(No Model.) 2 Sheets—Sheet 1.

V. POPP.

ROTARY ENGINE.

No. 496,954. Patented May 9, 1893.

Fig. I.

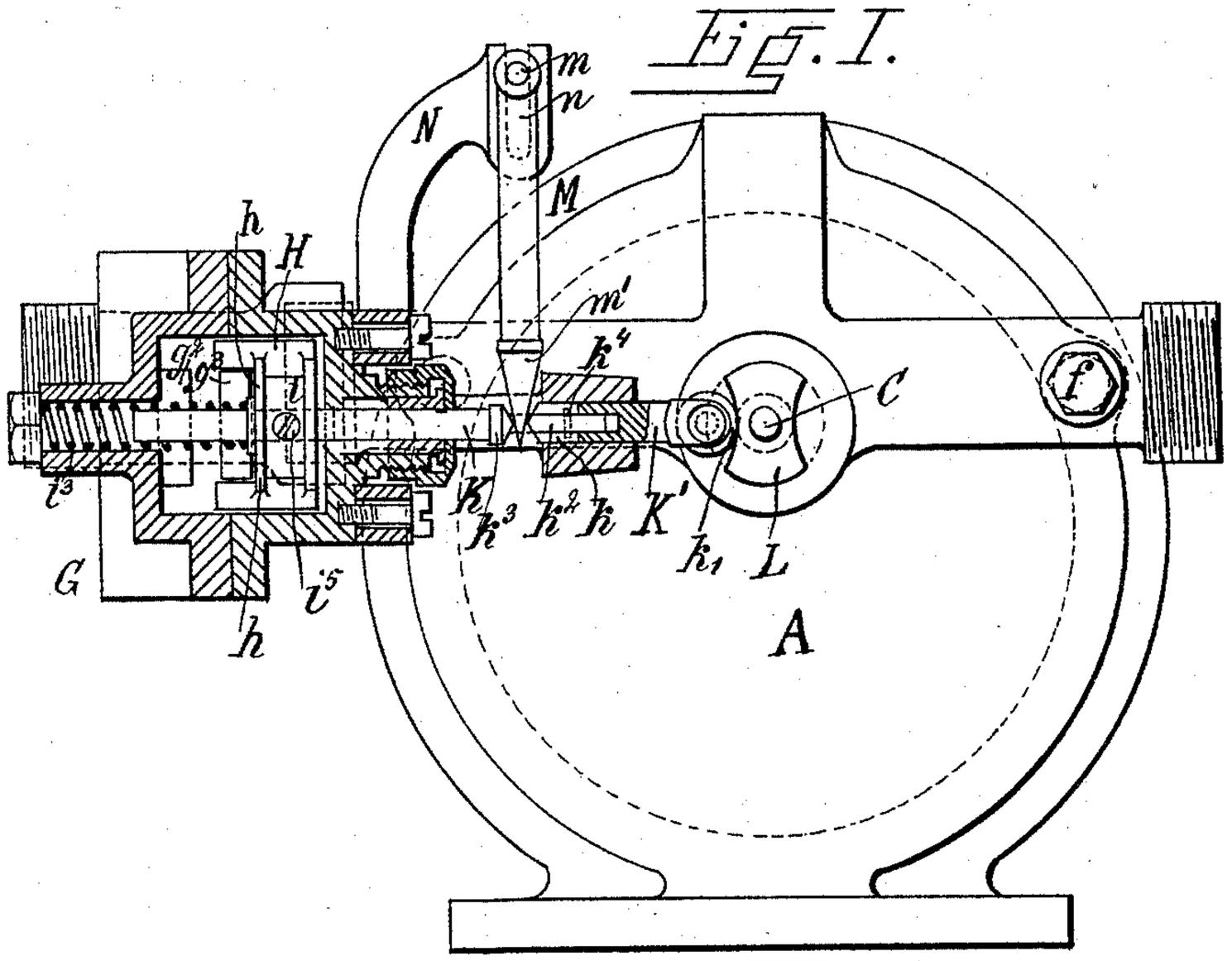
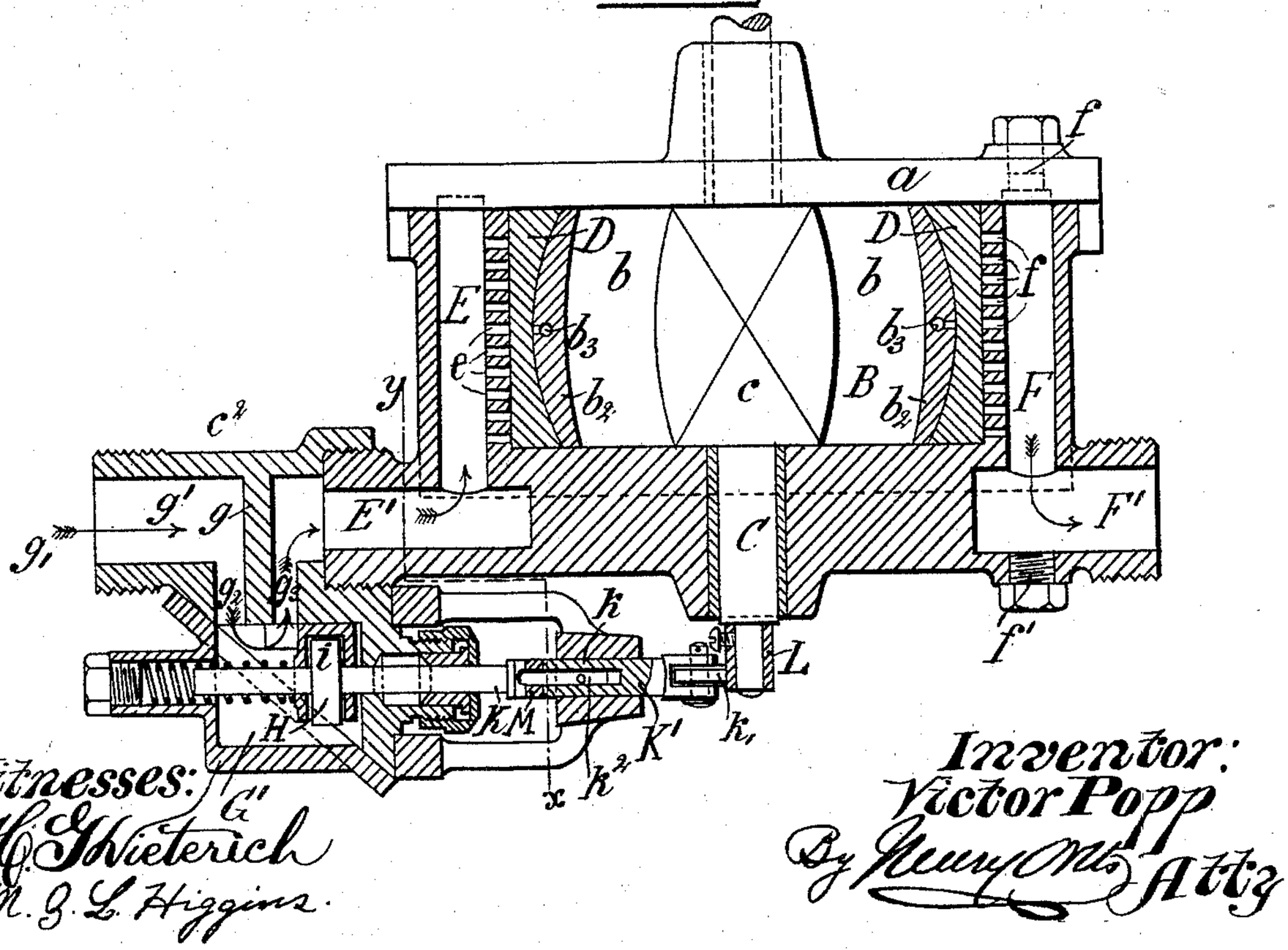


Fig. III.



