

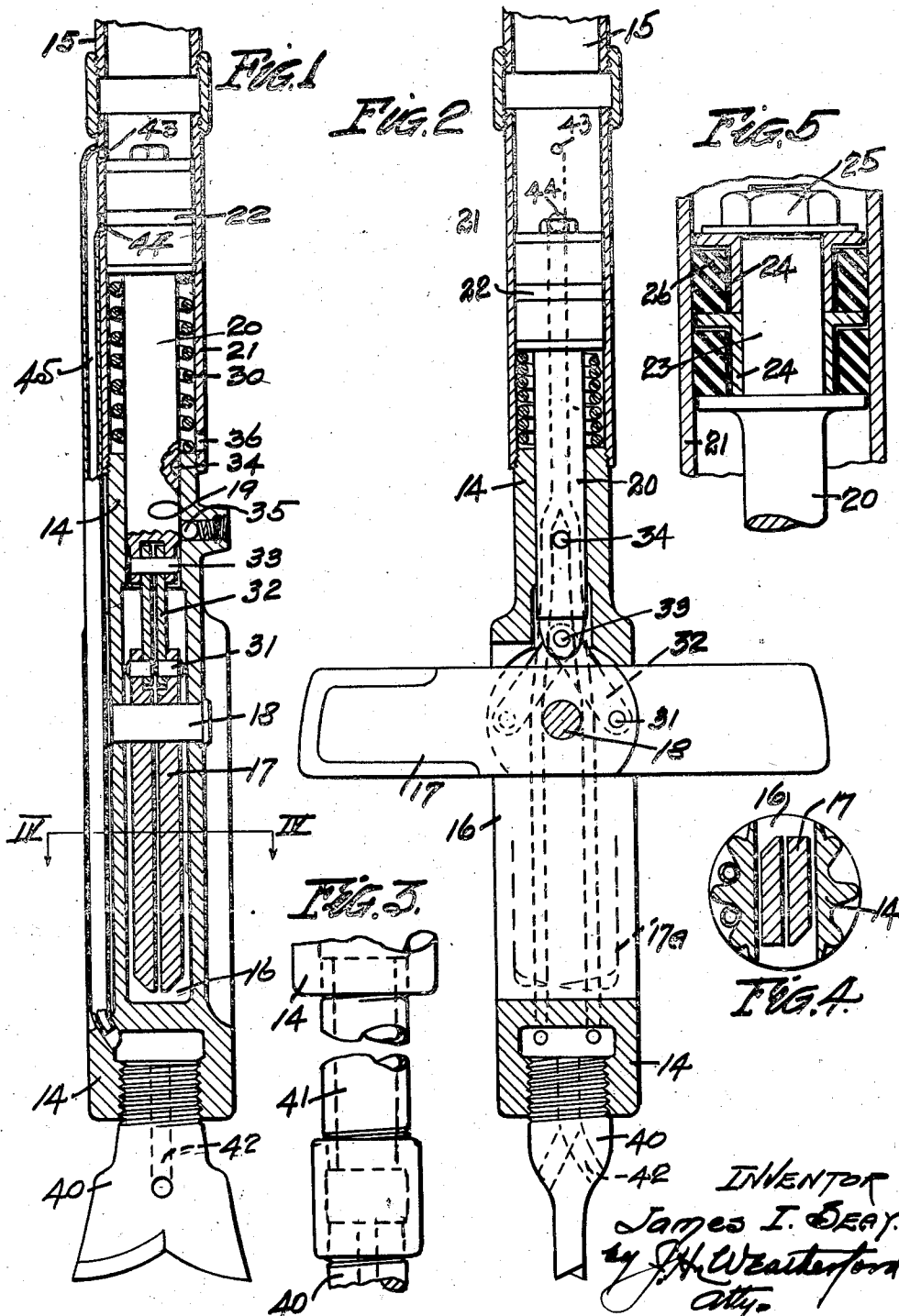
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WELL REAMER

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WELL REAMER

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9 Claims. (Cl. 255—76)

This invention relates to improvements in tools for drilling wells and more particularly to tools which have reamers for use in connection therewith, for the purpose of locally enlarging the well bore at a desired place or places.

