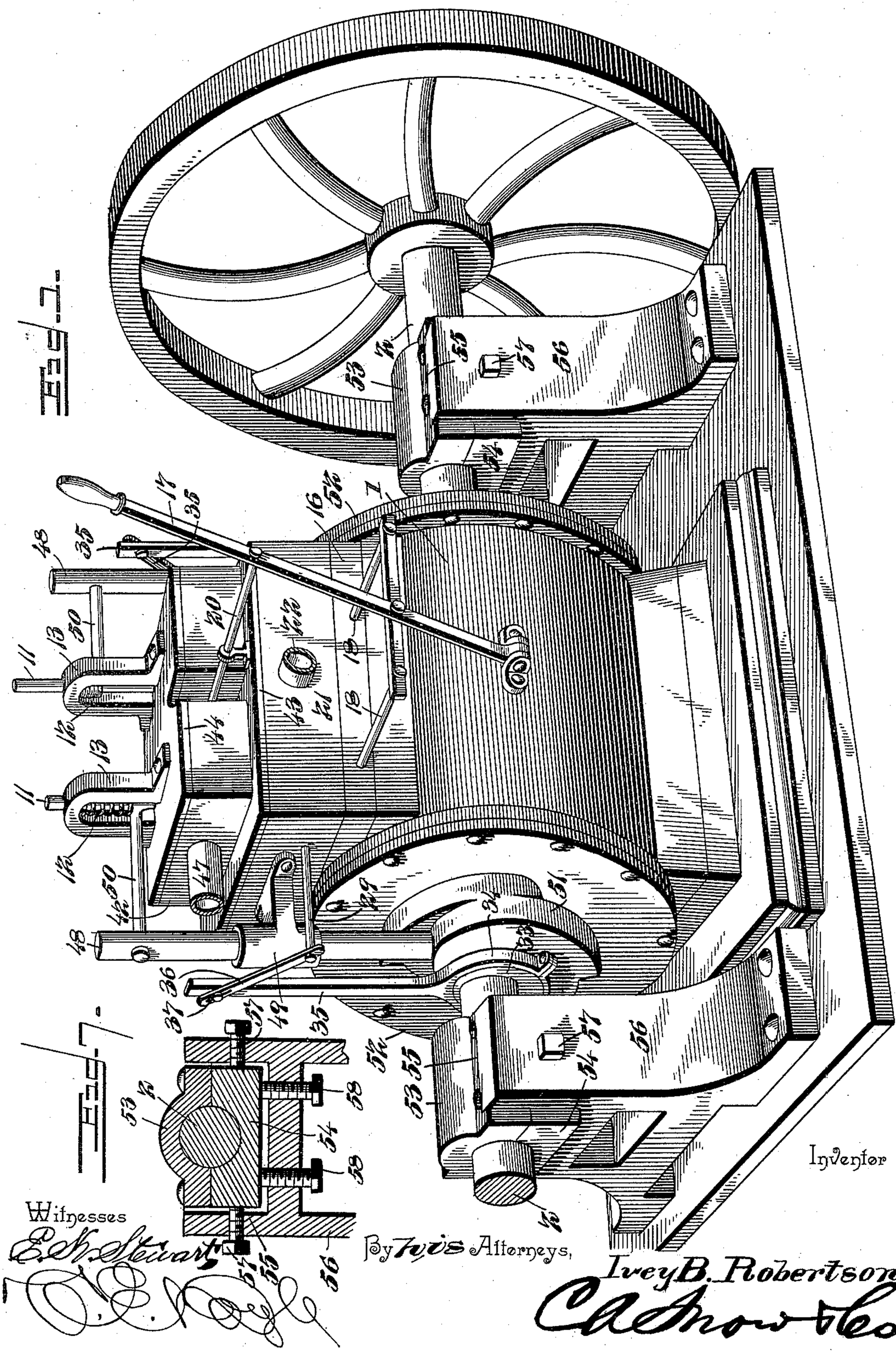
(No Model.)

3 Sheets—Sheet 1.

I. B. ROBERTSON.

ROTARY STEAM ENGINE.

No. 584,560. Patented June 15, 1897.



Witnesses
E. K. Stewart
C. E. Hoge

Inventor
Ivey B. Robertson
By his Attorneys,
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(No Model.)

3 Sheets—Sheet 2.

I. B. ROBERTSON.

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No. 584,560. Patented June 15, 1897.