Witnesses:
H. G. Wieterich
M. G. L. Higgins.

Inventor:
Victor Popp
By Munn & Co
Attys

(No Model.)

2 Sheets—Sheet 2.

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Fig. II.

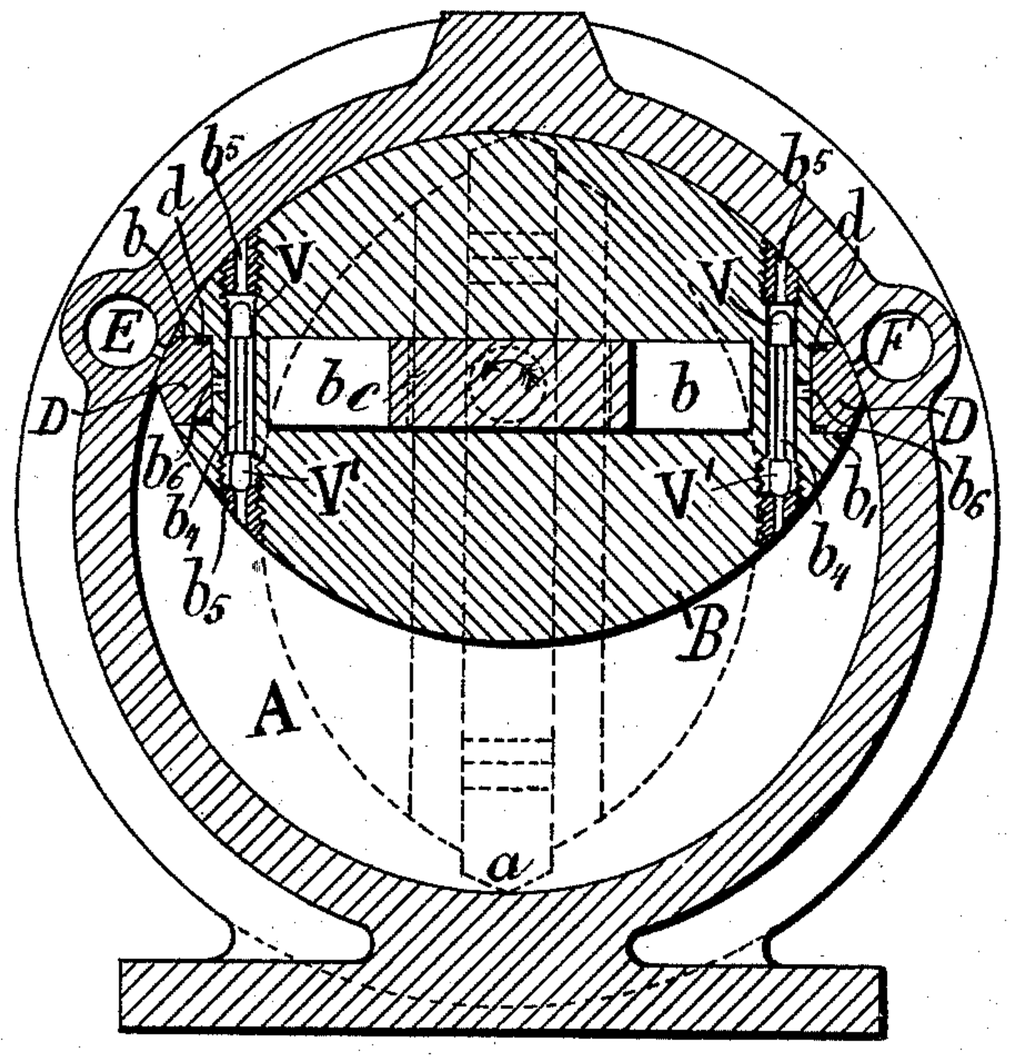
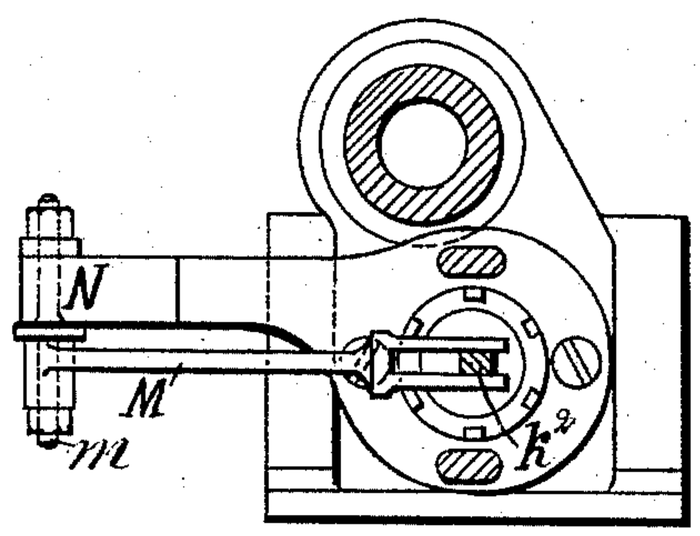


