2 Sheets—Sheet 1

W. HUSTON & H. N. WICKERSHAM.

Rotary Steam-Engine.

No. 205,868. **Patented July 9, 1878.**

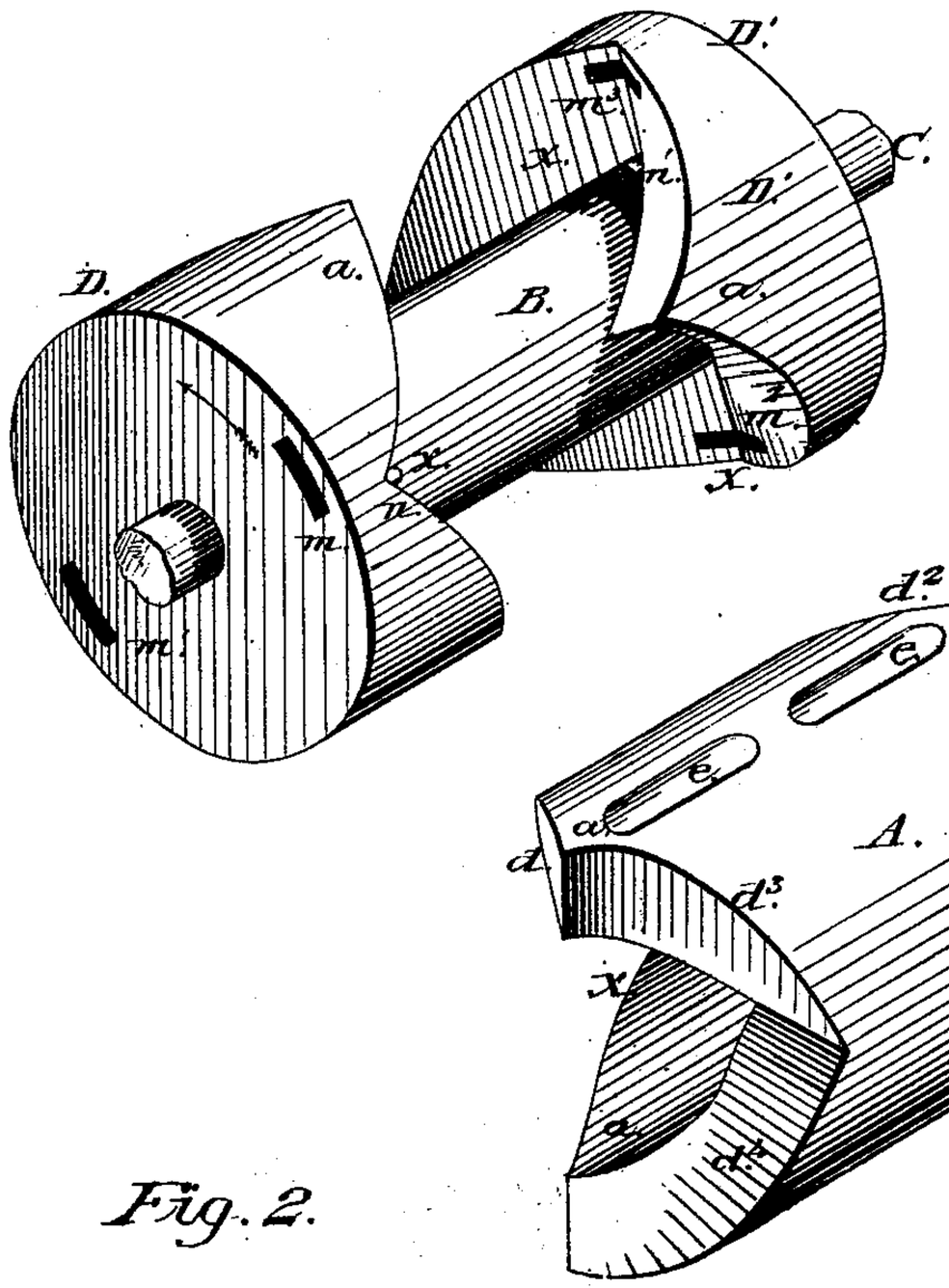


Fig. 1.

