(No Model.)

5 Sheets—Sheet 1.

J. J. UNBEHEND.

ROTARY ENGINE.

No. 606,606. Patented June 28, 1898.

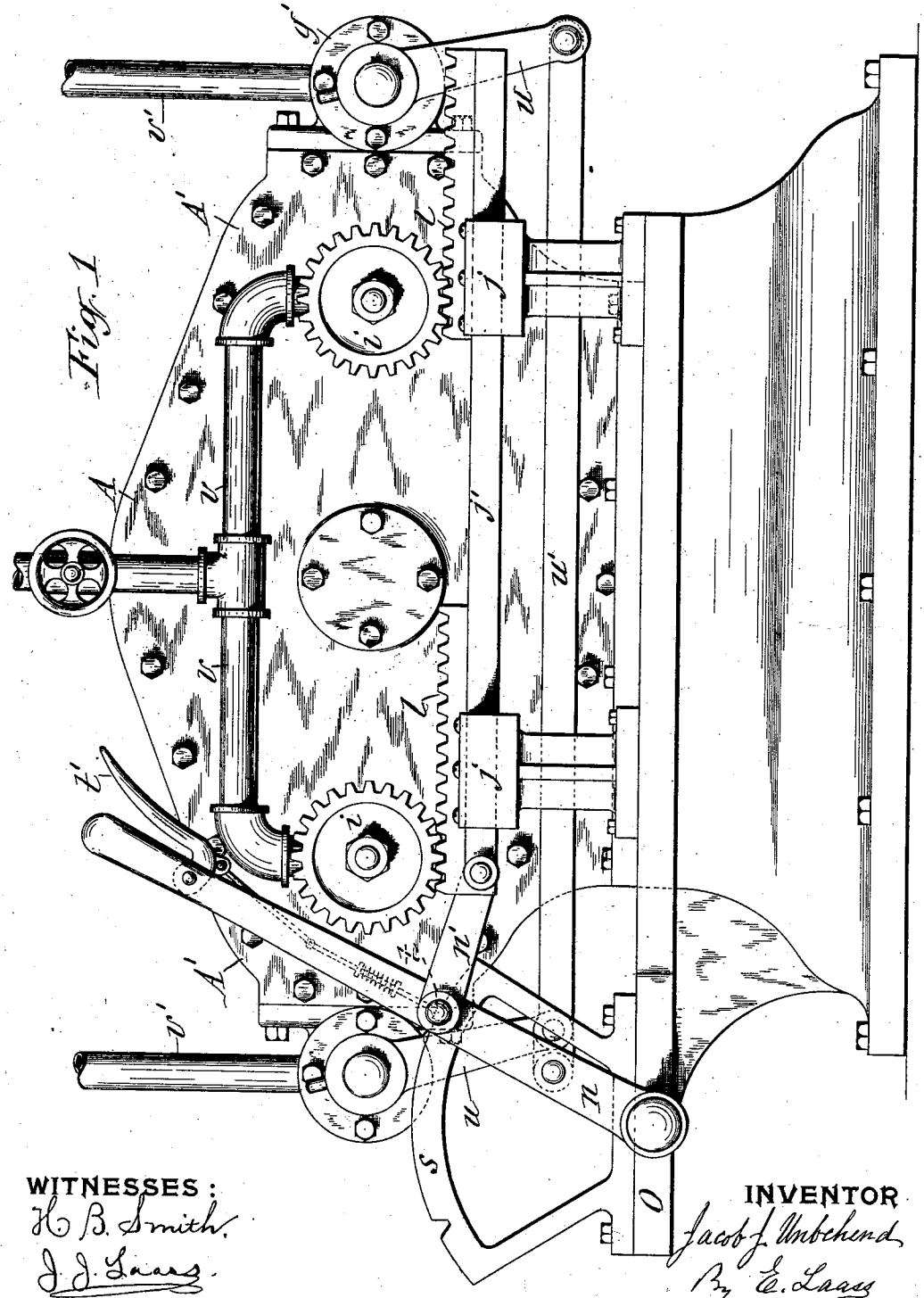

Fig. 1.

