(No Model.) 2 Sheets—Sheet 1.

R. C. BERRY.

FLUID PRESSURE ENGINE.

No. 582,257. Patented May 11, 1897.

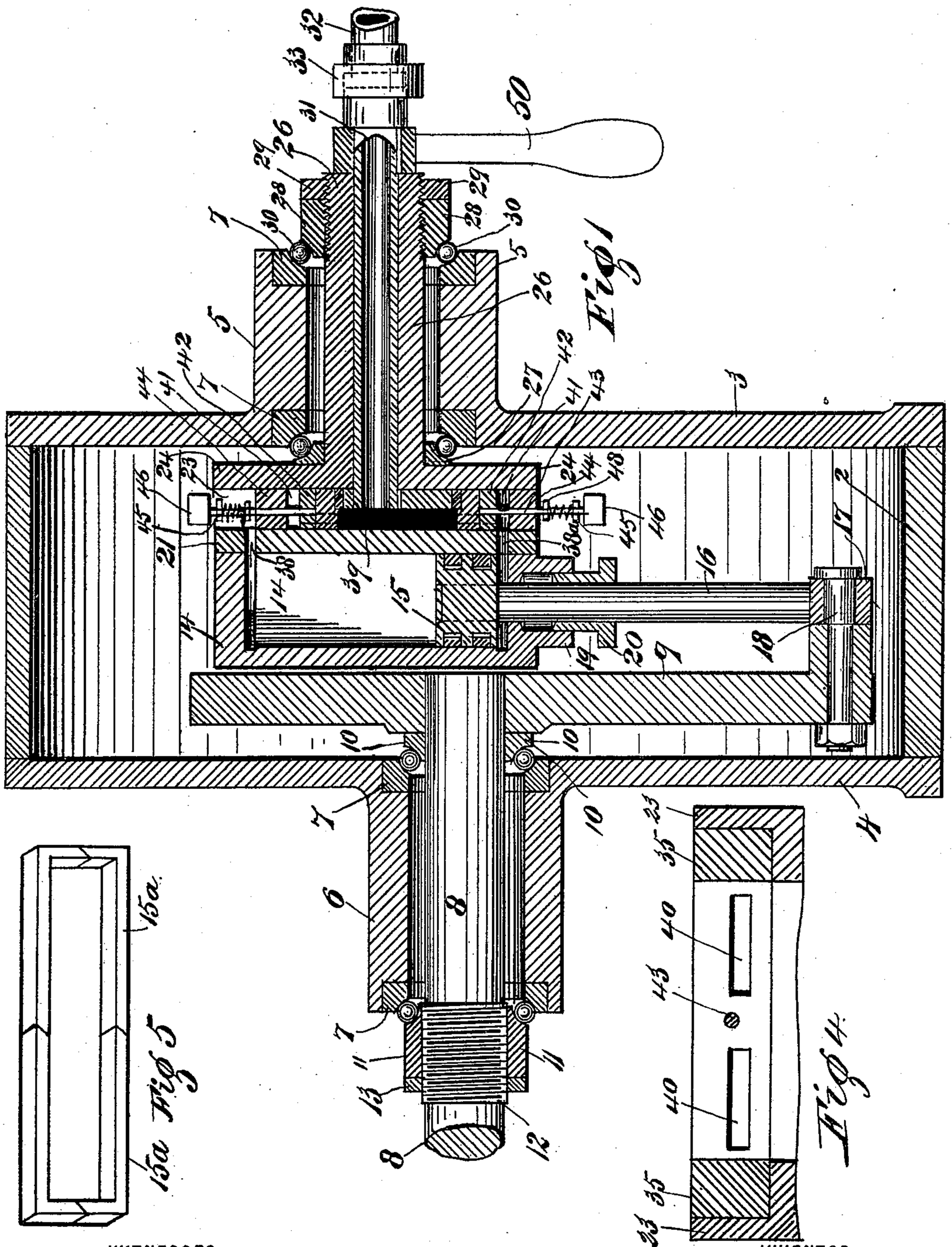

Fig 1.

15a Fig 3.

Fig 4.

WITNESSES:
W. P. Mooney
C. B. Rockwood

INVENTOR
Robert C. Berry
BY
Thompson & Peel.
ATTORNEY.

(No Model.)

