No. 720,598. PATENTED FEB. 17, 1903.

R. MAY.

ROTARY ENGINE.

APPLICATION FILED JULY 31, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 2.

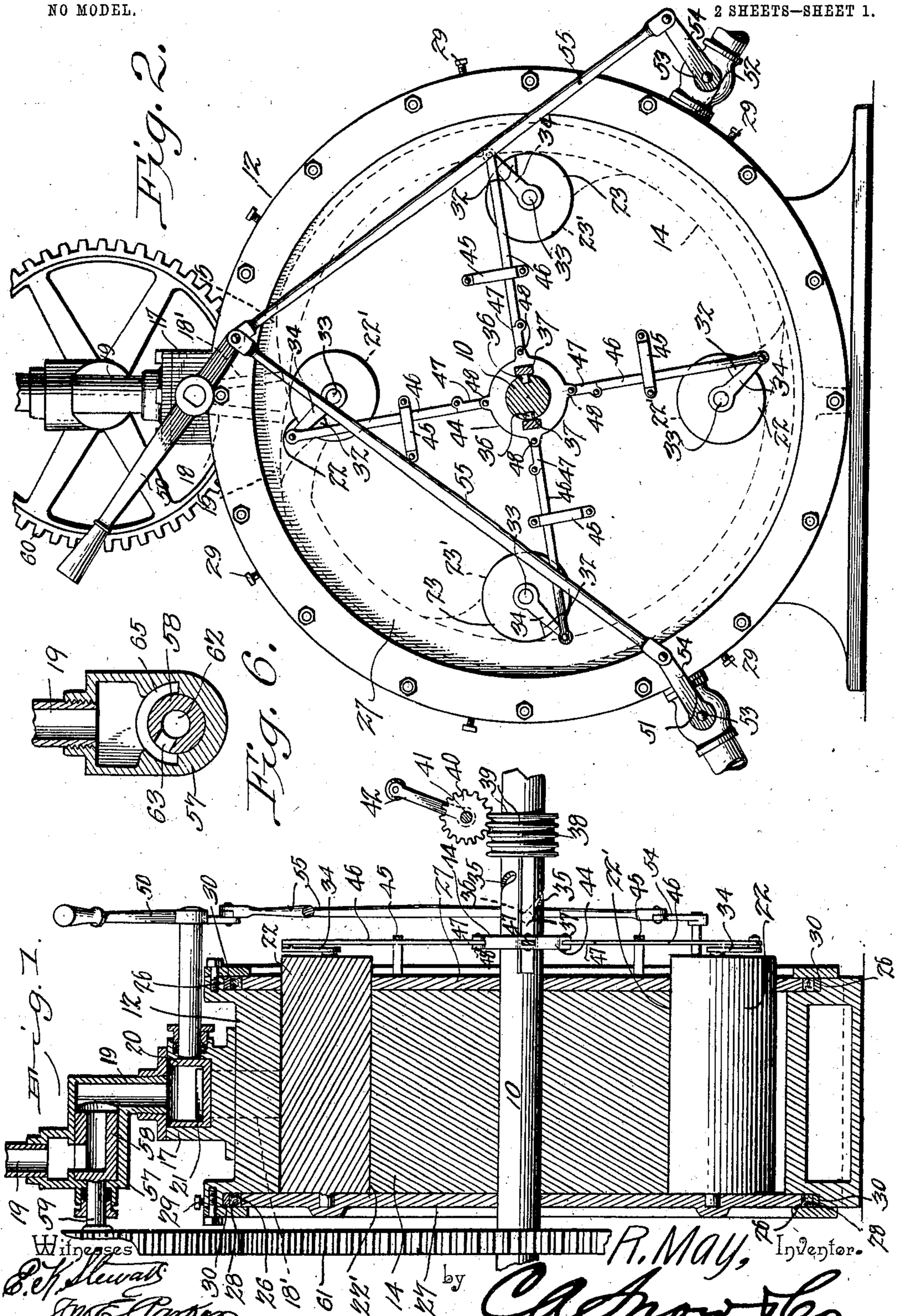

Fig. 6.

Fig. 7.

Witnesses
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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.

