

No. 825,770.

PATENTED JULY 10, 1906.

W. C. SMALSTIG.

ROTARY ENGINE.

APPLICATION FILED AUG. 23, 1905.

2 SHEETS—SHEET 1.

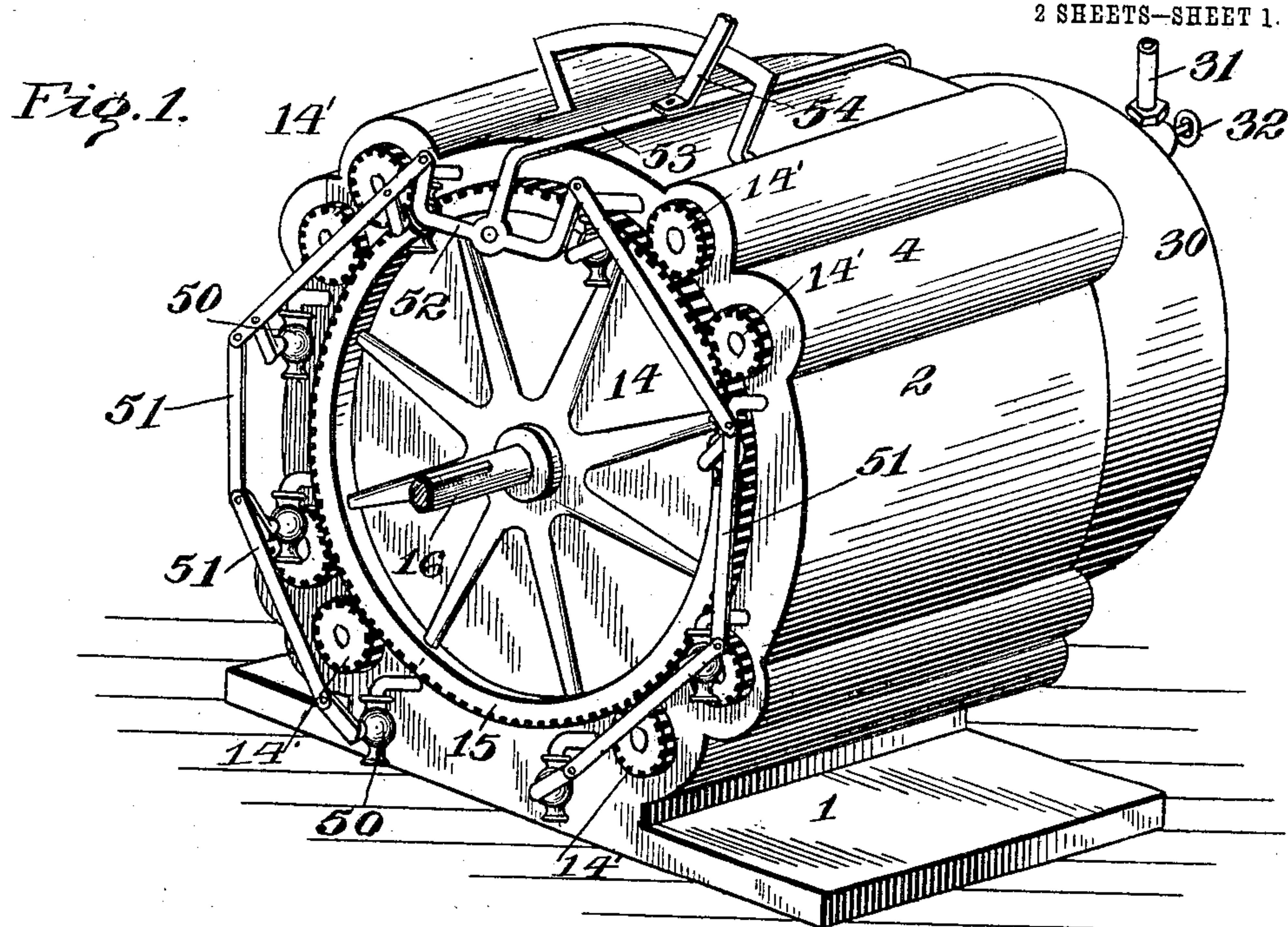
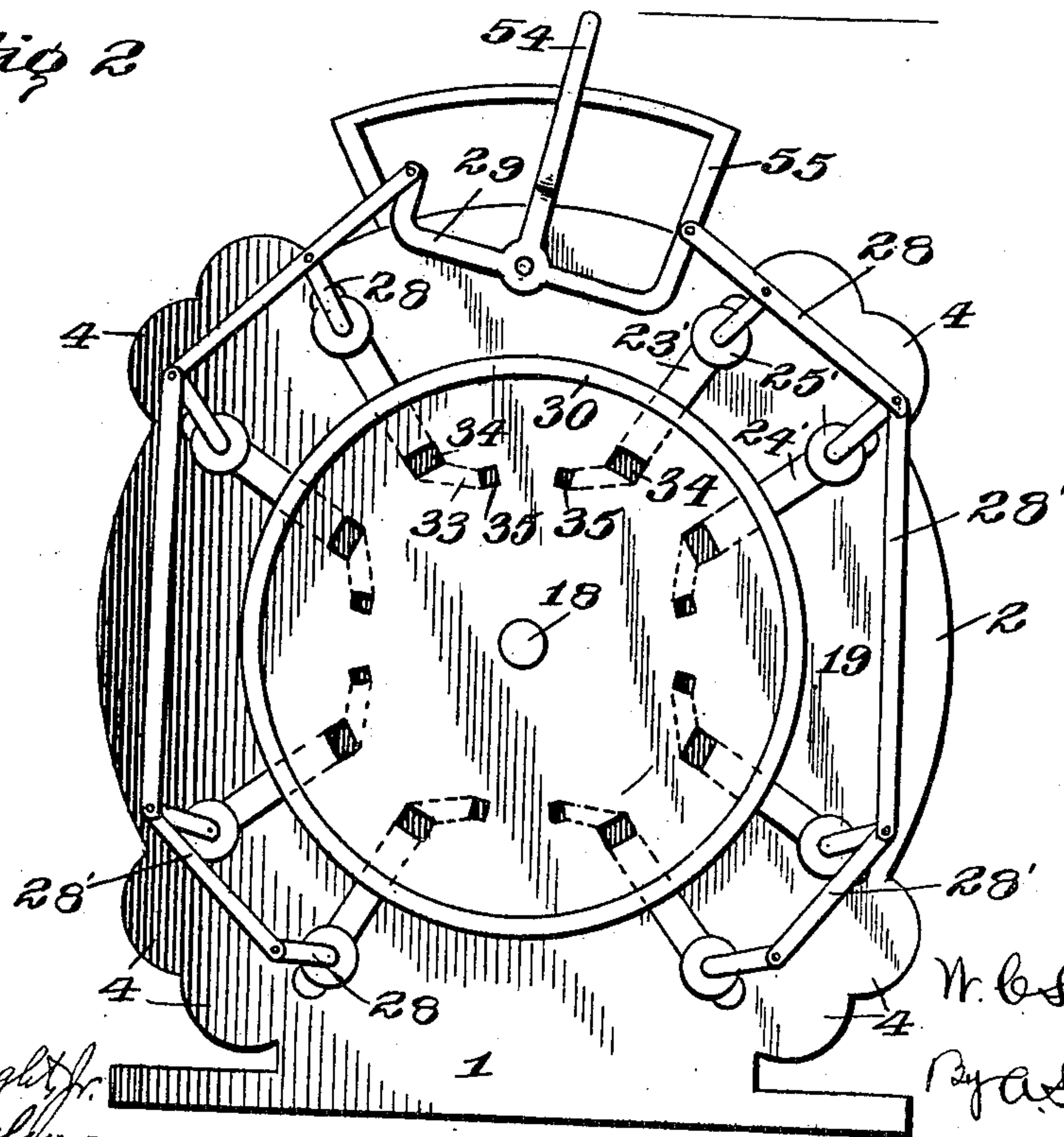


