Aug. 16, 1932. F. L. LE BUS 1,871,536

WELL DRILLING APPLIANCE

Filed Feb. 25, 1929

Fig. 1.

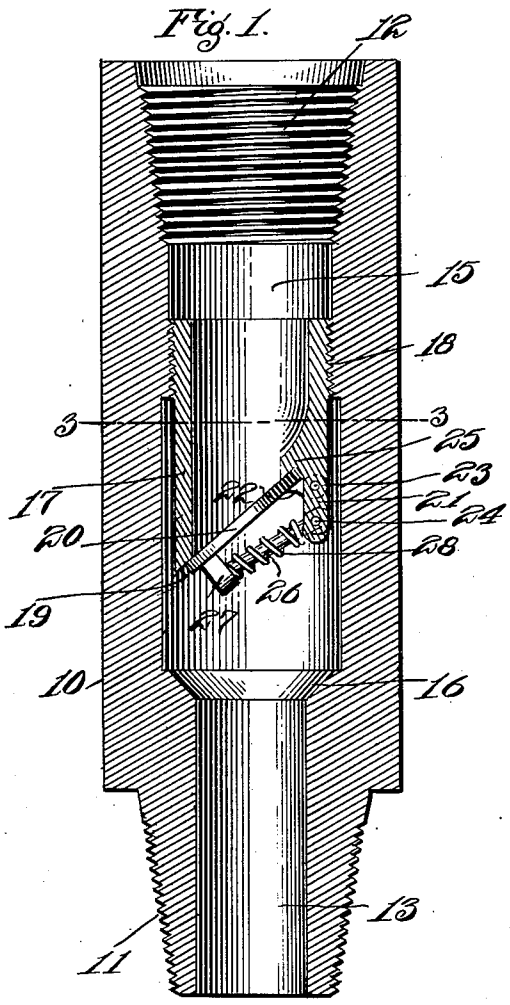


Fig. 2.

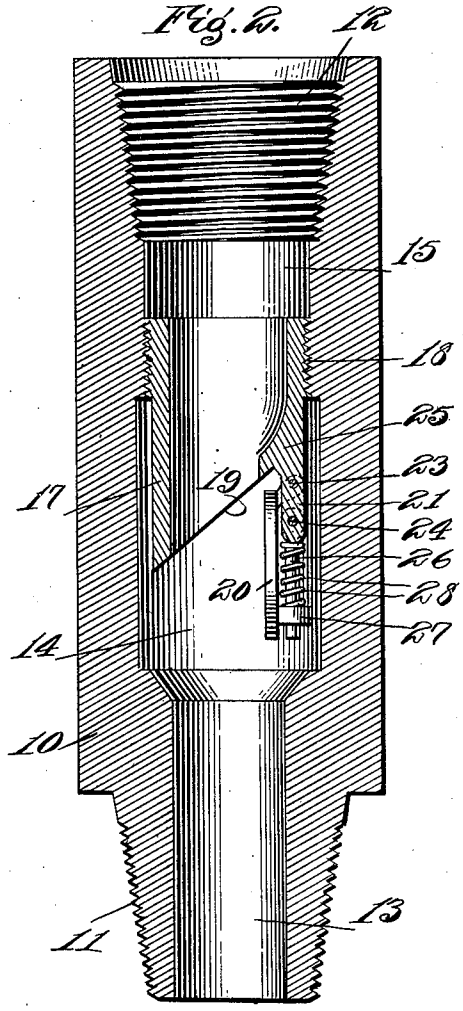
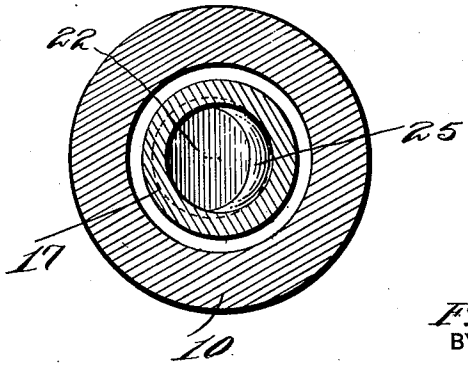


Fig. 3.



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WELL DRILLING APPLIANCE

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This invention appertains to improvements in well drilling appliances generally, and more particularly to a type of the same for facilitating the lowering of a drill pipe string downwardly of a well bore.

In the well drilling practice, it is the common method to drill a well by means of a rotary drill, which is provided with cutting blades, and is carried at the lower end of a string of inter-connected pipe sections. As the pipe string is rotated, and the drill blades are cutting an earth strata, the cuttings are carried out of the well bore by means of a water supply which is forced downwardly of the pipe string from water pumps on the ground surface, the cuttings being carried by the water upwardly of the well bore at the outer side of the pipe string. Hence, during the entire drilling operation, the well bore is full of mud and water.

