No. 728,263. PATENTED MAY 19, 1903.

W. H. MASTERMAN & J. P. MAGNEY.

ROTARY ENGINE.

APPLICATION FILED JULY 22, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1

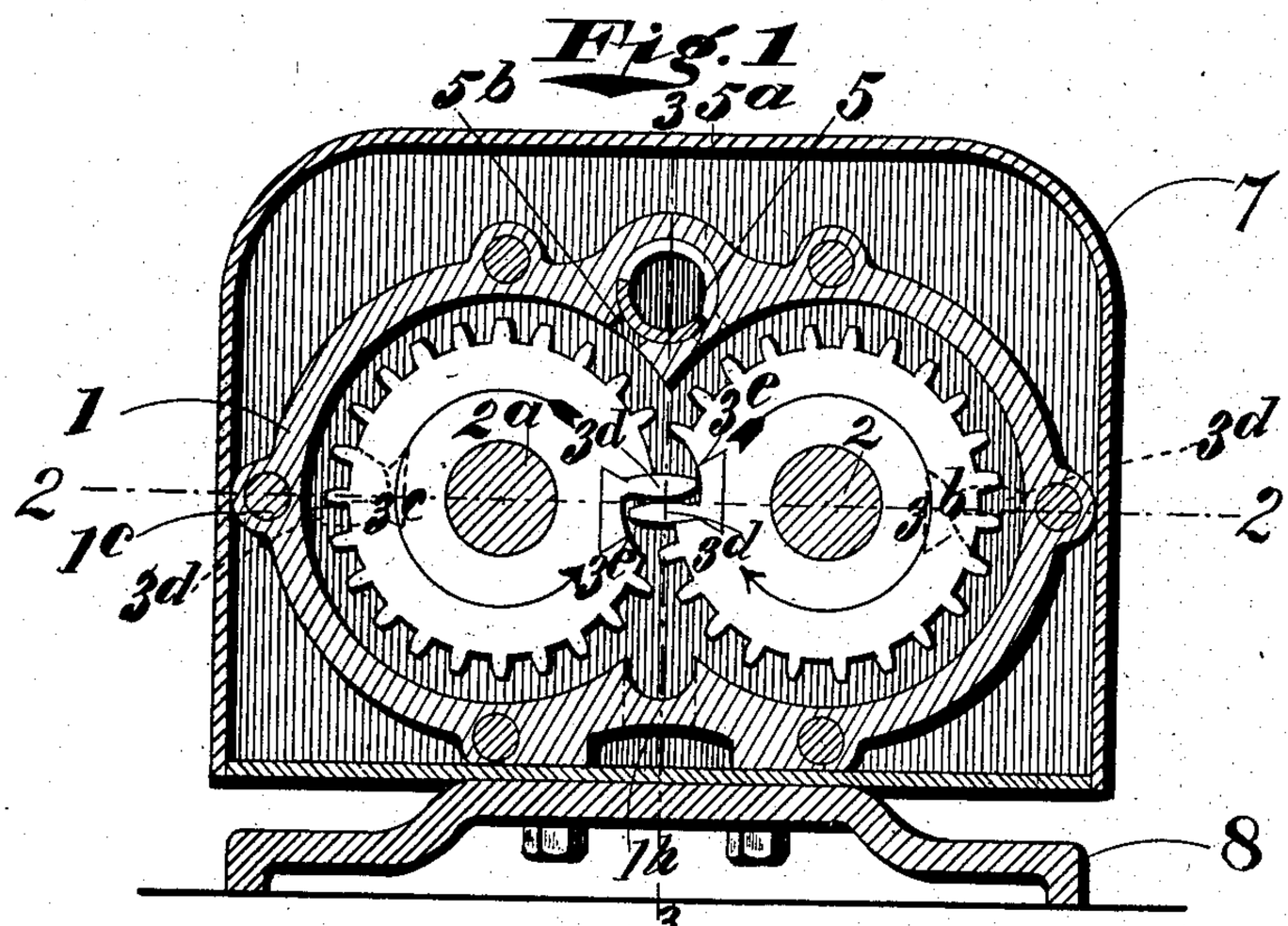
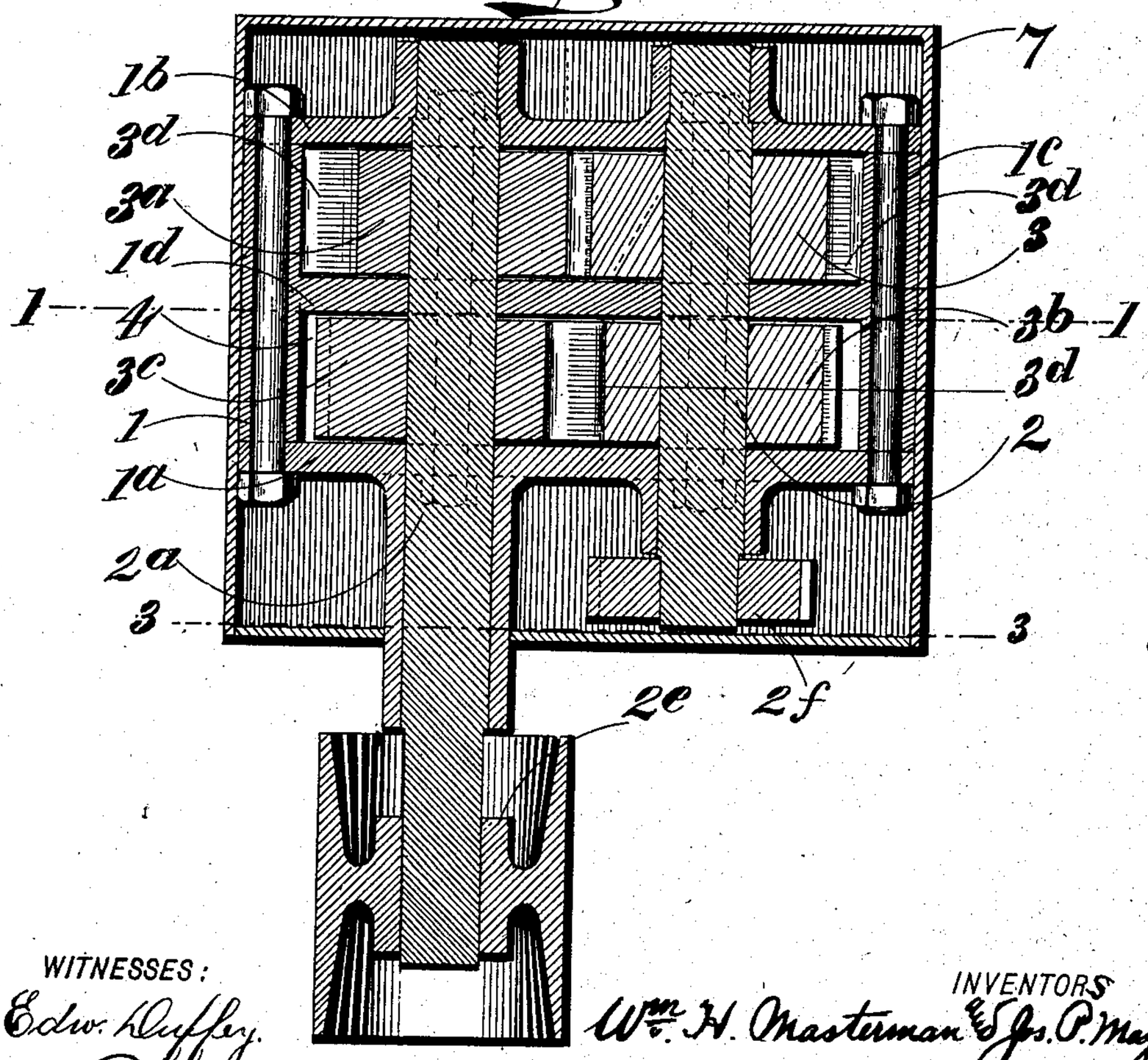


