(No Model.) 3 Sheets—Sheet 1.

F. MEYER, J. S. KIEHL & A. GRANT.

ROTARY STEAM ENGINE.

No. 461,161. Patented Oct. 13, 1891.

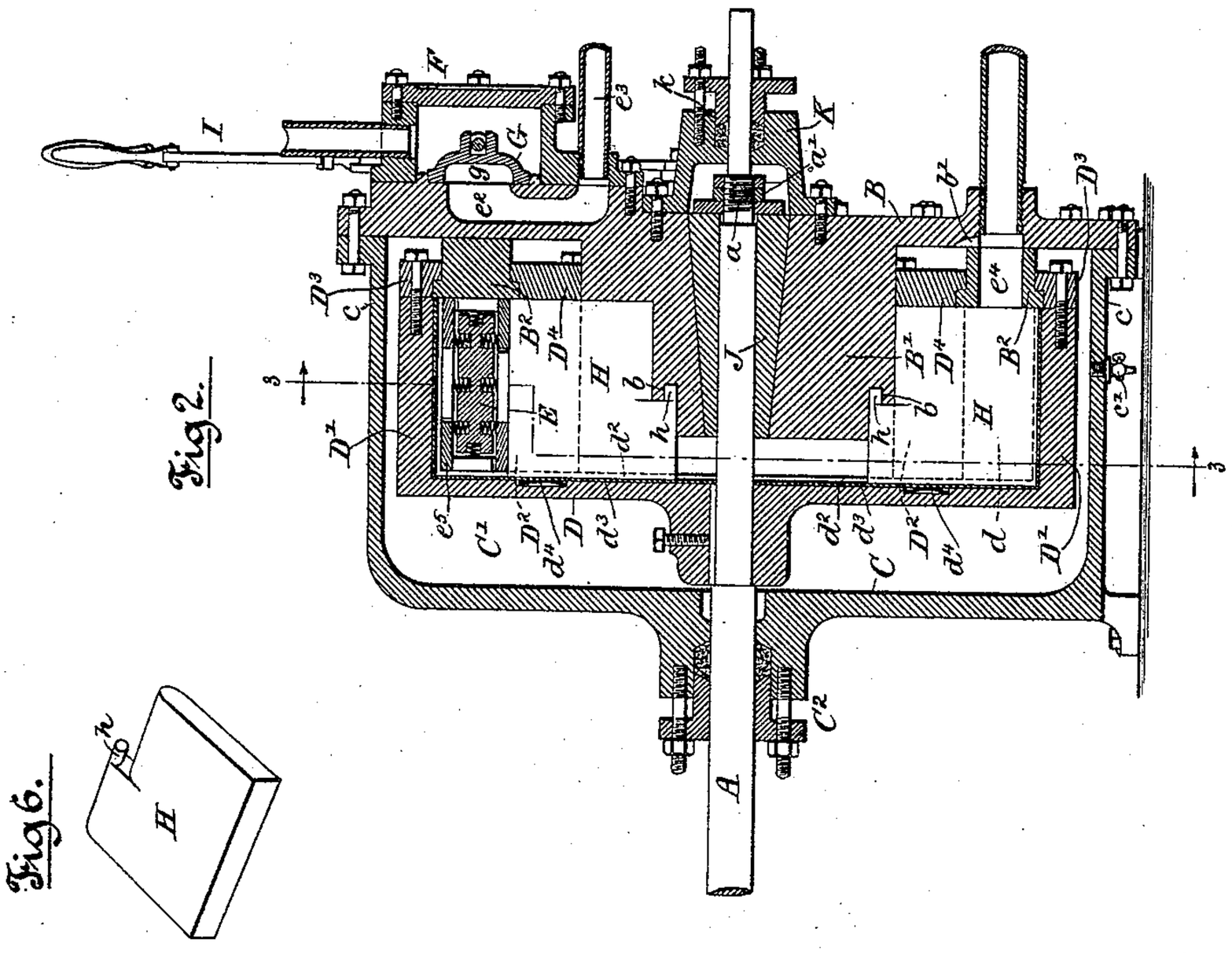

Fig 2.

Fig 6.

