(No Model.) 3 Sheets—Sheet 1.

G. E. BOOM.

ROTARY ENGINE.

No. 557,476. Patented Mar. 31, 1896.

Fig. 1,

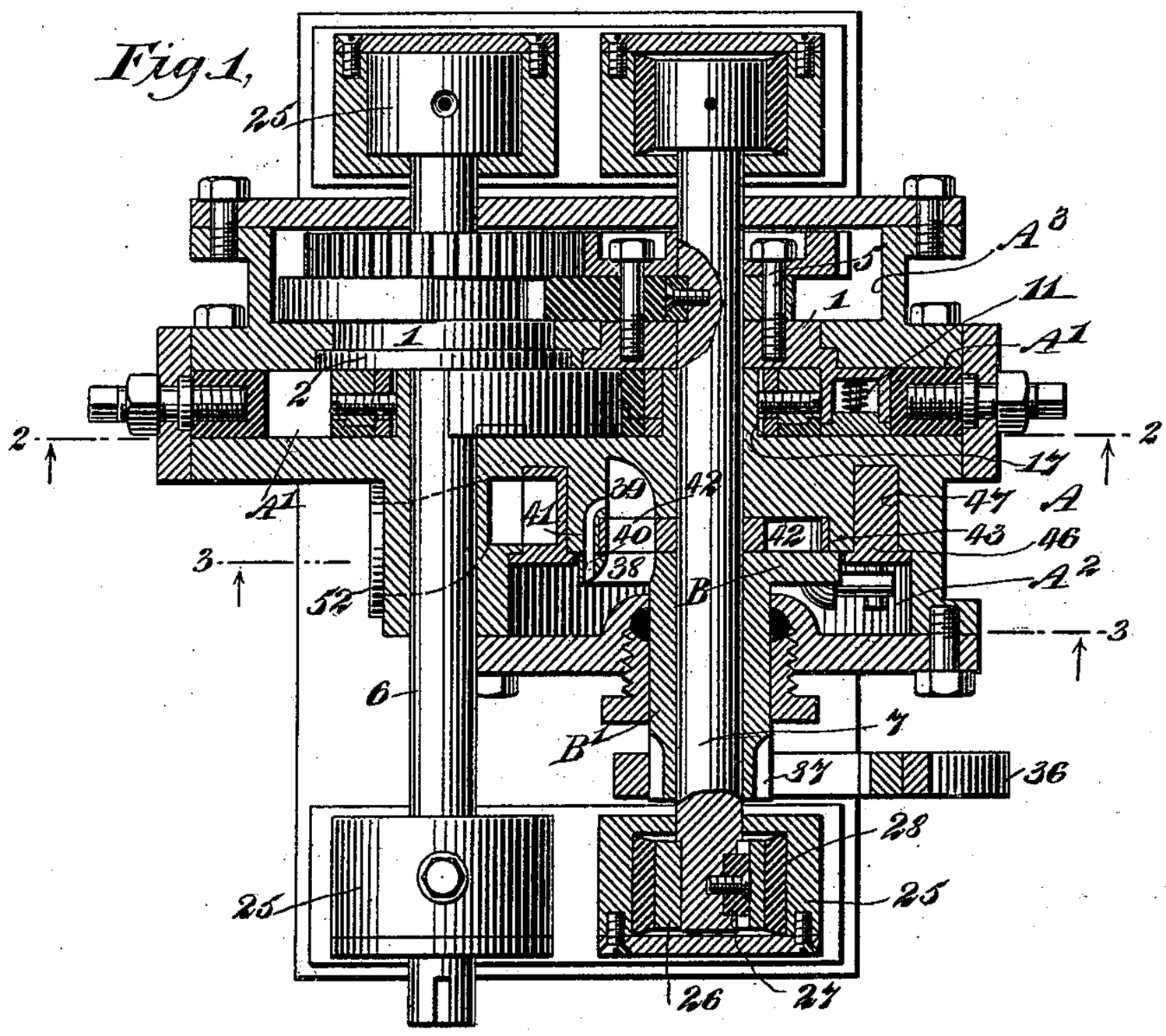

Fig. 2,

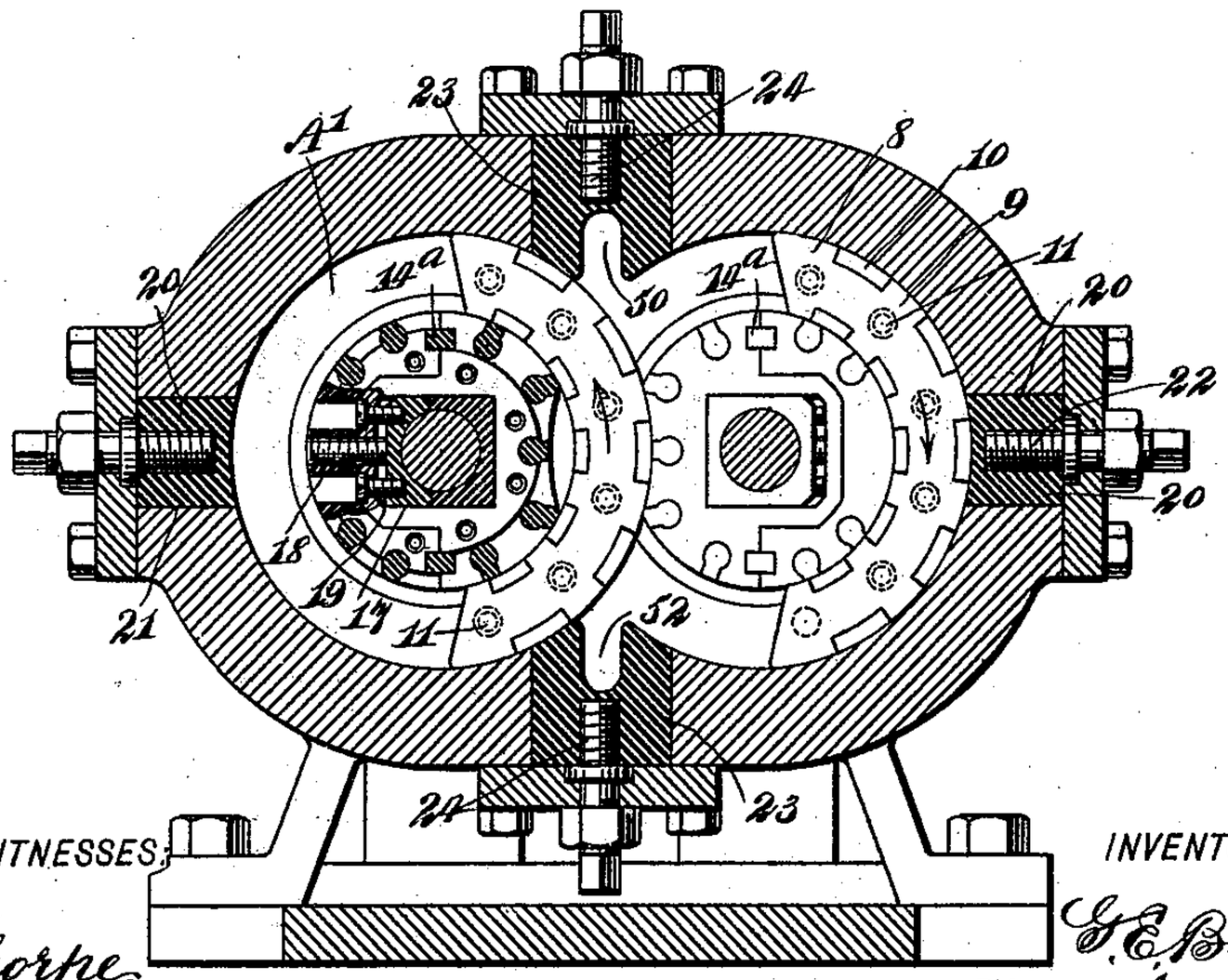