Fig. 2



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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3

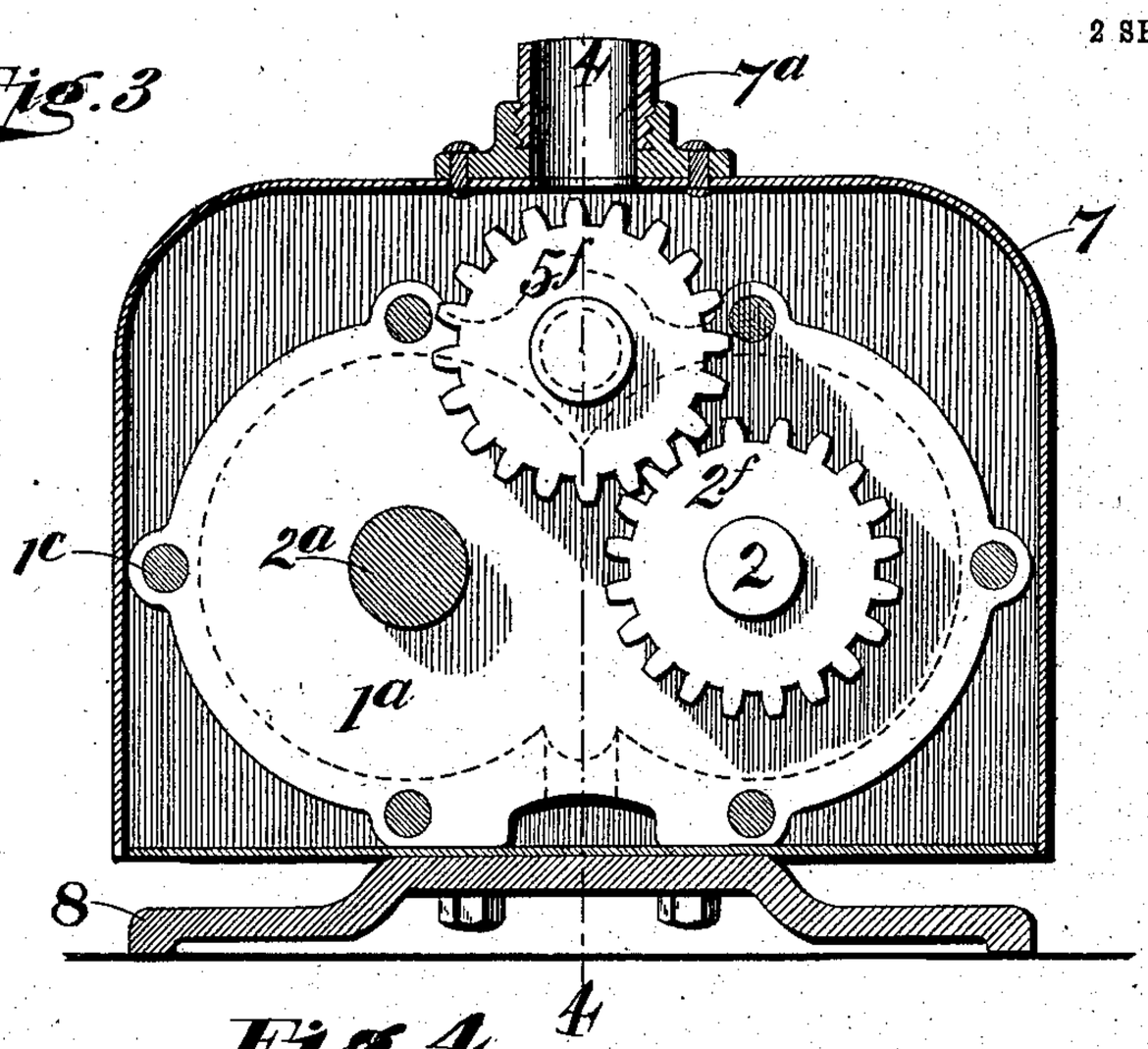


Fig. 4

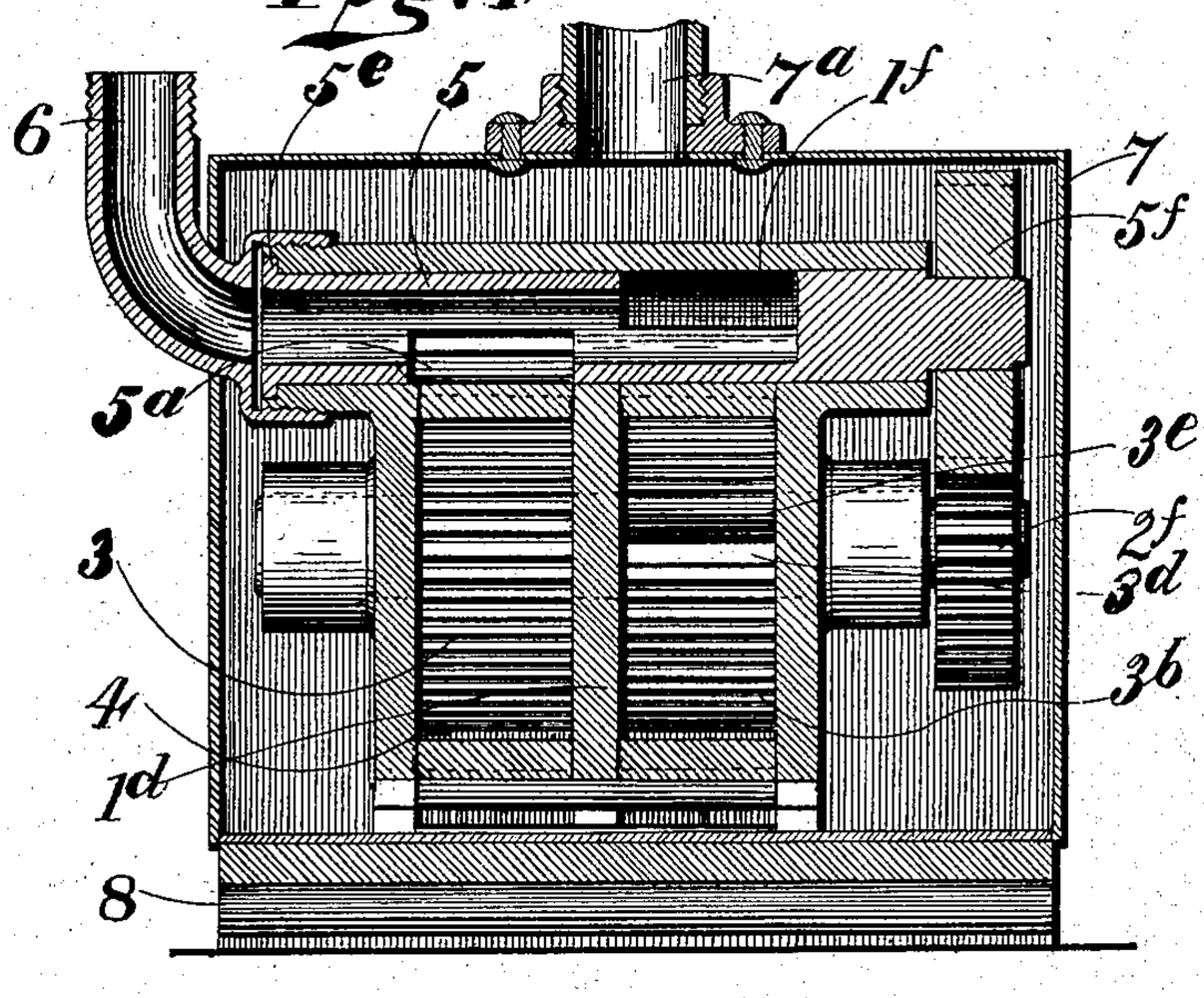
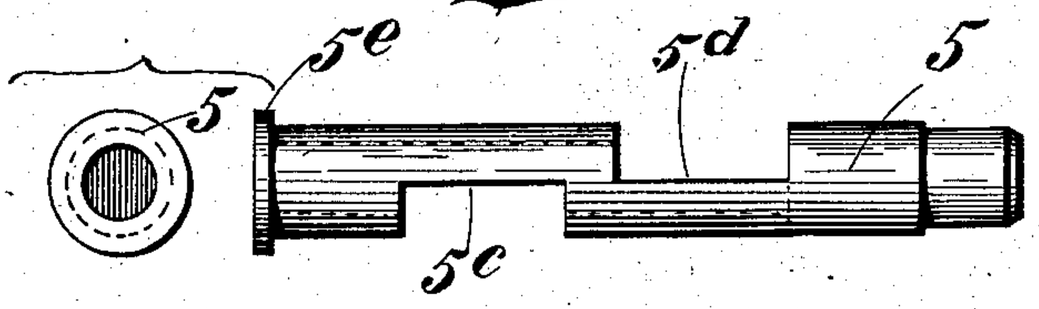


