No. 811,747. PATENTED FEB. 6, 1906.

W. J. ROWE & A. L. WITBECK.

ROTARY ENGINE.

APPLICATION FILED MAR. 3, 1904.

4 SHEETS—SHEET 1.

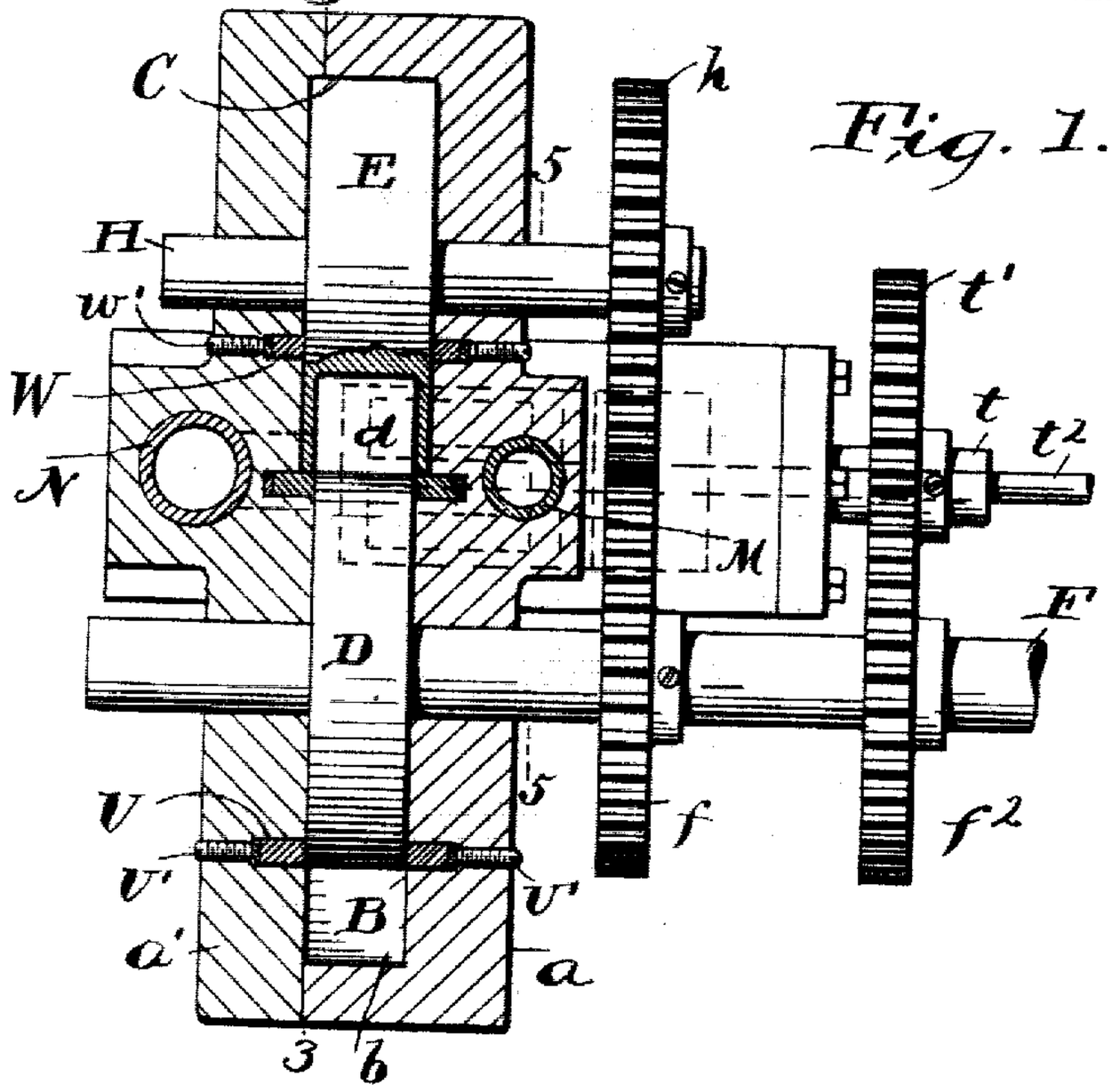


Fig. 1.

