No. 679,129. Patented July 23, 1901.

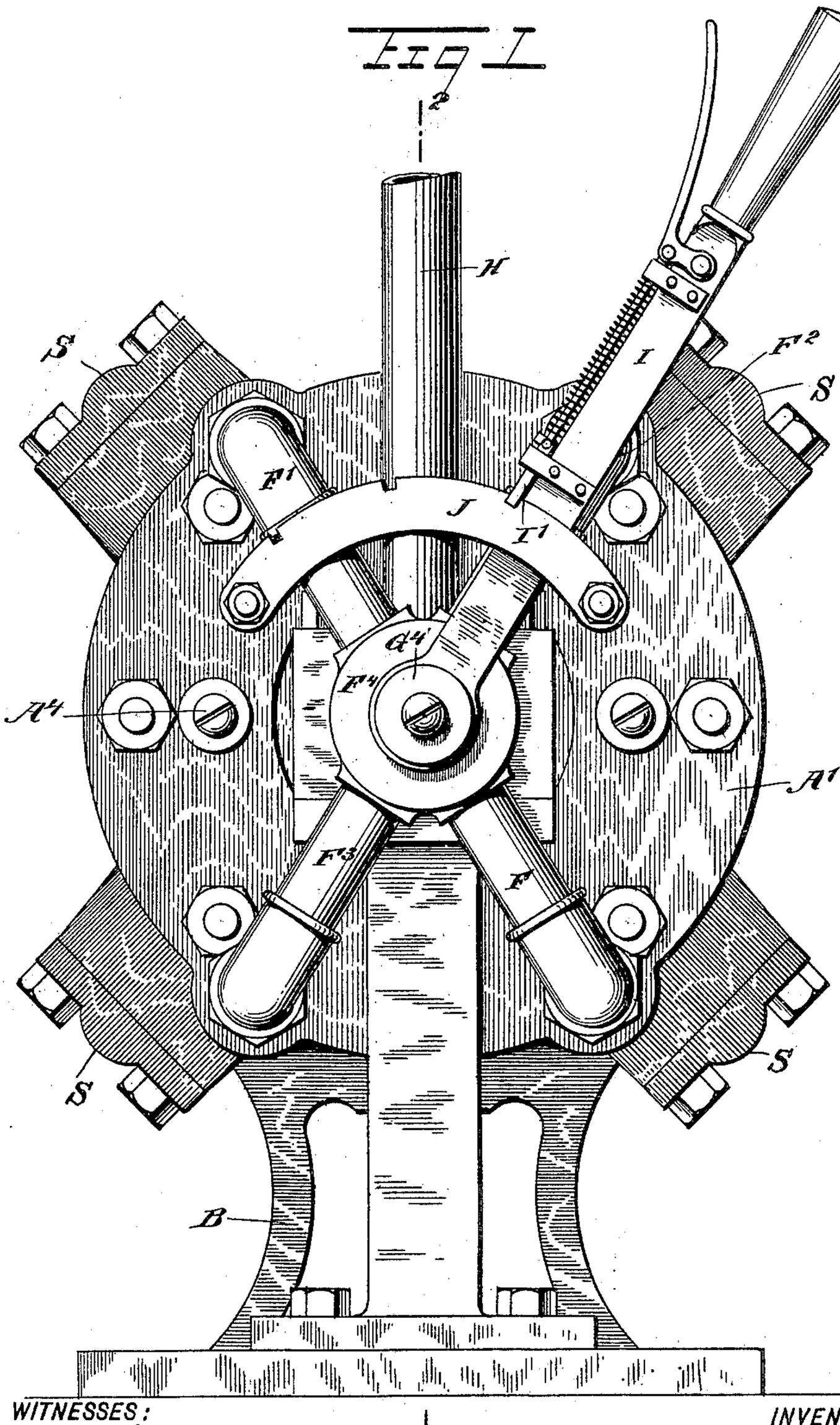
G. W. SMITH.

ROTARY ENGINE.

(Application filed Dec. 11, 1900.)

(No Model.) 3 Sheets—Sheet 1.

FIG. 1.