Fig. 5



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UNITED STATES PATENT OFFICE.

WILLIAM H. MASTERMAN AND JOSEPH P. MAGNEY, OF ALLEGAN, MICHIGAN, ASSIGNORS TO MICHIGAN ENGINE CO., OF ALLEGAN, MICHIGAN, A CORPORATION.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 728,263, dated May 19, 1903.

Application filed July 22, 1902. Serial No. 116,581. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM H. MASTERMAN and JOSEPH P. MAGNEY, of Allegan, Allegan county, Michigan, have invented certain new and useful Improvements in Rotary Engines; and we hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form part of this specification.

This invention is an improved rotary-piston engine, and its object is to provide an efficient compact engine having two sets of geared rotary pistons operating in adjacent pairs of chambers, the adjacent pistons in the sets being keyed to the same shafts, one set of pistons being set in advance of the other, so that the engine will at no time be dead-centered. The admission of steam to both sets of cylinders is controlled by a single tubular rotary valve, which is geared to one of the piston-shafts, and the exhaust-steam is admitted into a housing inclosing the engine proper and will lubricate the external gearing and keep all the working parts at a substantially uniform temperature.

The invention therefore consists in the novel construction and combination of parts hereinafter described and claimed, and the accompanying drawings illustrate an engine embodying the invention, Figure 1 being a transverse section of the engine on line 1 1, Fig. 2; Fig. 2, a horizontal section of the engine on line 2 2, Fig. 1; Fig. 3, a vertical section on line 3 3, Fig. 2; Fig. 4, a longitudinal section on line 4 4, Fig. 3, and Fig. 5 is a detail view of the valve.

