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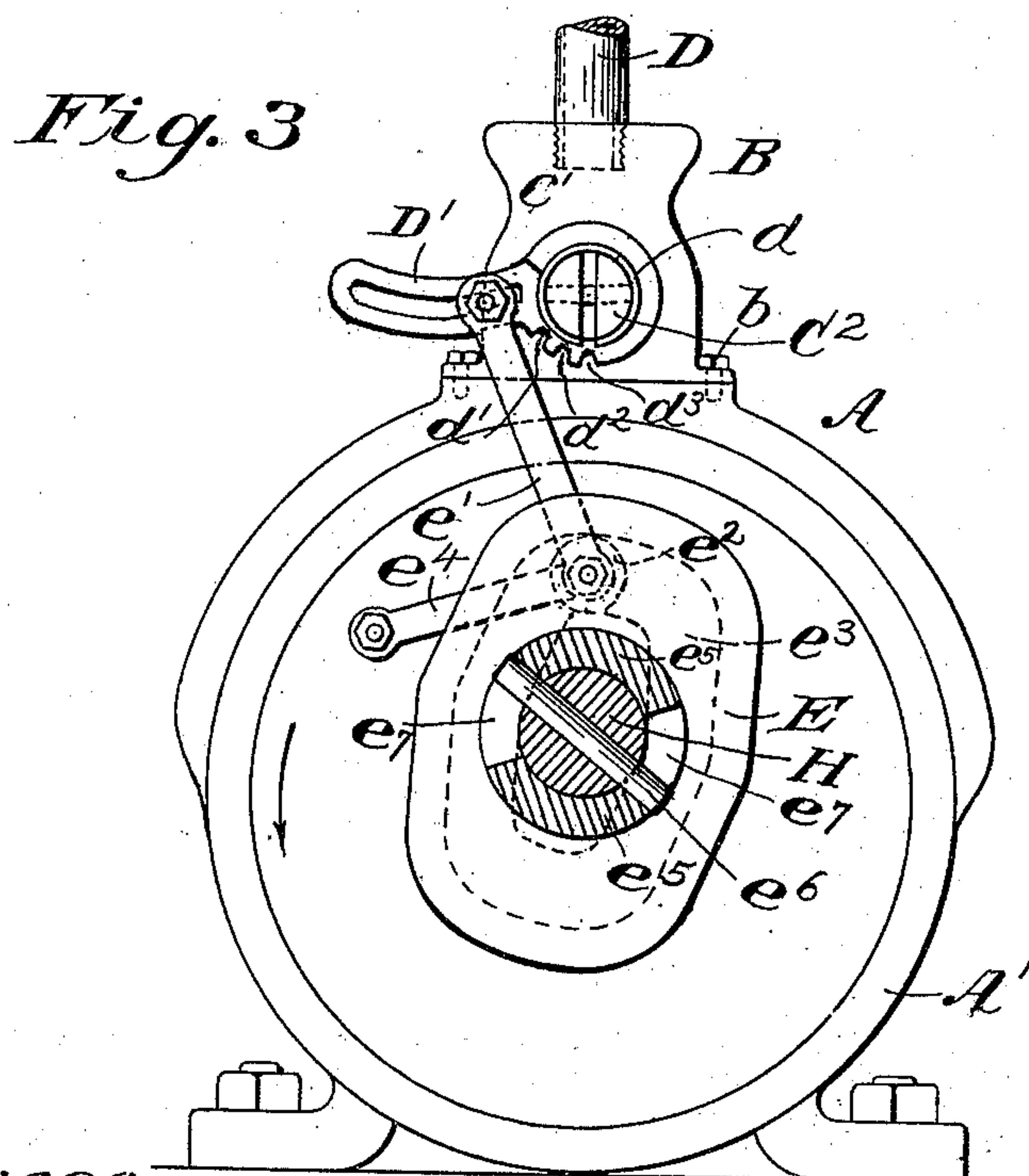
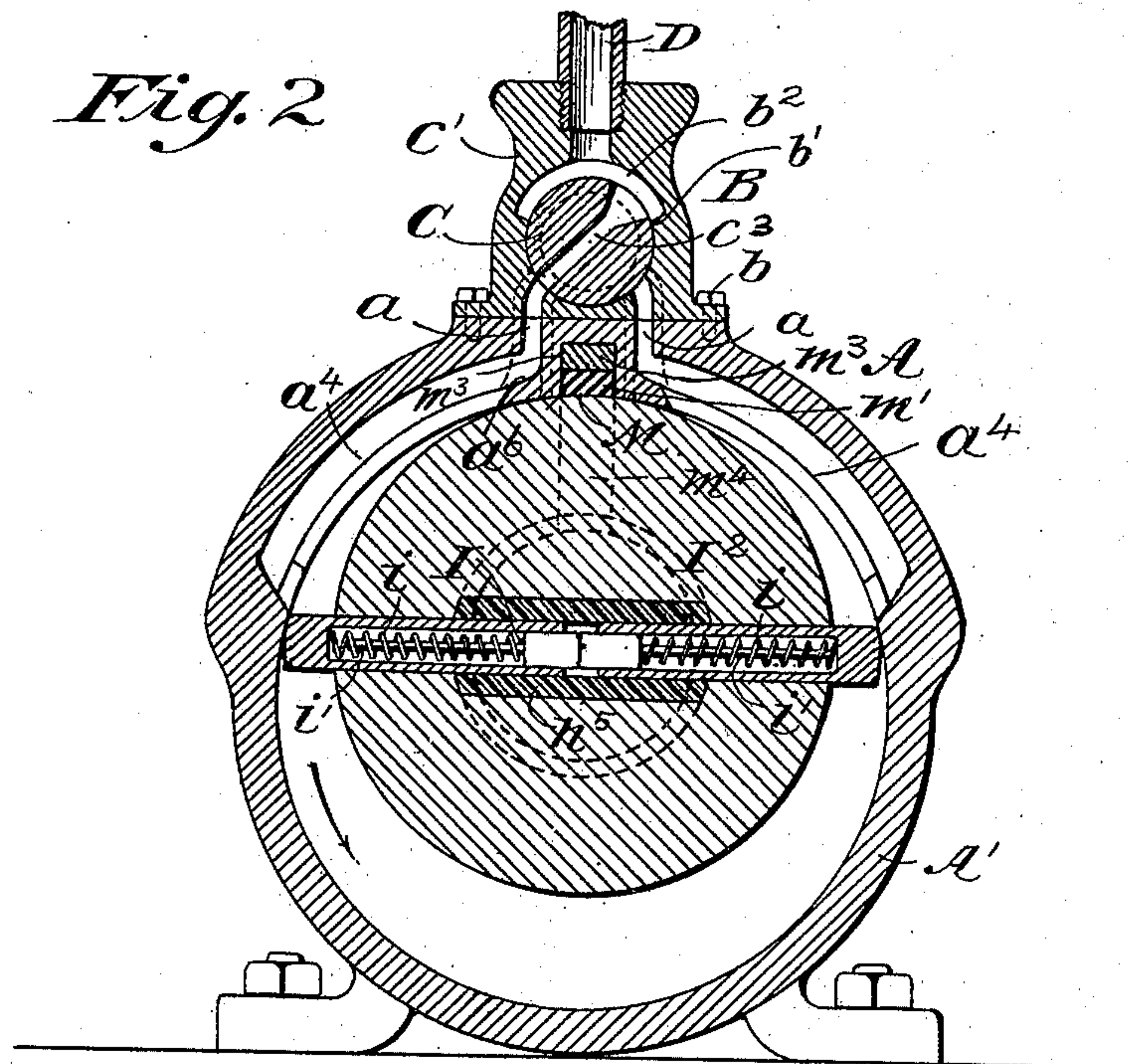
Patented Nov. 28, 1899.

