No. 630,767. Patented Aug. 8, 1899.

C. H. BEADLE.

ROTARY DISTRIBUTING VALVE.

(Application filed Oct. 3, 1898.)

(No Model.) 3 Sheets—Sheet 1.

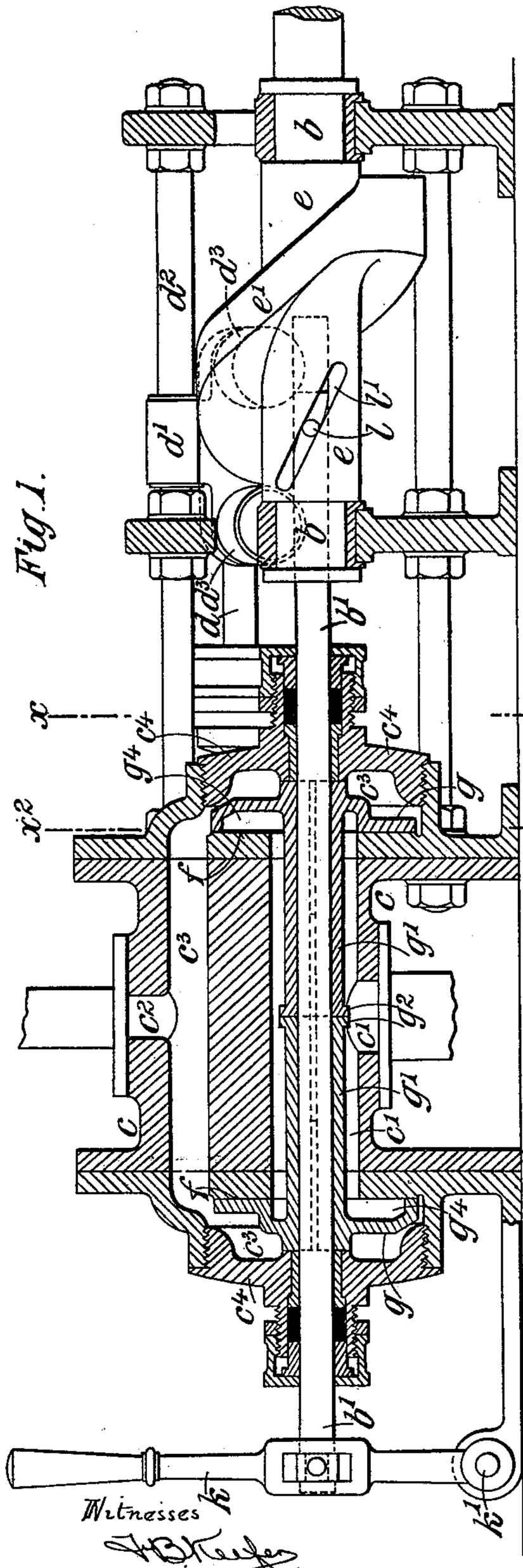

Fig. 1.