WITNESSES:

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3 Sheets—Sheet 2.

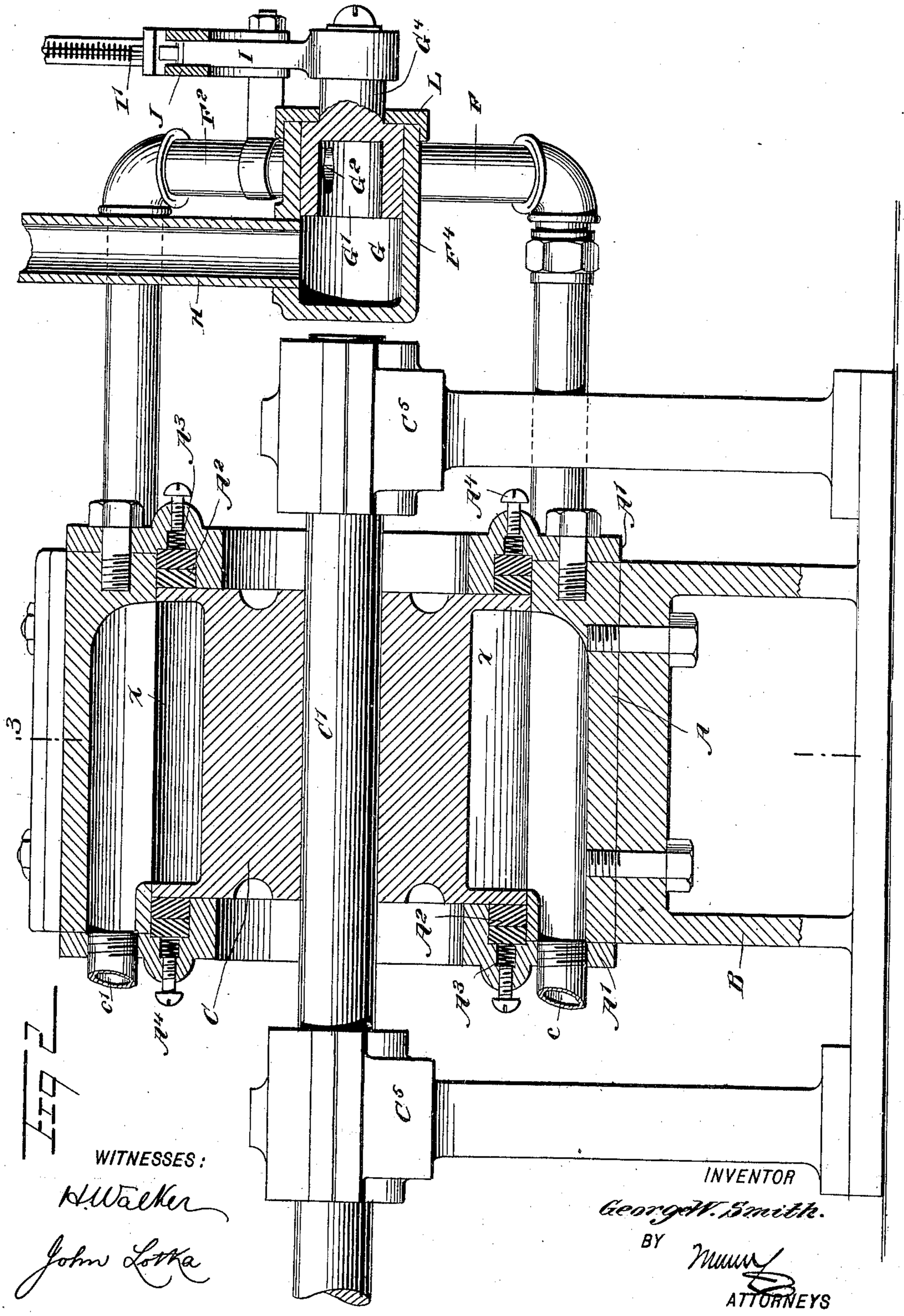

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Fig 3

