Feb. 22, 1938. T. SEIFER 2,108,946

HYDRAULIC BORING MECHANISM

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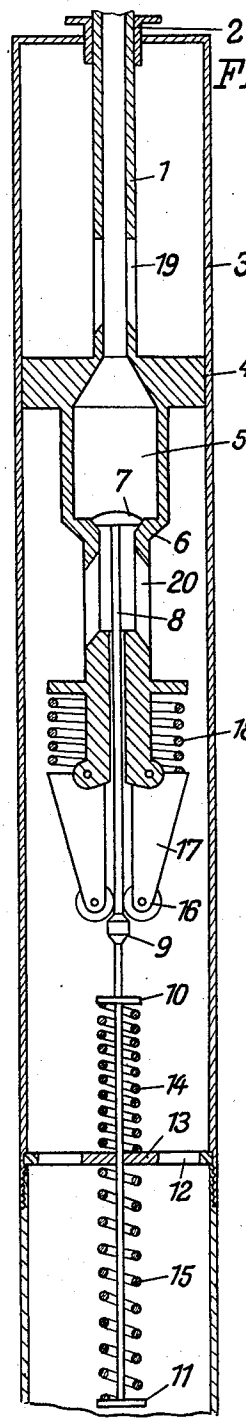

Fig.1

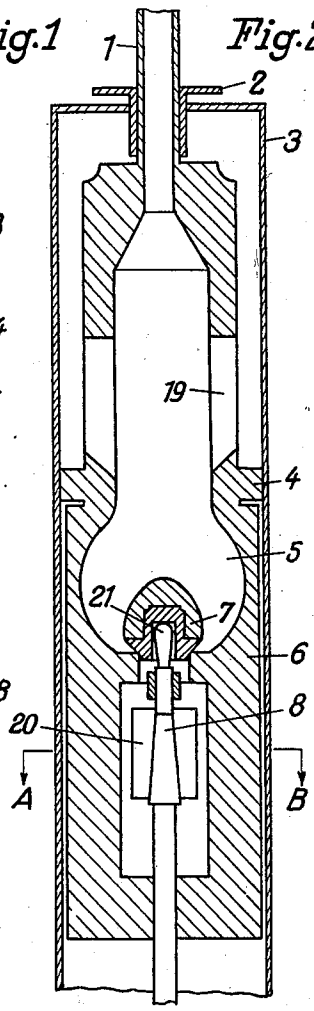

Fig.2

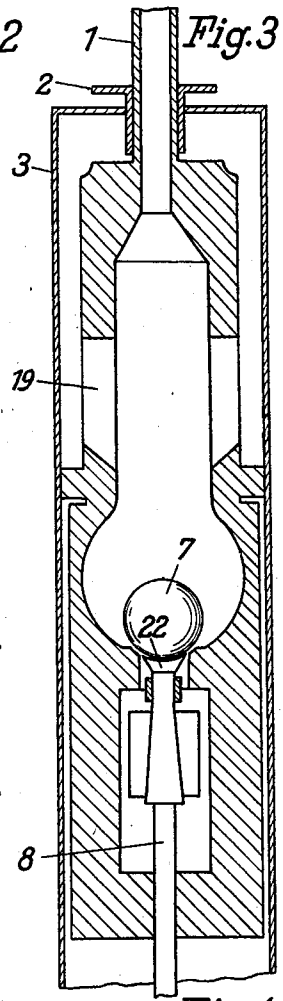

Fig.3

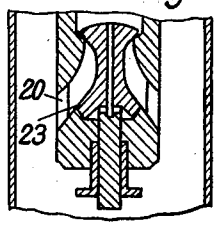

Fig.4

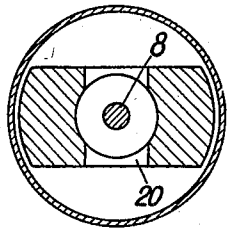

Fig. 5

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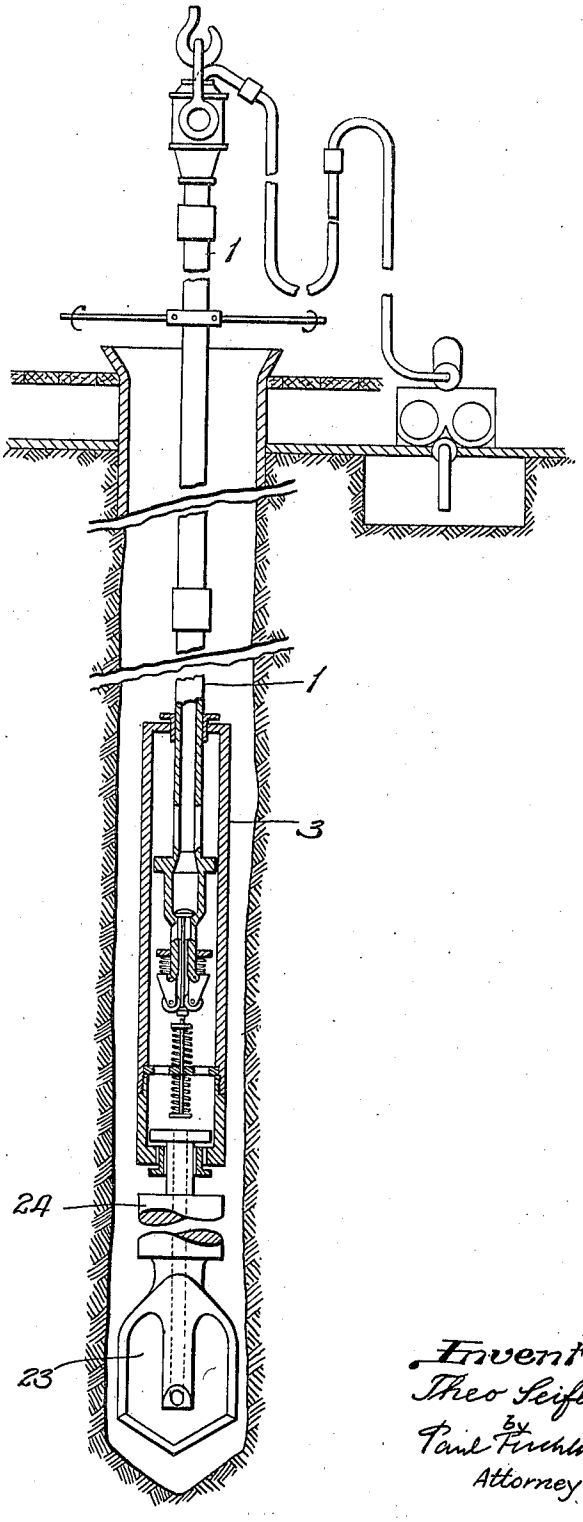
Fig. 6.



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UNITED STATES PATENT OFFICE

2,108,946

HYDRAULIC BORING MECHANISM

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Application November 1, 1935, Serial No. 47,889
In Germany September 23, 1933

5 Claims. (Cl. 255—4)

This invention relates to hydraulic motors working in a bore-hole. Such motors comprise a cylinder in which a piston slides. The piston is rigidly connected to a tubing, opening into the upper part of the cylinder, through which tubing a fluid under pressure may be introduced so as to lift the cylinder. A heavy bit or chisel is carried by the cylinder and is lifted therewith. In the piston is a valve which when opened will allow the fluid to flow off through the piston to the bottom of the bore-hole whereby the pressure in the upper part of the cylinder is released, and the cylinder including the bit drops down. Then the valve is closed and the play of the motor begins anew.

Hitherto the valves controlling the supply of the flushing water had only a short life because they used pistons or annular slides, and small particles of stone circulating between the contacting surfaces cut grooves into the surfaces in which before long larger fragments of stone settled so as to complete the destruction.

According to the present invention cavities are provided in the tubing above and beneath the piston between which an annular valve surface substantially vertical to the axis of the tubing is formed, and the valve body cooperating with this valve surface is controlled by a spring actuated by the ascending and descending cylinder.

When in operation the contacting surfaces of these valves do not slide along one another over a great distance so that no grooves are cut therein by circulating particles of stone. Moreover owing to the wide free cross-section of the valves, the rate of flow of the flushing water and therefore the destroying power of the sand particles contained therein is reduced to a minimum.

