No. 670,867. Patented Mar. 26, 1901.

R. D. WATSON.

ENGINE.

(Application filed July 29, 1897.)

(No Model.)

3 Sheets—Sheet 1.

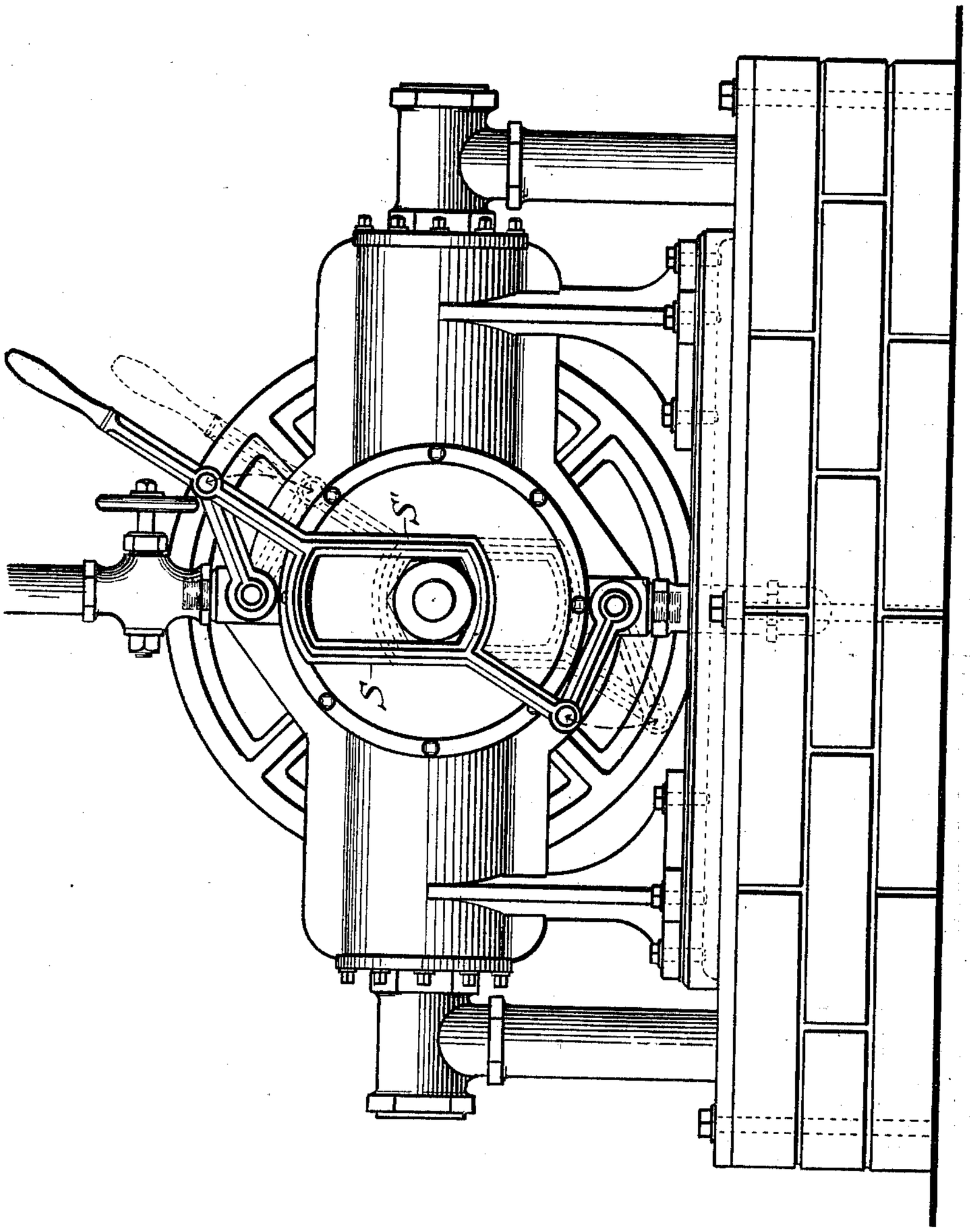

Fig. 1.