2 Sheets—Sheet 2.

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Fig 2

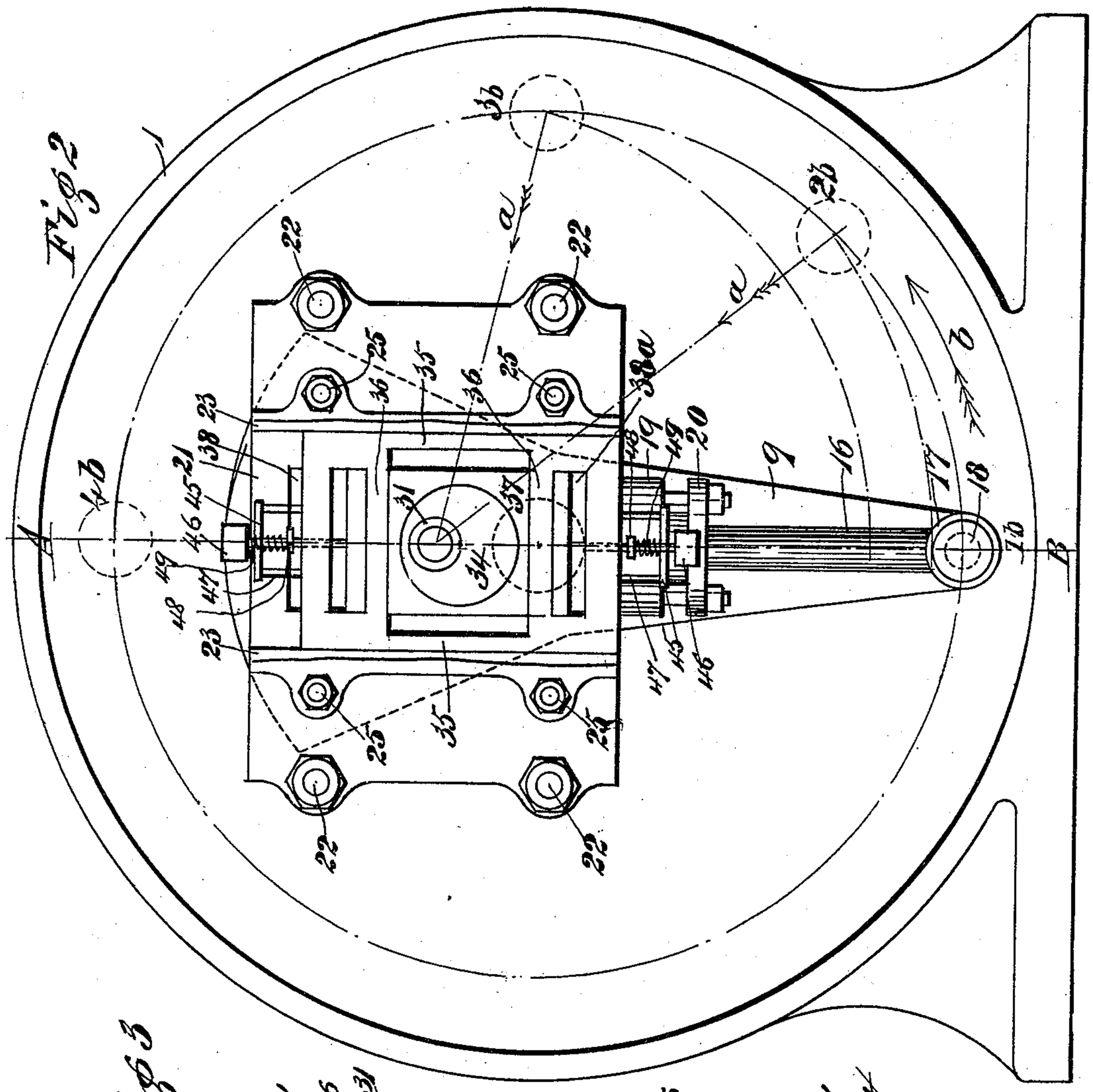
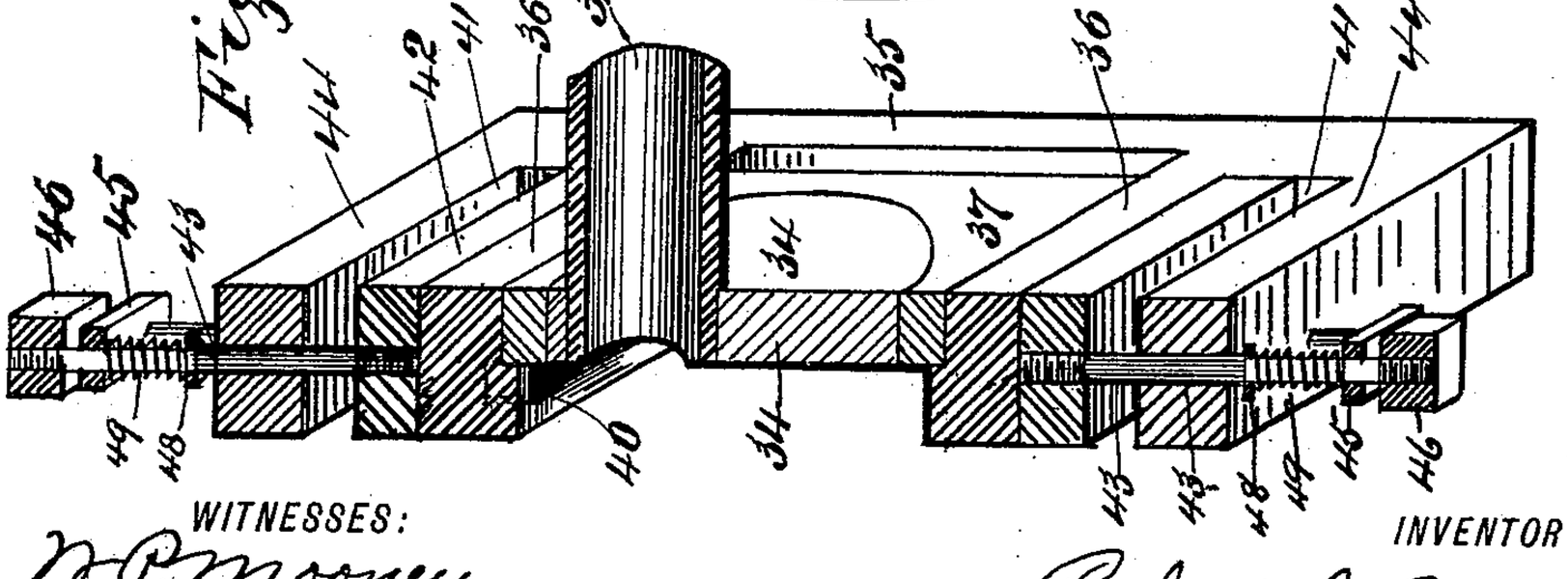


