No. 822,410. PATENTED JUNE 5, 1906.

E. WALDRON.

COMPOUND ROTARY ENGINE.

APPLICATION FILED AUG. 29, 1905.

3 SHEETS—SHEET 1.

Fig. 1.

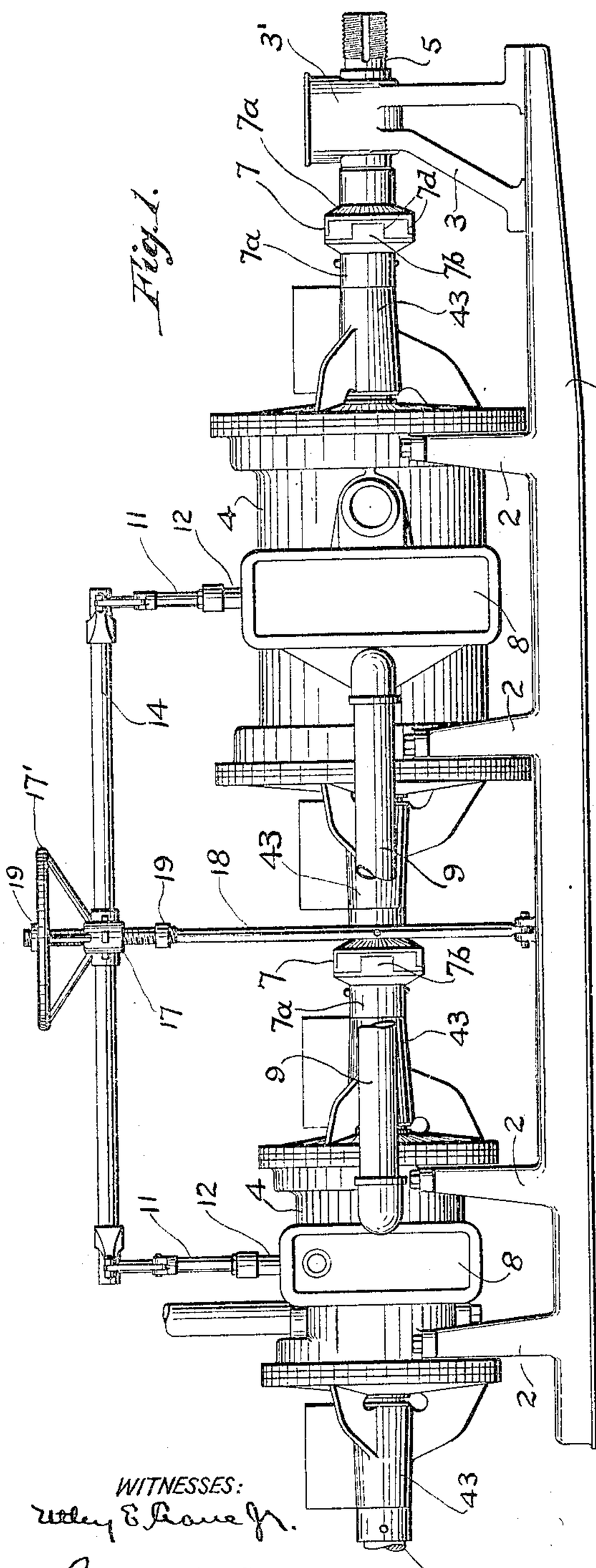
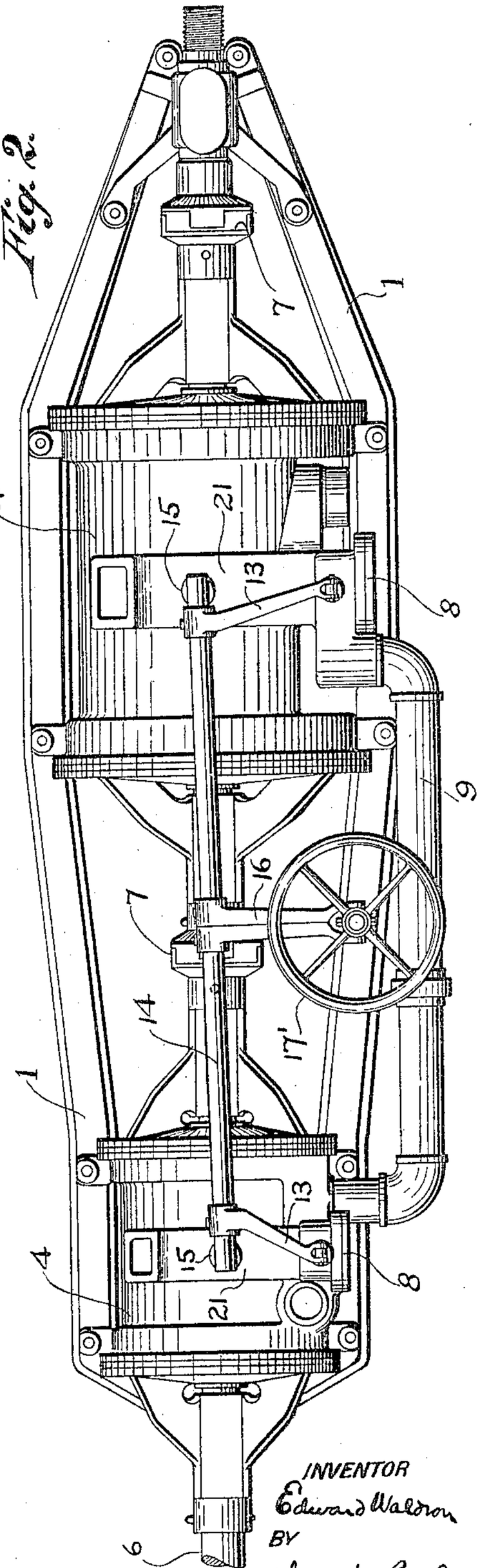


