enlarged front elevation of the upper portion of the drill stem and showing its connection with the hammer leads,

Figure 4 is a transverse, vertical sectional view of the parts shown in Figure 3,

Figure 5 is a horizontal, cross-sectional view, taken on the line 5—5 of Figure 3, and

Figure 6 is a horizontal, cross-sectional view, taken on the line 6—6 of Figure 3.

In the drawings, the numeral 10 designates a pile driver, which may be of any desired construction. The pile driver includes the usual boom 11, which extends upwardly therefrom, and also has the cable drums 12 and 13 on which cables A and B are wound. The usual hammer leads 14 are secured to the outer end of the boom and these leads extend vertically in parallel relation in the usual manner. At the outer end of the boom, the cable sheaves 15 are mounted, and the cables A and B pass thereover. The cable A extends downwardly and is known as the pile line, being adapted to have its outer end connected to the pile to draw the same into driving position. The cable B passes upwardly over its sheave and has its end fastened to the hammer 16, which is slidable vertically between the leads 14. All of the above parts are of the usual construction and are standard equipment in pile drivers, and are, therefore, subject to variation.

In carrying out the invention, the usual follow block 17, which has a recess 18 in its underside, which normally fits over the upper end of the pile to be driven, is attached to the hammer by cables 19. It is noted that the recess may be either round or square depending on the piles to be driven. For purposes of description the recess will be assumed to be square. The cables 19 are secured to the sides of the block and are formed in a loop, whereby they may be engaged over hooks 20 which are secured in the side of the hammer 16. As is clearly shown in Figure 3, such arrangement suspends the follow block 17 from the lower end of the hammer 16.

A section of drill stem 21, which has its lower end connected to the upper end of a kelley 22 by a coupling 23 is located between the hammer leads and extends vertically therebetween. The upper end of the drill stem 21 has a collar 24 threaded thereon and a split supporting collar 25 encircles the drill stem just below the collar 24. It is noted that the collar 25 does not engage the surface of the stem snugly, whereby said stem is rotatable therein, as will be explained. This supporting collar is provided with diametrically opposite radial arms which are suitably bolted together. These arms are secured to the underside of the follow block 17 by chains 26. It is obvious that since the split collar 25 engages beneath the collar 24 that the drill stem 21 will be suspended from the follow block 17 by the chains. It is

pointed out that the length of the chains is such that when the extreme upper end of the stem 21 engages the follow block, said chains will be loose. However, when the block is raised, the chains will raise the stem. As is clearly shown in Figure 4, the upper end of the drill stem 21 engages in the usual recess 18 in the block 17, and for centering said stem within the recess which is considerably larger than the stem, a centering block, or other centering device, 27 is supported on the collar 24 and has its outer peripheral edge engaging the sides of said recess. This block serves to center the drill stem between the hammer leads 14.

It is pointed out that the upper ends of the chains 26 engage over hooks 26' on the block, whereby the engagement or disengagement of said chains may be readily accomplished. In this way, it will be obvious that the drill stem may be readily connected with or disconnected from the follow block. As has been stated, a square kelley depends from the lower end of the drill stem 21, being connected therewith through the coupling 23. The lower end of the kelley extends through a rotary table 28 which may be suitably supported in any desired manner. It is noted that all the connections in the drill stem above the table are left-handed while the connections below the table are right-handed. The rotary table has the usual gear teeth 29 on its underside which are arranged to be engaged by a drive pinion 30. The pinion is mounted on the shaft 31 of a suitable drilling engine 32. It will be obvious that when the engine 32 is operated, the pinion 30 is rotated. This pinion, in turn, rotates the table 28 whereby a rotation is imparted to the kelley and stem. The lower end of the kelley is attached to the drill pipe 33 which carries the drill bit 34. It is obvious that rotation of the kelley will impart rotation to the drill bit 34 to drill the hole.

From the above, it will be seen that the drill stem, kelley and bit are suspended from the ordinary follow block 17 which, in turn, is suspended by the loops 19 from the hammer 16. After the kelley and stem have been assembled and drilling is about to start, the hammer 16 is lowered so as to rest upon the follow block 17. Since the upper end of the stem 21 is in engagement with the follow block 17, it will be obvious that the weight of the hammer will be exerted on the drill stem through the kelley and onto the drill bit 34. This weight of the hammer is thus utilized to force the bit to penetrate the formation being drilled. With such arrangement, it is not necessary to spud the drill stem downwardly into the hole, or to employ any other means for obtaining the proper penetration of the drill bit. By utilizing the weight of the hammer the additional expense of employing other means for accomplishing this purpose is obviated. Therefore, a cheap and inexpensive structure is had.

