No. 679,689. Patented July 30, 1901.

E. L. SPENCER.

ROTARY ENGINE.

(Application filed Feb. 14, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

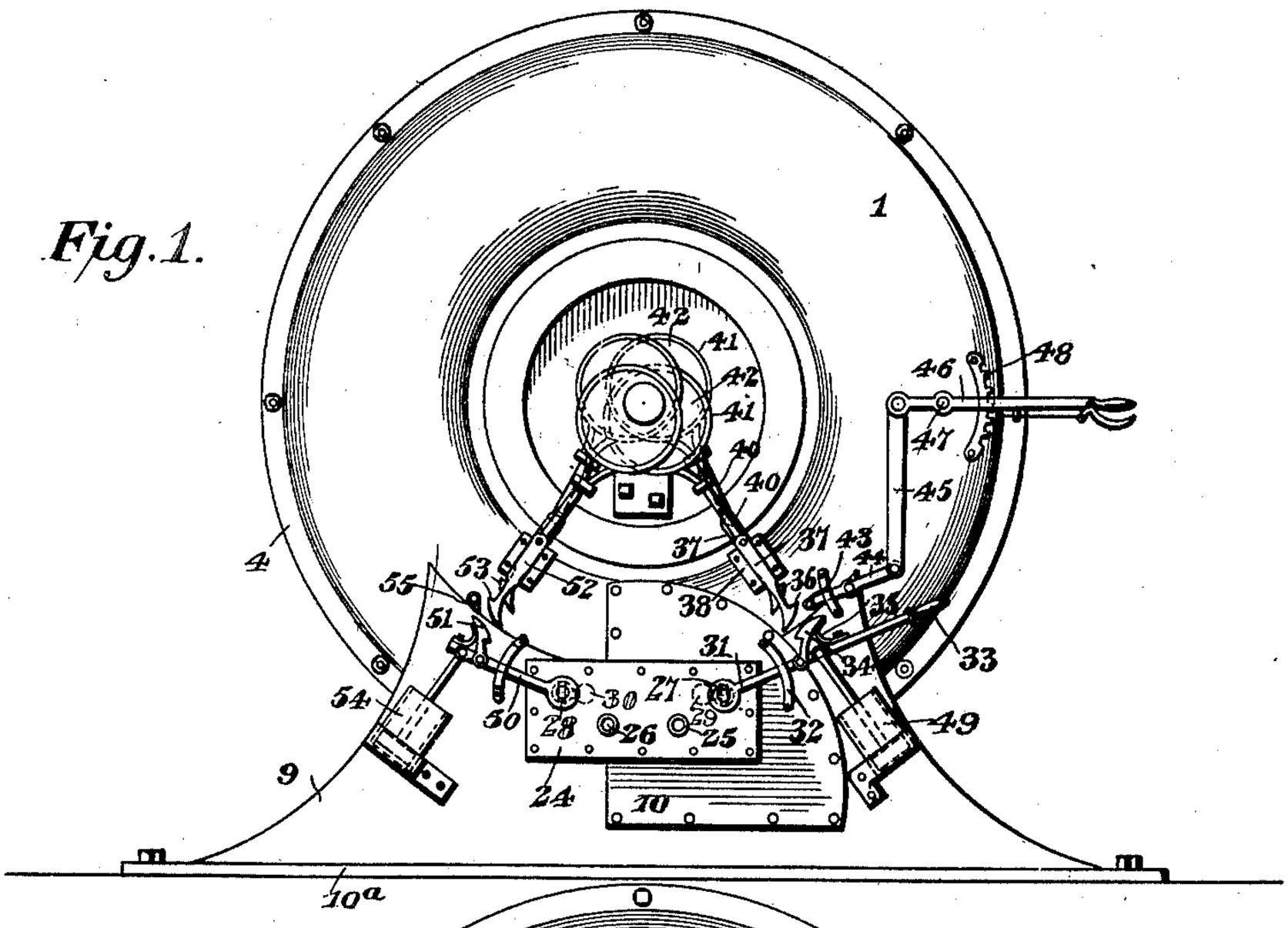

Fig. 2.