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(No Model.) 5 Sheets—Sheet 2.

J. J. UNBEHEND.

ROTARY ENGINE.

No. 606,606. Patented June 28, 1898.

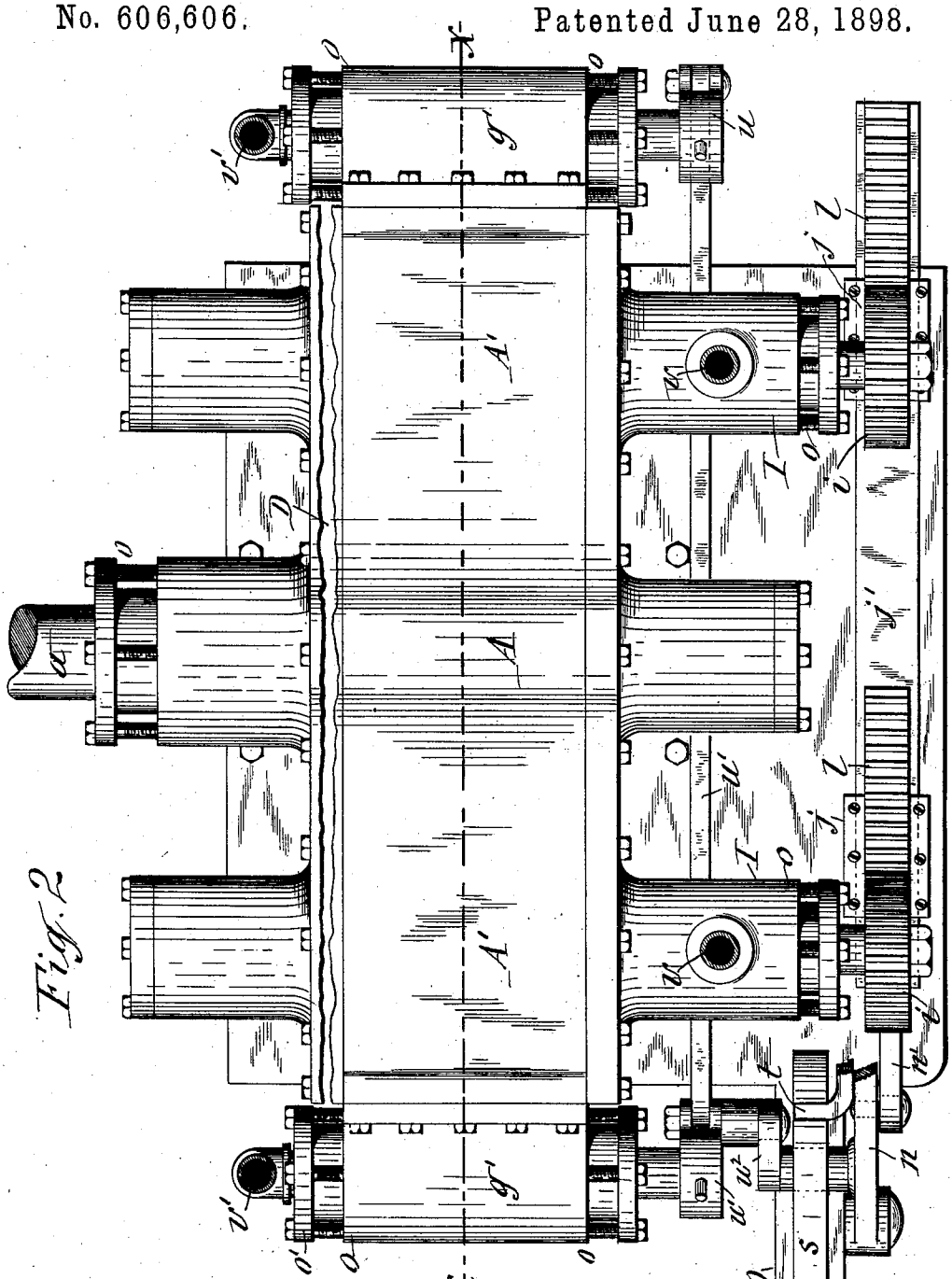

Fig. 2.

