(No Model.)

3 Sheets—Sheet 1.

F. D. MOON.

ROTARY STEAM ENGINE.

No. 604,333. Patented May 17, 1898.

Witnesses:
Peter F. Edwards
F. M. Ewing

Inventor:
Frank D. Moon
by O. M. Clarke
his attorney.

(No Model.) 3 Sheets—Sheet 2.

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Fig. 8.

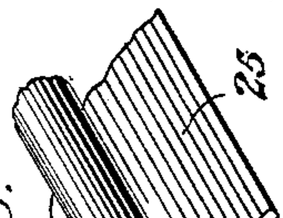

Fig. 6.

Fig. 7.

Fig. 5.

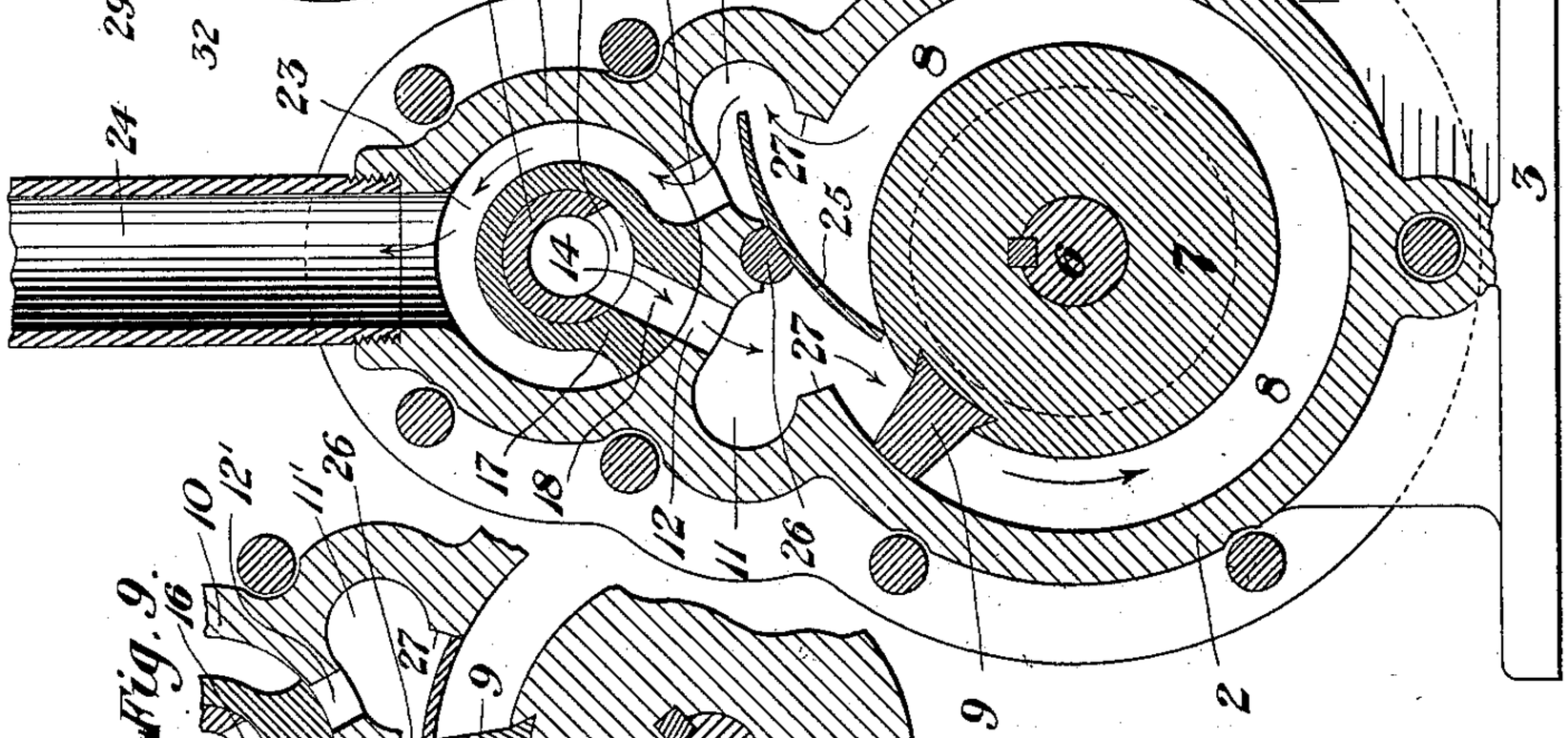

Fig. 9.