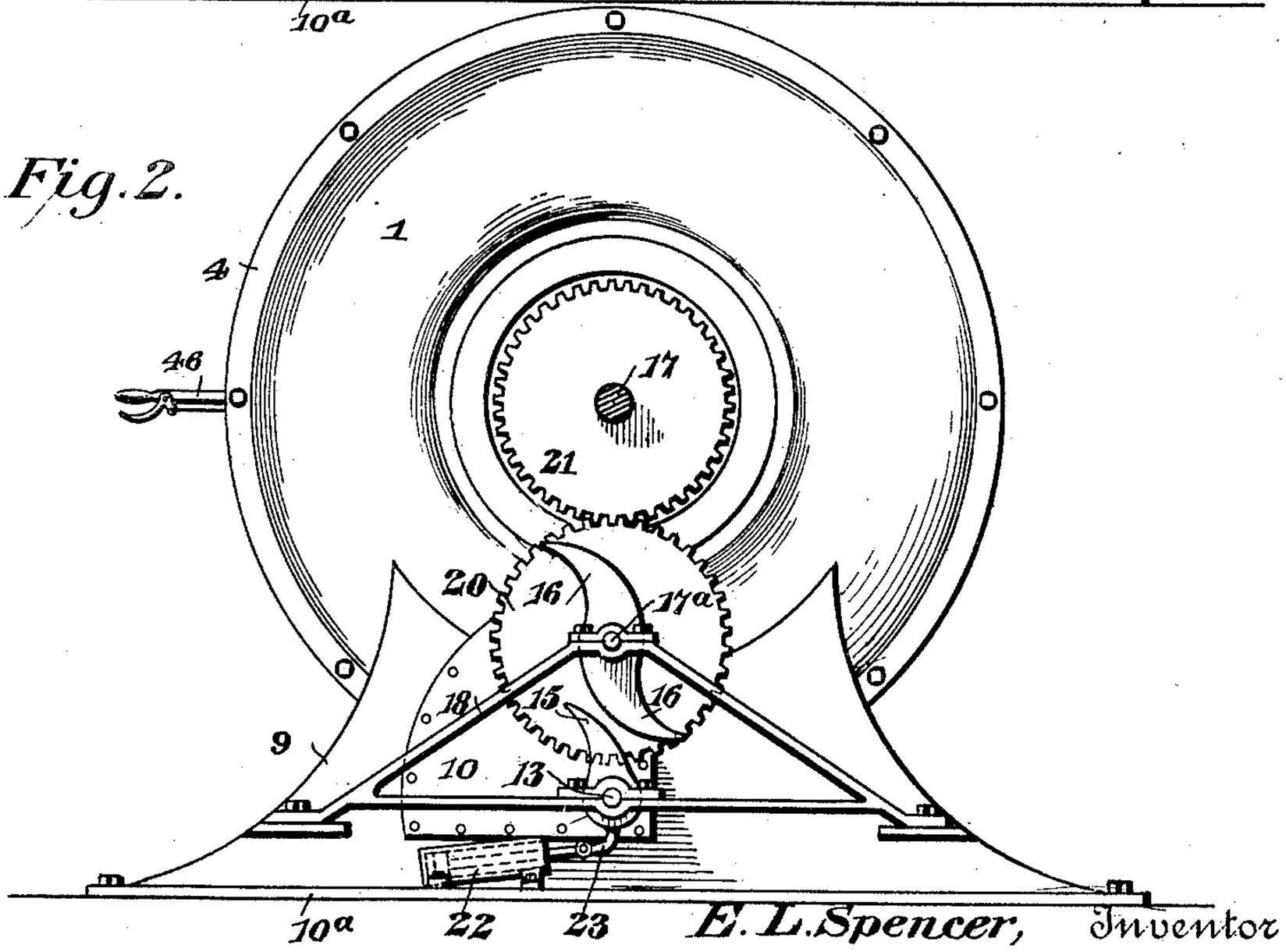

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Fig. 3.

