(No Model.) 3 Sheets—Sheet 1.

J. A. COCKER.

ROTARY STEAM ENGINE.

No. 591,032. Patented Oct. 5, 1897.

Fig. 1.

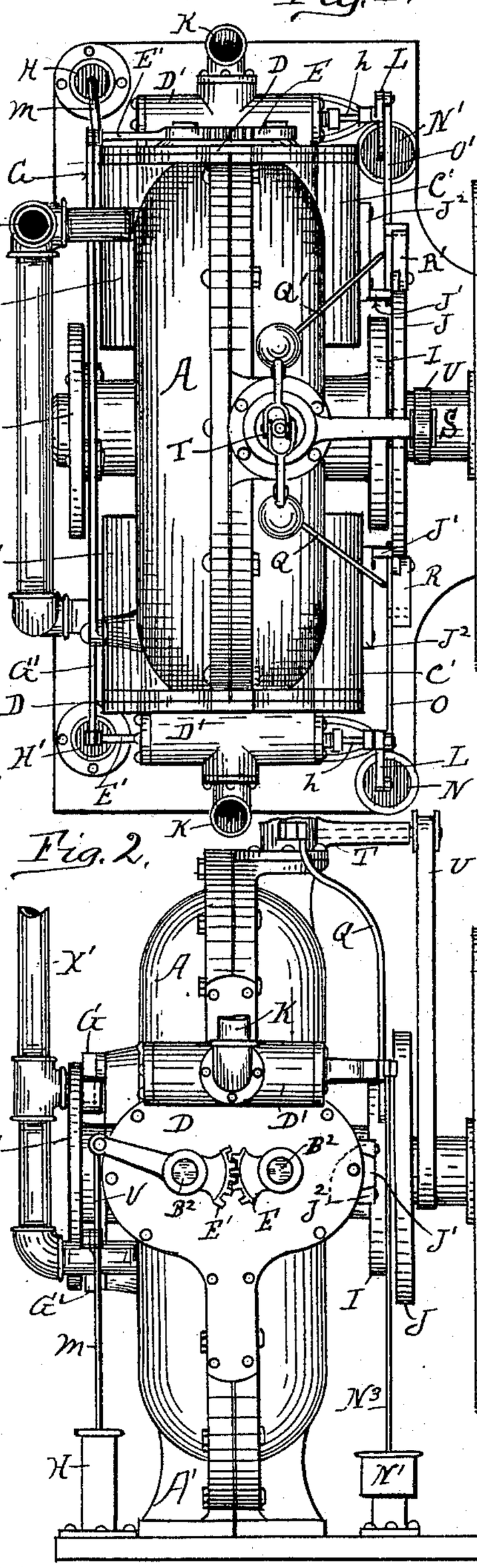

Fig. 2.

Fig. 3.

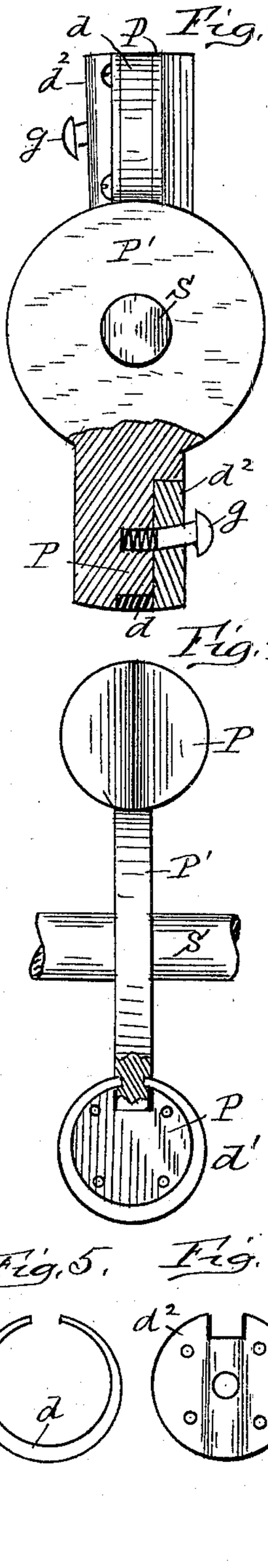

Fig. 4.

Fig. 5.

Fig. 6.

Witnesses.
Wm. J. Hutchins.
C. R. Hutchins

Inventor.
John Arthur Cocker

(No Model.)

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Fig. 7.

