

L. J. C. VAN ES.
 DRILL.
 APPLICATION FILED MAY 1, 1913.

1,112,498.

Patented Oct. 6, 1914.
 2 SHEETS—SHEET 1.

Fig. 1.

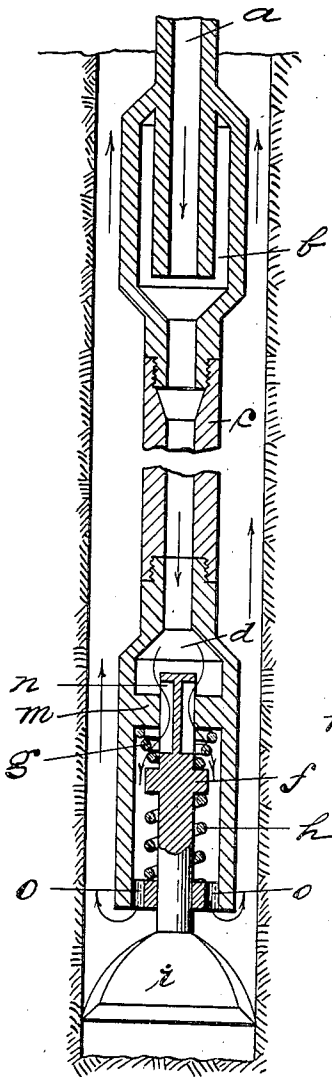


Fig. 2.

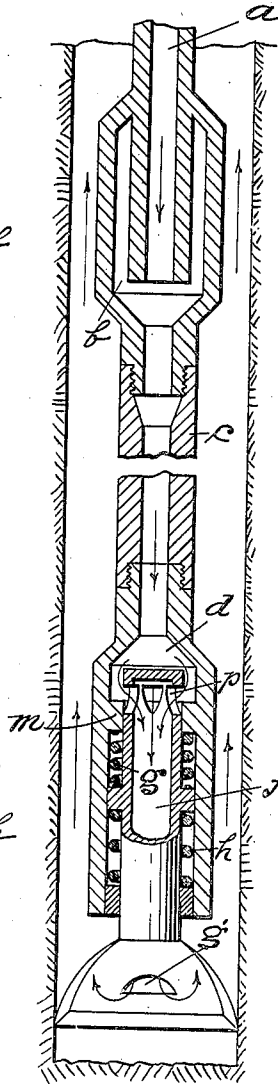
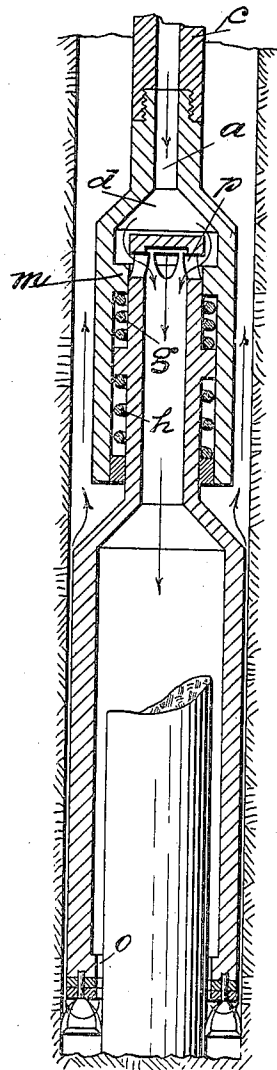


Fig. 3.



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Fig. 4.