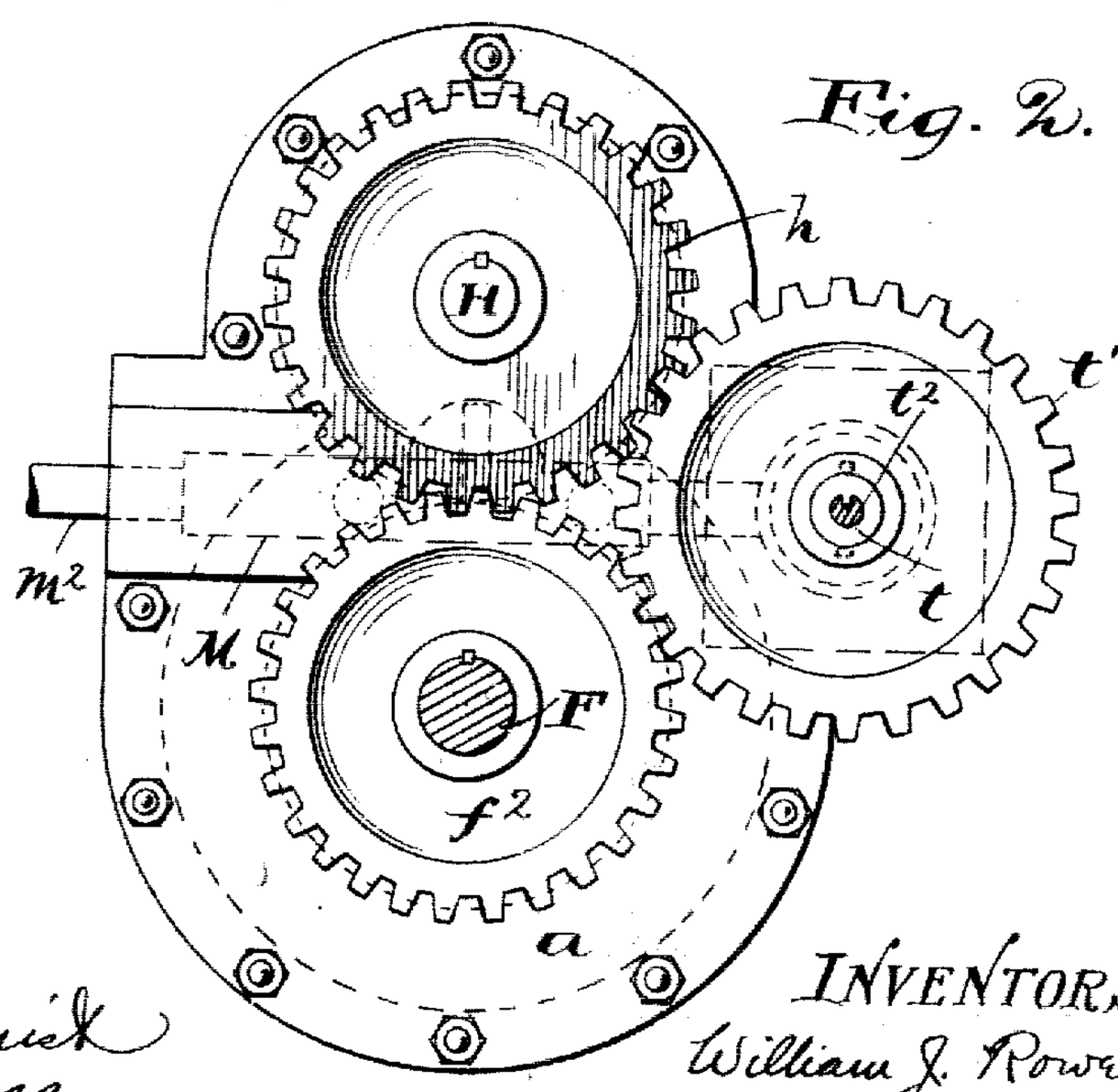


Fig. 2.

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4 SHEETS—SHEET 2.

Fig. 3.