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Fig. 3,

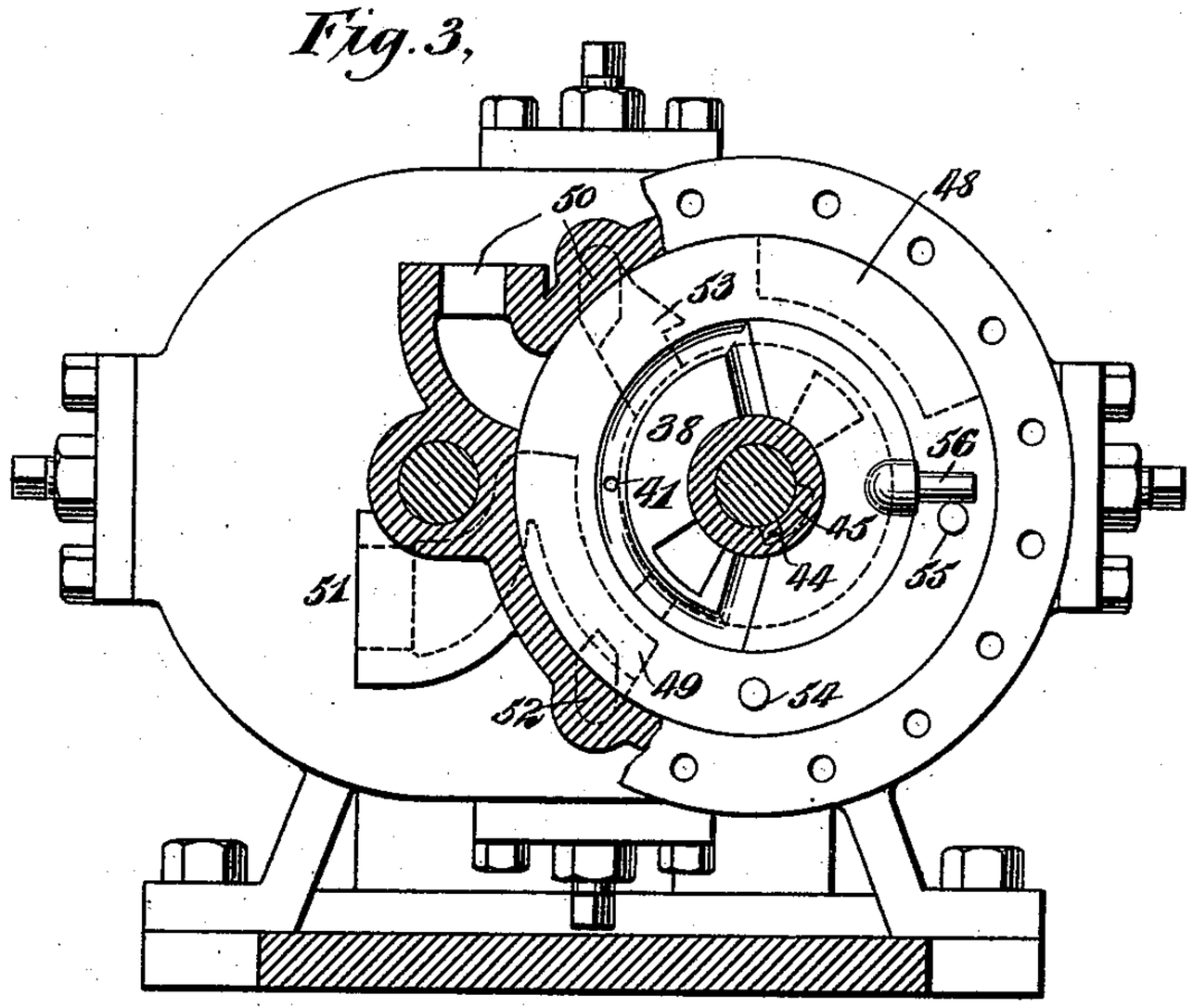

Fig. 4,