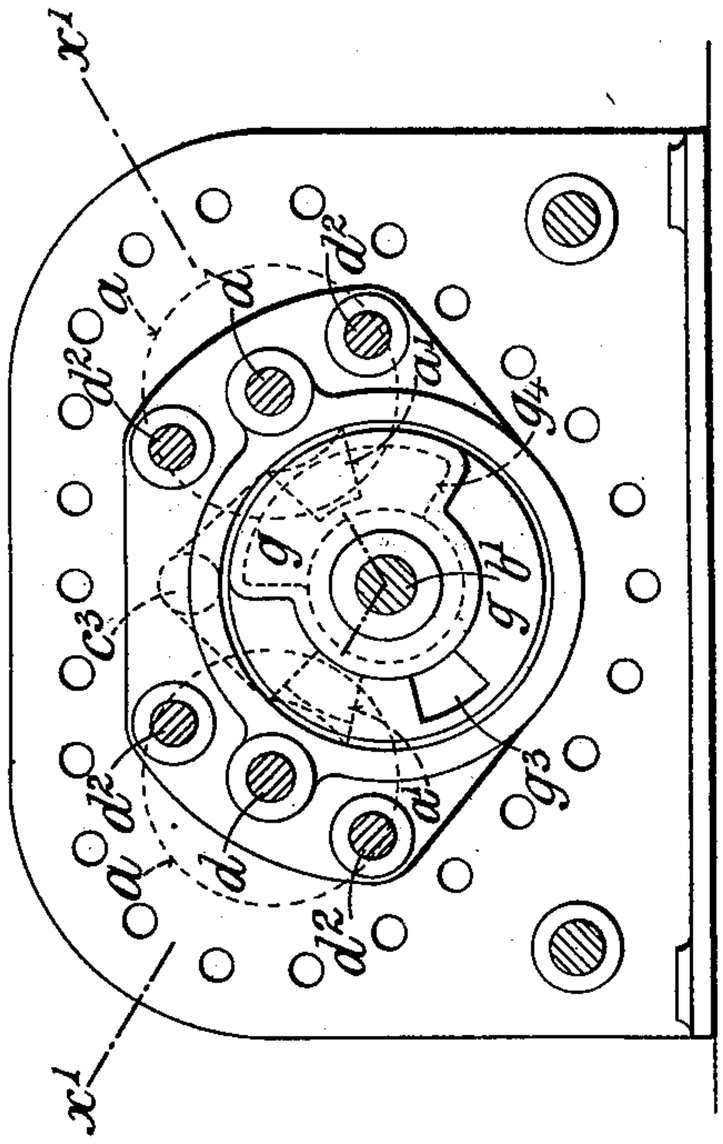

Fig. 2.

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Fig. 3.