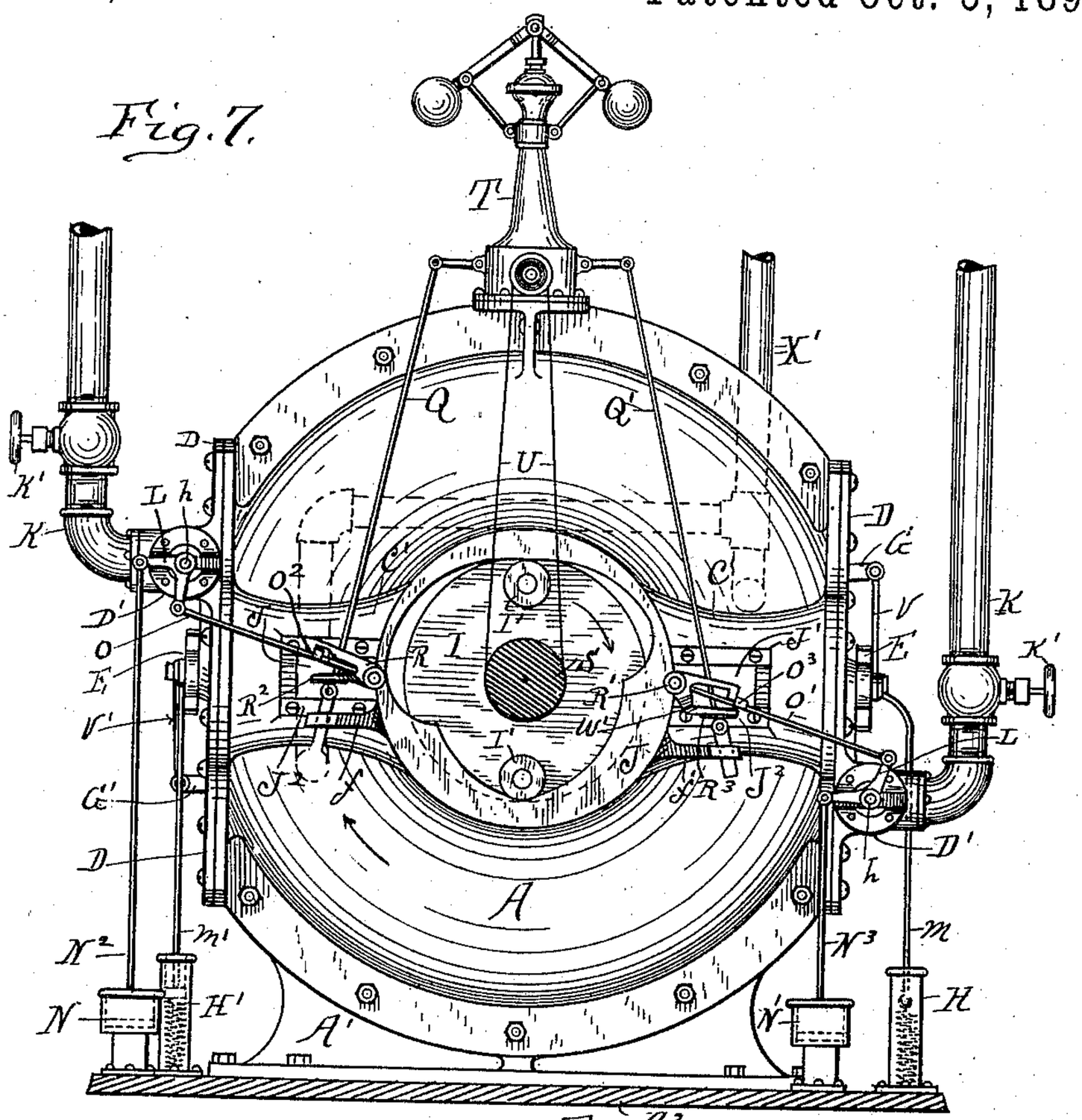
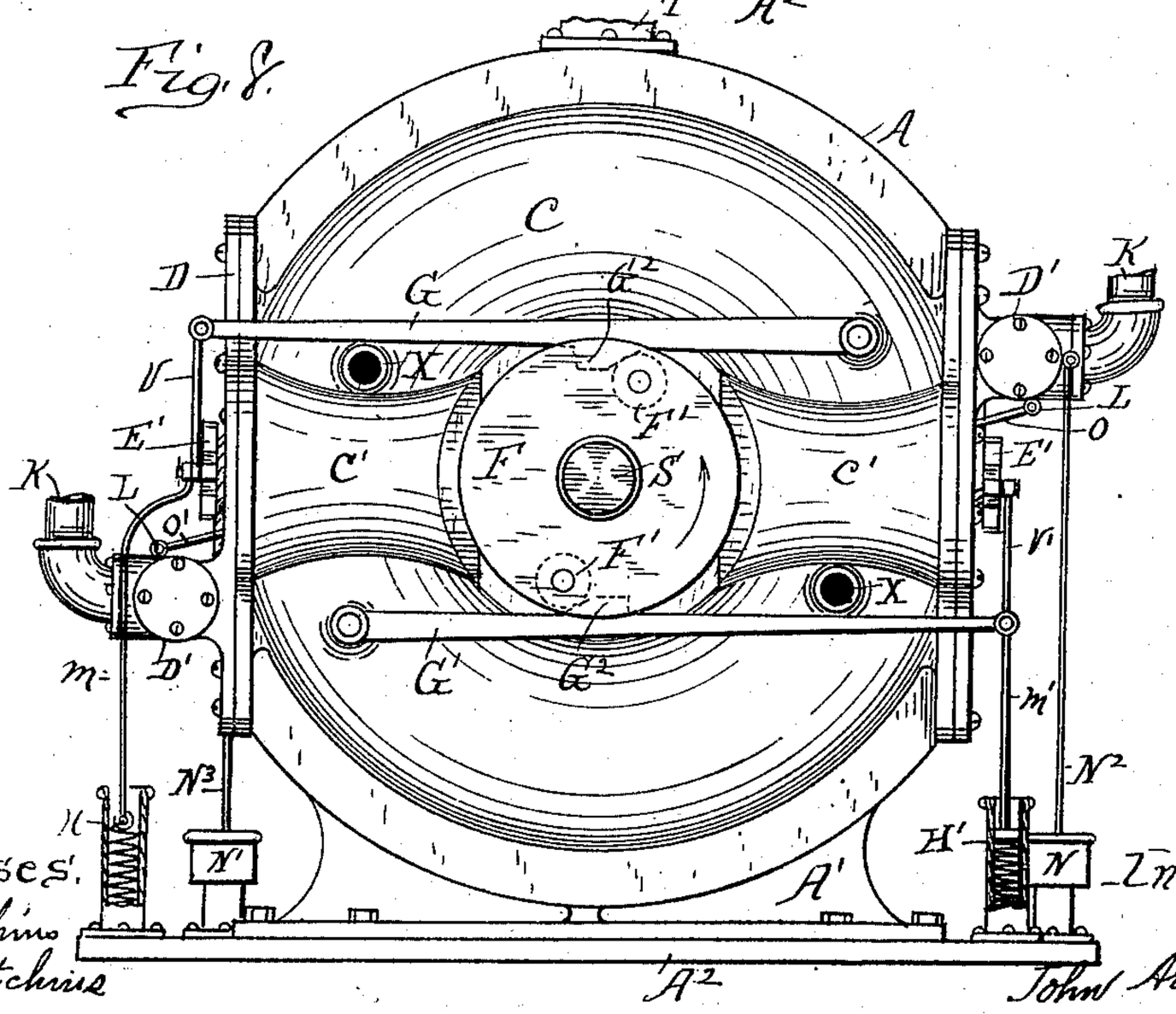