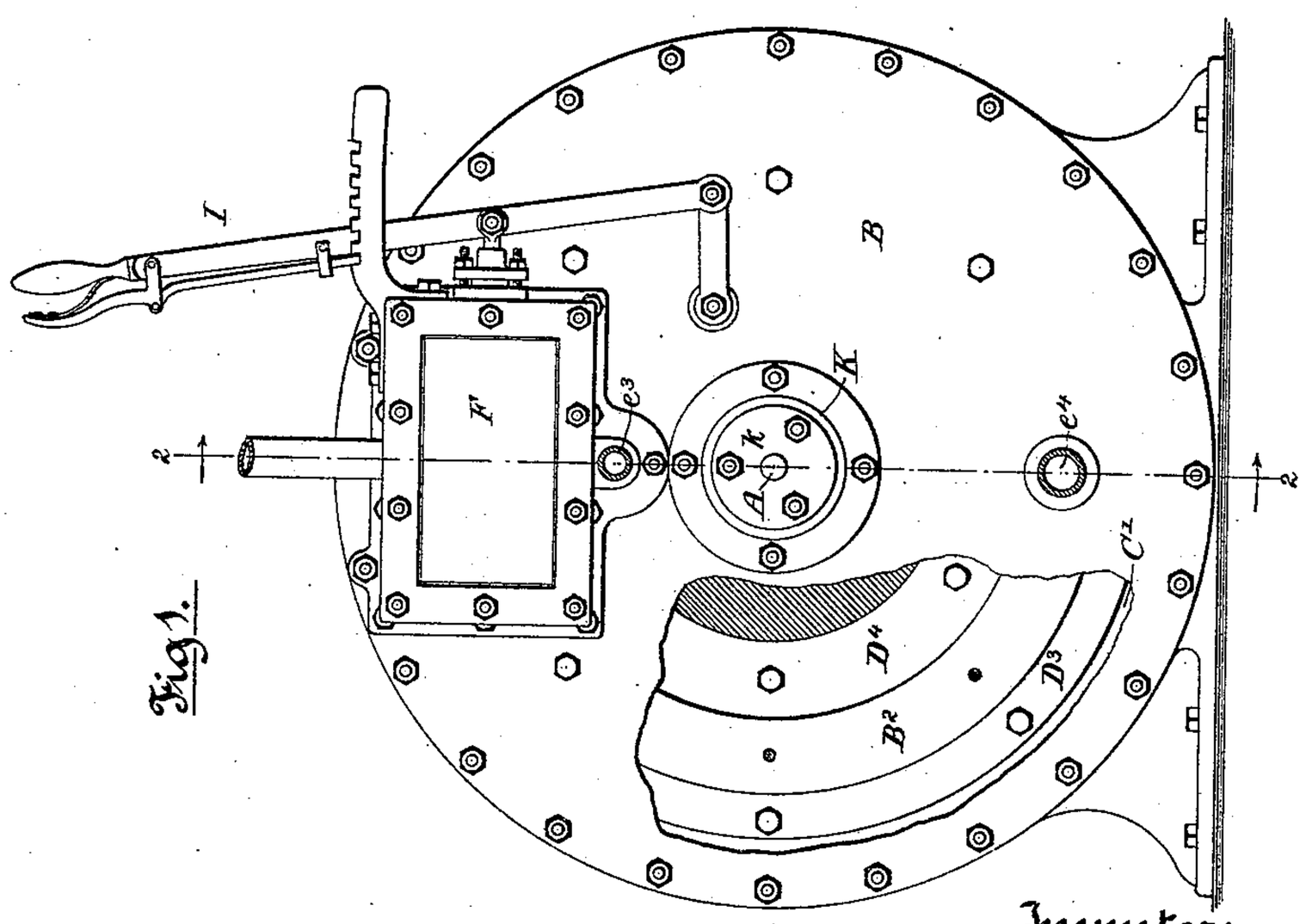

Fig 1.

Witnesses
Wm. F. Heyming.
Louis M. F. Whitehead.

Inventors
Frederick Meyer
Joseph S. Kiehl
Alexander Grant
by Dayton, Poole & Brown Attorneys.

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Fig 4.