Fig. N.



Witnesses:
H. G. Dieterich
M. J. L. Higgins.

Inventor:
Victor Popp
By Munn & Co Attys.

UNITED STATES PATENT OFFICE.

VICTOR POPP, OF PARIS, FRANCE.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 496,954, dated May 9, 1893.

Application filed March 2, 1891. Serial No. 383,518. (No model.) Patented in Belgium January 3, 1891, No. 93,321; in Spain January 3, 1891, 12/352, and No. 11,641; in Norway January 3, 1891, No. 2,050; in England January 3, 1891, No. 167; in Germany January 3, 1891, No. 58,020; in Italy March 31, 1891, XXV, 29,084, and LVIII, 114, and in Austria-Hungary June 1, 1891, No. 1,234 and No. 19,706.

To all whom it may concern:

Be it known that I, VICTOR POPP, engineer, a citizen of the Republic of France, residing at 54 Rue Etienne Marcel, Paris, France, have invented certain new and useful Improvements in Rotary Engines, (for which I have obtained Letters Patent in Belgium, No. 93,321, dated January 3, 1891; in Spain, 12/352, and No. 11,641, dated January 3, 1891; in Norway, No. 2,050, dated January 3, 1891; in Great Britain, No. 167, dated January 3, 1891; in Germany, No. 58,020, dated January 3, 1891; in Austria-Hungary, No. 1,234 and No. 19,706, dated June 1, 1891, and in Italy XXV, 29,084, and LVIII, 114, dated March 31, 1891;) and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

The invention has relation to rotary engines, and it consists essentially in structural features and combinations of co-operative elements as will now be fully described, reference being had to the accompanying drawings, in which—

Figure 1 is an end view of the motor, the valve mechanism being shown in section. Fig. 2 is a vertical transverse section of the cylinder and its piston. Fig. 3 is a horizontal section of the motor, and Fig. 4 is a section on line *x*—*y*, of Fig. 3.

In the above drawings, A, indicates the engine cylinder that has formed therein on opposite sides and at points above its horizontal diameter, a longitudinal passage, marked, respectively, E, and F, the passage, E, being the inlet or induction passage, and the passage, F, the exhaust passage, both of which communicate with the interior of the cylinder, A, through numerous small ports, *e*, and, *f*, respectively, as shown in Fig. 3. It will be readily seen that a fluid under pressure admitted to, E, will at once expand and be uniformly distributed over the cylinder length through the ports, *e*, while the exhaust fluid instead of flowing out through a single port, which tends to more or less compress the same and retard the exhaust, flows out of a comparatively large number of ports into a chamber or passage of considerable area, so that the expansion of the fluid is not checked, but assisted, and the power necessary to expel such fluid from the cylinder reduced to a minimum. The exhaust passage, F, has at each end an opening normally closed by a screw plug, *f'*, so that access may readily be had thereto for the removal of congealed moisture. The induction or inlet passage, E, communicates with the feed branch, E', and the exhaust passage, F, with the exhaust branch, F', of the cylinder.

