W. MAUSS.

AUTOMATIC PERCUSSIVE APPARATUS.

APPLICATION FILED MAY 5, 1909.

955,976.

Patented Apr. 26, 1910.

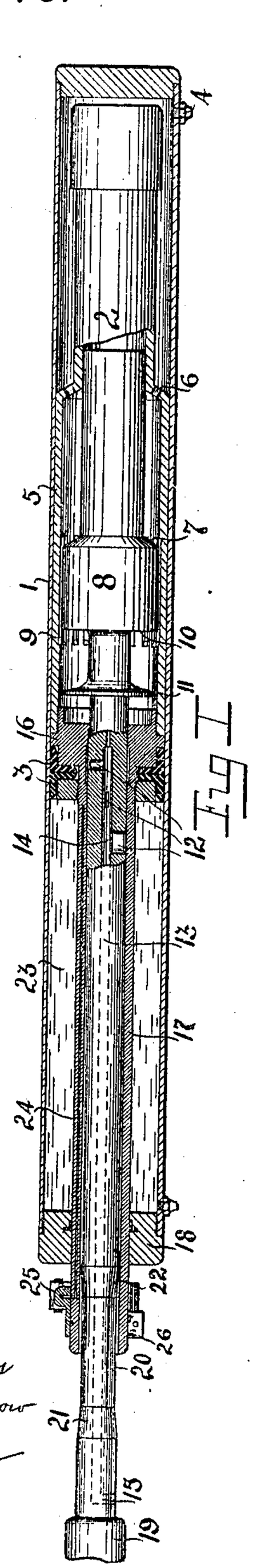

FIG I

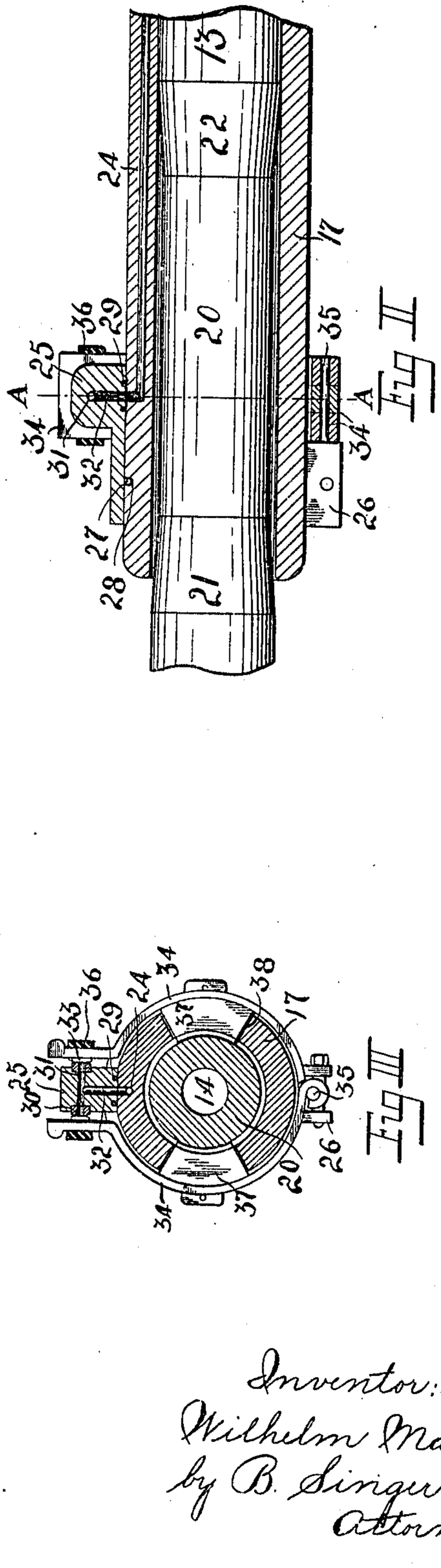

FIG II

FIG III

Witnesses
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WILHELM MAUSS, OF JOHANNESBURG, TRANSVAAL.

AUTOMATIC PERCUSSIVE APPARATUS.

955,976. Specification of Letters Patent. **Patented Apr. 26, 1910.**

Application filed May 5, 1909. Serial No. 494,099.