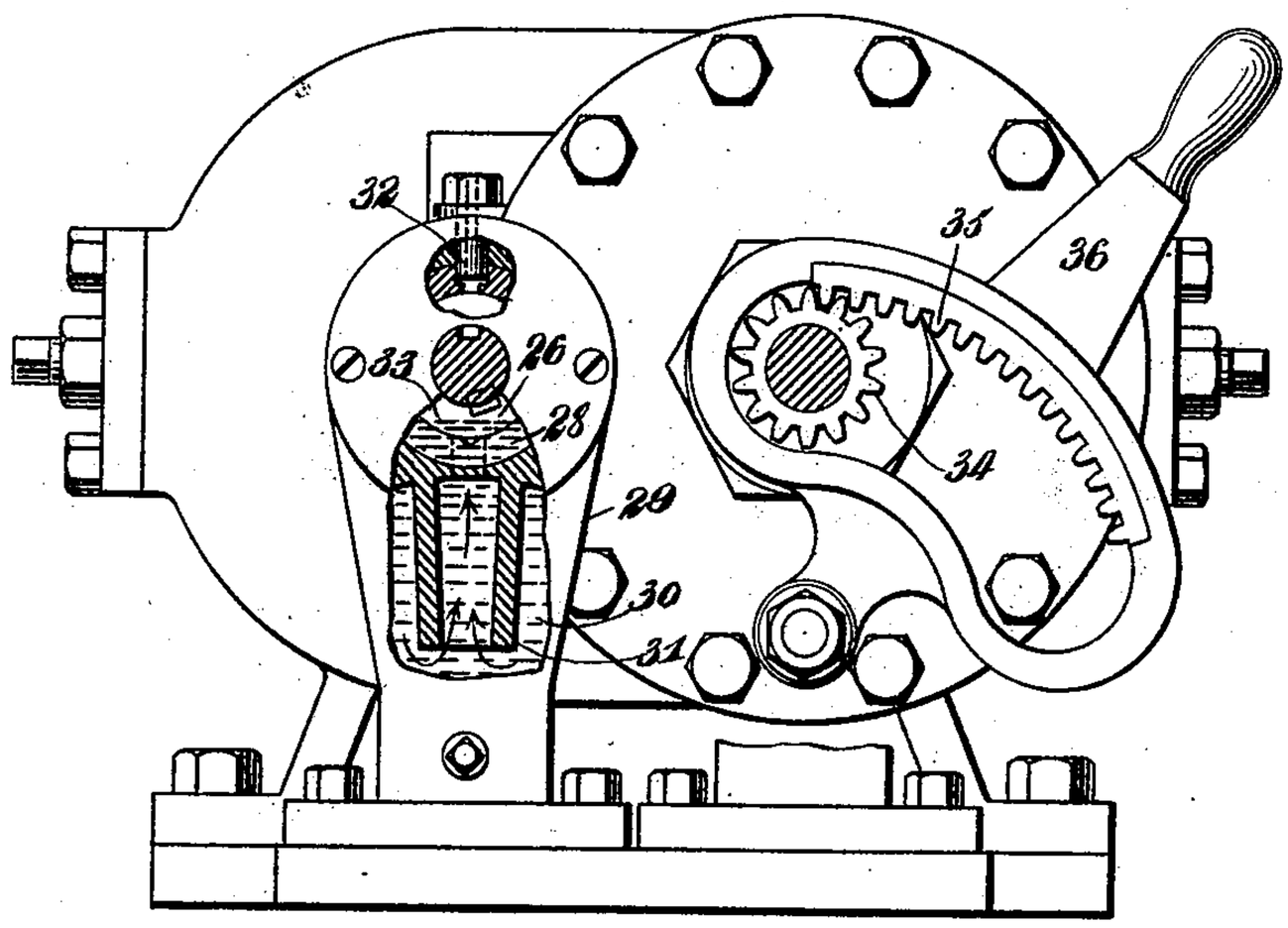

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Fig. 5.