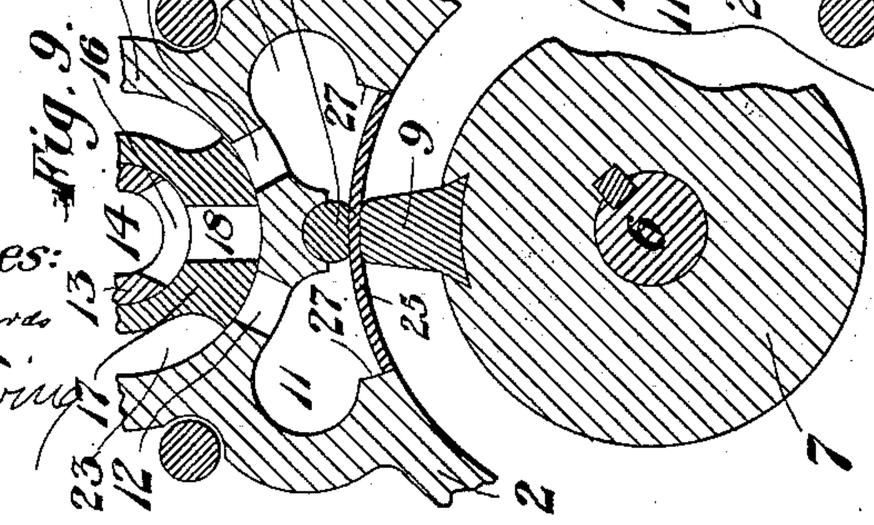

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Fig. 10.