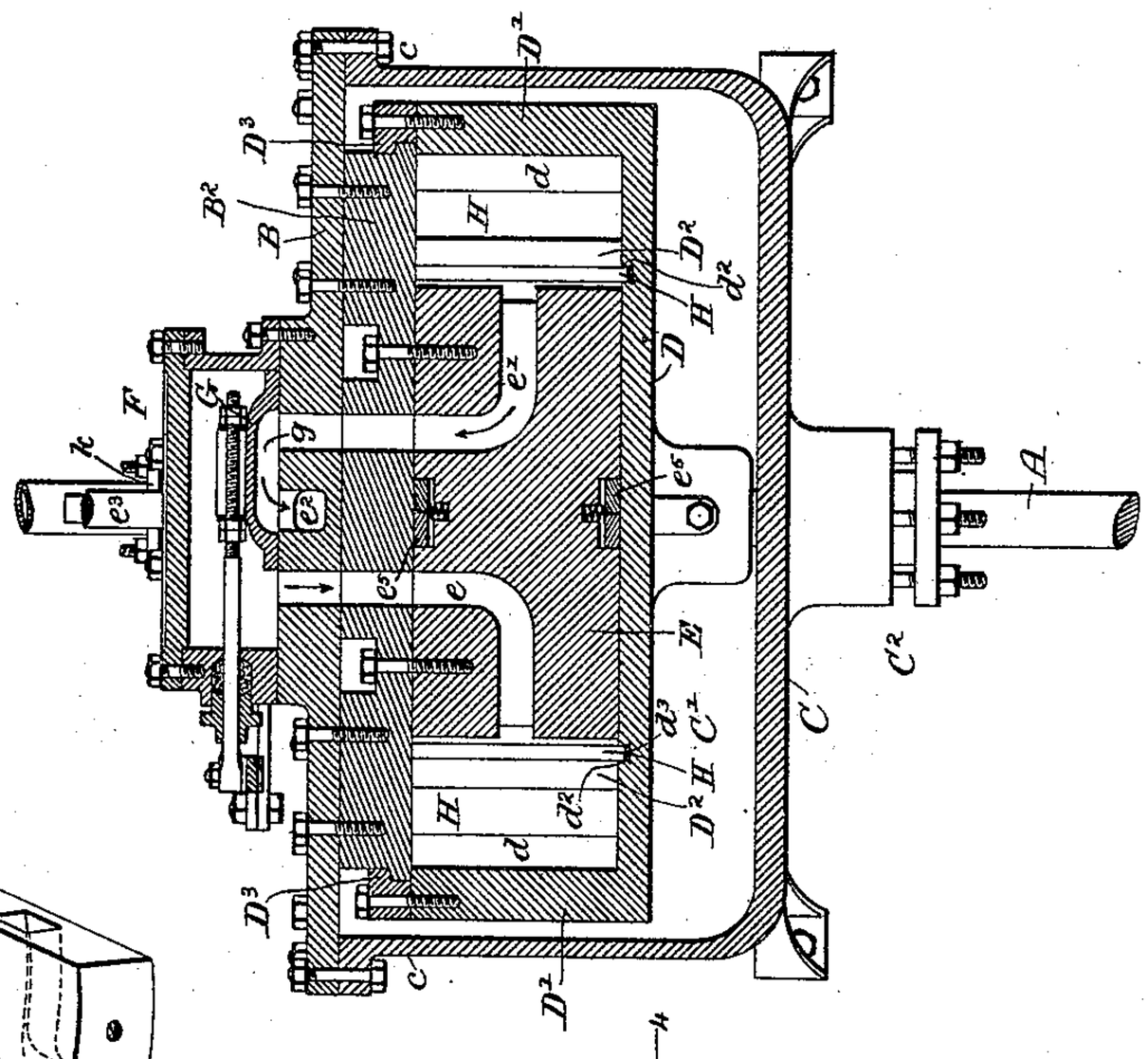


Fig 5.