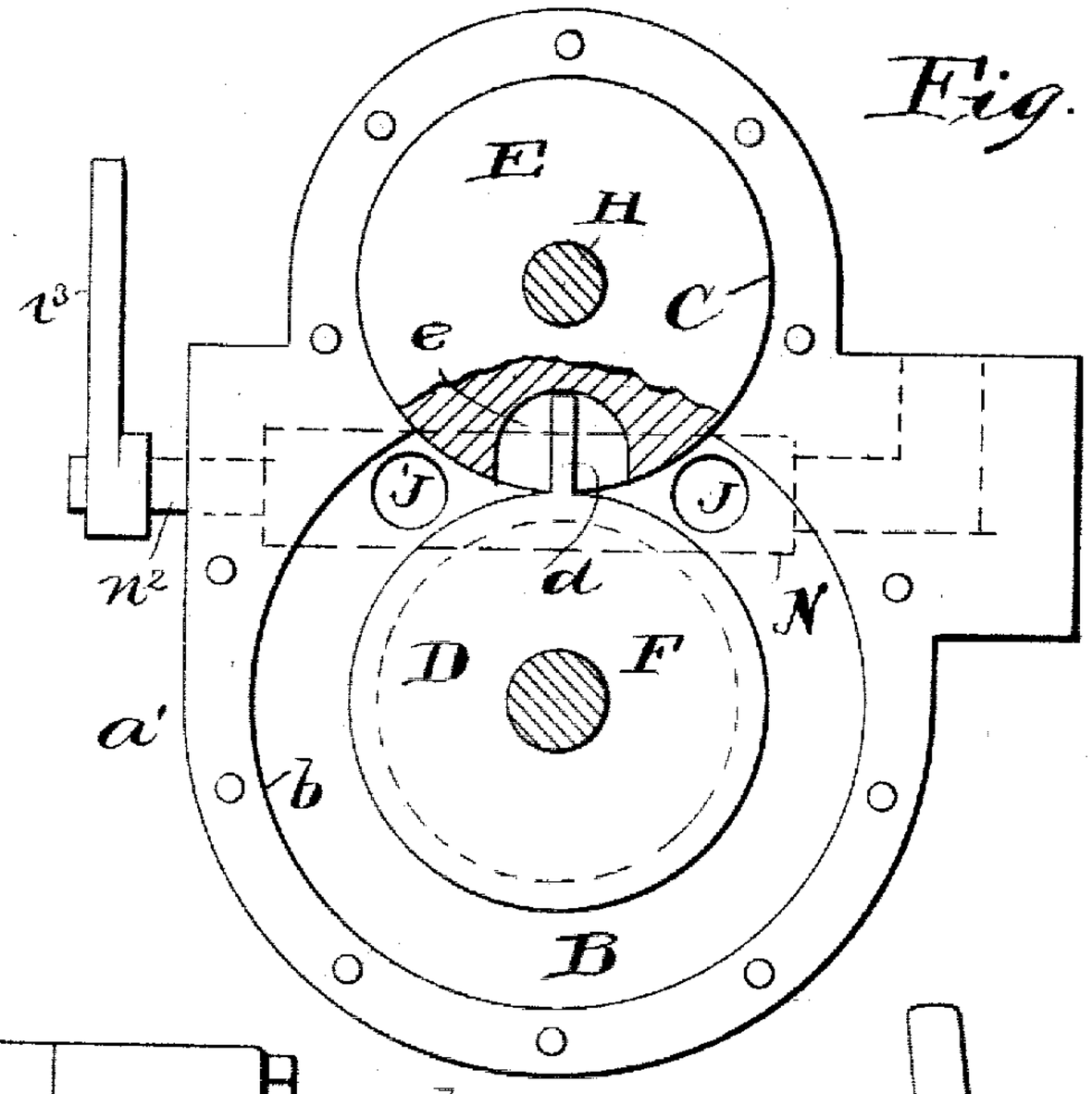
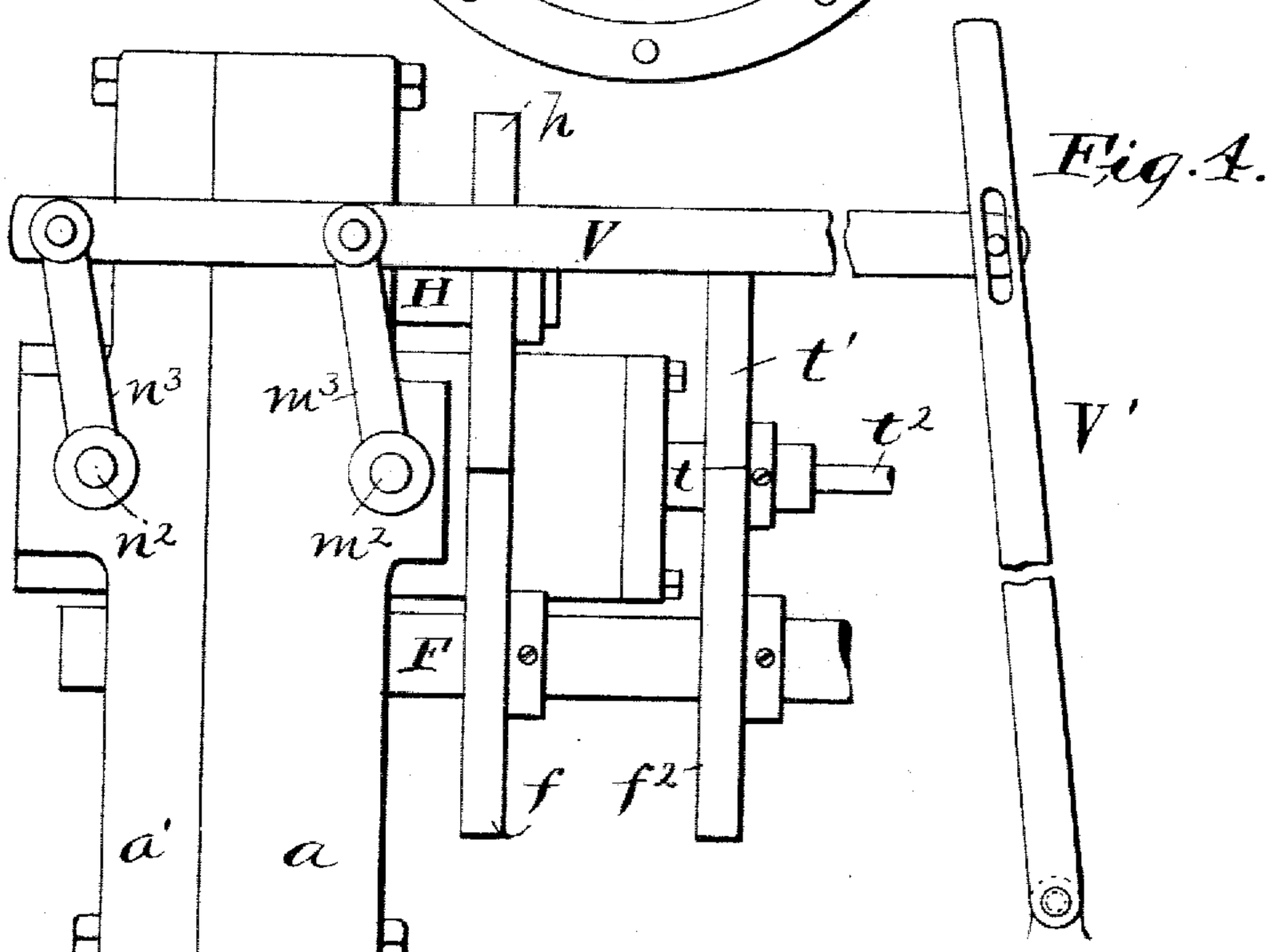



