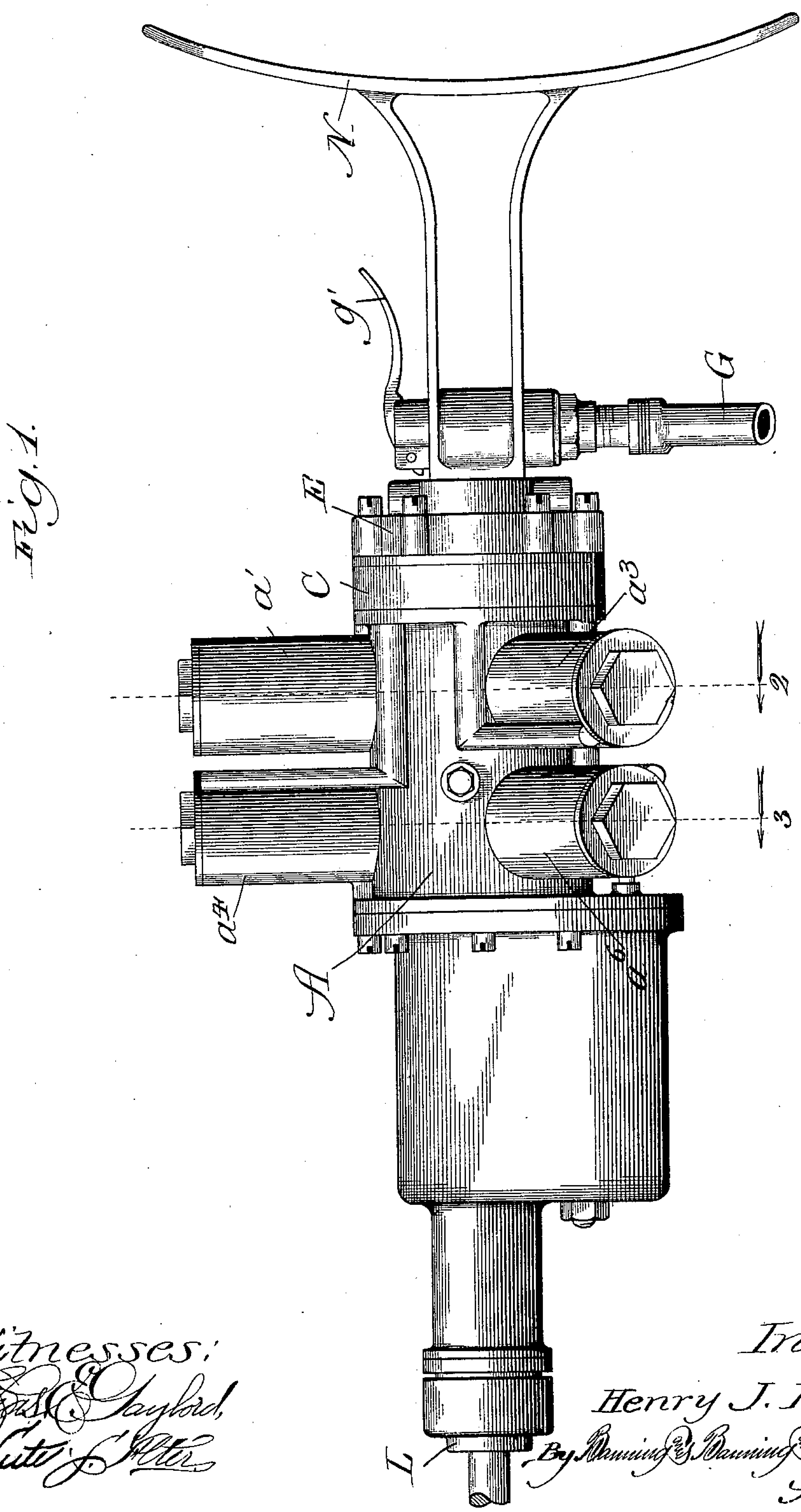
No. 639,737. Patented Dec. 26, 1899.

H. J. KIMMAN.

FLUID PRESSURE ENGINE.

(Application filed June 12, 1897.)

(No Model.) 5 Sheets—Sheet 1.



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(No Model.) 5 Sheets—Sheet 2.

Fig. 2.