To all whom it may concern:

Be it known that I, WILHELM MAUSS, engineer, a subject of the King of Great Britain, residing at Consolidated Buildings, Johannesburg, Transvaal, have invented new and useful Improvements in Automatic Percussive Apparatus, of which the following is a specification.

This invention relates to self feeding percussive apparatus in which the feeding means is caused to be actuated upon the stroke of the percussive member exceeding certain prescribed limits.

It relates especially to that class in which a cylinder or equivalent part, being constantly pressed forward, is checked by a body of liquid of which a portion is released by the piston or other percussive member when its stroke exceeds the limits aforesaid.

A purpose of the present invention is to provide, in conjunction with a certain class of percussive engine, a feed arrangement which operates automatically to maintain the engine under the most efficient and economical working conditions under widely varying circumstances. The above mentioned class of percussive engines which is amenable to the invention is characterized broadly by the possible extent of the rearward stroke being controlled by and dependent upon that of the forward stroke; both being measured by a full normal stroke. As an example there may be cited the valveless fluid actuated type of engine in which constant pressure is applied to a small rear piston area and fluid is worked expansively against a larger front area; and in which the average pressure of the actuating fluid during the backward stroke varies with the extent to which the admission port to the front cylinder space is opened by the piston.

In the accompanying drawings Figure I is a longitudinal section through a complete percussive apparatus embodying the invention, Fig. II is an enlarged detail view thereof and Fig. III is a section taken upon plane A—A, Fig. II.

1 represents the external shell in which the cylinder of the percussive machine proper 2 is free to slide being packed therein by leathers 3. The particular percussive machine is of the valveless type described in application Serial No. 447182. Actuating fluid admitted through cock 4 maintains constant pressure both on the rearward surface of the cylinder 5 and also by means of ports 6, on the shoulder 7 of piston 8. In the cylinder walls are formed slots 9 which, upon the piston completing a forward stroke, admit fluid to act upon the relatively large front face 10 of the piston thereby driving the latter back against the constant pressure. Exhaust from the front cylinder space 11 is afforded by holes 12 in the piston rod 13, which holes enter said space 11 on the backward stroke of the piston. Such holes 12 communicate with an axial aperture 14 in the piston rod, which conducts the exhaust to atmosphere through outlets 15.

The head 16 of the cylinder 5 is extended as a neck 17 which projects through the front cap 18 of the shell 1. Through said neck works the piston rod 13 carrying the tool-chuck 19. Near to the front end, the piston rod is turned down as indicated by numeral 20 and such reduced part is connected to the unreduced parts by cones 21 and 22. The front space 23 of the shell contains the checking liquid, and the eduction port 24 for said liquid is carried up the neck 17.

25 indicates a valve seating mounted upon the part of the neck which is external of the shell. As shown, the valve seating is detachably secured to the neck by means of a clip 26, in order that the neck may be passed through cap 18. The seating is positioned by means of a part 27 on the inside of the clip 26 engaging a socket 28 in the neck; and a water-tight connection between the seating and the neck is made by packing 29. Renewable valve seats 30, having rounded surfaces, are fitted in the opposite faces of the valve seating; a port 31 passes through said seats and the seating is connected to port 24 by the port 32. The two rubber or like valves 33 coöperating with said valve seats are carried by a stirrup formed of the two arcuate arms 34 hinged together by a pin 35 and of such diameter when assembled as well to clear the neck 17. The valves are held to the seats by a rubber band 36 passed around the free ends of the arms 34. Each such arm carries a block 37 which extends through an aperture 38 in the neck 17 in close proximity to the reduced portion 20 of the piston rod.

In the operation of the invention pressure fluid is admitted through cock 4 and by acting upon the rear of the cylinder 5 puts the fluid in chamber 23 under pressure.

