J. HOLGATE.

RECIPROCATING ENGINE.

APPLICATION FILED OCT. 10, 1908.

943,829. Patented Dec. 21, 1909.

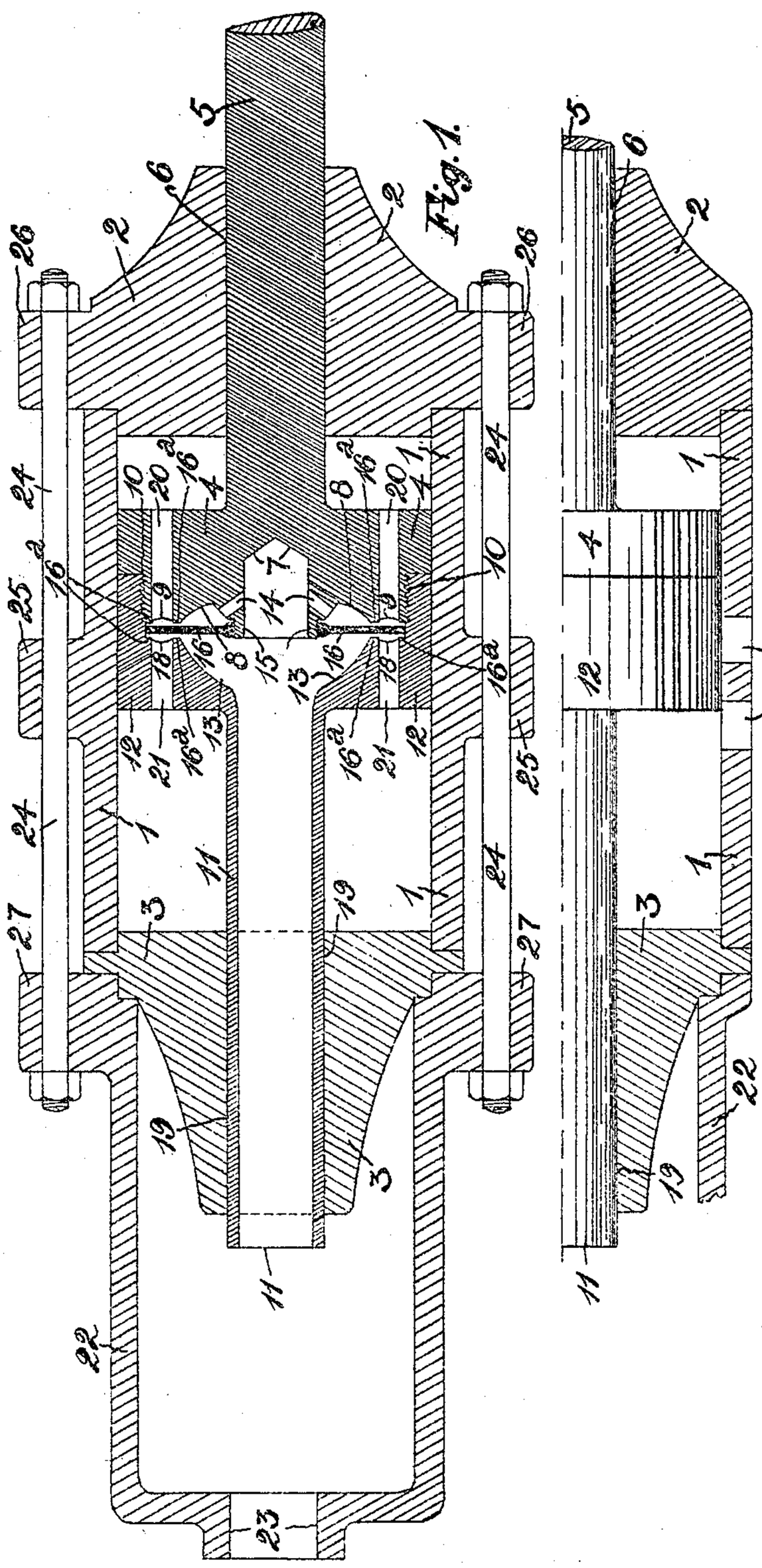

Fig. 1.

Fig. 2.