Fig. 4.

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4 SHEETS—SHEET 3.

Fig. 5.

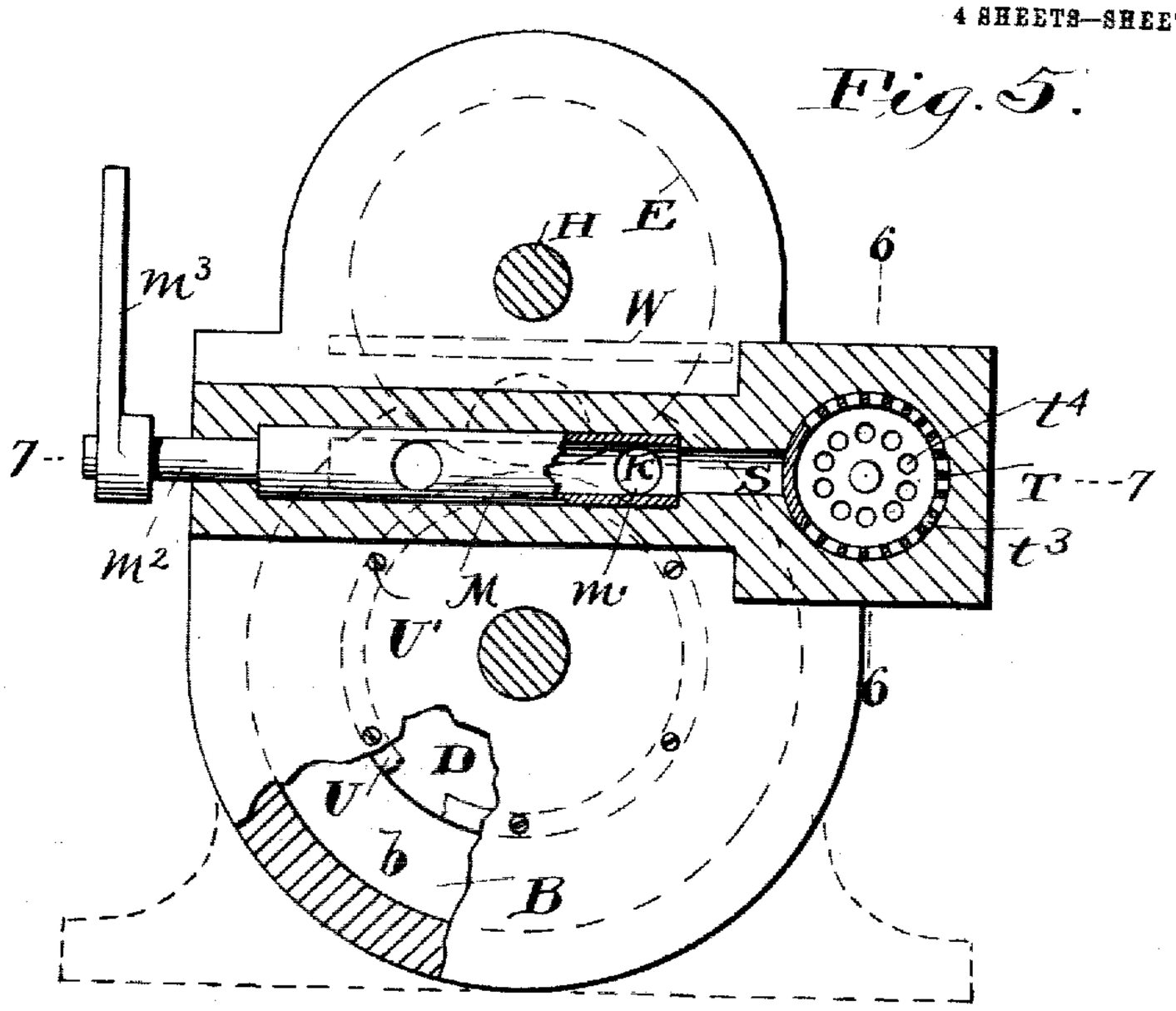
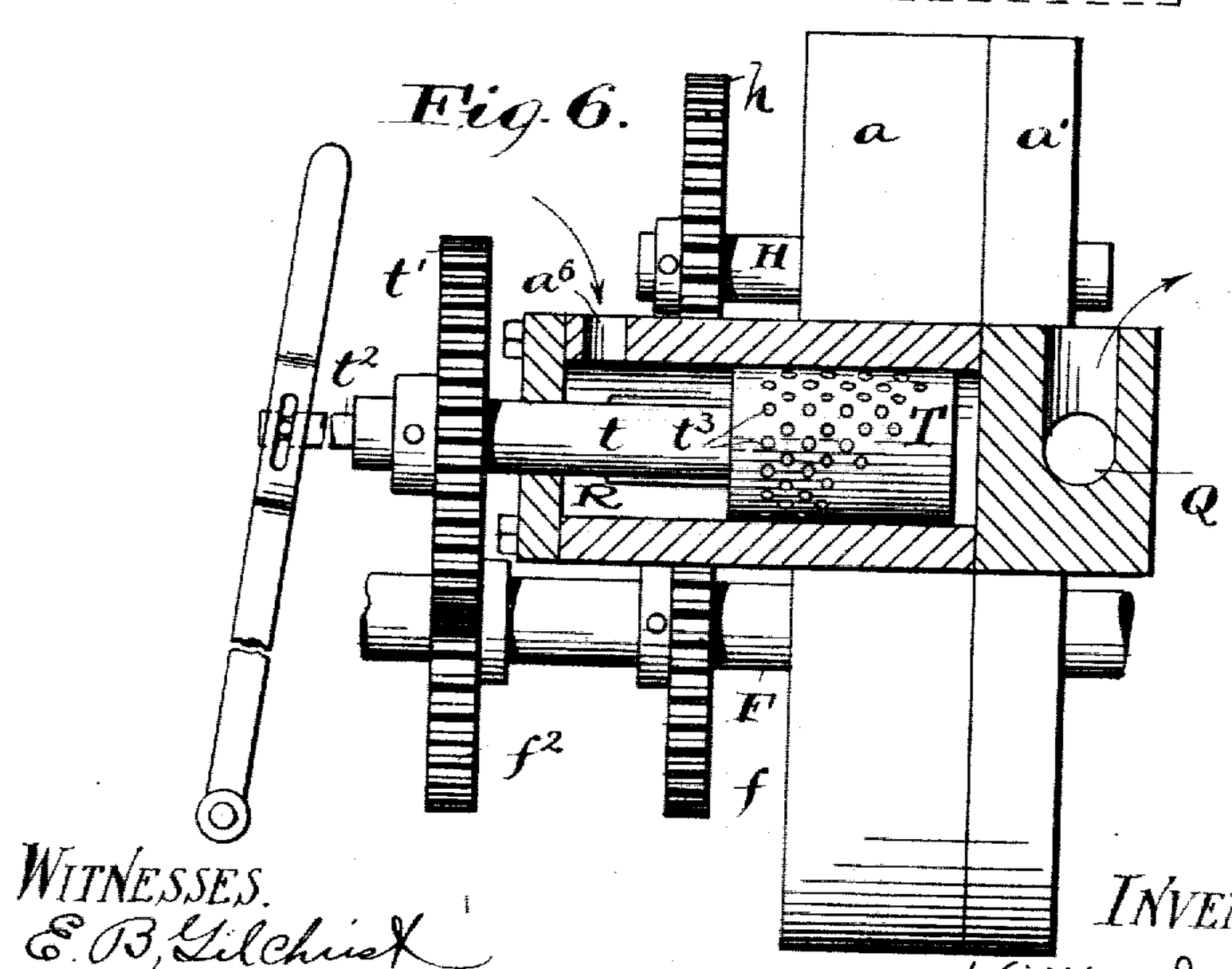



