No. 704,385. Patented July 8, 1902.

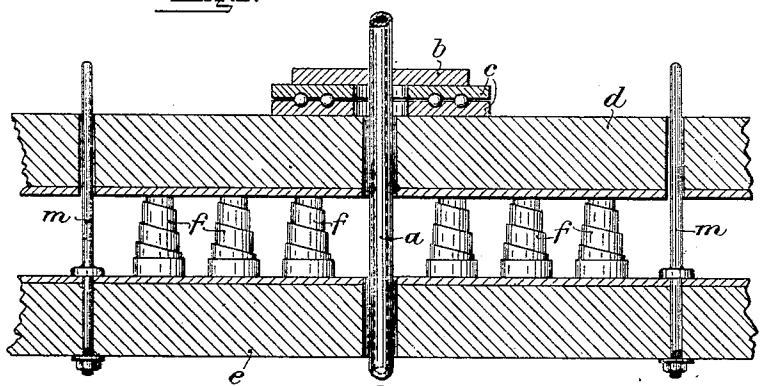
G. SCHMIDT.

HYDRAULIC BORING APPARATUS.

(Application filed May 17, 1902.

(No Model.)

Fig. 1.



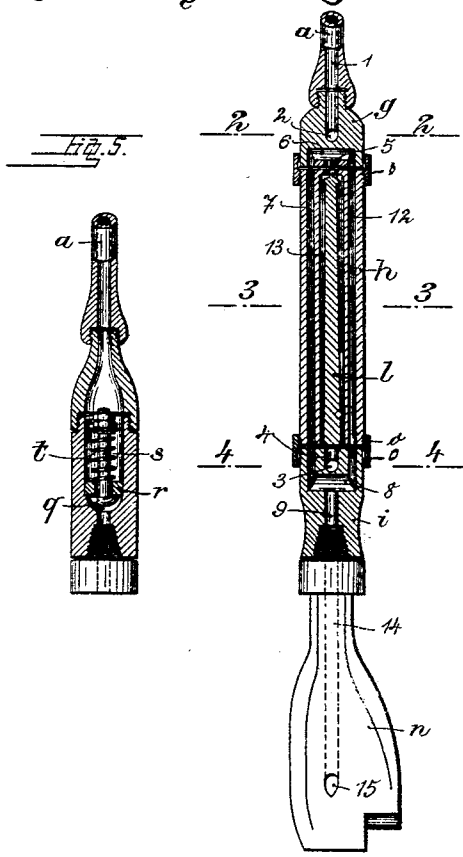


Fig. 5.

Fig. 2.

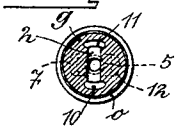


Fig. 3.

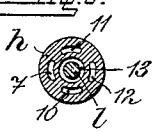
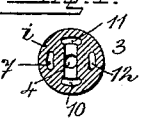


Fig. 4.



Witneses

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UNITED STATES PATENT OFFICE.

GEORG SCHMIDT, OF CHARLOTTENBURG, GERMANY.

HYDRAULIC BORING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 704,385, dated July 8, 1902.

Application filed May 17, 1902. Serial No. 107,758. (No model.)

To all whom it may concern:

Be it known that I, GEORG SCHMIDT, a subject of the Duke of Brunswick, residing at and whose post-office address is No. 160 Kantstrasse, Charlottenburg, near Berlin, Kingdom of Prussia, German Empire, have invented certain new and useful Improvements in or Relating to Hydraulic Boring Apparatus, of which the following is a specification.

The present invention relates to improvements in beamless hydraulic boring apparatus; and it consists in elastically suspending the piping connecting the tool to the pump on springs arranged above the bore-hole and in inserting a hydraulic check-valve between the piping and the tool. Owing to the friction of the circulating water in the piping, the latter, and consequently the tool, is moved downwardly to a certain extent, compressing the springs until by the action of the hydraulic check-valve a shock is exerted upon the tool by the momentum of the water. On bringing the water to rest, and consequently removing the friction, the tool and the piping are raised by the rebound of the tool and by the resilient expansion of the springs. The operation then begins again.

In the accompanying drawings, Figure 1 is an elevation, partly in section, of a hydraulic boring-tool constructed in accordance with the present invention. Figs. 2, 3, and 4 are cross-sections of the hydraulic check-valve on the lines 2 2, 3 3, and 4 4 of Fig. 1, respectively; and Fig. 5 is a modified construction of the hydraulic check-valve.

Like characters indicate like parts throughout the drawings.

