No. 670,439. Patented Mar. 26, 1901.

E. A. STARK.

FLUID PRESSURE ENGINE.

(Application filed Feb. 28, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 2.

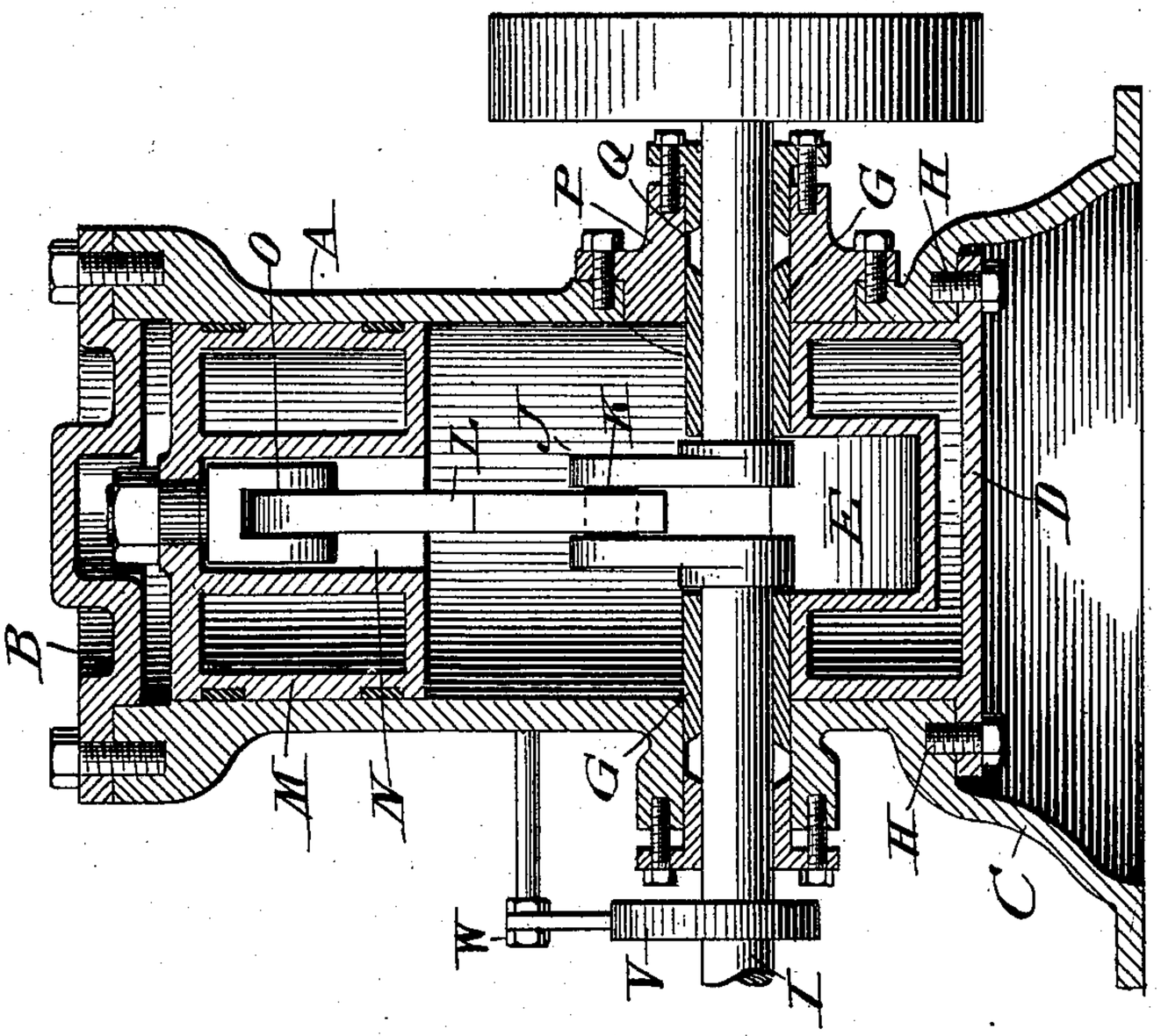

Fig. 1.

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Fig. 3.