Fig. 2.



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INVENTOR

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3 SHEETS—SHEET 2.

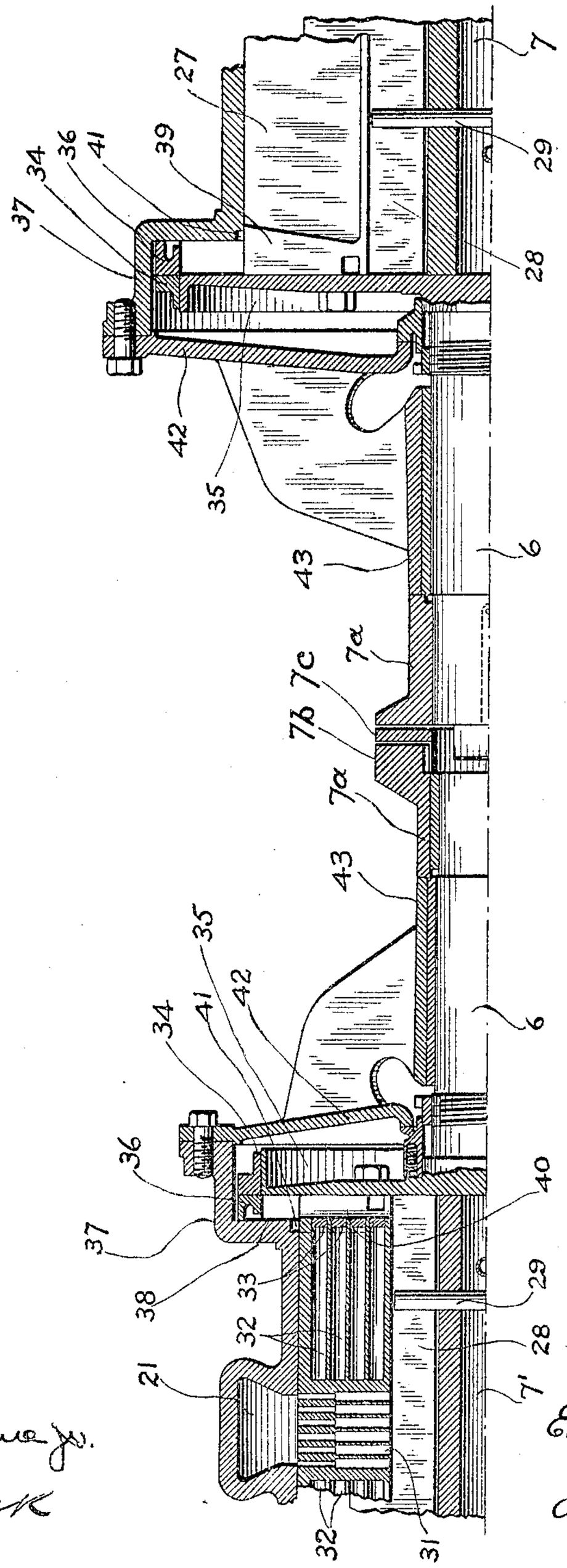

Fig. 3.