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Fig. 2.

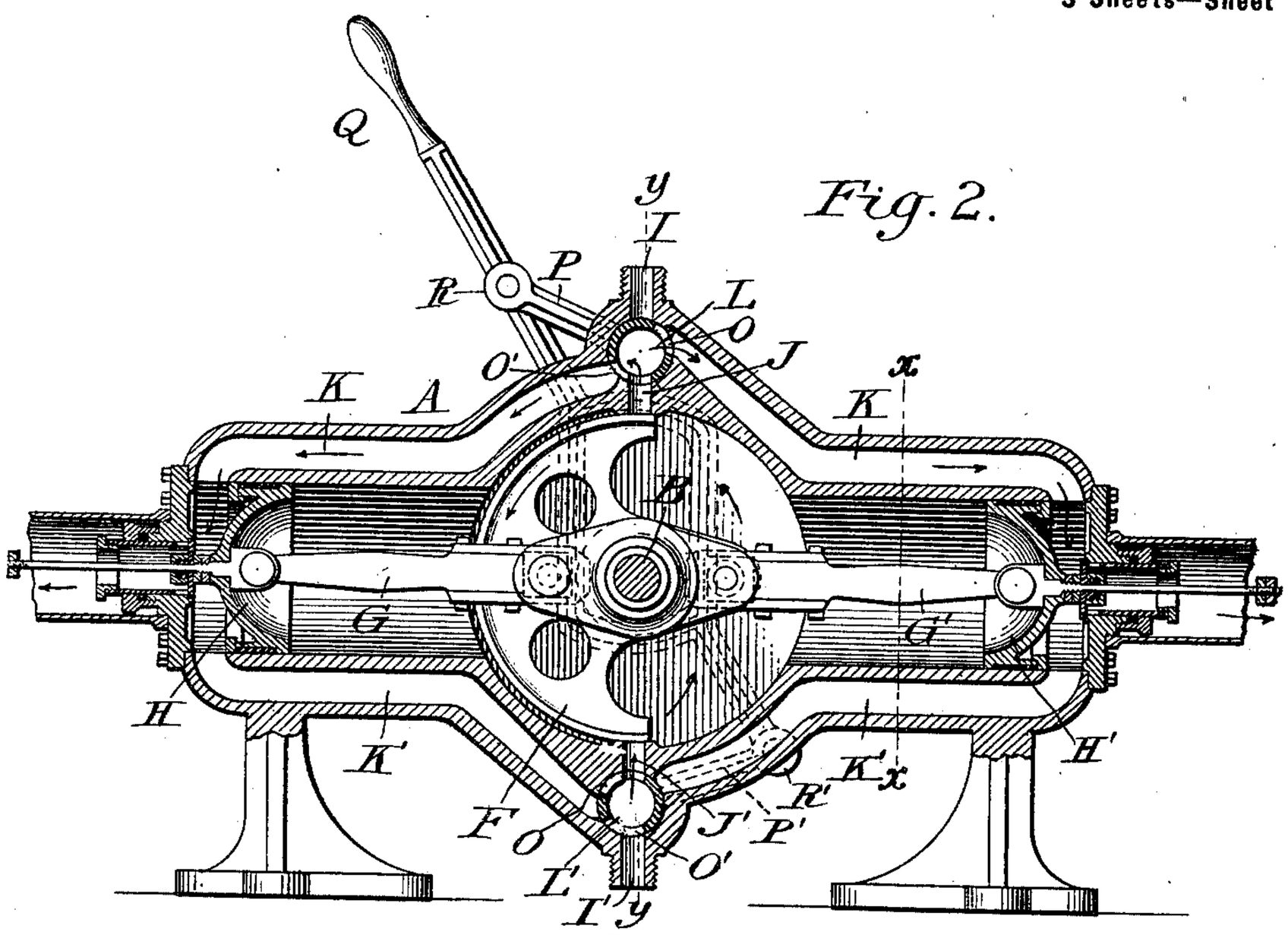

Fig. 3.

