

(No Model.)

2 Sheets—Sheet 1.

A. ROSENKRANZ.  
STEAM ENGINE.

No. 361,598.

Patented Apr. 19, 1887.

Fig. 2.

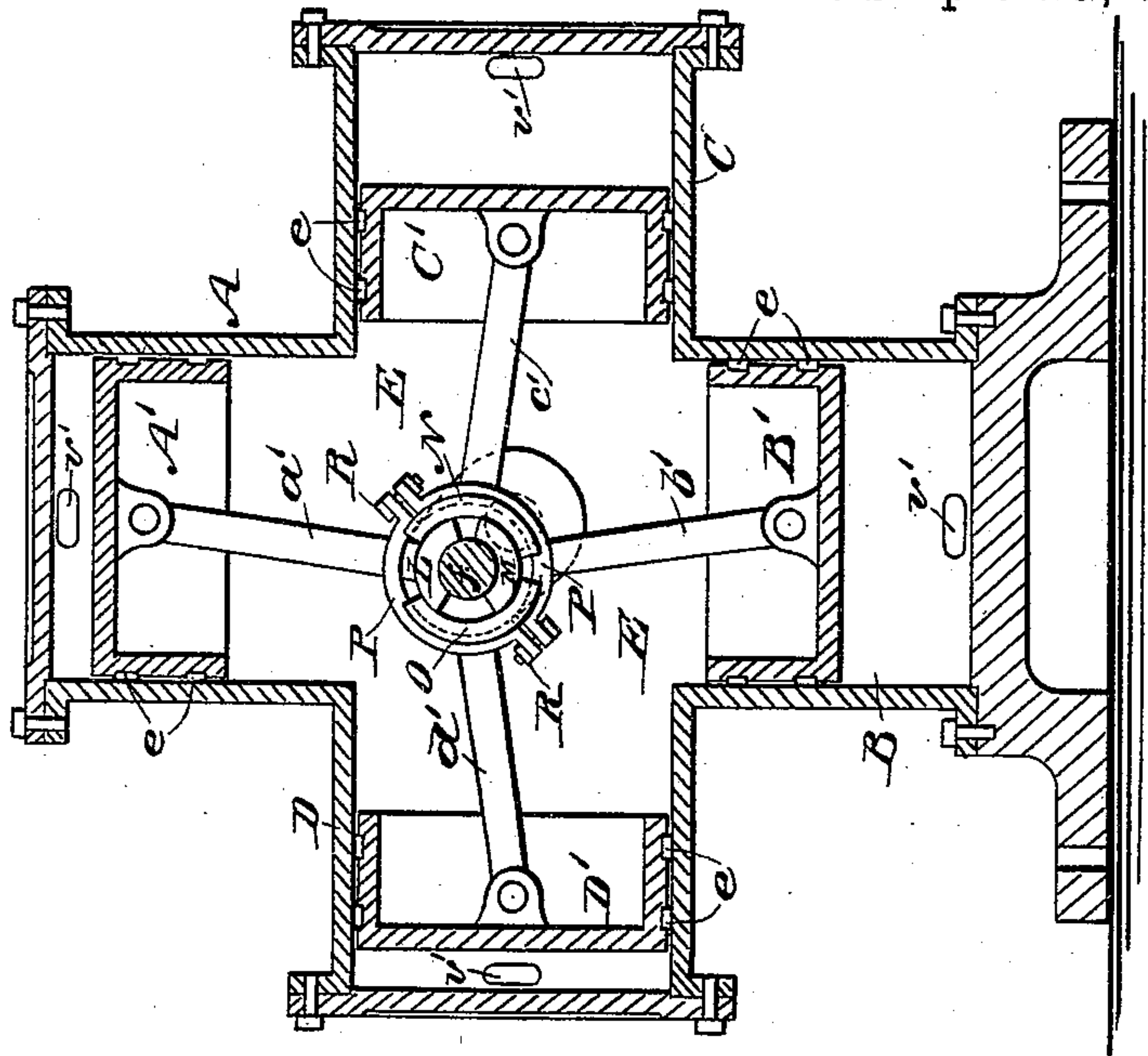
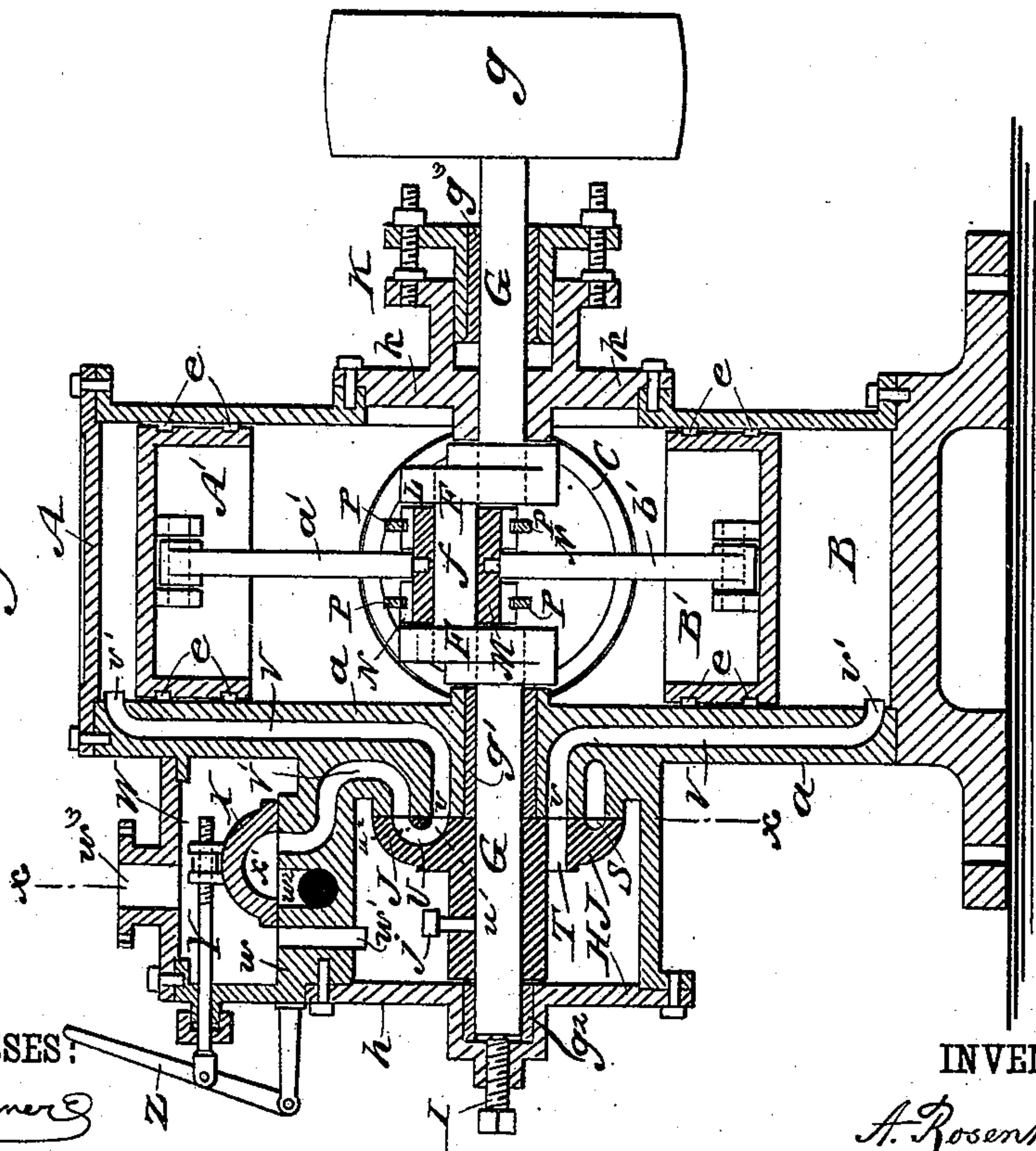