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3 SHEETS—SHEET 3.

Fig. 4.

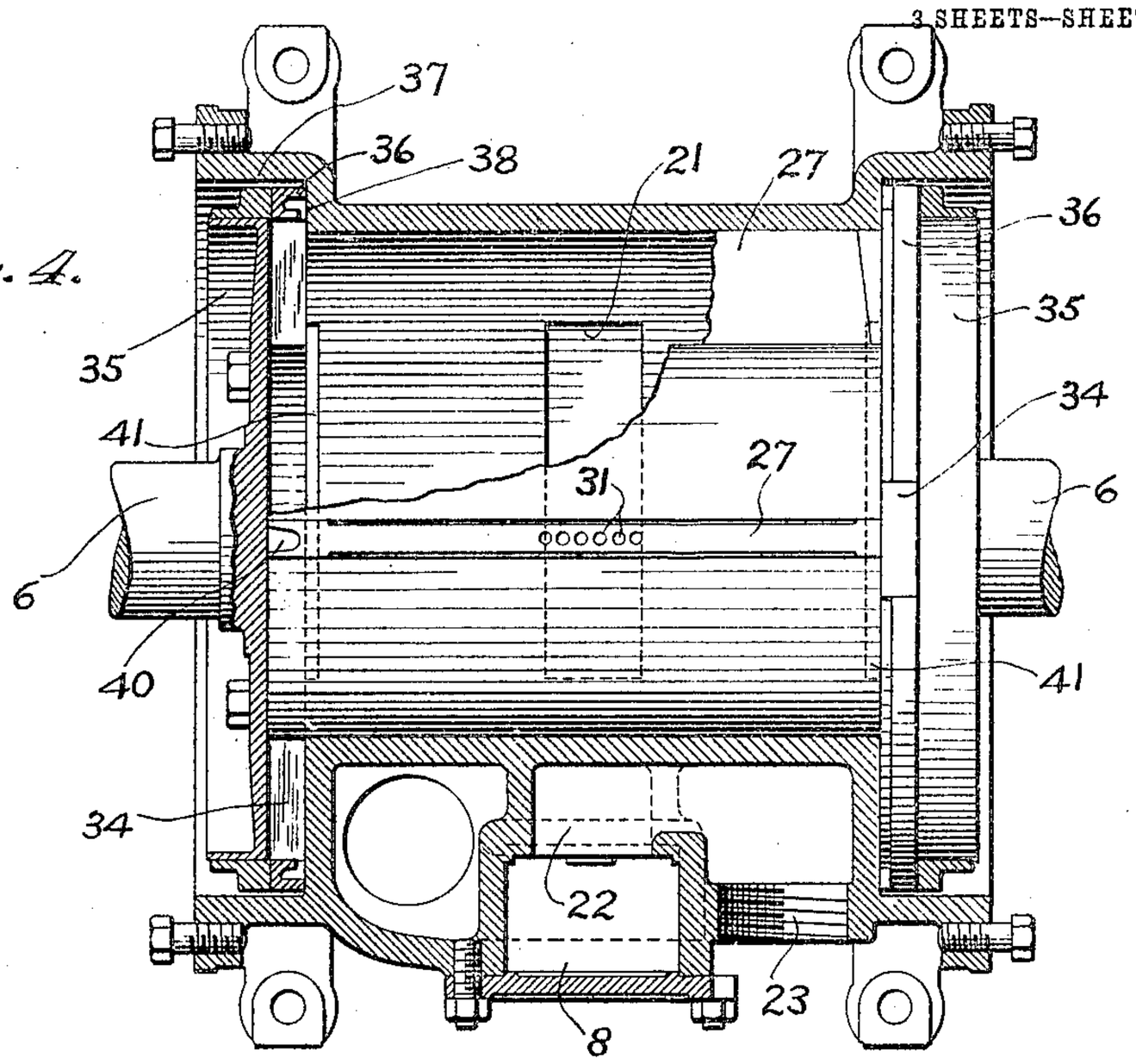
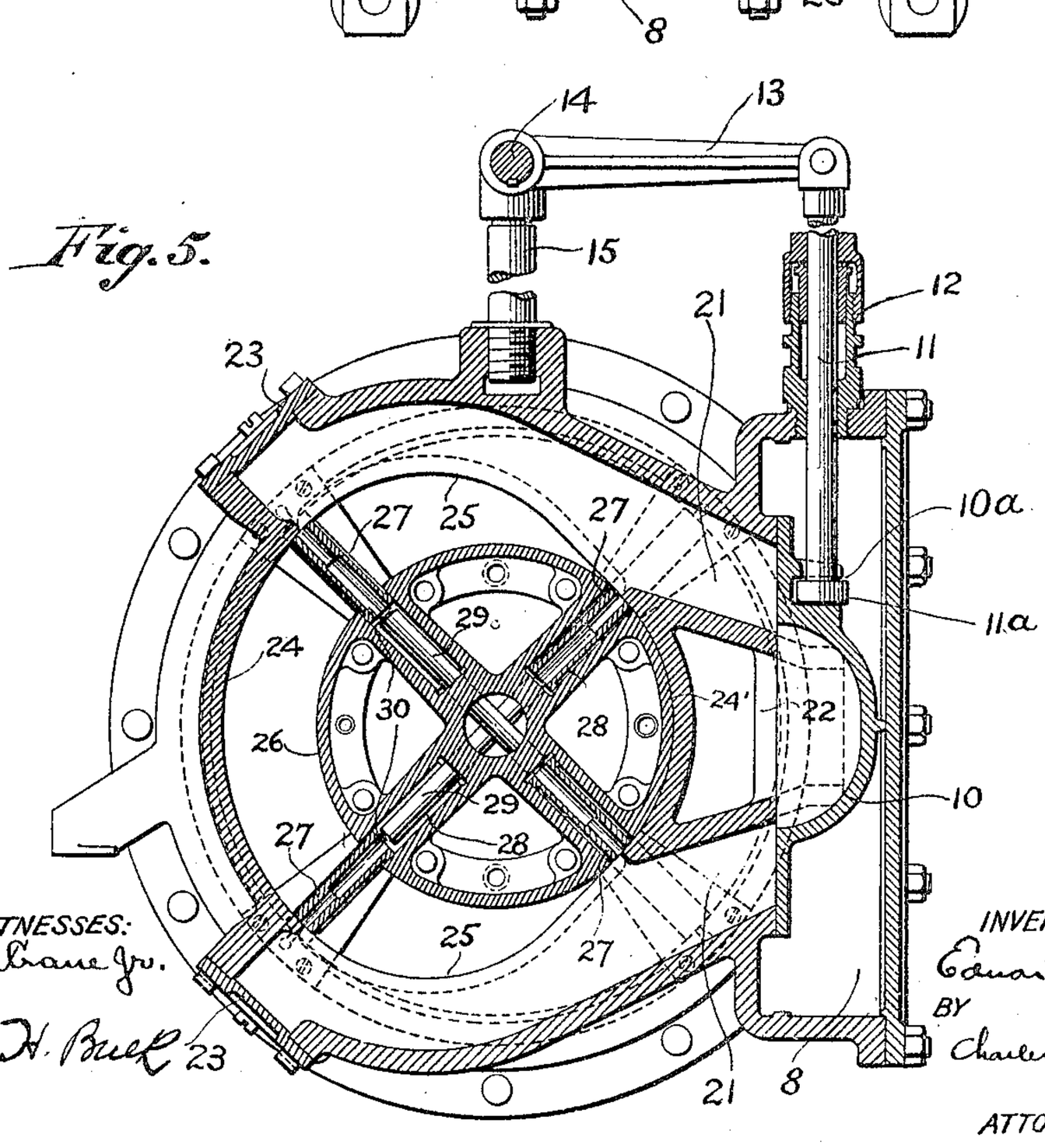