W. L. CASADAY.
ROTARY ENGINE.

(Application filed July 18, 1899.)

(No Model.)

3 Sheets—Sheet 2.



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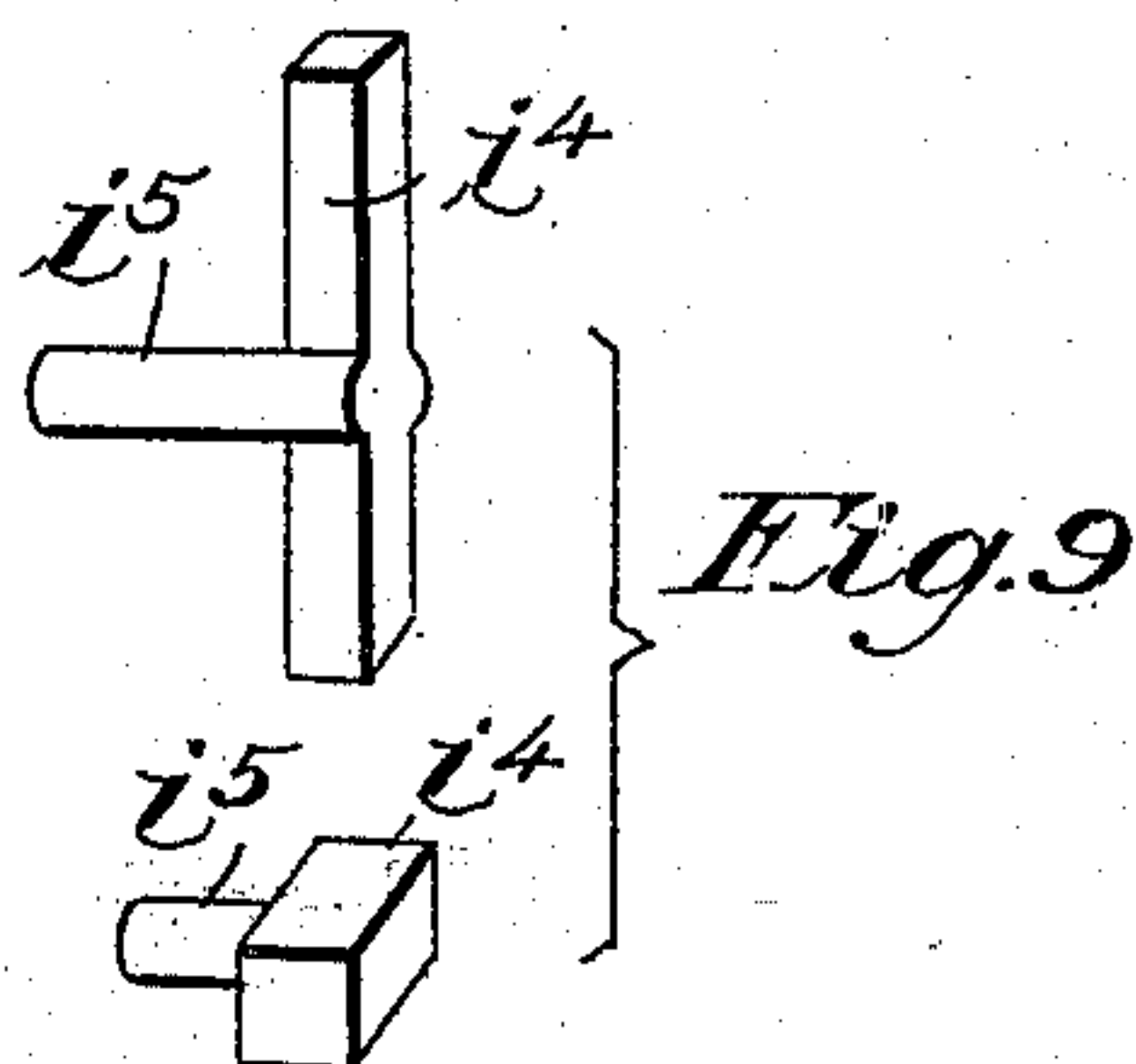
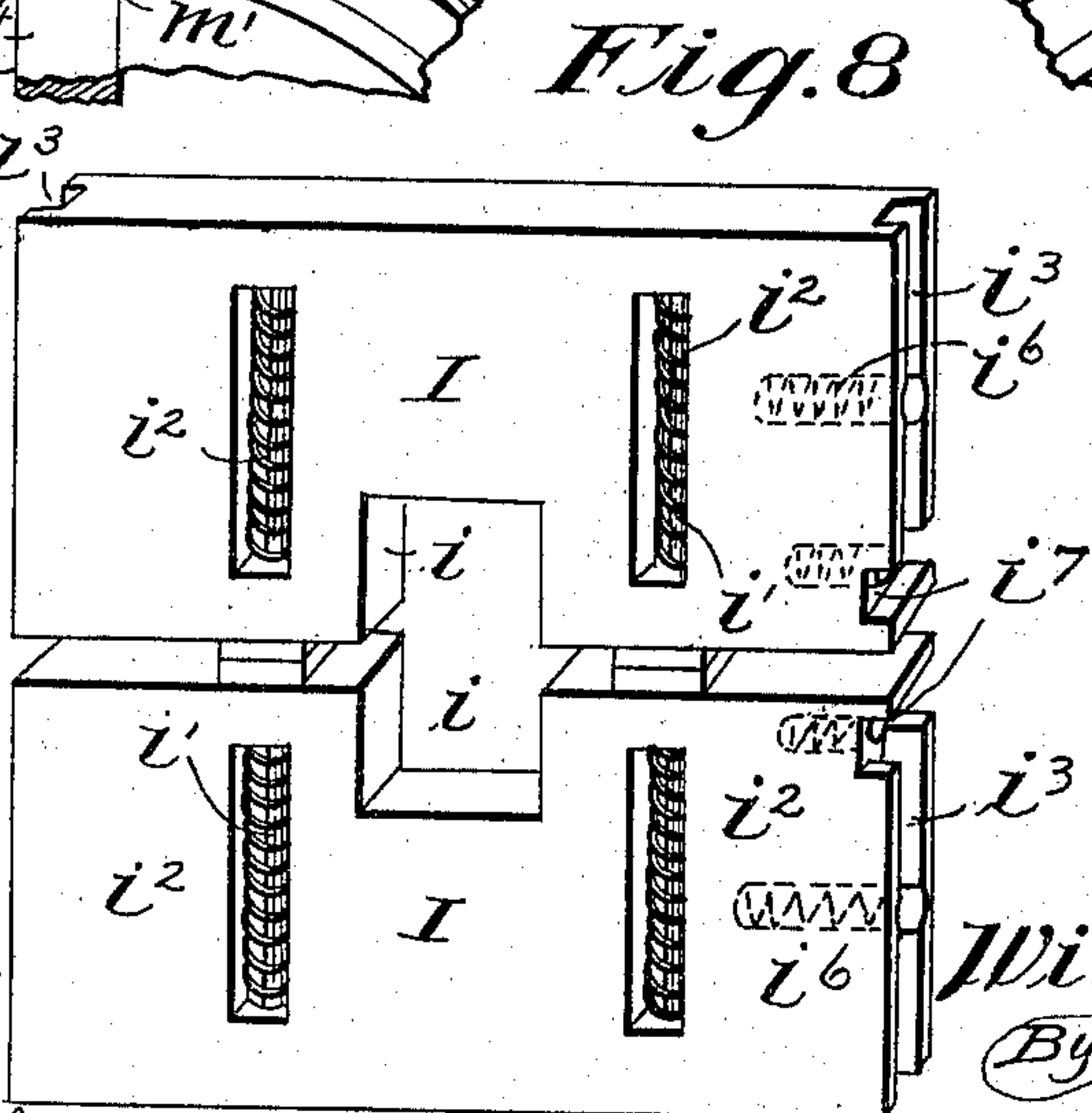
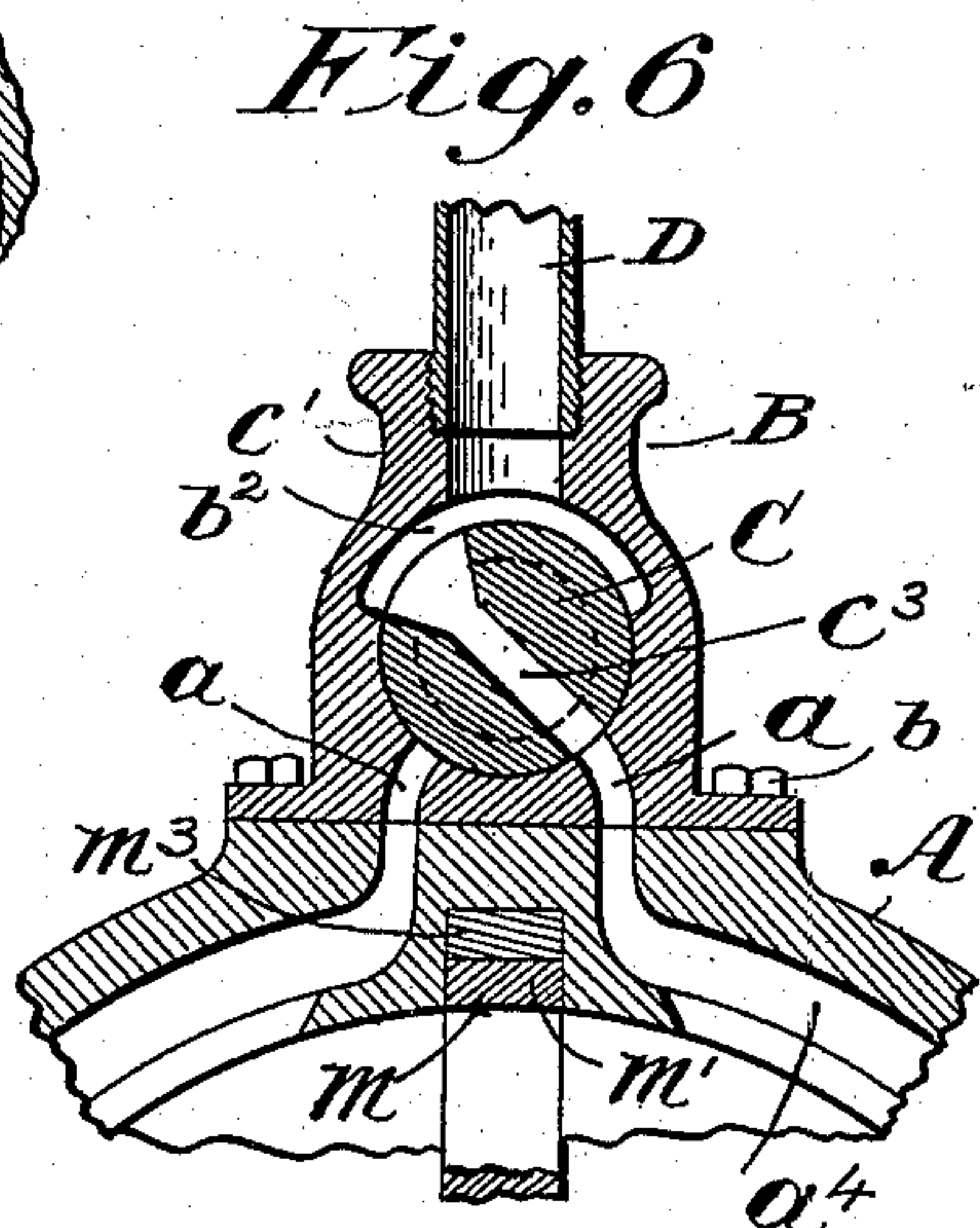