Artesian wells particularly for water supply are drilled through varied strata and into water bearing sand. A well casing is provided which extends through these varied strata and a strainer is secured to and projects below the lower end of the casing deep into if not entirely through the sand strata. Water must flow through this strainer from the sand and the openings in the strainer must be large enough to allow the water flow, yet fine enough to restrain the sand. Even so the openings are rapidly enlarged and the strainer must eventually be replaced or the well be abandoned.

As one way of overcoming these difficulties a bore much larger than the strainer used has been made and the space around the strainer has been filled with gravel. In such case reliance is placed on the gravel to restrain the sand and the openings in the strainer need only be small enough to prevent the gravel entering. Such gravel type of wells have not only largely increased the strainer life but have also effected tremendous increases in well capacity; but it has been necessary to make, at large extra cost, and ordinarily to completely case at still greater cost, a bore from the surface of the ground downward which approximated the desired diameter of the gravel section except that some enlargement in the sand has been accomplished by washing the sand walls down. Unfortunately however, even then the resulting bore in the sand is uneven and cannot be satisfactorily controlled. It is the purpose of the present tool to cut, and control the size of, this larger bore thereby permitting the bore and casing through the overlying strata to be only sufficiently larger than the strainer and strainer pipe to be used to allow feeding in, or placing, of the gravel around the strainer after the strainer is in place.

In such work trouble is often had in holding the reamer straight and therefore it is found advantageous to use in connection with the reamer portion of the apparatus a pilot bit which extends below the reamer and guides the bottom end of the boring rig. It is generally found necessary to do some boring with this pilot bit at a time when reaming is not being done and therefore at a time when it is necessary that the reamer plates be closed and in inoperative position.

To do this drilling it is necessary that water be forced directly to the pilot bit as it is necessary

that water be also forced to the reaming plates when the latter are in use. However the amount of water which is needed for the pilot bit alone is much less than that which is needed where reaming is being done.

Also in all cases, it is necessary that all the water furnished be delivered through the pilot bit, both for the pilot bit and for the reamer, it having been found that where part of the water may escape directly to the reamer the pilot bit chokes up and does not pass any of the water, and therefore clogs and effectually prevents further operation.

It is found too, that some of the material removed by the reamer drops down and assists in the choking of the pilot bit, so that the need for flushing through the pilot bit is even further emphasized.

The primary object of the present invention is to provide in a well reamer having a pilot bit, means for compelling flushing fluid to flow directly to the pilot bit when the reaming means are closed, and means for augmenting the supply of water furnished through the pilot bit when the reamer blades are open and in working position.

A further object is to provide means in a device employing a piston to extend the reaming means, whereby the piston employed may be freed from sand or other material such as is necessarily in suspension therearound during operation.

The means by which the foregoing and other objects are accomplished and the manner of their accomplishment will readily be seen from the following specification on reference to the accompanying drawing, in which,—

Fig. 1 is a vertical section on the center line of a drill stem and head and at right angles to reamer bits carried by the head, showing the bits in closed or inoperative position.

Fig. 2 is a sectional elevation at right angles to Fig. 1, with the reamer blades extended into cutting position and the bit carried by an extension bar.

Fig. 3 is a fragmentary elevation showing a hollow drill bar between the head and bit.

Fig. 4 is a transverse section taken on the line IV—IV of Fig. 1, and

Fig. 5 an enlarged sectional elevation of a fragmentary portion of the cylinder forming part of the drill head, together with piston therein.

Referring now to the drawing in which the various parts are indicated by numerals, the tool comprises essentially a head 14, which is screwed on to a drill pipe 15 which extends to the sur-

face of the ground. The head 14 is transversely slotted at 16 to provide a pocket in which reamer blades 17 are housed. In Figs. 1 and 4, these blades are shown in retracted position, and in Fig. 2 in open position. Fig. 2 also shows in dash lines the position 17A the blades occupy when closed. Adjacent the upper end of the pocket, is a pin 18 on which the blades 17 are pivoted, the holes for the pivot pin in each blade being adjacent an end thereof. Extending upward from the slot 16 is a restricted bore 19 in which a piston rod 20 is slidably mounted. Above the bore 19 the head is provided with an enlarged cylindrical bore or cylinder 21 in which is disposed a suitable piston 22. Preferably this piston comprises a solid cylindrical center 23 rigidly secured on or forming an integral part of the piston rod 20 around which center portion are two flanged sleeves 24 which are securely held in place by a nut 25. These sleeves together with other portions of the piston form two annular pockets in which are disposed annular packing rings 26, of soft rubber. The sleeves 24 and other solid parts of the piston are spaced away from the cylinder walls, and the soft rubber rings project beyond such parts into loose contact only with such walls. The rings are definitely of less height than the pockets, and are spaced away from the back of such pockets, providing spaces between such rings and the body and flange of the sleeve.