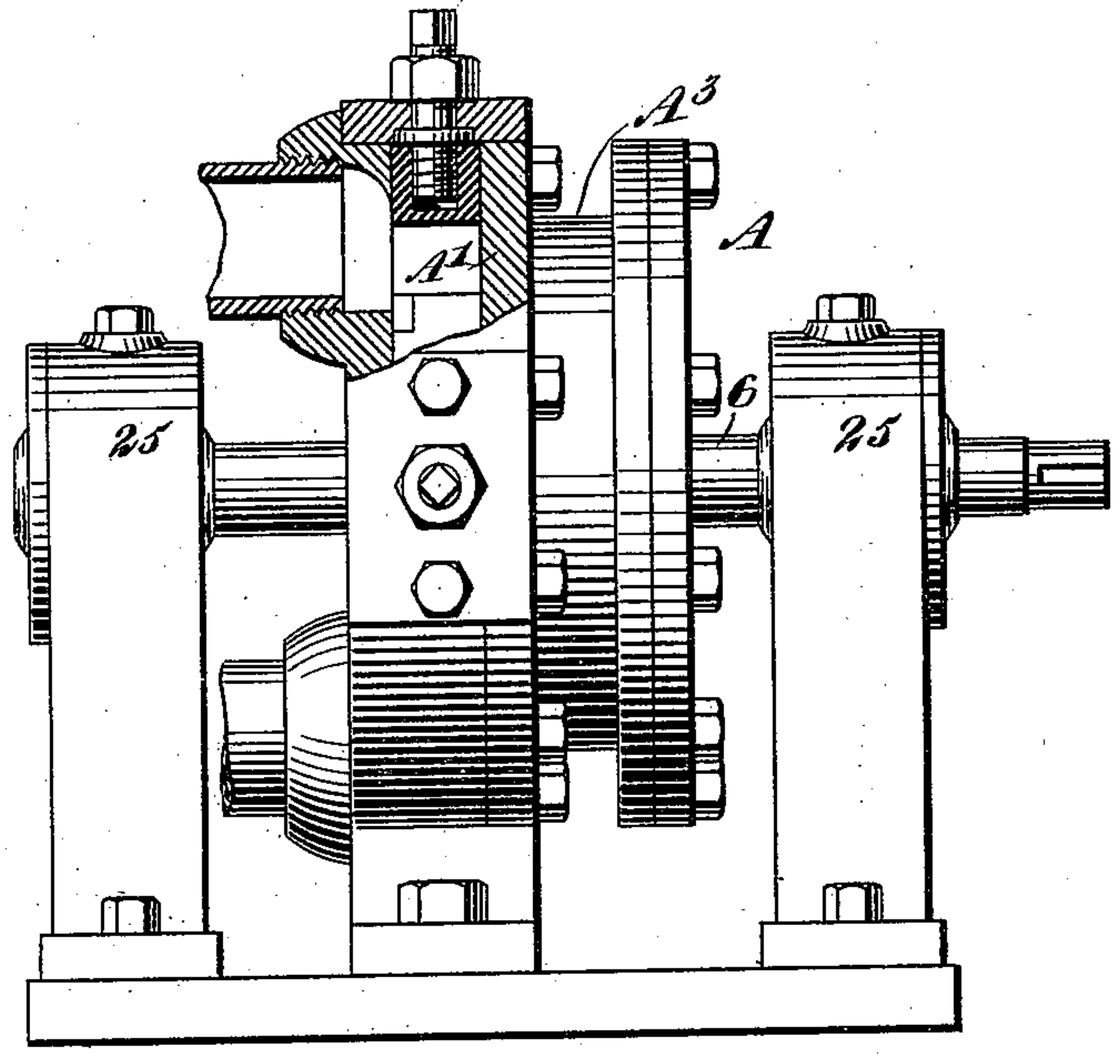
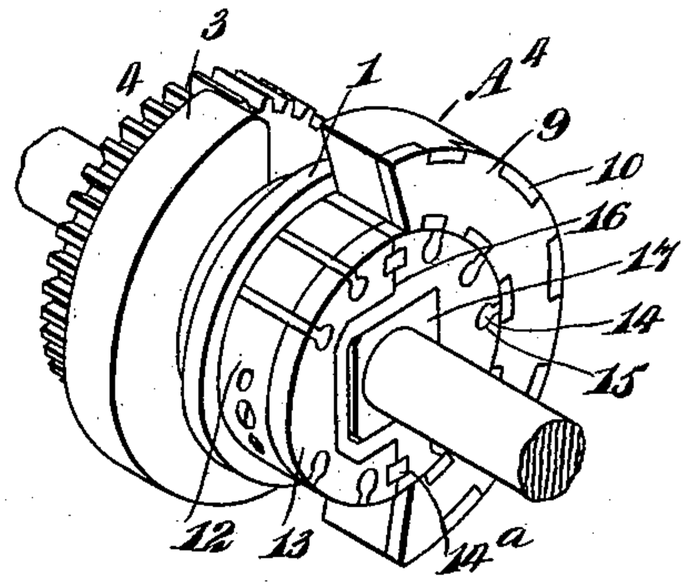


Fig. 6.



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UNITED STATES PATENT OFFICE.

GEORGE E. BOOM, OF NEW YORK, N. Y.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 557,476, dated March 31, 1896.

Application filed August 7, 1895. Serial No. 558,536. (No model.)