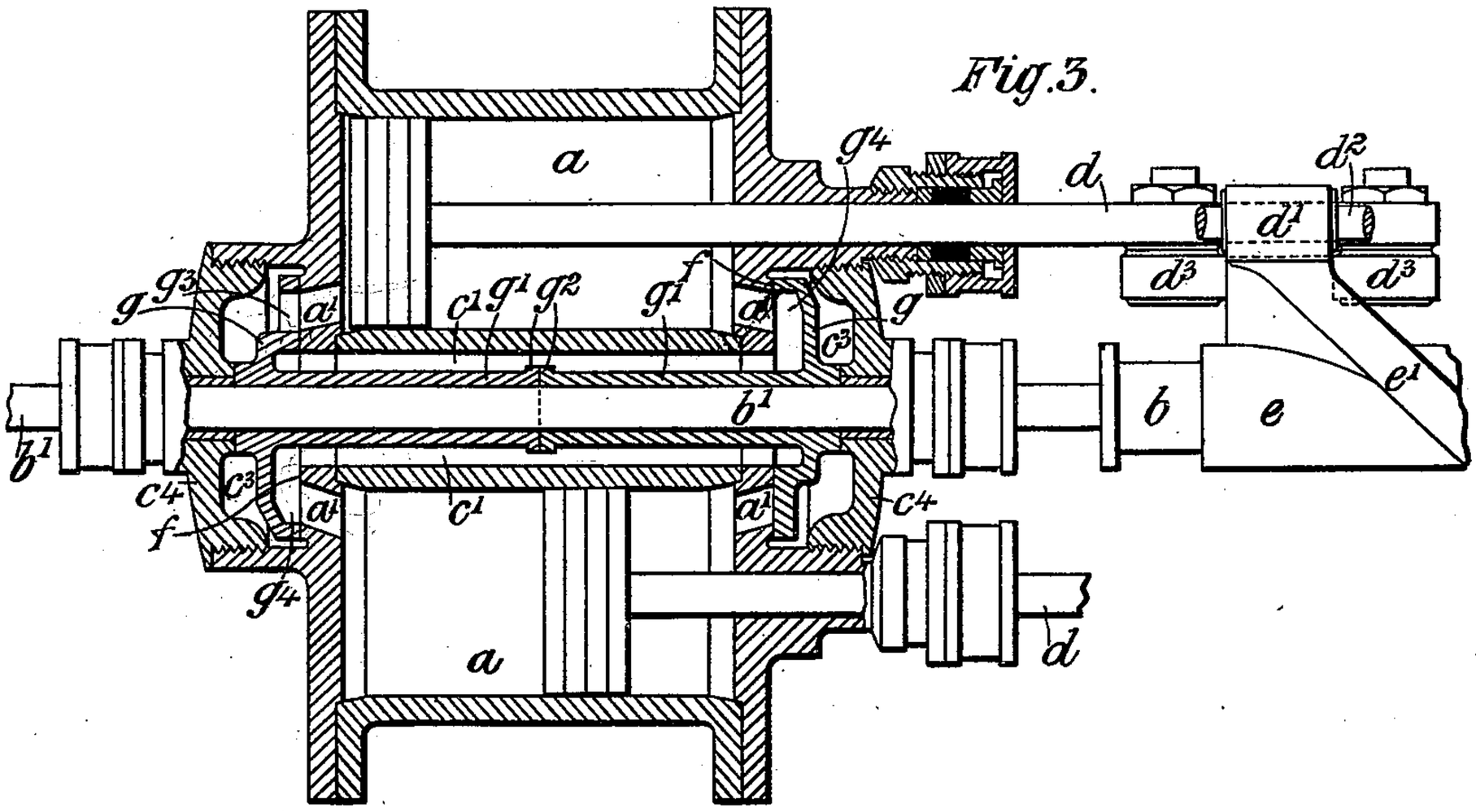

Fig. 4.

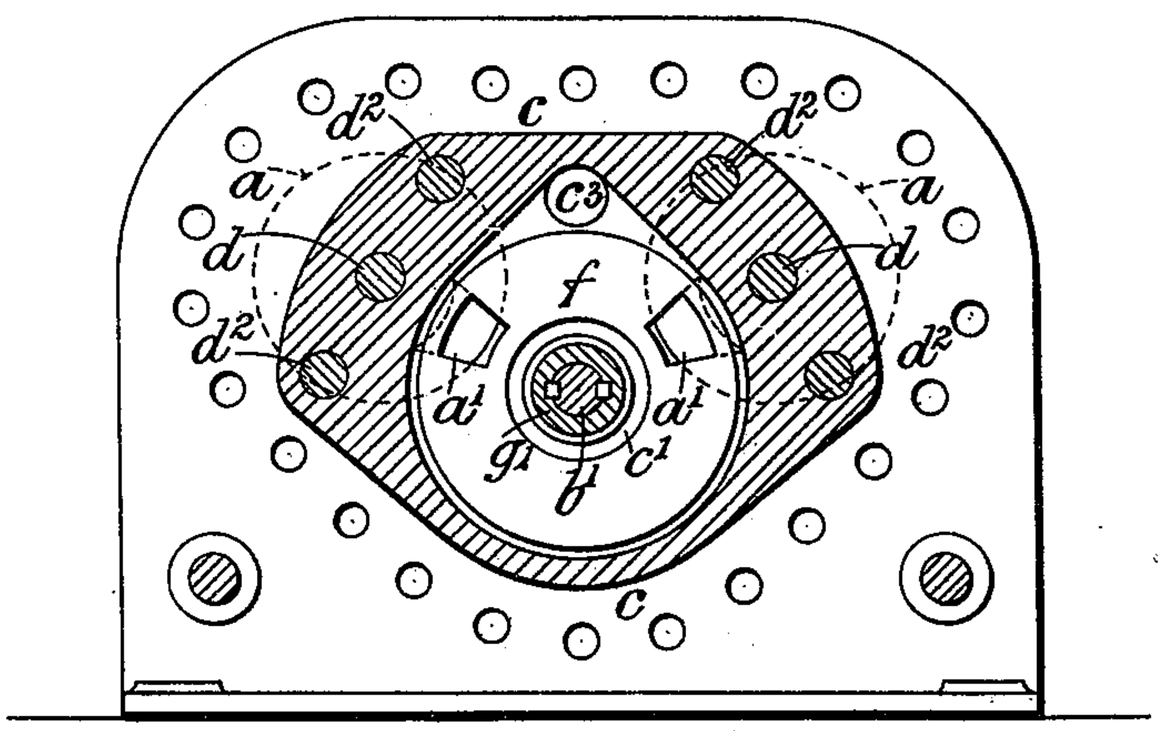

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Fig. 5.