Fig. 8.



Witnesses:
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(No Model.)

3 Sheets—Sheet 3.

J. A. COCKER.

ROTARY STEAM ENGINE.

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Fig. 11.

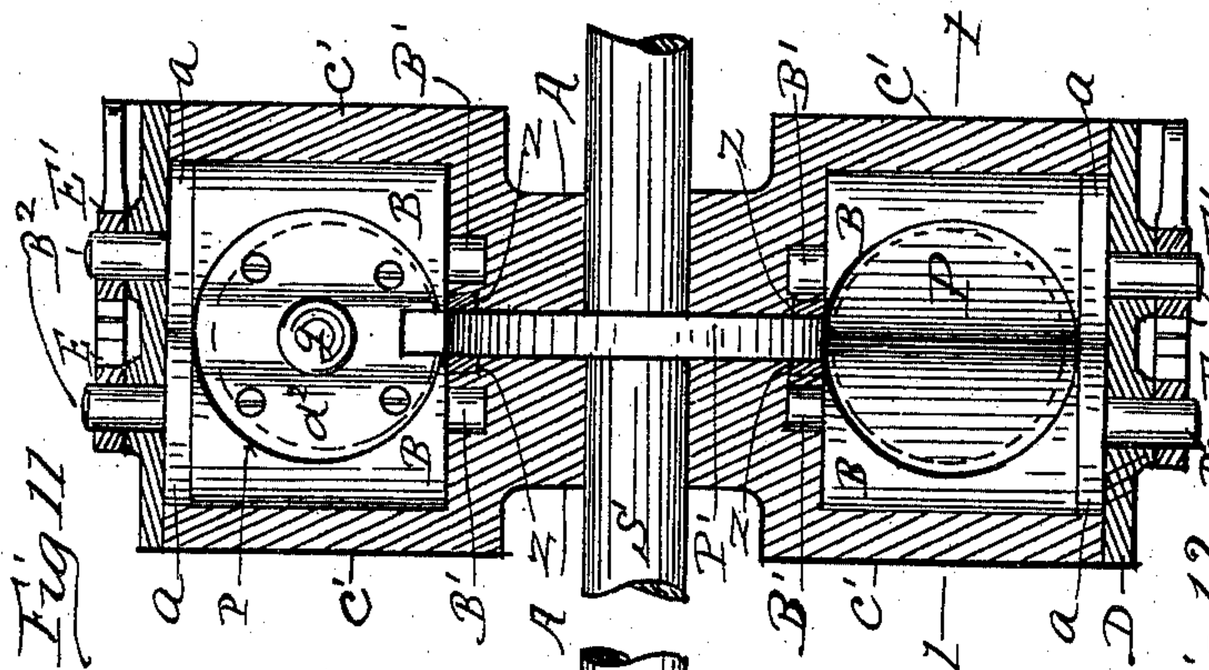

Fig. 12.