Disposed beneath the piston and abutting the underside thereof is a compression spring 30 which acts to hold the piston and the piston rod attached thereto in raised position. Pivottally connected to the blades 17, as by pins 31, are links 32 one link being connected to each of the blades. The opposite ends of these links are both connected by a joint pin 33 to the lower end of the piston rod 20, the relation of the linkage, the piston rod and the reamer blades being such that when the piston is in raised position the reamer blades are retracted into closed position 17A in the head, and when the piston is fully depressed the reamer blades are extended substantially at right angles to the head.

Intermediate its length the piston rod is provided with a notch or pocket 34, with which a spring pressed detent 35 engages, when the piston and rod are fully depressed to extend the blades 17 into working position. 36 is an opening or vent in the cylinder below the piston.

The lower end of the head 14 is adapted to carry a drill bit 40, which may be either secured directly into such head, as shown in Figs. 1 and 2, or to a hollow drill rod 41 which may be of desired length and which in turn is carried by the head. The drill bit 40 is provided with a passageway or passageways 42 which lead from its upper end downward adjacent its point.

The cylinder 21 is provided with two openings 43 and 44, both of which lead into a passageway 45 that extends downward along the head 14, and is connected therinto above the end of the drill bit, thereby establishing a passageway from the hollow drill stem to the lower end of the bit. This passageway may be formed in the metal of the head itself but preferably is a tube, the lower portion of which may be double, to pass the pin 18 with full capacity.

The opening 43 into the passageway 45 is above the upper end of the piston 22 and is held to the minimum size which will serve the drill point 40. This hole fortunately may do this and yet be so small that enough pressure may still be put

on the piston to force it down and expand the blades into reaming position. The lower opening 44 is immediately above the piston when the latter is in its lowest position, and is of sufficient size to provide flushing water for the reaming blades. The passageway 45 is continuous from these openings to the bit, so that all water or other flushing fluid must be discharged through the bit, thereby definitely flushing the bit, both when the reamer blades are operative or inoperative. Two of these passageways obviously may be used.

In use; the assembly with reaming blades held closed, as by the action of the spring 30, is lowered into the well. If desired, drilling is done with the bit 40, flushing water being delivered through the opening 43 and passageway 45 to the drill bit. When it is desired to expand the reamer blades into operative position, much heavier pressure is exerted upon the fluid in the drill stem and the piston 21 is forced downward, moving the blades outward. As this action progresses the spring tension becomes greater but the pressure due to cutting action of the bottom of the blades assists in accomplishing the outward movement especially if the drill stem is moved, as is customary, downward at the same time. When the piston reaches its lowest position the fluid pressure is lessened but at the same time the detent 35 engages the notch 34 and together with the remaining fluid pressure and work-action of the blades holds the latter in extended position. With the piston down, a full supply of fluid flows through the two openings, the passageway and the bit to flush and remove material cut both by the bit and the blades, and effectually prevents material dislodged by the blades from dropping down and clogging the bit.

On completion of reaming operations, fluid pressure is cut off and the spring 30 allowed to retract the blades and allow removal of the assembly.

In order that pressure due to hydrostatic head be balanced it is necessary that the cylinder 21 be provided with some means such as an opening or vent 36 by which pressure due to head equalized on the piston. During operation, sand or other material entering this opening or otherwise, finds its way to the packing of the plunger, in many cases heretofore tightly wedging this packing and the plunger. In the present construction it is found that the pressure exerted from above the loose soft rings spread them into an effective piston packing, and that removal of such pressure permits them to resume their original shape and such sand to be loosened and washed out, restoring the piston to its original efficiency, either by interruption of operation or thereafter.

It will be understood that the drawing and description herein are intended as illustrative only, and that various details thereof may be modified within the scope of the claims.