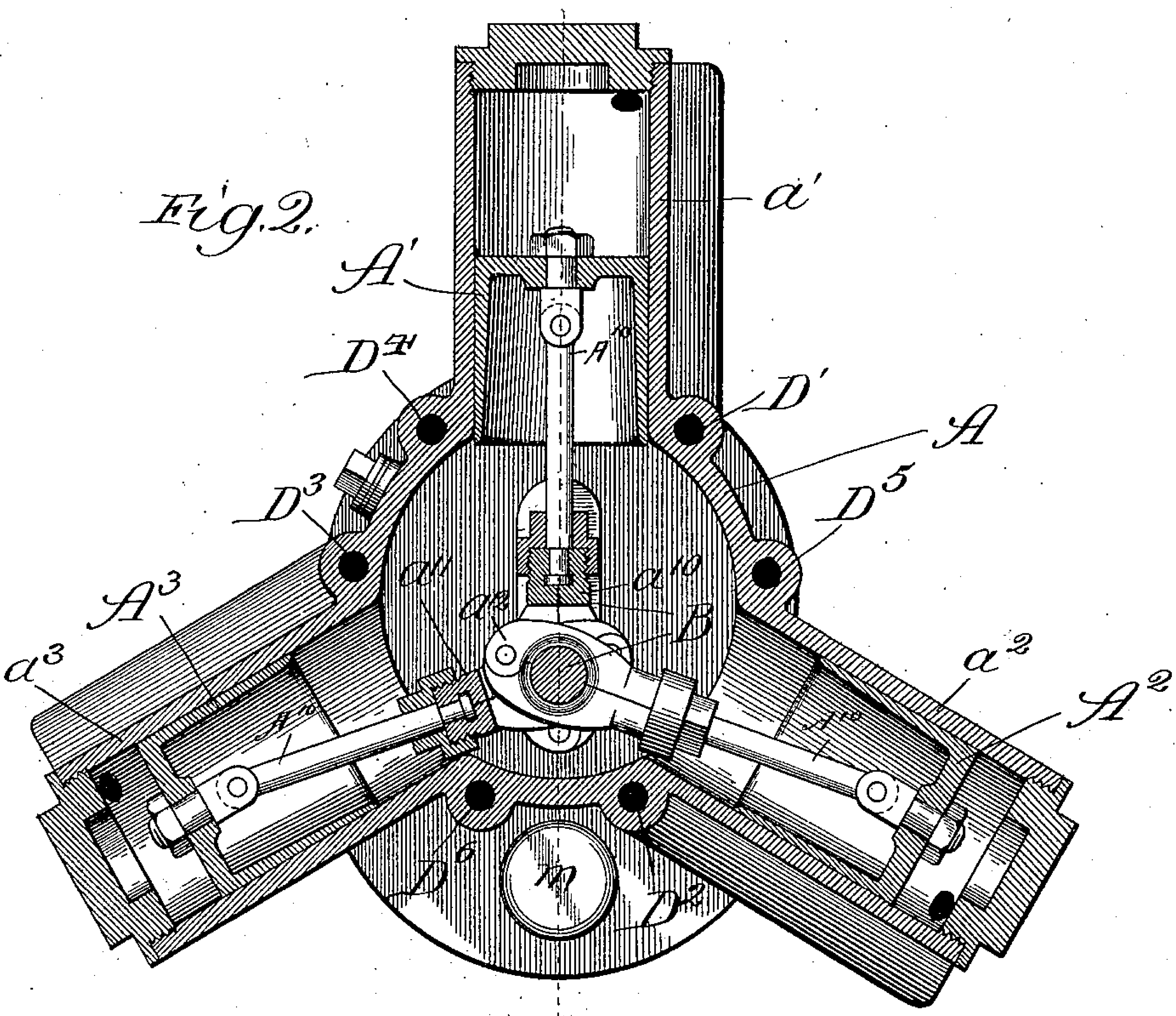
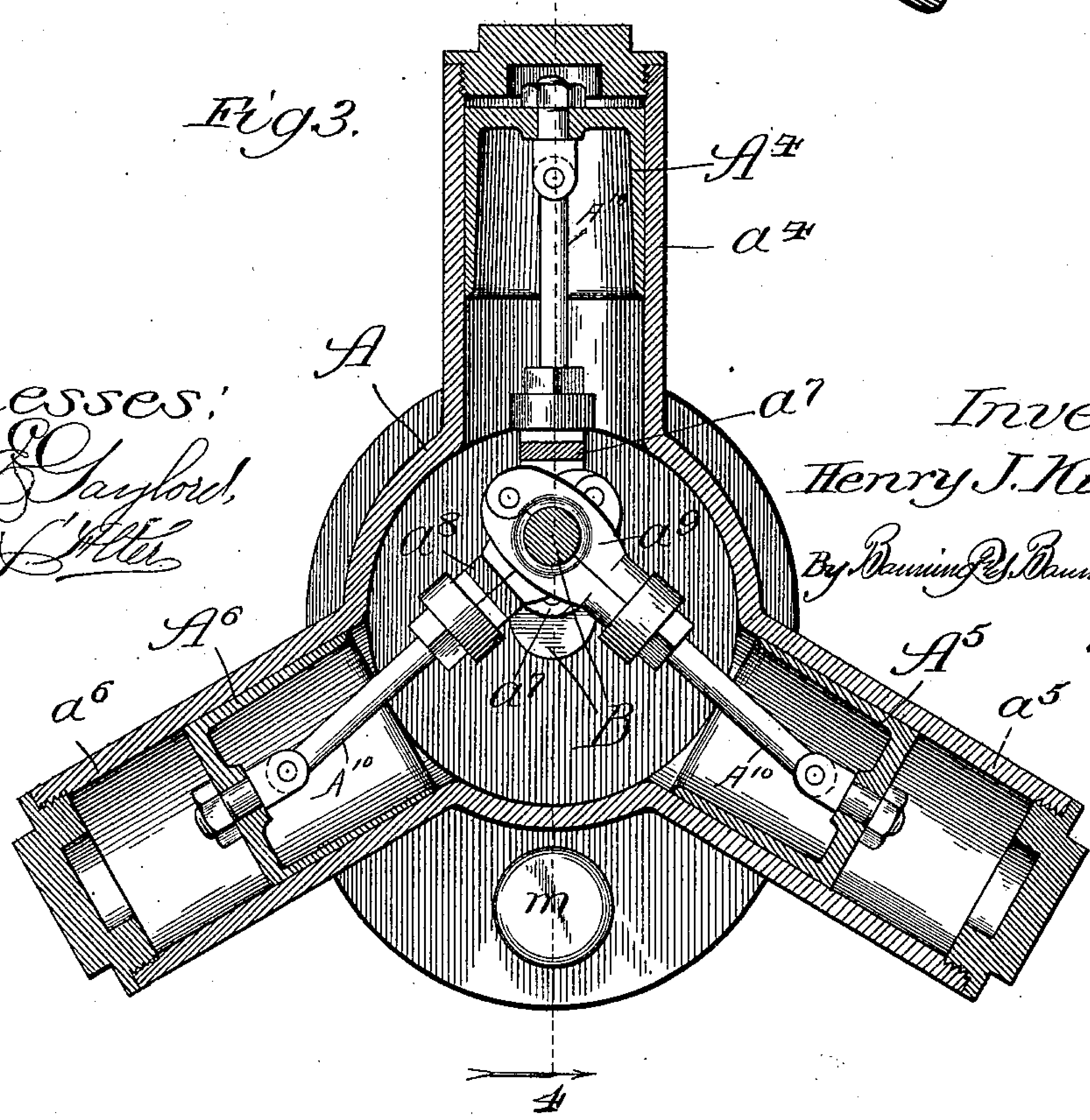


Fig. 3.