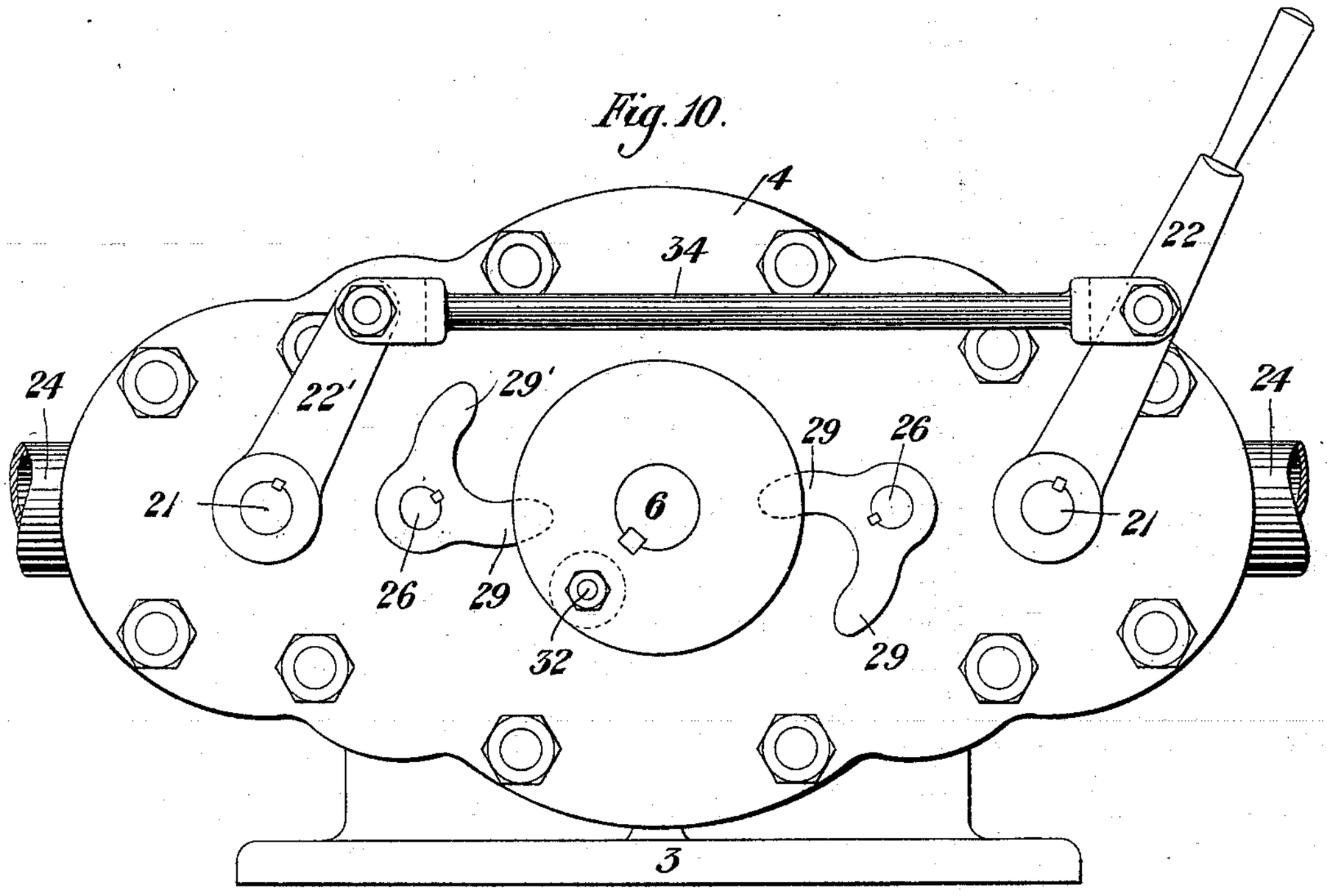
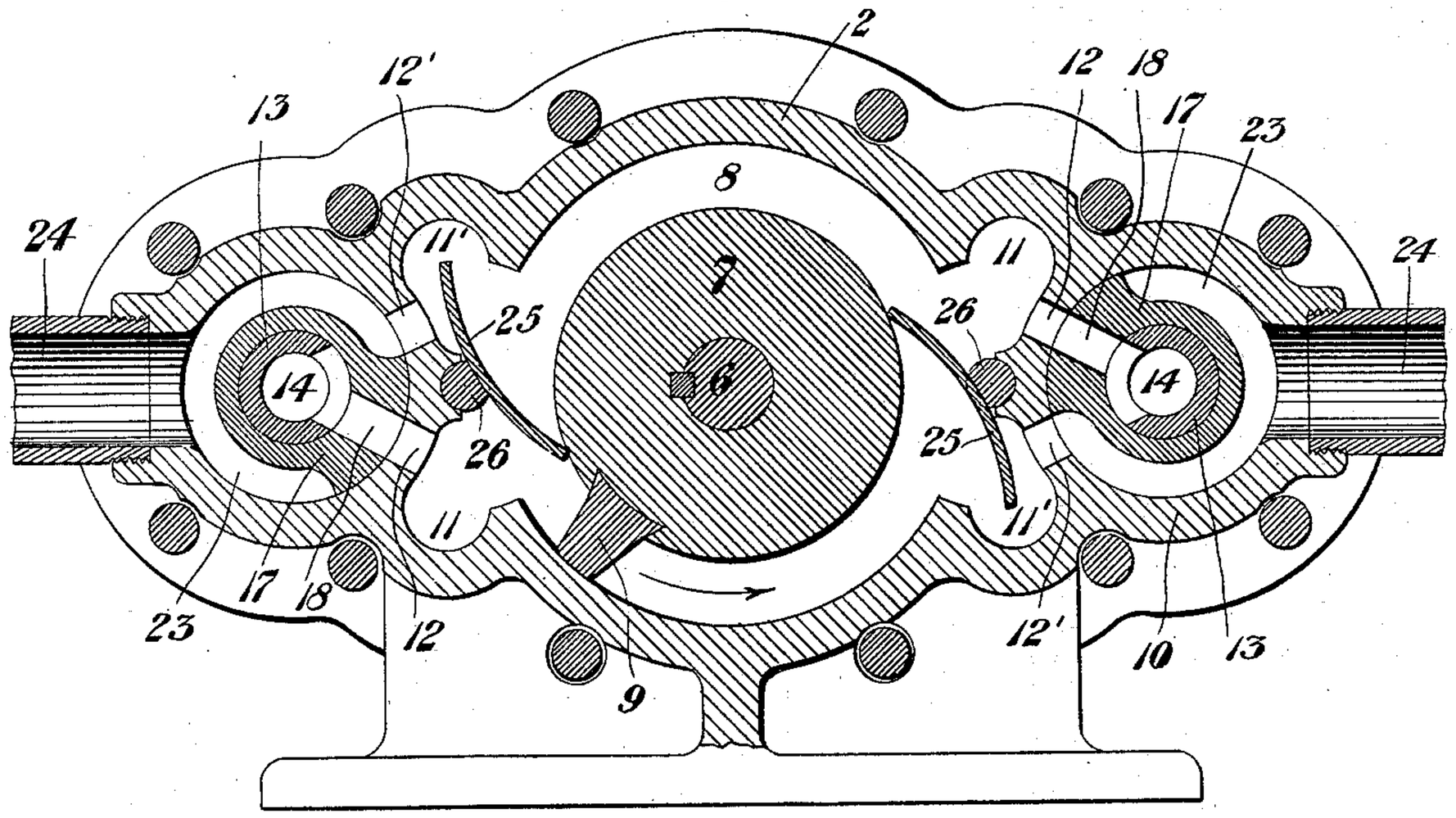