Fig. 2



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Fig. 3.

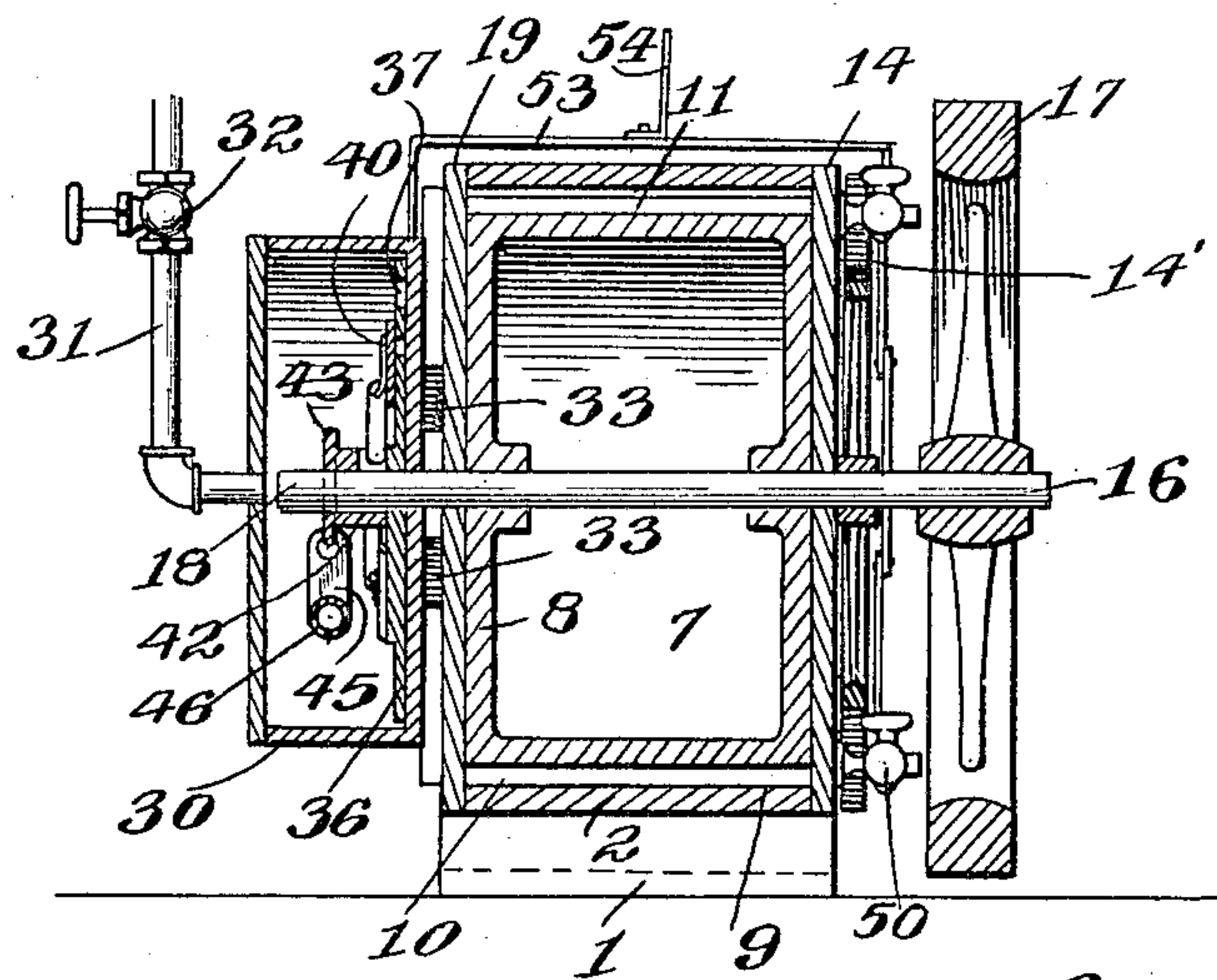


Fig. 4.

