4 Sheets—Sheet 1.

# J. McKAY.

## STEAM ENGINE.

No. 9,600. Patented Mar. 1, 1853.

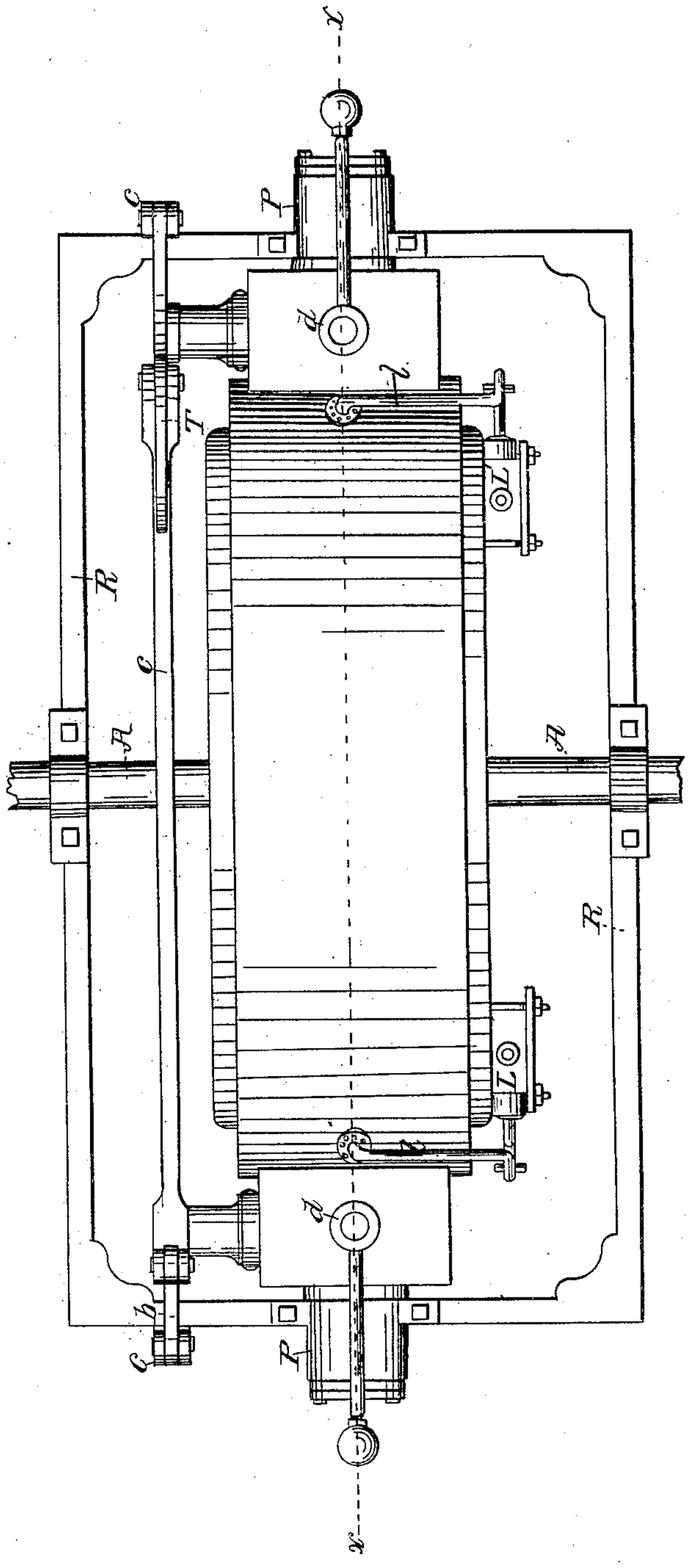


Fig. 1.