Fig. 2.

Fig. 3.

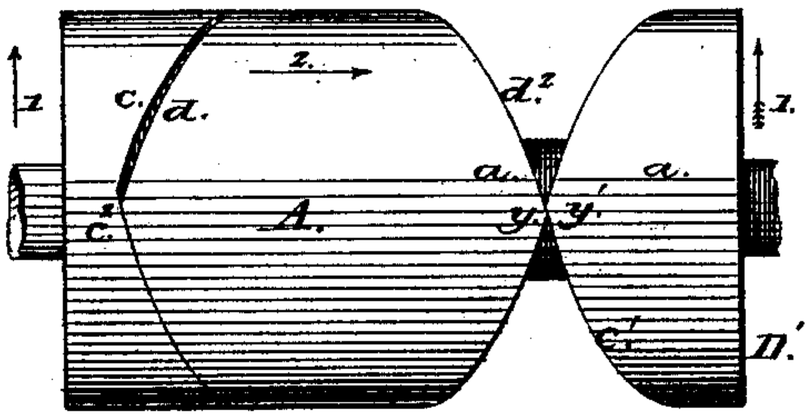


Fig. 4.

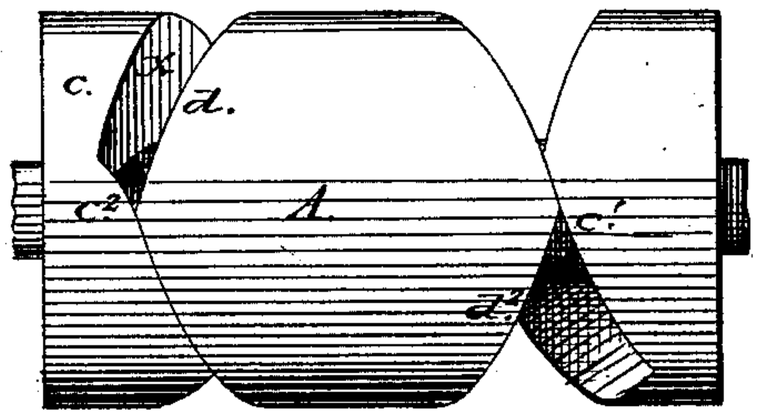
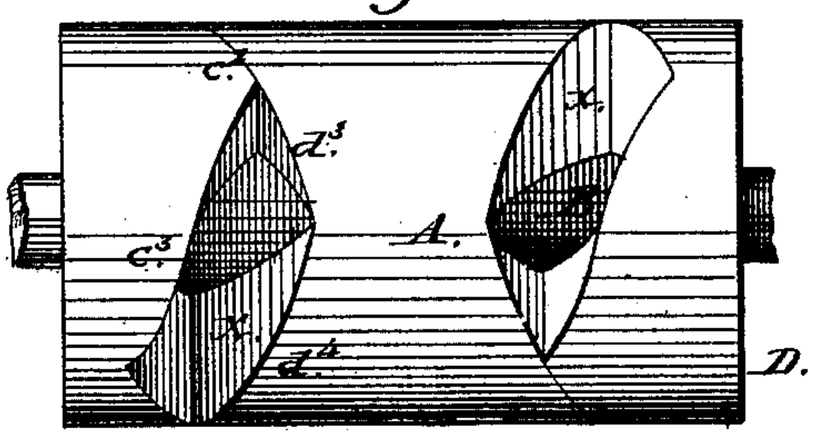
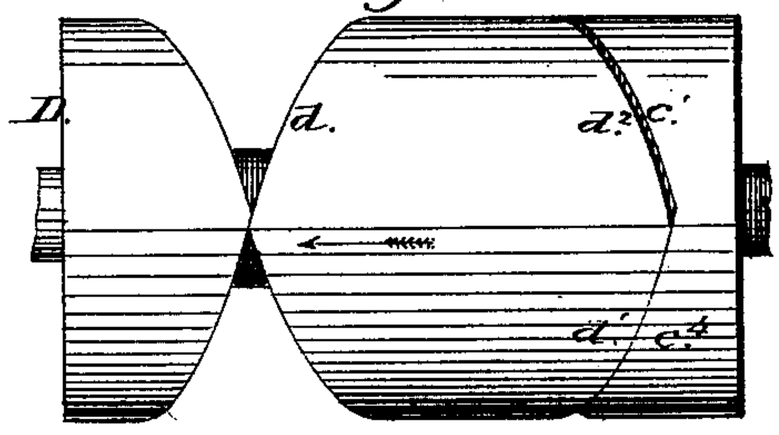