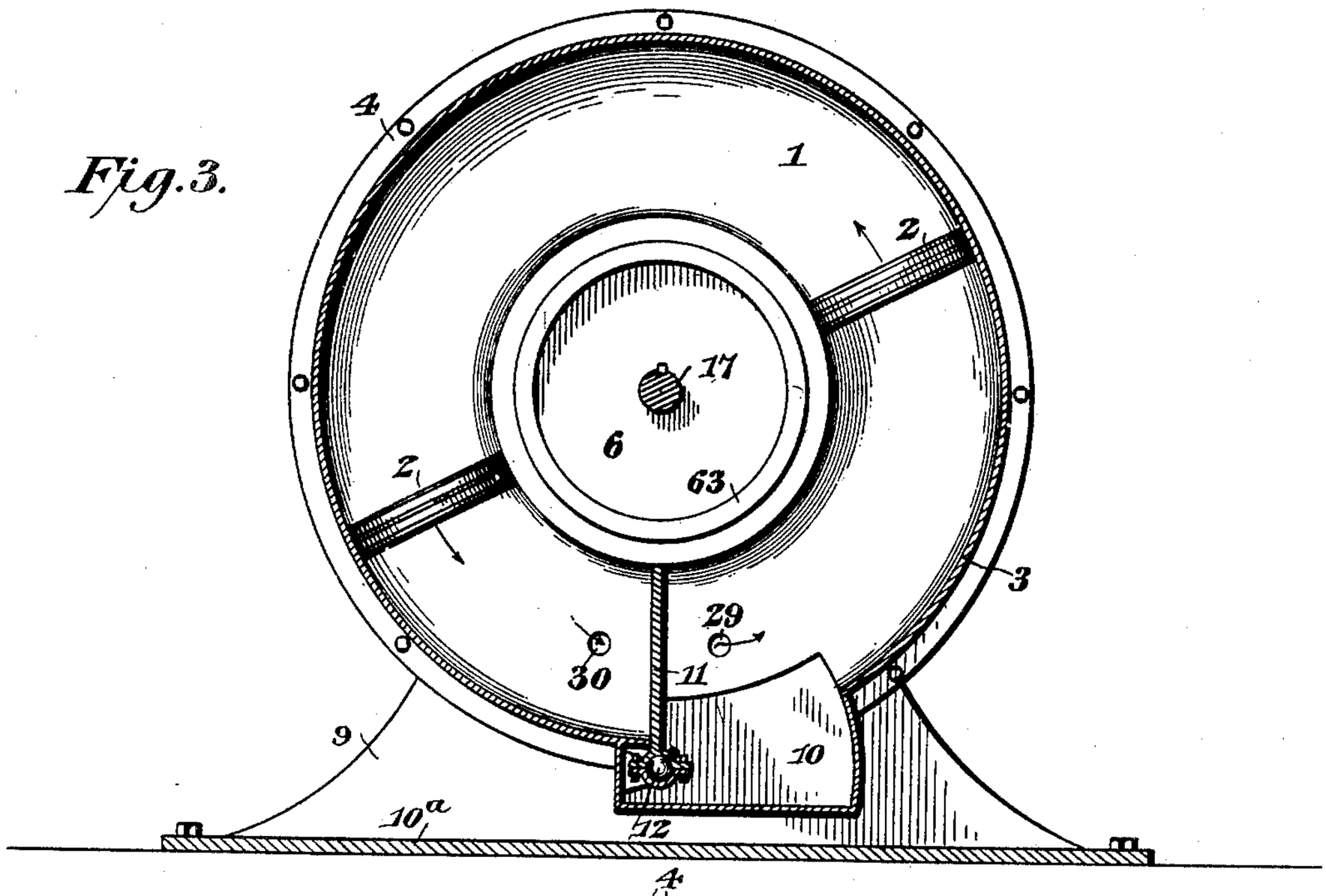


Fig. 4.