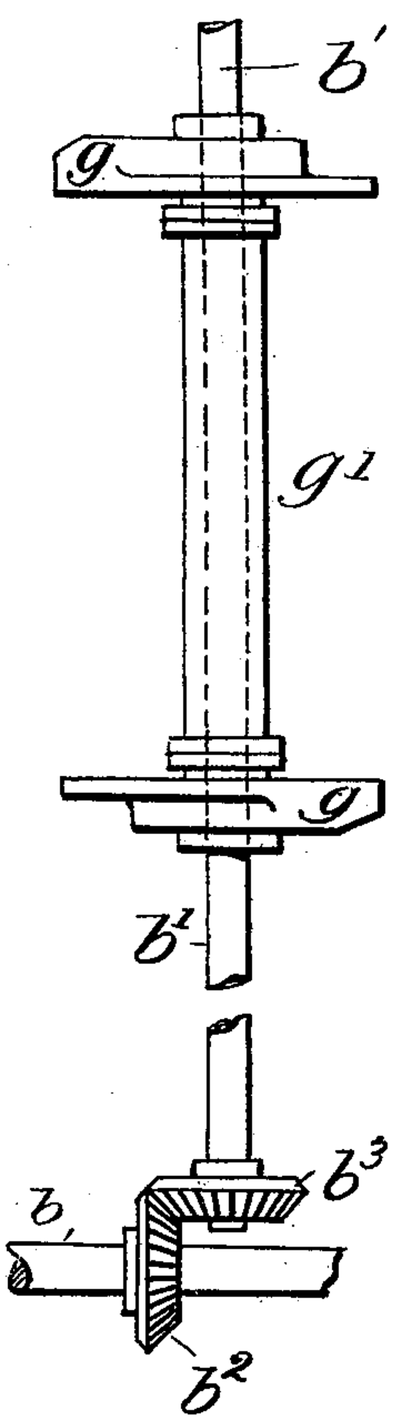


Fig. 6.

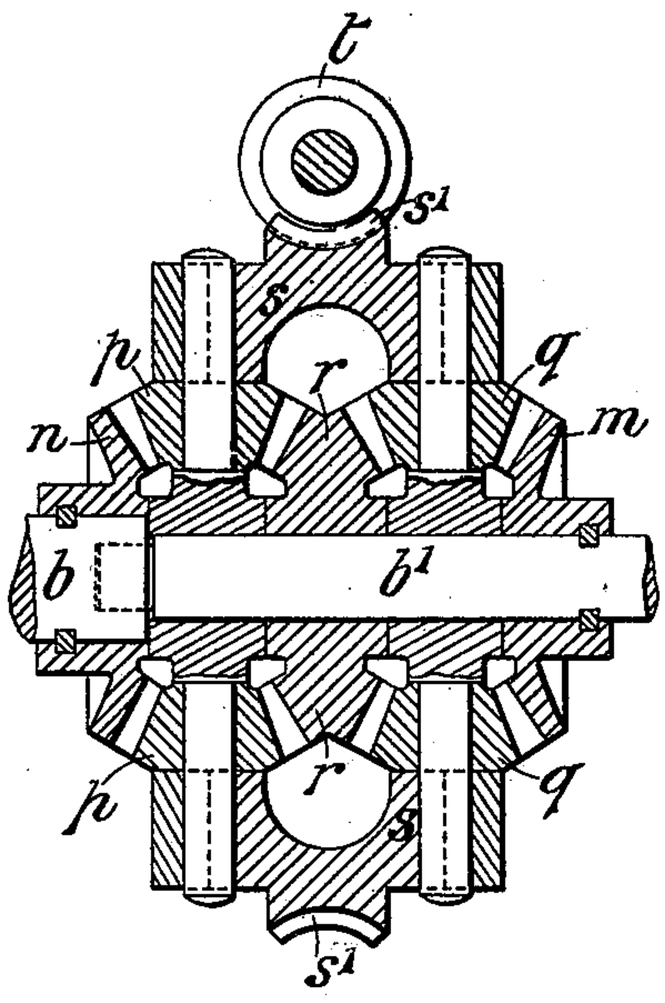
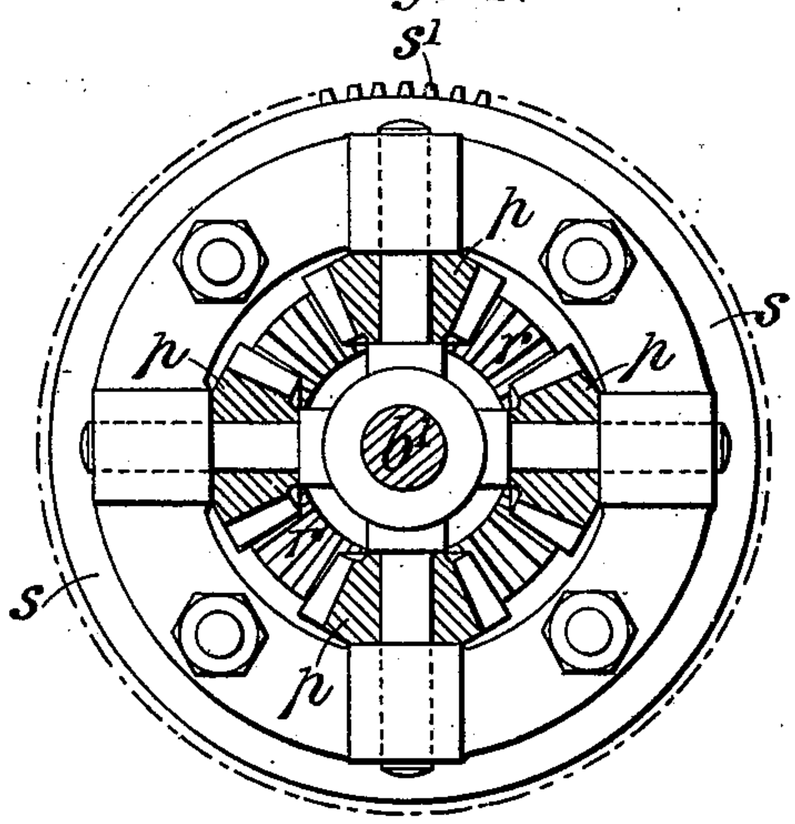


