

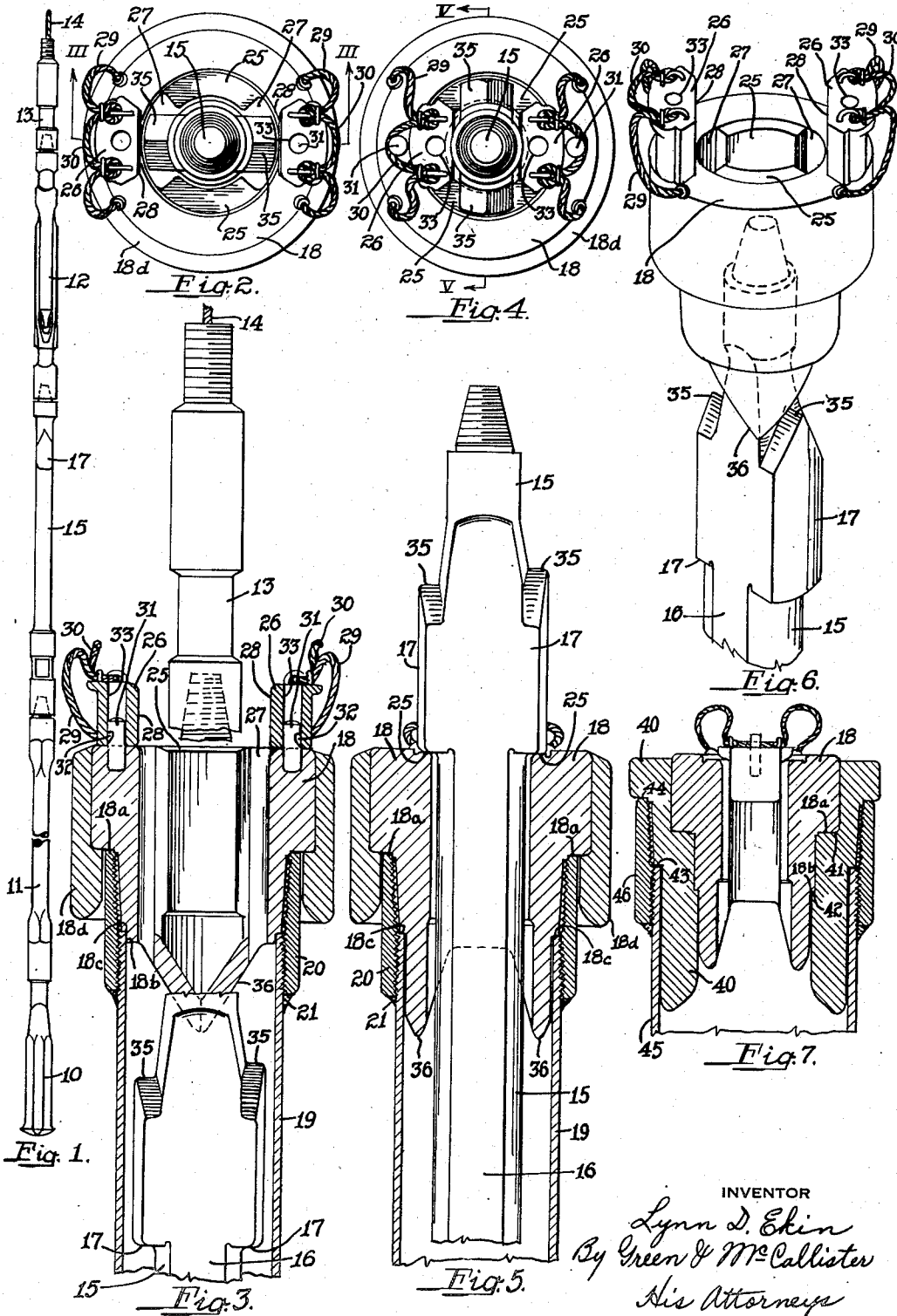
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MECHANISM FOR DRIVING PIPE

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MECHANISM FOR DRIVING PIPE

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This invention relates to mechanism for driving pipe, and more particularly to an improved mechanism for driving pipe or casing into the bore hole during the drilling of an oil or gas well by the percussion method to prevent cave-ins and the like, and is a continuation-in-part of my co-pending application Serial No. 138,843, filed April 24, 1937.

