(No Model.) 2 Sheets—Sheet 1.

A. B. LIPSEY.

ROTARY ENGINE.

No. 280,194. Patented June 26, 1883.

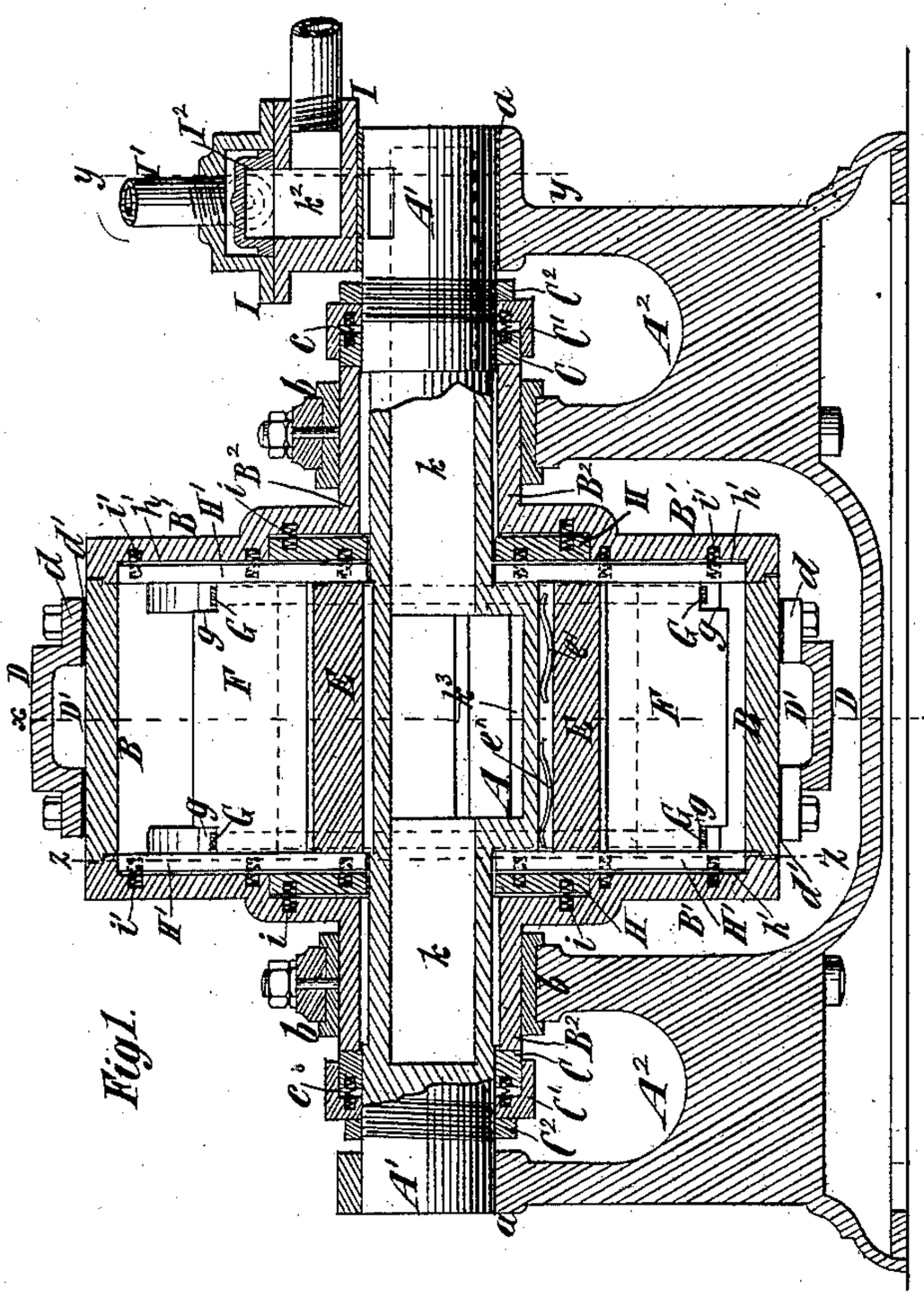


Fig1.

