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HYDRAULIC EXPANDER FOR WELL DRILLS AND THE LIKE

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1 Sheets-Sheet 1
To all whom it may concern:

Be it known that I, JESSE PERKINS MILLER, a citizen of the United States, and a resident of Houma, in the parish of Terrebonne and State of Louisiana, have invented certain new and useful Improvements in Hydraulic Expanders for Well Drills and the like, of which the following is a specification.

My invention relates to improvements in well drills and it consists in the constructions, combinations and mode of operation herein described and claimed.

An object of the invention is to provide an attachment to the drill stem, which operates by hydraulic pressure to expand the drill bit.

A further object of the invention is to provide an attachment which operates on the principle stated above, which can be used for expanding underreamers and the like.

A further object of the invention is to provide a device for expanding the blades of the drill bit which is actuated and held in the operative position by the force impressed on the water by the pump at the top of the well.

Other objects and advantages will appear in the following specification, reference being had to the accompanying drawings, in which:

Fig. 1 is a sectional view illustrating the general arrangement of a drill stem and bit head, showing the attachment in place between the two.

Fig. 2 is a detail section of the attachment alone.

Fig. 3 is a detail perspective view of the piston and rod.

Fig. 4 is a longitudinal section illustrating one application of the attachment to expand an underreamer, and

Fig. 5 is a similar view illustrating another application of the attachment to expand an underreamer.

The purpose of the invention is to expand the blades 1 and 2 of the drill bit in the head 3 to the operative position, and to hold them there. The bit blades are of the construction disclosed in my copending application for a patent on expansive drill bits, filed August 3, 1921, Serial No. 499,523 and matured into Patent No. 1,448,762, March 20, 1923. The attachment 4 is intended to be used to expand those blades. But its use is not limited to this particular purpose. It may be used in a variety of ways to expand the parts of an underreamer as illustrated in Figs. 4 and 5.

The construction comprises a section of heavy pipe, designated above as the attachment 4. This pipe is threaded at 5 at the upper end and has a tapering thread 6 at the lower end. The drill stem 7 screws into the upper end, and the tapering thread 6 screws into the bit head 3.

According to the mode of operation of the bit blades 1 and 2 of the copending application above referred to, the blades must be lifted in respect to the bit head 3 in order that they may be expanded into the operative position. This is done in the present instance by hydraulic pressure. Water from the pipe above enters the drill stem 7, passes around a cylinder 8 down to a plug 9, up into the cylinder 8 where it drives the piston 10 to the top. The major volume of water passes down through the plug 9 through wash holes 11. It is this water that keeps the blades 1 and 2 clear of the cuttings.

But returning to the piston 10; this piston carries a rod 12 which terminates in a plunger or head 13. The blades 1 and 2 are pivoted at 14 to this head. Obviously, raising the piston 10 will raise the blades, cause the successive engagement of the bevels 15 and 16 with the beveled shoulders 17 of the bit head 3 and in turn cause the expansion of the blades to the position shown in Fig. 1. A tube 18 supports the cylinder 8 inside of the attachment 4. Spacers 19 stabilize the free end of the cylinder. The tube 18 passes through a plug 20 which closes the top of the cylinder. A port 21 in the bottom of the plug communicates with the tube 18.

As the piston 10 rises, water, mud, etc., is driven out of the top of the cylinder ahead of the piston and so the movement of the piston is not impeded. The piston rod 12 passes through a packing 22 and a stuffing box 28. The packing is carried by the stuffing box and the stuffing box screws into the plug 8. It is unnecessary to unscrew the
The stuffing box 23 from the plug 9 in disassembling the device.

The operation will be more fully understood by a brief additional description. The drill herein disclosed is intended for rotary drilling in materials such as sand, clay, shale and the like. It is of the familiar fish-tail type. A pump at the top forces water down into the drill stem 7 so that it passes around the cylinder 8 through the wash holes 11, around the blades 1 and 2 and then back to the top with the cuttings. A part of the water under pressure enters the cylinder 8 from the bottom and drives the piston 10 to the top so that the piston rod 12 carries the head 13 and the blades 1 and 2 with it.

The upward movement under the influence of the water under pressure naturally stops when the blades 1 and 2 are seated in the head 3. The piston, and consequently the blades 1 and 2, remain in the uppermost position as long as the fluid pressure is sustained. Therefore, the blades remain in the operative position as long as the pump at the top works. The pressure inside of the attachment 4 and inside of the cylinder 8, exceeds that on the outside of the attachment. It is this excess of pressure that keeps the parts mentioned in the operative positions.

The modifications in Figs. 4 and 5 are merely intended to show different applications of the invention. It is by no means to be understood that the applicability of the invention is confined to the particular uses herein illustrated, because it may be used to actuate a casing cutter, casing perforator, casing splitter and many other types of rotary well tools which must be opened in the well.