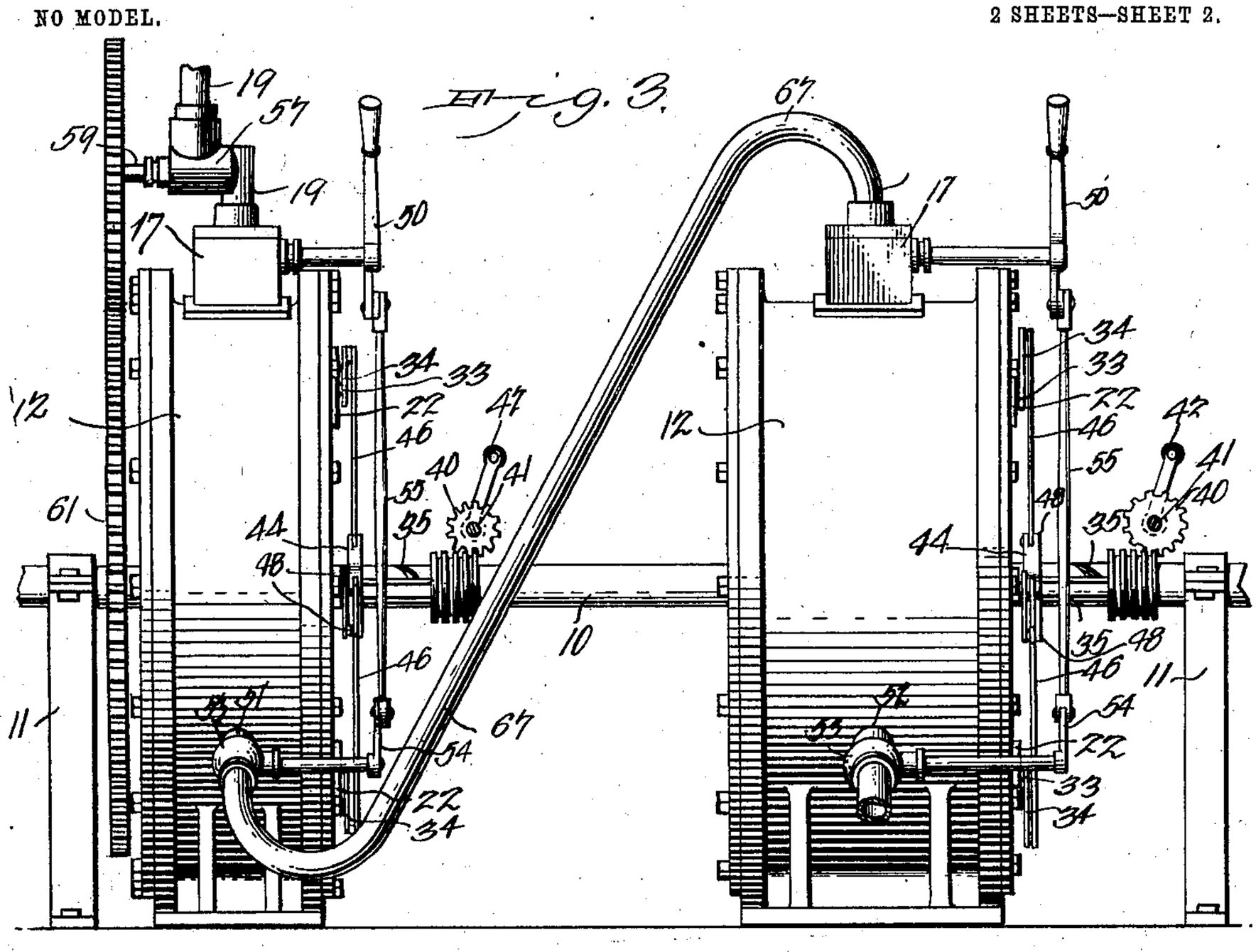


Fig. 4.