The valves hitherto used had only a short duration owing to the fact that the motors are operated with thick drilling mud. Small particles of stone produce corrugations in the seating surfaces of the valves into which soon larger pieces of stone intrude to continue the destruction. Therefore in some constructions of boring mechanisms ring or piston slide-valves are avoided by dividing the valve into two parts and disposing the ports for introducing and withdrawing the water at the same level. With this arrangement only a small cross-section of the water inlet and outlet is available, so that the number of strokes per unit of time is diminished.

According to the present invention apertures are provided in the tubing through which the flushing fluid streams above and below the piston on which the cylinder carrying the chisel slides between which apertures an annular valve surface in a plane approximately prependicular to the axis of the tubing is provided, the valve body coacting with this valve surface being controlled by a spring actuated by the reciprocating cylinder carrying the chisel.

The valve body may have a dish-like, conical or spherical shape, and the valve may be of the double-seat type, so that the body is released from the pressure of the flushing fluid. The spherical form warrants a long duration of service, because the supporting face may be changed after each operation of the valve so as to distribute the wear over the whole mass of the ball. The ball may also readily evade the water jet.

The movable connection of the valve body with the rod controlled by the spring ensures a forcible guidance of the valve body and an exact adjustment with respect to the valve surface and thereby an efficient closure.

Preferably the valve body may be shaped to conform with the streamline rules and may be guided axially, for instance, by a rod acted upon by the spring influenced by the cylinder. Also the dish-valve or a calotte may be connected fixedly or movably with this rod.

Fig. 1 is a vertical axial cross-section through the tubing and the greater part of the cylinder including the valve mechanism.

Fig. 2 is a similar view showing another form of valve.

Fig. 3 is a similar view showing a ball-valve.

Fig. 4 is a detail of a similar view showing a double-seated valve.

Fig. 5 is a cross-section on the line A—B of Fig. 2.

Fig. 6 is a comprehensive view, mainly in vertical cross-section, of the total boring mechanism working in a bore-hole.

In Figs. 1, 2 and 3 1 is the stationary tubing through which the flushing fluid flows on which the cylinder 3 carrying the chisel 23 weighted by a heavy bar 24 (see Fig. 6) slides by the intermediary of a stuffing-box 2. A piston 4 is secured to the tubing 1, over which piston the cylinder 3 slides. The hollow space of the tubing is enlarged to a valve chamber 5 terminating in the valve seat 6. The valve cone or ball 7 is secured to a rod 8 provided with an enlargement 9 (Fig. 1) and two disks 10 and 11. Between the disk 10 and the partition 13 secured to the cylinder 3 and provided with holes 12 the spring 14 is inserted. A further spring 15 is placed between the partition 13 and the disk 11. Rolls 16 are linked by means of levers 17 to the bottom end

of the tubing 1. These rolls and levers are pressed against the rod 8 by a spring 18. In the tubular shaft 1 slots 19 and 20 are provided through which the flushing fluid enters the cylinder 3.

The modifications shown in Figs. 2 to 5 differ only in the construction of the valve body 7 and the valve seat 6 from the modification shown in Fig. 1, the other parts of the devices being practically identical with the corresponding parts in Fig. 1.

In Fig. 2 the valve body 7 has a streamline contour and is movably mounted with a cylindrical cavity on the conical and rounded end 21 of the rod 8.

In the modification shown in Fig. 3 the valve body forms a ball carried by a bowl 22 formed at the upper end of the valve rod 8.

The valve body shown in Fig. 4 is shaped to form a double-seated valve, the outlet ports 20 for the flushing fluid being situated between both seats. The valve body being pierced by an axial bore the flushing fluid presses also against the lower surface of the valve body thereby releasing it partially so that it may be more easily lifted from its seat.