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J. J. UNBEHEND.

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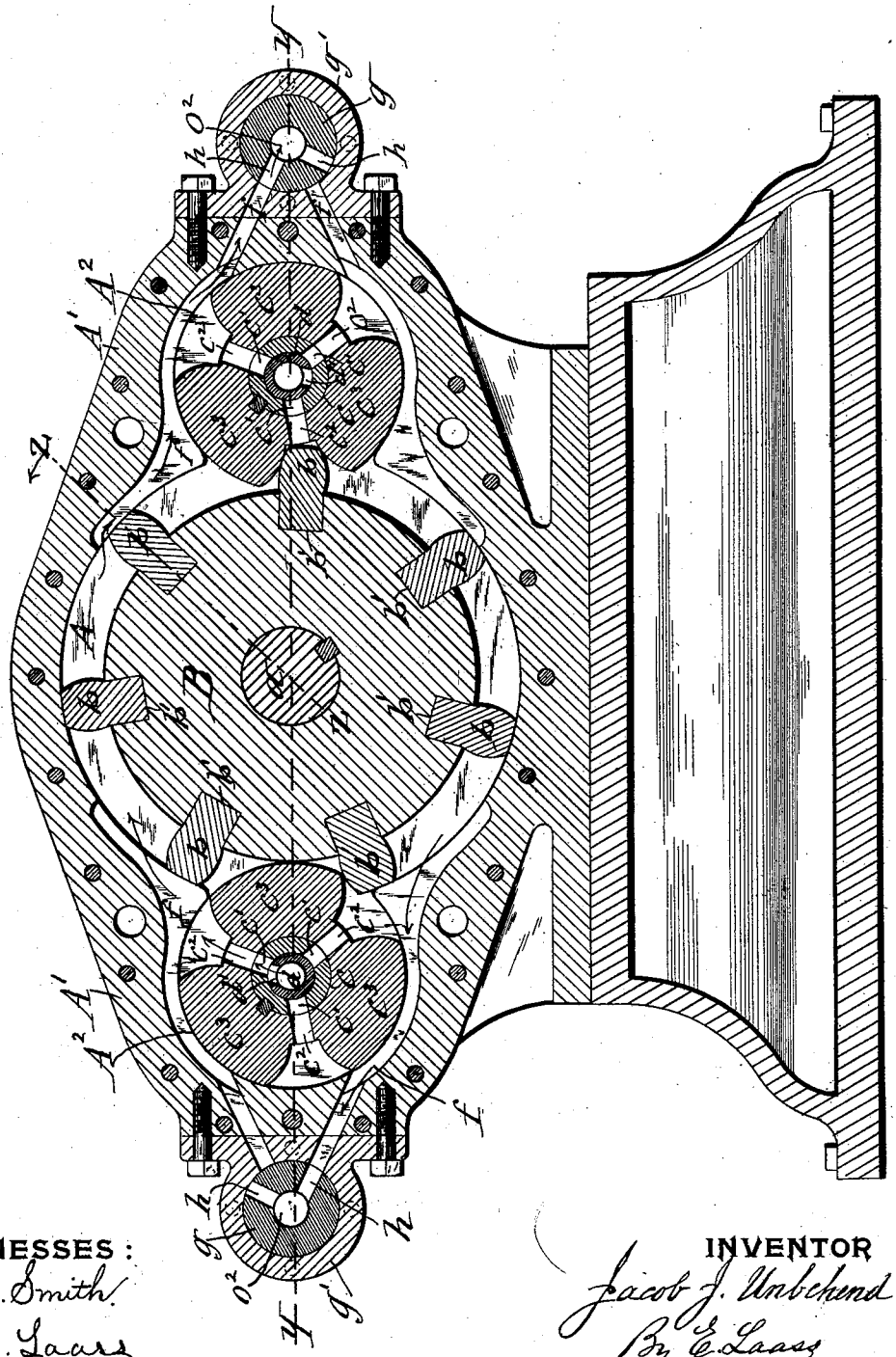