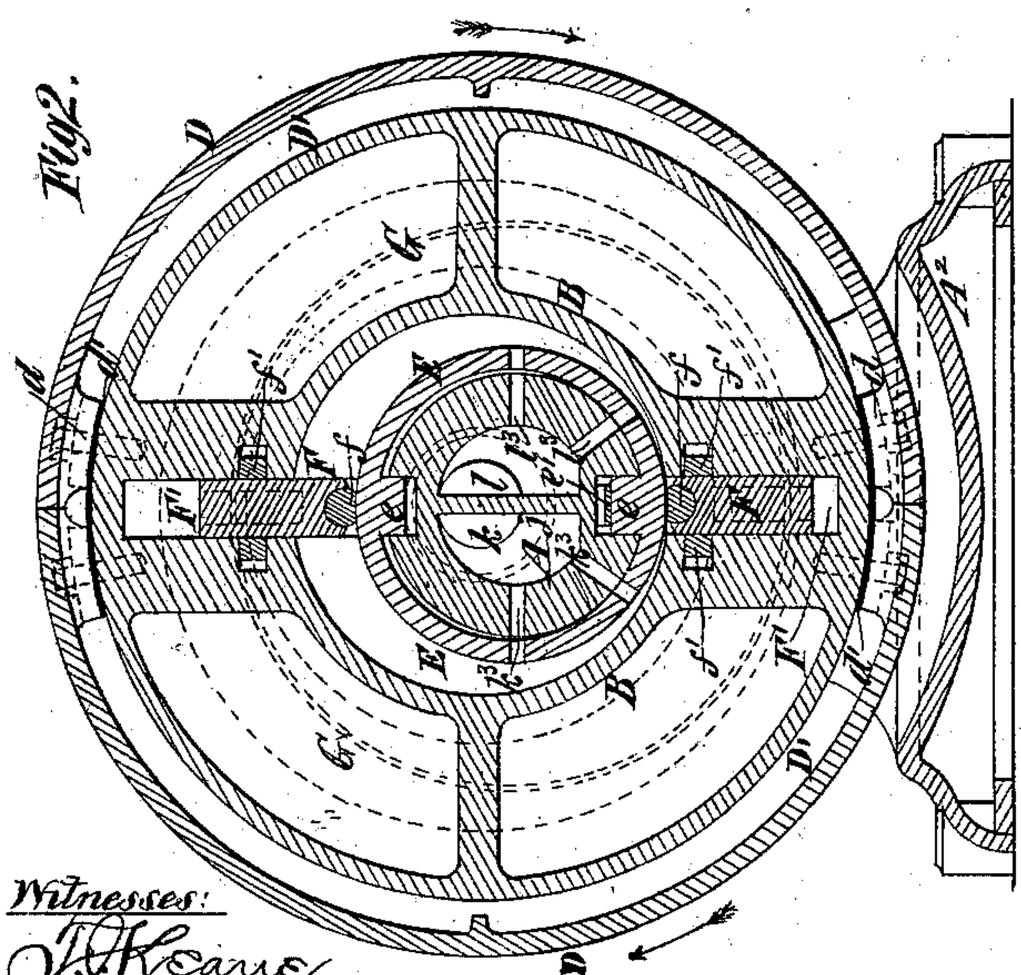
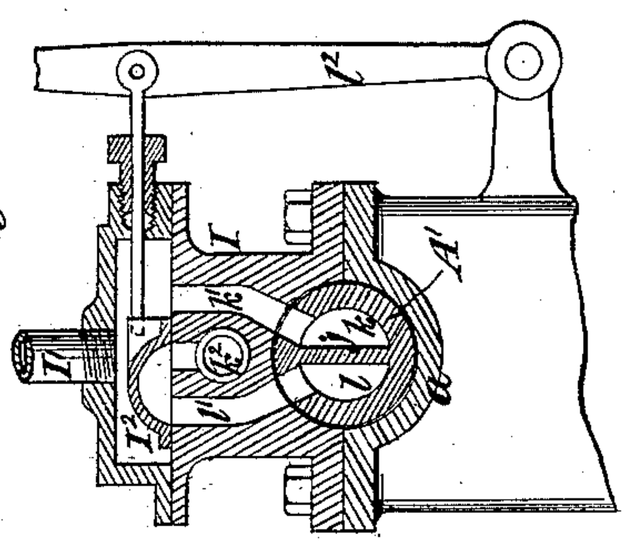


Fig2.



Figs3.