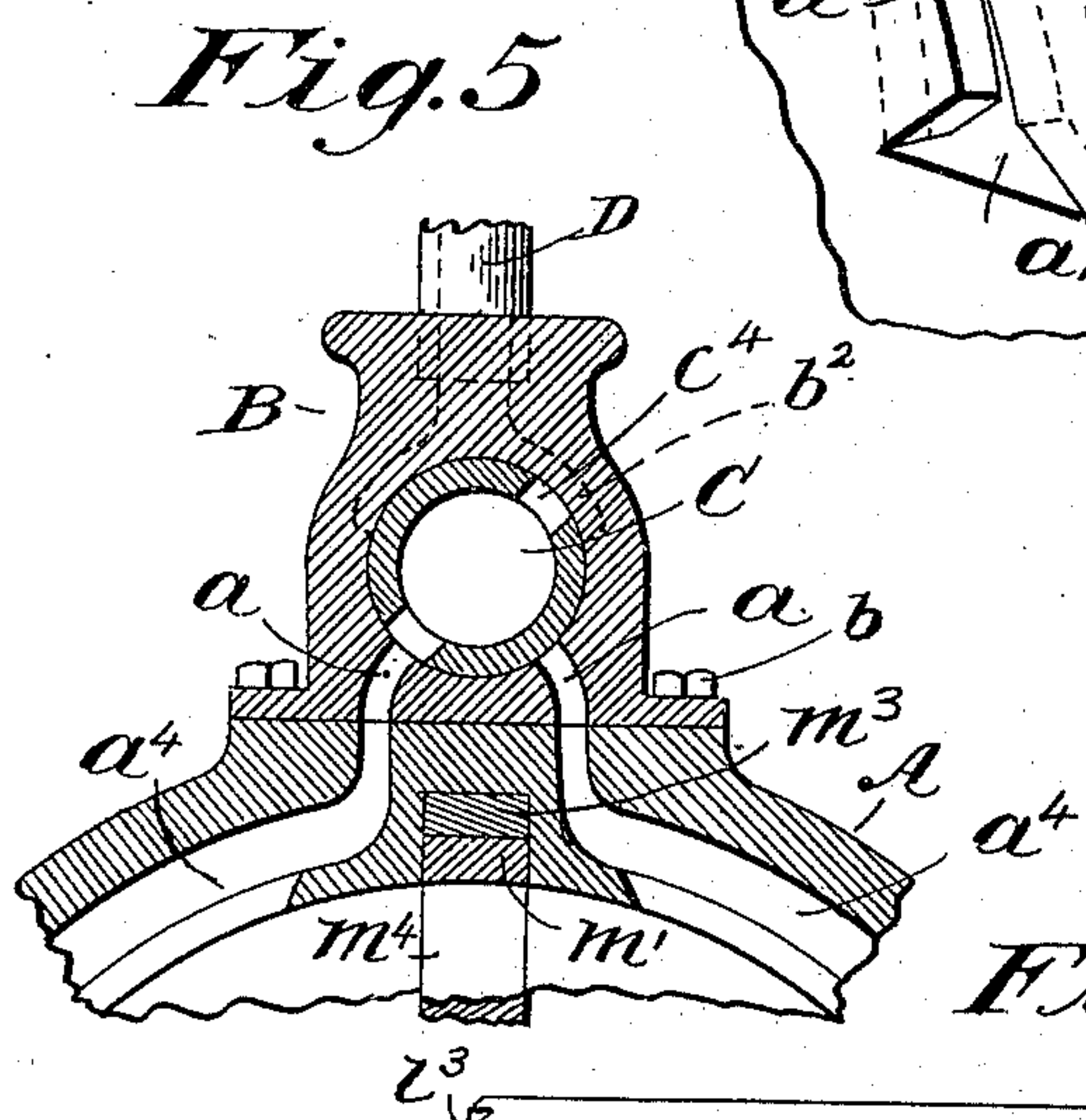
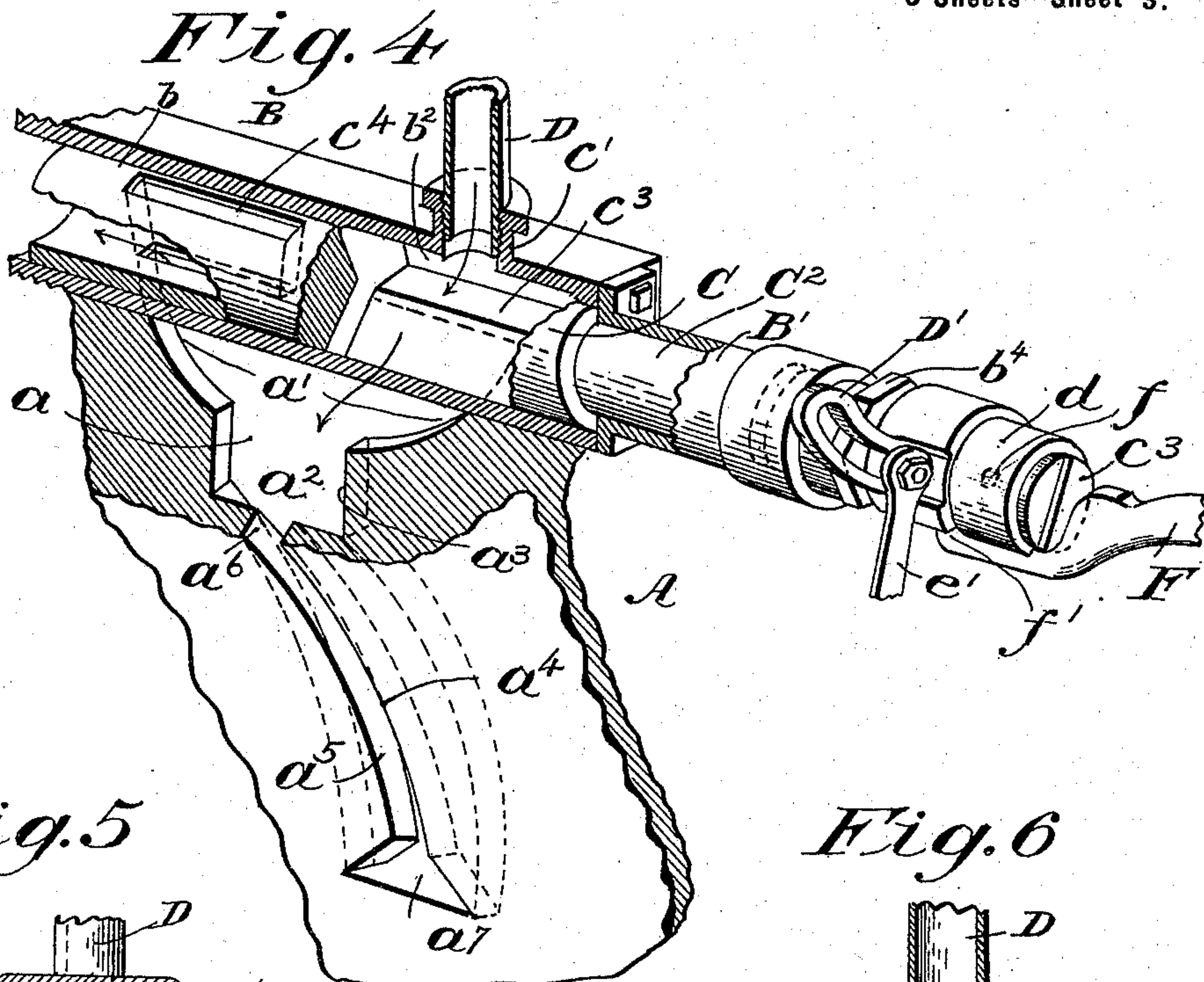
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WILLIAM L. CASADAY, OF SOUTH BEND, INDIANA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 638,173, dated November 28, 1899.