To all whom it may concern:

Be it known that I, GEORGE E. BOOM, of New York city, in the county and State of New York, have invented new and useful Improvements in Rotary Engines, of which the following is a full, clear, and exact description.

This invention relates to that class of engines having rotary pistons operating in piston-cylinders; and the object of the invention is to provide such an engine with a construction requiring a comparatively small floor-space, and in which the rotary pistons and, in fact, all rotary parts are evenly balanced, so that vibratory motion is reduced to a minimum, thereby making it possible to employ a light base and framework and, further, to secure a very high rate of rotary speed.

I will describe a rotary engine embodying my improvements, and then point out the novel features 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 a horizontal section of a rotary engine embodying my improvement. Fig. 2 is a vertical section on the line 2 2 of Fig. 1. Fig. 3 is a partial elevation and a section on the line 3 3 of Fig. 1. Fig. 4 is a side elevation with certain parts broken away and certain parts in section to show self-oiling mechanism for the bearings. Fig. 5 is an end elevation and partial section showing certain parts of the engine omitted to convert the same into a water pump or meter, and Fig. 6 is a perspective view of a piston and its appurtenances employed.

Referring to the drawings, A designates a casing, within which are arranged the communicating piston-cylinders A′, the steam-chamber A^2, and a housing A^3.

A^4 indicates the pistons, adapted to rotate in the cylinders A′. Each piston A^4 is made in a segmental form of about one-half the circumference of the cylinder within which it works.

The pistons A^4 are mounted on disks 1, which have bearings in the wall 2 of the cylinders A′, and to the opposite sides of these disks are attached segmental counterbalance-weights 3, and to the outer sides of these counterbalance-weights 3 are attached gear-wheels 4. The gear-wheels and the counterbalance-weights are attached to the disks 1, as here shown, by means of screws 5, and the disks and pistons and the parts connected therewith are respectively mounted on shafts 6 and 7, which extend parallel with each other and have bearings in the casing, as will be hereinafter described.

It will be seen by reference to Fig. 1 that the parts 3 and 4 are incased within the housing A^3 and that the gear-wheel 4 on one shaft meshes with the gear-wheel 4 on the other shaft. It will also be seen that the counterbalance-weights are located on the opposite side of the shaft to that of the pistons.

Each piston A^4 is of a greater outer diameter than the disk to which it is attached and is made hollow or box-like and substantially rectangular in cross-section. Each piston is closed at one side by a packing-segment 8. At the edges the packings 8 have lateral projections 9, engaging between lateral projections 10 extended from the rear of the piston, and springs 11 bearing at one end against the inner wall of the piston and at the other end against the inner wall of the packing segmental surface, forcing the packing-segments against one wall of the piston-cylinder and the outer side of the piston against the opposite wall of the cylinder, thereby forming a steam-tight joint.

I provide an interior packing for each piston. This packing consists of a shell-like portion 12 and a covering or disk-like portion 13, secured together by keys or packing-strips 14 inserted in kerfs 15 formed in the edges of these parts. The portions 12 13 are each made in two separable sections adapted to slide one upon the other, as indicated at 16 in the drawings, and made steam tight at the connecting parts by packing-blocks 14^a. The parts 12 13 each have an angular opening through them, through which passes an angular hub 17 extended rigidly from one wall of the piston-cylinder. Therefore it will be seen that there is no rotary motion for the interior packings; but they are transversely adjustable, and as a means therefor I employ a right and left hand threaded screw 18, having engagement with the respective sections of the portion 12 of the packing, as plainly indicated

in the left-hand cylinder shown in Fig. 2, and screws 19 are employed to fasten one section of the interior packing to the angular hub 17, as also shown in Fig. 2. These screws may be manipulated by inserting a screw-driver through an opening 20 formed in the outer side of the cylinder, which is normally closed by a packing-block 21, adapted to bear upon the outer side of the piston and mounted on an adjusting-screw 22. At the top and bottom, at the meeting-points of the two cylinders, are packing-blocks 23, adapted to bear upon the pistons and having adjusting and holding screws 24.