Since exit from said chamber is closed by the valves 33 no immediate forward movement of the cylinder occurs. Meanwhile actuating fluid passes through ports 6 and causes the piston to reciprocate as described above. Whenever the piston approaches the limit of its stroke in either direction, one or other of the cones 21 or 22 comes between the blocks 37 and, forcing them apart, opens the valves 33, thereby permitting some of the liquid in chamber 23 to escape and the cylinder to move forward to a corresponding extent in the shell. The precise method of operation, however, varies under different circumstances. Thus when a more or less horizontal hole is being drilled, in sticky ground or where the drill is "fitchering," and the engine is consequently called upon to exert its maximum power in order to overcome wasteful resistance and still maintain its drilling speed, such resistance will tend to prevent the piston from traveling its full backward stroke. All feeding will thus occur on the forward strokes and the fluid admission slots 9 being thereby fully opened, the greatest possible amount of fluid will be passed through to the front cylinder space and usefully consumed by the engine. Similarly, when drilling downwardly or using a heavy jumper horizontally the mass of the piston and drill tends to retard the backward motion of the piston, feeding will again occur on the forward strokes, and the engine will work at full power. In this case, however, the extra power is usefully expended, since the momentum of the blow is increased to the extent of the greater available mass factor. The third typical case occurs in drilling upwardly at a high angle, when the weight of the piston and tool not only reduces the force available for striking a blow, but tends to throw the piston onto the bottom of the cylinder at each backward stroke. The former defect is of course unavoidable; but impact of the piston on the cylinder end is avoided and the consumption of actuating fluid is reduced to that amount which can usefully be employed, by feeding being caused to take place on the backward strokes. The effect of such feeding is to keep the cylinder,—so to speak,—ahead of the piston, so that as the slots 9 are but slightly opened at each forward stroke, less fluid will be admitted to drive the piston back. With a properly designed engine the relative position of the piston and cylinder varies so slightly whether the slots 9 are fully opened or throttled, that the length of the stroke is not appreciably affected, and thus remains substantially constant under all circumstances.

It will of course be understood that variations of operation intermediate to the typical cases described will occur according to the conditions of working. For example where drilling is being done under the most favorable circumstances *e. g.*, with little internal or external friction and with a light tool in good drilling ground, feeding might occur regularly on both forward and backward strokes. In point of fact, owing to slight variations in the resistance of the tool in the hole, feeding would in practice alternate irregularly between the backward and forward strokes. The engine would in this case be consuming the maximum amount of fluid, and also employing it to the greatest advantage.

In the description of the operation given above it is understood that the pressure of the actuating fluid is unchanged, but an important function of the invention is to adjust the engine to varying pressures of the motive fluid. Thus assuming that under certain conditions and with a given pressure, the combined resistance of the constant pressure on face 7 and of friction is such as to cause the slots 9 to be fully opened in order to effect the return strokes. With the same frictional resistance but increased pressure of the actuating fluid, the piston tends to throw farther back; feeding thus occurs on the rearward strokes, and causes the opening of ports 9 to be so restricted as to admit just sufficient fluid to effect a normal backward stroke. Thus less compressed fluid is used per stroke than at the lower pressure; only so much being consumed as the size of the engine admits of being utilized. No throttling of the inlet cock 4 is required.

It will be seen that the feed device operates to maintain the length of the stroke substantially constant under all reasonable conditions; to cause the engine to work up to the maximum power which the circumstances permit of being utilized and to regulate the consumption of actuating fluid correspondingly; thus insuring the maximum efficiency and economy of actuating fluid.

What I claim and desire to secure by Letters Patent is;

1. In combination, a percussive engine including a reciprocating percussive member, guiding means in which the engine is mounted to slide freely in a longitudinal direction, means adapted automatically to effect controlled forward movement of the engine, said last named means being governed by the percussive member and operating to produce forward movement of the engine upon the percussive member exceeding prescribed limits in each direction.

2. In combination, a percussive engine including a reciprocating percussive member of which the possible extent of each rearward stroke is dependent upon the extent of its preceding forward stroke, means adapted automatically to effect controlled forward

movement of the engine, said last named means being governed by the percussive member and operating to produce forward movement of the engine upon the rearward stroke of the percussive member exceeding a prescribed limit.

3. In combination, a fluid actuated percussive engine including a reciprocating percussive member and in which the quantity of fluid admitted to the front cylinder space varies with the extent of the forward stroke of the percussive member, means adapted automatically to effect controlled forward movement of the engine, said last named means being governed by the percussive member and operating to produce forward movement of the engine upon the rearward stroke of the percussive member exceeding a prescribed limit.

In testimony whereof I affix my signature in presence of two witnesses.

WILHELM MAUSS.

Witnesses:
WM. HILLMAN VINCENT,
ALFRED L. SPOOR.