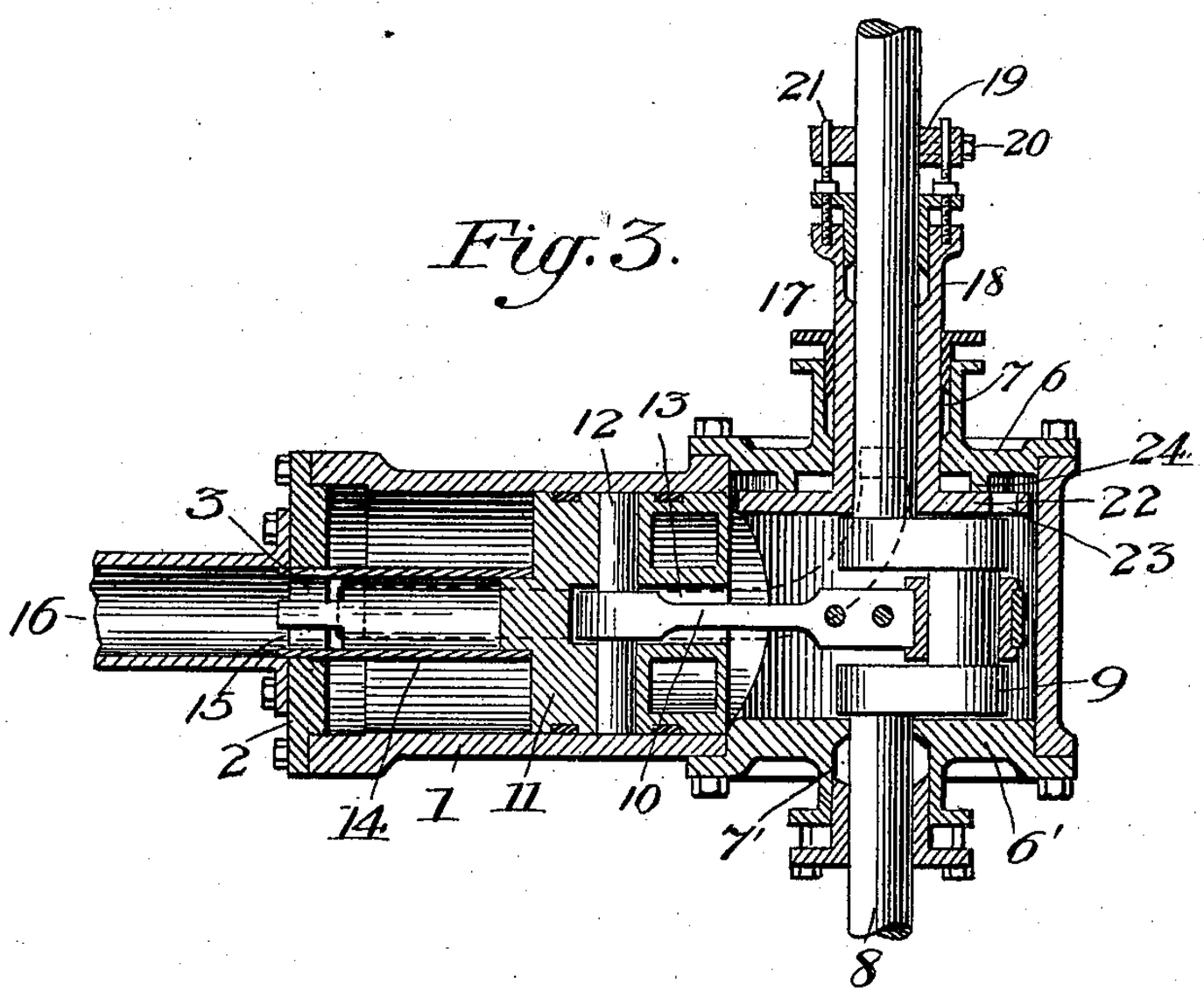


Fig. 4.