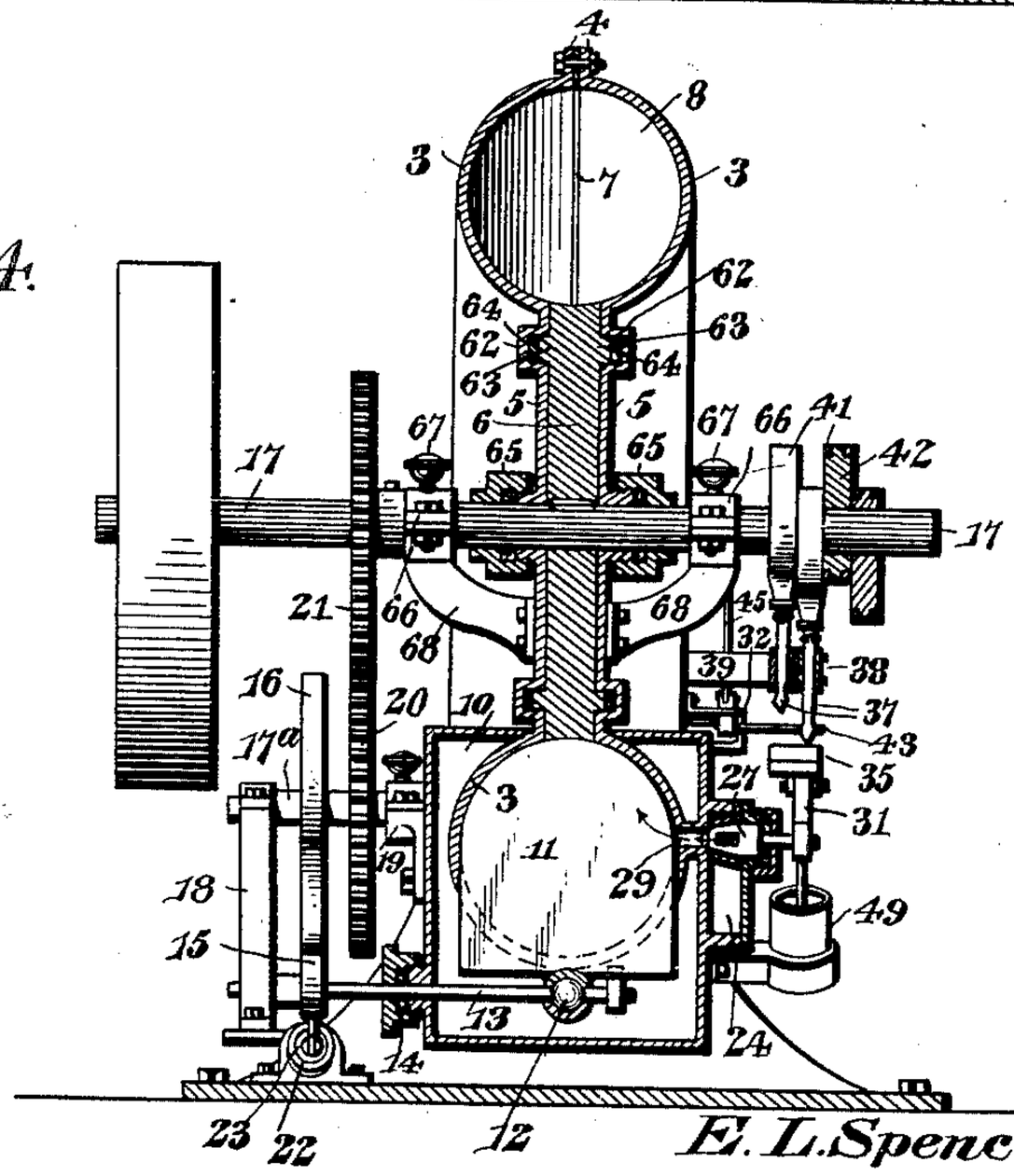
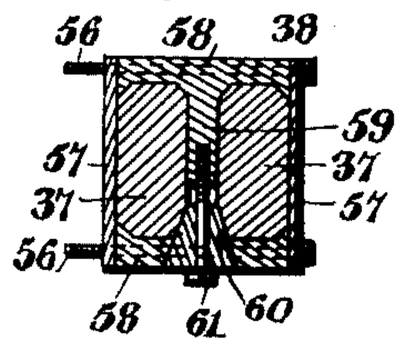


Fig. 5.