For supplying water or drilling fluid to the drill bit 34 during the drilling operation, a floating housing 35 (Figure 4) is provided. This housing is mounted on the drill stem 21 between the split collar 25 and the upper end of the tool joint 23. The housing includes an elongated sleeve 36 which surrounds the stem 21. This sleeve has its inner diameter somewhat larger than the outer diameter of the stem 21, whereby an annular space 37 is formed between the collar and stem. A pair of flat rings 38 are located within the sleeve 36 and are spaced from each other being welded within the sleeve. As is clearly shown in Figure 4, the flat rings 38 extend across the annular space 37 and have their inner peripheries engaging the drill stem. It is obvious that the rings 38 form wells 39 at each end of the sleeve. Suitable packing 40 is inserted in these wells and this packing is retained therein by packing glands 41. The packing glands are held in a tightened position by tie-bolts 42 which extend vertically between the flanges of the packing glands 41. By tightening the tie-bolts 42, it is obvious that an increased pressure may be exerted on the packing 40. The packing serves to pack off the drill stem since it is in constant engagement with the surface thereof. For retaining the sleeve 36 and its associate parts which form the housing 35, in a central position between the split collar 25 and the tool joint 23, a pair of coiled equalizing springs 43 are provided. One of the springs surrounds the drill stem 21 and is confined between the split collar 25 and the upper packing gland 41. The other spring surrounds the drill stem, being confined between the lower packing gland 41 and the tool joint 23.

For conducting water, or other drilling fluid to the annular chamber 37 within the sleeve 36 a flexible hose or other connection 44 is connected in the side wall of the sleeve 36 opposite the annular space 37. Thus, it will be seen that the drilling fluid passing through the hose 44 will enter the annular space 37 around the drill stem 21. The drill stem is provided with diametrically extending ports 45 and these ports, as is clearly shown in Figure 6, extend at right angles to each other and also extend entirely through the stem 21. The ports 45 communicate with the upper end of an axial opening which extends to the lower end of the drill stem. Thus, it will be seen that the ports 45 establish communication between the annular space 37 within the housing 35, and the axial opening or passage 46, whereby the drilling fluid which is introduced through the connection 44 flows through the ports 45 and to said passage. This drilling fluid then passes through the tool joint 23 and downwardly through a vertical axial passage 47 which is formed throughout the vertical length of the kelley 22. From the passage in the kelley, the fluid passes through the drill pipe 33 and finally to the outlet ports 34' in the drill bit. From the above, it will be seen that the drilling fluid introduced through the hose connection 44 passes through the stem 21, kelley 22 and finally outwardly at the bottom of the hole through the outlet ports in the drill bit. This drilling fluid serves to wash the cuttings and other material upwardly in the hole.

In actual operation, it is manifest that when a formation is reached which is too hard for driving the ordinary piles therein, it is only necessary to attach the follow block to the hammer and then attach the drill stem and kelley to the follow block by hooking the chains 26 on the hooks 26' of said block. The drilling equipment is then in position for the drilling operation. It is an entire unit and may be readily mounted in its proper place between the leads 14. The hammer 16 is then lowered on to the follow block 17 so that the weight of the hammer is exerted against the drill stem and onto the drill bit 34. It is the structure of the stem 21, together with the housing 35 and its associate parts, which take the place of the usual swivel and which permits the weight of the hammer to be imposed on the drill bit. In this way sufficient weight is placed on

the bit to insure a proper penetration of said bit into the formation. The rotary table **28** is then operated to rotate the kelley and drill bit to perform the drilling operation. The drilling fluid is introduced through the connection **44** and enters the drill stem, passing downwardly through the kelley and finally out through the outlet port **34'** in the bit. It is pointed out that the housing **35** is non-rotatable and, therefore, the drill stem **21** will rotate therein. The packing **40** which is located in the ends of the sleeve **36** of said housing, is in constant engagement with the surface of the rotating stem **21**, and this packing serves to prevent the escape of the drilling fluid from within the housing. It is obvious that when the packing **40** becomes worn, it is easily replaced by merely removing the tie-bolts **42** and the packing gland **41**, and replacing the worn packing.

It has been found that in some cases the formation to be drilled is so hard that the weight of the hammer **16** is insufficient to force the bit downwardly so as to obtain proper penetration. In such cases, it is desirable to unhook the loops **19** to separate the follow block **17** from the hammer **16**. The hammer may then be raised and its weight dropped upon the follow block whereby the drill bit **34** is, in effect, driven into the ground. In order to absorb the shock of the blow when the hammer is used to drive the bit into the formation, the coil springs **43** which engage the top and bottom of the housing **35** serve as shock absorbers. These springs serve to pad the impact, which eliminates the danger of the blow breaking any of the fluid-tight connections of the housing **35**. The springs are important in that some sort of a shock-absorbing medium must be provided for protecting the housing **35** when the hammer is utilized to drive the drill bit into the ground.