In the drilling of oil and gas wells by the percussion method, the drilling is performed by reciprocating a string of tools, which are suspended from a cable attached to a suitable vertically swinging member or "walking beam" and which crush and cut away the earth formations as they move downwardly or drop. During the drilling operation, unstable earth formations, such as quicksand, shales and the like, are encountered which if not cased off cave into and fill in the drill hole, making further drilling impossible unless such unstable formations are walled in or cased off with pipe driven into the bore hole from the top thereof to the bottom of such formations. Heretofore, it has been customary in the industry to drive pipe into the well or bore hole by attaching a heavy drive clamp or ring, by bolting or wedging such clamp or ring to one of the wrench squares of one of the tools making up the drilling string and then, by reciprocating the drill string, cause the drive clamp or ring to strike repeated blows on a driving head or cap positioned on the top of the upper section of pipe being driven into the bore hole. During the driving process the drive shoe on the lower end of the pipe being driven into the well frequently encounters rock projecting into the bore hole, or other obstructions which make the further driving of the pipe into the bore hole impossible. When such obstructions are encountered, it is then necessary to lower the drill string so that such obstructions below the bottom of the drive shoe may be drilled away and in order to lower the drill string, it is necessary for the driller or operator to first remove the drive clamp so that the drill string may be lowered through pipe already driven, and since drive pipe is furnished commercially in sections twenty feet in length, it is apparent that the heavy drive clamp which must be removed to permit the obstruction below the bottom of the drive shoe to be removed may be anywhere from one to twenty feet above the derrick floor, depending, of course, on the distance the upper section of pipe has been driven and located in a position where it is substantially inaccessible to reach by the driller without climbing. Since the drive clamp is cumbersome and

heavy as well as frequently inaccessible to reach, the operation of removing the clamp from the stem is not only extremely difficult but is also quite hazardous as heavy tools are required in the operation and the task of removing the clamp often results in injury to the driller. Further, considerable time is required to remove and replace the clamp.

The primary object of this invention is to provide mechanism for driving pipe which will permit the operations of drilling and driving pipe to be alternately carried out by merely turning the drill string and without requiring the placing and removing of a drive clamp on and from the drill string with the resultant savings in time and labor, and I accomplish this object by interposing in the drill string a driving member which, when in one rotative position, will coact with and strike repeated blows on the drive head and by providing a drive head which is so shaped that when the driving member is in another rotative position, it will pass through the drive head and into the pipe already driven and permit the drill string to be readily lowered into the bore hole and used to drill away obstructions at the bottom of the drive pipe and in which means are provided for causing the driving member to pass through the head without disturbing the same when the drill string is being withdrawn from the well.

Another object is to provide a mechanism for driving a pipe which will eliminate the hazards encountered in securing and removing a drive clamp to the drill string and also eliminate the necessity for the use by the drillers of heavy wrenches, sledges and other like tools and with which the alternate operation of drilling and the driving of pipe may be accomplished with efficiency and dispatch.

Another object is to provide a mechanism for driving pipe, which is simple in construction, becomes a permanent part of the string of tools used in the drilling operation and is thoroughly reliable and efficient in operation, and is strong, durable and inexpensive to manufacture.

Another object of this invention is to provide an improved head for driving pipe which is so constructed as to readily guide the string of tools through the head when the drilling operation is to be performed; which is provided with means for causing repeated blows to be struck thereon when the pipe is to be driven, and which is so constructed as to be substantially free from the crystallizing effects of vibrations set up by the repeated blows struck thereon.

These and other objects which will hereinafter

be made apparent to those skilled in this particular art are accomplished by means of this invention, one embodiment of which is described in the following specification and illustrated in the accompanying drawing, wherein:

Figure 1 is a view in elevation of an assembled drill string used in the drilling of wells by the percussion method and provided with a pipe driving member made in accordance with one embodiment of my invention;

Fig. 2 is a plan view of my improved driving head with the driving member in position to pass through the head;

Fig. 3 is a sectional view taken on line III—III of Fig. 2 and having a portion of the drill string broken away and showing the driving member below the head;

Fig. 4 is a plan view of the driving head with the guide blocks in position to cause the driving member to strike repeated blows on the head;

Fig. 5 is a sectional view taken on line V—V of Fig. 4;

Fig. 6 is a perspective view of the driving head showing the means for turning the driving member into position to pass through the head as the drill string is being removed; and

Fig. 7 is a sectional view illustrating a modified construction of drive head for use with larger diameter pipes.