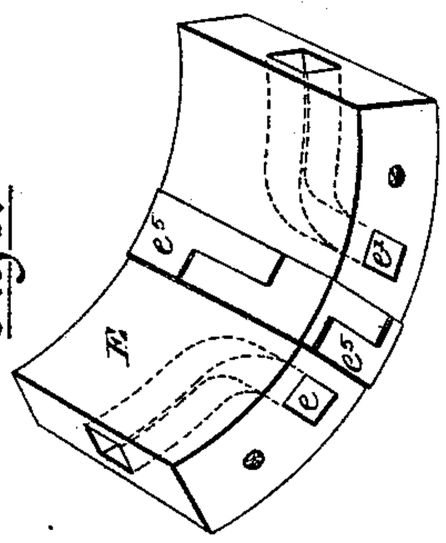
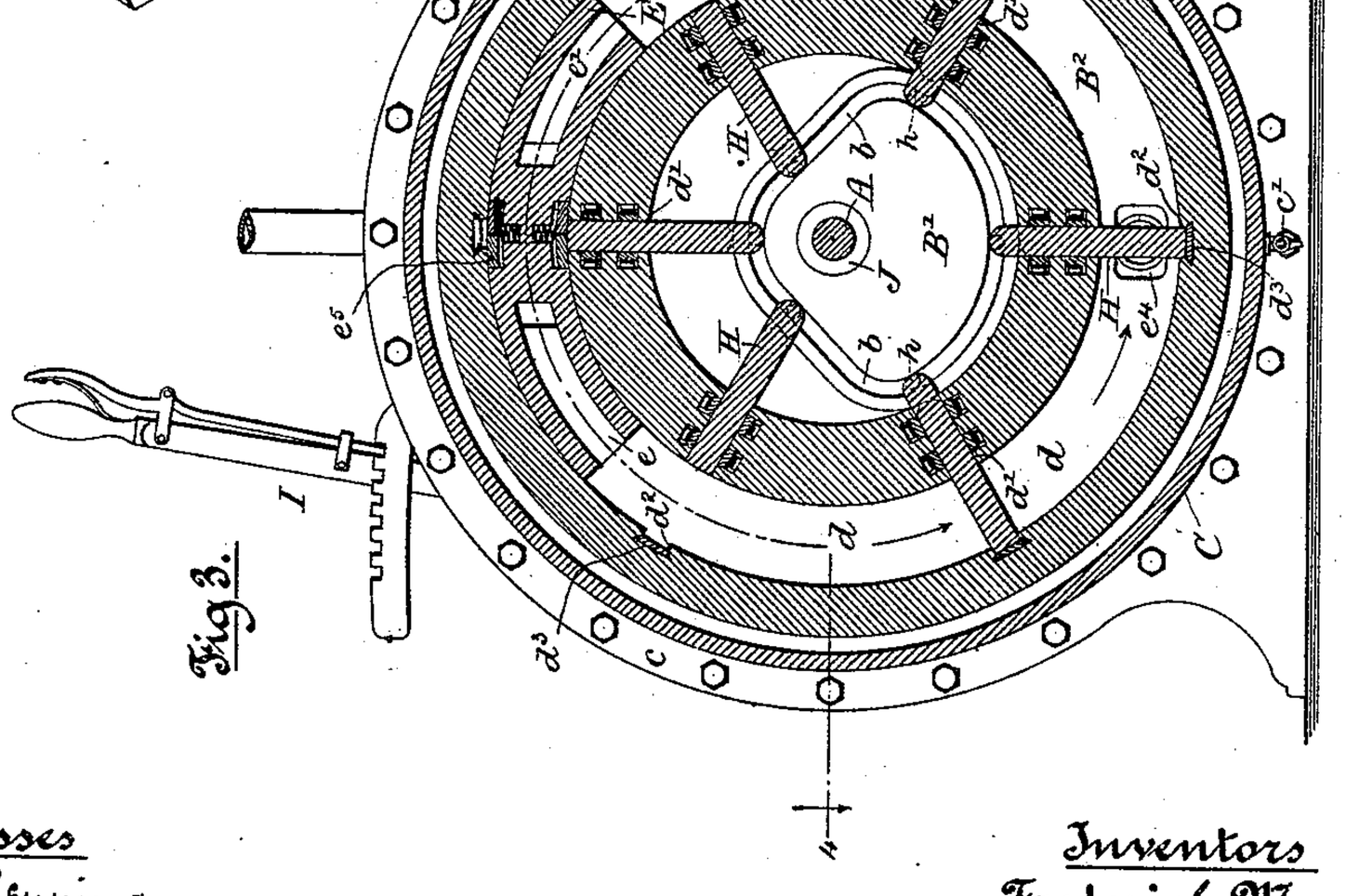


Fig 3.



