No. 669,447. Patented Mar. 5, 1901.

W. M. PIATT.

ROTARY ENGINE.

(Application filed Dec. 7, 1900.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

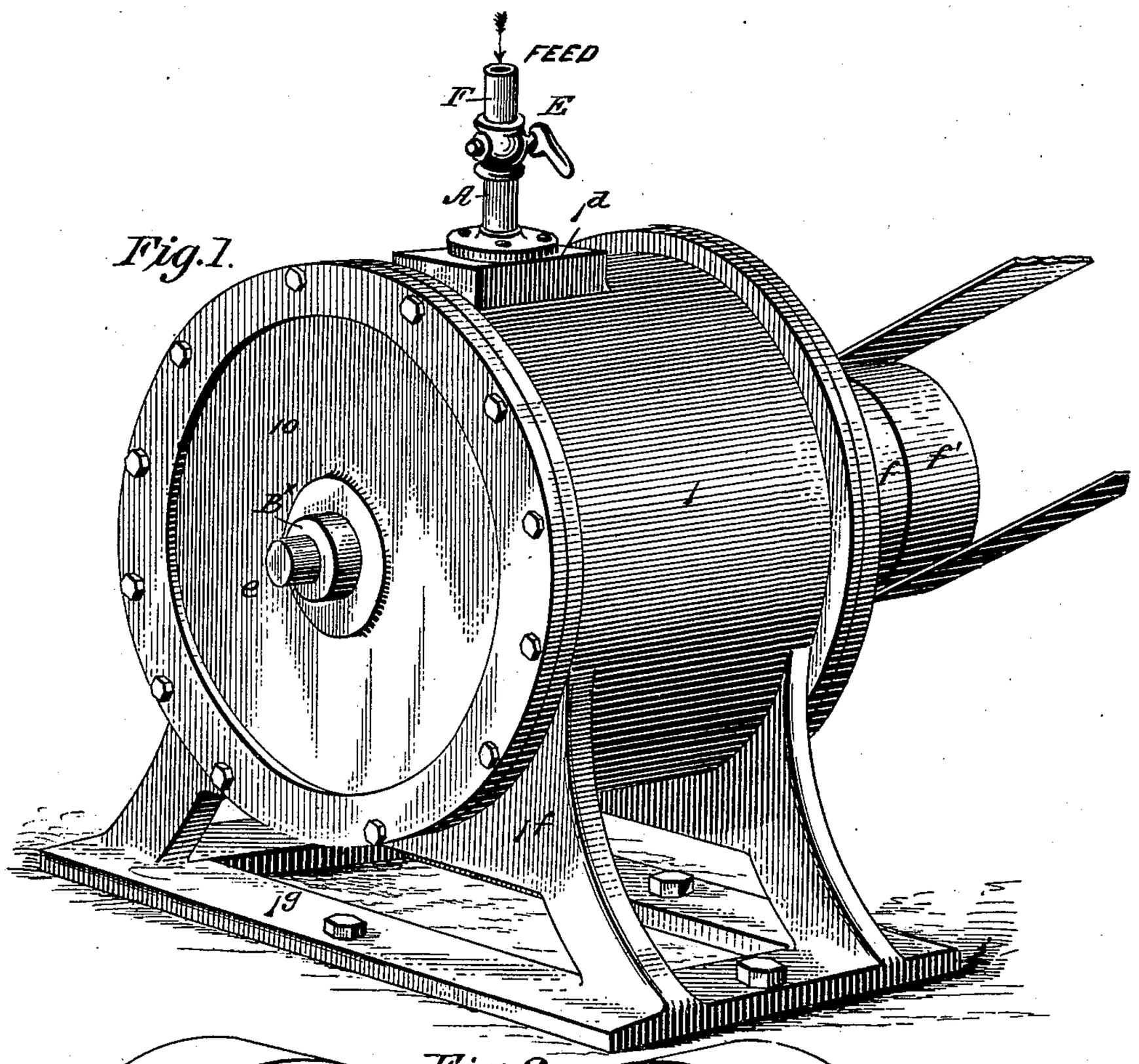

Fig. 2.