4 Sheets—Sheet 2.

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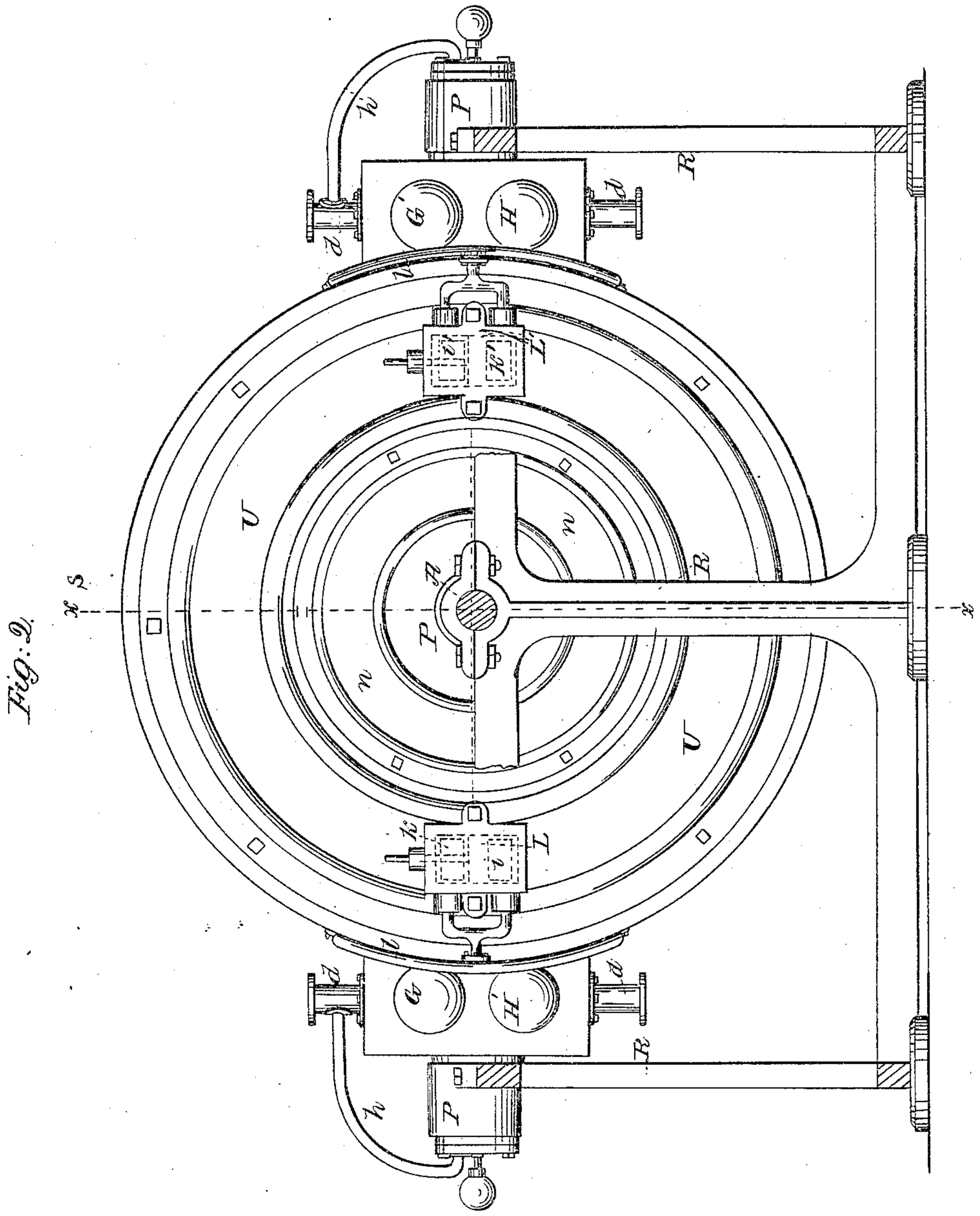
STEAM ENGINE.

No. 9,600. Patented Mar. 1, 1853.

Fig: 2.



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# J. McKAY.

## STEAM ENGINE.

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Fig. 4.