Fig. 6.

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4 SHEETS—SHEET 4.

Fig. 7.

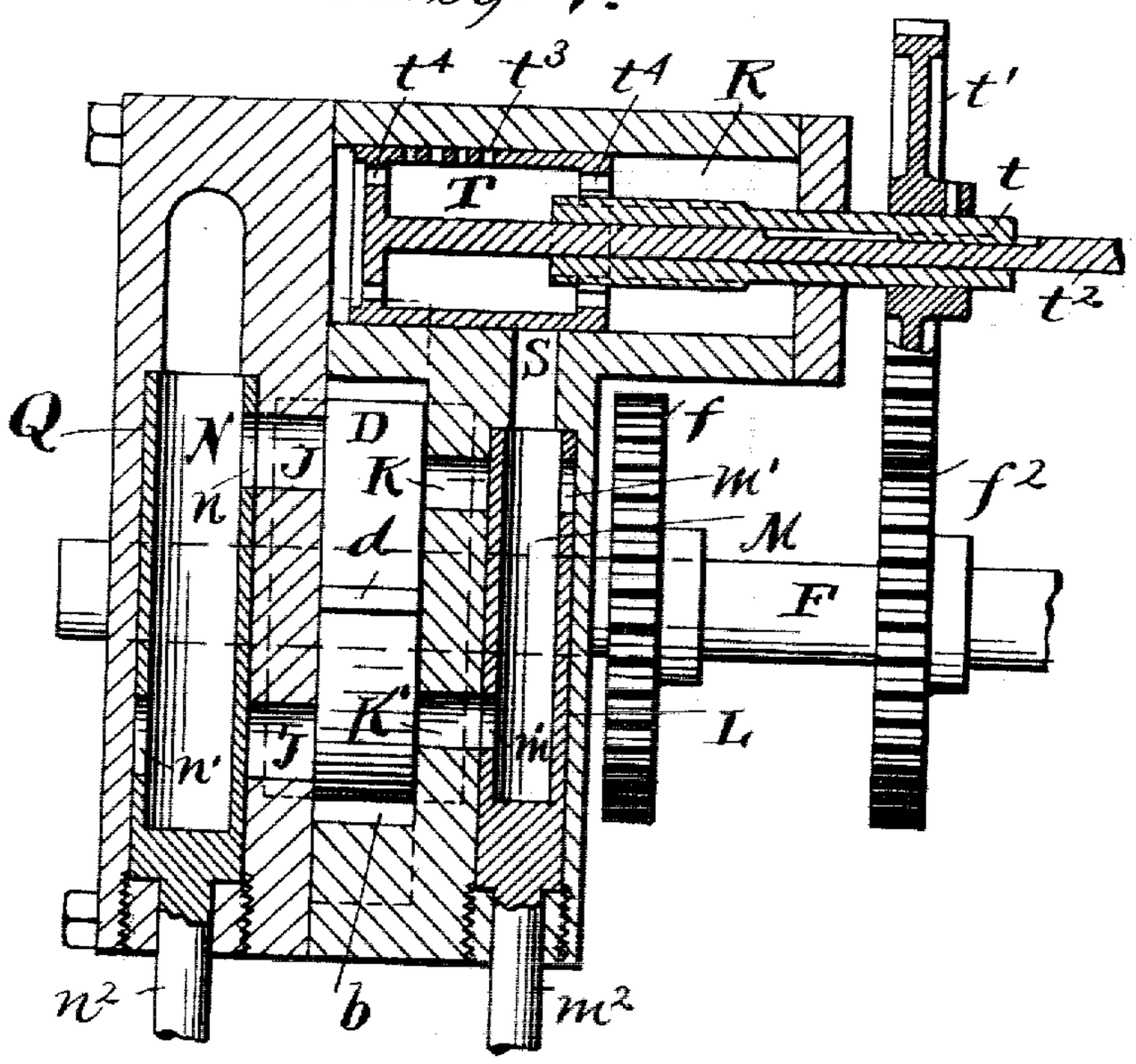



Fig. 9.

Fig. 8.

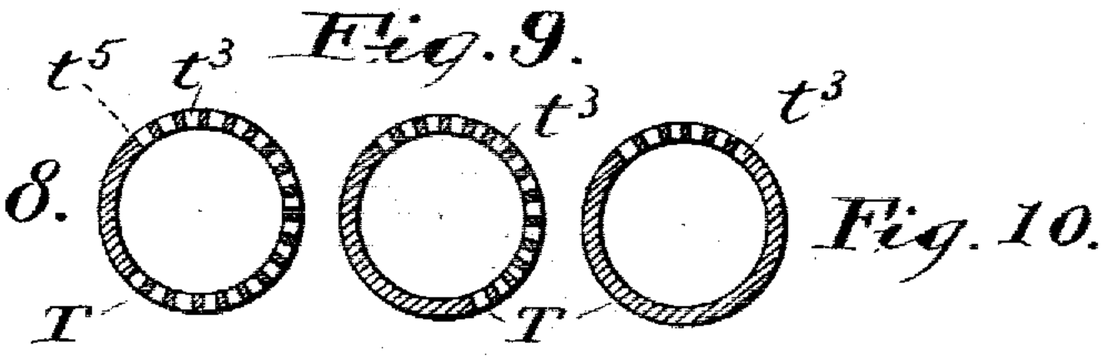
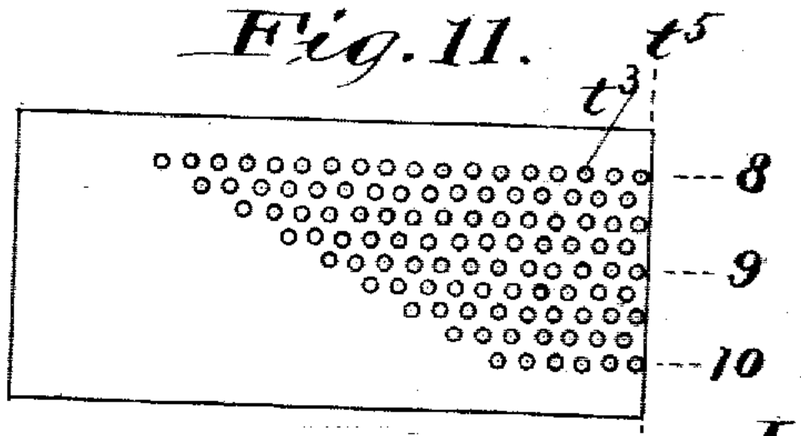



Fig. 10.