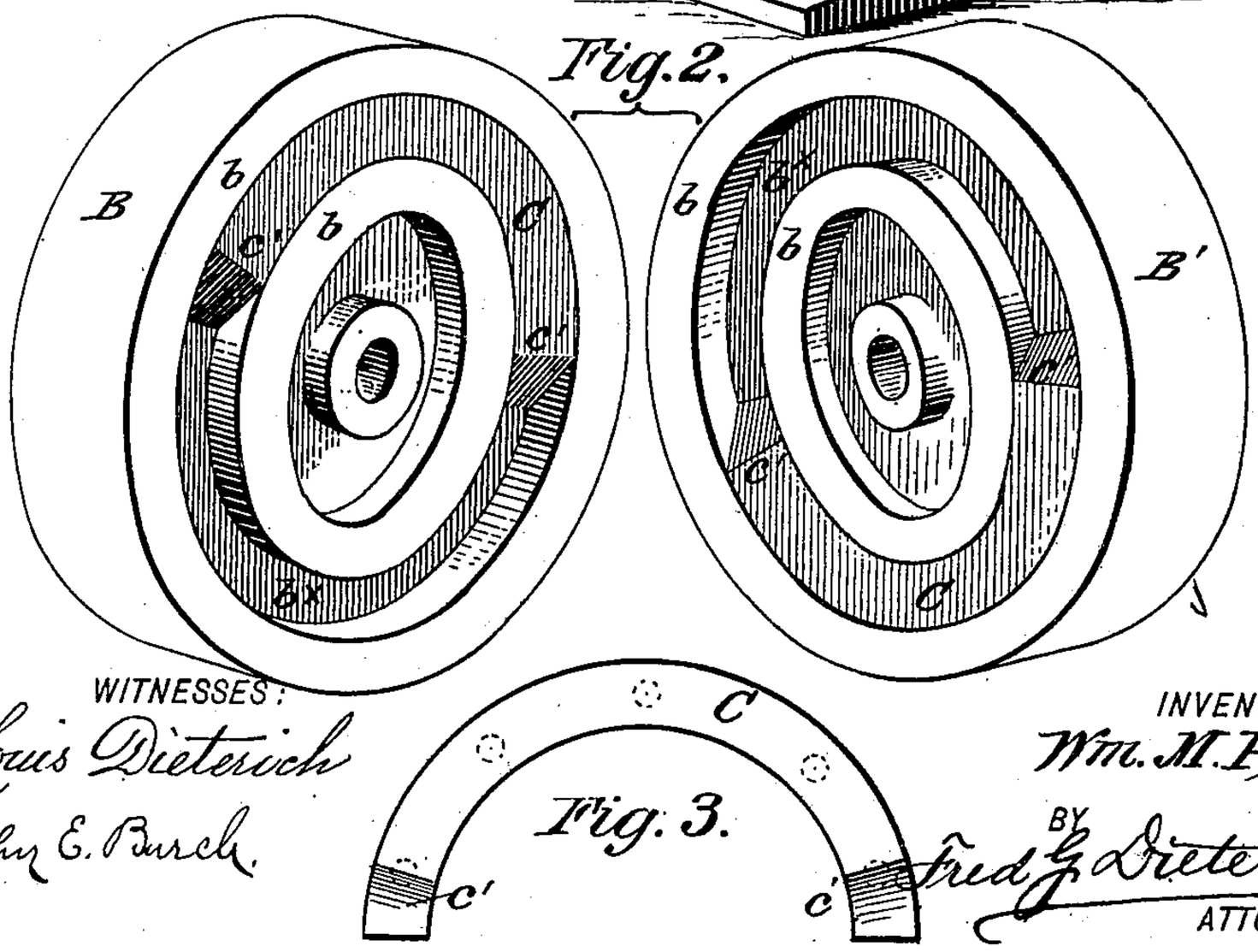

Fig. 3.

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(No Model.) 3 Sheets—Sheet 2.