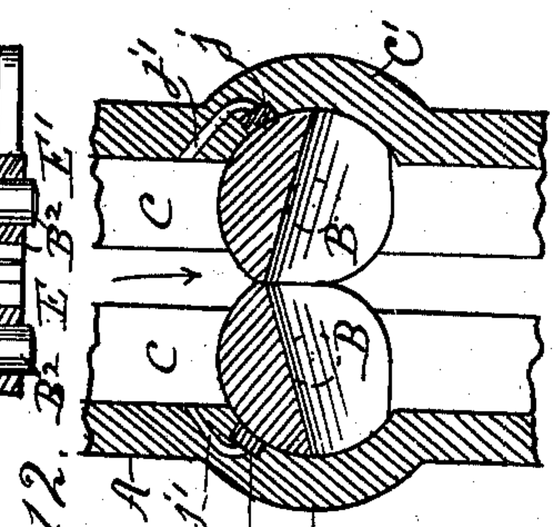

Fig. 10.

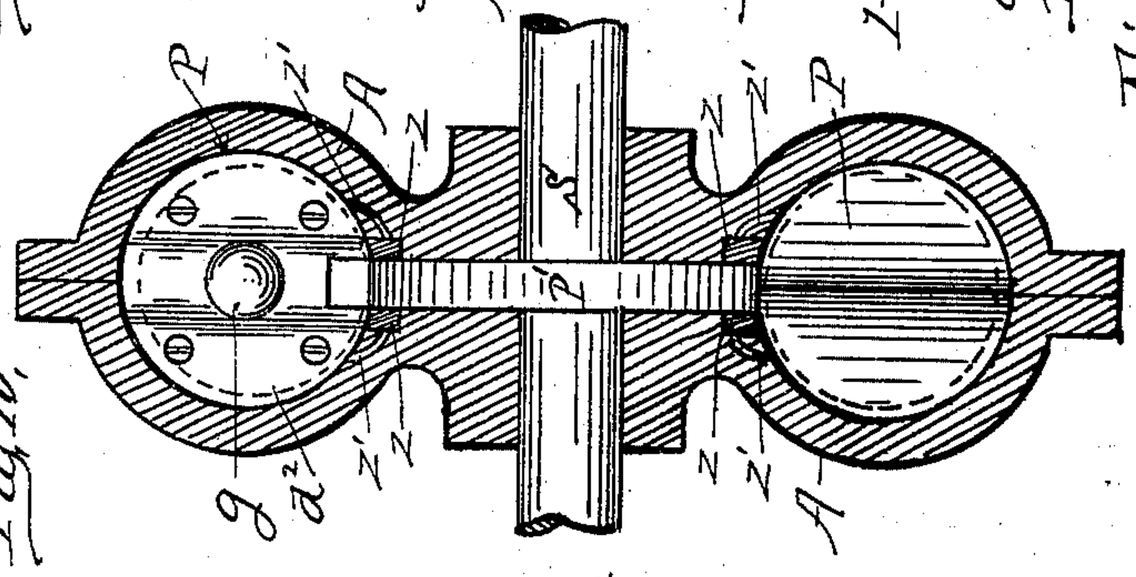

Fig. 13.

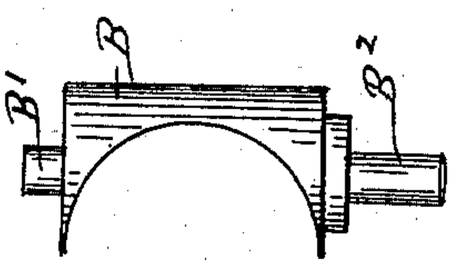

Fig. 14.

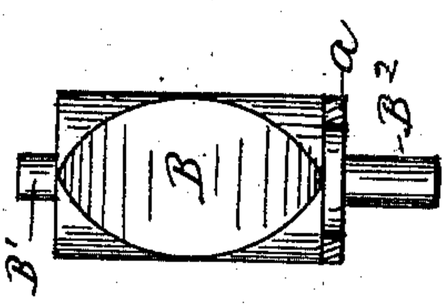

Fig. 9.