Fig. 5.





Witnesses:
Fred Benjamin.
E. A. Welsh

Inventors:
Wm. Huston
H. N. Wickersham
By their attorney
Charles E. Foster

2 Sheets—Sheet 2.

W. HUSTON & H. N. WICKERSHAM.

Rotary Steam-Engine.

No. 205,868. **Patented July 9, 1878.**

Fig. 6.

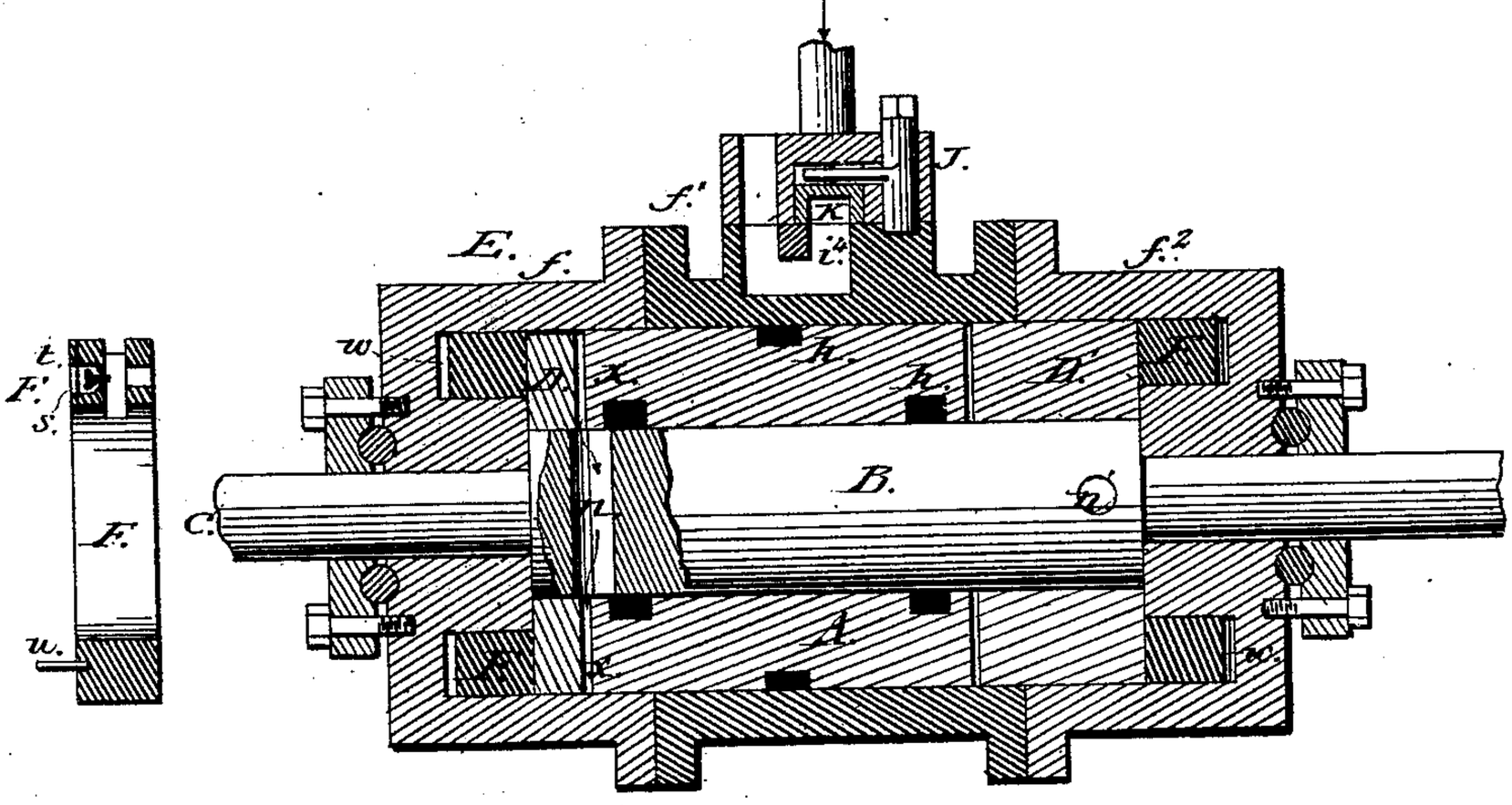


Fig. 7.

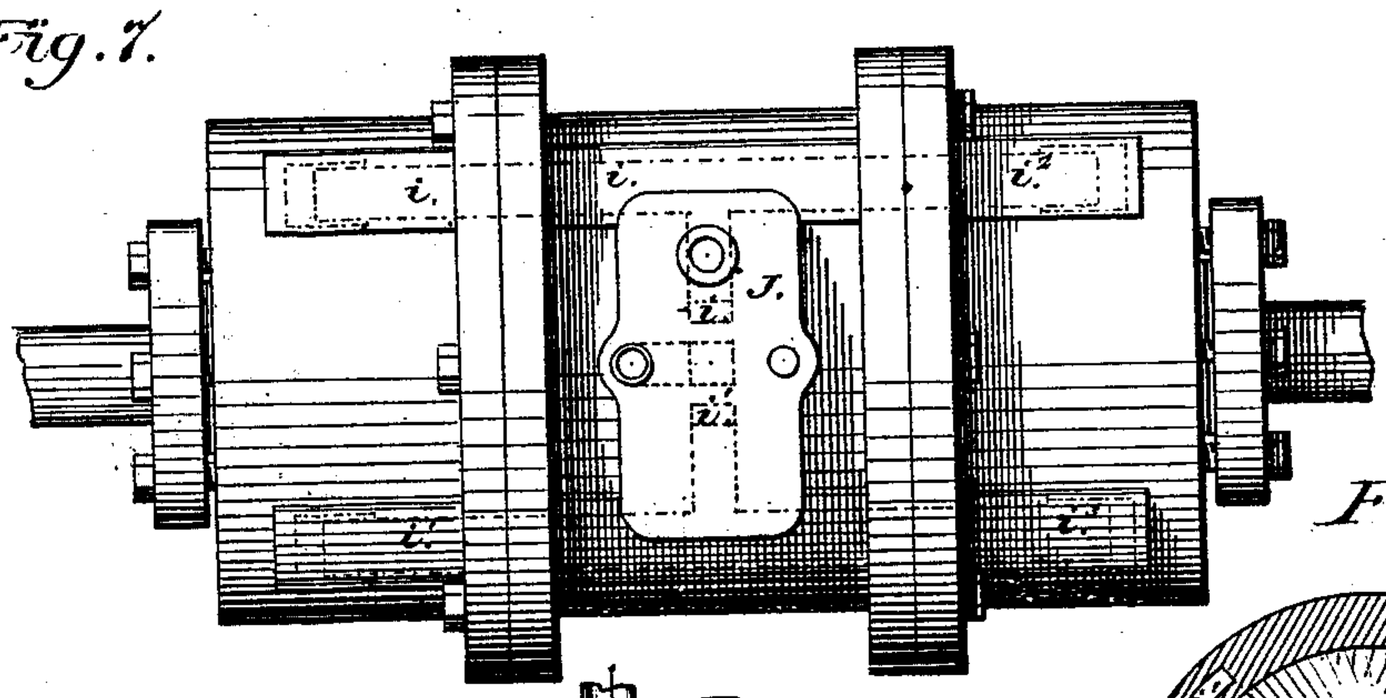


Fig. 9.