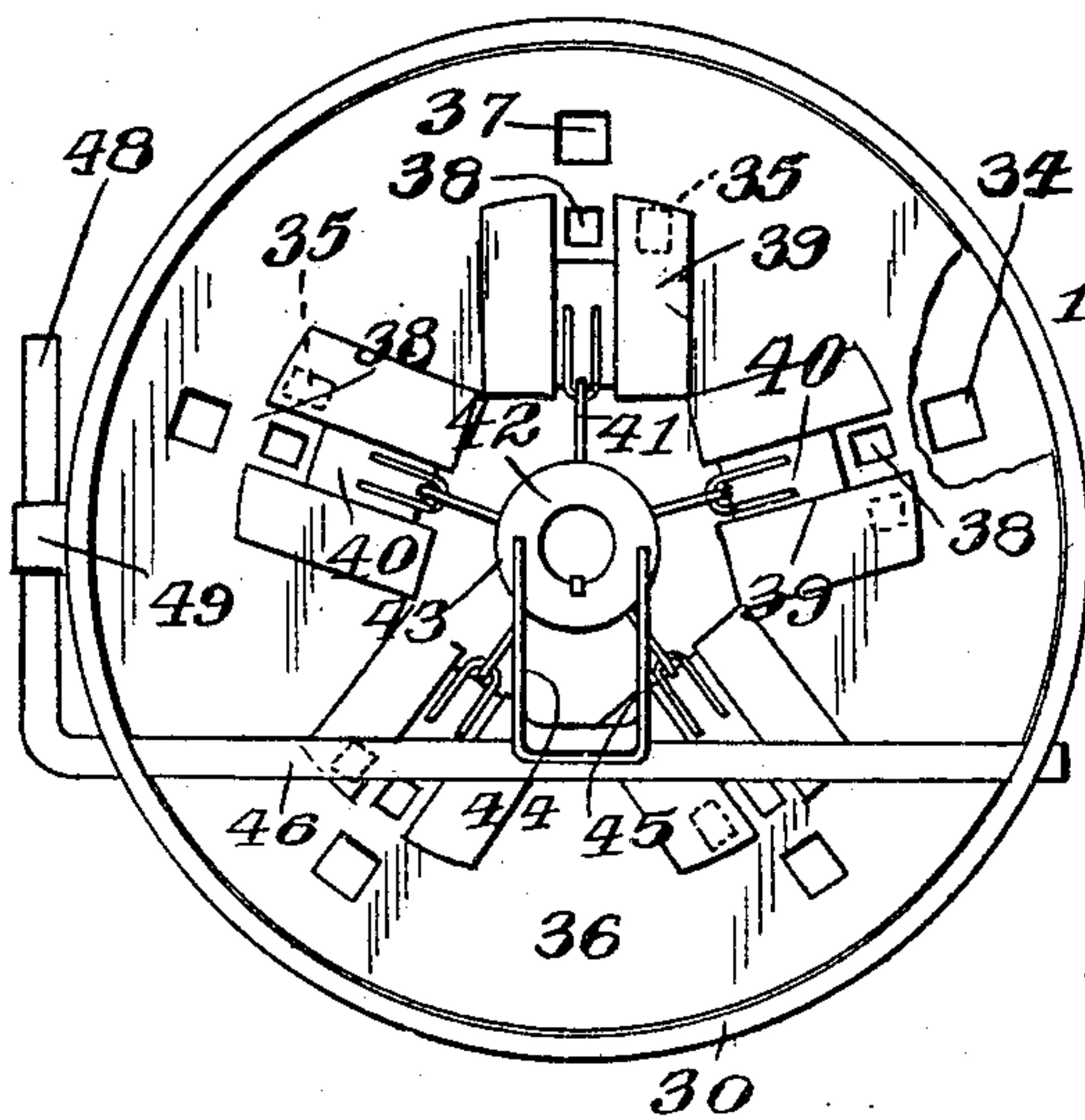
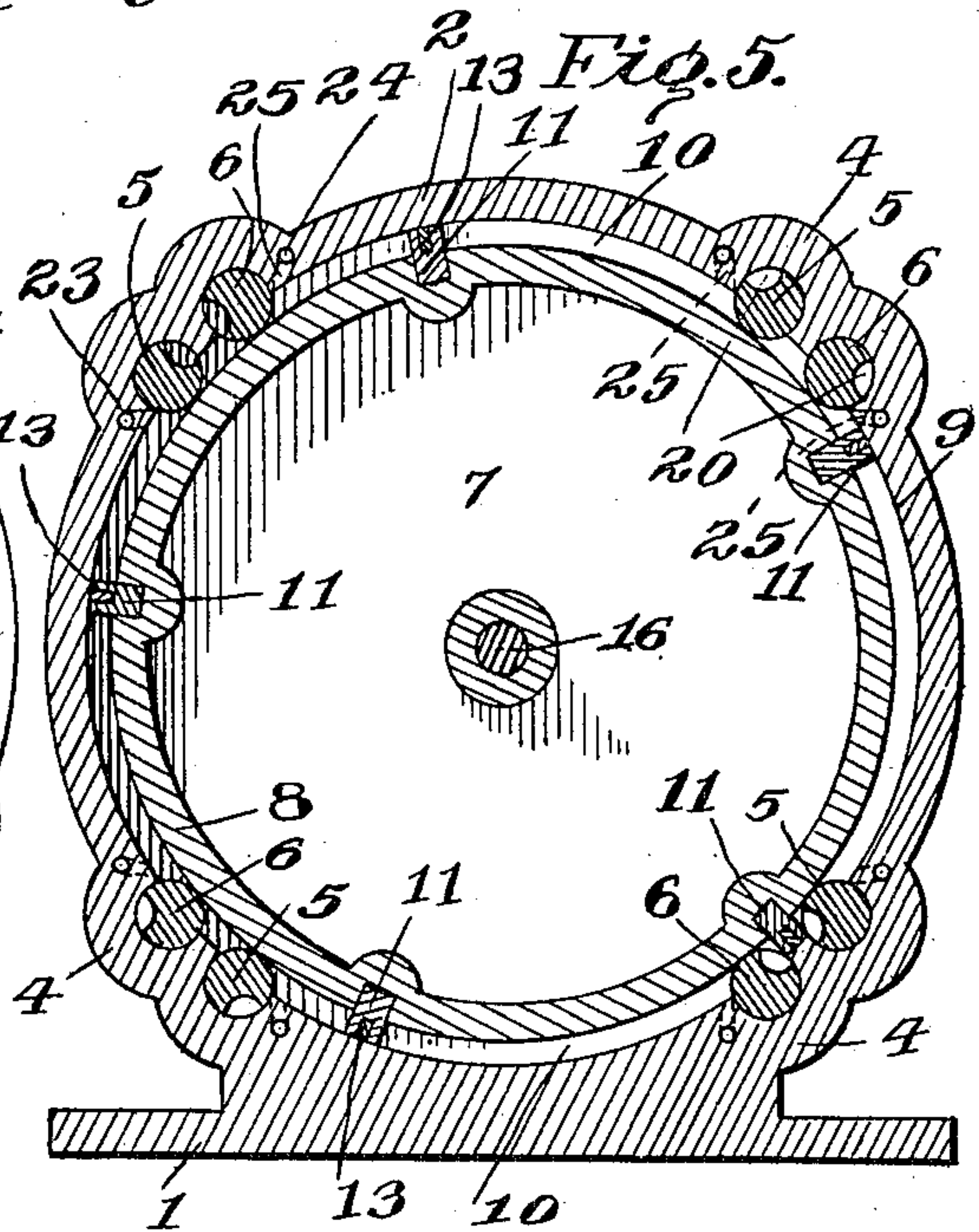