In the drilling of wells for the production of oil and gas by the percussion method, a string of drill tools is employed which, as shown in the drawing, comprises a drill bit 10, a drill stem 11, a set of jars 12, a rope socket 13 and a cable 14 which is secured in the rope socket 13 and is used to lower and withdraw the drill string into and from the well. During the drilling and pipe driving operations, a portion of the cable is clamped to a vertically reciprocating walking beam (not shown), whereby the tools are alternately raised and then dropped to crush and cut a bore hole through the various formations of the earth or to strike repeated blows.

Interposed in the string of tools between the stem 11 and the jars 12 is a pipe driving sub 15 made in accordance with my invention, which becomes a permanent part of the string of tools and remains in position in the drill string until the drilling and pipe driving operations have been completed. The driving sub 15 has its opposite sides flattened out to provide opposed parallel faces 16 and has integrally formed outwardly projecting wings 17 on each side of the faces 16 and adjacent the top of said sub which are adapted to coact with a drive head 18 that is positioned on the upper end of a section of pipe 19 and strike repeated blows thereon when such pipe is to be driven into the bore hole formed by said drill string. Pipe 19 is furnished commercially in standard lengths of approximately twenty feet and each section or length is provided at one end with a drive collar 20 which is threaded on the end thereof and which is welded circumferentially at 21 to the outer wall of the pipe. Collar 20 is attached to the pipe during the process of fabrication and the distance between the top of the pipe and the upper end of the collar is of standard dimension.

The body of the drive head 18 is of substantially circular or ring-like shape and the lower end thereof is of reduced diameter to fit within the collar 20 and to provide a shoulder 18a which seats on the top of that collar. The lower edge of the reduced portion of the body of the drive head 18 is recessed at 18b to provide a shoulder

18c which is so spaced below the shoulder 18a that when the shoulder 18a is in engagement with the collar 20, the shoulder 18c will engage and seat upon the top of the pipe 19. In order to increase the weight of the head 18 and to decrease and break up vibration therein, an annular band or ring 18d is shrunk on the outside of the head 18 which projects downwardly on the outside of the collar 20 when the head is positioned on the pipe 19.

During both the drilling and the pipe driving operations, the drill string operates through the opening in the head 18 and when the pipe 19 is to be driven the drill string is raised until the wings 17 on the driving sub 15 are slightly above the top of the drive head 18, after which the drill string is rotated until the wings 17 extend over fan or sector shaped portions 25 on the head 18, which extend inwardly from diametrically opposite sides of the head into the central opening thereof and form the striking shoulders of the head 18. The wings 17 are held in striking relation with the striking shoulders 25 by guide blocks 26 which are then placed in the recesses 27 between the ends of the sector shaped striking shoulders 25. Each guide block 26 is provided with an inner flat face 28 which when the blocks are positioned in the recesses 27 coact with the flat faces 16 of the driving sub and hold it from turning within the head 18. In order to prevent the guide blocks 26 from being dropped while being placed in or removed from the recesses 27, I prefer to attach the blocks to the head 18 with short lengths of flexible wire cable 29, or the like, arranged in such a way as to provide a hand loop or bail 30 for handling the blocks. After the blocks 26 have been positioned in the recesses 27, they may be held against accidental displacement by looping each of the bails 30 over an upstanding pin 31 on the top of the head 18 adjacent the recess 27, and which is provided with a notch 32 for receiving the bail 30. Pins 31 also act to hold blocks 26 on the head 18 after they have been removed from the recesses 27, as well as lock the blocks in position in the recesses and for this purpose each of the guide blocks 26 is also provided with a vertically extending opening 33 so that the block may be positioned over its respective pin 31 when it has been lifted out of the recess 26. The openings 33 in the guide blocks 26 are so spaced relative to the flat faces 28 thereof and the pins 31 are so positioned on the head that when the blocks are placed on the pins, the flat surfaces 28 form a continuation of the recesses 27, the purpose of which will hereinafter be described.