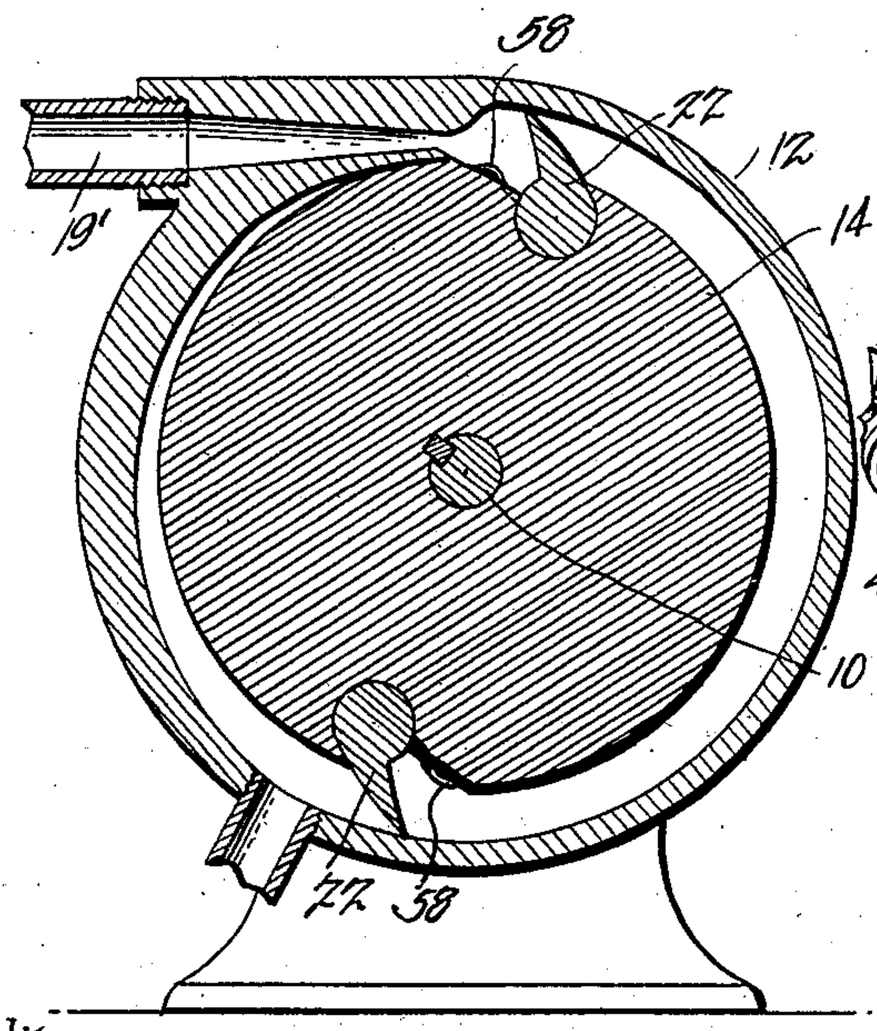
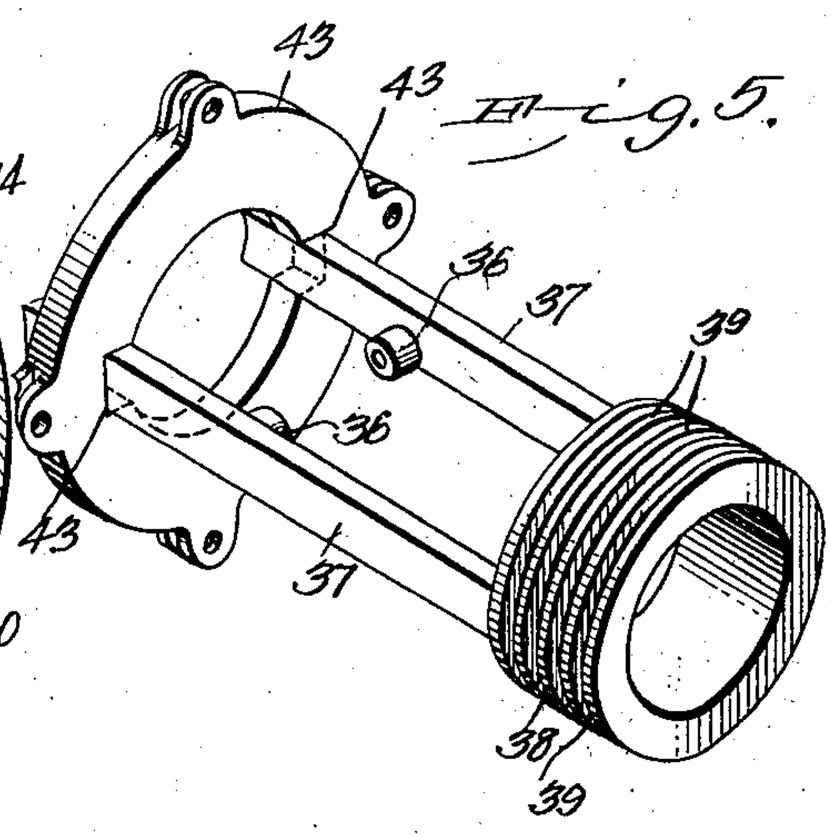


Fig. 5.