Fig. 5.



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UNITED STATES PATENT OFFICE.

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ROTARY ENGINE.

No. 825,770.

Specification of Letters Patent.

Patented July 10, 1906.

Application filed August 23, 1905. Serial No. 275,444.

To all whom it may concern:

Be it known that I, WILLIAM C. SMALSTIG, a citizen of the United States, residing at Bloomington, in the county of McLean and State of Illinois, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to improvements in rotary steam-engines, and pertains more particularly to that class where several abutments are used upon a single piston.

The object of my invention is to provide an engine of this character in which the piston is provided with any desired number of piston-heads provided with packing for engaging the inside of the cylinder and rotary abutments geared to the engine-shaft and having openings or recesses therein in which the piston-heads are adapted to enter while passing said abutments.

Another object of my invention is to provide a separate and independent steam-supply pipe on each side of all of the rotary abutments, whereby the engine is reversed and the valves for controlling the supply of steam being linked together the supply of steam for each side of the rotary abutment is simultaneously operated for reversing the engine.

A still further object of my invention is to so arrange the inlet-ports or communications between the steam-chest and the cylinder that the same can be opened for a longer period of time for admitting more steam to the cylinder in starting the engine and also in the running of the engine when a heavy load is placed on the engine.

In the accompanying drawings, Figure 1 is a perspective view of my improved engine, showing the gearing for operating the several rotary abutments and the arrangement of the levers for operating the exhaust-cocks simultaneously with the inlet-ports. Fig. 2 is a side elevation looking from the direction carrying the steam-chest and showing the lever-and-link connection for operating the several valves simultaneously for reversing the engine and operated by the same lever by means of which the exhaust-cocks are operated. Fig. 3 is a vertical longitudinal sectional view taken through the cylinder. Fig. 4 is an enlarged side elevation showing the steam-chest and the sliding valves therein for increasing or decreasing the time that the steam is admitted within the cylinder. Fig.

5 is a transverse vertical sectional view showing the arrangement of the several rotary abutments and the piston working in conjunction therewith.

Referring now to the drawings, 1 represents the base, upon which is mounted the cylinder 2, and said cylinder, as shown, is arranged in a vertical position on the base and is provided, as shown, on its outer periphery with the enlarged portions 4, which, as shown are four in number, but which may be of any desired number, and in which are rotatably mounted the abutments 5 and 6, which are two in number, within each of said enlarged portions.

Rotatably mounted within the said cylinder is the rotary piston 7, which is formed of an outer solid portion 8, which is of a diameter less than the diameter of the central bore 9 of the cylinder, thus leaving the steam-expansion chamber 10 surrounding the cylinder. The said piston, as shown, is provided with five piston-heads 11, which, as shown, is one greater in number than there are pairs of rotary abutments and are arranged at equal distances apart, and thus so positioned on the piston in respect to the abutments and their respective valves that one of said piston-heads is at all times in such a position when the steam is admitted to the steam-chest that its respective valve is open and that steam will engage said piston-head and start the engine, and thus the engine cannot possibly stop at any point wherein the engine cannot be readily started. The outer ends of the piston-heads, as shown, are provided with a packing 13 at its sides and ends to form a tight joint with the cylinder and prevent the leakage of the steam from around the same.