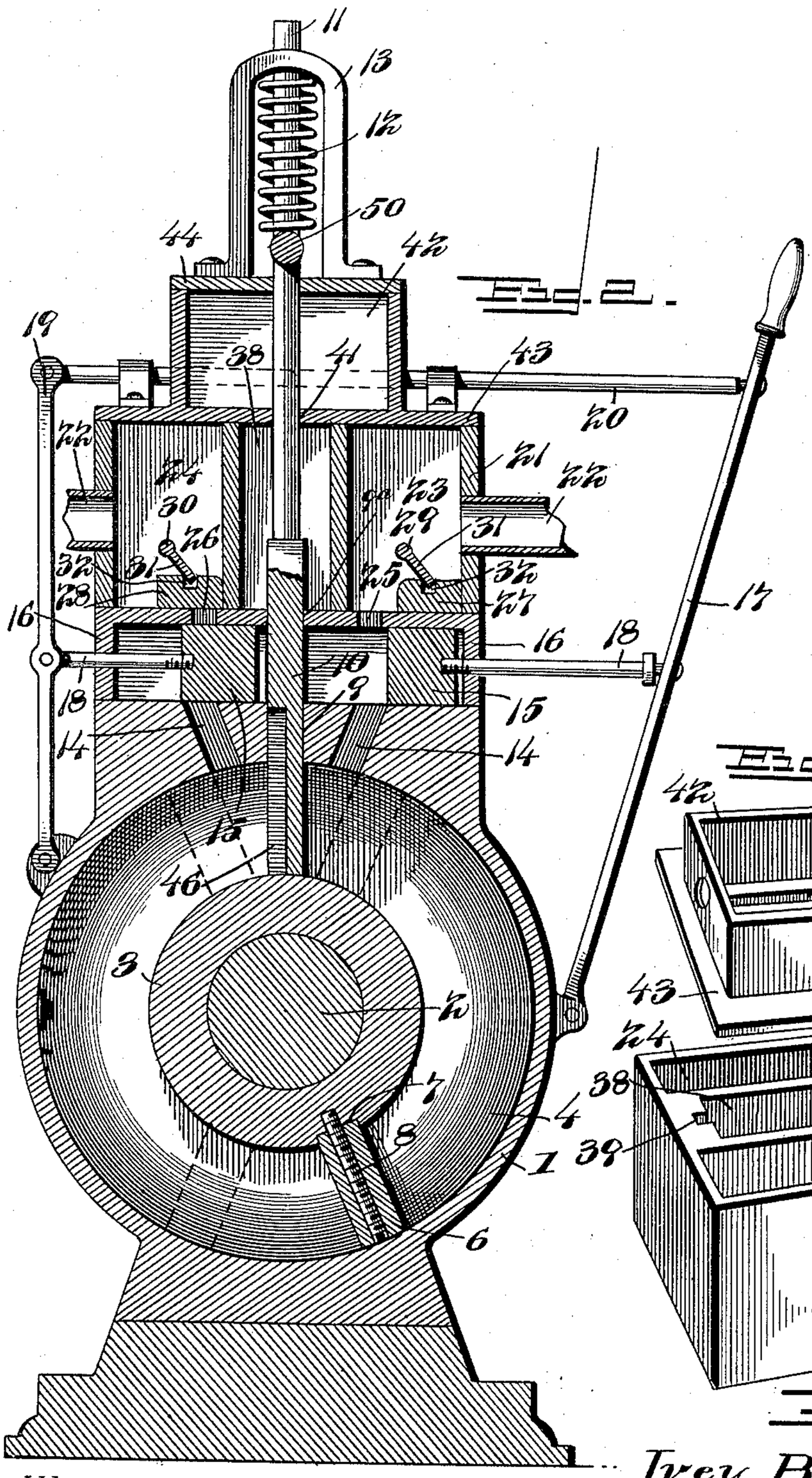

Fig. 2.