Fig 3



WITNESSES:

W. P. Mooney

C. B. Rockwood.

INVENTOR

Robert C. Berry

BY

Thompson & Bell

ATTORNEY.

UNITED STATES PATENT OFFICE.

ROBERT C. BERRY, OF INDIANAPOLIS, INDIANA, ASSIGNOR OF FIVE-EIGHTHS TO GEORGE W. PANGBORN AND JOHN FEIGEN, OF SAME PLACE.

FLUID-PRESSURE ENGINE.

SPECIFICATION forming part of Letters Patent No. 582,257, dated May 11, 1897.

Application filed December 21, 1896. Serial No. 616,522. (No model.)

To all whom it may concern:

Be it known that I, ROBERT C. BERRY, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented new and useful Improvements in Fluid-Pressure Engines, of which the following is a specification.

My invention relates to certain new and useful improvements in steam or other fluid-actuated engines; and it consists in a double-acting steam chamber or cylinder rotatably mounted in a suitable framing and provided with a reciprocating piston directly connected to a crank, which latter is secured on a shaft mounted opposite to, eccentric with, and independently of said steam cylinder or chamber and will be hereinafter more fully set forth.

The object of this my invention is to provide a simple, durable, and compact fluid-pressure engine the working parts of which will be inclosed and completely concealed from view, and that will be automatically controlled in speed, and which will have a simple valve mechanism capable of being adjusted instantaneously to reverse the motion of rotation of the engine. I attain these objects by means of the mechanism illustrated in the accompanying drawings, in which similar numerals of reference designate like parts throughout the several views.

Figure 1 is a transverse sectional elevation of the engine, taken through the line A B. (See Fig. 2.) Fig. 2 is a side elevational view of the same with the end disk or cover of the frame removed and showing the steam-chest cover broken off. Fig. 3 is an enlarged detail longitudinal sectional perspective view of the main slide-valve and the eccentric thereof. Fig. 4 is a transverse detail sectional broken view of the valve-seat and the valve, and Fig. 5 is a detail perspective view of the piston-ring.