Application filed July 13, 1899. Serial No. 724,329. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM L. CASADAY, a citizen of the United States, residing at South Bend, in the county of St. Joseph and State of Indiana, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

My invention relates especially to an improved form of rotary valve and means for operating it from the engine-shaft and means for shifting it for direct or reverse movement for a cut off and for throttling the steam to the engine and to a novel form and arrangement of port-opening and steam-channel cored out of the valve-box and wall of the cylinder to a point immediately before the time of exhaust, thus giving each piston a full admission-opening for the greater part of its revolution and also providing a narrow open slot from the abutment to the enlarged admission-aperture at the end of the steam-channel to prevent back pressure upon the piston.

My invention has also special reference to the novel form of steam abutment-packing and set-up plates which allows of the nicest working adjustment of those portions which in other engines have been found liable to excessive wear—namely, the plane surfaces of the piston and cylinder ends; and my invention also relates to certain other devices for taking up wear and for packing the shaft and end extensions of the piston-hub and for supporting and packing the valve-stem extension and to certain details of construction not particularly designated in the above statement of the object of my invention; and the invention consists in certain devices, novel form of construction, and combinations of parts hereinafter particularly described with reference to the accompanying drawings, wherein—

Figure 1 is a central longitudinal section of the engine in the line of the shaft and valve-stem; Fig. 2, a transverse vertical sectional elevation in line xx of Fig. 1; Fig. 3, an elevation of the engine, showing the valve-gear and cam-disk; Fig. 4, a sectional perspective view of the valve, valve-box, valve-stem, the valve-operating arm, part of the valve-lever, and also showing a fragment of the cylinder and the steam-channel and slot therein leading to the interior of the cylinder; Fig. 5, a sectional view of the valve, showing the exhaust-

port, and Fig. 6 a similar view thereof, showing the steam-port, both in relative positions opposite that shown in Figs. 1 and 2. Fig. 7 is a sectional perspective view of the valve, showing the steam-port at the right and the exhaust-port at the left thereof; Fig. 8, a perspective view in detail of the piston-sections; Fig. 9, a perspective view of the piston-packing; Fig. 10, a perspective view of the abutment-packing with one of the wedges above the abutment-packing elbows; Fig. 11, a perspective view of one of the abutment-packing elbows, and Fig. 12 a perspective view of the follower-ring for the shaft-packing.

The cylinder A has a flat face at the top to receive the flat under side of the valve-box B, secured by bolts b therein and having a conical bore b' tapering from the steam to the exhaust end thereof to receive a similarly-shaped oscillatory valve C and having a neck c' to receive the steam-pipe D and screw-threaded at the open exhaust end thereof to receive the elbow c of the exhaust-pipe E, a recess b^2 opposite the steam-ports of the valve serving to give free access for the steam around the valve to the ports therein.

The valve C has a steam-port c^3 passing diametrically through it, the receiving side thereof having wide flaring sides to open fully to the steam from both sides of its throw, and thus give free conduit in conjunction with wide-cored channels a of novel form provided in the side walls of the cylinder from the steam-pipe directly to the interior of the cylinder, thus to allow the steam to act with full force upon the pistons. The perspective detail, Fig. 4, and the section, Fig. 2, show the valve C receiving steam on the right-hand side and exhausting through the exhaust-port c^4 on the left-hand side of the cylinder, the said views also clearly showing the steam-channel a upon each side of the cylinder, the said channel having a flaring upper end a' , a broad passage a^2 , having a straight upper section a^3 , and segmental lower sections a^4 , the latter following concentrically the inner surface of the cylinder and communicating with the interior thereof by a narrow slit a^5 , extending from a middle abutment a^6 at the top of the cylinder to a broad angularly-expanding aperture a^7 , the base of which is located in a line or approximately in a line

opposite the upper edge of the piston I when the latter is in a horizontal position. The steam will thus have both egress and ingress at all times to and from the lune-shaped sections of the cylinder above the aperture a^7 at the termini of the steam-channels, and thus prevent back pressure upon the piston of the exhaust side and exhaustion at the steam side of the cylinder. The steam end of the valve has a stem C^2 fitted with a sleeve B^1 , secured by a flange and bolts to the squared end of the valve-box, a threaded end b^3 of the sleeve providing a packing-box and suitable adjustment-ring b^4 , the end of the valve-stem adjoining the ring b^4 having a slotted segment-arm D^1 journaled thereon and held in place by a slotted ring d , which embraces the slotted end c^3 of the valve-stem to reinforce it. The segment-arm D^1 provides means for adjustably connecting the upper end of a link e^1 , the lower end of the said link having a roller e^2 thereon to engage with a slot e^3 upon the inner face of the cam-plate E upon the engine-shaft H, and a supporting-link e^4 pivoted to the roller end of the link e^1 and to the adjacent end of the cylinder, provides a simple and effective valve-gear. Each revolution of the cam opens the valve, respectively, to the steam and to the exhaust twice, and by adjusting the upper end of the link e^1 in the segment-slot the valve will operate more or less quickly, and thus regulate the point of cut off. The cam has two concentric outer sections which hold the valve full open and two concentric inner sections to hold the valve full closed during such portions of the stroke as it may be decided to use the steam expansively. The valve may be shifted easily to either reverse, stop, or start by means of a handle pivoted at f to the slotted end of the valve-stem to extend axially therefrom and which will oscillate with the stem in a fixed position when not in use and may be thus easily grasped and fitted to disengage a finger f^1 , projecting inside the pivot f , from notches d^1 d^2 d^3 in the hub of the segment-arm, the notch d^1 holding the valve forward, the notch d^2 holding the valve reversed, and the notch d^3 holding the valve closed. The weight of the handle F always holds the finger f^1 in engagement with the notches when not lifted and held up.

The link e^1 of the valve-gear is connected, as shown in Fig. 1, to the slot of the segment-arm D by means of a wrist-pin P, having a screw-section to pass through the slot, a shoulder p^1 upon one side and a nut p^2 to bear upon the other side of said arm, and a journal p^3 to receive a bearing in the upper end of the link and to provide simple means for fixing the wrist-pin upon the arm.