What I claim is:

1. In a well boring tool having reamer-means optionally movable into operative or inoperative position, and a pilot bit carried by said tool below said reamer-means, means for delivering a flushing fluid to said pilot bit when said reamer-means are in inoperative position and means for augmenting such flow to said bit when said reamer-means are moved to operative position.

2. In a well boring tool having reamer blades optionally movable into operative or inoperative position, and a pilot bit carried by said tool below

said blades, means for supplying a flushing fluid and for delivering said fluid to said pilot bit when said blades are in inoperative position and means for augmenting such delivery to said bit when said blades are moved to operative position.

3. In a well boring tool having reamer-means optionally movable into operative or inoperative position, a pilot bit carried by said tool below said reamer-means, means for supplying a flushing fluid and for compelling delivery of said fluid past said reamer-means to said pilot bit when said reamer-means are in operative position, and means for augmenting such delivery to said bit when said reamer-means are moved to operative position.

4. In a well boring tool, having reamer-means and a pilot bit therebelow, means urging said reamer-means into inoperative position, piston actuated means for moving said reamer-means into operative position, means for supplying a flushing fluid and for delivering fluid past said reamer means to said bit when said blades are in inoperative position, and means, controlled by movement of said piston to extend said blades, for augmenting flow of said fluid past said reamer-means to said bit.

5. In a well boring tool, having reamer blades and a pilot bit therebelow, means urging said blades into inoperative position, piston actuated means for extending said blades into operative position, means for supplying a flushing fluid to said tool, and for conveying said fluid past said blades to said bit when said blades are in inoperative position, and means, controlled by movement of said piston to extend said blades, for augmenting flow of said fluid past said blades to said bit.

6. In a well boring tool, having reamer-blades and a pilot bit therebelow, a spring urging said blades into inoperative position, piston actuated means for extending said blades into operative position, means for supplying a flushing fluid and for conveying said fluid past said blades to said bit when said blades are in inoperative position, and means, controlled by movement of said piston to extend said blades, for augmenting flow of said fluid past said blades to said bit.

7. In a well tool, a hollow actuating stem, a head secured to the lower end of said stem and a pilot bit carried by said head and extending therebelow, said head carrying shiftable reamer-means above said bit, and including a cylinder in communication with said hollow stem, a piston in said cylinder, movable by fluid pressure in said cylinder to extend said reamer-means, means operatively connecting said piston and said reamer-means, means urging said piston in-

to position to hold said reamer-means in inoperative position, a passageway leading continuously from said cylinder past said reaming-means adjacent the point of said bit, said cylinder having a pair of longitudinally spaced openings leading into said passageway, one of said openings lying above said piston when said reaming-means are in inoperative position, and the other thereof being covered by said piston and both thereof lying above said piston and being unobstructed when said reaming-means are in operative position.

8. In a well tool, a hollow actuating stem, a head secured to the lower end of said stem and a pilot bit carried by said head and extending therebelow, said head carrying shiftable reamer blades above said bit, and including a cylinder in communication with said hollow stem, a piston in said cylinder, movable by fluid pressure in said cylinder to extend said reamer blades, means operatively connecting said piston and said reamer blades, means urging said piston into position to hold said reamer blades in inoperative position, a passageway leading continuously from said cylinder past said reamer blades adjacent the point of said bit, said cylinder having a pair of longitudinally spaced openings leading into said passageway, one of said openings lying above said piston when said reamer blades are in inoperative position, and the other thereof being covered by said piston and both thereof lying above said piston and being unobstructed when said reamer means are in operative position.

9. In a well tool, a hollow actuating stem, a head secured to the lower end of said stem and a pilot bit carried by said head and extending therebelow, said head carrying pivotally mounted reamer blades above said bit, and including a cylinder in communication with said hollow stem, a piston in said cylinder, movable by fluid pressure in said cylinder to extend said reamer blades, arms operatively connecting said piston and said reamer blades, means urging said piston into position to hold said reamer blades in inoperative position, a passageway leading continuously from said cylinder past said reamer blades adjacent the point of said bit, said cylinder having a pair of longitudinally spaced openings leading into said passageway, one of said openings lying above said piston when said reaming means are in inoperative position, and the other thereof being covered by said piston and both thereof lying above said piston and being unobstructed when said reamer blades are moved to operative position.

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