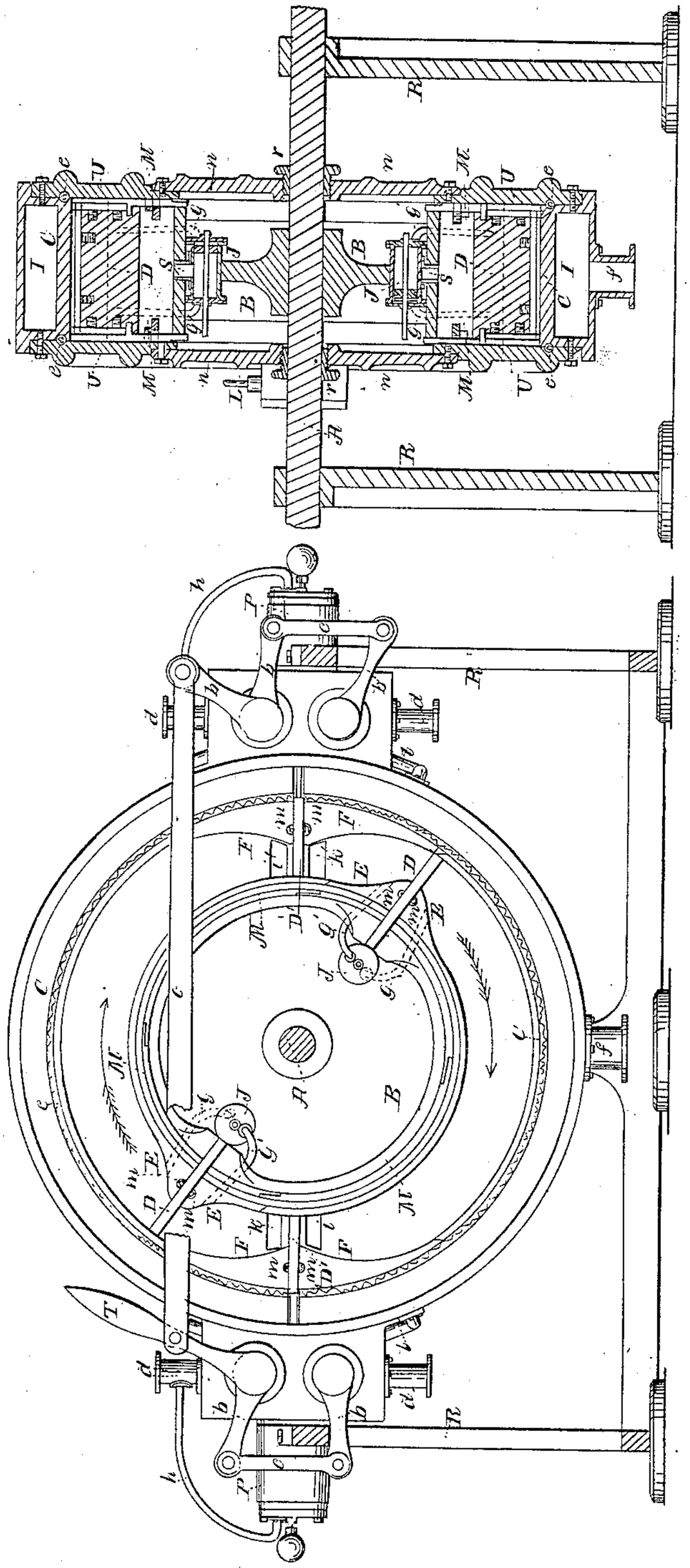

Fig. 3.

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# J. McKAY.