Fig. 1.



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2 Sheets—Sheet 2.

A. ROSENKRANZ.  
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Fig. 4.

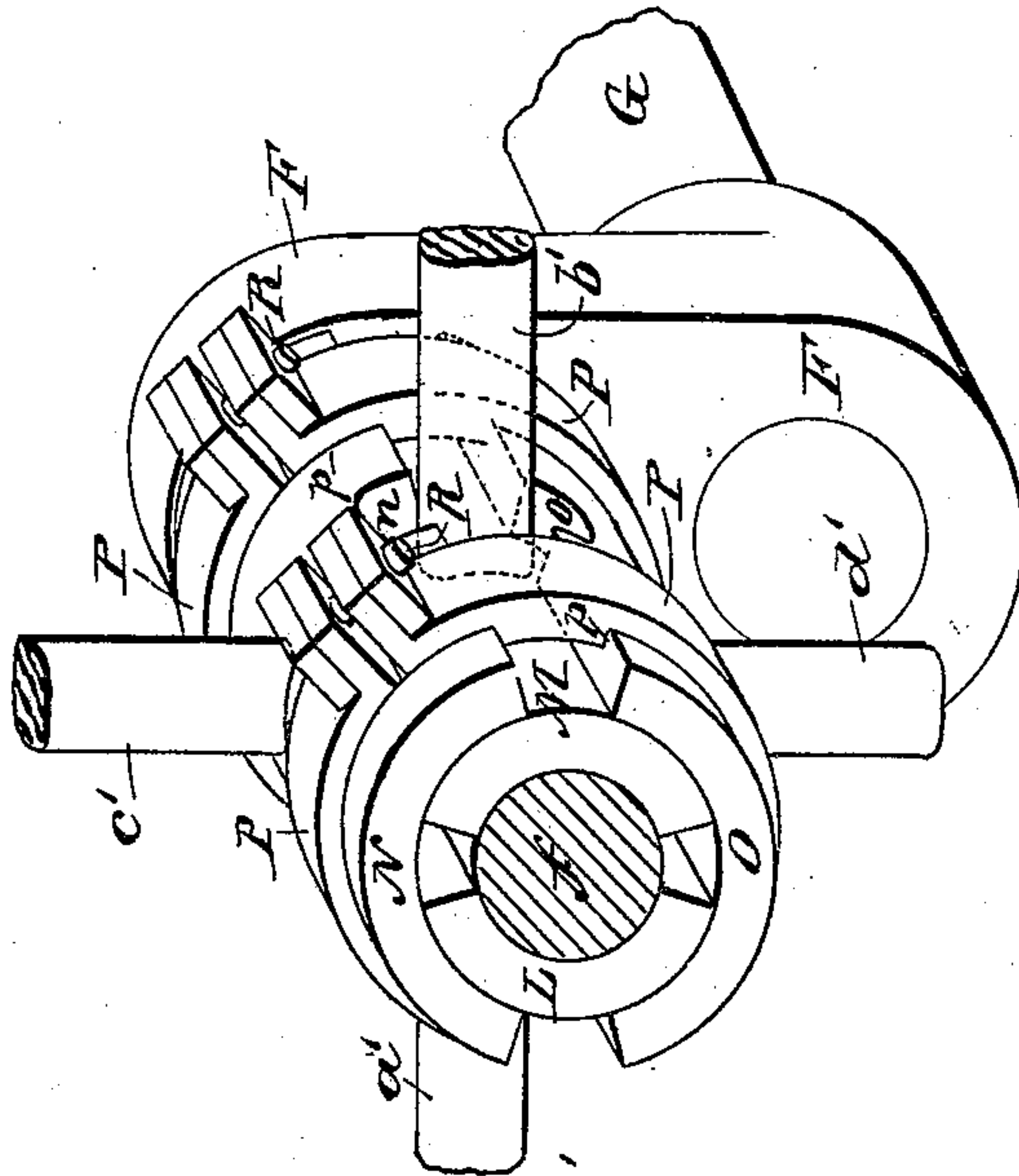


Fig. 6.