When the motive fluid is used expansively and the exhaust fluid is used for the purpose of refrigeration, I provide means hereinafter to be described for controlling the cut-off for the purpose of regulating the temperature of the exhaust fluid.

C, indicates the driving shaft, it is mounted in suitable bearings and extends through the cylinder on a line parallel with but eccentric to the longitudinal axis of said cylinder, and has formed thereon or secured thereto a cross head or block, *c*, that fits into a longitudinal slot of the piston head or hub, B. As more plainly shown in Fig. 2, the piston head or hub, B, is of ellipsoidal form, its convex faces being segments of the inner periphery of the cylinder, A. The end faces of the piston hub abut against the cylinder heads, and are trued to form a substantially fluid tight joint therewith, and said piston hub has a transverse slot, *b*, for the reception of the cross head or block, *c*, on the driving shaft, by means of which cross head the hub is revolved, and on which said hub has lateral motion. The hub has at opposite sides a longitudinal groove, *b'*, extending the full length of the hub, in which groove is seated a piston, D, whose outer or bearing faces are continuations of the convex sides, of the piston, as shown in Fig. 2.

The pistons are provided with a suitable packing, *d*, so that they may work fluid tight in their seats in the hub, B, said pistons being held in contact with the inner periphery of the cylinder by the pressure of the motive fluid admitted thereto. To this end the pis-

ton hub, B, has two vertical through passages, b^3, into the enlarged outer ends of which are screwed valve seats, b^5, and between which seats is formed a valve chamber that contains two gravity valves, V, and V′, secured to opposite ends of a valve stem, b^4, said valves co-operating with the valve-seats, b^5. As shown in Fig. 2, the valve chambers, b^3, are in communication with the piston seats, b', by a passage, b^6, so that as the hub revolves in the direction of the arrow, Fig. 2, both lower valves, V′, are on their seats, while both upper valves, V, are off their seats, the motive fluid having access to the piston seats to hold the pistons in fluid tight contact with the cylinder. As the position of the piston hub is reversed in its revolution about and reciprocates on the driving shaft, C, the position of each pair of valves, V, and V′, will be correspondingly reversed by gravity, as will be readily understood. Any moisture congealing upon the inner periphery of the cylinder will be removed by the pistons and carried to the exhaust ports, f', from which it is expelled into the passage, F, by the exhaust. The exhaust branch, F′, may be left open when the engine is used as a motor only, and when used to produce cold, said exhaust branch is connected with a suitable conduit to conduct the cold exhaust fluid where wanted.

From the description of the construction of the engine it will be seen that any suitable motive fluid may be used to drive the piston, but when such fluid is used expansively it is necessary that means should be provided for regulating the degree of expansion and therethrough the temperature of the exhaust fluid. To these ends I provide an adjustable cut-off and means for operating the admission and cut off valve directly from the driving shaft of the engine.

To the branch, E′, of the inlet passage, E, is screwed a valve casing, G, whose branch, g', is connected with the compressed fluid supply pipe, and in said casing are formed two passages, g^2, g^3, leading to and from the valve chamber, G′; the passage, g^2, is always open, while the passage, g^3, is controlled by a slide valve, H, that has two flanges, h, through which passes the valve rod or stem, K, which carries between the valve flanges a collar or disk, i, adjustable longitudinally of said valve rod by means of a set screw, i^5, so that the valve, H, can be adjusted on the rod relatively to the port or passage, g^3. The valve, H, is moved in one direction to close the port, g^3, by a cam, L, on the driving shaft, C, that operates on the valve rod, and in a reverse direction to uncover said port, g^3, by a coiled spring, i^3.