Fig. 7.



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By James L. Norris
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UNITED STATES PATENT OFFICE.

CHARLES HYDE BEADLE, OF COWES, ISLE OF WIGHT, ENGLAND.

ROTARY DISTRIBUTING-VALVE.

SPECIFICATION forming part of Letters Patent No. 630,767, dated August 8, 1899.

Application filed October 3, 1898. Serial No. 692,506. (No model.)

To all whom it may concern:

Be it known that I, CHARLES HYDE BEADLE, engineer, a subject of the Queen of Great Britain, residing at Clarendon Quay, Cowes, Isle of Wight, England, have invented certain new and useful Improvements in Rotary Distributing-Valves for Fluid-Pressure Engines, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 shows a central longitudinal section of an engine of the kind or class hereinafter mentioned fitted with my improved balanced valves. Fig. 2 shows a section on the line $x\ x$, Fig. 1, looking toward the left, the cover of the valve-chest being removed. Fig. 3 is a plan, partly in section, on the line $x'\ x'$, Fig. 2. Fig. 4 is a section on the line $x^2\ x^2$, Fig. 1. Fig. 5 is a side elevation illustrating modifications hereinafter described. Fig. 6 is a face view, partly in section; and Fig. 7, a transverse section showing another form or arrangement of the cut-off and reversing-gear.

My invention has for its main object to provide for the distribution of the fluid in steam and other fluid pressure engines with less friction than is practicable with the sliding or oscillating valves heretofore employed.

My said invention, moreover, affords simple and efficient means for distributing the fluid in engines of the kind or class wherein the axis of the main shaft is parallel with the axes of the cylinders and rotary motion is imparted to the said shaft by means of studs or rollers mounted upon reciprocating piston-rods and acting upon a zigzag projection or rib extending around the said shaft or around a drum fixed thereon or working in a zigzag groove or channel extending around the said shaft or drum.