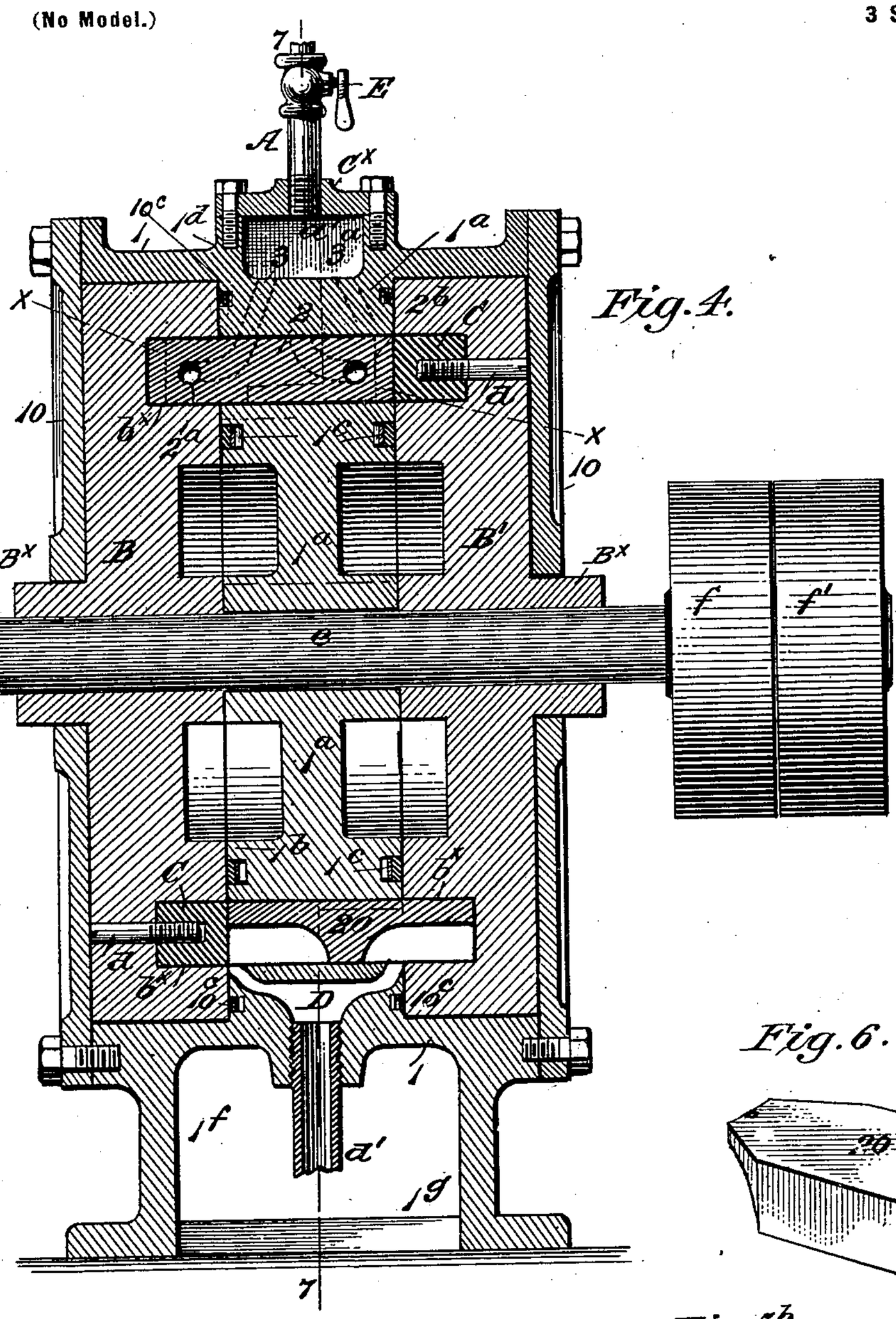

Fig. 4.

Fig. 6.

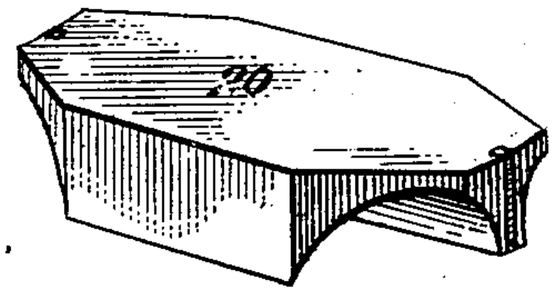

Fig. 5^b.

Fig. 5.

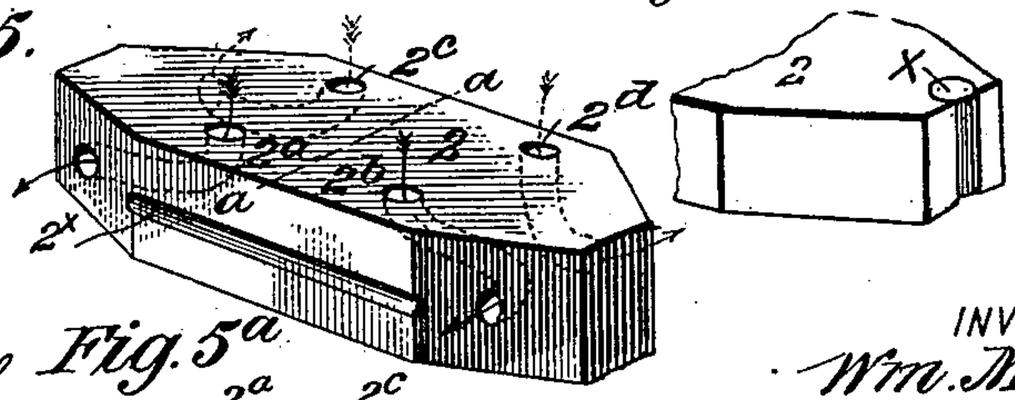

Fig. 5^a

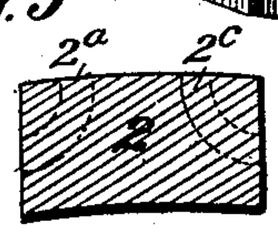

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Fig. 7.