Fig. 11.



Witnesses:
Peter F. Edwards
O. M. Ewing

Inventor:
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by O. M. Clarke
his Attorney.

UNITED STATES PATENT OFFICE.

FRANK D. MOON, OF LOCKPORT, NEW YORK, ASSIGNOR OF THREE-TWENTIETHS TO LUCIUS F. ADAMS AND JOSHUA GASKILL, OF SAME PLACE, AND FREDERICK S. JACKSON, OF HOLLAND, NEW YORK.

ROTARY STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 604,333, dated May 17, 1898.

Application filed May 14, 1897. Serial No. 636,532. (No model.)

To all whom it may concern:

Be it known that I, FRANK D. MOON, a citizen of the United States, residing at Lockport, in the county of Niagara and State of New York, have invented or discovered a new and useful Improvement in Rotary Steam-Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a face view of my engine, showing the valve-lever thrown to admit steam for operation to the right. Fig. 2 is a side elevation thereof. Fig. 3 is a face view of the valve-operating disk and valve-shaft cam-arms. Fig. 4 is a partial central vertical cross-section through the valve mechanism and casing, showing the engine reversed. Fig. 5 is a central vertical cross-section through Fig. 2 on the line V V. Fig. 6 is a similar section on the line VI VI of Fig. 1. Fig. 7 is a detail view similar to Fig. 3, showing the parts in a position of rest, the steam being cut off. Fig. 8 is a detail perspective view of the two-way pivoted valve. Fig. 9 is a detail view similar to Fig. 4, showing the steam cut off and the drum in a middle position. Fig. 10 is a view in side elevation of an engine provided with a double valve. Fig. 11 is a central longitudinal sectional view thereof.

My invention relates to rotary engines, and has for its object the construction of an engine wherein the expansive properties of the steam may be utilized with economy and with simple and inexpensive mechanism, together with an improved valve-gearing by which the admission of steam to the engine may be readily controlled and the engine reversed for operation in either direction.

Other details of construction forming novel and essential features of my invention will be more fully set forth in the following specification and embodied in the accompanying claims.

Referring now to the drawings, 2 is the main cylinder of the engine, provided with a suitable base 3 and heads 4 4, in which are mounted bearings 5, supporting the main shaft of the engine 6. Upon this shaft is mounted the drum 7, secured by a key, the drum being of considerably less diameter than the internal diameter of the cylinder, between which and the drum there is therefore an intervening annular space 8, representing the mean effective steam area. Upon the drum, extending across its length, is mounted an abutment 9, constituting the piston of the engine, which abutment completely fills the space 8, making a tight moving fit thereon and free to rotate with the drum under action of steam-pressure on the abutment.

10 is the valve-chamber, located above the cylinder, and between the valve-chamber and cylinder are intervening pocket-chambers 11 11′, into which open ports 12 12′ from the valve-chamber 10.

Steam is admitted into the valve-chamber by an inlet-barrel 13, having a central opening 14, in communication with the steam-inlet pipe 15, and a lateral port 16, opening toward the ports 12 12′. Journaled upon the barrel 13 is the rocking valve 17, provided with a port 18, adapted to register with the port 16 of the hollow barrel 13 and with the ports 12 and 12′, leading to the steam-cylinder.

The valve 17 is sleeved on the barrel 13, making a steam-tight fit, and one end is reduced in diameter and has a bearing in a suitable bushing 20 in the frame of the engine and an extended reduced stem 21, to which is secured the operating-handle 22, by which the valve may be thrown to any desired position.