My improved rotary distributing-valves work on valve-seats arranged opposite each other and kept at a predetermined distance apart by one or more distance-pieces, so that they cannot be forcibly pressed against their seats by the fluid-pressure, and consequently the friction between the valves and their seats is independent of the fluid-pressure.

In Figs. 1, 2, 3, and 4, $a\ a$ are the cylinders. b is the main shaft, which is provided with an extension b', passing through the valve-chest c and working in stuffing-boxes in the covers c^4 thereof. The piston-rods d are fixed in cross-heads d', working on guide-rods d^2, and provided with rollers d^3, that bear against opposite sides of a zigzag projection or rib e', extending around a drum e, formed or fixed on the said main shaft b, so that the reciprocating motion of the pistons will cause the main shaft to revolve. The extension b' of the main shaft traverses the exhaust-space c', formed in the valve-chest c between the cylinders a. The ports a' of the cylinders a extend through faces or valve-seats f, which are provided at the ends of the cylinders, respectively. The rotary valves g are mounted on the extension b' of the main shaft b in such a manner that they are constrained to rotate therewith; but the said extension can be moved axially through the said valves for the purpose of reversing the engine. The valves g are preferably constructed with hollow or tubular stems g', extending from the under or inner sides of the said valves and of such length that their flanged ends g^2 will be in contact with each other when the valves are in contact with their respective seats. These tubular stems keep the valves a certain distance apart, but do not connect the said valves together. The said valves are very accurately fitted to their seats, so that when held thereon with a minimum amount of pressure they will prevent leakage of the fluid. The steam or other fluid enters the steam-space c^3 of the valve-chest c through the inlet c^2, and the fluid-pressure acting in inverse directions upon the outer sides of the valves g the latter will be exactly balanced, the valve-stems g' being simply pressed tightly against each other without any alteration in the pressure of the valves against their seats, and since the valves and distance-piece or distance-pieces are motionless relatively to one another the friction opposing the rotation of the valves cannot be increased by the fluid-pressure, but is independent thereof.

The steam-passages g^3 and the exhaust-passages g^4 of the valves g, which are continuously in communication respectively with the steam-space and the exhaust-space of the valve-chest c, alternately register with the

ports a' of the cylinder a, and the said passages or ports can be so arranged as to give any predetermined amount of cushioning or expansion.

To permit the reversal of the motion of the engine at will, I provide means for changing the position of the valves relatively to the aforesaid drum on the main shaft. For this purpose a slotted lever k is pivoted at k' to the bed-plate or other convenient part of the engine and is suitably connected with the extension b' of the main shaft. The other extremity of the said extension b', which extension forms the valve-spindle, is received in a central socket in the shaft b. A pin l, secured in the valve-spindle b' and extending into a spiral slot l' in the said shaft, serves as the means for making a driving connection between the two parts. By turning the lever k about its pivot in one or the other direction the pin l can be caused to travel in the slot l', and thus rotate the spindle b' relatively to the main shaft b, by which operation the valve-passages can be shifted so that the engine will be driven either ahead or astern or so as to vary the amount of cushioning and expansion.

In applying my improved balanced valves to inverted-cylinder engines and to other engines where the axis of the main shaft is at right angles to the axes of the cylinders the said valves are mounted upon a separate rotary valve-spindle b', as shown, for example, in Fig. 5, which spindle is driven by gearing, such as the bevel-gearing b^2 b^3, from the main shaft b.

I sometimes replace the tubular valve-stems above described by one or more separate distance-pieces g', Fig. 5, which will rotate with the said valves and have the same effect as the said tubular stems in preventing increase of resistance to the rotation of the valves due to friction.

While the aforesaid valves are keyed upon the spindle, so that they are constrained to rotate therewith, they are not restrained from axial movement relatively thereto, though such movement of the valves when in place is limited by the covers of the steam-chest, respectively, and also by the abutting of the distance-pieces between them. The said valves will therefore be pressed into close contact with their seats by the fluid-pressure; but this pressure cannot unduly increase the friction between the valves and their seats, because the distance-pieces limit the approach of the said valves toward each other, and the said valves will be held in contact with their seats by the fluid-pressure notwithstanding axial movement of said spindle.

In applying my invention to a rotary engine the valves can be mounted on the main shaft substantially as hereinbefore described.