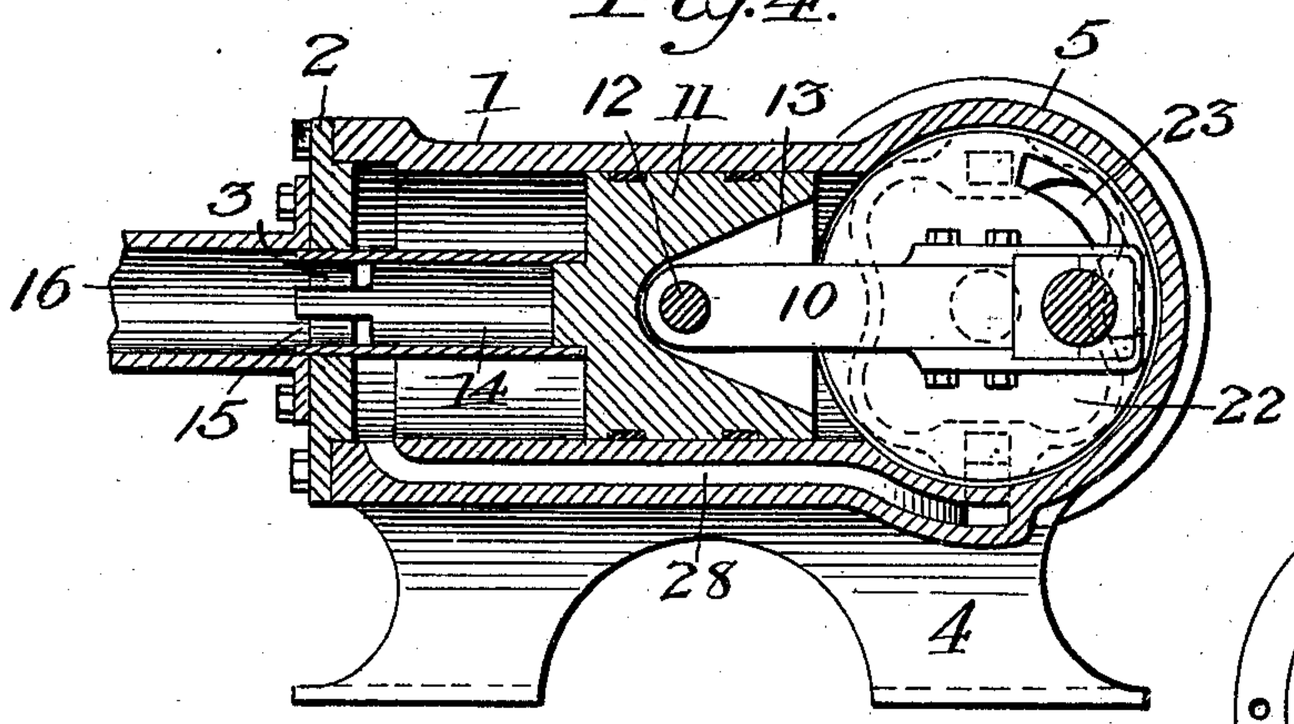


Fig. 6.

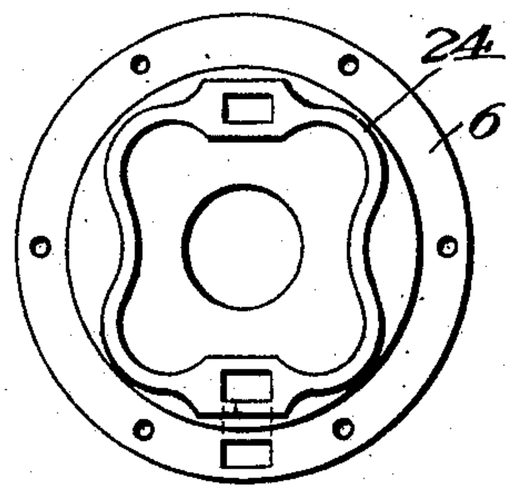
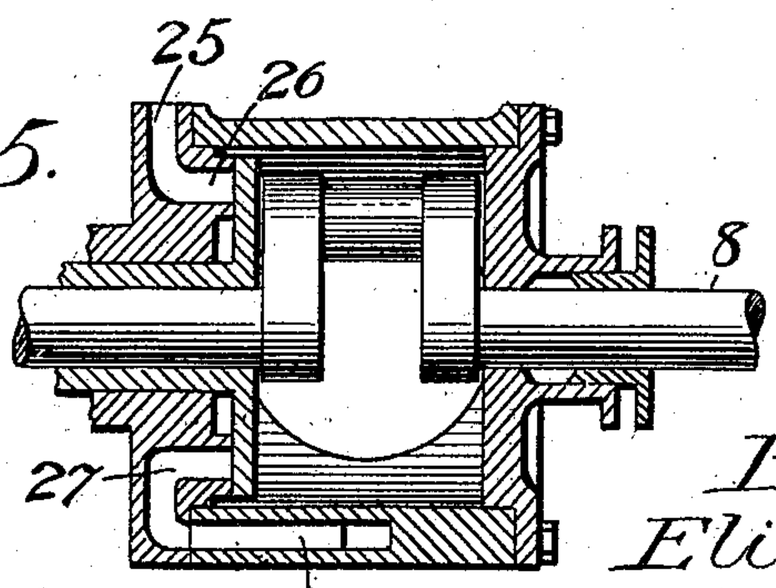


Fig. 5.



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UNITED STATES PATENT OFFICE.