Fig. 11.

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# UNITED STATES PATENT OFFICE.

WILLIAM J. ROWE AND ARBA L. WITBECK, OF CLEVELAND, OHIO.

## ROTARY ENGINE.

No. 811,747. Specification of Letters Patent. Patented Feb. 6, 1906.

Application filed March 3, 1904. Serial No. 196,384.

*To all whom it may concern:*

Be it known that we, WILLIAM J. ROWE and ARBA L. WITBECK, citizens of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Rotary Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

The object of the invention is to make a simple, efficient, and durable rotary engine capable of running forward or backward at different speeds.

The invention resides in the novel combinations of parts which contribute to the attainment of these results, substantially as shown in the drawings and hereinafter described, and definitely pointed out in the claims.

In the drawings, Figure 1 is a central sectional front elevation of the engine. Fig. 2 is a right-end elevation thereof. Fig. 3 is a sectional end view in the plane of line 3 3 of Fig. 1, the piston and abutment being unsectioned. Fig. 4 is a front view. Fig. 5 is a side view, partly in section, in the plane indicated by line 5 5 on Fig. 1. Fig. 6 is a rear view, partly in section, in the plane indicated by line 6 6 of Fig. 5. Fig. 7 is a sectional plan view in the plane of line 7 7 of Fig. 5. Figs. 8, 9, and 10 are three transverse sectional views of the rotary cut-off, the views being taken in planes corresponding with lines 8, 9, and 10 in Fig. 11; and Fig. 11 is a development of the said rotary cut-off.

Referring to the parts by letters, A represents the engine casing or frame, which consists of two principal parts *a a'*, which are bolted together. Within the casing and between these parts thereof are two intersecting cylindrical recesses B and C. The recess B is the piston-chamber, and it contains the cylindrical piston D. This piston is attached to the main driving-shaft F, which is mounted in and extends out at one or both ends through the casing. The piston is of less diameter than the chamber B, wherefore there is within said chamber and around the piston an annular steam-space *b*. A piston-blade *d*, attached to the piston, extends across and is fitted to this annular steam-space.

Within the cylindrical chamber C is a rotating cylindrical abutment E, attached to a shaft H, which is mounted in and projects out at one or both ends from the casing. The abutment-cylinder E is slightly wider than the piston-cylinder B, and these two cylinders are of the same diameter and their peripheries are in contact. A recess *e* is formed in the periphery of the abutment, and it is of such shape and width that the piston-blade *d*, as the piston and abutment are rotating, enters and substantially bridges said recess. Attached to the shafts F and H are the gears *f* and *h*, which are of the same size and mesh together, so that the piston and the abutment will rotate at the same speed.

Through one end of the engine-casing are two inlet-ports K K', which are located on opposite sides of what might be called the "dead-center"—that is to say, the point at which the peripheries of the abutment and piston-cylinders contact. These inlet-ports lead to the annular steam-space. Directly in the line with them, but through the opposite end of the casing, are two exhaust-ports J J'.

In the casing is a cylindrical recess L, with which the outer ends of the inlet-ports engage. In this recess is a cylindrical tubular valve M, having one end closed. In this valve are two ports *m* and *m'*, which are formed through opposite sides thereof, but one of these ports is in line with the inlet-port K and the other is in line with the inlet-port K'. The stem $m^2$ of the valve extends out of the casing.

In the casing on the opposite side of the piston is another cylindrical recess Q, containing a similar valve N, having in opposite sides thereof the ports *n* and *n'*, which are adapted to communicate with the outlet-ports J and J', respectively. The stem $n^2$ of this valve also extends out of the casing. To these valve-stems $m^2$ and $n^2$ operating-arms $m^3$ and $n^3$ are respectively secured, and both of these arms are connected together by a bar V, to which power may be applied—as, for example, through the lever V'—to operate them both simultaneously, and therefore to turn said valves M and N. These valves are the reversing-valves, and they may also be used as throttle-valves.

Steam is admitted through port $a^6$ to a cylindrical cut-off chamber R in the casing, which cut-off chamber communicates with the hollow valve M through a port S. Within the cut-off chamber is a cylindrical cut-off valve T. It is hollow and has openings $t^4$ through both ends thereof, so that when steam is admitted to said chamber it will press equally against both ends of the valve