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UNITED STATES PATENT OFFICE.

EDWIN L. SPENCER, OF CANON CITY, COLORADO, ASSIGNOR OF ONE-HALF TO WILLIAM H. DYER, OF SAME PLACE.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 679,689, dated July 30, 1901.

Application filed February 14, 1901. Serial No. 47,289. (No model.)

To all whom it may concern:

Be it known that I, EDWIN L. SPENCER, a citizen of the United States, residing at Canon City, in the county of Fremont and State of Colorado, have invented a new and useful Rotary Engine, of which the following is a specification.

This invention relates to steam-engines of the rotary class, employing a continuously-rotated piston-head actuated by the expansion of steam admitted at a suitable point and in the required quantity and adapted to propel the piston around within the cylinder, provision being made at the same time for periodically exhausting the spent steam.

One of the principal objects of the present invention is to provide, in connection with the steam-cylinder and rotary piston-head, a division-head, which prevents the steam from passing entirely around the cylinder and when in position forms one end of the chamber in which the steam expands for acting upon the piston-head, the said division-head being mounted to oscillate within the cylinder and being geared to the driving-shaft in such manner as to be thrown downward or moved out of the way as the piston-head approaches, so as to allow the piston-head to pass thereby. Associated with the cylinder and division-head are steam inlet and exhaust devices, which are also geared to the driving-shaft in such manner as to be opened and closed thereby at the proper time to admit the steam to the cylinder and allow the same to exhaust therefrom in advance of the piston-head.

Another object of the invention is to provide, in connection with the steam-supply valve, a tripping device which, in connection with the pneumatic recoil serves to close the valve quickly, the said tripping device being adjustable by means of a hand-lever, so that the steam may be admitted to the cylinder in any desired quantity, according to the work required of the engine and other conditions.

With these and other objects in view, which will more fully appear as the nature of the invention is described, the invention consists in the novel construction, combination, and arrangement hereinafter fully set forth, illustrated, and claimed.

In the accompanying drawings, Figure 1 is a side elevation of a rotary engine constructed in accordance with the present invention, showing the steam supply and exhaust mechanism, the tripping devices, and the trip-adjusting means. Fig. 2 is a similar view taken from the opposite side and showing the operating mechanism for the division-head. Fig. 3 is a central vertical longitudinal section through the engine, showing the division-head in its operative position. Fig. 4 is a central vertical cross-section through the engine. Fig. 5 is a detail section showing one set of parallel slides, the guides therefor, and the means for taking up wear between said parts.

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

The rotary engine contemplated in this invention comprises, essentially, a cylinder 1, one or more piston-heads 2, steam inlet and exhaust mechanism, and a division-head for dividing the interior of the cylinder and forming an abutment between which and one of the piston-heads the steam is admitted and allowed to expand for driving the piston-heads. The cylinder is of annular form, as illustrated particularly in Figs. 3 and 4, and is preferably composed of the heads 3, which are of corresponding shape and provided with peripheral flanges 4, by means of which they are securely bolted together. The central portions of the cylinder-heads are in the form of flat disks 5, arranged in parallel relation to each other, as shown in Fig. 4, but spaced apart sufficiently to receive between them and admit of the rotation of the disk-shaped hub or central portion 6 of the piston, the hub being provided at diametrically opposite points with the radial projecting piston-heads 2, each of which is of disk form to fit accurately within the cylinder. Each piston-head is preferably composed of parallel members or side plates, suitably bolted together upon opposite sides of an interposed packing 7, thereby serving to spread the packing and secure a steam-tight joint within the steam-chamber of the cylinder. The cylinder-heads adjacent to their peripheries are of semicircular form in cross-section, so that when brought together they form an annular steam-

chamber 8, around and within which the piston-heads 2 are mounted to revolve as they are actuated upon by the expansion of the steam. The cylinder is mounted upon a pedestal or base 9, suitably flanged at its bottom to form a bed-piece 10, adapted to rest upon or be secured to a floor or other suitable support.