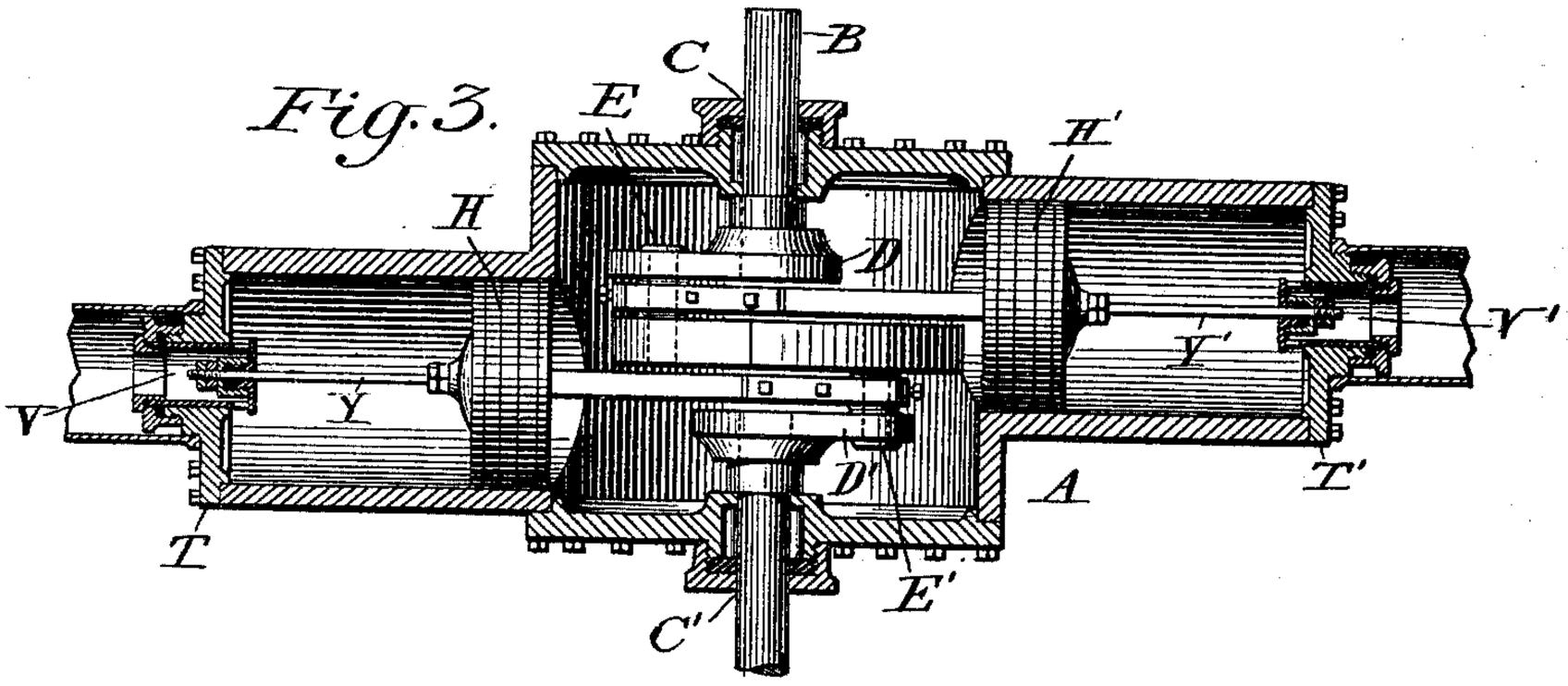

Fig. 4.