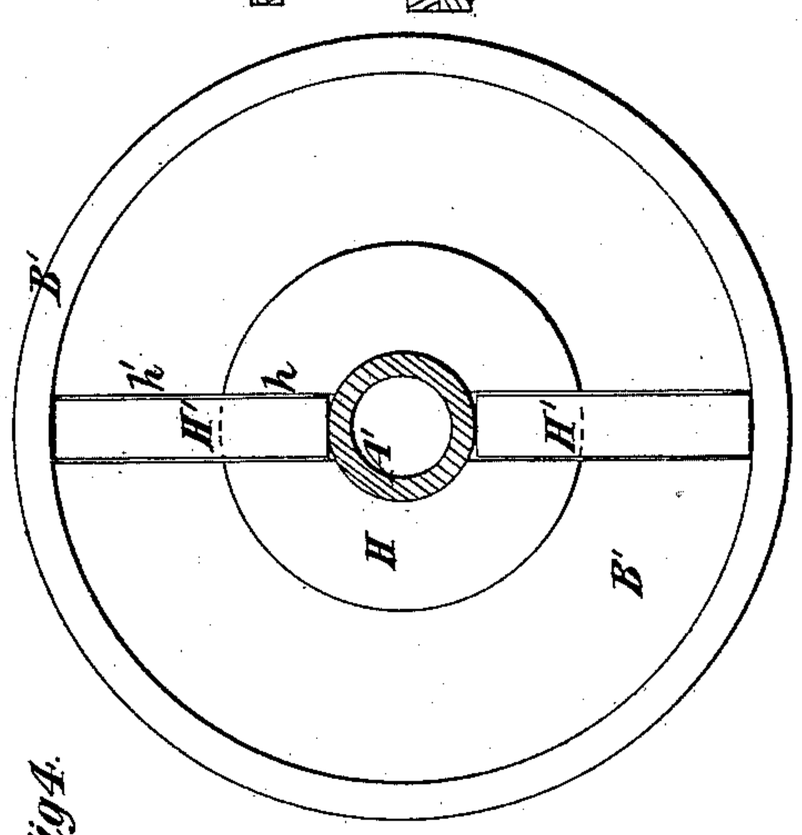


Fig4.

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(No Model.)

2 Sheets—Sheet 2.

A. B. LIPSEY.

ROTARY ENGINE.

No. 280,194. Patented June 26, 1883.

Fig10.

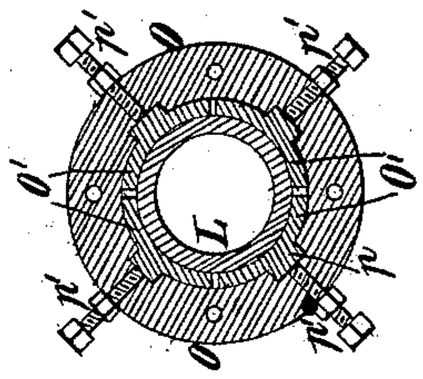


Fig5.