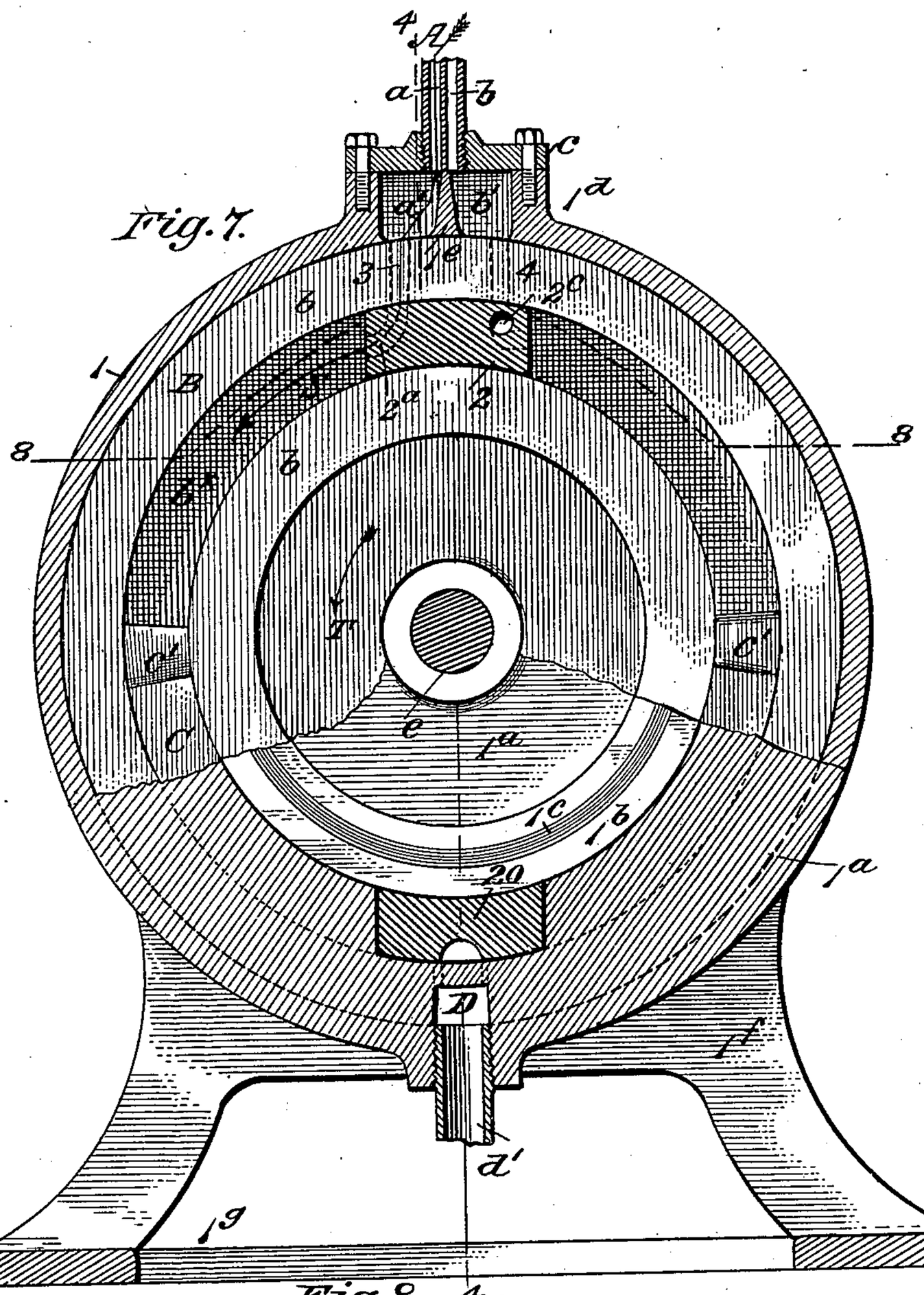
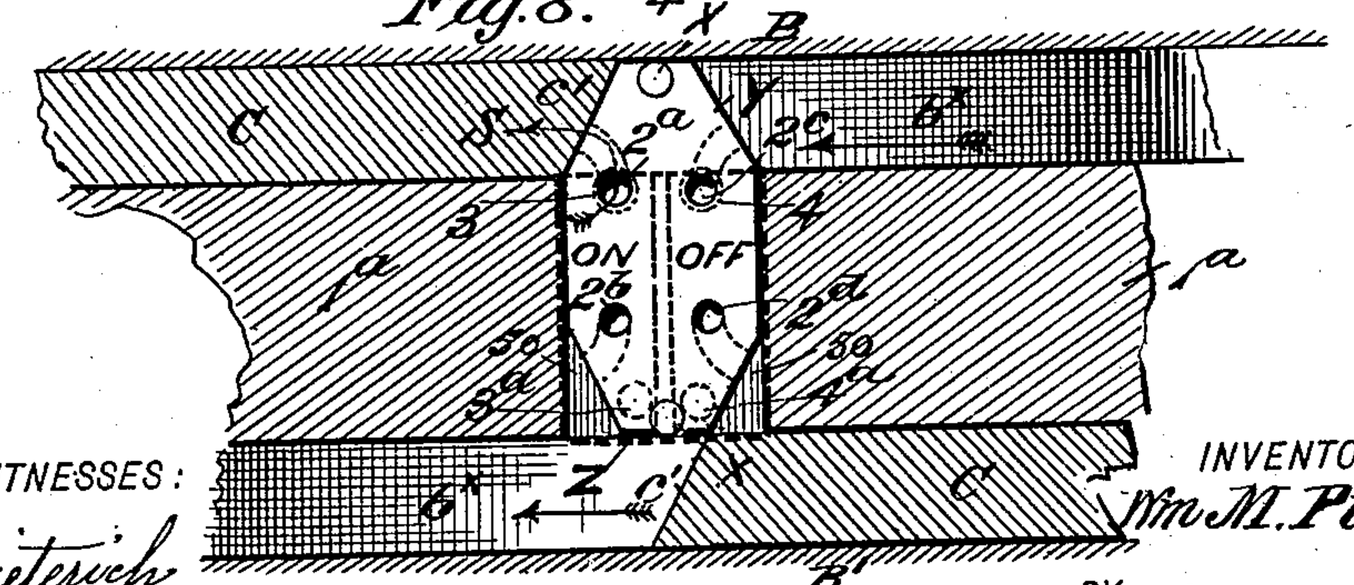