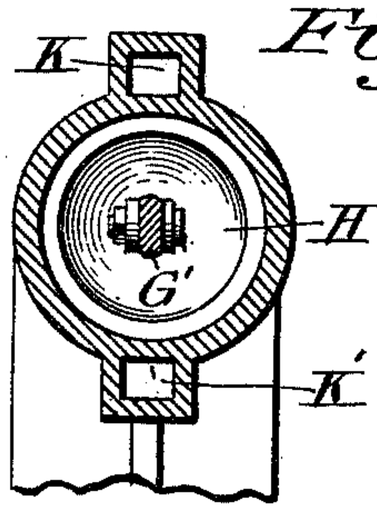

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Fig. 5.

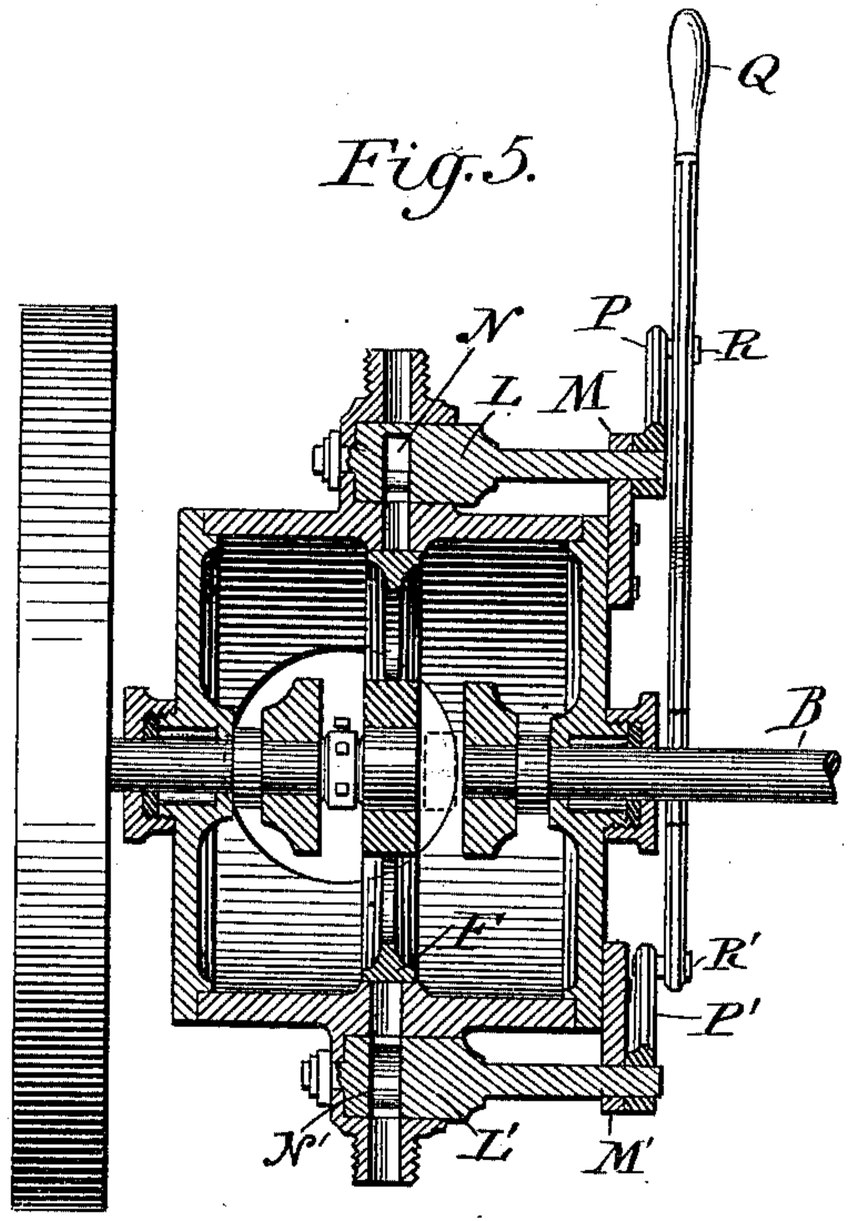
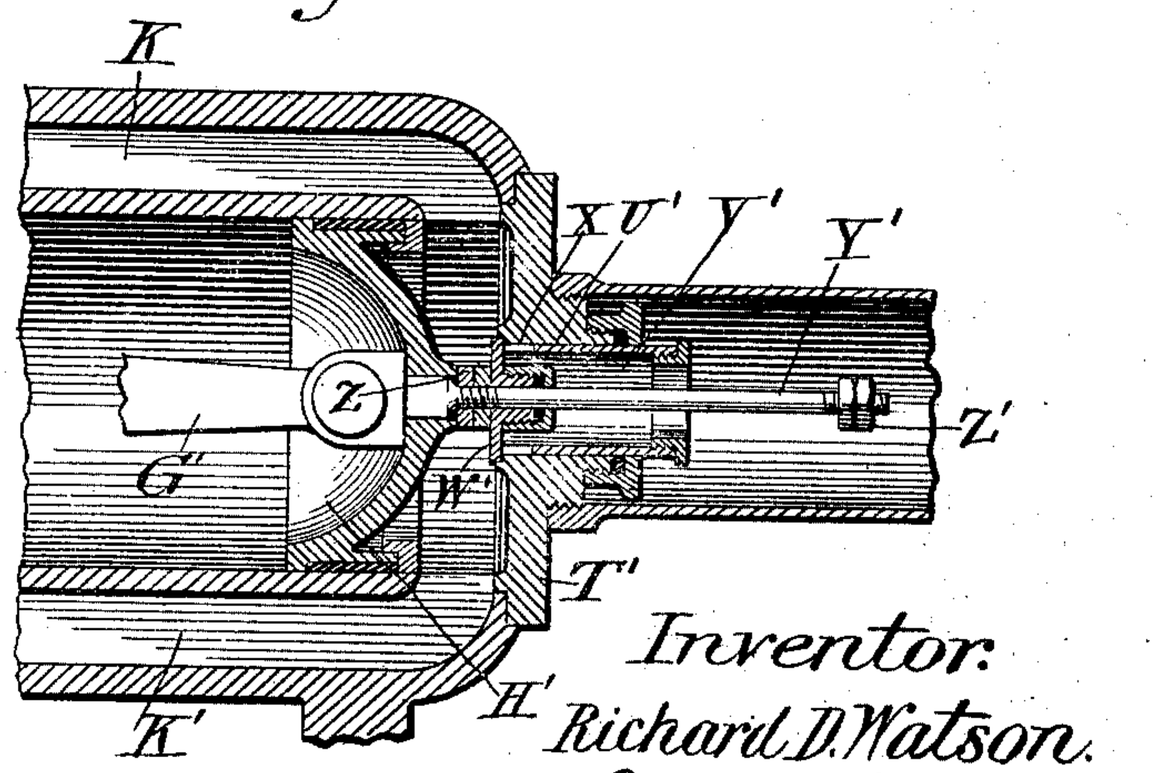