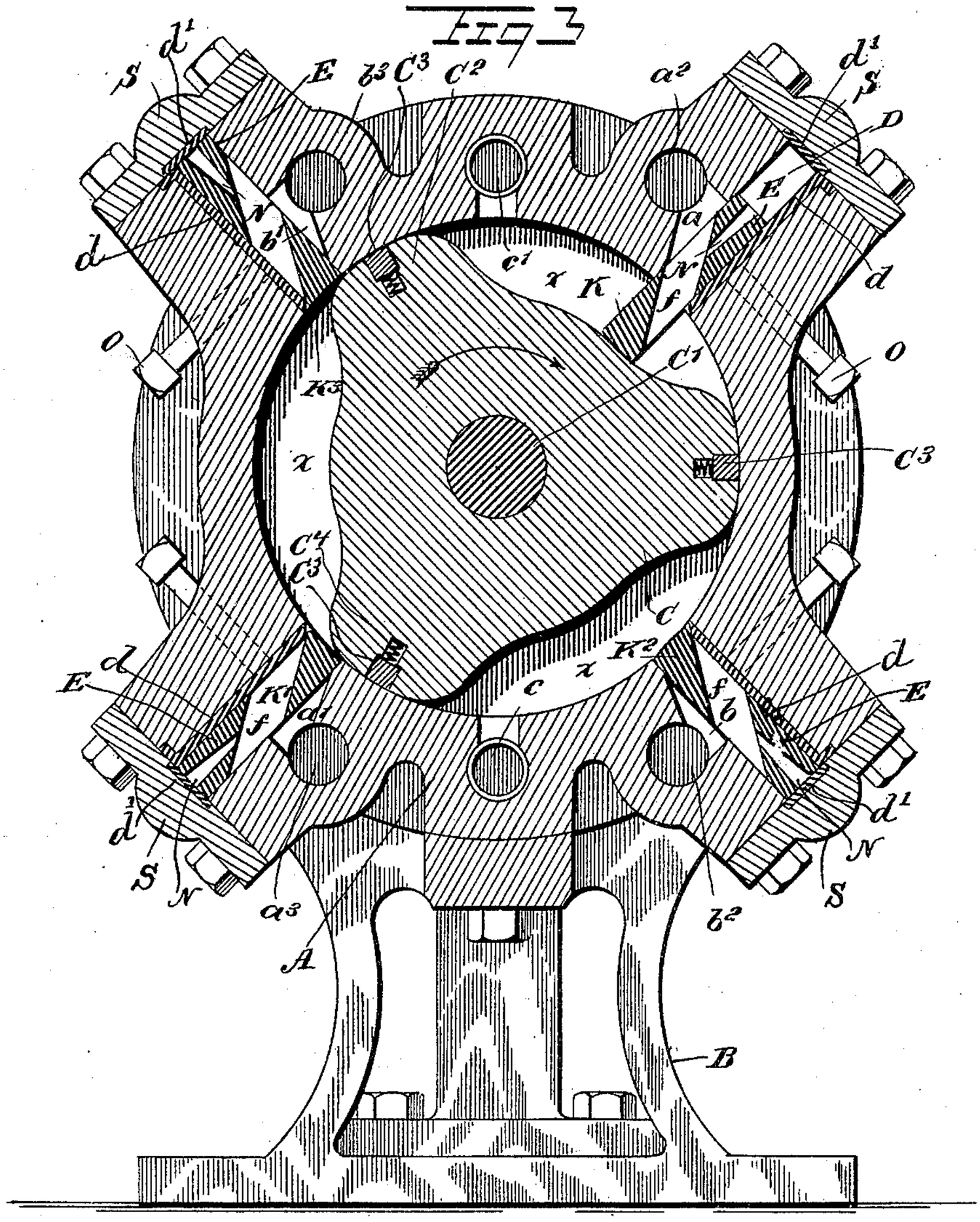
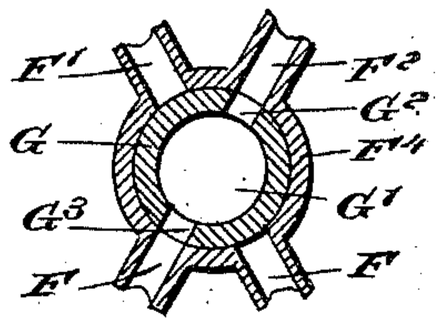


Fig 4



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UNITED STATES PATENT OFFICE.