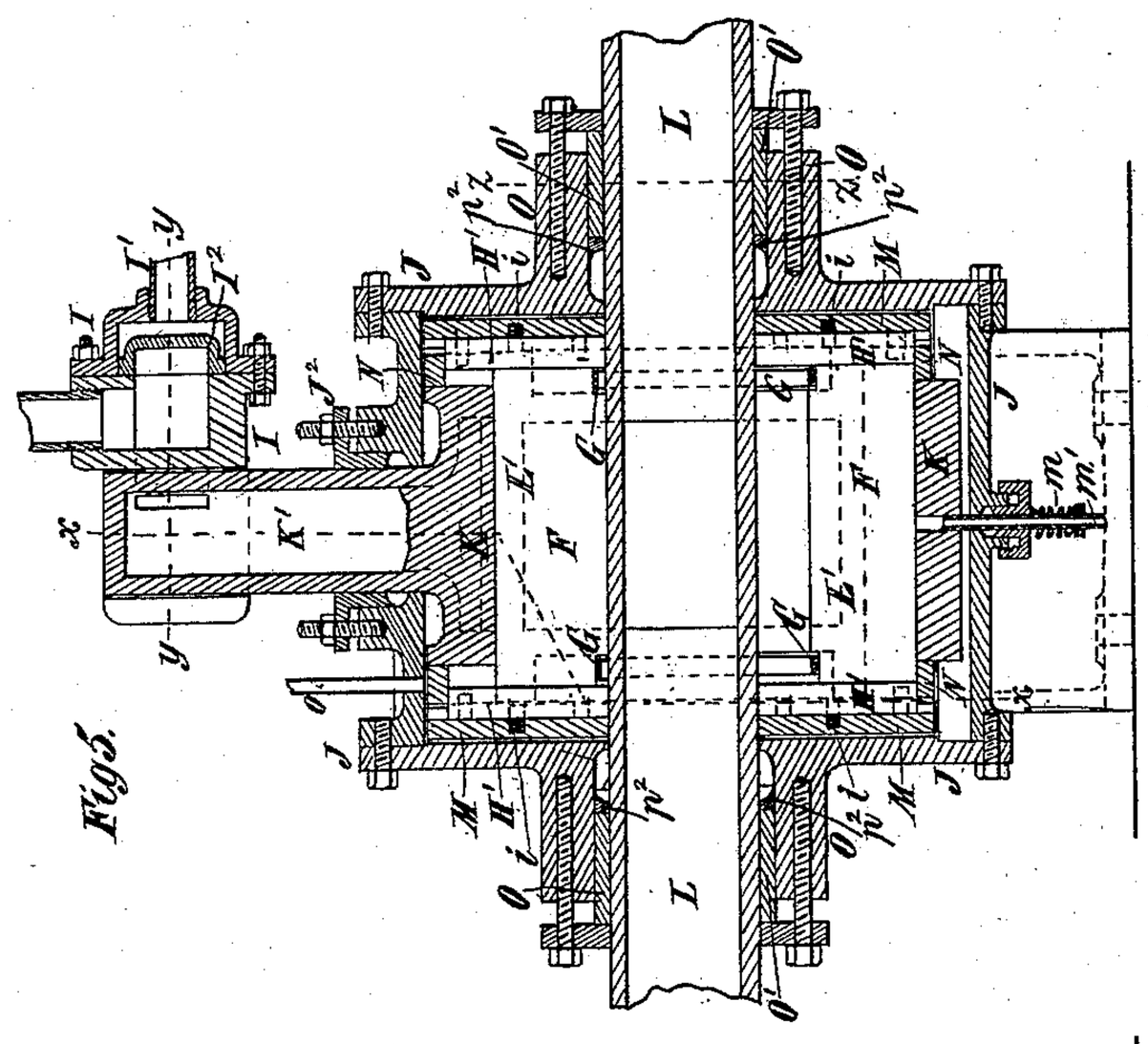


Fig7.

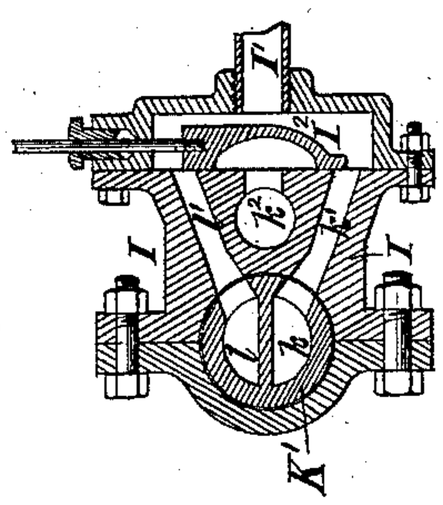


Fig9.

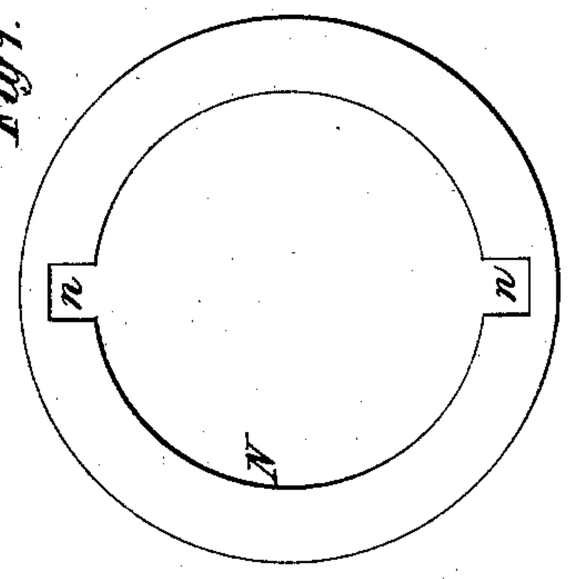


Fig6.