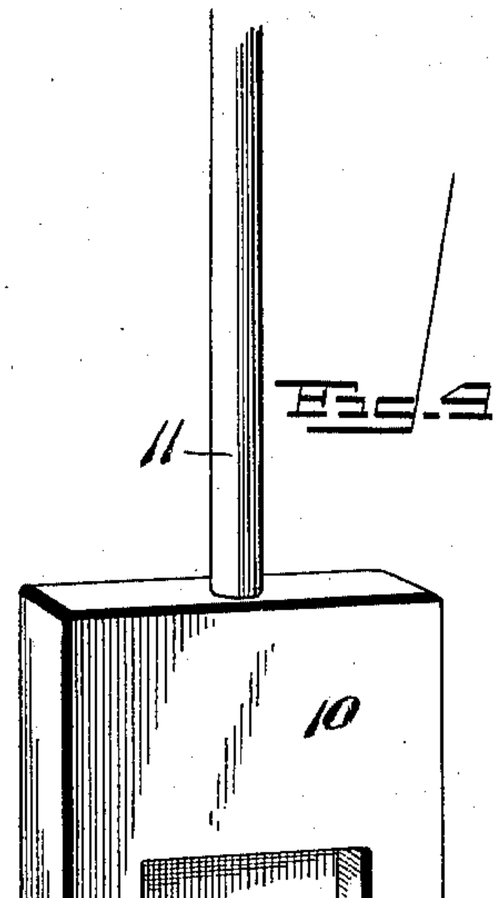

Fig. 4.

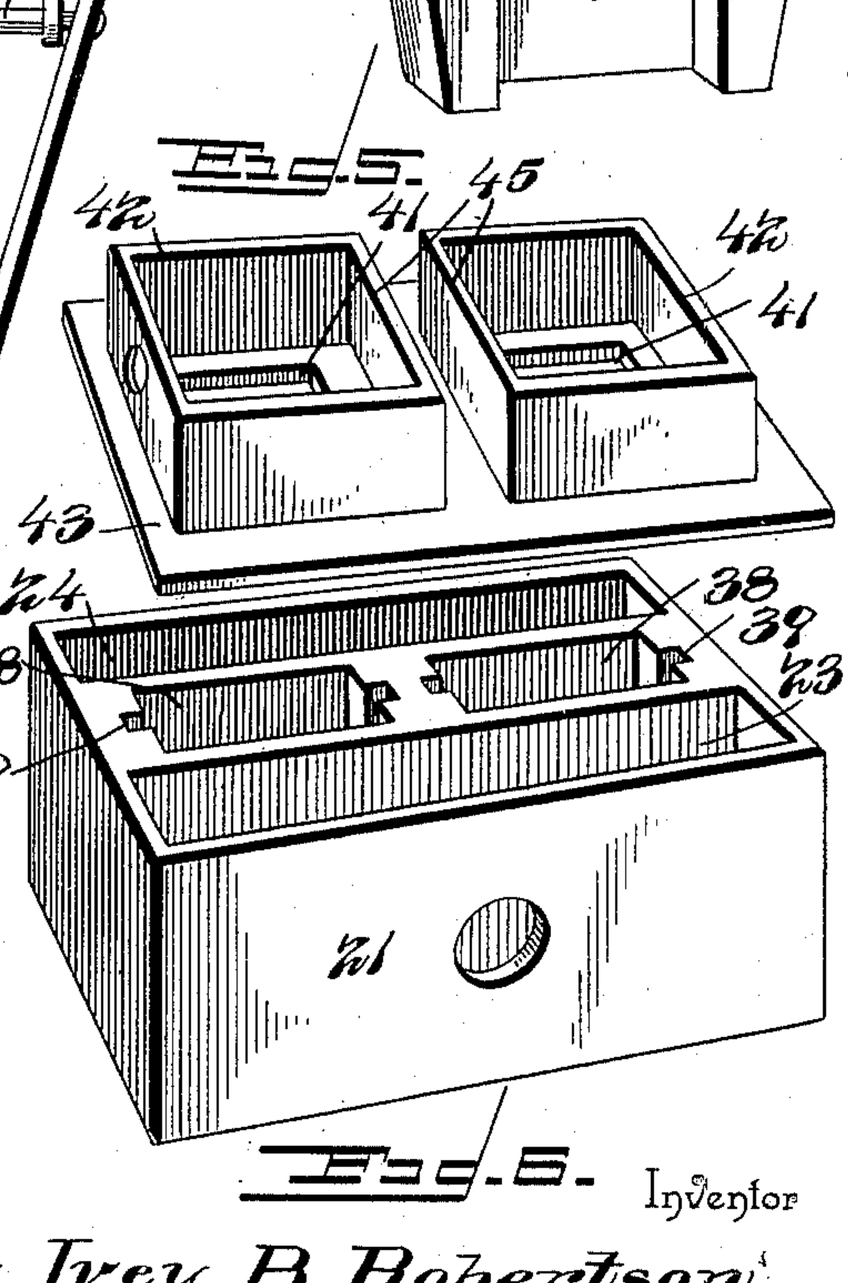

Fig. 5.

Fig. 6.

Witnesses

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(No Model.) 3 Sheets—Sheet 3.