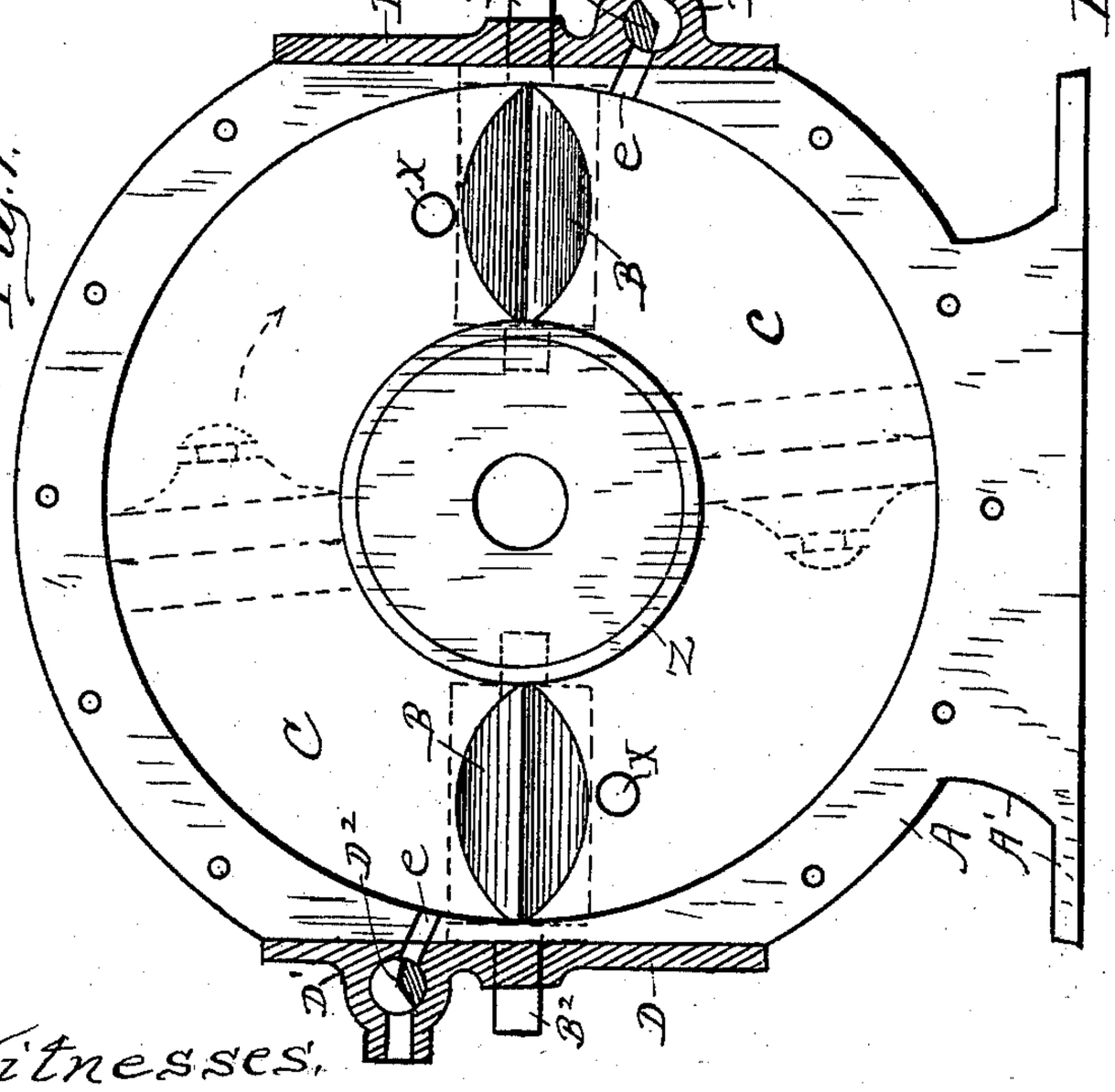

Fig. 15.

Witnesses.
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C. R. Hutchins.

Inventor.
John Arthur Cocker

UNITED STATES PATENT OFFICE.

JOHN ARTHUR COCKER, OF JOLIET, ILLINOIS, ASSIGNOR OF TWO-THIRDS TO COLIN N. MACDONALD, OF SAME PLACE, AND HERBERT M. COCKER, OF LOCKPORT, ILLINOIS.

ROTARY STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 591,032, dated October 5, 1897.

Application filed December 30, 1896. Serial No. 617,510. (No model.)