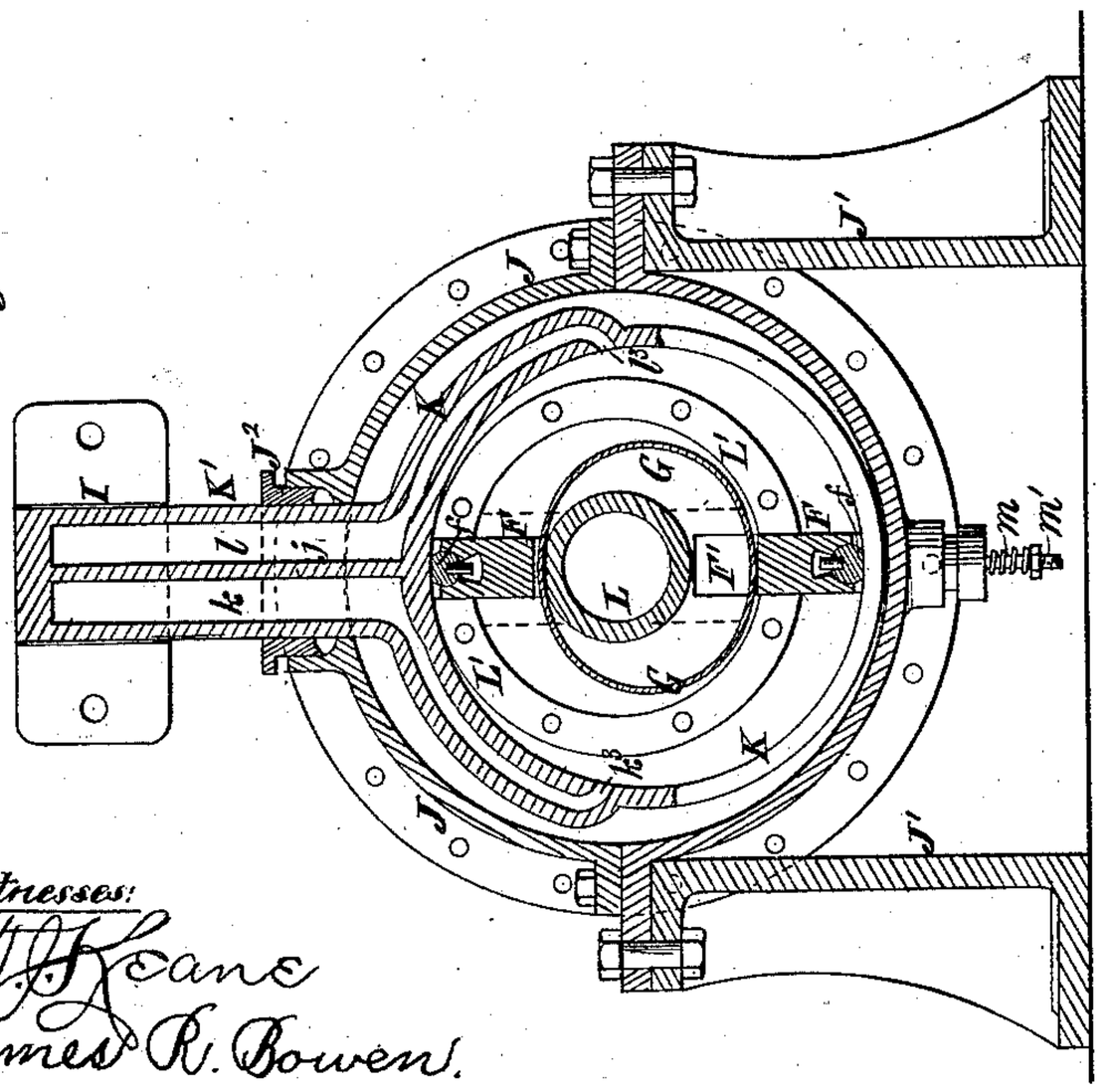
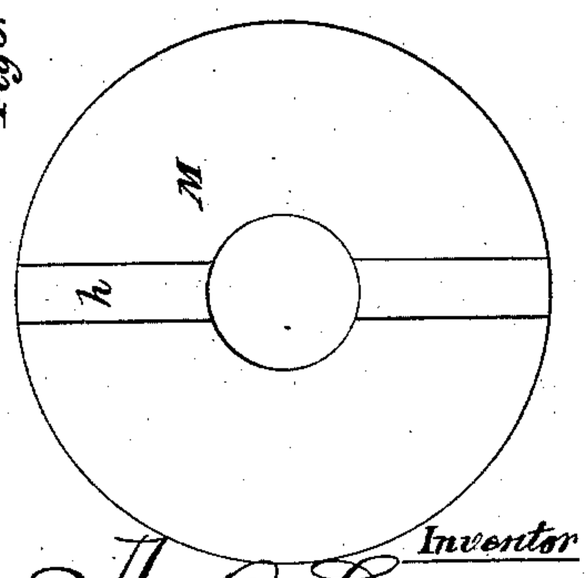


Fig8.



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UNITED STATES PATENT OFFICE.

ANDREW B. LIPSEY, OF WEST HOBOKEN, NEW JERSEY, ASSIGNOR TO WILLIAM BELL, OF NEW YORK, N. Y.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 280,194, dated June 26, 1883.

Application filed June 10, 1882. (No model.)

To all whom it may concern:

Be it known that I, ANDREW B. LIPSEY, of West Hoboken, in the county of Hudson and State of New Jersey, have invented a certain new and useful Improvement in Rotary Engines, of which the following is a specification.

My improvement consists in the combination, in a rotary engine, of a cylindric stationary hub provided with a non-rotary shaft or arms, an outer rotary cylinder carrying a radially-sliding piston or pistons adapted to work upon the stationary hub, as it or they rotate with the cylinder, hollow journals projecting from said rotary cylinder and surrounding said shaft or arms, bearings or supports for said shaft or arms, and bearings wherein said hollow journals may turn, arranged between the first-mentioned bearings.

The improvement also consists in a novel construction of packing employed to prevent leakage between the said shaft and said annular journals, and in details of construction and combinations of parts hereinafter described.