Fig. 3

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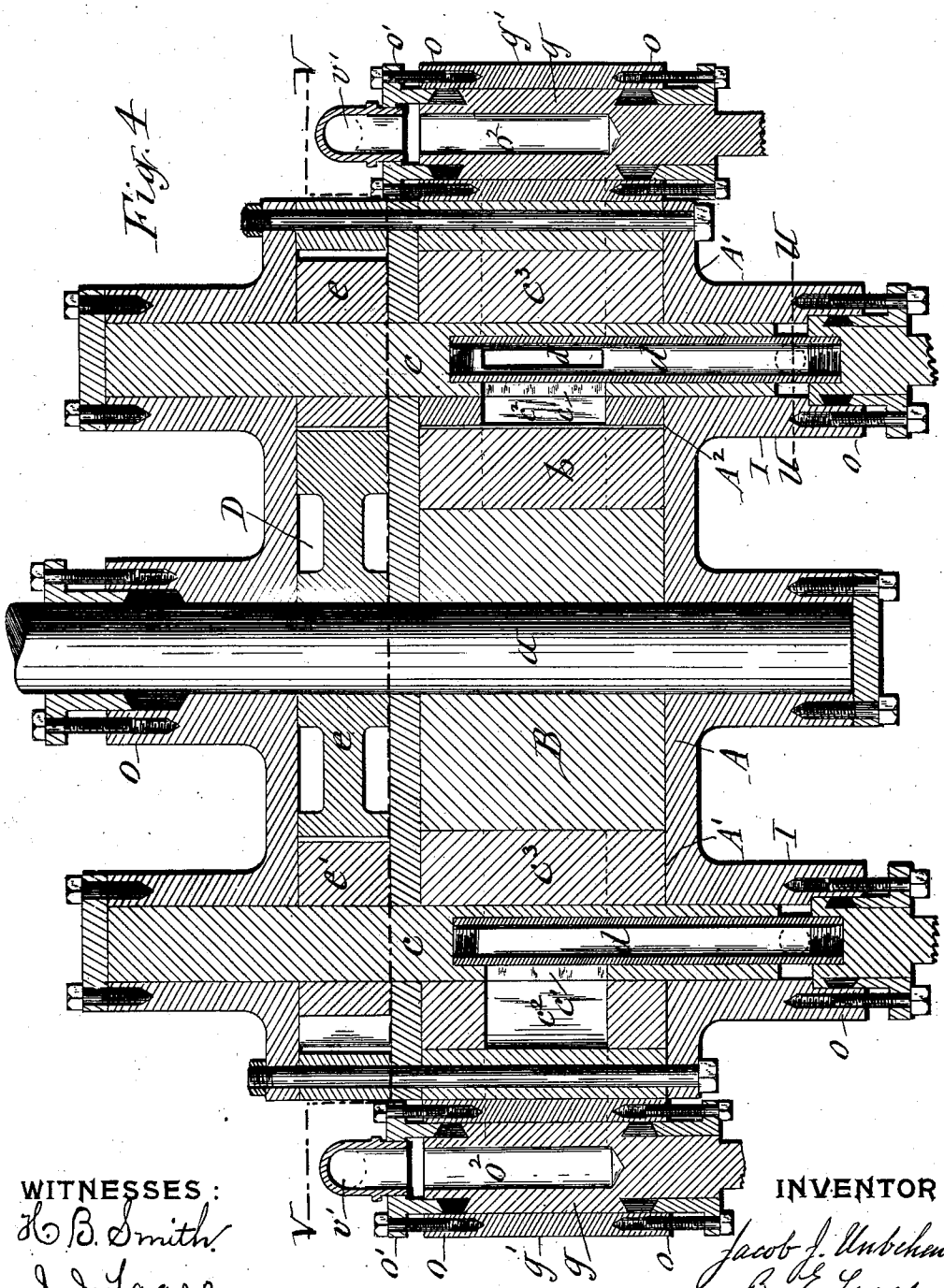
J. J. UNBEHEND.

ROTARY ENGINE.

No. 606,606. Patented June 28, 1898.