The cylinder 1 adjacent to its bottom is provided with a quadrant-shaped extension or enlargement, forming a box or chamber 10, in which is received an oscillatory division-head 11, the free edge of which corresponds as closely as possible with the inner contour of the steam-chamber of the cylinder, as shown in Fig. 4, and forms a movable partition or cut-off, against which the steam is adapted to expand in actuating one or the other of the piston-heads. The box or chamber 10 forms a pendent continuation or extension of the cylinder, so as to allow the division-head 11 to fold downward into the same and pass entirely outside of the plane of the steam-chamber of the cylinder in order to allow the piston-heads to pass by the division-head at the proper time. Said division-head is connected by a ball-joint 12 at its lower edge to a rock-shaft 13, mounted in suitable bearings on the frame of the engine, the said shaft passing through a stuffing-box 14, mounted on the side of the box or chamber 10 and having secured rigidly thereon exterially of the chamber 10 a dog 15, which under the preferred embodiment of this invention normally projects upward into the path of a double cam 16, mounted fast on a rotary counter-shaft 17, arranged parallel to the rock-shaft 13 and the main driving-shaft 17 of the engine. The counter-shaft 17 is mounted on a pedestal 18 at one side of the engine and also in a bearing 19 at one side of the extension box or chamber 10, and in addition to the double cam 16 said shaft has rigidly mounted thereon a spur gear-wheel 20, which meshes with a second spur gear-wheel 21, of the same size and number of teeth, the last-named gear-wheel being mounted fast on the main driving-shaft 17 of the engine.

It will be observed from the foregoing description that the counter-shaft is driven at exactly the same speed as the main driving-shaft of the engine and that the double cam 16 in each complete revolution of the driving-shaft operates twice upon the dog 15, throwing said dog downward and correspondingly depressing the division-head 11 for permitting the two piston-heads to pass by the space occupied by the division-head. After the piston-heads pass by the division-head the latter is quickly returned to its operative position, as illustrated in Fig. 3, by means of a pneumatic recoil 22 engaging the crank arm or extension 23 on the rock-shaft 13, the said pneumatic recoil being supported in convenient position upon the bed of the engine, the air in the recoil-cylinder being compressed between its outer end and a piston therein when the dog 15 is rocked by the two-throw cam 16, so that when a member of the cam has passed the dog the air in the cylinder will operate automatically to return the division-head to its normal position.

Arranged at one side of the engine is the steam-chest 24, having in communication therewith the steam inlet or supply pipe 25 and the exhaust-pipe 26, which pipes communicate with the steam supply and exhaust valves 27 and 28, respectively. These valves are mounted to oscillate within their seats and are in communication, respectively, with an inlet-port 29 and an exhaust-port 30, located, as shown in Fig. 3, at opposite sides of the division-head when in its upright operative position.