The rotary abutments, as heretofore mentioned, are arranged in pairs and have their outer ends extending through the cylinder-head 14 and carrying gears 14', which are adapted to mesh with the large gear 15, carried by the piston-shaft 16, and the gears are so proportioned in size that the rotary abutments are timed to rotate, as hereinafter more fully described. The said piston-shaft 16 at its outer end is provided with the usual balance-wheel 17, and the opposite end 18 of the piston-shaft extends through the cylinder-head 19 and carries the valve mechanism, which will also be hereinafter described. The said abutments 5 and 6 are each provided with a cut-away portion 20, into which the piston-heads 11 are adapted to pass, and the

abutments are, as heretofore described, so geared to the engine-shaft that the said opening is in its proper position to receive its respective piston-head and to be rotated as the piston-head travels forward. The positioning of the rotary abutments in pairs, as shown, is such that as the piston-head passes from the opening of one abutment it passes into the opening in the companion abutment, and thus the space between the two abutments is prevented from receiving any steam whatever, and the two abutments necessarily form a tighter connection than one and not only prevents the leakage of exhaust-steam, but also of live steam. The said abutments are so geared to the shaft that they rotate at the same rate of speed as the piston, and thus there is no grinding between the abutments and the piston.

The enlarged portions 4 of the cylinder adjacent their connection with the main portion of the cylinder are provided with transverse steam-passages 23 and 24, which have in communication therewith the inwardly-extending passages 25, which communicate with the steam-space 10 around the piston, and through which the steam is admitted thereto. The said communication 25 extends obliquely inward toward the rotary abutment, and thus admits steam to the space 10 at a point very close to the abutment, thus giving as large a steam-chamber as possible for the expansion of the steam. The outer ends of the passages 23 and 24 extend through the cylinder-head 19 and have in communication therewith the steam-supply passages 23' and 24', leading from the steam-chest on the outside of the cylinder-head. The said passages intermediate their connection with the cylinder and steam-chest are provided with a turning-plug 25', by means of which the steam is cut off from said passages. The said turning-plugs are each provided with an operating-lever 28, which are so connected together by links 28', which are operatively connected to the intermediately-pivoted lever 29, which is adapted to operate said links and necessarily operates the turning-plugs through the medium of the links. The said turning-plugs and their respective levers are so arranged that all of the plugs on the left of the rotary abutments are opened when the lever is swung in one direction and the valves on the opposite side are closed and when the lever is swung in the opposite direction the valves are opened and closed in just the reverse direction, and thus the engine is readily reversed.

The end of the shaft 18 of the piston, as before described, projects through the cylinder-head 19, and, as shown, the steam-passages 23' and 24', carrying the valves 25, are on the outside of the cylinder-head and carried thereby. Carried by said cylinder-head on the outside of the cylinder is a steam-chest 30, which is of a circular box-like form and is

provided at its center with the steam-inlet supply-pipe 31, which enters the center thereof and is provided with a turning-plug 32, which is adapted to cut off the steam for stopping the engine. The said steam-passages leading from the cylinder to the steam-chest, as shown, have their inner ends curved, as shown at 33, opposite the steam-chest, and, as shown, each pair of inlets are turned or curved in opposite directions, which is for the purpose now to be described. Each of said steam-passages is provided with two openings 34 and 35, the opening 34 being adjacent the outer periphery of the steam-chest, while the opening 35 is at the inner ends of the curved portion 33 of the steam-passage, thus bringing the same out of a radial line with the opening 34, hereinafter described.

Rotatably mounted within the steam-chest upon the shaft 18 is a rotary valve 35, which is in the form of a disk and normally closing the ports 34 and 35. The said valve is provided at or adjacent its outer periphery with the openings 37, which are adapted to register with the openings 34 adjacent the outer periphery of the steam-chest, and thus the steam is admitted to the cylinder and cut off. The positioning of said openings in the valve is such in respect to the piston-head that the respective head has just passed the inlet-opening in the cylinder when the respective opening in the valve registers with its opening 34, and the steam passes through the passage 18 into the cylinder and works against the piston-head. The said rotary valve 36 is provided with a series of openings 38, arranged circumferentially around the shaft on the inside of the openings 37, and each of said openings is provided with a slideway 39, in which is radially slidable the gates 40, which when in their normal outward position close the openings 38, and said openings 38 register with the openings 35 in the inner curved ends of the passage-ways 23. The inner ends of said sliding gates 40 have links 41 pivotally connected thereto, and said links are pivotally connected at their outer ends to a sleeve 42, which is slidably mounted upon the shaft 18 of the piston. The said sleeve 42 is keyed upon the shaft, thus rotating with the rotary valve, and thus the links and the sliding gates are held in their normal positions in respect to the sleeve. The said sleeve being slidably mounted upon the shaft, it will be readily seen that inward movement of the sleeve will move the sliding gates 40 outward and close the openings 37. The outer end of the sleeve 42 is provided with a radially-extending flange 43, which is adapted to pass within the outer bifurcated ends of the arms 44 and 45, which are rigidly carried by a rock-shaft 46, which is mounted within the steam-chest, and thus the rocking of said shaft throws the sleeve in or out and opens or closes the inner series of openings

for allowing the steam to pass from the steam-chest into the steam-passages to the cylinder. The outer end of the rock-shaft 46 extends through the steam-chest and is provided with an operating-lever 48, which works in a guide 49, carried by the outer face of the steam-chest and is provided with means for holding the lever in its adjusted position.