Witnesses
Wm. T. Heming.
Louis M. T. Whitehead.

Inventors
Frederick Meyer
Joseph S. Kiehl
Alexander Grant
by Dayton, Poole & Brown Attorneys.

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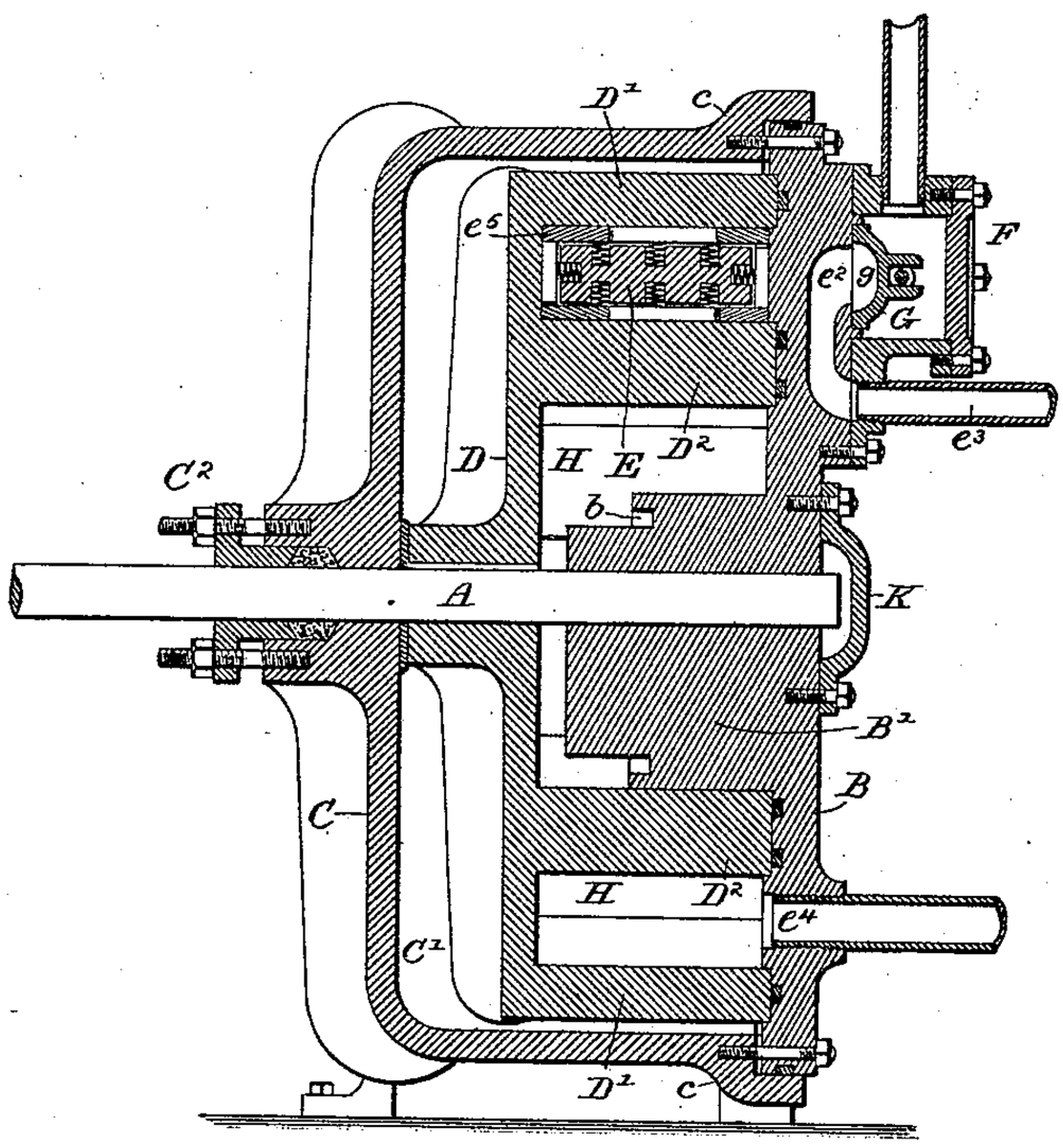
Fig 7.