To all whom it may concern:

Be it known that I, JOHN ARTHUR COCKER, a citizen of the United States of America, residing at Joliet, in the county of Will and State of Illinois, have invented certain new and useful Improvements in Rotary Steam-Engines, of which the following is a specification, reference being had therein to the accompanying drawings, and the letters of reference thereon, forming a part of this specification, in which—

Figure 1 is a plan of the engine; Fig. 2, an end elevation of the same; Fig. 3, a detailed side view of the double piston of the engine, showing one piston in section; Fig. 4, a face view of the same; Fig. 5, a detailed view of one packing-ring of said piston; Fig. 6, a detailed face view of one face-plate of said piston. Figs. 7 and 8 are side elevations of the engine; Fig. 9, a vertical longitudinal sectional elevation of the engine; Fig. 10, a vertical cross-sectional elevation of the engine; Fig. 11, a horizontal cross-sectional elevation of the engine; Fig. 12, a detailed sectional view of the cylinder-gate chamber and gates therein of the engine on line 1 1 of Fig. 11. Figs. 13 and 14 are detailed views of said cylinder-gates, and Fig. 15 a detailed perspective of one of the engine-valves.

This invention relates to certain improvements in steam-engines and of that type of engines known as "rotary" steam-engines; and it consists in certain novel construction, arrangement, and combination of parts, which improvements are fully set forth and explained in the following specification and pointed out in the claims.

The objects of this invention are to so construct a rotary engine as to embody mechanism of such character as to maintain control of the steam-supply to the engine, to govern the cut-off of said steam-supply, so as to utilize the full expansion of the steam in the cylinder, and to so arrange the necessary packing as to be automatically adjustable in the way of taking up wear thereof and hence maintain practical fittings of the engine-piston and parts operating in conjunction therewith; and as a means of attaining said objects I have devised the construction set forth in the accompanying drawings and in the following description.

Referring to said drawings, A represents the engine-cylinder, which is circular in form, made in two equal parts, placed in an upright position, and provided with a pedestal A′, which is fixed upon one end portion of a base-plate A^2. The cylinder-chamber is by reason of such form cylinder annular and is made circular in cross-section, as I have represented at C. (See Figs. 9 and 10.)

Either way from and on a horizontal line parallel with the center of cylinder A the cylinder-chamber is intersected by a pair of oppositely-arranged oscillating gates B B, placed in recesses C′, formed in the shell of the cylinder, as represented, which gates are of the form shown more particularly in Figs. 13 and 14, having trunnions B′ at their inner end stepped in bearings in the inner end of said recesses, (see Fig. 11,) with stems B^2 extending out horizontally from said recesses, which stems are boxed in bearings made in plates D, which attach to the cylinder-shell and cover the end of said recesses, with packing-rings *a* fitted about an annular offset at their end portion and arranged bearing against plates D and hollowed in one side in such manner as to perfectly conform to the walls of the cylinder-chamber C when turned open, as represented in Fig. 11, so when in such position the engine-pistons may pass them. In the construction of said gates their radius at their cut-away sides is less than their opposite sides, (see Fig. 12,) and in placing them said lesser sides are brought to register with each other, or that portion of their ends which is not removed thus register, and therefore when they are turned on their trunnions their solid sides will be brought to extend across the cylinder-chamber C, one from either side, meeting at the center and thereby closing, with their portion of the greatest radius bearing together prior to reaching a point on a line with trunnions B′ B′ and thus forming a lock against further movement in that direction. (See Fig. 12.)

I have represented the pistons at P made

integral with a center web P′, which is either fixed upon or made integral with the drive-shaft S, (see Figs. 3 and 4,) and in placing said pistons they are brought within cylinder-chamber C, and together with packing-rings *d*, which are placed in peripheral recesses *d′* therefor, (see Figs. 3 and 4,) perfectly fit across in said cylinder, as represented in Fig. 10, with the web P′ filling the space between the two parts of the cylinder-shell within the limit of the cylinder-chamber and with the shaft S horizontally boxed in the side parts of said shell, as also shown in said Fig. 10, the margins of said web being packed by means of annular packing-rings Z, placed in corresponding recesses of said shell parts, as represented in Figs. 9, 10, and 11. As a means of readily placing the piston-packing rings *d* I have made the said pistons with a detachable face-plate (shown at d^2) which confines said packing, and is further provided with a buffer *g*, set in a socket in its center portion, which buffers are for the purpose of preventing any severe shock or pounding by reason of the pistons coming in contact with gates B should it occur by any reason that said gates should fail to open fully prior to the said pistons reaching their junction.

Fixed upon the extending stems B^2 of gates B are toothed segments E and E′, arranged in mesh, so that when one is turned both will turn jointly, and one segment E′ of each pair of said gates is made with a side extending arm. (See Figs. 2 and 11.)

Fixed upon shaft S, adjacent one side of the cylinder, is a disk F, having studded thereto a pair of oppositely-disposed wrist-rollers F′ F′. Studded to the side of the cylinder-shell, in line with said wrist-rolls, is a pair of oppositely-arranged levers, which are of the third class (shown in Fig. 8 at G G′) and are, by means of rods V V′, connected, respectively, with the arms of segments E′, and by reason of lugs G^2, formed on said levers, which are engaged by wrist-rolls F′, said levers are given intermittent movement to operate said segments and thereby turn gates B B to open them, and at other times said levers are held in such position as to hold said gates closed by means of springs in spring-pots H H′, which are connected with the levers through the agency of rods M M′.