Fig. 8.



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UNITED STATES PATENT OFFICE.

WILLIAM McCOY PIATT, OF WEST LIBERTY, OHIO.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 669,447, dated March 5, 1901.

Application filed December 7, 1900. Serial No. 39,071. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM McCOY PIATT, residing near West Liberty, in the county of Logan and State of Ohio, have invented a new and Improved Rotary Engine, of which the following is a specification.

This invention relates more particularly to that type of rotary engines having a plurality of abutments and a shifting-valve mechanism whereby to effect the shifting or alternation of live steam against the different abutments at predetermined intervals and maintain, as it were, a live-steam impact against one part of the piston as the other part thereof is carried forward under expansive force.

My invention in its more generic nature comprehends a stationary cylinder or casing centrally divided to provide two annular chambers, one at each end, a drive-shaft, two concentrically-disposed pistons, one for each chamber, a single exhaust common to both pistons and piston-holding chambers, and means for deflecting the feed to cause the pistons to rotate in reverse directions, a single shifting-valve automatically operated to shift the fluid-feed to discharge alternately against the two pistons, whereby to substantially maintain a live-steam impact force at all times, and an automatically-operating shifting-valve for governing the exhaust from each piston-holding chamber.

In its more complete form my invention embodies, in connection with a cylindrical casing having a plurality of annular piston-holding compartments, a novel construction of piston concentrically rotatable within each compartment, the two pistons each having a detachable and adjustable abutment arranged to coöperate with and aid in setting a single shifting-valve for governing the fluid-feed against the alternately-operating pistons, said abutments being also arranged to coöperate with and automatically shift an exhaust-regulating valve, and in its more subordinate features my invention consists in certain details of construction and novel combination of parts, all of which will hereinafter be fully explained, and particularly pointed out in the appended claims, reference being had to the accompanying drawings, in which—

Figure 1 is a perspective view of my improved rotary engine. Fig. 2 is a perspective view of the two rotary piston members forming a part thereof. Fig. 3 is a face view of one of the piston-block or abutment members. Fig. 4 is a transverse section of my engine, taken practically on the line 4 4 of Fig. 7. Fig. 5 is a detail view of the shifting-valve hereinafter referred to. Fig. 5^a is a cross-section of the same on the line *a a* of Fig. 5. Fig. 5^b is a detail view of a slightly-modified construction of the shifting-valve. Fig. 6 is a detail view of the exhaust-governing shifting-valve. Fig. 7 is a longitudinal section of the engine, taken substantially on the line 7 7 of Fig. 4; and Fig. 8 is a detail horizontal section taken on line 8 8 of Fig. 7.