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UNITED STATES PATENT OFFICE.

REYNOLDS MAY, OF WHITEWRIGHT, TEXAS.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 720,598, dated February 17, 1903.

Application filed July 31, 1902. Serial No. 117,852. (No model.)

To all whom it may concern:

Be it known that I, REYNOLDS MAY, a citizen of the United States, residing at Whitewright, in the county of Grayson and State of Texas, have invented a new and useful Rotary Engine, of which the following is a specification.

This invention relates to certain improvements in rotary engines, and has for its principal object to construct an improved form of engine in which a plurality of pivoted abutments are carried by the piston or drum and held out in operative position by the action of the steam, a further object being to so construct and arrange the inner wall of the cylinder and the abutments as to lessen the amount of wear and produce an easy-running high-speed engine.

A further object of the invention is to so construct and arrange the drum and abutments as to provide for the ready reversal of the engine, the active abutments when the drum is rotating in one direction being locked in inoperative position when the drum is rotating in the opposite direction.

A still further object of the invention is to provide a form of engine which may be used as a compound engine, a plurality of engines being mounted on the same shaft and the exhaust from the initial or high-pressure cylinder being conducted to the secondary or low-pressure cylinder.

With these and other objects in view the invention consists in the novel construction and arrangement of parts hereinafter described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims.

In the drawings, Figure 1 is a transverse sectional elevation of a rotary engine constructed in accordance with my invention. Fig. 2 is an end elevation of the same, illustrating the reversing-gear. Fig. 3 is an elevation illustrating a pair of engines connected to the same shaft, one of such engines being driven by the exhaust-steam of the other. Fig. 4 is a view of a form of non-reversible engine, illustrating a piston-drum provided with a single pair of wings or blades. Fig. 5 is a detail view of the reversing mechanism which it is preferred to employ. Fig. 6 is a detail sectional view of the cut-off.

Similar numerals of reference are employed to indicate corresponding parts throughout the several figures of the drawings.

In the construction illustrated in Fig. 1 the main shaft 10 is provided with supporting-bearings 11 and extends through the central portion of the cylinder 12, the greater portion of the inner wall of which is concentric with the shaft and forms an approximately annular steam-space for the working of the abutments. On the shaft is secured a cylindrical drum 14, which makes contact at one point with the inner wall of the cylinder, and from this point such inner wall extends on oppositely-curved lines 15 to the concentric portion of the cylinder-wall, the curvature being such that the two walls gradually merge into each other in order to afford a smooth surface for controlling the opening and closing movement of abutments carried by the drum and preventing any shock or noise due to the formation of an abrupt shoulder or angle at this point. The point of contact between the drum and the inner wall of the cylinder is such as to prevent the passage of steam from one side of the drum to the other, and in the cylinder is a steam-chest 17, having two ports 18 and 18′, leading, respectively, to the steam-space on opposite sides of such point of contact. The steam-chest is connected by a feed-pipe 19 to a boiler or other source of supply, and the flow through the ports 18 and 18′ is governed by a crescentric valve 20, arranged in the steam-shaft and having a single port 21, which may be brought into alinement with either of the cylinder-ports to control the direction of the engine or to stop the same.

In the periphery of the drum are formed two sets of recesses 22′ and 23′ for the reception of swinging abutments 22 and 23, respectively, said abutments having a substantially cylindrical pivotal portion adapted to fit in the recesses and provided with curved wings against which the steam impinges when the wings are projected into the steam-space between the drum and cylinder. The outer wall of each wing is curved on an arc corresponding to the curvature of the peripheral

wall of the drum and when in inoperative position remains flush with the surface of the drum. In the present instance I have shown each drum as provided with two pairs of oppositely-facing abutments and when the drum is rotating in one direction one pair will be free to move outwardly into contact with the inner wall of the cylinder, while the opposite pair will be locked in the receiving-recesses, and thus retained in inoperative position. When the direction of the engine is to be reversed, the inoperative abutments are unlocked, while the previously-operated abutments are forced into and locked within their receiving-recesses.