Since these wells, particularly oil wells, are usually very deep, the pipe string is lowered into and taken out of the well in sections, and this is a necessary procedure in order to keep the drill head supplied with sharp cutters. The drill pipe string is handled by hoisting machinery which is composed, in part, of a crown block, a travelling block, a cable for operating the blocks, and a drum for winding in the cable. The drum is provided with brakes employed as controls, and in handling a long string of pipe as it is being lowered into a well, it is hard on these brakes whenever stops are made in the lowering operation to put on additional sections or lengths of the drill pipe. This is due to the fact that the weight of the string of drill pipe is borne directly on the cable at all times, and until the drill head at the lower end of the pipe string is supported directly on the earth strata at the well bottom.

An object of the invention, therefore, is to provide a means to be incorporated in the pipe string immediately adjacent the lower end thereof, which will tend to float the pipe string in the body of detritus, i. e. water and mud, filling, or nearly filling, as the case may be, the bore of the well, and thereby lightening to an appreciable degree the strain on the cable, and consequently on the drum brakes during the lowering and stopping movements of the drill string.

Another object of the invention is to provide a means of the class set forth, which is in the nature of a valve capable of functioning as aforesaid by closing the bore of the pipe string against the upflow therethrough of the detritus, but which will automatically open to permit of the discharge of a supply of water downwardly of the pipe string bore into the well, under the pressure of the water admitted to the pipe string at the ground surface.

A further object is to so construct the valve aforesaid that the water will pass straight through the pipe string to the cutters on the drill head at the extreme lower end thereof without any appreciable restriction of or retardation in the flow of the water, which construction will have the added advantage that in the case of the necessity to "shoot" the string or pipe below the valve, as when the latter becomes stuck in the well bore, a tube of nitro-glycerin or dynamite will also pass through the pipe string without interference from the valve.

In general, the invention is comprised in a tubular section to be connected directly between the lower end of the pipe string and the drill head usually carried directly thereby, and in the bore of which a valve seat is either formed or mounted. Cooperative with this seat is a valve member, preferably of flat form, which is hinged at one side of the seat, so as to give clear and unrestricted passage therethrough to a water supply or a charge of nitro-glycerin or dynamite passed downwardly of the pipe string from the upper end of the same. The valve is preferably lightly tensioned to closed position on the

valve seat at all times, excepting when water or a tube of nitro-glycerin or dynamite is being passed downwardly of the pipe string when it will readily open, under the pressure thereof at its upper side.

With the foregoing and other equally important objects and advantages in view, the invention resides in the certain new and useful combination, construction and arrangement of parts as will be hereinafter more fully described, set forth in the appended claim and illustrated in the accompanying drawing, in which:

Figure 1 is a vertical longitudinal section through a drill pipe section, showing a practical embodiment of the valve and valve seat as preferably incorporated therein, the valve member being shown as it appears when closed,

Figure 2 is a view similar to that in Figure 1, but showing the valve member as it appears in its open position, and,

Figure 3 is a horizontal section taken on the line 3—3 of Figure 1.

Referring to the drawing, wherein like characters of reference designate corresponding parts in the several views thereof, the embodiment of the invention, as shown therein by way of example only, is constituted in a tubular body or pipe section 10 of an equal exterior diameter to that of the connection end of a drill head (not shown), and a drill pipe section (not shown) between which it is to be interposed in connected relation therewith, the lower end of the body or pipe section being provided with a usual form of reduced and tapered screw threaded portion 11, and its upper end with an inwardly tapered screw threaded socket portion 12.

Opening concentrically upward of the lower end of the body 10 is a bore 13, which is of an equal diameter to that of the vertical bores in the drill head and the pipe sections aforesaid, and which communicates at its inner or upper end with an intermediate bore 14 of a greater diameter. The upper end of this intermediate bore 14 connects with a shorter bore portion 15, which is of a slightly less diameter than the same, but still of a greater diameter than the lower bore 13. This bore portion 15, in turn, opens into the lower end of the tapered socket 12.

Positioned within the body 10 is a shorter tubular body 17, which is exteriorly screw threaded at its upper end for engagement, as at 18, with a screw thread formed in the lower half of the wall of the bore portion 15. By this arrangement, the lower end portion of the tubular body 17 depends into the intermediate bore portion 14 in spaced relation with respect to the wall thereof, and with its extreme lower end spaced at a distance from the point of mergence of the lower end of the bore portion 14 into the bore portion 13. The lower end of the bore portion 14 is preferably connected with the adjacent end of the lower bore 13 by means of an annular sloping wall portion 16, substantially as shown.