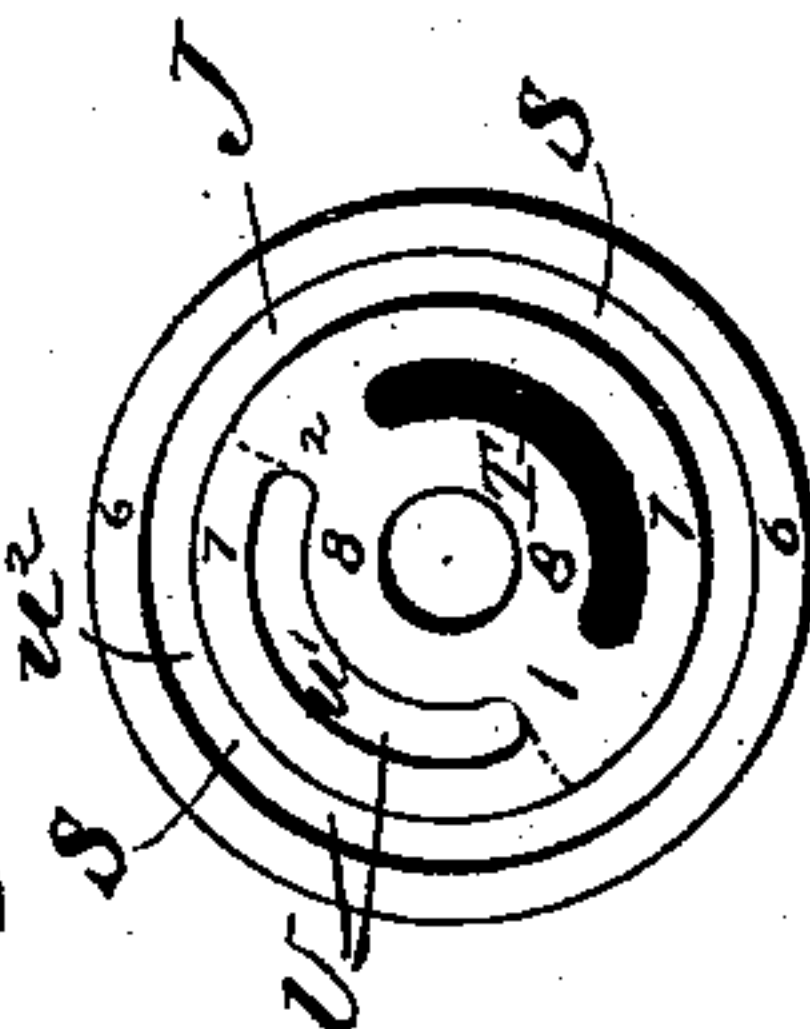


Fig. 3.