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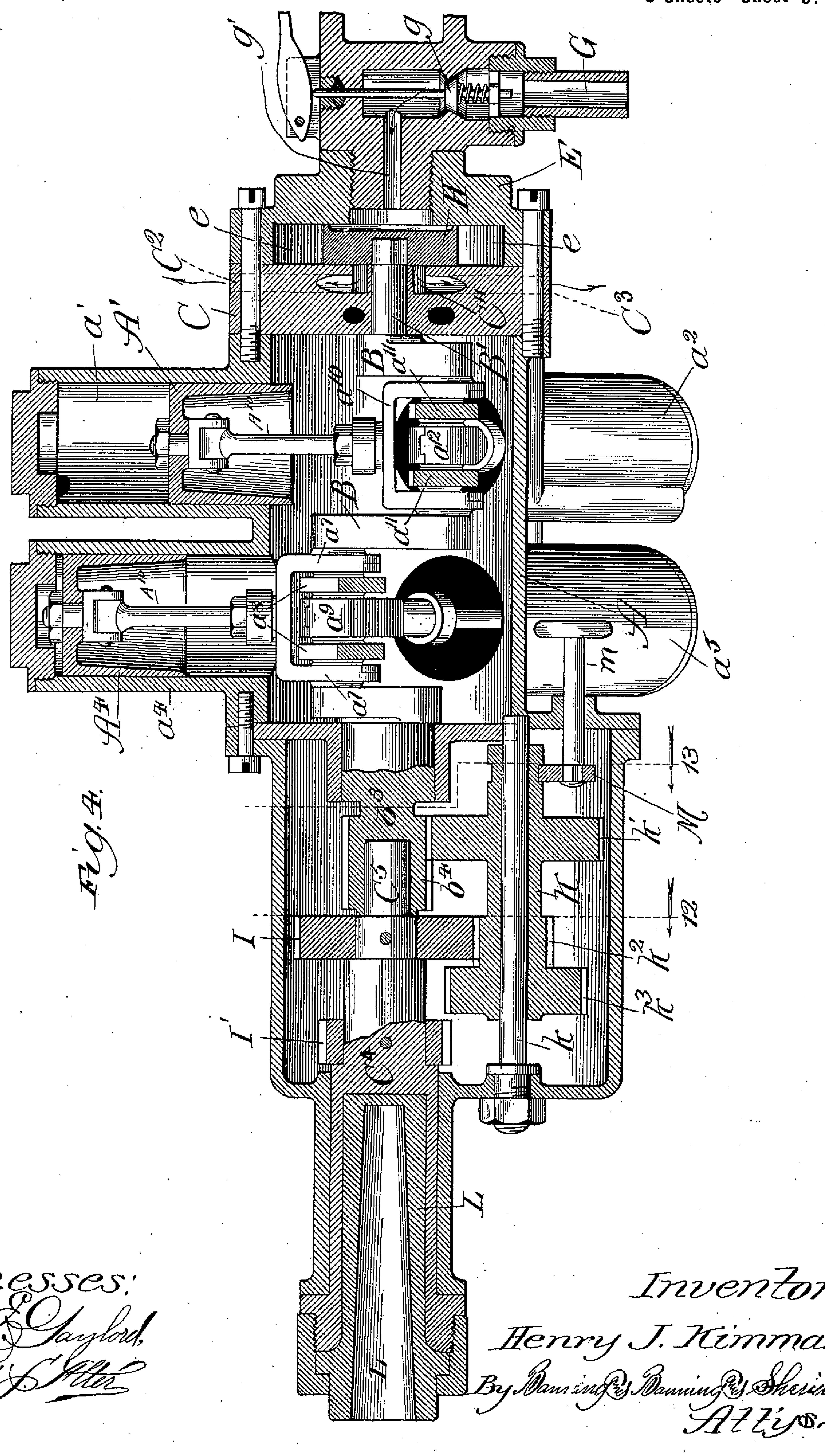

Fig. 4.

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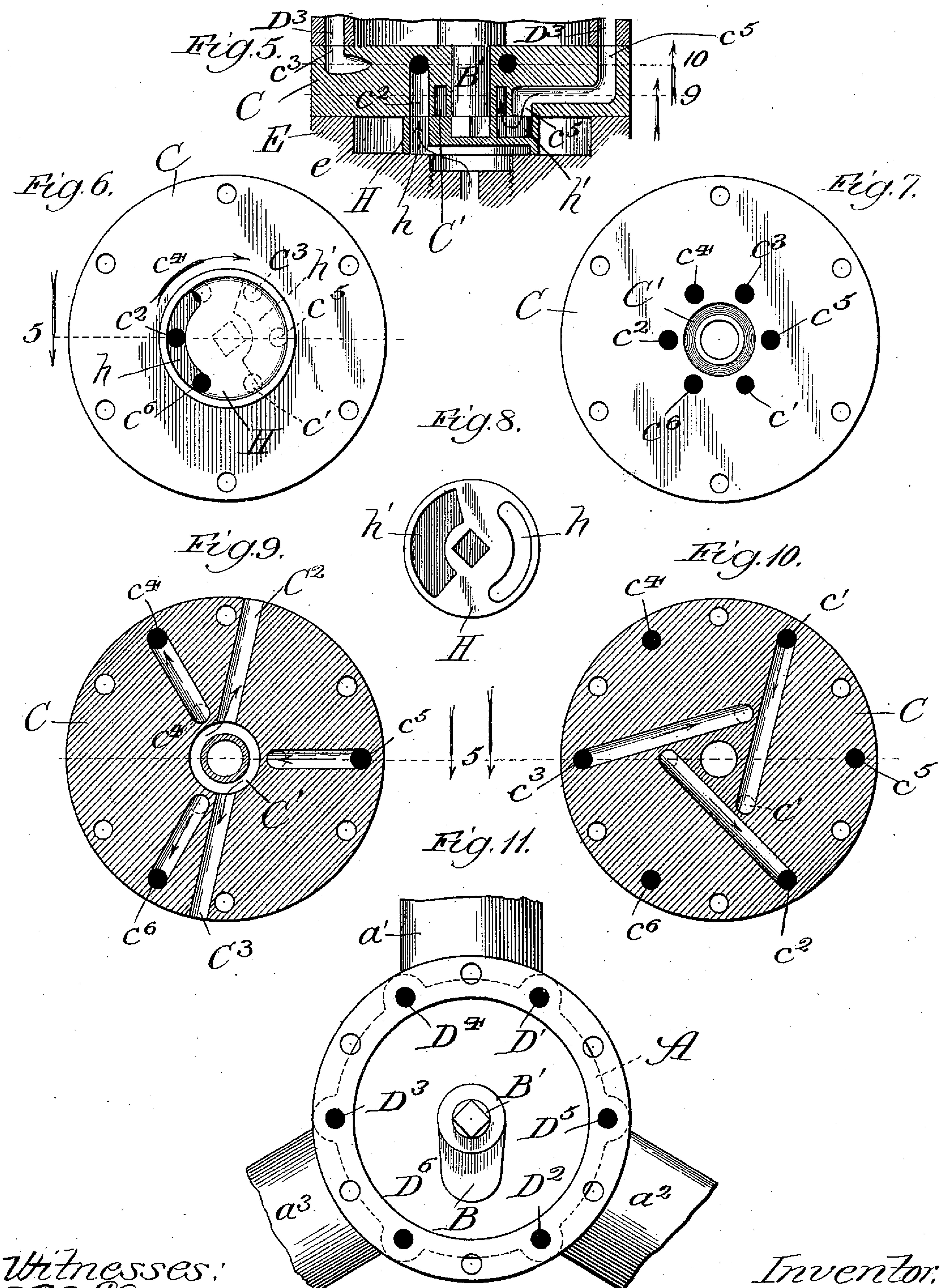

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(No Model.) 5 Sheets—Sheet 5.