The main frame of the engine is composed of the drum-pedestal 1, having the integral base 2 and the end-inclosing disks 3 and 4. The disk 3 is provided with the outwardly-projecting sleeve 5, formed integral thereon and eccentric therewith, and the disk 4 is also provided with a similar sleeve 6, formed integral thereon and central therewith. In the recessed or counterbored ends of the said sleeves are securely pressed or "shrunk in" the outer ball-races, which are preferably constructed of hardened steel. The crank-shaft 8 is provided with the crank 9, which is firmly secured on the inner or crank end of the said shaft. The inner cone or ball-race 10 is firmly shrunk on or otherwise secured on the shaft 8, while the outer ball-race cone 11 is screwed on the threaded portion 12 of the said shaft, and is locked in position thereon by the locking-nut 13. Suitable balls are provided to race between said races 7 and the race-cones 10 and 11.

The steam-chamber 14 is preferably rectangular in cross-sectional form and is provided with a similarly-formed piston 15, which is adapted to slide in said rectangular chamber and to which is secured the piston-rod 16, which has the bearing-stub 17 formed integral on its outer end and which latter is adapted to receive the crank-pin 18, secured on the crank 9. The steam-chamber 14 is provided with a piston stuffing-box and a gland 20, which may be of any of the well-known and approved forms. The piston 15 is grooved to receive the piston packing-strips 15^a and which substantially answer the same purpose of the usual circular piston-rings of the ordinary engine having cylindrical pistons. (See particularly Fig. 5, which illustrates the form of construction of said packing-rings.)

The steam-chamber 14 is provided with the inclosing cover 21, which is accurately faced to a true surface on both its sides and is removably secured to the said steam-chamber by the securing-bolts 22. The cover 21 is provided on its valve side with the side-inclosing walls 23, formed integral therewith, and the steam-chest or the valve-chest cover 24, which has its inner bearing-face truly faced to an even surface, is accurately fitted to the bearing end surfaces of the walls 23, to which said cover is removably secured by the bolts 25.

Integral on the face of the steam-chest or the valve-chest cover 24 is secured, intermediate between the ends thereof and centrally with the stroke or length of the steam-chamber 14, the outwardly-projecting and cen-

trally-bored cylindrical sleeve or trunnion 26, on the inner end or base of which is secured the fixed ball-bearing or cone-race 27, and on the outer threaded end of said trunnion is screwed the outer adjustable cone-race 28, which is locked in position thereon by the locking-nut 29, which cone-races 27 and the race 28, together with the races 7, form the raceways for the balls 30 and constitute the ball-bearing of the steam-cylinder trunnion.

The hollow eccentric-shaft 31 is tubular and turned truly on its outer surface to accurately fit in the bore of the trunnion 26. The end of the shaft 31 is connected to the steam-supply pipe 32 by a suitable pipe-coupling 33, by which the said hollow or tubular shaft 31 is held stationary and prevented from rotating with the said trunnion, and the resistance of the said coupling is adjusted to overcome the resistance due to the eccentric 34 operating to move the valve 35 and also the friction of the said eccentric-shaft in the bore of the said trunnion.

The next important feature of this my invention rests in the construction of the main slide-valve. The slide-valve 35 is of a rectangular gridiron type, is adapted to accurately fit on all its bearing-surfaces to form steam-tight joints, and is arranged to slide longitudinally in the rectangular valve-space formed by the cover 21, its walls 23, and the steam-chest or the valve-chest cover 24.

Integral with the slide-valve 35 are formed the slide-bars 36, between which the eccentric-yoke 37 accurately fits and slides transversely with the valve movement, said yoke bored centrally to accurately receive the eccentric 34, by which the said valve 35 is operated to reciprocate to alternately open and close the ports 38 and 38[a] to steam and exhaust.

The yoke 37 extends only a portion of the depth of the valve, or is of a thickness equal to half the thickness of the main valve, and thereby forms a steam-space 39 between said yoke and the cover 21, and which is at all times, during the operation of the engine, filled with live steam under pressure. The yoke slide-bars 36 are provided with the steam-openings 40, which connect with the end spaces 41 of said main valve. In these end spaces 41 are also accurately fitted the cut-off valves 42, which are also provided with similar openings, and the said cut-off valves accurately fit and slide in said end spaces. To each of the cut-off valves are secured the governor-stems 43, which accurately fit and slide longitudinally in suitable bearings formed in the end bars 44 of the valve and are prolonged to extend beyond the spring-yokes 45, to the projecting ends of which are firmly secured the governor-weights 46. The yokes 45 are held in their relative positions to the said valve by the tie-rods 47, secured in any suitable manner at their ends to said yoke and to the end of the main valve. Intermediate between the yokes 45 and the collars 48 of the stems 44 are the coiled or centripetal springs 49, said springs surrounding said stem and of tension necessary to regulate the engine to a fixed speed of rotation.