The cam-plate E has a collar e^5 and is secured to the shaft H by a fixed pin e^6 in a novel manner a suitable distance from the outer end of the packing-sleeve K to give clearance for adjustment, the said collar e^5 having slots e^7 therein to receive the ends of

the pin e^6 to hold the cam-plate securely endwise upon the shaft, but allow it to turn thereon a suitable distance to throw the cam-groove therein away from the direction of rotation of the shaft a distance determined by the length of the slots e^7 and sufficiently to allow the valve to be thrown upon the side opposite the direction the shaft is moving when the engine is reversed, the cam being then held by the valve-gear in its new position at the opposite ends of the said slots and in proper position to give steam to the piston at the moment the latter has passed the end of the port-opening.

The piston-hub H^1 has a shoulder h^1 and coned section h upon a shaft H, the face h^2 of the said shoulder providing steam-tight abutment for a ring-packing k and the slightly-coned shoulder h^1 fitting snugly within the tapered inner end k^1 of a packing-sleeve K, the latter being supported and adjusted upon the sleeve-extension a^8 of the cylinder-cover A in a novel manner. The reduced inner surface k^2 of the packing-sleeve K closely fits the coned section h and also the adjacent cylindrical portion h^2 of the shaft H, and the outer surface of the packing-sleeve K fits snugly within the sleeve extension of the cover and is moved endwise therein to press with any required force against the shoulder h^1 and against the coned section h of the shaft by means of screw-bolts L, passing freely through lugs k^3 and fitted adjustably into the ends of the sleeve extension a^8 , lock-nuts l holding the bolts in their adjusted position, and by coiled springs l^1 , held upon the bolts and between the bolt-head and the lugs k^3 of the sleeve, thus to hold the said sleeve to press inwardly with sufficient force to make the sleeve-packing steam-tight without unduly binding the shaft. The ring-packing k is similarly held with a spring-pressure to bear against the face h^2 of the piston-hub shoulder h^1 by means of a follower-ring k^4 , having stud-pins k^5 thereon to receive coiled springs k^6 , the said ring-packing, follower-ring, and springs being fitted in an annular recess k^7 in the end of the packing-sleeve K, thus providing an elastic and independent adjustment for the packing-ring and the steam thus abruptly cut off at the hub-shoulder without offering material resistance to the rotation of the shaft.

The novel take-up and abutment-packing between the piston-hub H^1 and the cylinder and cylinder-cover A' comprises a yoke M, fitted in slots in the cylinder abutment and covers and arranged in the central vertical longitudinal plane of the shaft and cylinder to bear above and at each end of the piston-hub and completely take up wear and shut off the passage of steam between the steam and the exhaust sides of the piston. The abutment-packing M consists in two oppositely-disposed elbows m , each having horizontal sections m^1 recessed at m^2 to match and overlap each other, the upper surfaces

thereof sloping downwardly from the middle outwardly to receive overlying wedges m^3 , which, together with the horizontal sections, fit snugly in a horizontal recess in the abutment a^6 of the cylinder to press upon the outer surface of the piston-hub, the wedges serving to take up the wear of the abutment-packing by means of coiled springs fitted in the ends of the said wedges and pressing against the cylinder-cover adjacent thereto. The cylinder-cover has radial recesses extending downwardly from the horizontal recess in the cylinder-abutment to receive the vertical sections m^4 of the abutment-packing elbows m , the outer sides of the latter and the said radial recesses being inclined inwardly to thus hold the inner sides of said vertical sections of the elbows always in close contact with the ends of the piston-hubs by the downward pressure of the spring-actuated wedges. The inner ends of the vertical sections m^4 of the abutment-packing are beveled to bear upon the adjacent miter-fillet h^x of the piston-hub at the inner end of the shoulder h , and the adjacent edge of the packing-sleeve K is cut out to receive the lower end of the said vertical section m^4 of the yoke-packing, thus making an interlocking connection between said parts which will admit of their adjustment without exposing open spaces for the escape of steam to the bearing-surface of the shaft.

The piston-sections I are recessed at i' to straddle a connecting-web h^4 of the hub between slots extending diametrically across the hub to slide freely therein, and are pressed outwardly by springs i^2 , fitted upon pins i' , located within the said sections, the hub portion within the hub extensions being coned out upon each side of the said connecting-web h^4 and filled with Babbitt or like metal while the pistons are in place therein, thus providing a smooth bearing-surface which requires no further finish, the portion outside of said hub extensions or shoulders being easily planed out and smoothly finished to receive the piston-sections. The web h^4 serves to guide the piston-sections and also reduces the area of the slots in the piston and serves to brace the opposite walls of said slots, thus giving much greater strength and stability to the hub.

The piston-sections I have longitudinal recesses i^3 extending from the outer ends to near the inner ends upon the sides thereof, the middle part of the recess having holes bored therein and packing-pieces i^4 having steady-bolts i^5 springs i^6 thereon fitted within said recess and holes to press the packing-pieces against the inner faces of the cylinder-covers, and the said piston-sections also have transverse recesses i^7 and stud-holes at the inner ends thereof and at the ends of the recesses i^3 to receive packing-blocks having studs and springs thereon within said transverse recesses and stud-holes to press the said blocks outwardly against the outer ends of the piston-hub slots and within the miter-fillets of the shoulders

upon said hubs, thus to take up any inequality existing between the length of the hub-slots and the distance between the inner faces of the cylinder-covers.