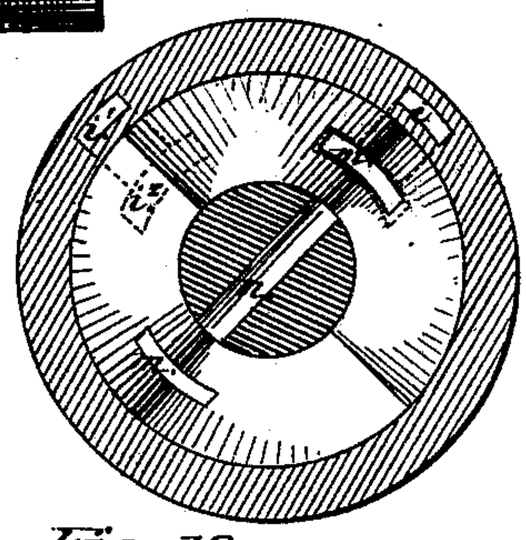


Fig. 8.

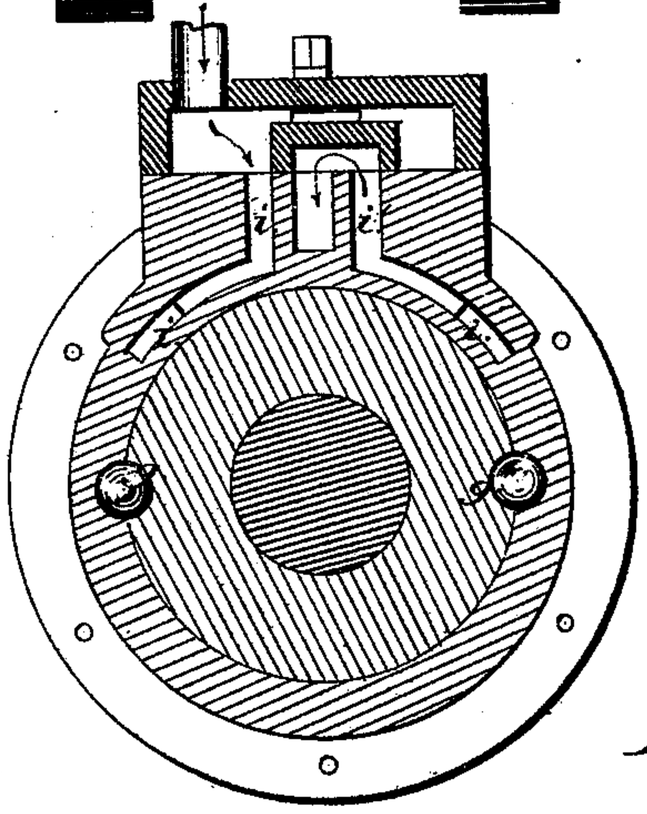


Fig. 11.

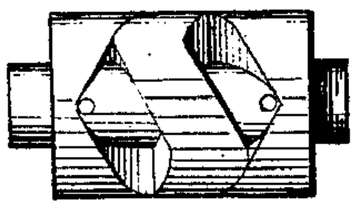


Fig. 10.

Witnesses:
Fred Benjamin.
Edwin A Welsh.

Inventors:
Wm Huston
H. N. Wickersham
By their attorney
Charles E. Foster

UNITED STATES PATENT OFFICE.

WILLIAM HUSTON AND HENRY N. WICKERSHAM, OF WILMINGTON, DELAWARE, ASSIGNORS OF ONE-FOURTH THEIR RIGHT TO WILLIAM G. PENNYPACKER, OF SAME PLACE.

IMPROVEMENT IN ROTARY STEAM-ENGINES.

Specification forming part of Letters Patent No. **205,868**, dated July 9, 1878; application filed January 3, 1878.

To all whom it may concern:

Be it known that we, WILLIAM HUSTON and HENRY N. WICKERSHAM, of Wilmington, New Castle county, Delaware, have invented an Improved Engine, of which the following is a specification:

The object of our invention is an engine provided with blocks or pistons and an intermediate abutment, constructed as fully described hereinafter, so that the reciprocating movement of one will impart rotation to the other.