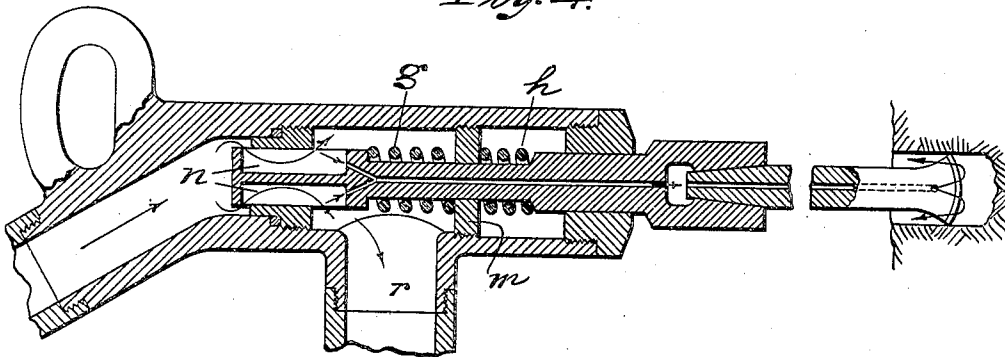
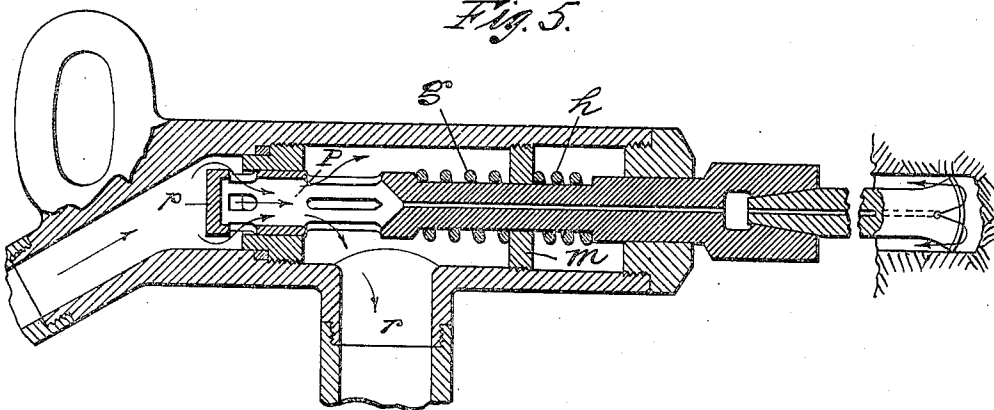


Fig. 5.



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UNITED STATES PATENT OFFICE.

LOUIS JEAN CHRÉTIEN VAN ES, OF BATAVIA, NETHERLANDS EAST INDIES.

DRILL.

1,112,498.

Specification of Letters Patent.

Patented Oct. 6, 1914.

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To all whom it may concern:

Be it known that I, LOUIS JEAN CHRÉTIEN VAN ES, a subject of the Queen of the Netherlands, and residing at Batavia, in the Netherlands East Indies, have invented a new and useful Improvement in Drills; and I do hereby declare the following to be a full, clear, and exact description of the same.

The invention relates to a percussion drilling device, in which the exhaust or discharge fluid is used for flushing the bored hole. Heretofore, devices of this kind have required employment of a special valve, normally held open in suitable manner, and which is closed when the water flowing through it attains or exceeds a determined speed; as a result of the consequent increase of pressure, a piston, connected with the drill is driven forward against the rock in opposition to the action of a spring, and, during the temporary diminution of pressure effected by the resulting recoil, is returned by the spring to its original position, whereupon the valve again opens and the operation commences anew. The special valve referred to has been arranged in the casing or on the movable piston. In the operation of either form, the valve must first be closed by the flowing water before the piston itself, due to the consequent increase of pressure, receives its motion,—in other words, there is a large phase-displacement between the speed of the water and the speed of the piston, so that the quantity of work, which during the stroke is transferred from the water column to the yielding piston and which is expressed by the equation

$$E = C.Q.(c-v)v,$$

in which C represents a constant, Q the cross section of the water column, c the speed of the water and v the speed of the piston, proves negative during a more or less large portion of the working period (with a negative value of v in relation to c). During the time required for the closing of the valve, there flows through the machine water that only does the work necessary for this closing and that has no effect upon the motion of the piston. With such a construction, the valve is closed again before the piston is returned into the initial position, and the rising pressure of the water will act upon the piston before its reversal and retard its motion. The mo-

tion of the piston being then in the opposite direction to the flow of water a large rise of pressure occurs which may even rise to triple the useful value and this high pressure will increase leakage to such an extent as to threaten the working of the machine, which as found in practice often stops when there is a leakage under normal pressure of only one per cent. It results that these known devices have only a comparatively small striking power and small efficiency and often stop by small leakage. According to the present invention, and for the purpose of avoiding the defect mentioned, the piston itself is formed as a controlling member acting as a slide-valve. The result is that now the valve movement and the piston movement are identical, that is to say, take place entirely simultaneously. Consequently, the phase displacement existing between the speed of the water and the speed of the piston, is considerably lessened, so that the quantity of work transferred to the piston during the working stroke always retains a positive value, because v always remains positive in relation to c , and hence a greater striking force is obtained with better efficiency.