Certain other features of my improvement are applicable not only to rotary engines of the kind above described, wherein the outer cylinder is adapted to rotate, but also to rotary engines of the ordinary kind, in which a rotary piston-head carrying a sliding piston or pistons is arranged eccentrically within a stationary cylinder; and such features consist in the combination, in a rotary engine, with a cylindric stationary part and a cylindric rotary part eccentric to each other, and two or more sliding pistons in said rotary part, of springs consisting of circular hoops or bands applied to said pistons to cause them to work tightly on the part in contact with which they move; these spring hoops or bands hold the pistons tightly against the part on which they work, and as the surface on which they bear is a true cylindric surface, the springs are not changed in form as the engine rotates, but are simply changed in position; also, in the combination, in a rotary engine, of an inner stationary hub, an outer rotary cylinder carrying a sliding piston or pistons and arranged eccentrically to said hub, a stationary sleeve surrounding said hub, and in contact with which said cylinder rotates, and a spring or springs between said hub and sleeve, for holding the latter in contact with the cylinder; also, in the combination, with a rotary engine provided with passages for the ingress and egress of steam, of a valve adapted to be adjusted so as to admit steam at the same time to both passages to hold the engine against movement, whereby the engine is particularly adapted for hoisting and analogous purposes, and also in a novel construction of packing for a rotary engine.

In the accompanying drawings, Figure 1 represents a longitudinal section of an engine embodying my improvement, and in which the cylinder is adapted to rotate. Fig. 2 represents a transverse section on the dotted line *x x*, Fig. 1. Fig. 3 represents a transverse section of a portion of the engine on the dotted line *y y*, Fig. 1. Fig. 4 represents a transverse section on the line *z z*, Fig. 1. Fig. 5 represents a longitudinal section of an engine embodying my improvement, in which the cylinder is stationary. Fig. 6 represents an irregular transverse section on the dotted line *x x*, Fig. 5. Fig. 7 represents a horizontal section of a portion of the engine and its valve upon the dotted line *y y*, Fig. 5. Figs. 8 and 9 represent detail views of the packing employed; and Fig. 10 represents a transverse section of the engine on the dotted lines *z z*, Fig. 5.

Similar letters of reference designate corresponding parts in all the figures.

Referring first to Figs. 1 to 4, inclusive, A designates the center hub or stationary part of the engine, which is formed in one casting with a stationary shaft, A′, it being eccentric thereto, and the said shaft is supported in bearings *a* in a frame, A^2.

B designates the cylinder of the engine, which is concentric with the shaft A′, and is therefore eccentric to the hub or stationary part A. The cylinder is closed on each side or end by heads B′, which are provided with hollow journals B^2, that surround the stationary shaft A′, and are adapted to rotate in suitable bearings, *b*.

In order to prevent leakage of steam outward between the shaft A′ and the inner surface of the hollow journals, I employ a packing at the end of each journal B^2. This pack-

ing may consist of a ring or collar, C, surrounding the shaft A′ and bearing against the end of the journal B^2, and a cup-shaped or recessed collar, C′, into which the ring or collar C fits, and which may be set up by a nut, C^2, screwed upon the shaft A′, so as to press the ring or collar C against the end of the journal. Springs *c* are inserted between the recessed collar C′ and the ring or collar C, so as to take up wear and maintain a steam-tight joint between the ring or collar and the end of the journal.

The cylinder B, being adapted to rotate, may receive a belt on its periphery to transmit power from it; but I prefer to attach a pulley, D, to the periphery of the cylinder, so as to leave an air-space, D′, between it and the cylinder. This pulley may be cast in two sections, as here represented, and be provided with lugs or ears *d*, through which bolts are inserted for securing it to the cylinder, and a packing, *d′*, of asbestus or analogous non-conducting material, may be placed between the cylinder and the lugs or ears *d*, to prevent the pulley from becoming unduly heated. The air-space D′, between the cylinder and the pulley, will serve to keep the pulley cool and prevent injury to the belt by heat.

E designates a circular sleeve, which surrounds the hub A, and is provided with ribs or tongues *e*, which enter corresponding recesses in the said hub, and thereby hold the sleeve stationary. Springs *e′* are arranged in one of the recesses in the hub A and back of the tongue or rib *e*, fitting therein, and these springs serve to press the sleeve E against the inner surface of the cylinder, and to take up wear, so that there shall be no leakage of steam between the sleeve and cylinder at that point. This sleeve constitutes a stationary cylindric part of the engine.

F designates the pistons, of which two are employed, but which may be more in number, and which are adapted to slide radially in suitable recesses or grooves, F′, in the rotary cylinder B, and which are adapted to bear continuously upon the periphery of the sleeve E; and as said sleeve is eccentric to the cylinder the pistons are caused to move radially as they pass over the periphery of said sleeve. The pistons F are here represented as having removable packing-pieces or tongues *f*, which are circular in shape, except where they bear against the periphery of the sleeve E, and are fitted in correspondingly-shaped grooves or recesses in the ends of the pistons, and the pistons are packed at the sides by pieces *f′*, inserted into grooves in the walls of the recesses F′, in which the pistons work, as best shown in Fig. 2.