The engine thus described may exhaust into the atmosphere or the exhaust-pipe may lead to a second engine placed adjacent thereto upon the same shaft, thus providing the shaft with double engines, which may be used either singly, compound, or in pairs, each using high-pressure steam, the cut-off-valve gear being so simple that the full expansive force of the steam required may be easily determined upon and employed.

The operation of the engine will be readily understood from the foregoing description, and any practical steam-engineer will readily perceive the advantages obtained by the use of the means described.

I claim as my invention and desire to secure by Letters Patent—

1. An oscillatory valve for rotary engines comprising a valve-box having a longitudinal tapering hole therein, a steam-inlet aperture at the top and larger end thereof, an exhaust-pipe leading from the smaller end thereof, a conical valve having a solid end provided with a steam-port located diametrically therein, and a hollow end having exhaust-ports therein, and a stem at the steam end thereof, and a sleeve adapted to receive the valve-stem and secured fixedly to the end of the valve-box to hold the conical valve in place therein, substantially as described.

2. In a rotary engine, the combination with the cylinder and oscillatory valve, of the piston and engine-shaft, a grooved cam on the engine-shaft, a segment crank-arm, a link adapted to be adjustably pivoted to said crank-arm at one end, a roller at the other end thereof adapted to the groove of the cam, and a link pivoted to the roller end of the aforesaid link and to a fixed part of the engine, substantially as described.

3. An oscillatory valve and shifting gear for rotary engines, comprising a valve and valve-stem crank-arm adapted to be operated by the engine-shaft and loosely journaled upon the valve-stem and having notches therein, and a locking device affixed to the stem and adapted to engage with either of the notches in the crank-arm, substantially as described.

4. An oscillatory valve and shifting gear for rotary engines, comprising a valve and valve-stem, a crank-arm adapted to be operated by the engine-shaft and loosely journaled upon the valve-stem and having notches therein, and a lever pivoted to the valve-stem and adapted to engage with the notches of the crank-arm, substantially as described.

5. An oscillatory valve and shifting gear for rotary engines comprising a valve and valve-stem, a slotted crank-arm mounted upon the valve-stem, a driving-shaft, a cam-disk loosely mounted upon said shaft to have a limited rotary movement thereon, and means

for connecting the crank-arm and movable cam-disk, substantially as described.

6. In a rotary engine, the combination with the steam-cylinder having a fixed abutment 5 and a recess therein, and cylinder-covers, each having a recess to connect with the recess of the abutment, of a shaft and piston-hub, an abutment-packing having side bars depending therefrom and tapering toward 10 the lower ends to match the sides of the cylinder-heads, and means for holding the abutment-packing adjustably in contact with the piston-hub, substantially as described.

7. In a rotary steam-engine, the combination 15 with a steam-cylinder having a fixed abutment, of the cylinder-heads, a shaft, a piston-hub, an abutment-packing fitted in said cylinder and cylinder-heads comprising two elbow-sections having inclined outer sur- 20 faces and wedges upon the outer sides thereof to adjust the elbow-sections and hold them against the top and ends of the piston-hub, substantially as described.

8. In a rotary steam-engine, the combination 25 with a steam-cylinder having a fixed abutment, of the cylinder-heads, a shaft and piston-hub, an abutment-packing comprising two elbow-sections tapering upon their outer sides, and springs adapted to press the wedges 30 against the periphery and sides of the piston-hub, substantially as described.

9. In a rotary steam-engine, the combination 35 with the cylinder, of the shaft, a slotted piston-hub having exterior longitudinal through-slots, interior side slots, and an intervening stay-web at the middle of the slots of the piston-hub, slidable piston-sections having recesses to span said stay-web, and springs for forcing the piston-sections outwardly, 40 substantially as described.

10. In a rotary steam-engine, the combination 45 with the cylinder and cylinder-heads, of the shaft and piston-hub having slots passing longitudinally thereof and approximately extending between the inner faces of the piston-heads, slidable piston-sections, spring-actuated packing-pieces fitted in grooves in the sides of said sections, and spring-actuated

packing-blocks fitted in cross-slots in the sides of the piston-sections at the inner ends 50 of the packing-pieces, substantially as described.

11. In a rotary steam-engine, the combination 55 with the cylinder, of the cylinder-cover having a sleeve extension, the piston-hub, the shaft thereof having a shoulder near the inner end thereof and a conical section extending outwardly from said shoulder, a packing-sleeve adapted to said shaft-section, a packing and packing-springs at the inner end 60 of the packing-sleeve to hold the packing against the shoulder on the shaft, and means for connecting said packing-sleeve to the sleeve extension of the cover, substantially as described. 65

12. In a rotary steam-engine, the combination 70 with the cylinder, of the cylinder-cover having a sleeve extension, a piston-hub and shaft having a shoulder and coned section outside of said shoulder, a packing-sleeve similarly coned fitting within the sleeve extension and adapted to the coned-shaft section, means for adjusting the packing-sleeve, and a spring-actuated packing-ring fitted in 75 an annular recess in the inner end of the packing-sleeve, substantially as described.

13. In a rotary steam-engine, the combination 80 with the cylinder, of the cylinder-cover having a sleeve extension, the piston-hub, the shaft thereof having a shoulder near the inner end thereof and a conical section extending outwardly from said shoulder, a packing-sleeve adapted to said shaft-section, a packing and packing-springs at the inner 85 end of the packing-sleeve to hold the packing against the shoulder on the shaft, screw-bolts for adjusting the sleeve and a spring pressing between the said sleeve and bolts to hold the sleeve in elastic contact with the conical section of the shaft, substantially as de- 90 scribed.

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