## STEAM ENGINE.

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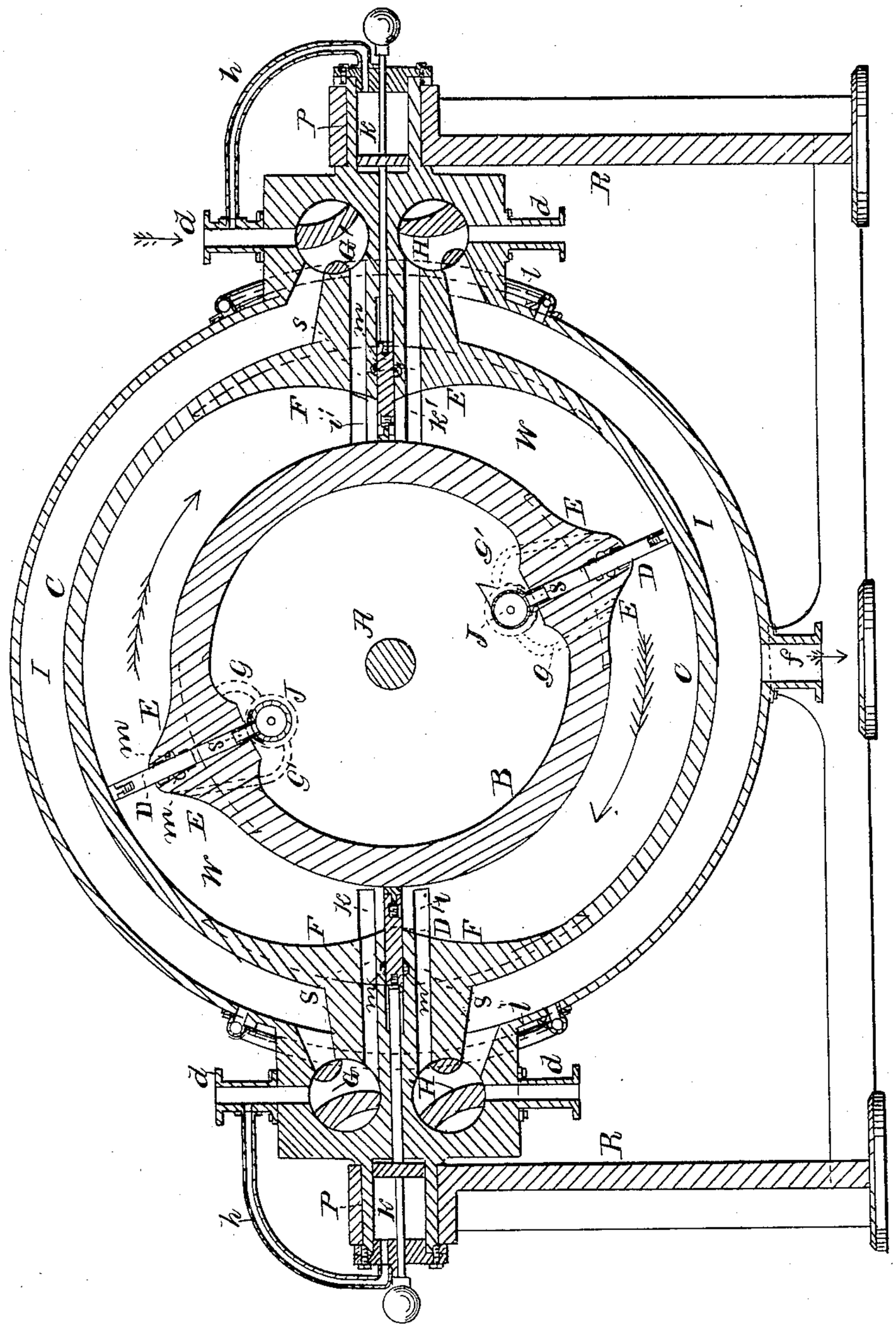

Fig. 5.

# UNITED STATES PATENT OFFICE.

JAMES McKAY, OF PHILADELPHIA, PENNSYLVANIA.

## ROTARY STEAM-ENGINE.

Specification of Letters Patent No. 9,600, dated March 1, 1853.

*To all whom it may concern:*

Be it known that I, JAMES McKAY, of the city and county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Steam-Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which make part of this specification, and in which—

Figure 1 is a top view. Fig. 2 is a side elevation. Fig. 3 is a similar view with the cylinder head off. Fig. 4 is a transverse section at the line *x x* of Fig. 2, and Fig. 5 is a longitudinal section at the line *x x* of Fig. 1.

My improvements are all applied in this instance to a rotary engine, although some of them are applicable to steam engines generally, and I propose to use them wherever they are applicable.