The operation of the engine will be readily understood from the following: Steam is admitted into the steam-space 39 through the pipe 31, which escapes through the ports 40, thence through the end port 38[a] (see Fig. 1) to move the piston upwardly in the steam-chamber 14 in the direction of the arrow *a*, and thereby cause the crank 9 to move in the direction shown by the arrow *b* from the position 1[b] to the position 2[b], thence to the position 3[b], at which position the valve is moving in a direction to close the port 38 to exhaust and to open the opposite port 38[a] to steam, till finally the crank-pin reaches the position 4[b], at which position the piston 15 has reached the end of its stroke and the opposing port 38 is now open to live steam to operate the piston 15 to move in the opposite direction and to continue to apply power to said crank during the time of and throughout the other portion of its path of rotation. The steam-chamber, it will be observed, constantly rotates with and necessarily must make the same number of revolutions as the crank with which it is connected, and which motion needs not be traced entirely throughout its course, as the same can be fully understood by referring to Fig 1. It will be also observed that the position of the eccentric may be changed by means of the reverse-lever 50, which is secured on the outer end of the tubular eccentric-shaft 31 and by which handle said shaft is turned with a force to overcome the tension or friction of the coupling 33 to cause a change of position of the eccentric 34 to reverse the motion of rotation of the engine or to change the lead of the valve 35 to regulate the time of pre-admission of the steam to the ends of the steam-chamber 14.

Having thus fully described the construction and operation of this my invention, what I claim as new and useful, and desire to cover by Letters Patent of the United States therefor, is—

1. In a fluid-pressure engine, the combination with a cylinder, a piston adapted to reciprocate in said cylinder, a valve-chest on said cylinder and having both its ends open and suitable ports connecting said valve-chest and the opposite ends of said cylinder, of a valve accurately fitted in said chest and adapted to be reciprocated therein, said valve having a central chamber adapted to receive the actuating fluid, a trunnion on the said steam-chest mounted in suitable bearings wherein it rotates, a steam-pipe passing centrally through said trunnion and connecting with said valve steam-chamber, an eccentric on the end of said steam-pipe whereby the said valve is actuated to distribute the steam, a crank-shaft opposite to and eccentric with said trunnion and means for directly connect-

ing said piston to said crank-shaft to transmit rotative motion to the latter, substantially as set forth.

2. In a fluid-pressure engine, the combination with a cylinder having a trunnion mounted in a suitable bearing wherein it rotates, a piston adapted to reciprocate in said cylinder, a steam or valve chest between said trunnion and said cylinder, said valve-chest having its ends open, a valve adapted to reciprocate in said valve-chest and means whereby the said valve is operated to supply the actuating fluid to the ends of said cylinder alternately and to alternately exhaust the same through the open ends of said valve-chest, of a crank-shaft opposite to and eccentric with the axis of said trunnion, said piston directly connected to said crank-shaft to transmit rotative motion to the latter.

3. In a fluid-pressure engine, the combination with a double-acting steam-cylinder mounted to rotate on a transverse central axis of rotation, a steam or valve chest on said cylinder between said trunnion and said cylinder, said valve-chest having its ends open, a valve fitted in said valve-chest to form a central chamber, said valve adapted to reciprocate in said chest and means for operating said valve to alternately supply the steam from the central chamber of said valve to the opposite ends of said cylinder, and for exhausting the same alternately through the open ends of said valve-chest, of a crank-shaft opposite to and eccentric with said axis of rotation of said cylinder and a rod directly connecting said piston with said crank-shaft, substantially as and for the purpose set forth.

4. In a fluid-pressure engine, the combination with a cylinder mounted to rotate on a transverse central axis, its reciprocating piston, a valve-chest on said cylinder having its ends open, ports connecting the ends of said cylinder with the said valve-chest, a valve fitted in the said chest and forming a central chamber, and means whereby said valve is operated to supply the actuating fluid from the said chamber to the opposite ends of said cylinder and for exhausting the same through the open ends of said valve-chest in alternation, of a crank-shaft opposite to and eccentric with the axis of rotation of said cylinder, and means whereby the said piston and crank-shaft are connected to transmit rotative motion to the latter.