The device operates as follows: When the valve body 7 rests on its seat 6, the flushing fluid coming from the tubing 1 enters the cylinder 3 through the slots 19 whereby the cylinder is lifted until the spring 14 by being compressed forces the rolls 16 outwards against the tension of the springs 18. Now the rod 14 is projected upwards so that the valve is opened, the stream-line-shaped cone (Fig. 2) or the ball (Fig. 3) or the double-seated valve (Fig. 4) releasing the valve seat 6. Thereby the flushing fluid is allowed to flow off through the opening 20 to the bottom of the bore-hole flushing away the cuttings produced by the chisel in the foregoing stroke. The cylinder 3 will sink down under the action of its own weight until the valve 6, 7 is again closed. This closing is effected in the following manner: On sinking down the cylinder 3 compresses the spring 15 and releases the spring 14 until the tension of spring 15 is strong enough to pull the valve rod 8 down against the action of springs 18 which must be compressed when the enlargement 9 of the valve rod 8 passes the space between the rolls 16. The valve once closed the flushing fluid again enters through opening 19 the upper part of the cylinder 3 and the play begins anew.

The provision of the annular valve surface approximately perpendicular to the axis of the tubing 1 ensures the flushing fluid flowing off towards the chisel in the same direction without substantially turning aside the flow or forming whirls, so that the hydrodynamical resistance is low and a high stroke number and strong strokes are warranted.

I claim:—

1. In a hydraulic mechanism, the combination of a vertical hollow shaft, a hollow piston rigidly and coaxially connected therewith, a cylinder closed at the top enclosing the said piston, a chisel carried by the cylinder, the interior of the hollow shaft below the upper surface of the piston being enlarged to form a valve chamber, a valve seat at the base of the chamber situated in a substantially horizontal plane, a valve body fitting into said seat, the hollow shaft communicating through ducts with the spaces above the piston and through other ducts with the space below the piston and the valve, and a resilient member transmitting the reciprocative movement of the cylinder to the said valve body.

2. In a hydraulic mechanism, the combination of a vertical hollow shaft, a hollow piston rigidly and coaxially connected therewith, a cylinder closed at the top enclosing said piston, a chisel carried by the cylinder, the interior of the hollow shaft below the upper surface of the piston being enlarged to form a valve chamber, a valve seat at the base of the chamber situated in a substantially horizontal plane, a ball-shaped valve body fitting into said seat, the hollow shaft communicating through ducts with the spaces above the piston and through other ducts with the space below the piston and the valve, and a resilient member transmitting the reciprocative movement of the cylinder to the said valve body.

3. In a hydraulic mechanism, the combination of a vertical hollow shaft, a hollow piston rigidly and coaxially connected therewith, a cylinder closed at the top enclosing said piston, a chisel carried by the cylinder, the interior of the hollow shaft below the upper surface of the piston being enlarged to form a valve chamber, a valve seat at the base of the chamber situated in a substantially horizontal plane, a double-seated valve body fitting into said seat, the hollow shaft communicating through ducts with the spaces above the piston and through other ducts with the space below the piston and the valve, and a resilient member transmitting the reciprocative movement of the cylinder to the said valve body.

4. In a hydraulic mechanism, the combination of a vertical hollow shaft, a hollow piston rigidly and coaxially connected therewith, a cylinder closed at the top enclosing said piston, a chisel carried by the cylinder, the interior of the hollow shaft below the upper surface of the piston being enlarged to form a valve chamber, a valve seat at the base of the chamber situated in a substantially horizontal plane, a streamlined valve body fitting into said seat, the hollow shaft communicating through ducts with the spaces above the piston and through other ducts with the space below the piston and the valve, and a resilient member transmitting the reciprocative movement of the cylinder to the said valve body.

5. In a hydraulic mechanism, the combination of a vertical hollow shaft, a hollow piston rigidly and coaxially connected therewith, a cylinder closed at the top enclosing said piston, a chisel carried by the cylinder, the interior of the hollow shaft below the upper surface of the piston being enlarged to form a valve chamber, a valve seat at the base of the chamber situated in a substantially horizontal plane, a valve body fitting into said seat, the hollow shaft communicating through ducts with the spaces above the piston and through other ducts with the space below the piston and the valve, a rod loosely connected with said valve body, and a spring actuated by the reciprocating cylinder and adapted to control said rod.

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