Fig. 12.

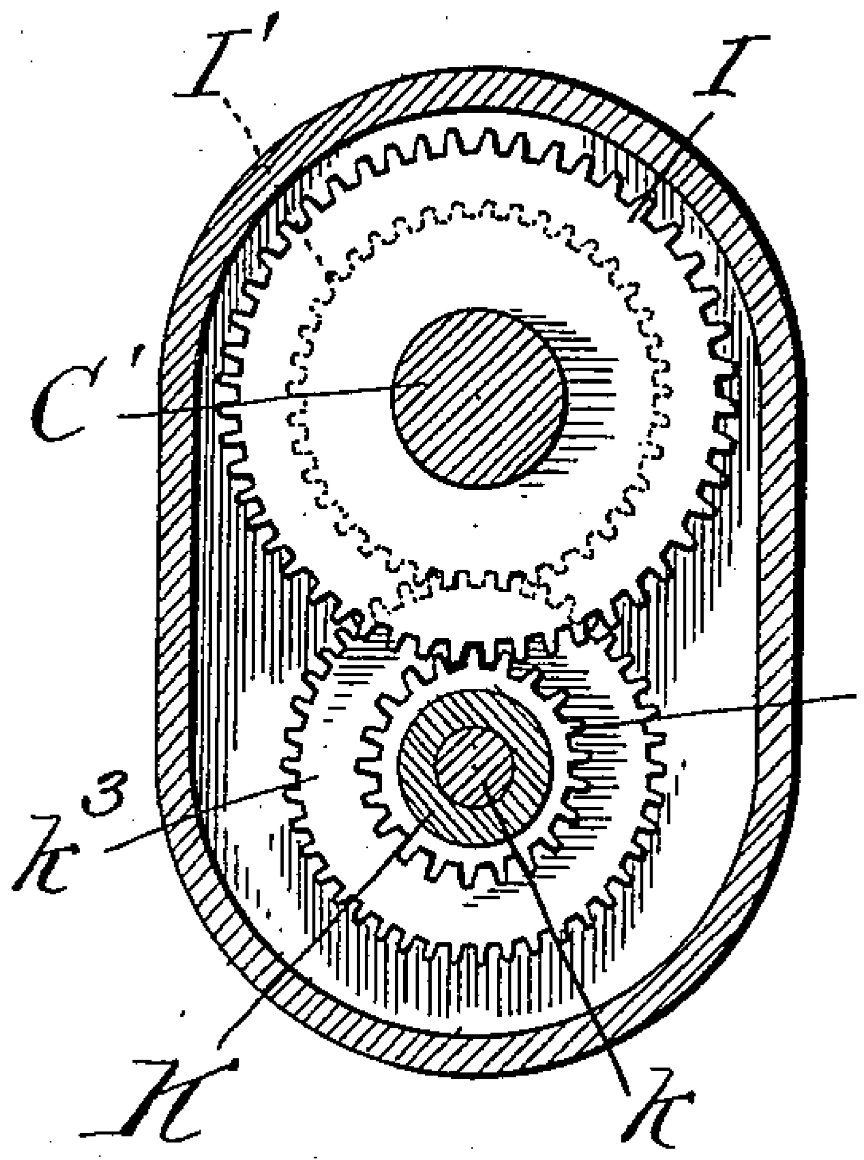


Fig. 13.