In order that the cut-off may be varied without adjusting the valve on its rod or stem, K, the latter is constructed of two parts having motion one within the other. The outer portion, K′, of the valve stem carries an anti-friction roller, k', which has bearing on the cam, L, on shaft, C, the inner end of this stem section being slotted and socketed for the reception of the attenuated outer end, k^2, of the inner section, K, of said valve stem to which the valve is secured. A pin, k^4, extending transversely through the outer attenuated portion of the valve stem section, K, within the slotted part of section, K′, locks said section, K, against rotation.

It will be seen that the valve stem, K, K′, is made adjustable as to length, and this adjustment is effected by means of a bar, M, adjustable vertically by means of a set screw or bolt, m, in a slot, n, formed in the head of an arm or standard, N, projecting from the valve casing, G. The lower end of the bar is forked the branches of the fork being made tapering or wedge shaped and straddling the attenuated squared outer end, k^2, of the valve stem section, K, between a collar, k^3, that has knife edge bearings, and the inner end of the outer section, K′, of said valve stem that has knife edge bearings also, as shown in Fig. 1. It will readily be seen that if the adjusting bar is moved downwardly or upwardly, the valve stem will be lengthened or shortened, thereby shortening or lengthening the duration of admission of the compressed fluid and the expansion thereof, such admission and expansion taking place twice during each revolution of the shaft, C.

The operation of the engine is a very simple one, and its power may be transmitted in any well known or desired manner to the organ or element to be driven, or such power if not utilized may be antagonized or taken up by suitable brake devices operating either upon the shaft or its fly wheel or other suitable element thereon.

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

1. In a rotary engine an ellipsoidal piston hub adapted to revolve about and reciprocate on its driving shaft, and means for forming a tight joint between said piston hub and the inner periphery of the cylinder, consisting of the pistons D, seated in grooves in said piston hub, the valve chambers, b^3, in communication with the said grooves, and the connected gravity valves, V, V′, in said chambers, substantially as set forth.

2. In a rotary engine, a piston cylinder having a cylindrical bore and inlet and exhaust ports extending the full length of the cylinder on opposite sides respectively and above the horizontal diameter thereof, and a driving shaft arranged in a plane parallel with but eccentric to the axial plane of the cylinder and carrying a cross-head or block, c, of the ellipsoidal piston hub, B, provided with a slot, b, for the reception of said block, and means for obtaining a tight joint between the piston hub and inner periphery of the cylinder, consisting of the pistons, D, seated in grooves in said piston hub, the valve chambers, b^3, in communication with said grooves and the connected gravity valves, V, V′, in

said chambers, substantially as and for the purpose set forth.

3. In a rotary engine, the combination with the piston, the piston cylinder, and its inlet port, of a distributing valve operating to open and close said port, a spring for imparting motion to the valve in one direction, a valve rod operating to move the valve in a reverse direction, said valve rod being constructed of two parts having motion one within the other and a wedge-shaped adjusting bar interposed between said parts and operating to lengthen or shorten the rod, for the purposes set forth.

4. In a rotary engine, the combination with a piston cylinder having a cylindrical bore and inlet and exhaust ports extending the full length thereof at opposite sides respectively above its horizontal diameter, a driving shaft having its bearing eccentric to the longitudinal axis of the cylinder and carrying a cross head or block, *c*, and an ellipsoidal piston slotted for the reception of the said block, said piston being of less diameter than the cylinder and adapted to revolve with and reciprocate on the block, *c*, of a cut off valve, its stem constructed of two parts having motion within each other, a wedge interposed between said parts and adapted to lengthen or shorten the stem, and means operating on the valve stem to reciprocate the valve, substantially as and for the purpose set forth.

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

VICTOR POPP.

Witnesses:
ROBT. M. HOOPER,
S. HARTAGH.