One of the shafts (here shown as the shaft 6) has its end extended to receive a power-transmitting wheel, and each of these shafts is mounted in housings 25. Within the housing each shaft has a hard-metal, preferably steel, collar 26, rigidly affixed to it by means of a key or otherwise, as indicated at 27, and these collars 26 rotate in soft-metal sleeves 28 secured within the housing 25. Below the sleeve 28 in a standard 29 is an oil-chamber 30, and from the lower portion of this oil-chamber 30 a tube 31 extends upward and communicates with an opening through said sleeve 28, and over which the part 26 rotates. The sleeve 28 is held in place by a hollow set-screw 32, extended through the upper wall of the housing 25. This hollow set-screw 32 serves as a port through which oil may be poured upon the journal.

I will now describe the steam-ports and the valve-controlling mechanism. B is a cut-off valve rotating in the steam-chamber A^2 and having a hollow stem B′ surrounding the shaft 7, and the outer end of this stem B′ is provided with a gear-tooth 37 adapted to be engaged by a curved rack 35 carried by a fulcrumed lever 36. The valve B is provided with a port 38 in one side equal in area to the main port 39, with which the port 53 is adapted to register. A by-port 40 extends through the valve B at the outer side of the port 38, and is adapted to register with a by-port 41 in the casing and leading to the main port 39. These by-ports will be in communication when the ports 38 39 are in full communication, and they are designed to admit enough steam to the piston-cylinders to move the pistons about one-half of one degree in case the engine is stopped when a port 42 in the main valve 43 is just line and line with the end of the main port 39. This main valve 43 is made in the form of a disk and is secured to the shaft 7, so as to rotate therewith, by means of a screw 44 extended from said shaft into an arc slot 45 within said main valve. This connection is made in order that the said valve may have a slight lost motion when the engine is reversed, in order that it may take its proper relative position with the pistons. The valve 43 is provided with two ports 42, one admitting steam to the right-hand cylinder and the other to the left-hand cylinder.

46 is a reversing-valve made substantially in ring form and adapted to rotate in a recess 47 formed in the inner wall of the steam-casing A^2. This reversing-valve is provided in one of its faces and at opposite sides of its axis with elongated exhaust recesses or chambers 48 49, the chamber 48 being adapted to provide communication between the steam-port 50 and the exhaust-port 51, and the chamber 49 being adapted to provide communication between said exhaust-port 51 and a steam-port 52 in the casing and extended within the cylinders. This reversing-valve is also provided with a live-steam passage 53 adapted to connect either one of the cylinder-ports 50 52 with the main port 39, the connection depending upon the direction in which the engine is required to run. Extended from one side of this reversing-valve and arranged between the end of the exhaust-chambers 48 49, as plainly indicated in Fig. 3, are pins 54 55, adapted to be engaged by a pin 56 extended laterally from the cut-off valve B. By this construction it will be seen that when the cut-off valve is revolved on its seat by means of the reversing-lever 36 live steam can be directed to either the port 50 or 52 to cause the pistons to rotate in the desired direction. For instance, by referring to Fig. 4, it will be seen that the lever is inclined to the right as far as it can be moved, thus indicating that the engine is running in the direction that the lever points to, and that the rotation of the pistons is in the direction of the arrows shown in Fig. 2. When the lever is in a vertical position, the blank side of the cut-off valve B entirely covers the space above the main port 39. Consequently no steam can enter the cylinder and the reversing-gear is in the position termed "out" motion. Thus the engine cannot run in either direction; but by throwing the lever to the left as far as it can go the engine will be reversed in its rotary motion, as the steam will then be admitted through ports 53 52.

As before stated, the main valve 43 has two ports 42, one port admitting steam to the right-hand cylinder, and the other to the left-hand cylinder. Now if we revolve the cut-off valve to the left, so as to leave only part of the main port 39 exposed to the direct action of the steam as the ports in the main valve pass over the port 39, it will be seen that the steam can only follow each piston for one-half of each period or half-stroke, when it will be cut off and allowed to expand to the end of the period or stroke.

By referring to Fig. 1 it can be seen how the steam passes through the cut-off valve B and main valve 43 into the main port 39, from thence, as shown by dotted lines in Fig. 3, through the portway 53 in the reversing-valve 47 to the open cylinder-port 50, and is exhausted when its work is done through the lower cylinder-port 52 into the exhaust-cavity 49 of the reversing-valve, and from thence to the exhaust-port 51.