Fig. 5.



WITNESSES:

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UNITED STATES PATENT OFFICE.

EDWARD WALDRON, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO WALDRON FLEXIBLE ROTARY ENGINE COMPANY, OF CAMDEN, NEW JERSEY, A CORPORATION OF NEW JERSEY.

COMPOUND ROTARY ENGINE.

No. 822,410. Specification of Letters Patent. Patented June 5, 1906.

Application filed August 29, 1905. Serial No. 276,235.

To all whom it may concern:

Be it known that I, EDWARD WALDRON, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented an Improved Compound Rotary Engine, of which the following is a specification.

This invention is a compound rotary engine developed from the invention disclosed by Letters Patent No. 479,479, granted to me July 26, 1892.

The present improvements are designed to increase the efficiency and practicability of the former construction and apply the same in compound form.

The nature and characteristic features of the improvements will more fully appear by reference to the following description and the accompanying drawings in illustration thereof, of which—

Figure 1 represents a side elevation of the compound engine having broken away the passage which conveys steam from the high to the low pressure motor. Fig. 2 represents a plan view of the compound engine. Fig. 3 represents a broken longitudinal sectional view thereof. Fig. 4 represents an irregular longitudinal sectional view taken through a motor, and Fig. 5 represents a transverse sectional view thereof.

As shown in the drawings, the frame 1 is provided with the standards 2 and 3.

The standards 2 support the high-pressure and low-pressure motors through their engagements with the piston-chambers 4 thereof. The standards 3 have the bearing 3′, in which is journaled the power-transmitting shaft 5. The shaft 5 is connected to the piston-shafts 6 and the latter connected together by couplings 7.

The piston-chambers are provided, respectively, with a valve-chamber 8, the two valve-chambers being connected by the steam-passage 9. Valves, as 10, in the respective chambers are operated by valve-rods 11, which work in stuffing-boxes 12, the valves having sockets, as 10^a, therein, with which heads, as 11^a, on the rods form flexible engagements or joints readily connected and disconnected when the stuffing-boxes are detached. To move the rods 11 together to operate the two valves simultaneously, arms 13 are pivoted thereto and fixed to a shaft 14, the shaft being journaled on bearings 15, carried by the respective piston-chambers. The shaft 14 has fixed thereon an arm or arms 16, in the outer end of which is journaled the hub 17 of a wheel 17′, having a screw-threaded engagement with a stem 18, fulcrumed on the frame, the stem having the adjustable stops 19 thereon for limiting the throw of the valves.

Each valve is adapted for controlling the introduction of steam from the corresponding valve-chamber to the piston-chamber through either of the ports 21, while the other of these ports is connected thereby to the exhaust-port 22, which discharges through the outlet 23. In the case of the high-pressure chamber this outlet 23 is connected with the steam-passage 9, which delivers the steam exhausted to the steam-chamber of the low-pressure motor.

The ports 21 are elongated channels of dovetail cross-section exterior to the piston-chamber proper, with which they communicate, these ports having the caps 23, whereby communication can be had to the interior thereof and of the piston-chambers.

The inner contour of the piston-chamber comprises the oppositely-disposed arcs of concentric cylinders 24 and 24′, connected by the irregularly-curved or cam surfaces 25. In close proximity to the smaller of the concentric arcs 24′ revolves the cylindrical piston-drum 26, while the larger of the arcs 24 and the cam-surfaces 25 provide the way for the passage of steam and the projection of the reciprocating piston-blades 27 in the path thereof for rotating the drum and the axial shafts 6, fixed thereto.

It is to be observed that the cylindrical surface 24 overlaps the adjacent ends of the ports 21 and has an arc of ninety degrees or more, by which the steam is permitted to exhaust the instant it ceases to do useful work upon any blade at the instant the succeeding blade takes the full steam-pressure. As adjacent blades, being separated by arcs of ninety degrees, approach the limits of the arc 24 the diametrically opposite blades coacting therewith approach the limits of the arc 24′. The exhaust-port is partially opened by a blade before the diametrically opposite blade is moved into the path of the live steam, and the lateral pressure upon

these blades is so low as to have practically no retarding influence on their reciprocations.

The blades 27, which reciprocate in races 28 in the drum, are separated and held in contact with the peripheral surface of the piston-chamber by the rods 29, which reciprocate at right angles to each other in the drum, the blades being cushioned on springs 30. Each blade has passages 31 radial to the center of revolution, by which communication is established between the ports 21 and the races 28, so that no fluid-pressure can be exerted to oppose the reciprocation of the blades, the passages being sealed by contact with the surfaces 24 and 24′.

The ends of the blades are also cored out, forming hollow spaces 32, closed by the plugs 33, which spaces, with the passages 31, provide a cellular construction having the desired lightness and strength.