The normal operation of the engine in running is the passage of the steam through the outer series of openings in the steam-chest into the passages 23 and to the engine-cylinder to the proper side of the abutment, according to the direction that the engine is running, which is governed by the lever which opens and closes the proper passages. In starting the engine or whenever an extra load is placed upon the engine the lever 48 is swung in the direction indicated by the arrow, which moves the sleeve 42 outward on the shaft and draws the sliding gates 40 inward and exposes the opening 34', and thus it will be seen that the openings 35' communicating with the steam-passages being a slight distance to one side of the openings about the time when the openings 35 are being closed by the rotating valve the openings are in communication with the openings 34' in the rotary valve and more steam is admitted to the engine-cylinder, which greatly increases the power of the engine and which provides means whereby such increased supply of steam can be shut off at any time and the engine run under its normal operation.

The cylinder on the opposite end from that carrying the steam-chest is provided with a series of exhaust-cocks 50, which are in communication with the steam-space 10 around the cylinder and, as shown, are equal in number to the steam-supply passages and opposite the same. The said cocks have connected thereto the links 51, which are connected to the intermediately-pivoted lever 52, which is provided with the arm 53, which extends upwardly over the cylinder and is connected to the intermediately-pivoted lever 39, and thus the levers are rigidly connected so that they may be operated together. Said arm 53 is provided with an upwardly-extending operating-lever 54, which works against the segmental bar 55, carried by the upper end of the cylinder. The said exhaust-ports are so arranged in respect to the inlet-cocks that one inlet and one exhaust between each pair of rotary abutments is opened, so that the steam is passing in at one end and out at the opposite end when the steam is running in either direction.

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

1. A rotary engine, comprising a cylinder, rotary abutments arranged in pairs, steam-supply openings on opposite sides of said

abutments, and a rotary piston within the cylinder and having piston-heads carried thereby.

2. A rotary engine, comprising a cylinder, rotary abutments arranged in pairs and having recesses in their outer periphery, steam-supply openings in opposite sides of each pair of abutments, a rotary piston within the cylinder, piston-heads carried thereby, and adapted to enter said recesses in their outer periphery.

3. A rotary engine, comprising a cylinder, a piston therein, rotary abutments arranged in pairs and geared to the piston, said abutments having recesses therein, steam-supply pipes in communication with the cylinder on opposite sides of each pair of abutments and piston-heads carried by the piston and adapted to enter the recesses in the abutments to pass the same.

4. A rotary engine, comprising a cylinder, a piston therein, a steam-chest in communication with said cylinder, a rotary valve within the steam-chest and having two openings radially arranged, and means for closing the inner opening.

5. A rotary engine, comprising a cylinder, a piston therein, a steam-chest in communication with said cylinder by two ports, a rotary valve within the steam-chest and having two openings communicating with the opening in the chest, and outwardly-sliding gates carried by the valve for closing the inner opening for admitting steam to the cylinder for a longer or shorter period of time.

6. A rotary engine, comprising a cylinder, a piston therein, a steam-chest in communication with said cylinder by two ports arranged out of a radial line, a rotary valve within the steam-chest and having two openings radially arranged, and outwardly-sliding gates carried by the valve for closing the inner opening for admitting steam to the cylinder for a longer or shorter period of time.

7. A rotary engine, comprising a cylinder, a rotary piston therein, rotary abutments engaging the outer periphery of the piston and geared to the piston, piston-heads carried by the piston, a rotary valve for controlling the supply of steam to the cylinder, two series of radially-arranged openings carried by the valve and communicating with the steam-supply pipe, and means carried by the valve for closing or opening one of said series of openings, whereby the supply of steam is increased or decreased.

8. A rotary engine, comprising a cylinder, a rotary piston therein, rotary abutments engaging the outer periphery of the piston, piston-heads carried by the outer periphery of the piston, a steam-chest carried by the cylinder, steam-supply pipes in communication with the cylinder at one end and the opposite ends of said pipes having two communications out of a radial line, a rotary valve in

said steam-chest and having two series of openings therein, and means carried by said valve for opening or closing one of said series of openings.

5 9. A rotary engine, comprising a cylinder, a rotary piston therein, a steam-chest carried by the cylinder, steam-pipes connecting the cylinder and the steam-chest, said pipes hav-
10 ing two communications with the steam-chest, a rotary valve in said steam-chest and having two series of openings communica-
15 ting with the openings in the steam-pipe, and means carried by said valve for opening or closing one of said series of openings in the valve.