Referring now particularly to the inlet-valve 27, it will be seen that the stem or shank of said valve has rigidly connected thereto an operating-lever 31, which works in a suitable guide 32 at the side of the engine and is provided with an operating-handle 33. The lever is also provided intermediate of its ends with a spring-pressed catch 34, which is pivotally mounted on the lever and held upward by means of a spring 35, so as to be readily engaged by one or the other of a pair of hooks 36 on the extremities of a pair of slides 37, mounted in guides 38 at the side of the engine and carried by the outer end of an off-standing bracket 39. (Shown in Fig. 4.) The slides 37 have pivotally connected thereto the arms 40 of a series of eccentric-straps 41, which encircle a corresponding series of eccentrics 42, fast on the counter-shaft 17 of the engine, as shown in Fig. 1, the said eccentrics being arranged at different points on the shaft 17 and extending in different directions therefrom, so as to consecutively and progressively act upon the several slides of the valve-operating mechanism for the supply and exhaust valves, two of such slides and eccentrics being employed for the inlet or supply valve and a corresponding number of similar elements for the exhaust-valve. As the slides 37 are pushed downward the beveled extremities of the hooks on the slides serve to push aside the catches 34, which are upheld by the springs 35, and said hooks 36 snap into engagement with shoulders on the catches 34, so that upon the return movement of any one of the slides 37 the lever 31 is raised, and this movement of the lever operates to open the inlet or supply valve 27 and admit steam to the cylinder. In its upward movement the catch 34 is released or disengaged from the hook 36 by means of a tripping device 43 in the form of a pin or rod extending laterally at one side of the engine and carried by a lever 44, fulcrumed intermediate of its ends and connected by means of a link 45 with the inner end of a valve-trip-adjusting lever 46. The lever 46 is fulcrumed at 47 intermediate of its ends and is in the form of a thumb latch-lever, having a hand-operated latch which engages with a segmental rack 48, attached to any convenient part of the engine, as shown

in Fig. 1. By moving the lever 46 in one direction or the other the tripping device 43 may be moved nearer to or farther from the beveled extremity of the catch 34, so as to operate at the desired moment on the catch for tripping the latter and throwing it out of engagement with the ascending hook 36, whereupon the lever is immediately and quickly retracted by means of a pneumatic recoil 49, mounted on the base of the engine. The exhaust-valve 28 is operated by similar devices, comprising a lever 50, connected to the valve-stem, a catch 51, connected with the lever, eccentric-operated slides 52, having terminal hooks 53, and a pneumatic recoil 54 for retracting the lever. As it is not necessary to adjust or regulate the throw of the exhaust-valve, I provide a stationary tripping device 55, with which the catch comes in contact at a certain point in its upward movement.

It is to be understood that eccentrics are so arranged upon the main driving-shaft of the engine that they will operate upon the slides in a manner to cause them to lift the valve-controlling levers at the proper times to open said valves, and thus make provision for the admission and exhaust of the steam to and from the steam-chamber of the cylinder. The steam is of course admitted to the cylinder just after the division-head has been returned to its upright operative position, so that the steam in expanding will drive the adjacent piston-head around the cylinder, and in the same manner the exhaust-valve is opened by one of the slides at the proper time to allow the dead steam to pass out.

The guides 38, in which the slides 37 move, are connected by bolts or screws 56 to the brackets 39, and each guide is adapted to receive and admit of the movement of two of such slides, as shown in Fig. 5, the said guide comprising the side walls 57 and the end walls 58 and in addition thereto a central division-wall or web 59, which separates the guide into two parts, each of which is adapted to receive one of the slides 37. The central web 59 is cut away in order to receive the wedge 60, which is inserted through a correspondingly-shaped opening in one of the end walls 58 and held in place and also rendered adjustable by means of a wedge-adjusting screw 61 passing through the wedge and engaging an internally-threaded socket in the web or division-wall 59, as clearly illustrated in Fig. 5. By adjusting the wedge 60 inward the wear which has taken place on the slides may be compensated for and the parts prevented from rattling.

In order to provide a tight joint between the hub 6 and sides or heads 5 of the casing, said heads are provided with laterally-projecting annular offsets 62, in which are received annular ribs or projections 63 on the hubs 6. The said annular offsets 62 form receptacles for a pair of packing-rings 64, which are interposed between the opposite faces of the ribs 63 and offsets 62, thus preventing the steam from passing between the inner surface of the cylinder-heads and the opposite side faces of the disk-shaped hub 6 of the piston-heads. The cylinder-heads also have attached to opposite sides thereof stuffing-boxes 65, through which the main driving-shaft 17 passes. Said shaft is journaled in bearings 66, provided with oil-cups 67 and mounted upon oppositely-projecting brackets 68, connected for convenience to the cylinder-heads, as shown in Fig. 4.