ELI A. STARK, OF TOLEDO, OHIO, ASSIGNOR TO THE TOLEDO STEAM AND AIR MOTOR COMPANY.

FLUID-PRESSURE ENGINE.

SPECIFICATION forming part of Letters Patent No. 670,439, dated March 26, 1901.

Application filed February 28, 1900. Serial No. 6,845. (No model.)

To all whom it may concern:

Be it known that I, ELI A. STARK, 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 Fluid-Pressure Engines, of which the following is a specification.

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 educt the motive fluid after having been used on one side of the piston to the opposite side of the piston and thereafter exhaust the same to the atmosphere; which shall use steam quickly and educt and exhaust it rapidly, so as to minimize the loss from condensation; which shall eliminate as far as possible friction of all the movable parts, and to that end dispense with the use of a reciprocating connecting-rod moving in a stuffing-box; which shall have both the pitman and the rotary shaft located in the same chamber; which shall be simple in construction, comparatively cheap in first cost, and, when necessary, easy to repair, and which, finally, shall be compact, suiting it for use within limited space or areas.

With the above end in view my invention consists, objectively, in an engine having a single cylinder divided by the piston into two chambers, in one of which is located the pitman and crank shaft.

It further consists in an engine having a single cylinder divided by the piston into two chambers, in one of which are located the shaft and means for transmitting the motion of the piston to the shaft and means for admitting motive fluid to one side of the piston and then educting it to the other side of the piston and thereafter exhausting it to the atmosphere.

Finally, it consists in certain novelties of construction and combinations and arrangements of parts hereinafter set forth and claimed.

The accompanying drawings illustrate two examples of the physical embodiment of my invention constructed according to the best of the several modes I have so far devised for the practical application of the principle.

Figure 1 is a perpendicular sectional view of one example, the section being taken in a plane at right angles to the rotary shaft. Fig. 2 is a similar view taken in a perpendicular plane parallel with the shaft. Fig. 3 is a sectional plan view of another example of the engine, taken in a horizontal plane parallel with the shaft. Fig. 4 is a sectional view in elevation taken in a perpendicular plane at right angles to the shaft. Fig. 5 is a sectional view taken in a perpendicular plane parallel with the shaft. Fig. 6 is a view of the inside surface of a removable bonnet, showing the boss against which the rotary disk-valve bears.

Referring to the first example, (illustrated in Figs. 1 and 2,) the letter A designates an upright-engine cylinder open at both ends; B, the removable top cylinder-head; C, a base for the cylinder made integral, in this instance, with the cylinder; D, a lower cylinder-head; E, a semicircular recess in the head of a depth and a width slightly greater than the length and width of the crank. F F are recesses in the head to receive the shaft-bearings; G G, bearings located within the recesses. H represents bolts which secure the lower head in place. I is a rotary shaft. J J are crank-arms. K is a crank-pin; L, the pitman; M, the piston; N, a slot in the piston; O, a pin by which the upper end of the pitman is pivoted to the piston; P, a removable bonnet; Q, an opening through the bonnet to receive the shaft and bearing; R, a rocking valve; S, a shaft passing longitudinally through and fixed relative to the valve. T T′ are slots in the valve. U is an arm on one end of the shaft S and rigidly secured thereunto; V, a cam on the shaft; W, a pivot-pin uniting the arm of the cam and the arm U, secured to the shaft S, as shown in Fig. 1; X, a steam-passage from the valve to the top end chamber; Y, a passage from the valve to the lower end chamber; Z, a motive-fluid inlet or supply-pipe, and Z′, a motive-fluid exhaust-pipe.

Referring to Figs. 3, 4, 5, and 6, which illustrate the second example, the numeral 1 designates an engine-cylinder having an end opening and disposed in a horizontal position. 2 is a cylinder-head; 3, an opening through the head; 4, the base of the engine; 5, the

crank-case. 6 6′ are removable bonnets; 7 7′, bearings for the rotary shaft at the centers of the bonnets. 8 is the rotary shaft; 9, a crank; 10, the pitman; 11, the piston; 12, a pin uniting the pitman and piston; 13, a slot in the piston; 14, a tube secured to the end of the piston. 15 are slots in the end of the tube. 16 is an exhaust-steam pipe; 17, a rotary valve on the shaft; 18, the tubular sleeve of the valve; 19, a collar on the shaft; 20, a set-screw in the collar. 21 are pins uniting the collar and sleeve to the valve. 22 is the disk of the valve; 23, a slot in the disk; 24, a tortuous boss on the inner surface of the bonnet against which the disk bears; 25, a steam-inlet passage; 26, an inlet-port; 27, an eduction-port, and 28, an eduction-passage from the crank-chamber to the opposite end chamber.