The piping *a*, to which the circulating water is supplied by a pump through a hose with a water-distributing head, is mounted upon a frame *d* by means of a clamp *b* and of a ball-bearing *c*, so as to allow the pipe to turn and to move with the frame *d*. The lower part *e* of the frame carrying the springs *f* is stationary.

In some cases it may be advisable to employ a beam in order to allow the boring device to be operated, if necessary, according to the Canadian system or according to the old water-circulating system, and in such a case the piping may be also attached to one end of the beam. The other arm of the latter is then made stationary, and the springs are preferably arranged at the fulcrum of the beam.

In order to prevent the springs *f* from working into the frame *e d*, the latter are lined on the sides in contact with the springs with sheet metal. For the purpose of safely guiding the upper part *d* of the frame the lower part *e* thereof is provided with guide-rods *m*. The number of the springs *f* can be increased or reduced, as desired; but their number and their effect should be so calculated as to allow the upper part *d* of the frame to yield to the extent of some centimeters under the influence of the shock of the water.

The hydraulic valve inserted between the piping and the tool and adapted to automatically check the circulating water at a certain speed of the latter and produce the shock which actuates the boring-tool consists of a weighted or spring-actuated valve. In the construction shown in Fig. 1 the valve inserted between the piping *a* and the tool *n* consists of a center piece *h* and two sockets *g i*, which are attached to the piping and to the tool and are connected with the center piece *h* by suitable screwed rings *o*. The center pieces *h* and the sockets are provided with five longitudinal passages 10, 11, 7, 12, and 13, Figs. 1 and 3, which are so connected with the transverse openings 2, 3, 6, and 8 in the sockets and with two openings 4 and 5 that the water coming from the passage 1 of the piping *a* flows through the opening 2 into the front and rear passages 10 and 11, Figs. 1 and 2. From these the water flows through the transverse opening 3 and the opening 4 into the central chamber 13 below the piston *l*, which piston is freely movable in this chamber, Figs. 1 and 3. The water afterward flows through the opening 5 and the transverse opening 6 into the lateral longitudinal passages 7 and 12 and thence through the passage 8 and opening 9 into the interior of the tool *n*. The hollow portion of the tool branches into two, so that the water leaves the tool on both sides at 15 above the cutting edge. The weight of the piston *l*, owing to its length, corresponds to the spring action in a spring-actuated valve. This piston can

be hollowed and filled with lead, in which case its length would be reduced without, however, reducing the weight of the piston.

The operation of the boring device described is as follows: The water on flowing through the valve and through the different passages of the valve raises the piston *l* when the speed attains a certain value. The passage 5 is then closed by the ball-shaped end of the piston *l*, thus checking the circulation of the water. The whole of the water contained in the piping consequently comes to a sudden stop and transmits its downward momentum to the piping and to the tool, which thereby receives a blow in the downward direction, which results in the boring action. Owing to the rigid connection of the tool with the piping, the latter is bodily moved in a downward direction and the springs *f* are still more compressed than they were by the slight depression of the piping caused by the friction of the water. As soon as the water has come to rest the springs *f* expand, thereby raising the piping, and, owing to the valve being reopened, the operation can begin again. An air vessel with a gage can be inserted between the pump and the piping and provided with a device for renewing the air.

In the construction shown in Fig. 5 the checking of the flow of water is effected by a spring-actuated valve *q*, which conveniently is a hemispherical valve. The projection *r*, on which the valve normally rests when open, serves also as a guide for the valve-spindle *s*, which is provided with a spring *t*. When the velocity of the water flowing through the valve attains a certain point, the valve *q* is moved down into its seat against the action of the spring *t*, thereby closing the passage for the circulating water, and thus effecting the same operation as the construction above described. The frequency of the stroke of the tool and the velocity of the water necessary to operate the valve can be controlled by the adjustment of the spring *t*.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. In a hydraulic boring apparatus, the combination with the boring-tool of a piping suspended on springs and a check-valve between the piping and the tool for automatically checking the circulating water at a certain speed of the latter, substantially as and for the purpose described.

2. In a hydraulic boring apparatus, the combination with the boring-tool of a piping suspended on springs and a check-valve between the piping and the tool, the check-valve comprising a valve-chamber with an inlet and outlet opening and a weighted or spring-actuated valve for closing the outlet-opening of the valve-chamber at a certain speed of the circulating water, substantially as and for the purpose described.

3. In a hydraulic boring apparatus, the combination with the boring-tool of a piping suspended on springs and a check-valve between the piping and the tool, the check-valve comprising a valve-chamber with an inlet and outlet opening, a valve-spring the tension of which is capable of being adjusted, substantially as and for the purpose described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

GEORG SCHMIDT.

Witnesses:
WOLDEMAR HAUPT,
HENRY HASPER.