and will enter the interior thereof. Through this cylindrical cut-off are a plurality of perforations through which as the cut-off rotates steam may escape into the port S and thence through one of the paths above indicated into the steam-space *b*. The cut-off T is provided with a stem *t*, to which is attached a gear *t'*, which meshes with a gear $f^2$ on the main shaft F. These gears are of equal size, and therefore the cut-off valve rotates at the same speed as the piston. This cut-off T is movable endwise in the chamber R, the means for so moving it consisting of a stem $t^2$, attached to the cut-off valve which passes axially through the stem *t*; but the latter stem is not movable endwise in its bearings, but has a tongue-and-groove connection with the stem $t^2$, so that by drawing upon the stem $t^2$ cut-off T is moved endwise, as stated, without disturbing the operative connection between the cut-off valve and the gear $f^2$. As will be seen from the development of this cut-off cylinder the holes $t^3$ through its walls extend different distances around the cylinder at different parts of its length; but all start from a common line $t^5$, (see Figs. 8 to 11,) parallel with the axis. When the engine is in operation running forward, steam is admitted to port S and thence to the steam-space *b* immediately the piston-blade has passed the inlet-port. When the cut-off valve T is in the position shown in Fig. 7, the steam will be cut off when the piston has made about one-third of its revolution. By moving the valve T to the right, as shown in Fig. 6, one may prolong the time during which steam is admitted, so that it may be admitted during substantially the entire time that the blade is traveling from the inlet to the exhaust port. When the engine is being run backward, the cut-off is not practically susceptible of the same variation, because the movement of the cut-off does not then vary the time when steam is cut off, but the time when it is allowed to flow through port S. This cut-off may be moved endwise by means of a forked lever having slots which receive pins on a collar which embraces the stem $t^2$. It is incapable of moving endwise thereon, while permitting the stem to rotate within it.

In the piston-chamber and in opposite ends thereof there are the annular packing-rings U, set in recesses in the casing and capable of being pressed with greater or less force against the sides of the piston by means of screws U'. The packing for the abutment, however, consists of two straight packing-strips W, set in recesses on opposite sides of said abutment, but passing between the shaft H and the recess *e*, which strips are capable of being pressed with greater or less force against the sides of the abutment by said screws *w'*.

Among the advantages of the construction it will be noted that so long as the engine is running the piston, abutment, and cut-off are rotating in one direction and at equal speeds, thus doing away with any reciprocating motion of any of said parts. The construction is easily assembled and taken apart, and everything is compact and durable.

If steam be admitted to the cut-off chamber, the volume which may enter the steam-chamber of the engine may be controlled by the valves M and N through the one operating-lever, or it may be shut off altogether. When steam is admitted through port K, it is of necessity exhausted through port J'. When the valves are turned so that steam is admitted through port K', the engine runs in the reverse direction and steam is necessarily exhausted through port J.

We claim—

1. In a rotary engine, the combination of a casing containing a cylindrical piston-chamber, a rotary piston, of smaller diameter located therein, a piston-blade secured thereto, there being two inlet-ports leading to one side of the annular space within said chamber around said piston, and two outlet-ports leading from the opposite side thereof, and said casing containing two cylindrical chambers with which said inlet and outlet ports respectively communicate, and there being an inlet-port to one of said chambers and an outlet-port from the other, with two cylindrical valves which are mounted respectively in said chambers and are each provided with two ports, and mechanism connecting said valves whereby they may be rocked simultaneously, substantially as and for the purpose specified.

2. In a rotary engine, the combination of a casing containing a cylindrical piston-chamber, a rotary piston therein having a piston-blade, and a movable abutment, there being two inlet-ports through one end of said piston-chamber but on opposite sides of said abutment, and two exhaust-ports through the other end of said piston-chamber and on opposite sides of said abutment, an exhaust-valve chamber with which the two exhaust-ports connect, an inlet-valve chamber with which the two inlet-ports connect, a valve in each of said two chambers adapted to simultaneously open one of the ports connected with it and to close the other port, connections between said two valves whereby they operate simultaneously, a cylindrical cut-off-valve chamber communicating with the inlet-valve chamber referred to, a rotary cut-off valve, and mechanism connecting said valve with the rotary piston, substantially as and for the purpose specified.

3. In a rotary engine, the combination of a casing which contains two intersecting cylindrical chambers of unequal diameter, a parallel cylindrical cut-off chamber adapted to be connected with the steam-supply, and two valve-chambers each having two ports

connecting it to the larger of the intersecting chambers and one having an exhaust-port and the other being connected with said cut-off chamber, valves in said valve-chambers to control and direct the flow of steam through the ports which communicate with said larger chamber, with a rotary cut-off valve in the cut-off chamber, a rotary piston carrying the blade in the larger of the intersecting chambers, a rotary abutment in the third chamber in peripheral contact with the piston and having a peripheral recess, and mechanism connecting said three rotatable elements, substantially as and for the purpose specified.

4. In a rotary engine, the combination of a casing containing a cylindrical piston-chamber, a rotary piston therein having a piston-blade, and a movable abutment, there being two inlet-ports to one end of said piston-recess and on opposite sides of said abutment and two exhaust-ports to the other end of said piston-chamber and on opposite sides of said abutment, with a valve for controlling the passage of steam to either of said inlet-ports, a rotary cut-off controlling the flow of steam to said valve, and mechanism intermediate of said piston and cut-off valve for operating the latter, substantially as and for the purpose specified.

In testimony whereof we hereunto affix our signatures in the presence of two witnesses.

WILLIAM J. ROWE.
ARBA L. WITBECK.

Witnesses:
E. L. THURSTON,
B. W. BROCKETT.