The engine-casing is composed of a central casting 1 and two end castings 1^a 1^b, secured to the central casting by through-bolts 1^c, suitably nutted, as shown. The casting 1 is divided into two compartments by a transverse partition 1^d, and at each side of said partition are two parti-cylindric working chambers, within which the pistons operate. Extending axially through the working chambers and journaled in suitable bearings in the end castings are a pair of parallel shafts 2 2^a, and fixed on shaft 2 within the adjacent working chambers are two rotary pistons 3 and 3^b, which respectively coact with opposed rotary pistons 3^a and 3^c, fixed on shaft 2^a within the adjacent working chambers. The pistons are all gear-pistons, the teeth of pistons 3 3^a meshing; also, the teeth of pistons 3^b 3^c mesh, and therefore neither piston can rotate without a corresponding rotation of the other pistons. The gear-pistons are each provided with an elongated piston-tooth 3^d, which is adapted to fill the cross-section of the annular space in the working chambers 4 4 concentric to the piston and to serve as a moving abutment against which the steam or other propelling medium acts to rotate the piston. It will be noted that the pistons are rotated solely by the action of the impelling fluid against these abutments 3^d and that the intermeshing gear-teeth on the opposed pistons are employed solely as gearing therebetween to cause them to rotate synchronously and are not useful as abutments. In order to permit the abutments 3^d to pass at the meshing-point of the gears, each piston has a concavity 3^e, into which the opposed abutment projects when the abutments are passing the meeting-point of the pistons, as shown in full lines in Fig. 1. While the abutments 3^d of one set of pistons are thus passing the meeting-point such pistons are idle and no steam is being admitted into their chambers, while at the same time the abutments on the other pair of pistons are under full working pressure. We thus maintain the speed of the engine at all times and prevent any dead-centering thereof.

Steam is admitted alternately to the pairs of pistons to propel them by means of the rotary tubular valve 5, which is journaled in a cylindrical valve-chamber 1^f in the top of casing 1, said chamber having ports 5^a 5^b leading to the adjacent pairs of working chambers 4 4, as shown. The valve is provided with ports 5^c 5^d, respectively adapted to communicate with ports 5^a 5^b, one port being closed, however, when the other is opened, so that steam is admitted alternately to the adjacent pairs of working chambers. The chamber 1^f is provided with a longitudinal extension at one end, onto which is screwed an elbow 6, which leads out through the outer housing 7

of the engine and communicates with a boiler or other propelling-fluid supply. The end of valve 5 may be flanged, as at 5^e, within the pipe 6, which serves as a bushing to make a tight but rotatable joint between the valve and pipe 6. (See Fig. 5.) The other end of valve 5 is closed, and thereon, exterior to the casing, is a pinion 5^f, which meshes with a pinion 2^f on shaft 2, so that the valve is rotated once for each rotation of the pistons. There is no exhaust-valve necessary; but an outlet 1^h is provided from each pair of working chambers directly opposite the inlet-ports, said outlets communicating with the interior of a housing 7, which incloses the engine proper and the gearing, shaft 2^a projecting beyond the side of housing and carrying a pulley 2^e, as shown, to enable power to be transmitted from the engine. The waste steam in housing 7 lubricates the exterior gears and maintains all working parts of the engine proper at a uniform temperature and finally escapes through an outlet 7^a in the housing to a suitable point of discharge. The engine and housing may be supported upon any suitable base, a stand 8 being shown in the drawings.

Operation: As shown in Fig. 1, steam is admitted through port 5^a and impels pistons 3 3^a in the direction of the arrows, pistons 3^b 3^c being idle, as their abutments 3^d are near the meeting-point; but said pistons are rotated by and with the other pistons. When abutment 3^d on piston 3^c passes port 5^b, steam is admitted therethrough and simultaneously port 5^a closed, and the exhaust begins from the working chambers of pistons 3 3^a until their abutments have passed the meeting-point, during which time pistons 3^b 3^c are propelled by and with pistons 3 3^a. The pairs of pistons act alternately; but at no time is the engine running by momentum. Thus dead-centering is prevented and a powerful continuously-acting engine produced. Preferably oil is injected into the propelling fluid or steam entering pipe 6, so as to supply lubricant to the pistons and gearing, as is commonly done, and the exhaust-steam in housing 7 lubricates the valve-gears and maintains the parts at a uniform temperature.

Having thus described our invention, what we therefore claim as new, and desire to secure by Letters Patent thereon, is—

1. In a rotary engine, the combination of adjacent pairs of working chambers, gear-pistons in said working chambers, the opposed pistons intermeshing, and each piston having an elongated tooth forming a working abutment, and a recess to accommodate the abutment of the opposed piston when the abutments are passing the meeting or meshing points of the gear-pistons; with an inlet-port to each pair of working chambers at one side of the pistons, a valveless continuously-open outlet-port at the opposite side of each pair of pistons, and a tubular rotary valve controlling both said inlet-ports and opening same alternately, and mechanism for rotating said valve synchronously with the pistons, substantially as described.