Fig. 6.



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UNITED STATES PATENT OFFICE.

RICHARD D. WATSON, OF TOLEDO, OHIO.

ENGINE.

SPECIFICATION forming part of Letters Patent No. 670,867, dated March 26, 1901.

Application filed July 29, 1897. Serial No. 646,419. (No model.)

To all whom it may concern:

Be it known that I, RICHARD D. WATSON, a citizen of the United States, residing at Toledo, in the county of Lucas and State of Ohio, have invented certain new and useful Improvements in Engines, of which the following is a specification sufficiently full, clear, and accurate to enable persons skilled in the art to embody and use the same.

The object of my invention is the production of a fluid-pressure engine which shall be economical in the use of motive fluid, which shall admit of the effective use of the motive fluid a second time, which shall use steam quickly and exhaust it rapidly, so as to minimize the loss from condensation, which will not leak motive fluid, which shall have the reciprocating parts accurately balanced, thus adapting the engine for high speeds without excessive wear or vibration, which shall eliminate as far as possible friction of all the movable parts and to that end dispense with the use of connecting-rods moving through stuffing-boxes, which shall be simple in construction, cheap in first cost, and, when necessary, easy to repair, and which, finally, shall be compact, suiting it for use within limited areas or spaces.

My invention consists in certain novelties of construction and combinations and arrangements of parts hereinafter set forth and claimed.

The accompanying drawings illustrate one example of the physical embodiment of my invention constructed according to one of the several modes or ways of applying the principle.

Figure 1 is a view in side elevation of the said example, showing at the top and bottom the pipes for conducting motive fluid to the engine and also a lever mechanism for shifting the rotary valves. Fig. 2 is a view of a partial section of Fig. 1, taken in a longitudinal and perpendicular plane through the body of the engine, the sectional part being turned end for end from the position it occupies in Fig. 1. Fig. 3 is a view of the engine in section, taken in a longitudinal and horizontal plane, and showing the positions of the cranks and rotary cam-shaped valve when the pistons are at the ends of their instrokes. Fig. 4 is a section of Fig. 2 taken on line *x x*. Fig. 5 is a section of Fig. 2 taken on line *y y*. Fig. 6 is a fragmentary view of a perpendicular and longitudinal section of the end of the engine-cylinder, showing the construction of a valve operated by a piston for the purpose of exhausting motive fluid from an end chamber.

Referring to the views, the letter A designates the cylinder of the engine, made in any desirable way. It may be an integral casting or composed of parts united by bolts.

B is a rotary shaft.

C C′ are bearings for the shaft, D D′ crank-arms secured to the shaft, and E E′ crank-pins.

F is a rotary valve or disk, in this instance cam-shaped, which is located between parts of the shaft B and rigidly secured to the crank-arms by the crank-pins.

G G′ are pitmen joined to the crank-arms and rotary valve by the crank-pins; H H′, pistons pivotally united to the ends of the pitmen; I I′, motive-fluid inlet-passages made in the cylinder at the top and bottom on opposite sides thereof and into which motive fluid is admitted through the medium of branch pipes which join a main supply-pipe; J J′, ports forming the intermediate inlets to the central chamber, the metal of the cylinder slightly projecting inwardly, so as to frictionally engage the external surface of the rotary valve; K K K′ K′, eduction-passages leading from the inlet-passages I I′ to the ends of the cylinder back of the pistons; L L′, valves having their ends located so as to be adapted to open and close the passages by which motive fluid is admitted to the central chamber; M M′, bearings for the projecting ends of the valves; N N′, slots through the rotary valves; O O′, small and large openings at the ends of the slots; P P′, arms rigidly attached to the ends of the rotary valves.

Q is a lever.

R R′ are pins by which the lever is pivotally united to the ends of the arms; S S′, branches of the lever passing around the shaft; T T′, the cylinder-heads; U U′, perforations through the cylinder-heads, the surfaces of which serve as bearings; V V′, hollow cylindrical reciprocating valves located in the perforations through the cylinder-heads; W W′, closed heads of the valves V V′, of greater diameter than the perforations and provided with stuffing-boxes, if desired; X X, openings through the walls of the valves adjacent the closed heads; Y Y′, reciprocating rods carried

by the pistons and passing loosely through the heads of the valves, and Z Z Z′ Z′ nuts adjustable on the reciprocating rods.

The mode of operation is as follows: The lever Q being adjusted to a raised position, as shown in full lines, and the shaft B being turned so that the valve will open the port J′, motive fluid will enter the central chamber at the bottom and force the pistons to their extreme outward positions (see Fig. 2) and at the same time cause the cam-shaped valve to rotate in the direction of the arrow. As the valve F rotates it closes the port J′ and opens the port J, whereupon part of the motive fluid confined in the central chamber passes to the end chambers back of the pistons by way of the openings O O′ and passages K K. Inasmuch as the pistons in moving toward their outward positions caused the adjustable nuts Z to engage the valves V V′ and closed them the motive fluid is prevented from passing out of the end chambers, and consequently acts upon the ends of the pistons. When the pistons approach the ends of the instrokes, the nuts Z′ engage and open the valves V V′, allowing the motive fluid to escape to the atmosphere, and simultaneously the cam-shaped valve F has completed a half-revolution, opening the port J′ and closing the exhaust-port J. To reverse the motion of the shaft, the lever is moved to its lower position, which action at the same time rotates the valves L L′ to such positions that the motive fluid is admitted to the central chamber at the top by way of the port J and exhausted by the port J′ and conducted by the passages K′ K′ to the end chambers back of the pistons. The mode of operation is then the same as before described except that the shaft rotates in an opposite direction. To allow of the introduction of the cranks into the central chamber of the cylinder, the parts thereof which carry the bearings C C′ are made separate and secured to the sides of the main casting by bolts.