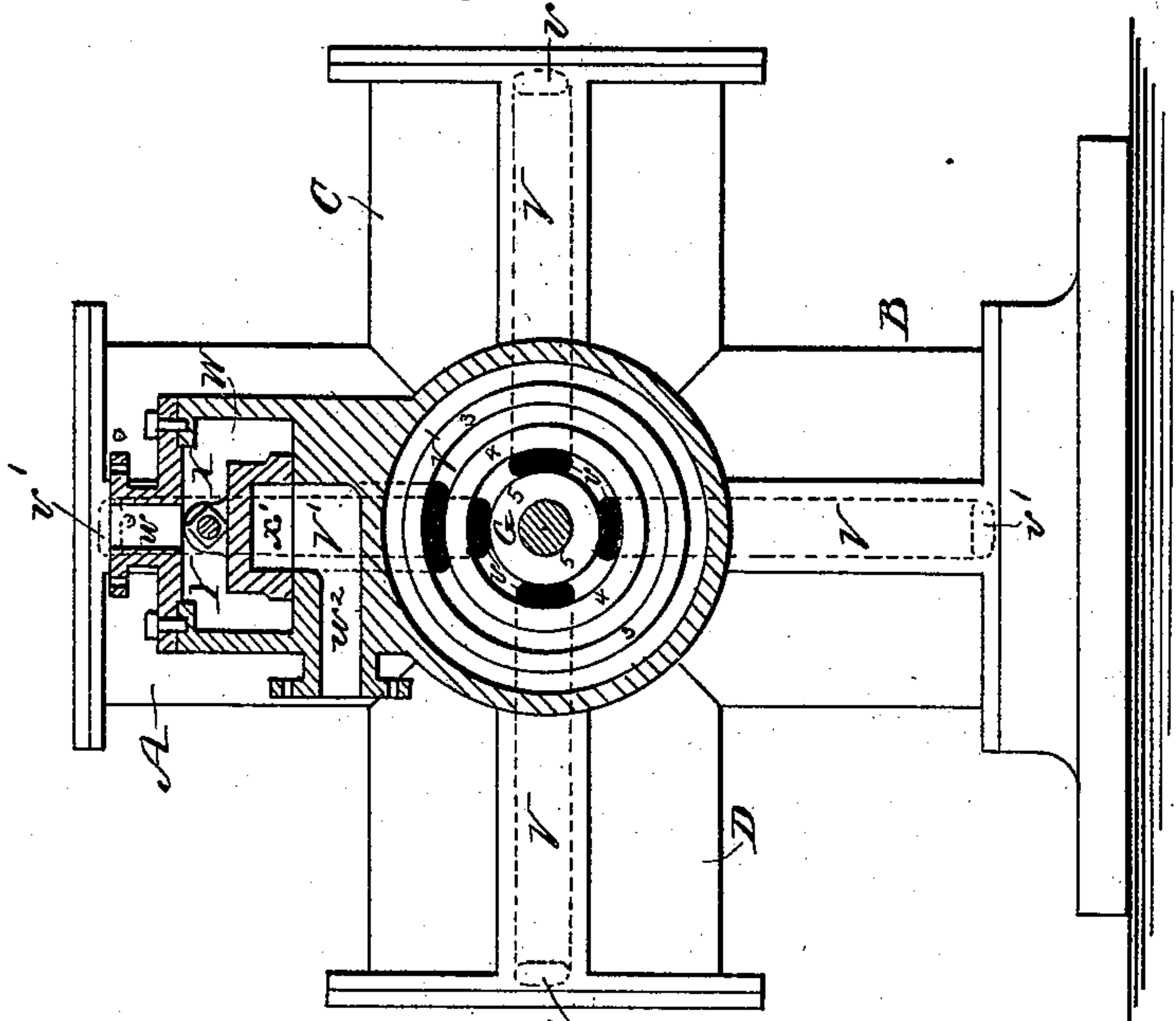
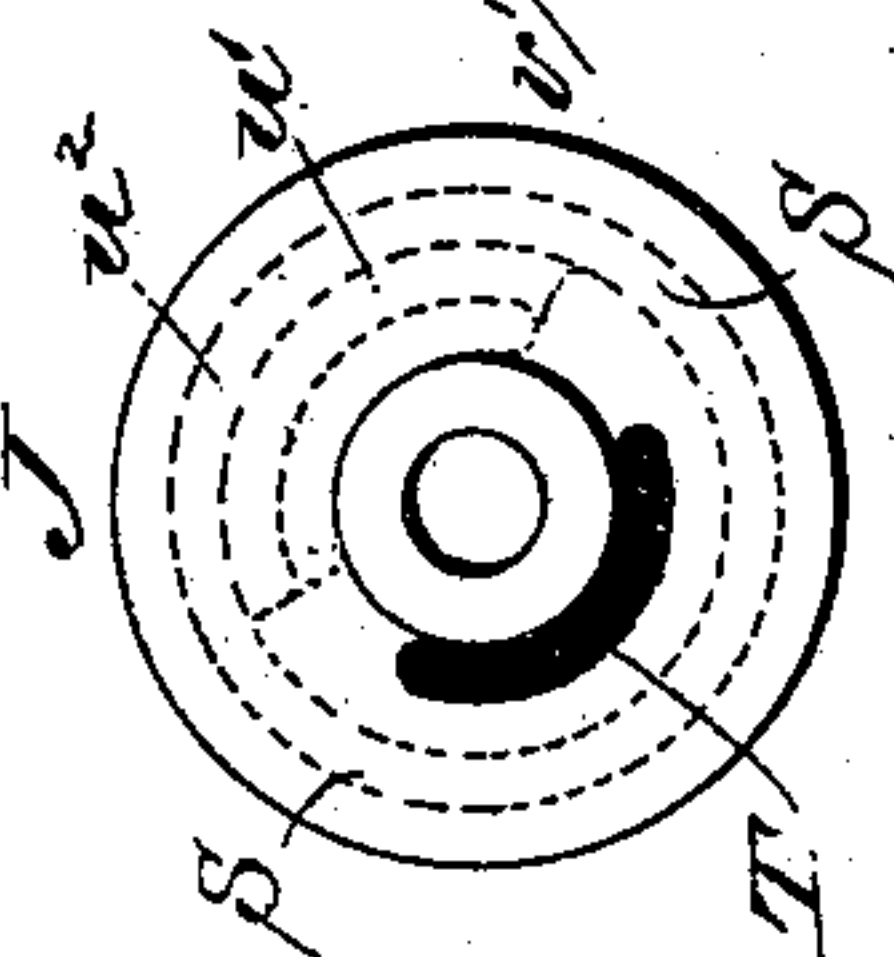