The lower end of the tubular valve body 17 is cut away to provide an angular or inclined seating surface 19, against which a valve member or flap 20 will seat when closed. Depending from the shorter side of the valve body 17 is an extension or lug 21, which is bifurcated vertically and inwardly of its lower end to receive in the space between the opposite leg portions thereof an ear or lug 22, angularly offset from the under side of the adjacent edge portion of the flap or valve member 20. This ear or lug 22 is suitably apertured for the engagement of the upper of a pair of pivot pins 23 and 24 therewith, which pins are mounted transversely of and in the bifurcated portions of the extension or lug 21. The wall of the valve seat 17 is inwardly thickened, as at 25, immediately above the adjacent underlying portion of the valve member 20, so that when the latter swings downwardly to full open position, it is protected by the overhang of this thickened portion or shoulder from undue wear thereon by the force of the flow of water downwardly of the pipe string in which it is incorporated. The upper side of the thickened portion of the shoulder 25 is preferably curved downwardly and inwardly from its point of mergence into the vertical wall of the upper portion of the valve seat, so that it will offer no impediment to the free downward flow of the water.

Engaged on the lower pivot pin 24, at one end is an elongated member or rod 26, which underlies the valve member 20, and has its other end engaged for free sliding movement in an aperture formed in a projection or lug 27, depending from the underside of the valve member. A coiled spring 28 is encircled about the intermediate portion of the rod 26, and is tensioned thereon between the extension 21 and the lug 27, whereby the valve member or flap 20 will be retained in open position as shown in Fig. 2 since it swings to full open position under the pressure of a downflow of water through the tubular body 17, or under the force exerted thereon by a charge of dynamite or nitro-glycerin lowered in the pipe string. On the other hand a back flow of water or other liquid will release the valve from the position shown in Fig. 2 so that the spring 28 will come into play and force the valve towards closing position. The back flow of the water at this time will cause a positive seating of the valve.

In the use of the device, when coupled in on a drill pipe string immediately above the drill head at the lower end of the latter, the valve member or flap 20 will be normally maintained in closed position on its seat 19 by the action of the spring 28. Now, as the

pipe string is lowered into a well bore, and the drill head enters the mud and water content of the well, air will be pocketed within the pipe string below the valve 20. Thus, the mud and water will be prevented from entering the pipe string above the valve member or flap 20, and the air trap below the same will act to impart a partial buoyancy to the pipe string and to an extent to greatly facilitate the lowering movements thereof with a minimum amount of wear and tear on the winding drum brakes, as well as on the operating machinery as a whole.

As soon as the pipe string has been lowered to the bottom of the well and the drilling operation is continued, water will be introduced into the upper end of the pipe string from the usual water pumps, and the pressure of the same will cause the valve 20 to open when the water will pass to the drill cutters and outwardly into the bore of the well, where it mixes with the bore cuttings in the usual manner to reduce the same to a liquefied state, commonly called "detritus," and thereby facilitating the removing of the cuttings from the well bore. This detritus is subsequently discharged upwardly of the well bore at the outer side of the drill pipe string, so that in the use of the valve 20 in the latter, the interior of the string, at least above the valve, is kept free of the detritus at all times.

In the event of it becoming necessary at any time to shoot the string of pipe below the valve 20 to recover it when it becomes stuck, a tube of nitro-glycerin or dynamite may be readily passed downwardly of the pipe string and through the valve body 17 without interference therewith of the valve member or flap 20, which will swing to open position beneath the thickened portion of shoulder 25, and entirely clear of the passage through the valve body 17. Immediately upon being relieved of the pressure of water, or after the passage of a tube of nitroglycerin or dynamite through the valve body, the valve member or flap 20 will be swung to closed position by the expansive action of the spring 28.

Without further description, it is thought that the features and advantages of the invention will be readily apparent to those skilled in the art, and it will of course be understood that changes in the form, proportion and minor details of construction may be resorted to, without departing from the spirit of the invention or its scope as claimed.

Having thus fully described the invention, what is claimed is:

In a device of the class described, a tubular body adapted to be coupled in on a string of drill pipe sections adjacent the lower end thereof, a sleeve threaded into the tubular body member and provided with a valve seat inclined at an angle to the horizontal, an arm projecting downwardly from the upper end of the valve seat, a valve pivotally mounted on the arm and adapted to engage the seat, a rod pivotally mounted on the arm adjacent the valve, an ear secured to the valve and provided with a passage adapted to receive the free end of the rod and a spring located between the ear and the arm, the sleeve, valve, and valve mounting being removable as a unit from the upper end of the tubular body.

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