In Figs. 6 and 7 I have shown another form or arrangement of the cut-off and reversing-gear in which a bevel-wheel m is fixed upon the valve-spindle b' and a bevel-wheel n, fixed on the driving-shaft b, is geared with the said bevel-wheel m through the medium of two sets of bevel-pinions p p q q, which engage, respectively, with the said bevel-wheels m n and with opposite sides of a double-faced bevel-wheel r, which is mounted loosely on the spindle b'. The bevel-pinions p p q q are carried by a ring s, provided with suitable means, such as a worm-wheel s' and worm t, whereby it can be turned about its axis to change the position of the valves for the purpose of varying the cut-off or reversing the motion of the engines, the rotary movement of the said ring s causing the turning of the bevel-wheel m about its axis relatively to the bevel-wheel n without disturbing the connection between them.

It is evident, however, that I can, if desired, use other suitable arrangements of cut-off and reversing-gear.

What I claim is—

1. In a fluid-pressure engine, the combination, with the valve-seats, of a rotary spindle extending through said valve-seats, valves on said spindle adapted to rotate therewith but free in respect of axial movement relatively thereto, and tubular distance-pieces on said spindle between the valves, adapted to abut against each other when said valves are in contact with their seats, for the purposes above specified.

2. In a fluid-pressure engine, the combination, with a cylinder and steam-chest, of rotary distributing-valves arranged one at each end of the steam-chest and provided with means to limit their approach toward each other, an exhaust-space between said valves, and a rotary spindle extending through said exhaust-space and on which said valves are mounted, substantially as described.

3. In a fluid-pressure engine, the combination with a cylinder and steam-chest, of rotary valves arranged to admit steam to and exhaust it from the ends of said cylinder, and provided with tubular valve-stems or distance-pieces extending from the valves toward each other and having their ends abutting when the valves are in contact with their seats, substantially as described.

4. In a fluid-pressure engine, the combination, with two parallel cylinders, of a steam-chest common to both, a shaft parallel to the axes of said cylinders, rotary distributing-valves mounted on said shaft one at each end of the steam-chest, and distance-pieces located between the valves, and the ends whereof abut when said valves are in contact with their seats and thus prevent increase of pressure by the valves upon their seats, substantially as described.

5. In a fluid-pressure engine, the combination with the shaft, of rotary distributing-valves mounted on an extension of said shaft and adapted to rotate therewith, but free in respect of axial movement relatively thereto, distance-pieces located between said valves to limit their approach toward each other,

and means for changing the position of said valves relatively to the ports of the cylinder, substantially as described.

6. In a fluid-pressure engine, the combination with valve-seats located opposite each other, of a rotary spindle, rotary distributing-valves movable on said seats and mounted on said shaft and adapted to rotate therewith, but free in respect of axial movement relatively thereto, and distance-pieces between said valves to prevent the fluid-pressure increasing the friction of said valves on their seats.

7. In a fluid-pressure engine, the combination with valve-seats, of rotary valves arranged on said valve-seats and provided with means to limit their approach toward each other, a rotary spindle on which said valves are mounted, a main shaft in line with the rotary axis of said valves, and a driving connection between said shaft and the rotary spindle, substantially as described.

8. In a fluid-pressure engine, the combination, with valve-seats upon the cylinder ends, of a driving-shaft, rotary distributing-valves movable on said seats, means to limit the approach of said valves toward each other, an extension of said driving-shaft forming a rotary spindle on which said valves are mounted so that they will rotate therewith but are free to move axially thereon, a driving connection for said spindle, and means for longitudinally adjusting the rotary spindle to vary the cut-off, reverse the engine, or regulate the expansion, substantially as described.

9. In a fluid-pressure engine, the combination with valve-seats upon the cylinder ends, of rotary valves movable on said seats, and provided with means to limit their approach toward each other, a rotary spindle on which said valves are mounted so that they will rotate therewith but are free to move axially thereon, a driving-shaft and means for adjusting the valves as to their position, substantially as described.

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

CHARLES HYDE BEADLE.

Witnesses:

WM. E. RANCE,

ARCHIBALD O. THOMPSON.