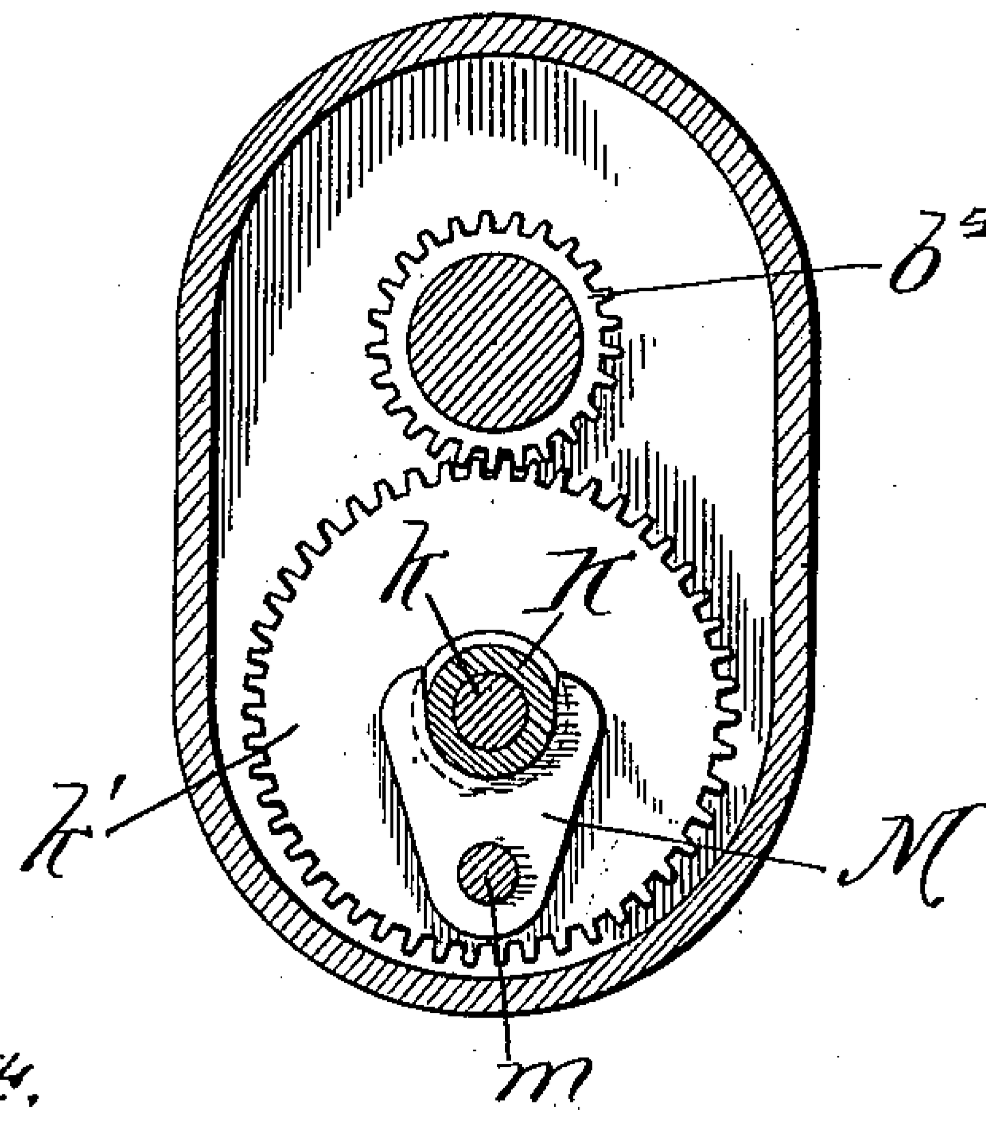


Fig. 14.

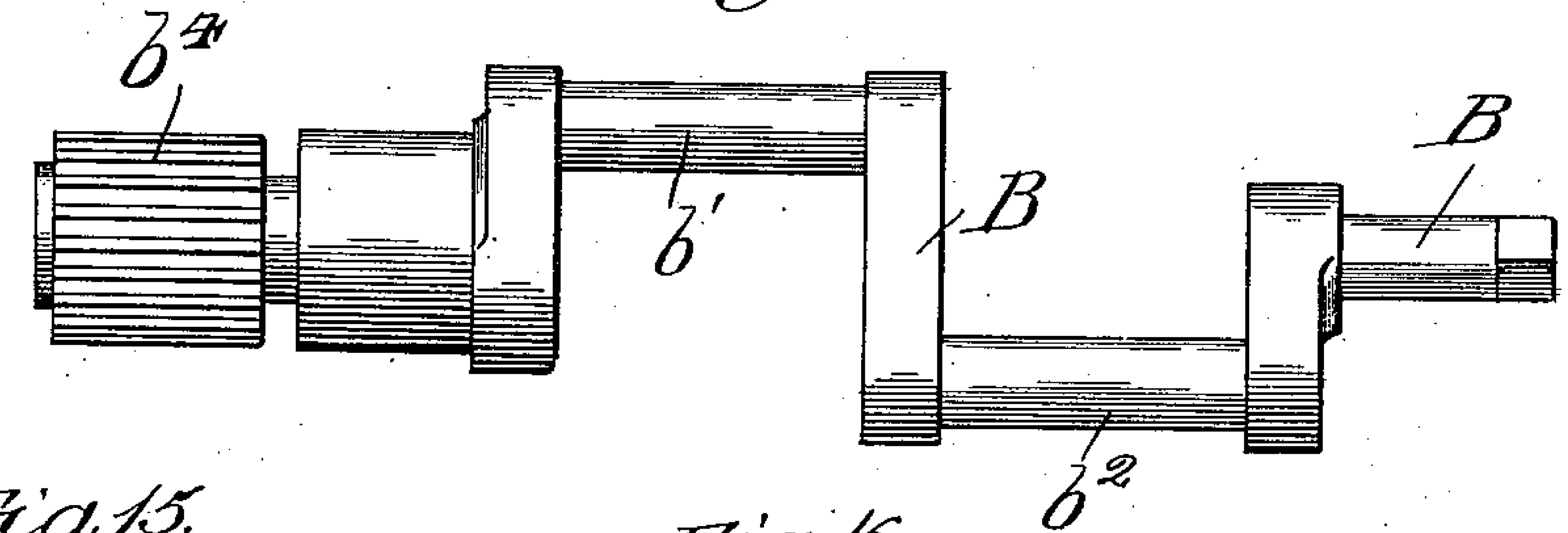


Fig. 15.

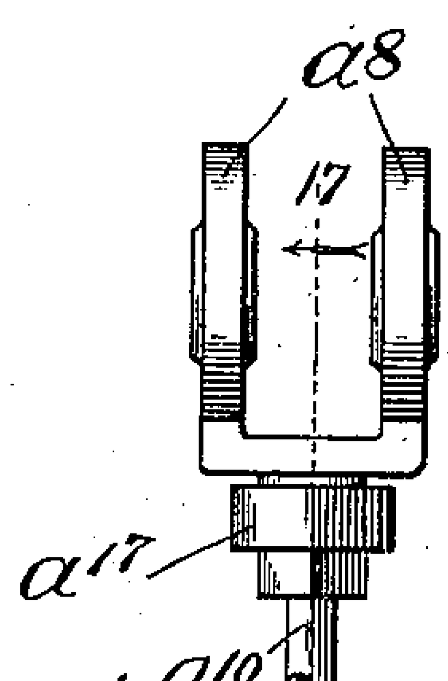


Fig. 16.

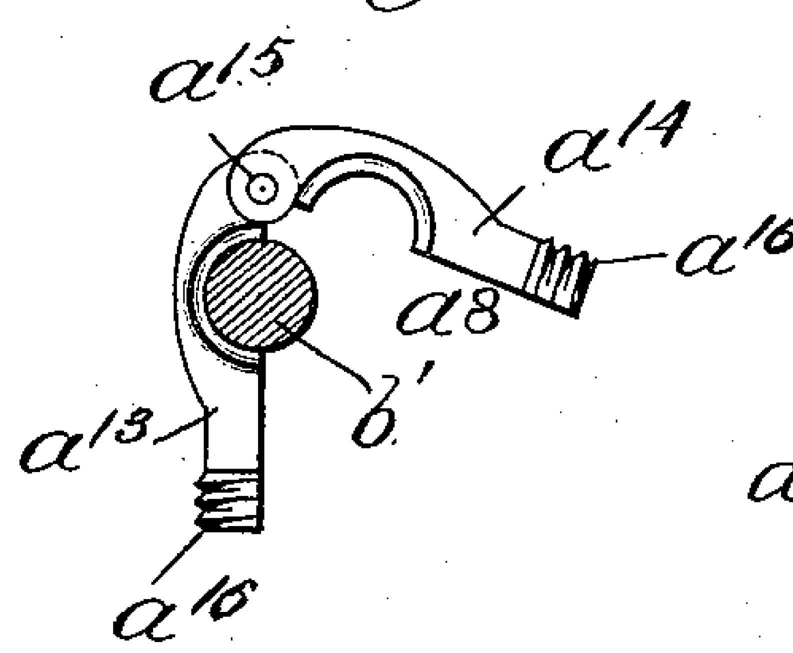


Fig. 17.