In order to keep the pistons F tightly pressed against the sleeve E, I employ springs consisting of circular hoops or bands G, which are placed over the ends of the pistons, as shown clearly in Fig. 1, and in dotted outline in Fig. 2, and the pistons are represented as shouldered or reduced in width at *g*, at the ends, so as to receive the springs. The spring hoops or bands may be made circular and of such size that they must be pressed into an oval form to apply them to the pistons, and the constant tendency of the springs to assume a circular form will keep them pressed against the sleeve E with proper force. As the sleeve E, on which the pistons F work, is perfectly cylindric, the springs are not changed in shape or distorted as the pistons rotate, but are simply changed in position, and hence are much more durable than they would be if the surface over which the pistons work were not perfectly cylindric.

In order to prevent the leakage of steam past the ends of the piston, I employ packings at each end, consisting of an annular plate, H, which fits in a recess in the head B′, and two bars, H′, which are fitted in grooves *h* in said annular plate, and in corresponding grooves, *h′*, in the inner surface of the head B′. The bars H′ are opposite the ends of the pistons F, and the pistons slide on them as they move radially inward and outward. The plate H is pressed toward the pistons by means of springs *i*, inserted between them and the head B′, and the bars are held against the pistons by springs *i′*, inserted in the grooves *h h′*, behind said bars. The arrangement of the bars H′ will be better understood by reference to Fig. 4.

I will now describe how steam is admitted to the engine. The hub and shaft A A′ are hollow, and are divided by a longitudinal partition, *j*, which forms two distinct passages, *k l*.

I designates a valve-chest, which forms part of one of the bearings *a*, and which is connected with ports *k′ l′*, which communicate with the passages *k l*, as shown in Fig. 3, and with an exhaust-port, k^2.

I′ designates the steam-pipe through which steam is admitted, and I^2 designates a slide-valve, which controls the passage of steam to the ports *k′ l′*, and which may be set or adjusted by a lever, l^2, so as to admit steam to one port and provide for the exhaust through the other port and to the exhaust-port k^2.

It will be observed that the valve I^2 is shorter than the distance between the outsides of the ports *k′ l′*, and hence, when the valve is adjusted to its middle position, steam will be admitted to both ports *k′ l′*, and the engine may be held by the steam against movement in either direction. This is advantageous for hoisting and other purposes, as it enables a load to be held without the use of a brake.

Referring to Fig. 2, let it be supposed that the valve is adjusted so that steam can enter through the passage *k* and exhaust through the passage *l*. The hub A is provided on one side of the partition *j* with two ports, k^3, and on the other side with two ports, l^3; but, if desirable, a single port, or more than two ports, may be provided on each side of the partition. The steam, entering through the passage *k*, issues into the cylinder through the ports k^3, and, acting upon the pistons F, drives the cylinder B in the direction of the arrows, and

is then exhausted through the ports l^3 into the passage l. In Fig. 2 the pistons are shown in the positions which they will occupy when the steam is acting with its maximum force on one piston while the other is inoperative.

Referring now to Figs. 5 to 10, inclusive, J designates the stationary casing of the engine, which is mounted on supports J′, and K designates the cylinder which constitutes the stationary part of this engine, and is provided with an upwardly-extending arm or stem, K′, which passes through a stuffing-box, J^2, in the top of the casing J. The arm or stem K′ is divided by a partition, j, into two distinct passages, k l, the lower ends of which are continued around the cylinder K, and terminate in ingress and egress ports k^3 l^3. (Shown in Fig. 6.) To the upper end of the said arm or stem K′ is secured a valve-chest, I, to which steam is admitted by a pipe, I′, and which is constructed with ports k' l', and an exhaust-port, k^2, like the valve-chest previously described. The valve-chest contains a slide-valve, I^2, for controlling the ports k' l'.

L designates the shaft, which is shown as hollow, and has rigidly fixed to it a rotary piston-head, L′, which contains two pistons, F, adapted to slide radially in recesses F′ therein. In this instance the pistons work against the inner surface of the cylinder K, and are pressed outward, with sufficient force to prevent leakage, by spring hoops or bands G, like those before described, except that they are here applied between the pistons to force them apart instead of outside of or embracing them to bring them together, as in the previous example of my invention.

I have described the cylinder K as stationary, which is true in the sense that it is non-rotary; but the cylinder may have a slight movement upward and downward, the stem K′ being free to slide in the stuffing-box J^2.

In order to take up wear and prevent leakage between the cylinder and the top of the piston-head L′, I employ a spring, m, applied to a stem, m', which passes through the casing J, and is screwed into the cylinder, as best shown in Fig. 5. The spring m is applied to the stem m', between a stuffing-box in the outer casing J and a nut or collar on said stem, as best shown in Fig. 5; and as the said stuffing-box, or the gland thereof, forms a fixed abutment for one end of the spring m, its resilience, acting on the nut or collar on the stem m', tends to draw down the cylinder K, and holds the upper part of its interior surface tightly pressed against the upper part of the exterior surface of the piston-head L′. The stem m' may be hollow, as shown, and may then serve as a drip-pipe through which the water of condensation is delivered, under control of a valve. (Not shown.)