The accompanying drawings show several forms of construction embodying the invention.

Figures 1-3 show the subject matter of the invention as a deep boring apparatus in three different forms of construction. Figs. 4 and 5 show the same as a rock boring machine in two forms of construction.

In the form shown in Fig. 1, the device consists, in familiar manner of the tubular rod a serving for the admission of the pressure or flushing water, which rod is below formed into an air-chamber and connected by the heavy rod c with the working cylinder d . In the working cylinder d is the striking piston f formed at its lower end as a plain drill i , which piston is acted upon by springs h and g , the tendency of the first of which is to hold the piston in the raised position shown upon the drawing, while the latter serves to retard the piston in the upward movement. According to the invention the piston f is at the same time formed as a controlling member, and in Fig. 1 in such manner that the upper portion of the piston, exactly fitted into the central bore of the partition wall m of the cylinder, is provided with lateral recesses n

through which, in the raised position of the piston, the water can pass into the lower portion of the cylinder, thence to be discharged through the apertures *o* provided in the base of the cylinder.

The manner of operation of the device is, briefly, as follows: The pressure water flows successively through the tubular rod *a*, the air chamber *b*, the heavy rod *c*, into the upper portion of the cylinder *d* and thence through the recesses *n*, the lower portion of the cylinder, and the orifices *o* to the base of the bore-hole, thence to rise again to the surface at the same time flushing the bore-hole. When the water has reached a certain speed the piston *f* will thereby be pressed downward against the action of the spring *h*, so that the passages formed by the recesses *n* are closed and the piston due to the consequent increase of pressure is driven powerfully downward upon the base of the bore-hole. Upon the recoil of the dammed up water the piston *f* will, during the consequent temporary diminution of pressure, be raised again by the spring *h*, whereupon the operation is repeated. As is apparent the opening and closing of the passages for the water is compulsorily effected at each stroke by the movement of the piston.

The form of construction shown in Fig. 2 differs from that described above in that the piston *f* itself is hollow and is provided above with lateral slit-like orifices *p* instead of the recesses *n* of Fig. 1, which orifices effect the control of the water in the same manner as the recesses, the water flowing off through the opening *q* provided at the bottom.

Fig. 3 shows a construction of the boring device with control according to Fig. 2, in which the lower portion of the piston is formed as a crown drill instead of as a plain drill. The manner of operation of the control is not altered thereby.

Finally, Figs. 4 and 5 show two forms of construction of the subject matter of the invention suitable for rock drilling machines for slight depths and small bore-holes. In this smaller form of construction, a lateral opening *r* is also provided for the escape of a portion of the used pressure water, while the remainder is used for flushing the bore-hole, flowing through the hole in the piston and in the plain drill.

I claim:

1. In a percussion drill, the combination

of a cylinder having a constricted part; a piston reciprocating in said constricted part and provided with a closed head adapted to close the constricted part, and with intermediate recesses adapted to unclosethe restricted part; and a spring for raising the piston.

2. In a percussion drill, the combination of a cylinder having a constricted part; a piston reciprocating in said constricted part and provided with a closed head adapted to close the constricted part, and with intermediate recesses adapted to unclosethe restricted part; a spring for raising the piston; and a drill on the lower end of the piston, said drill having a fluid discharge passage therein.

3. In a percussion drill, the combination of a cylinder; means for conducting fluid to the upper part of the cylinder, a partition in the cylinder provided with a bore; a piston within said cylinder and bore and having a closed upper end adapted to close said bore and provided with intermediate recesses adapted to permit the passage of fluid through the bore; yieldable means pressing on said piston to move the upper end of the piston from the bore; and a drill attached to the piston.

4. In a percussion drill, the combination of a cylinder having a single outlet opening, a single inlet opening and a constricting bore between said openings and closed at its sides; and a piston in said cylinder and bore having a part adapted to close said bore when the piston is in one position and provided with passages permitting the passage of fluid through said bore when the piston is in another position.

5. In a percussion drill, the combination of a cylinder having outlet and inlet openings, and a constricting bore between said openings, the cylinder being free from openings adjacent to said bore; and a piston in said cylinder and bore and having a part adapted to close said bore when the piston is in one position and provided with passages permitting the passage of fluid through said bore when the piston is in another position.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

LOUIS JEAN CHRÉTIEN VAN ES.

Witnesses:

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TH. F. G. ZIEGLER.