Fig. 4.



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(No Model.)

5 Sheets—Sheet 5.

J. J. UNBEHEND.

ROTARY ENGINE.

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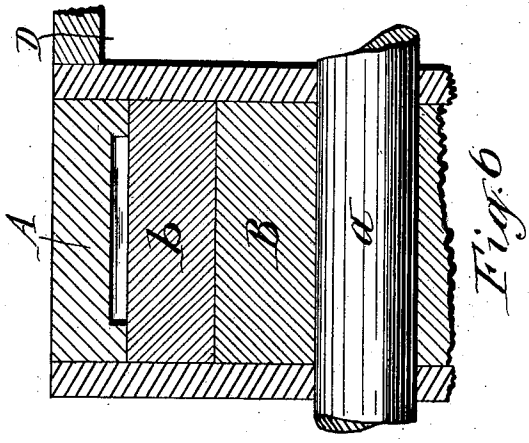

Fig. 6

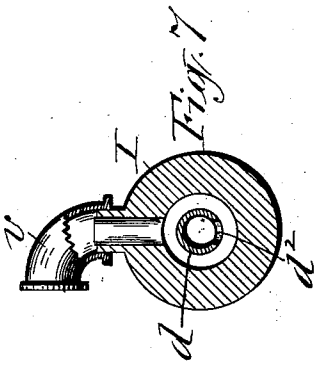

Fig. 7

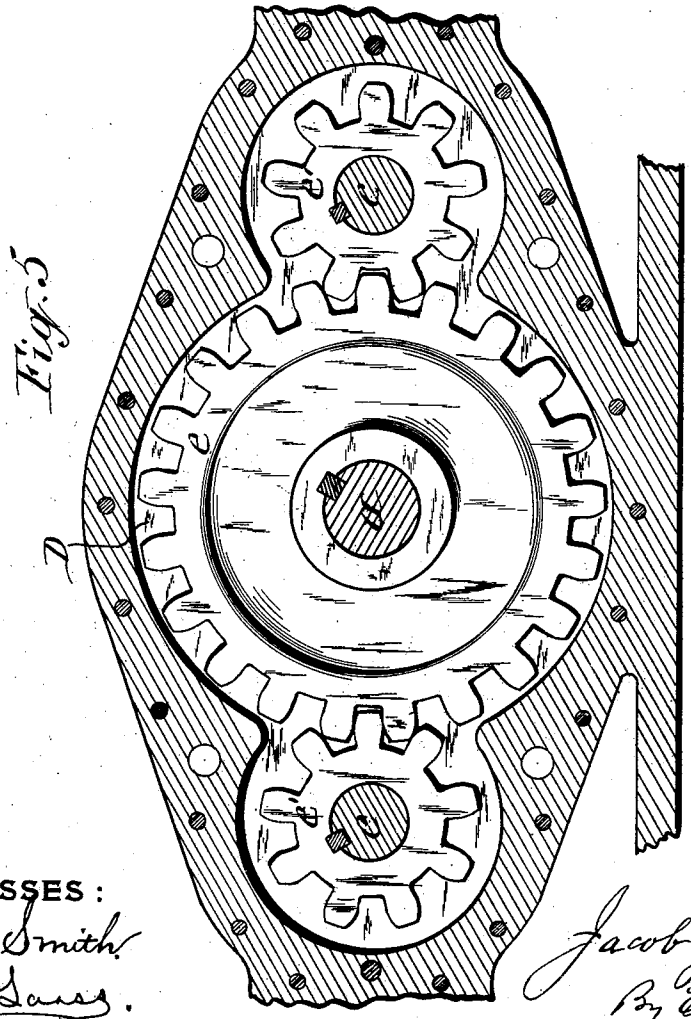

Fig. 5

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UNITED STATES PATENT OFFICE.

JACOB J. UNBEHEND, OF SYRACUSE, NEW YORK.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 606,606, dated June 28, 1898.

Application filed July 26, 1897. Serial No. 645,887. (No model.)