The cylinder proper is in the form of a stationary ring having near each end an annular groove 26, into which extend disks 27, secured to and rotating with the main piston or drum. In order to form a steam-tight joint between the disks and cylinder, I employ packing 28 in the annular grooves 26, such packing being held in place by screws 29, pressing on curved bars or plates 30, arranged in the inner portion of each of the grooves and adapted to force the packing into intimate contact with the disks.

The wing portions of the abutments are of a length equal to that of the main body of the piston or drum, terminating at the inner walls of the disk 27; but the cylindrical portions of each abutment extend through the disks at the opposite ends of the drum and are connected at one end to a reversing mechanism which serves to move one or other set of abutments to operative position.

To the end of each abutment is secured a projecting block 32, having one face on a radial line from the center of rotation of the abutment, and at the center of rotation is secured a stud or pin 33, on which is pivoted a lever 34, which may be moved into contact with the block 32 and adjust the abutment to inoperative position, with its wing seated wholly within the recess in the periphery of the piston.

In the main shaft or in a sleeve rigidly secured thereto are a pair of helical grooves 35, into which extend studs 36, mounted on arms 37, projecting from a revoluble sleeve 38, mounted on shaft. The sleeve is provided with a plurality of parallel ribs 39, forming gear-teeth adapted to engage with a pinion 40, mounted on a shaft 41, adapted to suitable bearings on the supporting-frame and provided with an operated handle 42. The turning of the gear 40 will move the sleeve 38 longitudinally of the shaft without regard to the circumferential position of the latter, and the sleeve will be rotated on the shaft by reason of the engagement of the studs 36 in the helical grooves 35. The arms 37 extend through guiding-slots 43 in a loose ring 44, carried by the shaft, said arms serving to rotate the ring, but being movable longitudinally without effecting the corresponding movement of said ring. On one of the end disks 27 of the drum are guides 45 for the reception of rods 46, connected at one end to the arms 34, and at the opposite end being connected by links 47 to lugs 48 or the ring 44. When the engine is to be reversed, the gear 40 is rotated in the proper direction, causing a longitudinal movement of the sleeve 38. The engagement of the studs 36 in the helical grooves 35 causes a partial rotation of the sleeve and the ring 44 and draws all of the connecting-rods 46 and the arms 34 in the direction of the shaft or forces them away from the shaft in accordance with the initial position. If the parts be arranged as illustrated in Fig. 2 and the various arms be drawn in the direction of the shaft, said arms will engage with the blocks 32 of the abutments 23 and will draw said abutments into the recesses of the drum or piston. At the same time the corresponding arms 34 of the opposite pair will be moved out of contact with the blocks 32 of the abutments 22 and will permit the latter to assume operative position. The arms are moved to a position somewhat below the greatest inward position of the blocks 32 and permit free movement of the abutments and blocks as the abutments follow the contour of the cylinder.

When the position of the abutments is changed, it is also necessary to change the position of the valve 20, a reversing-lever 50 being secured to one end of the valve for this purpose.

The exhaust takes place at approximately two-thirds of the stroke, and in the wall of the cylinder are two exhaust-ports 51 and 52, controlled by valves 53, either of which may be opened to permit the escape of steam. Each valve 53 is secured to an operating-arm 54, and the latter are connected by rods 55 to the lever 50, so that when one of the exhaust-ports is opened the other will be closed, the proper exhaust-port being opened by the movement of the lever in shifting the crescentric valve 20.

In order to operate the engine without permitting the continuous flow of steam through the cylinder, I preferably employ a cut-off of the character more clearly shown in Figs. 1 and 6. In the main steam-supply pipe 19, leading to the reversing-valve member, is placed a valve-casing 57, in which is arranged a revoluble valve 58, provided with a stem 59, extending out to a suitable stuffing-box in the valve-chamber, provided at its outer end with a pinion 60, intermeshing with a gear-wheel 61, carried by the main shaft 10, the gear-wheel being twice the diameter of the pinion, so that the valve will be revolved twice for each single revolution of the piston. The valve is provided with a longitudinally-disposed steam-passage 62, connected to radial ports 63, leading to the periphery of the valve, and the valve-casing is provided with a curved slot 65, extending around about one-

half of the circumference of the valve in order to supply steam to the valve and engine during one-half of a revolution of the valve and one-quarter of a revolution of the piston. The valve is so timed as to start the admission of steam to the cylinder each time one of the abutments passes one of the steam-passages 18 or 18′ and to continue to supply steam thereto until the piston has moved through about one-quarter of a revolution, the steam being then cut off and acting expansively in the cylinder. The valve may be so constructed and operated that steam will be supplied during one-third or any other desired part of a revolution or the construction may be modified to meet any special requirements.