Referring to the accompanying drawings, 1 designates the cylindrical casing, which has integrally formed therewith or otherwise made fast thereto a central division portion comprising a reduced web 1^a, having a hub-like bearing for the drive-shaft *e*, and annular rim members 1^b, in which are mounted packing-rings 1^c and 10^c, held spring-pressed against the opposing piston-faces to form steam-tight joints, as clearly shown in Fig. 4. The ends of the cylinder are closed by the cap-plates or heads 10, bolted to the flanges of the casing in the usual manner, said heads 10 in my construction having axial openings of greater diameter than the drive-shaft to receive the outwardly-projecting bearing-hubs $B^\times$ of the pistons. (See Figs. 1 and 4.)

As will be seen from Fig. 4, a separate annular chamber is provided at each end of the casing, and in each of the said chambers is held a concentrically-rotating piston, (designated by B and B′,) constructed alike, but set alternately—*i e.*, with their abutment or piston blocks arranged at diametrically opposite points—the reasons for which will presently appear.

The pistons B and B′, the construction of which is best shown in Fig. 2, each consists of a true circular head to snugly fit and turn within the annular compartments of the cylinder, said pistons being also of the same width as the said compartments, so that their inner and outer faces will run close to the adjacent faces of the central or division portion of the casing and the heads 10, respectively.

On the inner face pistons B and B′ are each

formed with a circular groove $b^{\times}$, that forms a steam-space, and in each steam-space is detachably fitted a piston-block or abutment C, one of which is shown in detail. The blocks C are approximately of semicircular shape and trued in such manner as to snugly fit fluid-tight within the steam-space and may be detachably secured therein by the screws *d*, as shown, or by any other equivalent means, the outer faces of the said blocks C being flush with the inner face of the pistons to form practically a continuation of said faces, as shown.

In the practical construction the steam-space $b^{\times}$ extends a trifle more than one-half around the piston-face and, as before stated, the space $b^{\times}$ of one piston is arranged diametrically opposite the space in the other piston, such arrangement being obtained by properly setting the blocks C. The ends of each block C are beveled or inclined, as indicated by c' c', the inclines being from the base of the space $b^{\times}$ outward. By beveling the ends of the blocks C, as stated, and arranging the two blocks as opposites—that is, fitting the two pistons to rotate with the shaft, so that their blocks C are disposed diametrically opposite each other, as illustrated clearly in Fig. 2—the inclines c' of the two blocks will relatively be in reverse directions, as best shown in Fig. 8, and thereby adapt the pistons to run in reverse directions without any special adjustment thereof when the fluid-feed is shifted in the manner presently explained.

In the upper end of the central division of the casing is formed a transverse slot, curved in the plane of and disposed in line with the annular spaces $b^{\times}$ of the two pistons, said slot having the height of said space, as shown. Within this slot plays a shifting valve-block 2, which has a length equal that of the space between the adjacent faces of the two pistons plus the depth of the steam-space $b^{\times}$, and the said block is held to reciprocally slide endwise, so that its opposite ends will alternately project first into the steam-space $b^{\times}$ of one piston and then into the space $b^{\times}$ of the other piston.

The valve 2 has its opposite ends beveled, as clearly shown in Figs. 2 and 8, each side of the two ends being beveled alike, the bevels being on the same angle as the bevel of the ends of the blocks C.

To reduce friction and avoid any lateral strain on the ends of the valve-blocks 2, their outer ends may be formed with friction-rollers X, as shown in detail in Fig. 5^{b}, said rollers bearing against the base of the spaces $b^{\times}$ when shifted to their innermost position. At a point just above the valve 2 is located the steam-chest 1^{d}, which has a central web 1^{c}, that divides the chest into two compartments a' b'. Each compartment a' and b' has two feed-ports, indicated, respectively, by 3 3^{a} and 4 4^{a}, the ones 3 3^{a} serving for feeding the steam through the valve 2 against the two pistons to cause them to rotate in one direction, while the other ports 4 4^{a} are provided for leading the steam through separate channels in the valve 2 against the pistons to rotate them in a reverse direction.

$C^{\times}$ designates a cap-plate adapted to be detachably fitted on and form the top of the steam-chest, and into the said cap is threaded the feed-pipe section A, centrally divided and held to communicate through one channel with the compartment a' and through the other channel with compartment b', and said pipe A is fed from a main feed-pipe, a two-way valve E being provided to direct the fluid-feed into either one of the channels of pipe A desired, it being understood that to cause a reverse motion of the engine it is only necessary to set the valve to deflect the feed from the running-compartment to the other compartment.

The valve 2 has two sets of feed-ports—one set at each side—designated, respectively, by 2^{a} 2^{b} and 2^{c} 2^{d}, the channels 2^{a} and 2^{b} in the present instance working in harmony with the feed-ports 3 3^{a} and the ones 2^{c} 2^{d} in harmony with ports 4 4^{a}.