To all whom it may concern:

Be it known that I, JACOB J. UNBEHEND, of Syracuse, in the county of Onondaga, in the State of New York, have invented new and useful Improvements in Rotary Engines, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

This invention consists in a novel construction of a rotary engine which applies the steam to the pistons in the most effective manner to obtain maximum power therefrom and has its component parts constructed and combined so as to effectually balance the engine, and thus obviate vibrations and jars or strains of its supporting frame or bed.

In the accompanying drawings, Figure 1 is a side elevation of a rotary engine embodying my invention. Fig. 2 is a top plan view of the same with the central and main portion of the gear-case broken away. Fig. 3 is a vertical longitudinal section on line X X in Fig. 2. Fig. 4 is a horizontal longitudinal section on line Y Y in Fig. 3. Fig. 5 is a vertical longitudinal section of the gear-case, taken on line V V in Fig. 4. Fig. 6 is a transverse section on line Z Z in Fig. 3, and Fig. 7 is a transverse section on line U U in Fig. 4.

Similar letters of reference indicate corresponding parts.

A represents the steam-cylinder, through the axis of which passes longitudinally the main shaft *a*, designed to furnish power for various purposes. To said shaft is rigidly secured the cylindrical piston-head B, which is thus disposed concentric in the cylinder. Said piston-head has projecting from its periphery the pistons *b b*, which extend to the internal peripheral wall of the cylinder and formed with convex front and rear faces, as shown in Fig. 3 of the drawings. I preferably set the pistons removably in mortises *b' b'* in the piston-head to allow the pistons to be readily removed therefrom when required for repairing or renewing them.

The cylinder-case is formed with extensions A' A' and with annular chambers A^2 A^2 in said extensions. These chambers I preferably locate at opposite sides of the cylinder and with the centers of the chambers in a straight line, passing diametrically through the center of the shaft *a* in order to balance the engine. Through the center of each of said chambers passes a tubular shaft *c*, which is parallel with the main shaft *a* and is provided with lateral steam-induction ports *c' c'* in the chamber A^2. To each of these tubular shafts is firmly attached the steam-inlet or induction valve, which is formed with a plurality of radial steam-channels c^2 and with abutments c^3, projecting from the valve between said channels. Said abutments are formed with convex walls extending divergent from the channels c^2.

Steam is admitted into the tubular shafts *c c* by means of suitable ducts or pipes *d*, which are inserted into said shafts and are provided with lateral ports *d'*, in positions to be traversed by and communicate with the successive ports *c' c'* of the shafts during the rotation of the latter, which motion is imparted to said shafts by pinions *e' e'*, attached thereto and meshing with a gear-wheel *e*, attached to the main shaft *a*. I preferably house said gear and pinions in a case D, attached to the side of the cylinder-case and its extensions, as shown in Fig. 4 of the drawings.

During the rotation of the piston-head B the successive pistons *b b* enter between the abutments, and the engagement of the convex faces of the pistons with the convex walls of the abutments form steam-tight joints thereat which effectually cut off the steam from the rear of the valves, and the succeeding contact of the peripheral portions of the abutment with the periphery of the piston-head maintains the steam so cut off and compels the steam to enter the cylinder in front of the valve, and by pressure on the piston in front of it the piston-head receives rotary motion.

f f represent exhaust-passages which lead directly from the cylinder A at opposite sides of each of the aforesaid valves to exhaust-valves *g g*, which are seated revolubly in cages *g'* and are each provided with two channels *h h*, which by turning said valve are made to communicate with the adjacent exhaust-ports *f f*, one at a time. Said cages and valves are on the farther sides of the chambers A^2, and all are arranged axially at right angles to a straight line passing diametrically through the cylinder A, and thereby preserve the equilibrium of the engine.