Witnesses
Wm. J. Hemming.
Louis W. T. Whitehead.

Inventors
Frederick Meyer
Joseph S. Kiehl
Alexander Grant
by Dayton, Poole & Brown
Attorneys.

UNITED STATES PATENT OFFICE.

FREDERICK MEYER, OF ENGLEWOOD, JOSEPH S. KIEHL, OF CHICAGO, AND ALEXANDER GRANT, OF RIVERDALE, ASSIGNORS TO THE DUPLEX ROTARY ENGINE COMPANY, OF CHICAGO, ILLINOIS.

ROTARY STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 461,161, dated October 13, 1891.

Application filed April 6, 1889. Renewed June 25, 1890. Again renewed March 16, 1891. Serial No. 385,167. (No model.)

To all whom it may concern:

Be it known that we, FREDERICK MEYER, of Englewood, JOSEPH S. KIEHL, of Chicago, and ALEXANDER GRANT, of Riverdale, all in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Rotary Steam-Engines; and we do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to rotary steam-engines.

The primary feature of the invention is the combination, with a rotative shaft, of a disk fixed to said shaft and having parallel annular flanges separated by an annular space, a stationary or non-rotative disk or plate covering the open side of the annular space in the rotative disk and having secured thereto a block which fills an arc of said annular space, a series of pistons which slide through slots in one of the annular flanges of the rotative disk, an eccentric or its equivalent, which insures the retraction of said pistons, so that they may pass the stationary block and thereafter advance across the annular space between said flanges, and ports for the admission and discharge of steam to and from the said annular space.

In the drawings, Figure 1 is a side elevation of the engine, a part of the side plate nearest the eye being broken away to reveal certain inner features from that point of view. Fig. 2 is a central vertical section in the line 2 2 of Fig. 1. Fig. 3 is a central vertical section in the indirect line 3 3 of Fig. 2. Fig. 4 is a section in the indirect line 4 4 of Fig. 3. Fig. 5 is a perspective view of what will be hereinafter called the "port-block" of the engine. Fig. 6 is a perspective view of one of the several similar radially-sliding pistons detached. Fig. 7 is a section of a modification.

First describing Figs. 1 to 6, inclusive, A represents a shaft, to which the revolving parts of the engine are secured and which is intended to be rotated by the direct action of steam.

B is a stationary or non-rotating plate.

C is a second disk or plate of dished form, the marginal flange *c* of which is bolted to the plate B, thereby forming a chamber C′, within which the rotating parts secured to the shaft are placed.

D is a circular disk fixed to the shaft A in any suitable manner and provided with two annular cylindric flanges D′ and D², standing out from the body of the disk D on the same side thereof and concentric with the shaft A, said flanges projecting toward the stationary plate B.

B′ is a cam fixed to the plate B and extending inward around the shaft toward the disk D.

B² is a shouldered or sectionally-T-shaped ring fixed to the plate B concentric with the shaft A and opposite the space *d* between the flanges D′ and D².

D³ and D⁴ are shouldered rings fastened to the edges of the flanges D′ and D², respectively, and engaged with the shoulders of the ring B² for the purpose of holding the plate B and disk D from separation by pressure of steam admitted between them, while at the same time allowing the flanged disk D to rotate.

E is a curved or segmental block located in the space *d* between the flanges D′ and D², and secured to the stationary ring B² by suitable bolts, as indicated in Fig. 4 or otherwise. Said block serves as a stationary abutment with respect to the steam employed for driving the engine; but as it is also provided with steam-passages in the construction herein shown and preferred it will be hereinafter termed the "port-block."

F is a valve-chest secured to the outside of the plate B opposite the port-block E, and G is a valve located in the steam-chest.

H H are pistons or plates fitted to slide radially in slots *d′* in the inner flange D² and in grooves *d²* in the adjacent face of the disk D. These radially-sliding pistons H are all of equal dimensions, and when in their outer positions stand across the annular space *d* between the flanges D′ and D², so that steam admitted into said space between the fixed

port-block E and a piston so standing across the space *d* will impel a rotary movement of the disk D, in which said piston is mounted.