5. In a fluid-pressure engine, the combination with a steam-cylinder having end induction and eduction ports, of a valve-chest on said cylinder having its ends open to exhaust, a valve adapted to accurately fit and to slide longitudinally in said valve-chest, said valve adapted to close the open ends of said valve-chest and to form a central chamber, and suitable means for reciprocating said valve to alternately supply the actuating fluid from the central valve-chamber to the ends of said cylinder and for exhausting the same through the ends of the said valve-chest.

6. In a fluid-pressure engine, the combination with a steam-cylinder mounted to rotate on a transverse central axis, a steam-chest on said cylinder, and a valve adapted to slide in said chest, said valve having end steam-chambers, of independent cut-off valves adapted to fit and to slide in said end chambers, centrifugal weights connected to said cut-off valves, and counter or centripetal springs connected to said weights, all substantially as and for the purpose set forth.

7. In a fluid-pressure engine, the combination with a cylinder, a piston adapted to reciprocate in said cylinder, a valve-chest on said cylinder having its ends open to exhaust, and suitable ports connecting the ends of said cylinder with said valve-chest, of a valve fitted in said chest and adapted to reciprocate therein, said valve having a central chamber adapted to receive the actuating fluid, a trunnion mounted transversely on said valve-chest and centrally therewith, a steam-pipe passing centrally through said trunnion, and connecting with said valve-chamber, an eccentric on the end of said steam-pipe whereby said valve is actuated to distribute the steam alternately to the ends of said cylinder and means whereby the position of the said eccentric may be changed to reverse the rotation of the engine, of a crank-shaft opposite to and eccentric with the axis of said trunnion, and means whereby said piston and crank-shaft are connected directly, all substantially as and for the purpose set forth.

8. In a fluid-pressure engine, the combination of a cylinder, rotatably supported, a piston adapted to reciprocate in said cylinder, a valve-chest at the side of said cylinder opening thereinto, exhaust-ports at each end of said valve-chest, a reciprocating valve in said valve-chest, said valve comprising a central steam-chamber, end chambers, and ports leading from the central chamber to the end chambers, and means for reciprocating said valve in the valve-chest, whereby said end chambers are alternately brought into alinement with the corresponding ports to the cylinder, substantially as described.

9. In a fluid-pressure engine, the combination of a rectangular cylinder, rotatably supported, a rectangular piston adapted to reciprocate in said cylinder, a rectangular valve-chamber at the side of said cylinder, opening thereinto at its ends, said valve-chamber being open at the ends, and a rectangular valve reciprocating in said chamber, having a steam-chamber arranged to alternately communicate with the openings into the cylinder, said valve being also arranged to pass said openings in its exhaust movement so as to open the cylinder to the open end of the valve-chest, substantially as described.

10. In a fluid-pressure engine, the combination of a rectangular cylinder, rotatably

supported, a rectangular piston adapted to reciprocate in said cylinder, a rectangular valve-chamber at the side of said cylinder, opening thereinto at each end of the cylinder, said chamber being open at the ends, a rectangular valve reciprocating in said chamber so as to open at the limit of its stroke the ports from the cylinder to exhaust, said valve having a central steam-chamber arranged to be brought into communication with the cylinder-ports, a steam-pipe passing through the axial bearing of the cylinder and conveying steam to said central valve-chamber, and an eccentric mounted on said pipe for operating said valve, substantially as described.

11. In a fluid-pressure engine, the combination of a rectangular cylinder, rotatably supported, a rectangular piston adapted to reciprocate in said cylinder, a rectangular valve-chamber at the side of said cylinder opening into the ends thereof, said chamber being open at the ends, a rectangular valve extending between the wall of the chamber next the cylinder and the opposite wall, and having an internal steam-chamber, a steam-pipe extending through said opposite wall and an eccentric within the valve-chamber for actuating the valve, said eccentric being of less thickness than the valve whereby a steam-chamber is formed within the valve at the side of said eccentric, substantially as described.

12. In a fluid-pressure engine, the combination of a cylinder, rotatably supported, a piston adapted to reciprocate in said cylinder, a valve-chamber at the side of said cylinder, opening thereinto at its ends, said valve-chamber having openings at its ends, and a valve reciprocating in said chamber, having a steam-chamber arranged to alternately communicate with the openings into the cylinder, said valve being also arranged to pass said openings in its exhaust movement so as to open the cylinder to the openings in the end of the valve-chamber, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

ROBERT C. BERRY.

Witnesses:
THOMPSON R. BELL,
JOS. RINGLAND.