The device, as shown and above described, is simple in structure and may be readily suspended between the leads **14** of an ordinary pile driver. It is noted that no changes need be made in the pile driver and since the drilling equipment is suspended from the usual hammer, it is obvious that the cable which controls the movement of said hammer may be utilized to raise and lower the drilling equipment. It is, of course, manifest that the particular length of the drill stem or kelley is subject to variation and due to the tool joint, it is possible to drill a hole of any depth. As the drilling operation continues and the hole becomes deeper, it is possible to connect an additional section of drilling pipe between the lowermost pipe **33** which is shown and the lower end of the kelley **22**.

The provision of a device such as is shown in the drawings eliminates the necessity of setting up a special drilling rig and spudding the drill stem into the hole. The additional cost of such a rig, together with the necessary time and labor involved in both setting up such a rig and removing the same, is obvious. The equipment is shown as applied to a pile driver, but it is noted that it may be attached to the end of a boom, or other support of other devices.

What I claim and desire to secure by Letters Patent, is:

1. A drilling mechanism adapted to be connected to a pile driver having a hammer and a follow block suspended from said hammer including, a drill stem suspended from the follow block, a drill bit on the lower end of the stem, and means for rotating the stem to rotate the bit, the suspension between the stem and block being such that the weight of the hammer may be placed on the stem to force the drill into the formation.

2. A drilling mechanism adapted to be connected to a pile driver having a hammer and a follow block suspended from said hammer including, a drill stem suspended from the follow block, a drill bit on the lower end of the stem, means for rotating the stem to rotate the bit, the suspension between the stem and block being such that the weight of the hammer may be placed on the stem to force the drill into the formation, and means for conducting a drilling fluid to the stem and bit while said parts are rotating.

3. A drilling mechanism adapted to be connected to a pile driver having a hammer and a follow block detachably suspended from said hammer including, a drill stem detachably suspended from the follow block, a drill bit on the lower end of the stem, and means for rotating the stem to rotate the bit, the suspension between the stem and block being such that the weight of the hammer may be placed on the stem to force the drill into the formation.

4. A drilling mechanism adapted to be connected to a pile driver having a hammer and a follow block suspended from said hammer including, a drill stem suspended from the follow block, a drill bit on the lower end of the stem, means for rotating the stem to rotate the bit, the stem having an axial passage and also having radial ports extending outwardly to the surface of the stem from said passage, a floating housing surrounding the stem and having a fluid chamber communicating with the ports, and means for supplying a drilling fluid to the chamber whereby said drilling fluid is conducted to the stem and bit.

5. A drilling mechanism adapted to be connected to a pile driver having a hammer and a follow block suspended from said hammer including, a drill stem suspended from the follow block, a drill bit on the lower end of the stem, means for rotating the stem to rotate the bit, the stem having an axial passage and also having radial ports extending outwardly to the surface of the stem from said passage, a floating housing surrounding the stem and having a fluid chamber communicating with the ports, means for supplying a drilling fluid to the chamber whereby said drilling fluid is conducted to the stem and bit, the connection between the hammer and block permitting the weight of the hammer to be placed on said stem to force the bit on its lower end into the formation, said connection also being detachable so that the hammer may be utilized to drive the stem and bit downwardly into the formation, and means co-acting with the floating housing for absorbing the shock of the blows of the hammer to prevent damage to said housing.

6. The combination with a pile driving mechanism which comprises a boom having hammer leads suspended therefrom and a hammer vertically movable within the leads for normally driving piles: a drilling mechanism including, a rotatable drill stem adapted to be suspended from said hammer without changing the structure of the pile driving mechanism, and a drill bit on the lower end of said stem.

7. The combination with a pile driving mechanism which comprises a boom having hammer leads suspended therefrom and a hammer vertically movable within the leads for normally

driving piles; a drilling mechanism including, a rotatable drill stem adapted to be suspended from said hammer without changing the structure of the pile driving mechanism, a drill bit on the lower end of said stem, and means for conducting a drilling fluid to the stem and bit.

8. The combination with a pile driving mechanism which comprises a boom having hammer leads suspended therefrom and a hammer vertically movable within the leads for normally driving piles; a drilling mechanism including, a rotatable drill stem adapted to be detachably suspended from said hammer without changing the structure of the pile driving mechanism, a drill bit on the lower end of said stem, and means for rotating the stem and bit.

9. The combination with a pile driving mechanism which comprises a boom having hammer leads suspended therefrom and a hammer vertically movable within the leads for normally driving piles; a drilling mechanism including, a rotatable drill stem adapted to be detachably suspended from said hammer without changing the structure of the pile driving mechanism, a drill bit on the lower end of said stem, means for rotating the stem and bit, and non-rotatable means surrounding the stem for conducting a drilling fluid to the stem and bit, said non-rotatable means permitting the weight of the hammer to be imposed on the upper end of said stem to force the bit in the formation being drilled.

LESTON WATSON.