As heretofore stated, during both the drilling and the pipe driving operations, the drill string operates through the head 18 and within the casing or pipe 19. When it is desired to drive the pipe 19 further into the bore hole, the drill string is pulled up until the wings 17 on the driving sub 15 are above the top of the drive head 18 and the string is then rotated until the wings 17 are over the shoulders 25 after which the guide blocks 26 are positioned in the recesses 27 with the flat faces 28 thereof contacting the flat faces 17 of the driving sub 15 and the bails 30 are then looped over the pins 31 and positioned in the notches 32 to lock the blocks in the recesses. The drill string is then reciprocated and since the driving sub 15 is held against turning movement, repeated blows will be struck on the shoulders 25 and the pipe will be driven into the bore hole. If the drive shoe

(not shown) on the bottom of the drive pipe should come into contact with some obstruction in the bore hole and it should become necessary to drill out the obstruction before continuing the pipe driving operations, the balls 30 are released from the pins 31 and the guide blocks 26 are then lifted out of the recesses 27 and positioned on the pins 31 after which the drill string is rotated for a quarter of a turn to bring the wings 17 into registry with the recesses 27 which are of sufficient width to permit the wings 17 to pass through the opening in the head 18 and the string of tools to be lowered into the bore hole. Since the faces 28 of the blocks 26, when in this position, form a continuation of the recesses 27 the blocks act as guides to prevent the wings 17 from catching on the sides of the head and thus aid in lowering the drill string into the bore hole. After the obstruction has been removed by the drilling operation and it is desired to drive the pipe further into the bore hole, the drill string is pulled upwardly through the head and the operation as hereinbefore described is repeated. In order to facilitate the withdrawal of the drill string, the tops of the wings 17 on the driving sub 15 are made of substantially inverted V-shape to provide cam surfaces 35 thereon which are adapted to engage and coact with two downwardly projecting V-shaped members or cams 36 formed on the head beneath the striking shoulders 25 and impart such turning movement to the drill string as will position the wings 17 beneath the recess 27 and permit the driving sub to pass through the head, and in order to prevent accidental binding of the coating cam surfaces 35, 36, one of the cams on one of the wings 17 is somewhat lower than the tip of the cam on the other wing whereby the higher cam 35 first comes in contact with one of the cams 36 and starts the turning movement before the other cam 35 comes in contact with the other cam 36 and wedging of the driving sub in the drive head is thereby prevented.

From the foregoing description of my invention, it is apparent that I have devised a mechanism for driving pipe in which the drill string may be readily passed through the driving head by merely removing the guide blocks 26 and since these guide blocks are attached to the head by the cables 29 there is no danger of them falling and causing injury to anyone working beneath the head 18. Further, when the blocks 26 are not being used as a guide to hold the driving sub in striking position, they are positioned on the pins 31 and acts as guides to properly position the wings 17 over the recesses 27 where they may pass downwardly through the head and prevent the wings from hooking on. Since with my improved mechanism there are no clamps to be driven on and off the drill string and no bolts to be tightened and loosened, I have eliminated, to a great extent, the necessity for the use of hammers, sledges, wrenches and the like at inaccessible positions and materially reduced the hazard of such implements falling with resultant injury to the operators.

In Fig. 7 of the drawing, I have shown a drive head for use in driving pipe of larger diameter. In this construction, the head 18 has an extension bushing 40 shrunk therearound which is provided with vertically spaced offset portions 41-42 on its inner surface for engaging the shoulders 18a-18b of the head 18. The outer surface of the bushing 40 is of stepped or offset

construction to provide shoulders 43-44 for engaging the top of the pipe 45 and the collar 46 welded thereto so that blows delivered to the head 18 by the driving sub 15 will be transmitted equally to the collar and to the pipe.

From the foregoing it is apparent that I have provided a mechanism for driving pipe which will permit the driller to change readily from the drilling operation to the pipe driving operation, or vice versa, and which has a high safety factor since there are no loose parts or tools to be handled during the change from one operation to the other. It is further apparent that since it is only necessary to remove the guide blocks to change from a pipe driving to a drilling operation and to place the guide blocks in the recesses in the head to change from the drilling operation to a pipe driving operation, that such changes can be made without any appreciable loss of time and both operations can readily be carried on with efficiency and dispatch.

By making the head 18 as a laminated structure, I not only reinforce and strengthen the head, but the laminations have the effect of breaking up and deadening vibration set up by the repeated blows on the head by the driving sub and thus prevent the crystallization and resultant failure of the metal in the head.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A mechanism for use with the drill string in the cable system of drilling for driving pipe into a well comprising in combination a driving member interposed in said drill string, a driving head adapted to be positioned on a section of pipe and having an opening therethrough through which said drill string operates, means on said head and projecting into said opening for engaging said driving member when said member is turned to one position, and means adapted to be positioned in said opening for holding said driving member in position to strike repeated blows on the driving member engaging means of said head.