Fig. 5.



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# UNITED STATES PATENT OFFICE.

ADAM ROSENKRANZ, OF ALLEGHENY, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO DAMAS LUTZ, OF SAME PLACE.

## STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 361,598, dated April 19, 1887.

Application filed December 22, 1886. Serial No. 222,304. (No model.)

*To all whom it may concern:*

Be it known that I, ADAM ROSENKRANZ, of Allegheny, in the county of Allegheny and State of Pennsylvania, have invented a new and Improved Steam-Engine, of which the following is a full, clear, and exact description.

My invention relates to engines—steam-engines more particularly—and has for its object to provide a simple, compact engine capable of transmitting power by rotation of its driving-shaft in either direction, and operating smoothly and effectively under control of a single rotatory valve, and fitted with ports and a slide-valve, allowing instant reversal of the engine. The engine is adapted for high speed and for direct connection to electrical or grinding, rolling, or other machinery, and may also be utilized as a pump for water or ammoniacal or gaseous fluids.

The invention consists in certain novel features of construction and combinations of parts of the engine, all as hereinafter fully described and claimed.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a vertical sectional elevation of my improved steam-engine in the plane of the driving-shaft. Fig. 2 is a vertical sectional elevation of the engine, taken across the driving-shaft and through the cylinder and at a right angle to Fig. 1. Fig. 3 is a side view of the engine, in vertical section, on the line *x x*, Fig. 1, the valve being removed. Fig. 4 is a detail perspective view drawn to larger scale, and shows the connections of the piston-rods with the crank of the driving-shaft. Fig. 5 is an outside face or back view of the rotatory disk-valve, and Fig. 6 is an inside face view of the valve.

The engine-case is formed with four cylinders, A B C D, set opposite each other in pairs in the form of a cross, and all opening into a common central chamber, E, in which rotates the crank F of the engine-shaft G. At one side wall, *a*, of the engine-case the shaft passes through an anti-friction bushing, *g'*, and extends through the main steam-chest H and into an anti-friction bushing, *g''*, fitted into a

socket preferably cast onto the removable outside plate, *h*, of the steam-chest, and a screw, I, threaded into the end of this socket, bears by its inner end against the end of the shaft G, and whereby the main valve J, which is held by a set-screw, *j*, to the shaft within the steam-chest H, may be forced up tightly to its seat, which is formed at the outer face of the engine-case wall *a*, by turning the screw I inward, thus making simple and effective provision for taking up the wear of the valve and its seat. The pressure of the set-screw on the shaft simply holds the valve to its seat without preventing free rotation of the shaft, and the adjustment of the shaft in the engine-case and the connections of the piston-rods with the shaft-crank and pistons will be such as will allow the wear of the valve or its seat to be taken up as it occurs by turning up the set-screw. The other end of the shaft G passes through a bushing, *g''*, in the gland of a stuffing-box, K, which is fast to a removable central part, *k*, of the adjacent side wall of the engine-case, and the shaft carries a belt-pulley, *g*, for transmitting the power of the engine. The opening closed by the part *k* is large enough to pass the shaft-crank F through it, thus allowing easy adjustment of the shaft to the engine-case or its removal therefrom. The arrangement of the steam ports and valves will be hereinafter explained.