By referring now more particularly to Fig. 8 it will be noticed the two sets of ports in the valve 2 are arranged closely together, while the corresponding sets of ports 3 3^{a} and 4 4^{a} are spread, the increase of space between said ports 3 3^{a} and 4 4^{a} being equal that of the complete movement of the valve 2, so that at each movement the valve 2 will have only one of its ports in communication with the steam or other fluid pressure feed.

The ports 2^{a} 2^{b} and 2^{c} 2^{d} in valve 2 have their entrant ends near the center of the valve-block and open through the top thereof, from whence they extend downwardly and outwardly and discharge through the beveled side walls, as best shown in Figs. 5 and 8, so as to discharge the impelling fluid in a plane with the line of rotation of the pistons—*i. e.*, at right angles to the drive-shaft.

At the lower end and diametrically opposite the valve 2 is a second shifting or exhaust-governing valve-block 20, which has a contour the same as valve 2, but is made solid, its ends being also beveled and arranged to penetrate the piston-recesses $b^{\times}$. This valve-block 20, which in practice is preferably provided with end rollers (not shown) like those of valve 2, has its under face formed with escape-passages, that at proper times bring the recesses $b^{\times}$ in communication with the main exhaust D.

From the foregoing, taken in connection with the drawings, it is thought the operation and the advantages of my improved construction of engine will be readily understood. Assuming the fluid-pressure to be entering from the feed-pipe section A into compartment a' and the valves 2 and 20 to be in the position shown in Figs. 4 and 7, the said working agent—steam, air, or gas—will be passing down into port 3 and through port 2^{a}

in the valve 2, its impact force now being in the direction indicated by arrow *s* in Figs. 7 and 8 against the piston-block C in piston B, moving the piston forward under a live head of steam. At this time the exhaust-valve 20 will be in position to exhaust the steam in space $b^{\times}$ in piston B', which during the time live steam is led against the block C in piston B has its block C pass over the end of valve 2 adjacent the piston and holds the said valve 2 over to its proper shifted position, it being understood that the block C in piston B during such time likewise holds valve 20 over to exhaust the space $b^{\times}$ in piston B'. Now when the two pistons traveling in the direction of arrow T reach a point at right angles to that shown in Figs. 4 and 7 the forward end C' of block C on piston B will engage the edge Y of valve 2 and push it back, so that its end Z will now penetrate in the space $b^{\times}$ of piston B' and at the same time cut off port 2^a from port 3 and bring port 2^b in communication with port 3^a, it being understood that this occurs when the rear beveled end *c'* of block C in piston B' has just passed the valve end Z while moving in the direction of arrow S. During the movement of the parts described the forward end *c'* of block C in piston B' will engage with and shift the exhaust valve-block 20 to its proper position. Thus a substantially continuous feed of live steam is being utilized to rotate the drive-shaft, and by reason of the simple and compact arrangement of the parts the shifting action of the valves 2 and 20 is effected without any appreciable jolt or jerky rotary action, and by reason of the peculiar arrangement of the feed-ports 2^a 2^b and 2^c 2^d the valve 2 is partly shifted by steam-pressure against the inclined walls of the said ports, the steam force also serving to hold the valve solid against its end seats.

While I have more specially referred to the steam as a working agent, I desire it understood that by reason of the novel and compact manner of assembling the several parts they may readily be turned and trued to such nicety of adjustment as to admit of the use of compressed air or a gaseous fluid as a working agent.

The pistons and the central division portion of the casing may be cored or otherwise lightened to avoid bulkiness and such forms of packing means employed as will cause a strict confinement of the steam, a direct action of the same against the abutments or blocks C, and the avoidance of waste of energy.

By providing the web part of the casing with a long bearing-hub and likewise forming the pistons the shaft *e* will have ample bearing-surfaces and be held to run steady and without undue torsional or twist strain. The shaft has the usual fast and loose pulleys *f' f*.

By providing a double steam-chest *a' b'*, a double channel-pipe A, and a two-way valve, as described, the steam-supply can be instantly set to feed into the compartment *a'* and the ports 3 3^a and 2^a 2^b or the compartment *b'* and ports 4 4^a and 2^c 2^d.

Changes in the detail of construction may be made without departing from the scope of the appended claims.