In Fig. 4, the attachment 4 is screwed to the bottom of the underreamer 26 while in Fig. 5 it is screwed on top and bears the same relationship to the underreamer 26 as it does to the bit head 3 in Fig. 1. The blades 27 of the underreamer are expansively and contractively mounted so that pressure from beneath the respective pistons will drive them out for the performance of the underreaming function.

In Fig. 4 the head 13 is in contact with the lower end of the reamer blades 27. Fluid pressure of the well bore against the lower exposed end of the piston 10 drives the rod 12 up so that the head 13 is driven against the blades 27. The blades are beveled internally at 28 in such a manner that when the piston 10 is engaged the blades are forced apart and are caused to expand. The blades operate in slots 30 in the reamer body. In Fig. 5, parts are reversed but a similar mode of operation obtains. An upward pressure beneath the piston 10 lifts the rod 12. This rod has connection at 31 with the reamer blades 27, and when the internally beveled parts 32 move up against a pin 28 the blades are caused to expand. In Fig. 5 the pressure beneath the piston 10 is equal to the pump pressure and the pressure due to the depth of the well bore. There is also pressure on top of the piston due to the depth of the bore, but the pump pressure in the cylinder 8 predominates the bore pressure and therefore causes the piston to rise.

I claim:

1. A well tool comprising a cylindrical body, a bit head attached to said body, said head including a wash hole, a cylinder situated in the cylindrical body, a piston in said cylinder having a rod, blades carried by the bit head, and means through which the piston rod has connection with the blades for the expansion thereof under the influence of fluid pressure against the piston in said cylinder, said wash hole also conducting the fluid past the blades to wash out the cuttings.

2. A well tool comprising a cylindrical body, a bit head, means by which the bit head is attached to the cylindrical body, a piston, the blades carried by the bit head, and hydraulic operated means situated in said cylindrical body with connections for expanding the blades, said wash hole being adapted to direct some of the fluid past the blades to wash away the cuttings in operation.

3. A well tool comprising a cylindrical body, a bit head, means by which the bit head is attached to the body, means which provides a closure for the attached end of the bit head, said means having a wash hole providing fluid communication between the bit head and body, blades carried by the bit head, a cylinder situated in the body, a piston operable in the cylinder, and a piston rod extending from the piston through the closure means into contact with the blades for expanding them, some of the piston-operating pressure fluid being adapted to pass through the wash hole to clean the blades during operation.

4. A well tool comprising a cylindrical body, a bit head, means by which the bit head is attached to the body, means forming a partition between the bit head and body but which has a wash hole establishing fluid communication between the two, means which constitutes a packing carried by the partition, blades carried by the head, a cylinder situated in the body, a piston rod having operative engagement at one end with the blades and passing through the packing means into the cylinder, and a piston in the cylinder carried by the adjacent end of the rod adapted to be moved in said cylinder by fluid pressure to expand the
blades, a part of the fluid flowing through the wash hole in a stream past the blades to clear them of cuttings.

5. A well tool comprising a cylindrical body, a bit head having slots, means by which the head is attached to the body, means forming a partition between the head and body but which has a wash hole establishing fluid communication between the two, blades carried by the bit head which are adapted to be contracted within the slots, a cylinder, means by which it is suspended at one end in the cylindrical body, means by which the otherwise free end of the cylinder is stabilized, a piston rod having operative engagement at one end with the blades and passing through the partition into said cylinder, and a piston carried by said end of the rod adapted to be moved in the cylinder by fluid pressure to expand the blades out of said slots, some of said fluid passing in a stream past the blades.

6. In a well tool, a cylindrical body, a hydraulic cylinder, means by which said cylinder is suspended at one end in said body, means at the other end forming stabilizing means to keep the cylinder from swinging, and a piston in said cylinder against the motion of which said last means performs a stabilizing function.

7. A well tool comprising a cylindrical body, a hydraulic cylinder, means by which one end of the cylinder is rigidly secured inside of the cylindrical body, a plurality of lugs radiating from the cylinder adjacent to the other end and contacting the inside of the body, and a piston which is operable in the cylinder and in respect to the operation of which said lugs have a stabilizing function.

8. In a well tool, a cylindrical body, a hydraulic cylinder situated in the body, means by which the cylinder is suspended at one end in the body said means having a passage for fluid, a piston in the cylinder which is operable therein by virtue of the pressure of said fluid thereaginst, and means at the other and otherwise free end of the cylinder adapted to stabilize the cylinder during the operation of the piston.

9. A well tool comprising a bit head having slots, blades carried by the bit head, means in operative connection with the blades adapted to move them upward when the pressure of a pump is imposed thereon in a well bore, and means on the bit head with which said blades engage in said upward movement expanding them in said slots in a cutting position.

10. A well tool comprising a bit head having slots, blades carried by the bit head, a hydraulic cylinder, a piston rod having engagement at one end with the blades the other end extending into the cylinder, a piston in the cylinder adapted to be moved upward in respect to the well bore in which the tool is located by the fluid put under pressure by a pump, and means against which the blades operate during such movement causing them to expand in said slots to a working position.

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