Between the rocking valve 17 and the inner face of the valve-chamber is an intervening space 23, forming an exhaust-passage for the steam, and into the top of the valve-chamber is screwed an exhaust-pipe 24, communicating therewith. A double-acting rock-valve 25 is secured to a rod 26, pivoted centrally in the main frame of the engine, the inner face of the valve conforming to the same radius as the inner face of the cylinder and of a length to close the passage leading from the space 8 to chambers 11 11′, as shown in Fig. 9, the edges 27 of such passage conforming to a radius struck from the center of the pivoted rod 26, whereby the edges of the valve 25 will aline with such edges and make a tight fit. Upon the outer

end of the rod 26, which extends through the casing, is secured the tilting dog 28, having cam-arms 29 29′ at each side, and an open intervening space 30, keyed or otherwise secured to the rod 26, by which the rod and valve 25 are operated independently by the following-described mechanism.

Secured to the end of the main engine-shaft 6 is a disk 31, to the inner face of which is secured by bolt 32 a roller 33, so located as to revolve in the path of the cam-arms 29 and to engage one or the other of such arms, according to the direction of rotation. When steam is admitted from the valve through either of the ports 12 or 12′, the end of the valve 25 adjacent to such inlet-valve will be depressed by steam-pressure, admitting steam to the space 8, when by expansion against the abutment 9 the drum 7 and shaft 6 will be rotated, one end of the valve 25 being held down upon the drum by steam-pressure, as clearly shown in Fig. 5, while the other end is thrown up into the chamber 11′, thereby opening an exhaust-passage through such chamber, port 12′, and space 23 to the exhaust-pipe 24. When so thrown into position, the arm 29 of dog 28 will be thrown down into the path of roller 33, which will strike and raise the arm, and consequently the valve 25, out of the path of the advancing abutment 9, the roller passing up into the space 30 between the arms and in its passage releasing the arm 29. The action of the roller upon the arm is very easy and all knocking or jar is avoided by the curvature of the faces, while the partition formed by the valve 25 being momentarily raised, so that the steam on each side has an opportunity to commingle, a cushioning effect is thereby secured for the fall of the valve, thus avoiding unnecessary knocking of the parts. This feature of independent raising of the valve constitutes an important and valuable part of my invention, as I am enabled to thereby avoid the wear and objectionable friction of parts occurring were the abutment used to raise the valve.

It will be seen that when steam is admitted to act on the abutment the full expansive qualities are utilized, inasmuch as the walls of the chamber 11 and that part of the valve 25 from the rod 26 to the edge serve to confine the steam within a chamber so formed by the valve, thus furnishing a positive unyielding backing for the steam, against which it will expand and act upon the abutment.

It is obvious that the engine will operate equally well in the reverse direction, the port 12 in such case acting as an exhaust-port and the port 12′ as an inlet-port upon reversal of the valve, as shown in Fig. 4.

In Fig. 9 the valve is shown in the middle position, the ports 12 12′ being closed and the valve 25 assuming a similar position.

In starting the engine it is ordinarily only necessary to throw the valve to admit steam in the desired direction; but should the engine stop with the abutment in the position shown in Fig. 9 the drum should be thrown round slightly, so as to permit the steam to open the valve. If desired, the valve 17 may be supplied with cut-off mechanism and connected with an eccentric or other operative device on the engine-shaft, whereby the steam admission may be automatically regulated, as in the ordinary reciprocating engine. Good results may be secured by double and triple compound constructions built in accordance with my design, whereby the exhaust-steam from the high-pressure cylinder is reused down to atmospheric pressure, as in the usual practice with other types of engines at present. Such a construction is not shown in the drawings and will form the subject-matter of later applications for patents.

In the construction shown in Figs. 10 and 11 the engine is shown supplied with valves at each end, and the reversing-lever 22 is connected to a similar lever 22′ by a connecting-rod 34, whereby both valves are operated simultaneously.

If desired, in engines of large size three or or four valves may be arranged around the cylinder to good advantage, while for ordinary use one or two will be found sufficient, although I do not desire to be limited to such number or arrangement as is shown in the drawings, but to include all such variations and modifications as will suggest themselves to the skilled mechanic.

The advantages of a practical and economical rotary engine are well understood and recognized in the art of engine construction, and my invention will be appreciated by the users of steam-power.

In other and prior constructions of engines having in view an initial rotary motion of the main shaft difficulties of securing proper and sufficient expansion of the steam and packing of the various joints and working parts have not been adequately overcome, and I believe I am the first to secure practical and efficient results in these respects.