I. B. ROBERTSON.

ROTARY STEAM ENGINE.

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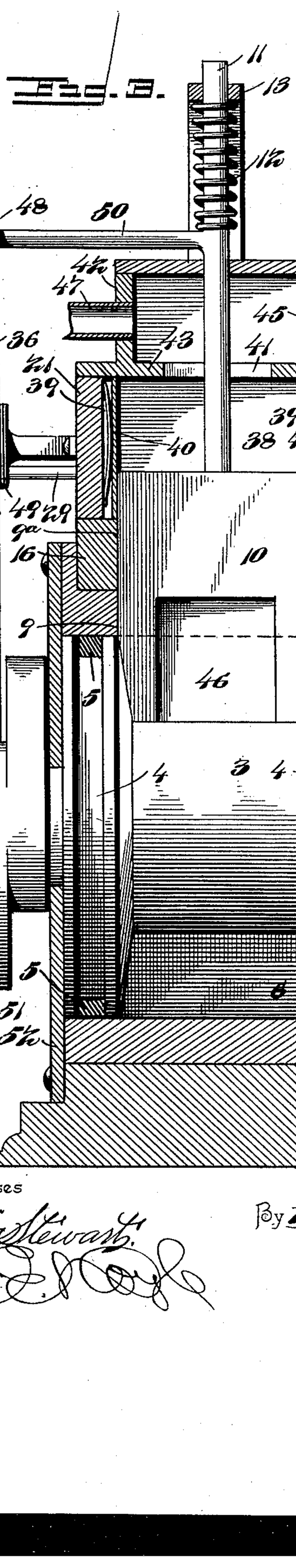

Witnesses
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Inventor
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UNITED STATES PATENT OFFICE.

IVEY BENTON ROBERTSON, OF HICKORY, NORTH CAROLINA, ASSIGNOR OF ONE-HALF TO MARCELLUS E. THORNTON, OF SAME PLACE.

ROTARY STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 584,560, dated June 15, 1897.

Application filed September 3, 1896. Serial No. 604,782. (No model.)

To all whom it may concern:

Be it known that I, IVEY BENTON ROBERTSON, a citizen of the United States, residing at Hickory, in the county of Catawba and State of North Carolina, have invented a new and useful Rotary Steam-Engine, of which the following is a specification.

My invention relates to rotary steam-engines of the concentric-piston type, adapted for use in the capacity of either a stationary, locomotive, or marine engine, and so constructed that when used as a stationary engine for driving machinery it may be applied directly to the shafting and suspended from either ceiling or side-wall timbers.

The objects in view are to provide an engine of simple construction wherein the ports are straight and direct, to avoid the expensive coring incident to the construction of engines of this class in the present practice, to provide a construction whereby the engine is operated with the minimum number of exhausts per revolution, and to otherwise simplify and strengthen the parts of the mechanism to secure compactness of structure and the minimum resistance and wear in operation.

Further objects and advantages of this invention will appear in the following description, and the novel features thereof will be particularly pointed out in the appended claims.

In the drawings, Figure 1 is a perspective view of an engine constructed in accordance with my invention. Fig. 2 is a vertical sectional view of the same, taken through the cylinder between the planes of contiguous piston-heads at right angles to the axis of the piston. Fig. 3 is a central vertical section at right angles to the plane of Fig. 2 or in the plane of the axis of the piston. Fig. 4 is a detail view in perspective of one of the reciprocatory cut-offs. Fig. 5 is a detail view in perspective of the exhaust-chamber casting with the top or covering-plate omitted. Fig. 6 is a similar view of the valve-chest. Fig. 7 is a detail sectional view of one of the shaft-bearings to show the means for centering the same.

Similar numerals of reference indicate corresponding parts in all the figures of the drawings.

1 designates a continuous open-ended cylinder through which extends a driving-shaft 2, carrying a piston 3, said piston consisting of a sleeve secured to the shaft and provided with terminal and intermediate heads 4, which fit snugly in the cylinder and are provided with suitable packing-rings 5.

Located between the planes of the terminal and intermediate piston-heads are diametrically opposite piston-wings 6, fitted at their inner edges in seats 7, formed in the surface of the sleeve and held in place by means of bolts 8.