The ends of the blades work in races or radial guides 34, secured to disks 35, fixed to the drum, the disks having the packing-rings 36 thereon, which revolve within the cylindrical end flanges 37 and bear against the face-flanges 38 on the steam-chamber. The blades between the end portions 39 have their respective faces cut away to avoid body contact and friction in the races in which they reciprocate, the thicker ends of the blades overlapping the ports 41 to provide tight joints. The ends of the blades are provided with the radially-disposed channels 40 to provide free steam circulation.

The flanges 37 of the piston-chamber have the chamber-heads 42 secured thereto, the heads having sleeves 43 thereon, in which revolve the shafts 6, these shafts being coupled together, so that the piston-blades in the high and low pressure motors are in line. The couplings provide flexible connections between the shafts, each coupling comprising an end piece 7^a, having lugs 7^b sleeved on a shaft end to which it is fixed, and a center piece 7^c, having recesses 7^d on opposite sides at right angles to each other engaged by the lugs 7^b, the end pieces and the shafts being thereby permitted longitudinal movement in expanding and contracting.

Having described my invention, I claim—

1. An engine comprising a pair of piston-chambers each having inlet and exhaust ports, a rotary piston having reciprocating blades in each of said piston-chambers, a flexible coupling connecting said pistons together, a valve-chamber connected with each of said piston-chambers, a conduit connecting said valve-chambers, and a valve in each of said valve-chambers for controlling the piston-chamber ports.

2. An engine comprising a pair of piston-chambers each having an inlet and an exhaust port, a rotary piston, in each of said piston-chambers, said pistons having alined blades, a coupling for connecting and disconnecting said pistons, a conduit connecting the exit-port of one piston-chamber with the inlet-port of another, a valve for controlling the ports of each piston-chamber, a rocker-arm connected with each of said valves for operating them in the same direction simultaneously, and means for oscillating said rocker-arms as a unit.

3. An engine comprising a plurality of sets of ports, a valve for controlling each set of ports, a reciprocating valve-rod for operating each valve, a journaled rod, a rocker-arm fixed to said rod and connected to each valve-stem, a rod having a screw thereon, a projecting member fixed to said shaft, and a nut engaging said screw and having a revoluble connection with said projecting member.

4. An engine having a chamber with an inlet and an exit port, a valve for controlling said ports, a chamber within which said valve reciprocates, a detachable stuffing-box set in said chamber, and a valve-rod reciprocating through said stuffing-box, said valve having a socket and said rod having a head making a flexible engagement with said socket and detachable therefrom by disengaging said stuffing-box.

5. An engine comprising a piston-chamber and a piston thereon, said chamber having ports of dovetail cross-section communicating therewith exterior to the surface traversed by said piston.

6. An engine comprising a piston-chamber and a rotary piston therein, said chamber having capped channels exterior to the surface traversed by said piston and providing inlet and exhaust ports therefor.

7. An engine having a piston-chamber comprising concentric cylindrical surfaces joined by irregularly-curved surfaces, a rotary piston having reciprocating blades which revolve in contact with said surfaces, and inlet and exit channels exterior to the peripheral surfaces against which said blades act, said channels having open communications with said chamber through said irregularly-curved surfaces and through the termini of the larger of said concentric curves.

8. An engine comprising a piston-chamber with concentrically-curved surfaces joined by irregular surfaces having inlet and exit channels communicating therewith, and a rotary piston having reciprocating blades acting in said chamber, said blades having passages therethrough which register with said channels.

9. An engine comprising a piston-chamber having centrally-disposed peripheral inlet and exit channels communicating therewith, peripheral exhaust-ports in the ends thereof, and a rotary drum with races therein and blades reciprocating in said races, said blades having central passages therethrough which register with said central channels and lateral

passages which communicate with said end ports.

10. An engine comprising a piston-chamber, a drum rotating therein, and blades reciprocating in said drum, said blades having their ends cored out and closed.

11. An engine comprising a piston-chamber, a rotary piston in said chamber, a shaft revolved by said piston, a second shaft, and a coupling for connecting said shafts so as to permit them to move longitudinally with respect to each other.

In testimony whereof I have hereunto set my hand, this 21st day of August, A. D. 1905, in the presence of the subscribing witnesses.

EDWARD WALDRON.

Witnesses:
ROBERT JAMES EARLEY,
UTLEY E. CRANE, Jr.