The motion of the engine can be reversed by turning the steam ducts or pipes *d d* so as to bring their ports *d'* into different positions in relation to the steam-passages c^3 of the induction-valves and at the same time turning the exhaust-valves *g* to bring their channels into different positions in relation to the exhaust-ports *f f*. For adjusting said valves to their desired position I prefer to attach to the pipes *d d* pinions *i i* and mount on suitable guides *j j* a longitudinally-sliding bar *j'*, to which are attached two racks *l l*, which mesh with the pinions *i i*. For moving the racks I connect the bar *j* by a link *n'* to a hand-lever *n*, which is pivoted at one end to a bracket O on the bed of the engine. A suitably-shaped dog *t*, connected to the lever *n*, engages a notched segment *s*, mounted on the bracket O, and serves to hold the lever *n* in its required position. A small supplemental lever *t'* is pivoted to the lever *n* and connected to the dog *t* for drawing said dog out of engagement in the usual and well-known manner to allow the lever to be swung on its pivot and thereby shift the racks *l l* and cause the steam-pipes *d d* to be turned by the turning of the pinions *i i*.

To turn the exhaust-valves *g g* simultaneously with the aforesaid adjustment of the steam-valves, I attach to said exhaust-valves cranks *u u*, which are connected by a rod *u'* and link u^2 to the lever *n*, as shown more clearly in Fig. 1 of the drawings.

o o denote stuffing-boxes employed to prevent leakage of steam from the engine.

v v represent steam-supply pipes, and *v' v'* are exhaust-pipes.

To allow the ducts *d* to receive steam during the different positions to which said ducts are adjusted, I provide the extensions A' of the cylinder-case with tubular hubs I I, into which the shafts *c c* extend part way, and at the inclosed ends of said shafts I attach the steam-pipes *v v* to said hubs and provide the ducts or pipes *d* with ports d^2, as more clearly shown in Fig. 7 of the drawings.

The exhaust-valves are provided with separate exhaust-pipes *v' v'*, which are attached to the glands *o'* of the stuffing-boxes and communicate directly with the channels o^2 of the exhaust-valves, as shown in Fig. 4 of the drawings.

What I claim as my invention is—

1. The combination of the steam-cylinder, the annular steam-chambers on opposite sides of said cylinder and cylindrical valve-cages beyond said chambers all arranged axially at right angles to a straight line passing diametrically through the cylinder, the rotary piston-head having a plurality of pistons projecting from its periphery, rotary steam-induction valves in the aforesaid chambers, and each provided with an axial steam-passage, a plurality of radial steam-channels and abutments projecting from the valve between said channels, exhaust-valves in the aforesaid cages and provided with axial exhaust-channels and separate exhaust-pipes communicating directly with said axial channels, as set forth and shown.

2. The combination of the steam-cylinder, two annular steam-chambers respectively on opposite sides of said cylinder and cylindrical valve-cages beyond the said chambers all arranged axially at right angles to a straight line passing diametrically through the steam-cylinder and formed with steam-passages from the said valve-cages around opposite sides of each of the aforesaid steam-chambers and directly to the inner wall of the steam-cylinder, the rotary piston-head provided with a plurality of radially-projecting pistons, rotary steam-induction valves in the aforesaid chambers and provided with axial induction-passages and radial channels leading from said passages, abutments projecting from said valves between the radial channels and formed with convex divergent walls forming steam-tight joints with the traversing pistons, cylindrical exhaust-valves in the cages provided with axial steam-passages and radial channels extending from the axial passages to communicate with the steam-passages in the valve-chambers as set forth.

3. The combination with the engine-bed, of the steam-cylinder, two annular steam-chambers respectively on opposite sides of said cylinder and cylindrical valve-cages beyond said chambers all arranged axially at right angles to a straight line passing diametrically through the cylinder, the rotary piston-head provided with radially-projecting pistons, rotary steam-induction valves in the aforesaid chambers, steam-induction pipes journaled in the axis of said valves, and cylindrical exhaust-valves in the aforesaid cages, of pinions attached to the aforesaid induction-pipes, cranks attached to the exhaust-valves, racks engaging said pinions, a rod connecting the two cranks and a hand-lever pivoted to the engine-bed and connected to the said racks and connecting-rod substantially as set forth and shown.

In testimony whereof I have hereunto signed my name this 21st day of July, 1897.

JACOB J. UNBEHEND. [L. S.]

Witnesses:

JOHN J. LAASS,

H. B. SMITH.