It will be observed that the two pistons divide the interior of the cylinder into a central chamber and two end chambers and that the pitmen, cranks, and rotary or cam-shaped disk are located entirely within the central chamber, and, further, that the friction of the movable parts is by the peculiar construction and arrangement reduced to a minimum.

From the description of the pictured example it will be obvious that I have produced an engine adapted to be operated by a motive fluid and which fulfils all the conditions hereinbefore set forth as the object or end of my improvements.

While I have illustrated and described only one example of the physical embodiment of my invention, I do not thereby intend to limit the scope thereof to this particular example or mode of embodiment, inasmuch as the principle can be applied in other ways and by other modes not involving a substantial departure.

The general way of constructing the engine and the provision of valve mechanism which allows the transmission of the motive fluid after its energy has been partially utilized on opposite sides of the pistons to corresponding opposite sides of the same pistons and finally to the atmosphere are among the essential features of my improvements. The details of construction, however, to accomplish the desired mode of operation may of course be varied and equivalents substituted for the elements illustrated. For example, in lieu of having the pistons out of line they may be in line, plain bearings may replace the roller-bearings, the rotary valves controlling the motive-fluid-inlet passages may be operated by independent means or levers, pipes of any form may be used for conducting the motive fluid to the central chamber and others for conducting the exhaust from the end chambers of the cylinder, the form of the rotary or cam disk changed, and for the particular means operated by the pistons for discharging motive fluid from the end chambers may be substituted other means which are independent of the rotary valve and operated or not operated by the said pistons. Such and many other changes in construction, modifications, substitutions, and incorporations I intend to embrace within the scope of my claims.

What I claim is—

1. An engine having a cylinder provided with an inlet-port for the motive fluid; two pistons dividing the interior of the cylinder into three chambers; a rotary shaft; two cranks; two pitmen; a rotary valve operated by the shaft and adapted to frictionally engage the edges of the inlet-port and periodically open and close it; means for periodically educting motive fluid from the central chamber to the end chambers back of the pistons; and means for discharging motive fluid to the atmosphere; in substance as set forth.

2. An engine having a cylinder provided with inlet and exhaust ports for the motive fluid; two pistons dividing the interior of the cylinder into three chambers; a rotary shaft; two cranks; two pitmen; a rotary valve operated by the shaft and adapted to frictionally engage the edges of the exhaust-port and periodically open and close it; means for periodically opening and closing the inlet-port; means for conducting the motive fluid from the central to the end chambers; and means for exhausting the motive fluid to the atmosphere; in substance as set forth.

3. The combination in an engine, constructed and operating substantially as set forth, of a cylinder having inlet and exhaust ports located at opposite sides of the cylinder, and a rotary valve operated by the shaft and periodically and frictionally engaging the edges of the ports; in substance as set forth.

4. The combination in an engine, constructed and operating substantially as set forth, of

a cylinder having ports J, J′; a rotary valve F adapted to periodically and frictionally engage the edges of the ports; and means whereby the valve F can be caused to revolve in either direction; in substance as set forth.

5. The combination with an engine having a cylinder, a rotary shaft, cranks, pitmen, pistons dividing the cylinder into three chambers, passages I and I′, passages K, K, K′, K′, and exhaust mechanism, of means for controlling the introduction of motive fluid to the central chamber, at either the top or bottom of the cylinder, and also for controlling the passages for the motive fluid leading from the central chamber to the end chambers; in substance as set forth.