By my construction the evil effects of leakage are reduced to a minimum, and such packing as is necessary is a matter of comparative ease.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a rotary engine comprising a cylinder, a drum mounted therein provided with an abutment, a valve-chamber located to one side of the cylinder, a valve mounted therein, and a double-acting rock-valve pivotally mounted between the valve-chamber and the cylinder with means for actuating the rock-valve: intervening pocket-chambers between the valve-chamber and the cylinder constituting enlarged communicating passages for supply and exhaust steam around the ends of the rock-valve, substantially as set forth.

2. A rotary engine comprising a cylinder, a drum mounted therein provided with an abut-

ment, a valve-chamber located to one side of the cylinder, a valve mounted therein, intervening pocket-chambers between the valve-chamber and the cylinder formed into enlarged laterally-extended cavities, a double-acting rock-valve pivoted between the pocket-chambers adapted to open and close communication between such chambers and the cylinder, a cam-arm on the rock-valve shaft and means attached to the main shaft for operating the cam to actuate the rock-valve, substantially as set forth.

3. In a rotary engine provided with a cylinder and a drum mounted therein provided with an abutment, a double-acting pivoted rock-valve with its inner face conforming to the inner face of the cylinder and a valve-chamber located to one side of the cylinder with a valve mounted therein; intervening pocket-chambers between the valve-chamber and cylinder having extended lateral cavities allowing for free circulation around the ends of the rock-valve when deflected and contracted to meet the edges of said valve when closed, substantially as set forth.

4. The combination, in a rotary engine, of a cylinder, a drum mounted therein provided with an abutment, a valve-chamber located to one side of the cylinder, intervening pocket-chambers between the valve-chamber and the cylinder, a double-acting rock-valve pivoted between the pocket-chambers with its inner face curved to conform to the inner face of the cylinder, a double-arm cam on the valve-stem, a disk on the main shaft provided with a roller for engagement therewith, and a rotatory valve mounted on an inlet-barrel in the valve-chamber and adapted to open supply and exhaust passages leading to the intervening pocket-chambers; substantially as set forth.

5. In a rotary engine, the combination of a cylinder, a drum mounted therein provided with an abutment, a plurality of valve-chambers located laterally to the cylinder with valves mounted therein, means for simultaneously reversing the valves, intervening pocket-chambers between the valve-chambers and the cylinder, constituting enlarged communicating passages for supply and exhaust steam around the ends of the rock-valves, double-acting rock-valves pivoted centrally between the pocket-chambers with their inner faces curved to conform to the inner face of the cylinder, actuating-cams on the valve-stems and a disk on the main shaft provided with a roller for engagement therewith, substantially as set forth.

6. In a rotary engine comprising a cylinder, a drum mounted therein provided with an abutment, a valve-chamber located to one side of the cylinder, a valve mounted therein, a double-acting rock-valve pivotally mounted between the valve-chamber and the cylinder, and intervening pocket-chambers between the valve-chambers and the cylinder constituting enlarged communicating passages for supply and exhaust steam around the ends of the rock-valve: a double-arm cam with a concave recess between the arms, mounted on the end of the rock-valve shaft and a roller mounted on a disk secured to the main shaft adapted to enter the recess and engage one of the arms, substantially as set forth.

7. The combination, in a rotary engine, of a cylinder, a drum mounted therein provided with an abutment, a valve-chamber located to one side of the cylinder, intervening pocket-chambers between the valve-chamber and the cylinder, a double-acting rock-valve pivoted between the pocket-chambers with its inner face curved to conform to the inner face of the cylinder, a cam on the valve-stem, a disk on the main shaft provided with a roller for engagement therewith, and a rotatory valve mounted on the inlet-barrel in the valve-chamber and adapted to open supply and exhaust passages leading to the intervening pocket-chambers; substantially as set forth.

8. The combination, in a rotary engine, of a cylinder, a drum mounted therein provided with an abutment, a valve-chamber located to one side of the cylinder, intervening pocket-chambers between the valve-chamber and the cylinder, a double-acting rock-valve pivoted between the pocket-chambers with its inner face curved to conform to the inner face of the cylinder, a cam on the valve-stem, a disk on the main shaft provided with a roller for engagement therewith and a valve in the valve-chamber adapted to open supply and exhaust passages leading to the intervening pocket-chambers, substantially as set forth.

In testimony whereof I have hereunto set my hand this 28th day of April, 1897.

FRANK D. MOON.

Witnesses:
DE WITT C. GASKILL,
LEWIS T. BARNES.