GEORGE W. SMITH, OF PETERSBURG, ILLINOIS.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 679,129, dated July 23, 1901.

Application filed December 11, 1900. Serial No. 39,518. (No model.)

To all whom it may concern:

Be it known that I, GEORGE W. SMITH, a citizen of the United States, residing at Petersburg, in the county of Menard and State of Illinois, have invented a new and Improved Reversible Rotary Engine, of which the following is a full, clear, and exact description.

My invention relates to reversible rotary engines, and has for its object to provide an improved engine of the above-indicated class in which dead-centers are avoided entirely, so that the engine will start in any position, and in which provision is made for securing steam-tight packings and for securing an easy motion of the cut-off valves which control admission of steam to the cylinder.

The invention will be fully described hereinafter and the features of novelty pointed out in the appended claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is an end elevation of my improved engine. Fig. 2 is a longitudinal sectional elevation thereof on the line 2 2 of Fig. 1. Fig. 3 is a cross-sectional elevation on the line 3 3 of Fig. 2, and Fig. 4 is a cross-sectional detail of the reversing-valve drawn upon a smaller scale.

The engine comprises a cylinder A, having heads A′ and supported on a suitable base or frame B. In this cylinder is mounted a piston C, carried upon a shaft C′, which is journaled in bearings C^5, the said piston having three portions or heads C^2, adapted to engage the periphery of the cylinder, and three cavities x, forming working chambers, in a manner more fully set forth hereinafter. The cylinder is provided with oblique ports a a' b b', located approximately at equal distances from each other and leading into the cavities or working chambers x. These ports communicate with the inlet-ports a^2 a^3 b^2 b^3, connected with the pipes F^2 F^3 F F′, which lead to the valve-casing F^4. In this casing is mounted to turn the reversing-valve G, opening at one end, as shown at G′, into the casing F^4, so as to be permanently in communication with the steam-supply pipe H. The valve G further has peripheral ports G^2 G^3, located diametrically opposite each other, so that they will register either with the inlet-pipes F F′ or with the inlet-pipes F^2 F^3. The reversing-valve is normally stationary, but may be adjusted by means of a lever I, connected with a projection G^4 of the valve and held in position on a notched arc J by means of a spring-pressed locking-bar I′ in the ordinary manner. A nut L forms a cap for the valve-casing F^4 and at the same time a stuffing-box for the projection or stem G^4 of the valve.

The inlet-ports a a' b b' communicate at their inner ends with radial chambers D, in which are mounted to reciprocate the cut-off valves E. Each of these valves has an inner end K K′ K^2 K^3, adapted to engage the peripheral surface of the piston C, and a diagonal or oblique passage f, arranged to register with the ports a a' b b' and being of the same inclination. From the said passages f to the rear or outward face of each cut-off valve extends a channel N, flaring toward its outer end and establishing a permanent communication between each valve-chamber D and the passage f of the corresponding cut-off valve. The opposite ports a a' are inclined in one direction—for instance, the direction corresponding to clockwise rotation of the piston—and the other ports b b' are inclined in opposite directions—that is, the direction corresponding to contra clockwise rotation. Between two of the inlets and at diametrically opposite points are located the exhaust-ports c c', in permanent communication with the interior of the cylinder and with the atmosphere.

To secure steam-tight joints, I provide the following arrangements: Each of the piston-heads C^2 has a spring-pressed packing-bar C^3, pressed outward by springs C^4 to engage the inner surface of the cylinder. Each of the cylinder-heads A′ has a packing or ring A^2, pressed inward against the faces of the piston by means of springs A^3, the pressure of which may be graduated by means of set-screws A^4. To preserve a tight fitting of the cut-off valves E, I provide the chambers D with a lining or packing of substantially L shape, as shown at d, said packing being capable of inward adjustment by means of set-screws O, so as to take up wear. In order that the cut-off valves may be readily accessi-

ble, I provide caps S, which cover the ends of the valve-chambers D, so that upon removing the said caps the cut-off valves and the linings *d* may be removed and repaired. The caps S may be provided on their inner faces with cushions *d'* to receive the impact of the cut-off valves E when the latter are thrown outward.