2. In a rotary engine, the combination of the casing having adjacent pairs of working chambers, and an adjacent parallel valve-chamber, parallel shafts passing axially through adjacent working chambers of each pair, intermeshing gear-pistons on said shafts within the respective pairs of working chambers, each piston having a projecting working abutment, and a recess to permit the opposed abutment to pass the meshing-points of the pistons, the pairs of pistons being set so as to come into effective operation alternately; with a continuously-open outlet from each working chamber, an inlet-port to each pair of working chambers adjacent to the meeting-points of the gear-pistons, a rotary tubular valve controlling both said inlet-ports so as to admit steam alternately therethrough, and pinions on the end of said valve and an adjacent shaft for continuously rotating the valve once for each rotation of the pistons, substantially as described.

3. The herein-described engine, comprising the casing composed of a central casting divided longitudinally by a transverse partition into four working chambers, and two end castings, intermeshing gear-pistons within the chambers of the casing at opposite sides of the partition, said pistons having projecting teeth forming working abutments, and recesses to permit passage of an opposed abutment, a cylindrical valve-chamber in the central casting at one side of the working chambers and adjacent to the intermeshing points of the gear-pistons, a continuously-open outlet in said central casting opposite the inlet-ports, a rotary valve on the valve-chamber having diametrically opposite ports adapted to register alternately with the inlet-ports, and a steam-supply pipe connecting with one end of the valve-chamber, and gearing for rotating the valve continuously from one of the piston-shafts, substantially as described.

4. In a rotary engine, the combination of adjacent pairs of working chambers, gear-pistons in said working chambers, opposed pistons intermeshing, and each piston having an elongated tooth forming a working abutment, and a recess to accommodate the abutment of the opposed piston when the abutments are passing the meeting or meshing points of the gear-pistons; with an inlet-port to each pair of working chambers at one side of the pistons, an outlet-port at the opposite side of each pair of pistons, and a valve controlling said inlet-ports, a housing inclosing the engine-casing, and communicating with the engine-exhaust, a waste-steam outlet from the housing, and a steam-inlet pipe leading through the housing to the valve, substantially as described.

5. In a rotary engine, the combination of adjacent pairs of working chambers, gear-pistons in said working chambers, opposed pis-

tons intermeshing, and each piston having an elongated tooth forming a working abutment, and a recess to accommodate the abutment of the opposed piston when the abutments are passing the meeting or meshing points of the gear-pistons; with an inlet-port to each pair of working chambers at one side of the pistons, an outlet-port at the opposite side of each pair of pistons, and a valve controlling said inlet-ports, a housing inclosing the engine-casing, communicating with the engine-exhaust, a waste-steam outlet from the housing, and a steam-inlet pipe leading through the housing to the valve, substantially as described.

6. The herein-described engine, comprising the casting composed of a central casting divided longitudinally by a transverse partition, and two end castings, intermeshing gear-pistons within the chambers of the casing at opposite sides of the partition, said pistons having projecting teeth forming working abutments, and recesses to permit passage of an opposed abutment, a valve-chamber adjacent to the intermeshing points of the gear-pistons, an outlet opposite the inlet-ports, a valve in the valve-chamber having ports adapted to register alternately with the inlet-ports, and a steam-supply pipe connecting with the valve-chamber; with a housing inclosing the casing into which the exhaust-steam is admitted, an outlet from said housing and a steam-supply pipe leading through the housing and connecting with the valve-chamber, substantially as described.

In testimony that we claim the foregoing as our own we affix our signatures in presence of two witnesses.

WILLIAM H. MASTERMAN.
JOSEPH P. MAGNEY.

In presence of—
T. S. UPDYKE,
GEO. W. WISE.