10. A rotary engine, comprising a cylinder, a rotary piston therein, a steam-chest carried by the cylinder, steam-pipes in communica-
20 tion with the cylinder, said pipes having two communications with the steam-chest, a rotary valve in said chest and closing said open-
25 ings, said valve having two series of openings communicating with the openings in the steam-pipes, and sliding gates adapted to open or close one of said series of openings, whereby the length of time of the admission of steam is changed.

11. A rotary engine, comprising a cylinder, a rotary piston therein, piston-heads carried
30 by the piston, rotary abutments carried by the cylinder and arranged in pairs, and having recesses therein to receive the piston-head to allow the same to pass, steam-sup-
35 ply pipes in communication with the cylinder on each side, of said pair of abutments, and means for admitting steam to either side of each pair of abutments for reversing the engine.

12. A rotary engine, comprising a cylinder,
40 a rotary piston therein, piston-heads carried by the piston, rotary abutments carried by the cylinder and arranged in pairs and having recesses therein to allow the pistons to pass, steam-supply pipes in communication
45 with the cylinder on opposite sides of each pair of abutments, valves controlling said pipes, and links connecting said valves and adapted to close the valves on one side of all of the pairs of openings and open the valves
50 on the opposite side or vice versa.

13. A rotary engine, comprising a cylinder, a piston therein, piston-heads carried by the piston, rotary abutments arranged in pairs and geared to the piston and having recesses
55 therein for allowing the piston-heads to pass, steam-supply pipes in communication with the cylinder on both sides of each pair of abutments, valves controlling said passage-ways, links connecting the valves, and so ar-
60 ranged that one passage-way for each pair of rotary abutments is open and one closed.

14. A rotary engine, comprising a cylinder, a piston therein, piston-heads carried by the piston, rotary abutments arranged in pairs
65 and geared to the piston and having recesses

therein for allowing the piston-heads to pass, steam-supply pipes in communication with the cylinder, a steam-chest carried by the cylinder and in communication with the said supply-pipes at two points, a rotary valve in
70 the steam-chest and having two series of openings registering with the communica- tions with the supply-pipes, and sliding gates carried by the rotary valve and adapt-
75 ed to close one of said series of openings, whereby the steam-supply to the cylinder is increased or decreased.

15. A rotary engine, comprising a cylinder, a piston therein, piston-heads carried by the piston, rotary abutments within the cylinder
80 and having recesses to allow the piston-heads to pass, a steam-chest carried by the cylinder, pipes in communication with the cylinders and having their inner ends curved and hav-
85 ing two series of openings circumferentially arranged and out of a radial line with each other, a rotary valve within the chest and closing said openings, said valve having two series of circumferentially-arranged openings adapted to register with the openings in the
90 pipes, and sliding gates carried by the rotary valve and adapted to close the inner series of openings carried by the valve.

16. A rotary engine, comprising a cylinder, a piston therein, piston-heads carried by the
95 piston, rotary abutments within the cylinder and having recesses to allow the piston-heads to pass, a steam-chest carried by the cylinder, pipes in communication with the cylinder on each side of the abutments and having their
100 inner ends curved and having two series of openings circumferentially arranged and out of a radial line with each other, a rotary valve within the chest and closing said openings, said valve having two series of circumferen-
105 tially-arranged openings arranged in a radial line, whereby one of said series of openings registers with one series in the chest, and sliding gates carried by the rotary valve and adapted to close the inner series of openings
110 carried by the valve, links connected to the gates and having their outer ends connected to a sleeve slidably mounted upon the engine-shaft but held against rotation, and means carried by the sleeve for sliding the
115 same on the shaft, whereby the gates are moved in or out over said openings.

17. A rotary engine, comprising a cylinder, a piston therein, a steam-chest having two series of circumferential communications
120 with the cylinder out of a radial line, a rotary valve within the chest and having two series of radially-arranged openings communicating with the openings in the chest, and means carried by the valve for closing the inner se-
125 ries of openings.

18. A rotary engine, comprising a cylinder, a piston therein, a steam-chest having two series of circumferential communications
130 with the cylinder out of a radial line, a rotary

valve within the chest and having two series of radially-arranged openings communicating with the openings in the chest, and sliding valves carried by the valve for closing the inner series of openings.

19. A rotary engine, comprising a cylinder, a piston therein, a steam-chest having two series of circumferential openings out of a radial line, pipes leading from the cylinder to the outer series of openings and having their lower ends turned laterally and in communication with the inner series of openings, a ro-

tary valve within the chest and having two series of radially-arranged openings adapted to alternately register with the two series of openings in the steam-chest, and sliding valves carried by the rotary valve for closing the inner series of openings.

In testimony whereof I affix my signature in presence of two witnesses.

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Witnesses:

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FRED L. JOHNSON.