In operation, supposing the lever I to be so set that the ports G^2 G^3 will register with the pipes F^2 F^3, the steam-inlet ports *a a'* will be in action while the other steam-inlet ports *b b'* will be inactive. Steam will therefore pass through the pipe H to the valve-casing F^4, the bore G' of the reversing-valve G, the ports G^2 and G^3, pipes F^2 and F^3, and ports a^2 a^3 to the inlet-ports *a a'*. In the position shown in Fig. 3 the head or inner end *k'* of one cut-off valve is engaged by one of the heads C^2 of the piston, and is therefore in its outer position, thus closing the communication of the inlet-port *a'* to the cylinder. The cut-off valve with the head *k*, however, is in its inner position, so that the passage *f* registers with the inlet-port *a*, thus allowing steam to pass into the chamber and to impinge against one of the piston-heads C^2. A portion of the steam passes through the channel N of the cut-off valve and presses upon the outer face of the valve, holding the valve inward against the piston. During the rotation of the piston the curved surface of the latter acts as a cam-surface to again force the cut-off valve outward, and as this is done the steam which has previously passed into the outward end of the valve-chamber D is forced inward in a jet through the channel N, owing to the fact that said channel is contracted at its inner end. This feature facilitates the outward movement of the valve, and thus reduces the power necessary to shift the valve. It will be seen that as there are two steam-inlets to the cylinder in operation while the piston forms three working chambers it is impossible for the piston at any time to assume such a position that both steam-inlets will be closed. Therefore the engine has no dead-center position. Furthermore, the power exerted to turn the piston is more uniformly distributed, as the steam-inlets begin to admit steam at different times. It will be understood that steam exhausts through the ports *c c'*; but said ports are so located that they will never be opened to the same working chamber to which one of the steam-inlets is open at the same time. To reverse the engine, the lever I is thrown into position at the extreme left, thus bringing the valve-ports G^2 G^3 in communication with the inlet-pipes F' F. When it is desired to stop the engine, the lever I is brought into the central position, in which the ports G^2 G^3 remain closed.

While I have shown a cylinder having two inlets acting in conjunction with a piston having three heads, (two of the four inlets being inactive,) I do not wish to be understood as limiting myself to this specific construction, since the same result, so far as avoiding dead-centers is concerned, will be obtained whenever the number of piston-heads exceeds the number of inlets, without, however, being an exact multiple of the number of inlets.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In a rotary engine, a cylinder having an outlet an inlet and a valve-chamber at the inlet, a cut-off valve mounted to slide in said chamber and having a passage for the admission of the motive agent from the said inlet to the cylinder, and a channel leading from said passage to the outer end of the valve-chamber, said channel being narrowed or tapered toward said passage, and a piston mounted to turn in the cylinder and engaged by the cut-off valve.

2. In a rotary engine, a cylinder having outlets inlets arranged obliquely to the inner periphery of the cylinder and radial valve-chambers at said inlets, cut-off valves held to slide in said chambers and provided with oblique through-passages adapted to connect the inlets with the interior of the cylinder, and with outwardly-flaring channels leading from said passages to the outer ends of the valve-chambers.

3. In a rotary engine, a cylinder having outlets two sets of inlets arranged obliquely to the inner periphery of the cylinder, the inlets of one set facing in a direction opposite to those of the other set, and radial valve-chambers at said inlets, cut-off valves held to slide in said chambers and provided with oblique through-passages adapted to connect the inlets with the interior of the cylinder, and with outwardly-flaring channels leading from said passages to the outer ends of the valve-chamber, a reversing device for connecting one set of inlets or the other with the supply of motive agent, and a piston mounted to turn in the cylinder and engaged by the cut-off valves.

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

GEORGE W. SMITH.

Witnesses:
ADLEY M. BOYD,
JOHN C. JOHNSTON.