It will be seen that the piston-head L′ and the cylinder K constitute two circular parts eccentric to each other, and having a bearing on each other at one point in their circumference. The spring m has no other function than to hold the cylinder or stationary part tightly against the top of the piston-head or rotary part.

At each end of the cylinder K is a packing, consisting of a plate, M, secured to the end of the piston-head L′ and rotating with it, a ring, N, placed between said plate and the cylinder, and bars H′, which fit in grooves h in the inner face of the plate M and in slots or recesses n in the ring N. (Best shown in Figs. 8 and 9.) The bars H′ are placed at the ends of the pistons F, so that the latter work upon them in their radial movement, and through said bars the ring N is locked to the plate M, so as to rotate therewith and upon the end of the cylinder K. The bars H′ are pressed tightly against the ends of the pistons by springs i, placed in the bottoms of the grooves h, and the ring N is pressed against the end of the cylinder by springs interposed between it and the plate M.

In order to prevent leakage, the casing J, around the cylinder K, may be kept filled with steam admitted through a pipe, o.

The shaft L passes through stuffing-boxes O at the ends of the casing J, and the gland O′ of each stuffing-box may be made in several sections, as shown in Fig. 10, each of which has a tongue, p, fitting in a groove in a stuffing-box, so that it cannot turn with the shaft. The sections of the glands O′ may be set up independently of each other by means of set-screws p', so as to compensate for wear, and at their inner ends is a continuous ring, p^2, which is adapted to bear upon the packing.

It will be seen that in both engines herein described I employ springs of the same construction applied to the pistons, a valve of the same construction for controlling the ingress and egress of steam, and a packing-plate and bars fitting in grooves therein, against which the ends of the pistons work in their radial movements. Although each engine shown and described has two pistons, certain features of my invention may be embodied in an engine having but one piston.

It will also be seen that in the form of engine shown in Figs. 1, 2, 3, and 4 the sleeve E constitutes the stationary part, and is pressed against the rotary cylinder B by springs e', while in the form of engine shown in the remaining figures the cylinder K constitutes the stationary part, and is pressed against the piston-head L′, which constitutes the rotary part, by a spring, m.

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

1. In a rotary engine, the combination of a cylindric stationary hub provided with a non-rotary shaft or arms, an outer rotary cylinder carrying a radially-sliding piston or pistons adapted to work upon the stationary hub as they rotate with the cylinder, hollow journals projecting from said rotary cylinder and surrounding said shaft or arms, bearings or supports for said shaft or arms, and bearings wherein said hollow journals may turn, ar-

ranged between the first-mentioned bearings, substantially as herein described.

2. The combination of the stationary hub A and its shaft or arms A′, the rotary cylinder with the hollow journals B^2, the bearings *a b* for said shaft or arms and said journals, the sliding pistons F, and the packings, each composed of the ring or collar C, the recessed collar C′, the nut C^2, and springs *c*, substantially as herein described.

3. In a rotary engine, the combination of an inner stationary hub and a shaft or arms therefor, both of which are hollow and constructed with a partition forming separate passages, a valve for controlling the ingress and egress of steam through said passages, an outer cylinder eccentric to said hub and adapted to rotate, and a sliding piston or pistons in said cylinder, substantially as herein described.

4. In a rotary engine, the combination, with a cylindric stationary part and a cylindric rotary part eccentric to each other, and two or more sliding pistons in said rotary part, adapted to work upon the cylindric surface of said stationary part, of springs consisting of circular hoops or bands applied to said pistons, to cause them to work tightly on the part in contact with which they move, substantially as herein described.

5. In a rotary engine, the combination of an inner stationary hub, an outer cylinder eccentric thereto and adapted to rotate, two or more sliding pistons, and springs consisting of circular hoops or bands embracing said pistons and causing them to work tightly against said stationary hub, substantially as herein described.

6. In a rotary engine, the combination of a stationary hub, an outer cylinder eccentric thereto, carrying a sliding piston or pistons, and adapted to rotate, a stationary sleeve surrounding said hub, and in contact with which said cylinder rotates, and a spring or springs between said hub and sleeve, for holding the latter against the cylinder, substantially as herein described.

7. The combination, with a rotary engine provided with passages for the ingress and egress of steam, of a valve adapted to be adjusted so as to admit steam at the same time to both passages, so as to hold the engine against movement in either direction, substantially as herein described.

8. In a rotary engine, the combination of a rotary part carrying a sliding piston or pistons, packing-plates at the ends of the piston or pistons, and bars fitting in radial grooves in said plates and against the ends of the piston or pistons, substantially as herein described.

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