In the respective cylinders A B C D are fitted the pistons A' B' C' D', which are packed suitably at *e*. Rods *a' b' c' d'* are connected pivotally with the pistons A' B' C' D', respectively, and at their inner ends the piston-rods are connected with bearings or brasses fitted on the wrist *f* of the driving-shaft and on each other, as follows: The brasses L M, to which the inner ends of the piston-rods *a' b'* are fixed or screwed, are fitted directly on the crank-wrist *f*, and are nearly semicircular in form, or are cut away at the ends to permit lateral play of the rods as they are thrown by the crank, which is turned to rotate the driving-shaft by the thrust of the piston-rods, due to the forcing inward of the pistons by steam passing from ports at the outer ends of the cylinders. The brasses N O, to which the inner ends of the other pair of piston-rods, *c' d'*, are fixed or screwed, are fitted on the outside



of the brasses L M, and are nearly semicircular in form to allow lateral play of the rods, and are or may be notched, as at *n o*, to allow free movement of the rods *a' b'*. In the outer surfaces of the brasses N O are cut grooves *p*, into which split rings or collars P are set, and bolts R in the collars allow tightening of them to hold the entire series of brasses L M N O to the crank F, and also to take up wear of the crank-wrist and brasses as it occurs.

I purpose filling the entire space between the opposite side walls of the engine-case and inside of the four pistons A' B' C' D' with oil, whereby constant lubrication will be given the pistons, their rods and connections with the driving-shaft, and also the bearings of the shaft.

The enlarged head portion of the valve J has turned in its face an annular groove, S, and inside of this groove there is formed, at one side of the bore of the valve by which it is fitted onto the shaft G, a segmental slot, T, which passes directly through the valve, and opposite the slot T the valve is recessed segmentally at U, said recess or port being semicircular in cross-section, and opening at *u'* at the face of the valve in an arc of the same radius with the slot T, and opening also at the face of the valve at *u''* in the arc of the annular groove S, or into said groove, said port U not extending through to the back of the valve, (see Fig. 1 of the drawings,) and whereby the opening *u'* of the port is adapted to coincide with the openings *v* at the inner end of the main ports V, formed in the wall *a* of the engine-case, while the outer opening, *u''*, of the port communicates with a sinuous port, V', formed partly in the said wall *a* and in the floor *w* of an auxiliary steam-chest, W, which is arranged next the main steam-chest H, and communicates therewith by a port or passage, *w'*. The through-and-through valve-port T establishes communication directly between the interior of the steam-chest H and the end openings, *v*, of the ports V, which latter open at *v'* into the cylinders A B C D. The parts 1 2 of the face of the valve, between the adjacent ends of the ports T U, form cut-offs for the steam or fluid driving the engine.

The floor *w* of the auxiliary steam-chest W also has formed in it an exhaust port or passage, *w''*, to the outer end of which a pipe to discharge exhaust steam or fluid will be connected. Onto this floor *w* of the chest W, which forms a valve-face, there is fitted an ordinary slide-valve, X, having a central exhaust port or cavity, *x'*, and adapted to close either of the ports V' *w'* to either the live steam or exhaust. A rod, Y, is connected to the valve X, and passes through the wall of the chest W, and is connected to a lever, Z, which is fulcrumed on the chest, and by shifting the lever the position of the valve X may be controlled as desired, to cause the engine-shaft to turn in either direction, or reverse the engine at will. An opening, *w''*, in the lid of the auxiliary

steam-chest W allows connection of a pipe to admit live steam or other fluid under pressure, for operating the engine.

The face of the engine-wall *a*, which forms the valve-seat, is provided with a series of annular grooves, thereby producing three raised annular surfaces, 3, 4, and 5, (shown clearly in Fig. 3,) and against which bear the surfaces 6, 7, and 8, respectively, of the valve, (see Fig. 6;) hence the valve has a bearing all around at three separate contact-faces well distributed over its whole area, and whereby steadiness of action and durability of the valve are assured.