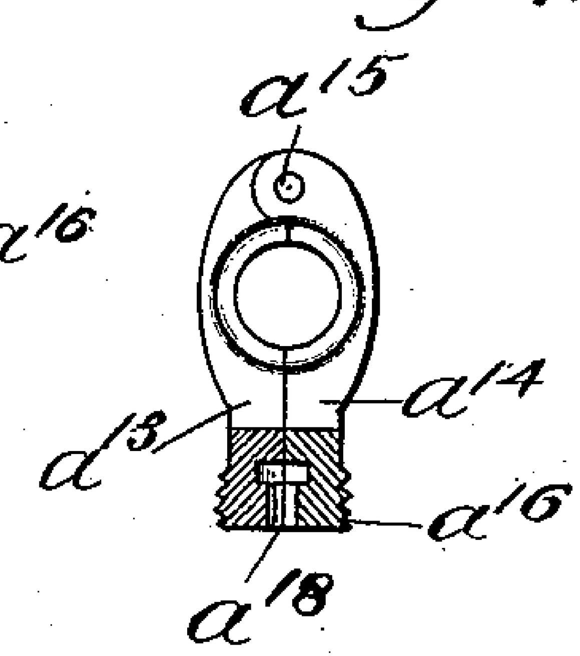
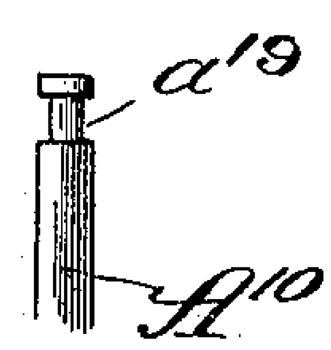


Fig. 18.



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UNITED STATES PATENT OFFICE.

HENRY J. KIMMAN, OF CHICAGO, ILLINOIS.

FLUID-PRESSURE ENGINE.

SPECIFICATION forming part of Letters Patent No. 639,737, dated December 26, 1899.

Application filed June 12, 1897. Serial No. 640,519. (No model.)

To all whom it may concern:

Be it known that I, HENRY J. KIMMAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Fluid-Pressure Engines, of which the following is a specification.

My invention relates particularly to that class of engines known as the "Brotherhood" type, and especially to the construction and operation of parts so as to permit of the economical and efficient introduction of the fluid-pressure behind the reciprocating pistons.

The object of my invention is to provide a simple, economical, and efficient multiple engine; and the invention consists in the features, combinations, and details of construction hereinafter described and claimed.

In the accompanying drawings, Figure 1 is an elevation of an engine constructed in accordance with my improvements, showing all of the operative parts inclosed and protected from external influences; Fig. 2, a transverse sectional view taken on line 2 of Fig. 1; Fig. 3, a similar view taken on line 3 of Fig. 1; Fig. 4, a longitudinal sectional view taken on line 4 of Fig. 3; Fig. 5, a sectional view taken on line 5 of Figs. 6, 9, and 10; Fig. 6, a view of the end ported plate of the engine with the rotating disk valve located thereon; Fig. 7, a similar view with the rotating disk removed; Fig. 8, a view of the inner side of the rotating disk valve; Figs. 9 and 10, transverse sectional elevations taken on lines 9 and 10 of Fig. 5; Fig. 11, an end view of the engine-casing and crank-shaft with the cap and ported plate removed; Figs. 12 and 13, transverse sectional views taken on lines 12 and 13, respectively, of Fig. 4; Fig. 14, a side elevation of the crank-shaft, and Figs. 15, 16, 17, and 18 detail views of the connecting-rod end and connecting-rod hereinafter described.

In constructing an engine in accordance with my improvements I make a casing A of the desired size, shape, and strength to support, contain, and inclose all of the operative parts of the engine and efficiently protect the same from exterior influences—such as dust, dirt, and the like. This casing is provided with six cylindrical pressure-chambers a', a^2, a^3, a^4, a^5, and a^6, arranged in two sets of three, each occupying different planes with regard to the rotation of the crank-shaft. Each cylinder is preferably arranged at an angle of about one hundred and twenty degrees from each other cylinder in the set and is provided with reciprocating pistons A', A^2, A^3, A^4, A^5, and A^6. A crank-shaft B is provided having two crank portions b' and b^2, arranged at one hundred and eighty degrees or diametrically opposite to each other, to which the connecting-rod ends a^7, a^8, a^9, a^{10}, a^{11}, and a^{12} of each of the pistons are connected. It will thus be seen that by arranging the cylinders in two sets containing three cylinders each, with each cylinder one hundred and twenty degrees from the next adjacent cylinder, and connecting their piston-rod ends in the manner above described, the objection of irregularity of rotation, which causes annoying vibrations, is obviated and an easy smooth-running engine produced.

The crank-shaft above described has one end B' mounted in a ported plate C and its opposite end connected with a rotating bearing portion C^4, such end containing an axial opening b^3 and provided with a pinion b^4 for transmitting power and motion to a compound train of gears, as hereinafter described.

In order to admit fluid-pressure to the cylindrical pressure-chambers in the rear of the pistons—that is, between the pistons and cylinder-head—the engine-casing is provided with six passages D', D^2, D^3, D^4, D^5, and D^6, one leading to each of the cylindrical chambers above indicated, the passage D' leading to the cylinder a', the passage D^2 leading to the cylinder a^2, the passage D^3 leading to the cylinder a^3, the passage D^4 leading to the cylinder a^4, the passage D^5 leading to the cylinder a^5, and the passage D^6 leading to the cylinder a^6.