Our invention also consists in certain details of the engine embodying the said pistons and abutments.

In the drawings, Figure 1 is a perspective view, showing one form in which the pistons and abutment may be made; Figs. 2 to 5, diagrams illustrating the operation of the engine; Fig. 6, a longitudinal section of an operative engine; Fig. 7, a plan view of Fig. 6; Fig. 8, a transverse section near the center; Fig. 9, a transverse section through the cylinder and shaft, showing the face of a piston; and Figs. 10 and 11, diagrams illustrating modifications.

Before describing the engine in detail, we will explain the principles of its operations by reference to the diagrams, Figs. 2 to 5, and the perspective view, Fig. 1, in which—

A represents an annular abutment sliding on the enlargement B of a shaft, C, between the blocks D D′ secured to the shaft, each of said blocks acting as a piston, and the two together constituting the piston of the engine.

The corresponding ends of the piston and the abutment have each an equal number of projections, *a*, and recesses *x*, the projections having spiral or inclined edges or faces, each of which is a section of a true screw-thread winding spirally around the axis of the shaft.

In the present instance the pistons have four (4) faces each, marked by the letters *c* c^1, &c., and the abutment has four faces at each end, marked by the letters *d* d^1, &c. These parts are relatively so adjusted that when the abutment is bearing against one of the pistons, Fig. 2, the point *y* of each projection *a* of the opposite end will be directly opposite and nearly in contact with the point *y′* of the projection of the adjacent piston.

The parts being in the position described, and shown in Fig. 2, and steam being admitted between the faces *c d* and between the corresponding faces on the opposite side of the shaft, there will be a twofold action tending to rotate the pistons and the shaft in the direction of the arrows 1: First, the direct pressure of the steam on the faces *c* will act to impart the rotary motion to the piston, carrying the point *y′* past the point *y;* second, the abutment will be forced in the direction of the arrow 2, and its inclined face d^2, bearing against the inclined face c^1 of the piston D′, will act as a wedge to aid in and continue the rotary motion of the shaft. As the abutment is carried to the right, the extent to which the face c^2, Fig. 3, is exposed to the action of the steam is increased, and the direct action of the steam on the face *c* is gradually counterbalanced; but the increased area of the abutment resulting from the exposure of the faces d^3, Fig. 4, which shows the abutment turned one-fourth of a revolution, insures a corresponding increase in the force with which the abutment bears upon the piston D′.

While the steam has thus acted between the faces *c d* on one side of the shaft the action in like manner upon the faces c^3 d^3 d^4, Fig. 4, on the opposite side at the same end duplicates the power applied, and exposes at one time and continuously to the action of the steam four changing faces equal in area to the area of the end of the piston or abutment.

When the opposite end of the abutment has been brought into full contact with the piston D′, the steam is cut off from the chambers *x* at the left, and is admitted between the faces c^1 d^2, Fig. 5, with precisely the same effect as before, except that the direct steam-pressure is upon the face c^1 and the wedge-like action upon the piston D. During the entire series of operations there is but an instant at the end of each movement of the abutment that the steam does not act to rotate the shaft, and at no time is there a dead-center, or absolute

resistance to the action of the steam, which follows the continuous rotation of the shaft without cessation or change in the direction of its motion.

The movement of the abutment on the face of either piston is precisely that of a nut upon the thread of a screw. Hence it is desirable that each face shall be the section of a perfect screw-thread; and it will be apparent that the number of faces may be increased or diminished, as may be desired, a face corresponding to a single thread being shown in Fig. 10.

In the diagram and drawing above referred to the points at opposite ends of the abutment are on the same line; but this is not material, as the arrangement shown in Fig. 11 may be used.