6. The combination with an engine having central and end chambers, two pistons, two pitmen, a rotary shaft, eduction-passages, and exhaust mechanism, of means for introducing motive fluid to the central chamber and controlling its eduction thence to the end chambers; said means being reversible so as to control the rotation of the shaft in either direction; in substance as set forth.

7. The combination in an engine, constructed and operating substantially as set forth, of a cylinder having three chambers and eduction-passages; two pistons; a rotary shaft in one of the chambers, and valves on opposite sides of the cylinder each adapted when properly adjusted to admit motive fluid to the central chamber and when the engine is reversed to educt it to the end chambers; in substance as set forth.

8. The combination with an engine, having a cylinder and two pistons dividing the cylinder into three chambers, and constructed and operating substantially as set forth, of the valves L, L′ located upon opposite sides of the cylinder, lever mechanism for operating them simultaneously; motive-fluid inlet-passages I I′; and eduction-passages K, K, K′ K′; in substance as set forth.

9. The combination with an engine having a central chamber and end chambers and a rotary shaft in the central chamber, said engine constructed and operating substantially as set forth, of means for admitting motive fluid to the central chamber; means for educting it to the end chambers; and means consisting of valves and rods carried by the pistons for exhausting the motive fluid from the end chambers to the atmosphere; in substance as set forth.

10. The combination in an engine, of a cylinder; a rotary shaft; two pistons dividing the cylinder into three chambers; means for introducing motive fluid to the central chamber; passages from the central to the end chambers and means for controlling the eduction of the motive fluid from the central to the end chambers; exhaust-valves; and means carried by the pistons for simultaneously operating the exhaust-valves.

11. The combination with an engine, constructed and operating substantially as set forth, of a rotary shaft, two pitmen pivoted to two pistons, and means carried by the pistons which simultaneously open exhaust-passages; in substance as set forth.

12. The combination with an engine, constructed and operating substantially as set forth, of pistons united to a rotary crank-shaft, means for admitting motive fluid to a central chamber; means for educting motive fluid to the end chambers; exhaust-valves; and means carried by the pistons which alternately open and close the said exhaust-valves; in substance as set forth.

13. The combination with an engine having a cylinder divided by two pistons into three chambers, and constructed and operating substantially as set forth, of valves V, V′, pistons H, H′ and rods Y Y′; in substance as set forth.

14. The combination with an engine, having a cylinder, two pistons, a rotary crank-shaft, and means for admitting and educting motive fluid from a central chamber to two end chambers; of valves V V′, pistons H H′, rods Y Y′, and means for regulating the travel of the valves V, V′; in substance as set forth.

15. The combination with an engine, having a cylinder and two pistons dividing the cylinder into three chambers, and constructed and operating substantially as set forth, of rotary valves L, L′, arms P, P′, located upon opposite sides of the cylinder; motive-fluid-inlet passages I I′, eduction-passages K, K, K′ K′ and lever mechanism pivoted to the arms for moving the valves and reversing the engine; in substance as set forth.

16. The combination with an engine, having a cylinder, three chambers, two pistons, a rotary shaft, means for admitting motive fluid, and means for educting the said motive fluid; of cylinder-heads provided with valves and means for operating the valves and simultaneously exhausting the motive fluid directly from the end chambers; in substance as set forth.

17. The combination with an engine, constructed and operating substantially as set forth, of valve mechanism controlling the admission and eduction of motive fluid to and from the central chamber, and valve mechanism operated by means independent of the first-mentioned mechanism for controlling the exhaustion of motive fluid from the end chambers; in substance as set forth.

18. An engine having a cylinder, two pistons dividing the cylinder into three chambers, a rotary shaft in the central chamber, means uniting the pistons and shaft, means for introducing motive fluid to the central chamber, means for educting the motive fluid to the end chambers, and means operated by the pistons for exhausting the motive fluid from the end chambers.

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