In Fig. 3 is illustrated a compound engine in which two drums are arranged on the same shaft and the exhaust from the high-pressure cylinder is conducted to the steam-chest of the larger low-pressure cylinder through a connecting-pipe 67, the expansive force of the steam being fully utilized.

Fig. 4 illustrates a simple form of non-reversing engine in which only a single pair of pivotal abutments are arranged on the drum, and in this case the steam-inlet port 19′ is arranged tangentially to the periphery of the drum in order to act with better effect on the abutments. In this construction, as well as in the construction previously described, it is preferred to employ small springs 58 for moving the abutments out from the receiving-recesses, it being necessary to employ some means for effecting an initial outward movement of the abutments in order that steam may act thereon.

While the construction herein described, and illustrated in the accompanying drawings, is the preferred form of the device, it is obvious that various changes in the form, proportions, size, and minor details of the structure may be made without departing from the spirit or sacrificing any of the advantages of the invention.

Having thus described my invention, what I claim is—

1. The combination in a rotary engine, of the cylinder, a revoluble drum therein, two sets of movable piston-heads or abutments carried by the drum, and a locking and releasing device arranged externally of the cylinder and adjustable to lock either set of piston-heads in inoperative position and to release the other set for operative movement.

2. The combination in a rotary engine, of the cylinder having annular grooves adjacent to the opposite ends thereof, a revoluble drum mounted in the cylinder and provided with peripheral recesses, disks secured to the ends of the drum and extending into said grooves, movable abutments adapted to the recesses and having end portions projecting through said disks, said abutments being arranged in sets and operable respectively in opposite directions, and means for locking one or other of the sets of abutments in inoperative position.

3. The combination in a rotary engine, of the cylinder having annular grooves near its opposite ends, a drum disposed in the cylinder, end disks forming a part of the drum and adapted to said annular grooves, oppositely-facing piston-heads or abutments carried by the drum and operable respectively in opposite directions, projecting blocks carried by the abutments at the outer face of the drum, arms pivoted to the abutments and adapted to engage with such block to lock either set of abutments in inoperative position, and a reversing mechanism operatively connected to all of said arms.

4. The combination in a rotary engine, of the cylinder having annular grooves near its opposite ends, a drum disposed in said cylinder and provided with peripheral recesses, oppositely-facing piston-heads or abutments arranged in said recesses and having projecting wing portions of a length approximately equal to the length of the drum, end disks secured to the piston or drum and fitting within said grooves, said disks having openings for the passage of the pivotal portions of the piston-heads or abutments, blocks secured to said abutments, arms pivoted on the abutments and adapted to engage said blocks, a main shaft carrying the drum and provided with a helical groove or grooves, a sleeve mounted on the shaft and having a plurality of annular grooves, an operating-gear engaging said sleeve, arms secured to the sleeve and adapted to the helical grooves of the shaft, a recessed ring mounted on the shaft and adjustable circumferentially thereof by said arms, and connecting rods and links extending from said ring to the pivoted arms, substantially as specified.

5. The combination in a rotary engine, of the cylinder, a drum arranged therein and provided with peripheral recesses, oppositely-facing abutments arranged in said recesses and adapted for operative movement respectively in opposite directions, and a manually-adjustable locking and releasing device arranged externally of the cylinder for simultaneously locking one set of abutments in inoperative position and for releasing the opposite set of abutments and permitting the same to assume operative positions, substantially as specified.

6. The combination in a rotary engine, of the cylinder, a revoluble drum therein, oppositely-facing piston-heads carried by said drum and adapted to operate respectively in opposite directions, a steam-chest, steam-ports extending therefrom to different portions of the cylinder, a valve arranged in the steam-chest and having a port movable into alinement with either of the cylinder-ports for

reversing the direction of movement of the engine, a pair of exhaust-ports arranged at opposite sides of the cylinder, valves for governing the escape of steam through said ports, and means for connecting both of said valves to the steam-valve, 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.

REYNOLDS MAY.

Witnesses:
A. D. CAGE,
W. P. Z. GERMAN.