Communicating with the cylinder, respectively upon opposite sides of the intermediate piston-head, are cut-off guides 9, in which are fitted reciprocatory cut-offs 10, having stems 11, which are normally held depressed by actuating-springs 12, said stems extending through yokes 13, by which the springs are held in place. Upon opposite sides of the longitudinal plane of the cut-offs are inlet-ports 14, controlled by throttle-valves 15, which are mounted to slide in a throttle-valve casing 16, secured to the cylinder-casting covering the valve-seat in which the inlet-ports 14 are formed. These throttle-valves are connected for simultaneous operation with a hand-lever 17 by means of valve-stems 18, an auxiliary lever 19, and a connecting-rod 20 between the auxiliary and hand levers.

Surmounting the throttle-valve casing is a slide-valve casing 21, communicating with steam inlet or supply pipes 22 and having separate compartments 23 and 24, which communicate with the throttle-valve casing, respectively, upon opposite sides of the plane of the cut-offs 10 by means of steam-ports 25 and 26. These steam-ports are controlled by means of the slide-valves 27 and 28, which are held seated by fluid-pressure in the compartments or chambers of the valve-casing, and they are connected with rock-shafts 29 and 30 by means of wings 31, fixed to said rock-shafts and engaging notches 32 in the upper sides of the slide-valves.

The rock-shafts receive motion from eccentrics 33 on the driving-shaft through the ec-

centric-straps 34, eccentric-rods 35, and swinging arms 36, said eccentric-rods and arms having a loose or sliding connection, (shown at 37.)

The cut-offs reciprocate in planes arranged radially with relation to the piston through the above-mentioned guides 9 and corresponding guides 9ª in the upper wall of the throttle-valve casing, the upper ends of said cut-offs extending into exhaust-passages 38, formed between the chambers or compartments 23 24 of the slide-valve casing, said exhaust-passages being of greater cross-sectional area than the cut-offs and being provided in their end walls with packing-strip seats 39, in which are fitted the yielding packing-strips 40 to bear against the side edges of the cut-offs. The exhaust-passages 38 have communication, by means of elongated exhaust-openings 41, formed in the upper end walls of said passages, with an exhaust-chamber 42, of which the side walls are preferably formed integral with a plate 43, which constitutes the cap or cover of the slide-valve casing. The cap-plate 44 of the exhaust-chamber forms a support for the yokes 13, in which are arranged the actuating-springs for the cut-offs. The elongated exhaust-openings 41 in the floor of the compartments of the exhaust-chamber 42 also receive the cut-off stems 11, which, however, are of less cross-sectional area than said openings, whereby permanent communication is maintained between the slide-valve casing and the exhaust-chamber. The exhaust-chamber is divided into compartments by means of parallel inner walls 45, in order to allow the connecting-rod 20 between the auxiliary and hand levers for operating the throttle-valves to pass transversely across the machine without necessitating the use of stuffing-boxes.

The cut-offs are provided with open-sided channels 46 of such a length that when a cut-off is elevated, as shown at the right in Fig. 3, the channel establishes communication between the interior of the cylinder and one of the exhaust-passages 38 by reason of the upper end of said channel being above the plane of the bottom or floor of said passage or above the plane of the guide 9ª, in which the cut-off fits snugly. Hence the exhaust-ports 47, which are connected with the compartments of the exhaust-chamber, are in communication with the cylinder only during the time that the upper ends of the channels 46 are above the plane of the guides 9ª. The means which I have illustrated in the drawings for actuating the cut-offs to establish communication between the cylinder and the exhaust-ports consist of reciprocatory rods 48, mounted in guides 49, supported by the ends of the slide-valve casing and connected to rigid arms 50 on the cut-off stems 11, and cams 51, fixed to the shaft 2 in the planes of said rods 48, the extent of the eccentric portion of each cam being approximately one-fourth of the circumference of the cam, whereby the cut-offs are in their inner or operative positions during approximately three-fourths of the revolution of the piston and are displaced only during one-fourth of the revolution.

From the above description it will be seen that in operation the piston receives motion by the expansion of the motive agent between the planes of a cut-off arranged in its normal position and a piston-wing, which respectively form the fixed and moving abutments, and the expansive force of the motive agent is applied to the piston-wing during three-fourths of the revolution of the piston and is only relieved when the cut-off which is arranged in the path of said wing begins its ascent to allow said wing to pass. At the moment that the cut-off begins its upward movement the steam-port, through which steam has been entering, is closed by the contiguous slide-valve, and when the cut-off reaches the limit of its upward movement, thereby establishing communication between the cylinder and the exhaust-passage, the entire cylinder—that is, the portion or compartment thereof between the intermediate and one of the terminal heads—is exhausted. By the time the piston-wing has passed beyond the contiguous inlet-port the cut-off is returned to its normal position, and simultaneously therewith steam is admitted by the movement of the slide-valves to apply further operative pressure to the piston-wing.