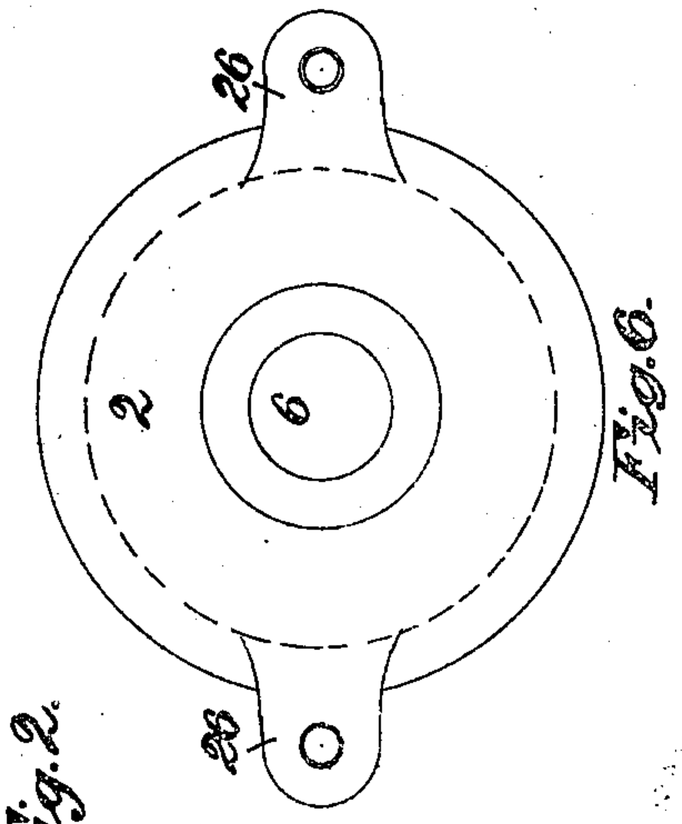

Fig. 6.

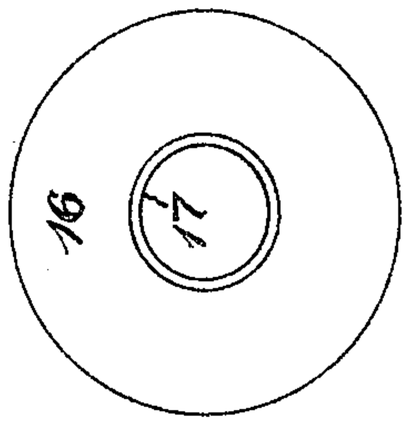

Fig. 5.

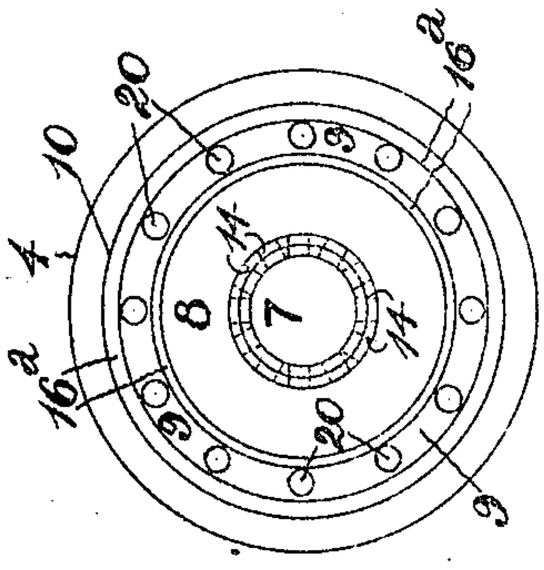

Fig. 4.

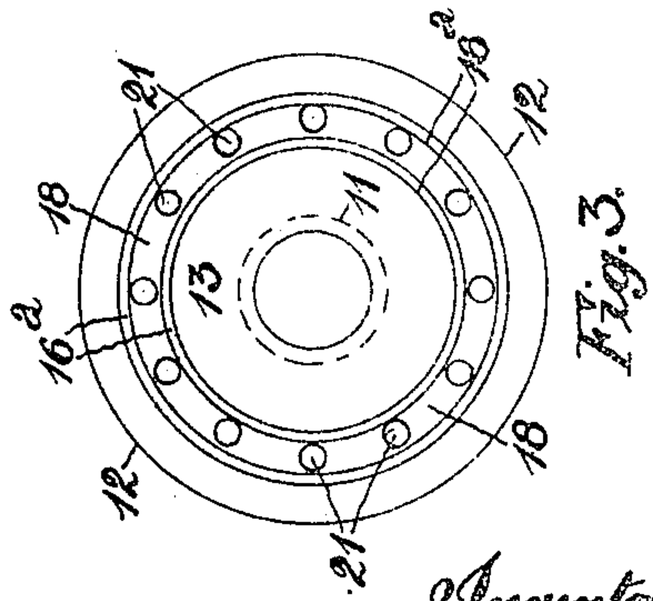

Fig. 3.