The cam B′ is reduced on its side toward the port-block sufficiently to allow the pistons to be drawn inward far enough to pass said port-block, as indicated; but beyond said reduced part the cam desirably extends into contact or proximity with the inside circumference of the inner annular flange D^2. For the purpose of retracting the pistons H or drawing them inward in passing the port-block said pistons are provided at their inner ends each with a projection *h*, which engages a groove *b* in the cam-block B′, and preferably this projection is placed in the median line of the piston in order that the strain applied to it by the cam in drawing it inward will be central and therefore not calculated to cause the piston to bind between the lateral guiding-surfaces therefor.

The port-block E is provided with two separate passages *e e′*, one of which opens at each end of the block into the space *d*, both communicating through the fixed ring B^2 with the steam-chest F at a distance from each other in a circular line drawn concentric with the shaft. Between these ports and formed in the plate B is a third passage or port e^2, intended as an exhaust. It is shown in Fig. 2 prolonged by the pipe e^3, which may be extended to any desired point of final discharge. A second exhaust-port is shown at e^4, consisting of an opening from the annular space *d* through the ring B^2 and plate B, said port e^4 being diametrically opposite the port e^2. This port e^4 is placed in the position stated with a view of providing a prompt discharge of the steam when the engine is adapted to be driven in either direction.

The valve G is shown as a slide-valve having a cavity *g*, adapted to put either of the ports *e e′* into communication with the exhaust-port e^2, while at the same sime exposing the other of the two ports *e e′* for the admission of steam from the steam-chest F. The ports *e e′*, covered by the valve, will of course give egress to any steam reaching it from the space *d*.

The number of pistons H is such that when a piston reaches the exhaust-port, or the first of the two exhaust-ports in case both are present, a second piston will have been advanced to its outer position between it and the port-block, so that the space into which steam is admitted will not be at the same time in communication with the exhaust-port.

From the above description it is obvious that steam admitted to the space *d* at one end of the port-block will act upon said block as an abutment and upon the first fully-extended piston at that side of the block with the effect of moving the piston away from the block and thereby rotating the parts by which said piston is supported. As soon as a piston is thrown out beyond the port-block the steam beyond that piston ceases to be effective and may be exhausted at once. It may, on the other hand, be retained until the space containing it is brought into communication with the opposite passage of the port block by the retraction of the more advanced one of the pistons confining it. We prefer to employ the exhaust-port e^4, diametrically opposite the port-block, because it is found in practice that a considerable portion of the steam will be thereby exhausted soon after becoming ineffective, the residue of the steam being exhausted by the opposite passage of the port-block in the further revolution of the engine. To reverse the engine, it is only necessary to shift the valve G, which will be done through the medium of any suitable means—as for example, the lever I, by which also the valve may be controlled to stop and start the engine. Manifestly any desired number of radially-sliding pistons H may be employed, provided there be a sufficient number to prevent communication between the steam-inlet port and the exhaust.

The port-block E may be packed in any suitable manner, a metallic packing being shown at e^5, consisting of parts set in a continuous transverse groove around the middle of the port-block and overlapping each other to prevent steam-communication past said port-block. The sections of this packing are shown to be thrown outward into contact with the moving surfaces of the disk D and its flanges D′ D^2 by springs. Any other construction of metal packing may be employed and any other form of packing may be substituted in place of that shown without departure from our invention. In Fig. 3, packing devices are also shown applied to the radial slots or grooves *d′* in the flange D^2, so as to prevent the passage of steam from the space *d* into the central cavity of the engine. The kind of packing here employed is not material. In the groove d^2, formed in the disk D for the further guidance of the pistons H, are placed packing-strips d^3, behind which are springs d^4, operating to press the pistons into contact at their opposite edges with the surfaces against which they bear at said opposite edges. For the purpose of slackening the pressure of contact between the overlapping shoulders or surfaces on the rings B^2, D^3, and D^4, when desired, the shaft A protrudes through the cam B′ and upon its protruding portion is provided with a screw-thread *a*, upon which is fitted a nut or nuts *a′*. By means of these nuts the shaft may be drawn slightly through the cam and the disk D thereby drawn proportionately toward the plate B, which of course relieves the pressure upon the overlapping surfaces of the rings B^2, D^3, and D^4. In this construction the prolonged shaft will turn in the cam B′, and it will be desirable to provide the conical metal bushing J around the shaft and within the cam, as indicated in Fig. 2. Over the nut *a′* is placed a cap K, which, if the shaft A is prolonged through it, will be provided with a stuffing-box *k*, as