2. Mechanism for use with the drill string in the cable system of drilling for driving pipe into a well comprising in combination a member interposed in said drill string and having driving means thereon, a driving head positioned on a section of pipe and having an opening therein through which said drill string operates, means on said head and projecting into said opening for cooperating with said driving means when said member is in one rotative position in said opening, and means removably positioned in said head for holding said driving member in such rotative position.

3. Mechanism for use with a string of cable drilling tools for driving pipe into a well comprising, in combination, a reciprocable driving member interposed in said string of tools having a flat face and a striking wing projecting therefrom on each side of said face, a ring-shaped driving head positioned on said pipe and having an opening through which the string of tools operates, and guide blocks associated with the driving head and adapted to be positioned in the opening thereof for coacting with the flat face of said member to hold said member in a position for striking action of its wings upon said head.

4. Mechanism for use with a string of cable drilling tools for driving well pipe comprising a driv-

ing member interposed in said string of tools and having a flat face and striking wings projecting therefrom on each side of said flat face, a driving head positioned on the well pipe and having an irregular opening therein through which the string of tools operates, said opening being of sufficient width to permit said wings to pass through said head when said driving member is in one position, and removable means associated with said driving head and coacting with the flat face of said member for holding said member in position for striking action of its wings upon said head.

5. Mechanism for use with a string of cable drilling tools for driving well pipe comprising in combination a driving member interposed in said string of tools, striking wings projecting from opposite sides of said driving member, a driving head positioned on the well pipe and having an irregular shaped opening therein through which the string of tools operates, means adapted to be positioned in the opening of said driving head for holding said driving member in position to cause the wings thereon to strike upon said head, said last mentioned means being removable to permit the striking wings on said member to pass through the opening in said driving head.

6. Mechanism for use with a string of cable drilling tools for driving well pipe comprising in combination a driving member interposed in said string of tools and having at least one flat face thereon, striking wings projecting from said member on each side of said flat face, a driving head positioned on the well pipe and having an opening therethrough through which the string of tools passes, a guide block adapted to be positioned in said opening for coacting with the flat face of said member to hold said member in position for striking action of its wings upon said head, and means for supporting said guide block on the top of said head.

7. Mechanism for use with a string of cable drilling tools for driving well pipe comprising in combination a member interposed in said string of drilling tools and having at least one flat face, striking wings projecting from said member on opposite sides of said flat face, a driving head positioned on said well pipe and having an opening therein through which said string of tools operates, said opening having a width somewhat greater than the width of said wings so that said wings may pass through said opening, sector shaped shoulders on said head and projecting into said opening, and a guide block adapted to be positioned in said opening between said shoulders for coacting with the flat face of said member to hold said member in a position

for striking action of its wings upon said shoulders, said guide block being removable to permit said member to be turned and the wings passed through said opening.

8. A mechanism for use with a string of cable drilling tools for driving well pipe comprising in combination a driving member interposed in said string of tools, striking wings projecting from opposite sides of said driving member, a driving head positioned on said well pipe and having a central opening therein through which said tools operate, there being opposed recesses in the wall of said opening to permit the wings of said driving member to pass through said head, a pair of guide blocks adapted to be removably positioned in said recesses, and coacting means on said head and said wings for directing said wings into alignment with said recesses.

9. A mechanism for use with a string of cable drilling tools for driving well pipe comprising in combination a driving member interposed in said string of tools, striking wings projecting from opposite sides of said driving member, a driving head positioned on said well pipe and having a central opening therein through which said tools operate, there being opposed recesses in the wall of said opening to permit the wings of said driving member to pass through said head, a pair of guide blocks adapted to be removably positioned in said recesses, and cooperating means for directing said wings into alignment with said recesses when said string of tools is being pulled upwardly through said head, said means including a downwardly projecting cam surface on the bottom of said head and a cam surface on the top of at least one of said wings.

10. Mechanism for driving pipe into a well comprising in combination a reciprocating driving member, a substantially cylindrical head through which said driving member reciprocates, said member being adapted to engage said head when turned to one position and to pass through said head when turned to another position, an extension bushing surrounding said head, and means on the outer surface of said bushing for supporting said head on a pipe.

11. Mechanism for driving pipe comprising a ring-shaped drive-head having upper and lower external annular shoulders, the upper shoulder being adapted to be supported on a drive collar and the lower shoulder being adapted to be supported on a pipe to which said drive collar is secured and an annular band shrunk around said drive head, said annular band having an inwardly extending annular shoulder adapted to receive the upper shoulder of said drive head concentrically of said drive collar.

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