It will be observed that in each of the examples the piston divides the cylinder into two chambers, that the pitman and rotary shaft are both located in the same chamber, and that the chamber inclosing the crank is made as small as possible and still allow the crank to be revolved.

The mode of operation of the first example is as follows: The parts being in the position shown motive fluid can pass from the pipe Z through the slot T and passage X to the top chamber by way of the passage Y, slot T, and exhaust-pipe Z′ to the atmosphere. As the piston approaches the lower end of the cylinder the cam rocks the valve, shutting off steam from the pipe Z, opens communication between the top and bottom chambers by way of the slot T, and closes the passage from the bottom chamber to the exhaust-pipe Z′. The piston then moves upwardly and the cam rocks the valve to its first position.

The mode of operation of the second example is similar; but the live steam or motive fluid is first admitted to the end chamber which contains the crank and shaft. As the slot 23 in the disk of rotary valve opens port 26 steam enters the crank-chamber for a period of time determined by the length of the slot and forces the piston outwardly. When the slot reaches the port 27, live steam is shut off and communication established by way of the passage 28 between the crank and the other end chamber. As the piston moves inwardly and reaches the end of its stroke the steam in the end chamber and which has been educted from the crank-chamber escapes by the openings formed by the slots 15 to the exhaust-pipe 16 and the atmosphere. The outward movement of the piston then closes the exhaust, as is obvious.

From the foregoing descriptions of the constructions and modes of operation of the two pictured examples it will be clear that I have produced a type of engine adapted to be operated by a motive fluid and which fulfils all the conditions set forth hereinbefore as the purpose or end of my invention.

While I have illustrated only two examples of the physical embodiment of the said invention, I do not thereby intend to limit its scope to these particular examples, inasmuch as the principle can be applied in other ways and modes not involving a substantial departure.

The general way of constructing the engine with a single cylinder, a piston dividing the same into two chambers, with the pitman and shaft in one of the chambers, and the provision of valve mechanism whereby the motive fluid is admitted to one of the chambers, educted to the other chamber, and then exhausted embrace the essential features of my improvements. The details of construction, however, to secure the desired mode of operation can of course be varied and equivalents substituted for the elements illustrated. For example, I may substitute a slide-valve or a piston-valve for any of those shown, contract the space in the crank-chamber in any desired way, substitute for the pitman and crank other means, form the cylinder in two parts, and introduce many other modifications, incorporations, or variations. These and other changes I intend to embrace within the scope of the claims.

What I claim as new, and desire to secure by Letters Patent, is—

1. An engine having a single cylinder divided by a piston into two chambers only and within one of which chambers is located a rotary shaft and means for transmitting the motion of the piston to the shaft; said engine also being provided with means for periodically admitting motive fluid to one of the chambers, means for educting it to the other chamber and confining it there, and valve mechanism controlling the exhaust of motive fluid from the last-mentioned chamber to the atmosphere.

2. The combination in an engine, of a cylinder; a piston dividing the cylinder into two chambers; a rotary shaft and means for transmitting the motion of the piston to the shaft located in one of the chambers; means for admitting motive fluid to one side of the piston and educting it to the other side of the piston and confining it there; and means consisting of valve mechanism for exhausting it to the atmosphere.

3. The combination in an engine, of a cylinder; a piston dividing the cylinder into two chambers; a rotary shaft in one of the chambers; means for uniting the piston and shaft; and valve mechanism for admitting motive fluid to one chamber, educting it to the other chamber and confining it there, and exhausting it thence to the atmosphere; said cylinder having a crank-chamber provided with a recess.

4. The combination in an engine, of a cylinder; a piston dividing the cylinder into two chambers; a rotary shaft and means uniting the piston and shaft located in one of the chambers; and valve mechanism which simultaneously admits motive fluid to one chamber and

exhausts motive fluid from the other chamber, and also simultaneously closes the admission and exhaust ports and opens communication between the two chambers.

5. The combination in an engine, of a cylinder; a piston dividing the cylinder into two chambers; a rotary shaft and means for uniting the piston and shaft located in one of the chambers; valve mechanism operated by the shaft which admits motive fluid to one chamber and educts it to the other chamber and confines it there; and means for periodically exhausting motive fluid from the last-mentioned chamber.

In testimony whereof I affix my signature in presence of two witnesses.

ELI A. STARK.

Witnesses:
O. P. BOWMAN,
FRED. H. MCINTOSH.