shown. The passage through the stationary or non-revoluble disk C, in which the shaft A revolves, is also provided with a stuffing-box C^2. This construction insures the confinement within the shell or inclosure C′, formed by the flanged disk C and the plate B, bolted thereto, of any steam that may escape through the joints between the movable and stationary parts, and the cavity of said shell may be placed in communication with the exhaust-passage e^4 by a passage b', cast or otherwise formed in the plate B, and the water of condensation, if any, which shall be formed in said chamber C′, may be withdrawn by means of a petcock c'.

It is obvious that the steam-ports may lead from the steam-chest directly into the space d without passing through the port-block or abutment E, or, in other words, at points beyond the ends of said port-block; but we prefer to make the port-block of considerable length, as indicated, and to form the ports therein.

In Fig. 7 a modification is shown in which the mutually-engaging rings B^2, D^3, and D^4 are omitted, and in which the edges of the flanges D′ and D^2 run in direct contact with the plate B. In this case the port-block or abutment E is also secured directly to the plate B. Another modification shown in this figure consists in employing the bolts which join the plate B with the dished disk C as a means for regulating the pressure of the flanges D′ and D^2 against the plate B, and for this purpose the disk C near the shaft bears directly against the hub of the inner and revolving disk D.

We claim as our invention—

1. The combination, with the shaft, of a non-revoluble plate, a disk secured to the shaft parallel with the said plate and provided with a concentric flange having radial slots for pistons, pistons in said slots, a cylindric flange parallel with the slotted flange and separated therefrom by an annular space, a stationary part or abutment between the flanges, suitable ports for the admission and discharge of steam to and from the annular space between the flanges, a suitable valve for the control of steam-supply, and a cam for retracting the pistons in their movement past the abutment, substantially as described.

2. The combination of a non-revoluble plate B, a shaft A, a disk D, secured to the shaft and provided with parallel and concentric flanges D′ D^2, pistons having radial movement in the flange D^2, and a cam engaged with the pistons, and ports leading through the plate B from the space d, substantially as described.

3. The combination of a non-revoluble plate B, a shaft A, a disk D, secured to the shaft and provided with parallel and concentric flanges D′ D^2, a sectionally-T-shaped ring B^2, fixed to the plate B opposite the space d between the flanges D′ and D^2 and provided with steam and exhaust ports extended through the plate B, an abutment occupying a place in the space d and secured to the ring B^2, rings D^3 and D^4, secured to the flanges D′ and D^2 and engaged with the ring B^2, pistons having radial movement in the flange D^2, and a cam engaged with the pistons, substantially as described.

4. In a rotary engine substantially as described, the combination, with the plate B, having the sectionally-T-shaped ring B^2 secured thereto, and the revoluble disk D, having the flanges D′ and D^2 engaged with the ring B^2, of the shaft upon which the disk D is secured, prolonged through the plate B and provided with a screw-thread and nut whereby the pressure of the engaging surfaces of the rings may be relieved, substantially as described.

5. The combination of a shaft, a disk secured thereto having concentric flanges separated by an annular space d, a fixed or non-revoluble plate parallel with the said disk, a block secured to the plate and projecting into said space d, provided with one or more steam-passages extended through the plate, a valve-chest and valve supported on the plate over the steam port or ports, pistons movable into and out of the space d, and a cam for actuating the pistons, substantially as described.

6. The combination, with the stationary and revolving disks, concentric flanges separated by an intermediate annular space, radially-movable pistons, and a stationary abutment in the said annular space supported by the stationary plate, of a steam-chest having ports communicating with the annular space at opposite sides of the abutment, and a valve within the chest adapted to close either of these ports and open the other, whereby the direction of rotation of the engine may be reversed by movement of the valve, substantially as described.

In testimony that we claim the foregoing as our joint invention we affix our signatures in presence of two witnesses.

FREDERICK MEYER.
JOSEPH S. KIEHL.
ALEXANDER GRANT.

Witnesses:
M. E. DAYTON,
C. CLARENCE POOLE.