We will now proceed to describe the mode of embodying the above-described principles of construction in an operative engine, referring to Figs. 1, 6, 7, 8, and 9, which show the shaft, pistons, and abutment arranged within a cylinder, E, consisting of three portions, f f^1 f^2, bolted together. Rotary motion of the abutment is prevented by balls g in slots c, Figs. 1 and 8, formed partly in the piston and partly in the cylinder, the passage of steam from the chamber at one end of the cylinder to the other being prevented by ring-packings h around and within the abutment. In chambers w, opposite the pistons, are disks or rings F, having openings arranged to form parts of ports i i^1 i^2 i^3, (see Figs. 8 and 9, and dotted lines, Fig. 7,) all communicating with a steam-chest, J, provided with a valve, K, sliding above the entrance to said ports and above the exhaust-port i^4 between them. In the pistons D D′ are ports m m^1 m^2 m^3, Figs. 1 and 9, communicating each with one of the chambers x, as shown in Figs. 1 and 4, and a communication between the chambers on opposite sides of the shaft is formed by transverse ports n n'.

The parts being in the position shown in Figs. 1, 6, and 7, steam will pass through the ports i^1 m n to both the chambers x at the left of the abutment, but cannot pass to the right, as the ports m^2 m^3 of the piston D′ are not opposite the port i^2 i^3.

When the shaft completes one-fourth a revolution in the direction of the arrow, Fig. 1, its rotation will close the outlet of the port i^1, and the port m^2 will be brought opposite the port i^3, from which the steam will pass through the ports m^2 and n' to the chambers at the right, between the faces d^1 e^4, Fig. 5, while the steam will exhaust from the chambers at the left through the ports n, m, and i to the exhaust-port i^4.

By adjusting the valve K the motion is reversed.

In order to balance the shaft and its attachments, steam is admitted freely to the chambers w, so that the rings F bear with equal pressure at both ends, the steam passing to the chambers w through openings s in the rings. To prevent the steam from passing inward when either port communicates with the exhaust, each port is provided with a valve, t, which is closed by pressure within the chamber w, but opens to admit steam to said chamber. A pin, u, or other projection prevents the ring from turning.

It will be obvious that the principle of our invention may be embodied in various forms of mechanism other than those described. For instance, the abutment may be bolted to the cylinder, so that the latter shall slide and turn upon the stationary pistons, or the cylinder may be stationary, and bolted to the abutment, the pistons sliding and turning within the cylinder.

It will also be apparent that air, water, or other fluid may be used as a propelling-power.

We have not specified any application of our improved engine, as it may be employed in any cases where it is necessary to transmit the power of a fluid under pressure, and as some of the special applications will be the subject-matter of separate applications for patents.

We claim as our invention—

1. The combination, in an engine, of a piston and an abutment having corresponding spiral faces, as described, forming two or more intermediate chambers, as set forth.

2. The combination, in an engine, of a piston and abutment having spiral faces, arranged as described, to afford at all times a piston-area equal to that of the entire end of the abutment, as set forth.

3. The combination, in an engine substantially of the character described, of the pistons, abutment, and packings arranged to prevent any communication between the chambers at the opposite ends of the abutment, substantially as specified.

4. The combination of the pistons and abutments, constructed substantially as set forth, and ports or passages forming communications through the pistons, with the chambers between the same and the abutment, as specified.

5. The combination of a piston and abutment, constructed substantially as described, and device for preventing the rotation of the sliding piece without interfering with its reciprocating movements.

6. The combination of a cylinder, a shaft, carrying pistons, an intermediate reciprocating abutment, and ports for passing steam or other fluid to and from chambers between the faces of the pistons and abutment, as set forth.

7. The cylinder E, its chambers w, and slotted rings F, combined with the abutment and pistons, substantially as specified.

8. The combination, with the revolving blocks or pistons, of the rings or disks F, and valves t, arranged to operate substantially as set forth.

9. The combination of the rotating pistons,

sliding abutment A, and balls *g*, for preventing the rotation of the abutment, substantially as set forth.

10. In an engine constructed substantially as described, the ports *n n'*, forming communications between the chambers on opposite sides of the shaft, substantially as specified.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

WILLIAM HUSTON.
HENRY N. WICKERSHAM.

Witnesses:
W. H. CORSE,
GEORGE O'NEILL.