As above indicated, one end of the engine-casing is closed by means of a ported plate C, in which one end of the crank-shaft is journaled. This ported plate has six passages c', c^2, c^3, c^4, c^5, and c^6 leading from each of the passages in the casing to a point or points near the center of the plate, where they open to the exterior outer plane surface of the plate. A cap E is secured to the engine-casing outside of the plate and is capped, so as to provide a chamber e, into which the pressure is admitted from the inlet-pipe G by means of the throttle-valve g, through the passage g'. The outer end of the crank-shaft is squared and provided with a disk valve H, which is fitted thereon and adapted to rotate therewith. This disk valve has a segmental perforation h and a segmental cup-recess h', the segmental perforation, as shown in Fig. 6, allowing the fluid-pressure from the valve-chamber e to pass through into several of the ported passages, and consequently into two or more of the cylindrical pressure-chambers, at one time. The segmental cup-shaped recess at the same time connects two or more of the ported passages above indicated with a central annular recess C', which is connected with the outer air by means of the exhaust-passages C^2 and C^3, so that fluid-pressure may be exhausted to the outer air from such cylinders as are connected with the annular recess by means of the rotating disk valve.

In Fig. 6 of the drawings the rotating disk valve is so located that fluid-pressure may flow from the valve-chamber through the passages c^4 D^4 into the cylindrical pressure-chambers a^4, through passages c^2 D^2 into the cylindrical pressure-chamber a^2, through passages c^6 D^6 into the cylindrical pressure-chambers a^6 and give an impulse to the pistons of such cylinders. It will be noted from an inspection of the drawings and the direction in which the disk valve is rotating that the piston of each cylinder obtains its impulse at practically the same period of operation—viz., the beginning of its forward stroke—and as the valve is arranged it will be seen that the piston A^4 is just obtaining an impulse while the piston A^2 is at its best position under full pressure and the piston A^6 at the limit of its forward stroke just previous to the closing of its passage. While these three cylinders, with their respective pistons, are receiving an impulse, the fluid-pressure is being exhausted from the other three cylinders, and as the index-letters a', D', and c' indicate similar cylinder-chambers and the passages with which they are connected the exhaust of the fluid can be readily followed.

It will be noticed from the above description of the construction of the parts that but one valve is used to control the admission and exhaustion of fluid from all the cylindrical chambers and that thereby the efficiency and regulation of the different parts is provided for, and practically no timing is necessary, the setting of the valve for one cylinder automatically adapting it to all the others.

To transmit power and motion as desired from the crank-shaft, such shaft is provided with an independent extension C^4, above alluded to, which has its end C^5 bearing in the axial recess of the crank-shaft. This independent rotating bearing portion is provided with a large spur-gear I and a smaller spur-gear I', adapted to be compounded with the spur-pinion b^4 on the crank-shaft. A second set of what might be termed "back" gears are provided and arranged in the following manner: A longitudinally-movable sleeve K is mounted on a fixed rod or shaft k and provided with three spur-gears k', k^2, and k^3, which may be shifted, as desired, so as to change the driving of the shank L, which is mounted in the rotating bearing portion from a slow to a high speed. As shown in Fig. 4 of the drawings, the pinion b^4 on the crank-shaft engages with the large pinion k' of the back gears, and the large gear of the rotating bearing portion engages with the small pinion of the back gears, so that the high speed of the rotating crank-shaft produces a slow speed of the bearing portion and its shaft. The back gears are slidingly mounted on the shaft above alluded to and provided with a yoke M and handle portion m, by which they can be moved longitudinally to the left, thereby causing the disengagement of the large spur-wheel I and the small spur-pinion k^2 and the engagement of the medium-sized spur-pinion I' and the medium-sized spur-gear on the back gear k^3. In this way a relatively higher speed of the bearing portion and its shank or tool-holder is produced. By this arrangement of compounding the gears and movably mounting the back gears the relative speed between the crank-shaft and the tool-holder may be changed to suit different circumstances and conditions.

As the crank-shaft is constructed it would be practically impossible to economically connect a solid connecting-rod end therewith, and in order to provide an economical and efficient connecting-rod end I construct such end in two parts a^{13} and a^{14}, pivoted together at a^{15} at their outer portions, their inner shank ends being screw-threaded, as at a^{16}, so that a nut a^{17} will effectually lock such parts and form a bearing for the crank-pin. The shank end of each connecting-rod end is recessed, as at a^{18}, (shown in Fig. 17,) to receive the shouldered end a^{19} of the connecting-rod A^{10} and effectually lock the same in position.

If it be desired at any time to use the engine and attached parts as a breast or hand drill, one end of the engine-casing may be provided with a rest portion N, secured thereto in any convenient manner, against which the breast or arm of the operator may be pressed for the purpose of holding it up to its work, and, in fact, the engine may be provided with any of the usual appliances to suit different circumstances and conditions necessary for its use in the arts.

While I have described my invention with more or less minuteness as regards details and as being embodied in certain precise forms, I do not desire to be limited thereto unduly or any more than is pointed out in the claims. On the contrary, I contemplate all proper changes in form, construction, and arrangement, the omission of immaterial elements and the substitution of equivalents, as circumstances may suggest or necessity render expedient.

I claim—

1. In a fluid-pressure engine or motor, the combination of a casing, a front set and a rear set of pressure-cylinders, each set consisting of three cylinders radiating from the casing at equidistant points with the cylinders of one set in line with the cylinders of the other set, the two sets of cylinders arranged in parallel transverse lines longitudinal of the casing, a piston for each cylinder, a piston-rod for each piston, a crank-shaft mounted in bearing portions of the casing, and two cranks on the shaft diametrically opposite each other, one crank for each set of cylinders, each crank separately connected with the piston-rods of its set of cylinders for the shaft to receive impetus from both sets of cylinders at the same time, substantially as described.

2. In a fluid-pressure engine or motor, the combination of a main casing, a front set and a rear set of pressure-cylinders, each set consisting of three cylinders radiating from the casing at equidistant points with the cylinders of one set in line with the cylinders of the other set, the two sets of cylinders arranged in parallel lines longitudinally of the casing, a piston in each cylinder, a piston-rod for each piston, a central crank-shaft, two cranks on the shaft diametrically opposite to each other, one crank for each set of cylinders, each crank separately connected with the piston-rod of its set of cylinders, a side passage in the wall of each cylinder opening into the cylinder-chamber at the outer end thereof back of the piston, a longitudinal passage in the main casing for each cylinder-passage extending to the end of the casing, the two passages forming an induction and eduction passage for the cylinder-chamber, an end head or plate for the casing, an induction-passage in the end head or plate for each casing-passage, eduction-passages in the end head or plate communicating with the casing-passages, and a valve controlling the induction and eduction passages of the end head or plate for admitting pressure to both sets of cylinders in part and exhausting pressure from both sets of cylinders in part, substantially as described.