In order to secure the accurate centering of the shaft 2 in the cylinder, (which may or may not be provided with the fixed cylinder-heads 52, which are illustrated in the drawings,) I employ centering-bearings consisting of upper and lower bearing-blocks 53 and 54, fitted in lateral vertical guides 55 on the fixed standards 56, said bearing-blocks being capable of lateral play between the lateral guides; lateral adjusting-screws 57, which are mounted in said lateral guides and impinge at their inner extremities against the sides of the bearing-blocks, and vertical adjusting-screws 58, which are threaded in the floors of said guides and impinge at their upper extremities against the under side of the lower bearing-blocks.

Various changes in the form, proportion, and the minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of this invention.

Having described my invention, what I claim is—

1. In a rotary engine, the combination with a cylinder having valved inlet-ports and an inclosed piston, of reciprocatory cut-offs adapted to form stationary abutments arranged between said inlet-ports and operatively connected with the piston, said cut-offs being provided with open-sided channels adapted to communicate with an exhaust-chamber, and through which the cylinder is exhausted only when the cut-offs are withdrawn from the cylinder, substantially as specified.

2. In a rotary engine, the combination of a

cylinder having a concentric piston and duplicate inlet-ports, reciprocatory cut-offs arranged between the planes of said inlet-ports, and each provided in one side with an open-sided channel, a throttle-valve casing in communication with said inlet-ports, throttle-valves provided with operating devices, a slide-valve casing having steam-ports in communication with the throttle-valve casing at the opposite side from said inlet-ports, slide-valves for controlling said steam-ports operatively connected with the piston, and connections between the cut-offs and the piston, the channels in the cut-offs being in communication with said exhaust-chamber only when the cut-offs are withdrawn from the cylinder, whereby the cylinder is exhausted through the cut-off guides, substantially as specified.

3. In a rotary engine, the combination of a cylinder having registering cut-off guides and inlet-ports arranged upon opposite sides of the plane of said guides, throttle-valves for controlling the inlet-ports and provided with means whereby they may be adjusted, a slide-valve casing having steam-ports in communication, respectively, with said inlet-ports and adapted to be cut off simultaneously therewith by said throttle-valves, slide-valves for controlling the steam-ports operatively connected with the piston, cut-offs mounted in said cut-off guides to separate the inlet-ports and provided with open-sided channels adapted, when the cut-offs are withdrawn from the cylinder, to communicate with exhaust-passages, and operating connections between the cut-offs and the pistons, substantially as specified.

4. In a rotary engine, the combination of a cylinder provided with cut-off guides and contiguous inlet-ports arranged upon opposite sides of the plane of said guides, a throttle-valve casing having parallel upper and lower sides, throttle-valves operating in said casing to control the inlet-ports, a slide-valve casing communicating with steam-ports formed in the upper side of the throttle-valve casing and having compartments in communication with inlet or supply pipes, said slide-valve casing having intermediate separated exhaust-passages in communication with exhaust-ports, slide-valves for controlling the steam-ports operatively connected with the piston, reciprocatory cut-offs mounted in said cut-off guides and extending into said exhaust-passages through guides formed in the floors of said exhaust-passages, said cut-offs being provided with channels adapted to communicate with the exhaust-passages when the cut-offs are withdrawn from the cylinder, and operating means between the cut-offs and the piston, substantially as specified.

5. In a rotary engine, the combination of a cylinder having a concentric piston and duplicate inlet-ports, reciprocatory cut-offs arranged between the planes of said inlet-ports, and each provided in one side with an open-sided channel permanently in communication with the cylinder, a throttle-valve casing in communication with said inlet-ports and having opposite chambers separated by the cut-offs, throttle-valves arranged in said casing and provided with operating devices, a slide-valve casing having steam-ports in communication with the throttle-valve casing at the opposite side from said inlet-ports, partitions being arranged in said slide-valve casing upon opposite sides of the plane of the cut-offs to form an intermediate exhaust-chamber, slide-valves for controlling said steam-ports operatively connected with the piston, and connections between the cut-offs and the piston, the channels in the cut-offs being in communication with said exhaust-chamber only when the cut-offs are withdrawn from the cylinder, whereby the cylinder is exhausted through the cut-off guides, substantially as specified.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

IVEY BENTON ROBERTSON.

Witnesses:
A. A. WHITENER,
JAS. L. CILLEY.