Fixed on shaft S, at the opposite side of the cylinder-shell from said lever mechanism, is a disk I, having studded thereto a pair of oppositely-disposed wrist-rollers I′ I′, and J is a cam made with its face presented inwardly and placed so said rollers will operate against said face, as represented in Fig. 7, and is provided with opposite horizontally-extending feet J′ J′, confined in guideways J^2 J^2, attached to the side of the cylinder-shell in such manner that said cam may reciprocate horizontally by the action of rollers I′ I′ against its face.

Made integral with each plate D is a steam-chest D′, having operatively placed therein a steam-cut-off valve D^2, adadpted to be oscillated to open ports *e* to admit steam to the cylinder-chamber C and to close said port and thus cut off such supply, and as a means of supplying said chests with steam steam-supply pipes K K are connected therewith, which pipes are provided with valves K′ for cutting off such supply when the engine is not in service.

Fixed to the extending stems *h* of each valve D^2 is a bell-crank lever, (shown at L and L′ in Fig. 7,) which are respectively connected at one arm with the dash-rods N^2 N^3 of dash-pots N N′ and have respectively pivoted to their opposite arm the rods O O′, which are guided at their free end in holes of the cam-feet portions J′ (see Fig. 1) and are respectively provided with side extending lugs O^2 O^3. Oppositely and pivotally connected with cam J is a pair of trip-hooks R R′, set so their hook portion will respectively engage the lugs O^2 O^3 of rods O O′, (see Fig. 7,) and are made with horizontally-extending arm portions R^2 R^3, respectively.

T represents a governor of the usual type, having controlling-rods Q Q′, which extend down immediately in rear of arms R^2 R^3 of trip-hooks R R′ and have studded to them immediately under said arms R^2 R^3 side extending wrist-rollers W W′, and are flatted and confined in guides *f f′* of cam J at their lower end portion, and are adapted under normal speed of the governor to rest sufficiently low so their rollers W W′ will permit arms R^2 R^3 to be sufficiently low, so the hooks of the trips R R′ will engage full against lugs O^2 O^3 of rods O O′, so movement of cam J horizontally will cause said hooks to pull one rod O and push opposite rod O′ to operate bell-cranks L and L′, and thereby operate valves D^2 to admit steam to the cylinder-chamber C, and by reason of said rods being arranged at an incline and the trip-hooks being arranged to move horizontally at a given point of said movement the hooks will disengage lugs O^2 O^3 and thus release rods O O′ so the action of the dash-pots will then instantly reverse said bell-cranks and thereby operate valves D^2 D^2 to cut off the steam-supply to the cylinder C. Increased speed of governor T will cause rods Q Q′ to be raised, thereby lifting the trip-hooks R R′, so as not to engage lugs O^2 O^3 in full, and hence the disengagement of said hooks and lugs O^2 O^3 will occur at a less portion of the cam movement, and therefore cause valves D^2 to be closed sooner and thus cutting off the steam-supply to the cylinder at a less portion of the revolution of the engine. It will therefore be understood that by such construction the supply of steam to the cylinder is governed so as to not use an excessive quantity of steam and to supply only such quantity of steam to the cylinder as will suffice, by expansion, to operate the engine with economy and to control the speed

of the engine by a greater or less supply of steam governed by the governor T through the agency of said rod and trip mechanism.

Motion is imparted to the governor T by means of a belt U in the usual manner.

Adjacent each pair of gates B B in the side of the cylinder-shell are two exhaust-ports X X, having fitted therein pipes X′ for conducting the exhaust-steam from the engine.

In service the pistons travel in the direction indicated by the arrows in Figs. 7 and 9, and as they approach in their circuitous movement the gates B B said gates are, by means of their connected mechanism, opened to permit the pistons to pass them, and immediately after the pistons have passed said gates their mechanism is further actuated to close them in rear of the pistons, at which time the valve mechanism is actuated to admit steam to the cylinder-chamber immediately in rear of the pistons and between the pistons and said gates, which supply is cut off at a fraction of the one-half revolution of the engine, so that by the expansion of the said steam-supply the pistons are forced in operation.

Bonnets of the usual type are fixed to the end of steam-chests D′ as a means of support to the ends of valve-stems *h*, and said stems are packed in the usual manner at their exit from said chests.

As a means of providing a more suitable support for shaft S, I have placed a bearing A^3 on the opposite end of base-plate A^2 from the cylinder, which supports that end of said shaft, and I have further provided a combined belt and fly wheel Y, fixed upon said shaft, as represented in Figs. 1 and 2, about which a belt may be passed for transmitting power from the engine.