In the operation of the engine it is obvious when the slide-valve X is set, as in Fig. 1, to open the port *w'* and connect the port V' with the exhaust-port *w''* that steam or other fluid entering the chest W, through a supply-pipe connected at *w''*, will pass through the port *w''* to the steam-chest H, and thence directly through the port T of the rotating valve J to all four ports V successively, and that while one port V is taking steam to drive the piston in the communicating-cylinder inward to rotate the driving-shaft the steam will be exhausted from the diametrically-opposite cylinder and its port V to and through the recessed port U, thence to the ports V' *x'* to the outlet at *w''*, the operation being controlled by the single valve J, and the engine-shaft will be rotated continuously in one direction. Should it be desired to reverse the engine, this may be done by shifting the valve X outward to open the port V' to the auxiliary steam-chest W and open the port *w'* to the exhaust-passages *x' w''*, and the engine will now take steam from the chest W, through the ports V' U, thence to the ports V, successively, while the steam in the diametrically-opposite cylinders is exhausting through their ports V, and directly through the port T to the chest H, and thence through the ports *w' x'* to the outlet at *w''*. To stop the engine the valve X will be set in the intermediate position to cover both ports V' *w'* and cut off supply of steam to the valve.

As hereinbefore intimated, the engine may be operated by the use of other fluids under pressure besides steam—such as water, air, or gas—and the machine may also be used as a pump for fluids—such as water, ammonia, and gases—as will readily be understood.

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

1. An engine provided with ports, as V, at one side wall of the case, and communicating with one or more cylinders containing pistons, and with a steam-chest, a cranked driving-shaft, connections therefrom to the piston or pistons, a valve fixed to the crank-shaft within the steam-chest, and having ports adapted to admit steam to and exhaust it from the cylinder or cylinders, in combination with a screw, as I, threaded into the engine-case and adapted to impart endwise movement to the crank-



shaft to hold the valve to its seat, substantially as shown and described.

2. An engine provided with ports, as V, at one side wall of the case and connecting with one or more cylinders containing pistons, and with a steam-chest, H, a cranked driving-shaft, connections therefrom to the piston or pistons, a valve, as J, fixed to the shaft within the steam-chest H and provided with a through-and-through port, T, and a port, U, having two openings,  $u' u^2$ , at the face of the valve, a port, V', connecting with the outer part,  $u^2$ , of the valve-port U and with an auxiliary steam-chest, W, a port,  $w'$ , connecting the chests H W, an exhaust-port,  $w^2$ , formed in the floor of chest W and opening thereto, and a slide-valve, as X, adapted to close either of the ports V'  $w'$  to either the live steam or exhaust, substantially as described, for the purposes set forth.

3. An engine provided with ports, as V, at one side wall of the case, and connecting with one or more cylinders containing pistons, and with a main steam-chest, a port, V', connecting said steam-chest, and an auxiliary steam-chest, as W, and the valve-seat on the case-wall formed with annular grooves providing bearings 3, 4, and 5, a driving-shaft connected to the piston or pistons, and a valve, J, fixed to said shaft and formed with an annular groove, S, and ports T U, providing bearing-faces 6 7 8, corresponding to those 3 4 5 of the valve-seat, substantially as described, for the purposes set forth.

4. The rotatory valve J, formed with a through-and-through port, T, and a port, U, opening at  $u' u^2$  at the face of the valve, substantially as shown and described.

5. The rotatory valve J, formed with a through-and-through port, T, a port, U, opening at  $u' u^2$  at the valve-face, and an annular groove, S, thereby providing with the ports three separate bearing-surfaces, 6 7 8, adapted to a ported valve-seat on an engine-case, substantially as shown and described.

6. In a steam-engine, the combination, with a case provided with two pairs of diametrically-opposite cylinders, A B C D, pistons A' B' C' D' therein, and a cranked driving-shaft, F G, journaled in the case, of rods  $a' b' c' d'$ , connected at one end to the pistons A' B' C' D', respectively, bearings L M, fitted on the wrist of the driving-shaft crank, and connected to the rods  $a' b'$  of pistons A' B', bearings N O, fitted on the bearings L M and connected to the rods  $c' d'$  of pistons C' D', and a retaining device holding the bearings L M N O to each other and the driving-shaft, substantially as shown and described.

7. In a steam-engine, the combination, with a case having cylinders A B C D, pistons A' B' C' D', cranked driving-shaft F G, and rods  $a' b' c' d'$ , connected to the pistons, of bearings L M on the crank-wrist and connected to the rods  $a' b'$ , bearings N O, fitted on the bearings L M and connected to the rods  $c' d'$ , and split collars P, fitted on the outer bearings, N O, substantially as described, for the purposes set forth.

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Witnesses:

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