In Fig. 5 I have shown the device organ-

ized for a water motor or meter, and the inlet and exhaust may be directly to the pistons, thus omitting the valve mechanism, as heretofore described in connection with the engine.

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

1. A piston for a rotary engine, comprising a disk, a segmental piston mounted thereon, substantially rectangular in cross-section, a packing-plate of segmental form connected with one side thereof and having lateral projections engaging between projections on the piston, and springs between said packing-plate and the inner wall of the piston, substantially as specified.

2. A piston for a rotary engine, comprising a disk, a segmental piston thereon and extended laterally therefrom, a packing-plate for the side of said piston, and an interior adjustable packing around which said piston revolves, substantially as specified.

3. A piston for a rotary engine, comprising a disk, a segmental piston extended laterally from said disk and having a larger exterior diameter than the diameter of said disk, a packing-plate on one side of said piston having lateral projections engaging between projections on the piston, and springs for forcing said plate outward, substantially as specified.

4. In a rotary engine, a piston comprising a disk, a segmental piston mounted on and extended laterally from said disk, and an interior packing around which said piston rotates and comprising overlapping portions adapted to be expanded or contracted, substantially as specified.

5. In a rotary engine, a piston therefor comprising a disk, a laterally-extended segmental piston on said disk, an interior packing for said piston comprising sections movable one relatively to the other, packing-strips extended transversely of said sections, and means for causing the adjustment of said interior packing, substantially as specified.

6. In a rotary engine, the combination with a shaft, of an expansible packing rigidly mounted with relation to said shaft, a piston of segmental form adapted to rotate around said packing, a disk attached to said piston and to said shaft, and a gear-wheel attached to said disk, substantially as specified.

7. In a rotary engine, the combination with a shaft, of a fixed packing surrounding said shaft, a segmental piston adapted to revolve around said packing and bear with its inner circumference thereon, a disk on which said piston is mounted, a counterbalance mounted on the disk at the side of the shaft opposite that of the piston, and a gear-wheel attached to the counterbalance, all of said rotating parts being attached to the shaft, substantially as specified.

8. In a rotary engine, a casing having two communicating piston-cylinders therein, pistons operating in said cylinders, rotary shafts to which said pistons are connected, gear connections between said shafts, and interior adjustable packings for the pistons rigidly affixed around the shafts, substantially as specified.

9. In a rotary engine, a casing having piston-cylinders therein, communicating one with the other, adjustable packing-blocks extended through the upper and lower part of the casing into the said cylinders and containing steam ports or ways, and adjustable packing-blocks at the end of said casing projecting into the piston-cylinders, substantially as specified.

10. In a rotary engine, the combination, with a casing having piston-cylinders therein, pistons operating in said cylinders, a steam-chamber having communication with said cylinders, a cut-off valve for governing the admission of steam from the steam-chamber to the piston-cylinders, a main valve, and a reversing-valve, substantially as specified.

11. In a rotary engine, a casing having piston-cylinders therein, a steam-chamber in said casing, a main port adapted to provide communication between the steam-chamber and the piston-cylinders, a valve for controlling said port, and a by-port leading from said steam-chamber to the main port, substantially as specified.

12. In a rotary engine, the combination, with a segmental piston and a shaft on which the same is mounted, of a cut-off valve for governing the admission of steam to operate on said piston, the said valve having a hollow stem surrounding the shaft, a gear on the outer end of said shaft, and a curved rack engaging therewith, substantially as specified.

13. In a rotary engine, the combination, with a piston and a shaft rotated thereby, of a cut-off valve for governing the admission of steam from a steam chest or chamber to said piston, a reversing-valve operated by the movements of said cut-off valve, and a main valve rigidly mounted on a shaft, the said valve having ports adapted to register one with the other, substantially as specified.

14. In a rotary engine, a ring-shaped reversing-valve adapted to rotate in an annular recess formed in the engine-casing and having oppositely-arranged segmental exhaust ports or recesses, and a cut-off valve having a projection to engage a projection on the reversing-valve for turning the same substantially as specified.

15. In a rotary engine, the combination, with a piston and a shaft rotated thereby, of a cut-off valve adapted to rotate on said shaft, a reversing-valve surrounding said shaft, and a main valve arranged within the reversing-valve and having a lost-motion connection with the shaft, substantially as specified.

GEORGE E. BOOM.

Witnesses:
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