Witnesses:
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UNITED STATES PATENT OFFICE.

JOHN HOLGATE, OF LUIPAARDSVLEI, TRANSVAAL.

RECIPROCATING ENGINE.

943,829. Specification of Letters Patent. **Patented Dec. 21, 1909.**

Application filed October 10, 1908. Serial No. 457,123.

To all whom it may concern:

Be it known that I, JOHN HOLGATE, a subject of the King of Great Britain, and resident of Luipaardsvlei, Transvaal, have invented certain new and useful Improvements in Reciprocating Engines, of which the following is a specification.

This invention relates to reciprocating engines.

The invention may be utilized in the construction of a reciprocating steam engine, or any other reciprocating engine actuated by means of gaseous fluid under pressure. It can, for example, be utilized in the construction of a percussive rock drilling machine, or in an engine intended for actuating a pump or the stamps of a power stamp mill, or other similar types of reciprocating machines.

The object of the invention is to obviate the necessity for the employment of complex valve motions or gear, and to construct an efficient engine in a simple manner.

In an engine constructed in accordance with my invention the valve is contained in the piston.

The invention will be fully described by aid of the accompanying drawing, wherein—

Figure 1 represents the engine in longitudinal section. Fig. 2 is a longitudinal section of a portion of the cylinder and its covers, and an elevation of one half of the piston, piston rod and tail rod, illustrating the position of the exhaust ports. Fig. 3 is an elevation of the front end of the tail rod, detached. Fig. 4 is an end elevation of the piston detached. Fig. 5 is an elevation of the valve detached, and Fig. 6 is an end elevation of the front cover of the cylinder also detached.

1 is the main cylinder, which is fitted as shown, or in any other convenient manner, with front and back covers 2, 3.

4 is the piston, which is adapted to reciprocate inside the cylinder 1 in the customary manner. The piston 4 may be formed integral with, or have suitably attached to it, the piston rod 5, which is adapted to work, as usual, through an aperture 6 in the front cover 2. To the outer extremity of the piston rod 5 there may be attached in any convenient manner, the part (such, for example, as the drilling tool in a rock drilling machine, the stamp stem of a stamp, or the pump rod of a pump) to which it is desired to impart the reciprocatory motion.

The back or rear end of the piston 4 is constructed with an axial hole 7, and around said hole with an annular recess 8, and encircling said recess with an annular groove 9—see Figs. 1 and 4. The rear end of the piston 4 is also reduced in diameter as indicated at 10, and formed with a screw-thread around the reduced portion.

11 is a hollow tail rod, formed at its forward end with a head or enlarged portion 12. The portion 12 is preferably made of the same external diameter as the larger forward portion of the piston 4. The portion 12 at the front end is constructed with an internal screw-thread for screwing it over the reduced portion 10 of the piston 4. The head 12 is made hollow as indicated at 13, and the bore of the tail rod 11 communicates through the medium of the hollow 13 with the axial hole 7. The axial hole 7 communicates through a plurality of ports or passages 14 with the annular recess 8. The piston 4 between the hole 7 and recess 8 is constructed with an annular projection 15.

16 is the valve, which is in the form of a disk valve and is formed with an aperture 17 at the center—see Fig. 5. The valve 16 is arranged on the projection 15 in such a way that it can move a short distance in either direction between the piston 4 and the head 12. The head 12 is constructed on the inside around the hollow 13 with an internal groove 18 which coincides with the groove 9 in the end of the piston. Between the groove 9 in the end of the piston and the groove 18 in the head the valve 16 is positioned—see Fig. 1. The piston and the head are constructed with flat annular concentric curfaces 16^a around the inner and outer edges of the grooves 9, and 18 respectively. These surfaces 16^a form the valve faces. A suitable number of ports 20 are formed through the piston communicating at one end with the groove 9 at the front of the valve 16 and at the other end opening into the cylinder 1 at the front of the piston 4. A suitable number of ports 21 are also formed through the tail rod head 12 communicating at one end with the groove 18 at the back of the valve 16 and at the other end opening into the cylinder at the rear of the head 12.