3. In a fluid-pressure engine or motor, the combination of a main casing, a front set and a rear set of pressure-cylinders, each set consisting of three cylinders radiating from the casing at equidistant points with the cylinders of one set in line with the cylinders of the other set, the two sets of cylinders arranged in parallel transverse lines longitudinally of the casing, a side passage in the wall of each cylinder opening into the cylinder-chamber at the outer end thereof, a longitudinal passage in the main casing for each cylinder-passage extending to the end of the casing, the side passage and the longitudinal passage together forming the induction and eduction passages for the cylinder-chamber, an end head or plate for the casing, an induction-passage in the end head or plate for each casing-passage, eduction-passages in the end head or plate communicating with the casing-passages, an annular groove in the end head or plate into which the eduction-passages open, and a rotating valve having an acting face open on one side to the induction-passages and entirely covering the annular groove on that side or face of the valve and open on the opposite side or face to both the induction-passages and the annular groove, whereby the valve on one side uncovers the induction-passages in rotation to admit fluid-pressure into the chambers of the pressure-cylinders and on the opposite connects the induction-passages with the annular groove for exhausting the fluid-pressure from the chambers of the pressure-cylinders, substantially as described.

4. In a fluid-pressure engine or motor, the combination of a main casing, a front set and a rear set of pressure-cylinders, each set consisting of three cylinders radiating from the casing at equidistant points with the cylinders of one set in line with the cylinders of the other set, the two sets of cylinders arranged in parallel transverse lines longitudinally of the casing, a piston and piston-rod for each cylinder, a side passage in the wall of each cylinder opening into the cylinder-chamber at the outer end thereof, a longitudinal passage in the main casing for each cylinder-passage extending to the end of the casing, the side passage and the longitudinal passage together forming an induction and eduction passage for the cylinder-chamber, an end head or plate for the casing, an induction-passage in the end head or plate for each casing-passage, eduction-passages in the end head or plate communicating with the casing-passages, an annular groove in the end head or plate into which the eduction-passages open, a crank-shaft mounted in the main casing, two cranks on the shaft diametrically opposite each other, one crank for each set of pistons, and a rotating valve carried by the shaft and having an acting face open on one side to the induction-passages of the end head or plate and entirely covering the annular groove on that side and open on the opposite side to both the induction-passages and the annular groove for the rotation of the crank to rotate the valve and control the induction of fluid-pressure to the cylinders and the eduction of fluid-pressure from the cylinders, substantially as described.

5. In a fluid-pressure engine or motor, the combination of a main casing, a front set and a rear set of pressure-cylinders, each set consisting of three cylinders radiating from the casing at equidistant points of one hundred and twenty degrees angle to each other with the cylinders of one set in line with the cylinders of the other set, the two sets of cylinders arranged in parallel transverse planes longitudinally of the casing, a piston in each cylinder, a piston-rod for each piston, a crank-shaft mounted in the main casing, and two cranks on the shaft located diametrically op-

posite each other, one crank for each set of cylinders, each crank separately connecting with the piston-rod of its set of cylinders, whereby the shaft alternately receives impetus from two cylinders of one set and one cylinder of the other set enabling both sets of cylinders to drive the shaft, substantially as described.

6. In a fluid-pressure engine or motor, the combination of a main casing, a front set and a rear set of pressure-cylinders, each set consisting of three cylinders radiating from the casing at equidistant points, with the cylinders of one set in line with the cylinders of the other set, the two sets of cylinders arranged in parallel transverse lines longitudinally of the casing, a side passage in the wall of each cylinder opening into the cylinder-chamber at the outer end thereof, a longitudinal passage in the main casing for each cylinder-passage extending to the end of the casing, the side passage and the longitudinal passage together forming an induction and eduction passage for the cylinder-chamber, an end head or plate for the casing, an induction-passage in the end head or plate for each casing-passage, eduction-passages in the end head or plate communicating with the casing-passages, an annular groove in the end head or plate into which the eduction-passages open, a cap or cover on the end head or plate, a fluid-pressure chamber between the cap or cover and the end head or plate, and a rotating valve in the fluid-pressure chamber operating to cover and uncover the passages in the head or plate and connect such passages with the annular groove, for the covering and uncovering of the passages to admit pressure to and shut off pressure from the cylinder-chambers and for the connection with the annular groove to exhaust pressure from the cylinder-chambers in succession, substantially as described.

7. In a fluid-pressure engine or motor, the combination of a main casing, a front set and a rear set of pressure-cylinders, each set consisting of three cylinders radiating from the casing at equidistant points with the cylinders of one set in line with the cylinders of the other set, the two sets of cylinders arranged in parallel transverse lines longitudinally of the casing, a piston in each cylinder, a piston-rod for each piston, a crank-shaft, and two cranks on the shaft located diametrically opposite to each other in different planes with regard to the rotation, one crank for each set of cylinders, each crank having the piston-rods of its set of cylinders separately connected therewith, whereby the crank receives impetus from one cylinder and two cylinders of the two sets of cylinders alternately, substantially as described.

8. In a fluid-pressure engine or motor, the combination of a main casing, a front set and a rear set of pressure-cylinders, each set consisting of three cylinders radiating from the casing at equidistant points, the two sets of cylinders arranged in parallel transverse lines longitudinally of the casing, a side passage in the wall of each cylinder opening into the outer end of the cylinder-chamber, a longitudinal passage in the main casing for each cylinder-passage extending to the end of the casing, the side passage and the longitudinal passage together forming an induction and eduction passage for the cylinder-chamber, an end head or plate for the casing, an induction-passage in the end head or plate for each casing-passage, eduction-passages in the end head or plate communicating with the casing-passages, and a valve controlling the induction and eduction passages of the end head or plate for contemporaneously admitting pressure to three cylinders consecutively and exhausting pressure from three cylinders consecutively, whereby one cylinder and two cylinders of the two sets of cylinders alternately receive an exhaust-pressure, substantially as described.

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