While the improvement hereinabove described may be employed in connection with a single piston-head, it is preferred to employ a pair of oppositely-located piston-heads and to connect the division-head with the main driving-shaft of the engine by gearing which will throw down the division-head twice in each complete revolution of the driving-shaft. The particular mechanism for effecting the operation of the division-head at the proper intervals may be varied in details, as also the mechanism for opening and tripping the supply and exhaust valves, and the division-head may be duplicated at the top of the cylinder, or, in other words, two division-heads may be employed. I do not therefore desire to be limited to the exact details of construction and arrangement of parts hereinabove set forth and accordingly reserve the right to change, modify, or vary the construction within the scope of this invention.

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

1. In a rotary engine, an annular steam-cylinder, a rotary piston-head therein, an oscillatory division-head, a driving-shaft, steam supply and exhaust mechanism, a two-throw cam actuated from the piston-head, a dog arranged in the path of travel of the said cam, and connections between the dog and the division-head, whereby the division-head is caused to be depressed twice in each complete revolution of the driving-shaft.

2. In a rotary engine, an annular steam-cylinder, a rotary piston-head, a driving-shaft, steam supply and exhaust mechanism, a two-throw cam actuated from the piston-head, a dog arranged in the path of travel of said cam, an oscillatory division-head, connections between the dog and the division-head, whereby the division-head is caused to be depressed twice in each complete revolution of the driving-shaft, and automatically-operating means for returning the division-head to its normal position.

3. In a rotary engine, an annular steam-cylinder, a rotary piston-head therein, an oscillatory division-head, a driving-shaft, steam supply and exhaust mechanism, a two-throw cam actuated from the piston-head, a dog arranged in the path of travel of the said cam, connections between the dog and the division-head, whereby the division-head is caused to be depressed twice in each complete revolu-

tion of the driving-shaft, and a pneumatic recoil connected by interposed mechanism with the division-head to cause the same to resume its normal position after having been depressed by the cam.

4. In a rotary engine, an annular steam-cylinder, a driving-shaft, oppositely-arranged rotary piston-heads mounted on the driving-shaft, an oscillatory division-head, steam supply and exhaust mechanism, a shaft bearing a two-throw cam, gear connection between the latter shaft and the driving-shaft, a dog mounted in the path of movement of the cam, interposed mechanism connecting the dog and the division-head, and a pneumatic recoil also coacting with the division-head.

5. In a rotary engine, an annular steam-cylinder, a driving-shaft, a rotary piston-head thereon, an oscillatory division-head, steam supply and exhaust mechanism, a counter-shaft geared to the driving-shaft, and means whereby the counter-shaft is adapted to intermittently operate the division-head.

6. In a rotary engine, an annular steam-cylinder, steam supply and exhaust mechanism, a driving-shaft, a rotary piston-head thereon, an oscillatory division-head, a dog connected with the division-head, and a two-throw cam operated by the driving-shaft and coöperating with the dog for intermittently operating the division-head.

7. In a rotary engine, an annular steam-cylinder, steam supply and exhaust mechanism, a driving-shaft, a rotary piston-head thereon, an oscillatory division-head, a dog connected with the division-head, and a two-throw cam operated by the driving-shaft and coöperating with the dog to produce two full movements of the division-head for each revolution of the driving-shaft.

8. The combination with the driving-shaft of a rotary engine, and the steam-supply valve for the cylinder, of a lever connected with said valve, a catch carried thereby, a pair of slides operatively connected with the driving-shaft, a double guide in which the slides move, a wedge for taking up wear on the slides, and means for adjusting said wedge.

9. In a rotary engine, the combination with valve opening and closing mechanism, comprising a pair of parallel slides operated by the driving-shaft of the engine, of a double guide in which the slides move, said guide comprising a frame having an intermediate web which lies between the slides, a wedge movable through one side of the guide, and an adjusting-screw passing through the wedge into the web, said parts being combined and arranged substantially as and for the purpose specified.

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

EDWIN L. SPENCER.

Witnesses:
W. A. SANFORD,
J. C. HOWELLS.