In placing the packing-rings Z steam-ports Z′ are formed, as represented in Fig. 10, leading from the cylinder-chamber C to the outer side of said rings for the purpose of cushioning the rings by steam-pressure, so as to closely bear against the piston-web P′ and to automatically take up wear of the rings.

Packing-strips, as shown in section at *j* in Fig. 12, are placed in corresponding pockets in cases C′, so as to bear against and pack the outer sides of gates B, and steam-ports *j*′ are formed leading from the cylinder-chamber to the rear of said packing-strips for cushioning them against said gates and thereby maintaining a close fit against said gates.

The exhaust-ports are constantly open, and hence any utilized steam or condensation in the cylinder in advance of the pistons is exhausted prior to the opening of the gates B.

It will be observed by the form of cam J and the arrangement of the valve mechanism that at each revolution of the engine drive-shaft the gates B B and steam-valves D^2 D^2 are actuated twice.

Having thus described my invention, what I claim as new and useful, and desire to secure by Letters Patent, is as follows:

1. In a rotary steam-engine in combination with the annular cylinder provided with gate-recesses as set forth; the double piston carried upon the drive-shaft by means of circular web; the oscillating gates, provided with hollowed sides adapted to conform to the walls of the cylinder-chamber when open, placed in said recesses; toothed segments arranged connecting the stems of said gates; intermittently-actuated lever mechanism arranged to open said gates at the approach thereto of the engine-pistons and to close them immediately preceding the passing thereof of said pistons; steam-chests provided with ports leading to within the cylinder in close proximity to said gates; oscillating valves arranged in said chests; intermittently-actuated mechanism for oscillating said valves to supply steam to within the cylinder in rear of the pistons at a point in close proximity to said gates, and to cut off such supply at a fraction of one-half revolution of the engine drive-shaft; exhaust-ports leading from the cylinder-chamber adapted to permit the escape of utilized steam and condensation; and a governor arranged and connected with the steam-valve-actuating mechanism and adapted to control the steam-supply to the cylinder, substantially as specified.

2. In the herein-described rotary engine; the combination with the cylinder provided with the oppositely-arranged gate-recesses; the oscillating gates hollowed in their side and oppositely-arranged in said recesses in pairs, and connected by means of segments, whereby they are adapted to operate jointly; and the rotating pistons arranged in said cylinder and adapted to operate in conjunction with said gates, in the manner substantially as and for the purpose specified.

3. In the herein-described rotary engine in combination with the oscillating steam-valves provided with the bell-cranks fixed to their extending stems, the disk fixed upon the drive-shaft and provided with the opposite wrist-rollers; the annular cam reciprocally supported by the cylinder-shell, and adapted to be reciprocated horizontally by said wrist-rollers; the rods provided with the side extending lugs pivotally connected with said bell-cranks and arranged extending in an inclined position toward said cam; the trip-hooks carried by said cam and adapted to engage said rod-lugs, to operate said rods and thereby operate said valves in one direction; the dash-pots and dash-rods thereof arranged connecting said bell-cranks and adapted to reversely operate said valves when released by said trip-hook mechanism; and governor-controlling rods provided with the side extending wrist-rollers, and adapted to control the position of said trip-hooks to thereby govern the duration of time of their operative contact with said rod-lugs, substantially as and for the purpose specified.

4. In the herein-described rotary engine in combination with the oscillating gates provided with the extending stems; the toothed

segments fixed on said stems and arranged in mesh with each other in pairs; the disk fixed upon the drive-shaft and provided with the opposite wrist-rollers; the levers fulcrumed to the cylinder-shell and adapted to be intermittently actuated by said wrist-rollers; the rods arranged connecting one segment of each said pairs with said levers; and springs arranged connecting said levers through the agency of rods for yieldingly holding said levers in operative contact with said wrist-rollers; substantially as and for the purpose specified.

5. In the herein-described rotary engine the combination of the disk I provided with the rollers I′ I′, and the cam J provided with the feet J′ J′, and the guides for guiding said feet and supporting said cam, substantially as set forth.

6. In the herein-described rotary engine, the combination of the reciprocating cam J′; the trip-hooks R and R′ carried by said cam; the steam-valve bell-cranks L, L′, the rods O and O′ provided respectively with the lugs O^2 and O^3; the governor-controlling rods Q and Q respectively provided with the rollers W and W′; and the dash-pots and their dash-rods, substantially as and for the purpose set forth.

7. In the herein-described rotary engine the gates B B hollowed in one side and made of such cross-sectional form, at their end portions as to have a less radius at said cut-away or hollowed side than at their solid side, substantially as and for the purpose specified.

JOHN ARTHUR COCKER.

In presence of—
WM. GRINTON,
FRANK. E. DE LONG.