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

1. In a rotary engine, a cylinder having a central division member, whereby to produce two independent annular compartments, a shaft passed axially through said cylinder, two pistons mounted on the shaft, one for each annular compartment, said pistons each having an annular steam-space facing the central division member, and an abutment fitting in the said space, a working-agent-holding chamber having feed-ports leading to both pistons, a slide-valve coöperating with the pistons, and adapted to be shifted by the rotary motion of said pistons, said valve having feed-ports for alternately opening up the working-agent feed to the opposite pistons, and an exhaust-valve mechanism common to both pistons arranged diametrically opposite the feed end of the engine and held coöperatively with the pistons movable in reverse directions by the rotary action of said pistons, as specified.

2. A rotary engine, comprising a cylinder, having a feed-chamber at one end, an exhaust diametrically opposite the feed end and a central fixedly-held division, whereby two independent annular chambers are provided, a drive-shaft extended axially through the cylinder, concentrically-operating pistons, one for each annular compartment fixedly connected to the shaft, each having an abutment and a steam-space, a slide-valve held to engage with and adapted to be shifted by the pistons, in alternate directions at predetermined times, to first lead the steam against one piston and then the other, and a similarly-operated slide-valve for governing the exhausts from the pistons, as set forth.

3. In a rotary engine of the character described, the combination with the cylinder having a pair of parallelly-disposed but independent annular compartments, a drive-shaft passed axially through said compartments, said cylinder having a feed-chamber formed into two compartments, means for discharging the working agent in either of the said compartments, each compartment having a pair of feed-ports, the ports of one compartment being arranged to discharge against the pistons to rotate them in one direction, and the ports in the other compartment being arranged to discharge against the pistons to rotate them in a reverse direction, the cylinder also having a single exhaust common to both annular compartments, a pair of concentric pistons on the shaft, one for each annular compartment, each having an annular steam-space, and a double-ended abutment, a slide-valve mounted in the station-

ary part of the casing, constructed to engage with and adapted to be shifted alternately in reverse directions by the rotation of the pistons, said valve having two sets of feed-ports adapted to register with the feed-ports from the supply-chamber and at proper intervals lead the working agent against the pistons, and an exhausting-valve, governed by the rotation of the pistons, for the purposes described.

4. In a rotary engine of the character described, the combination with the cylindrical casing having a central web portion, an annular compartment upon each side of said web portion, an exhaust at the bottom common to both compartments, and a divided feed-space at the top, each space having a pair of outlets for conveying the working agent toward each annular compartment, the said web portion of the casing having a transverse slotway just under the feed-space and a similar slotway over the exhaust, of the pistons B B′, the drive-shaft *e*, to which the pistons are secured, said pistons each having an annular space $b^{\times}$, and a semicircular abutment or block C, the opposite ends *c′* of which are beveled, the slide-valve 2, having tapered ends and a double set of apertures 2^a 2^b and 2^c 2^d, and the valve 20, having beveled ends, said valves 2 and 20 being relatively of such length that their beveled ends project in the path of the beveled ends *c′*, of the piston members C, all being arranged substantially as shown and for the purposes described.

5. In a rotary engine as described, the combination with a cylindrical casing having a feed-inlet provided with laterals discharging toward the opposite ends of the cylinder, two independent and separated annular compartments within the cylinder, and an exhaust diametrically opposite the inlet common to both annular compartments; of the pistons B B′, the shaft *e*, to which they are made fast, said cylinders each having an annular recess $b^{\times}$, and a detachable semicircular block or abutment held in said recess, said pistons being mounted with their abutments disposed at diametrically opposite points, a sliding cut-off having ports for leading the feed-supply to the piston-recesses $b^{\times}$, alternately, and a similarly-operated cut-off for regulating the exhaust, all being arranged substantially as shown and for the purposes described.

6. In a rotary engine as described, the combination with the cylindrical casing 1, said casing having a central web portion 1^a, and transverse slotways at diametrically opposite points, the upper end of said casing terminating in a divided steam-space, and a valve-controlled means for leading the working agent into either side of the steam-space, the compartment or steam-space at one side having outlets 3 3^a, and the other side having similar outlets 4 4^a; of the pistons B B′, the shaft *e*, on which they are fixedly held, said pistons each having an annular steam-space $b^{\times}$, and abutment-block C, having its opposite ends *c′ c′*, beveled outwardly, detachably held on the said spaces $b^{\times}$, the valve 2, transversely slidable through the web portion 1^a, of the casing, said valve having its opposite ends tapered, and having two sets of ports 2^a 2^b and 2^c 2^d, said ports having their entrant ends at the upper face of the valve and their exits in the side walls of the beveled ends of the valve, the spaces between the ports 2^c 2^d and 2^a 2^b being less than the spaces between the feed-ports 3 3^a and 4 4^a, with which the valve-ports coöperate, an exhaust in the casing common to both annular piston-holding chambers, and the valve 20, having tapered ends adapted to project in the path of the piston-abutments, all being arranged substantially as shown and for the purposes described.

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