The tail rod 11 projects in a rearward direction through an aperture 19 in the cylin-

der back cover 3, in which aperture it is adapted to reciprocate.

22 is a cylindrical or other suitably shaped vessel positioned at the rear of the cylinder back cover 3, and bolted or otherwise suitably attached to the cylinder 1. This cylinder 22 constitutes a receiver or chamber into which, through an aperture provided at 23 or in any other convenient position, the steam, compressed air or other actuating gaseous fluid under pressure is admitted. The cylinder 22 is shown fixed to the cylinder 1 by means of two longitudinal bolts 24, which pass through holes formed in lugs 25 on the cylinder 1, lugs 26 formed on the front head 2 and lugs 27 formed on the cylinder 22. The cylinder back cover 3 is shown retained in position on the end of the cylinder 1 by means of the front end of the cylinder 22. The open rear end of the tail rod 11 is always in communication with the chamber 22, and it serves for conducting the actuating fluid from said chamber to the valve chamber between the inside of the tail rod head 12 and rear end of the piston 4.

28—see Fig. 2—are the exhaust ports provided in the walls of the main cylinder. When two exhaust ports are provided they may be placed in any desired positions to give any desired length of stroke. For a constant stroke one exhaust port will be provided placed at or about the center of the cylinder 1 or midway of the stroke of the piston 4.

In the operation of the engine, the actuating fluid having been admitted to chamber 22 passes through the tail rod 11 to the valve chamber. If the piston 4 is moving through its forward stroke then the cylinder at the front of the piston is open to exhaust, and the valve is forced in to its seat on the faces 16ª provided around the recess 9 by the pressure upon the back of the valve exceeding the pressure on the front of the valve owing to the ports 20 being open to exhaust, and so closes the ports 20 to the recess 8. When the valve is in this position the fluid can pass freely through the ports 21 to the rear of the head 12 and so force the piston through its forward stroke. When the piston overruns the exhaust port, (or when two exhaust ports are provided the back exhaust port) the pressure at the rear of the head 12 and piston 4 and in the ports 21 at the back of the valve immediately falls, and the valve is then reversed by the pressure of the fluid (which is free to pass from the hole 7 through the ports 14 to recess 8) acting on the front of the valve exceeding the pressure on the back of the valve. The valve is then forced on to its seat on the faces 16ª around the recess 18 and closes the ports 21 to the interior of the tail pipe 11 and at the same time opens the ports 20 to the recess 8 thereby admitting the actuating fluid to the front of the piston to move it through its backward stroke. When the piston overruns the forward exhaust port the valve is again reversed in the manner explained and the air admitted to the rear of the piston for the forward stroke.

What I claim as my invention and desire to protect by Letters Patent is:—

1. In a reciprocating engine in combination with the piston a tubular member having a head connected to the rear of the piston said head being made hollow and placed in communication with the bore of the tubular member and having ports formed therethrough from the back of the head to an annular groove around the hollow part a disk valve positioned between the head of the tubular member and piston, the piston having passages placing the tubular member in communication with the front of the valve and ports in the piston from the front of the piston to an annular groove formed in the piston at the front of the valve, substantially as described.

2. In a reciprocating engine in combination a cylinder having an exhaust port or ports in the wall thereof a piston in the cylinder, covers for the ends of the cylinder, a chamber fixed to the cylinder at the rear of the back cover said rear cylinder forming the actuating fluid chamber a tubular member constructed with a hollow head portion connected with the piston said tubular member working through the cylinder back cover and being in communication with the rear cylinder a disk valve positioned between the piston and the hollow head of the tubular member the piston having a hollow annular projection upon which the valve is adapted to move in either direction, the piston also having ports placing the tubular member in communication with the front of the valve and with front inlet ports leading from the front of the valve to the front of the piston and the head of the tubular member having back inlet ports leading from the back of the valve to the back of the head. the contiguous faces of the piston and head having flat annular concentric valve faces around the front and back inlet ports, substantially as described.

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

JOHN HOLGATE.

Witnesses:

CHAS. OVENDALE,

F. A. OVENDALE.