The engine represented in the accompanying drawings consists of a revolving main shaft (A), supported in bearings on the frame (R) carrying a cylinder (B), turning concentrically within a stationary cylinder (C), and fitted with radially sliding pistons (D and D) diametrically opposite each other, and passing through double inclined planes or saddles (E and E), which project outward from the periphery of the cylinder (B) while the stationary cylinder (C) is provided with similar saddles or abutments (F F) projecting inward half way across the space between the cylinders, so that when the inner cylinder (B) revolves, the saddles (E E) touch or nearly so the abutments (F F) which are also fitted with radial slides (D′ D′). The pistons (D D) and slides (D′ D′) are fitted with metallic or other suitable packing on their edges. The several saddles or abutments are of the form of double inclined planes on their projecting faces, as seen in Figs. 3 and 5. On either side, that is, above and below the slides (D′ D′) are entry and exhaust passages (S, S, S, S,) communicating with valves (G G′) and (H H′), which are respectively, alternately made to admit or exhaust steam according to the direction in which the engine is required to rotate, the upper valve on the one side, and the lower valve on the opposite side acting alternately as entry valves, while the remaining two act alternately as exhaust valves; these valves (G and H) and (G′ and H′) are of the plug or cylinder form, and made to turn to and fro, for the purpose of admitting or exhausting steam, according to the direction in which the engine is revolved, by means of crank (*b*) connected by rods (*c*) operated by a hand lever (T).

Steam is admitted to the valves (G and H) by steam pines (*d*). These valves are arranged in suitable steam chests, on the outside of a chamber or exhaust steam passage (I) that incloses the periphery of the cylinder (C). This steam passage conducts the exhaust steam simultaneously from the upper valve (G) or (G′), and lower valve (H or H′) around the stationary cylinder (C), thereby causing the waste steam by entering these chambers or passages on opposite sides, to heat the cylinder equably, and thereby more effectually preserve an equality of expansion, than if the exhaust steam were admitted on the one side only, to circulate around it, and then escape. This preservation of the equality of expansion of the cylinder (C), renders the space for the movement of the pistons more regularly and truly round, while at the same time it prevents loss of power, by condensation of steam. The exhaust steam passes off by the outlet (*f*). The steam space between the cylinders in which the pistons and abutment slides protrude, is inclosed at each end by an annular head (U) secured to the outer cylinder (C) by screw bolts, and made steam tight by packing (*e*) Fig. 4.

Rotary motion is communicated to the cylinder (B) and main shaft (A) by admitting steam through the valves (G and H) or (G′ and H′), according to the direction of motion required. The steam thus admitted, presses in opposite directions against the pistons (D, D) and the saddles (E, E) until the pistons have reached the next abutment slides, which gives to the cylinder (B) half a revolution nearly, when the remaining two valves (G and H) or (G′ and H′) being open, the cylinder is exhausted by said steam, which escapes into the passage (I), and the pistons (D D), passing, by the momentum they acquired the radial slides (D′ D′), steam is again admitted through one of the upper, and one of the lower valves (G and H) or (G′ and H′) so as to press on the pistons in the same direction as that which previously acted upon them, to

continue the rotary motion, when the pistons arriving again at the radial or abutment slides (D′ D′) the escape of the steam that has just acted, and the admission of a fresh supply takes place as before, and the rotary motion is thus made continuous; the pistons in thus revolving, slide radially in and out, alternately, as they pass the abutments (F F) and are constantly pressed outward, by steam acting on their inner edges or backs. To produce this action, self acting plug or piston valves (J, J,) are employed which work within chambers or cylinders, in the body of the cylinder (B) which communicate with openings (*s*) with the slots within which the pistons slide. Steam ways (*g′ g′*) and (*g g*) connecting the said valve chambers or cylinders at opposite ends, with the steam space (W) of the engine, are made on opposite sides of the pistons (D), so that steam, entering either of the ways (*g′* and *g′*) or (*g* and *g*), (according to the direction the engine turns), the valves (J J) are forced along their chambers and prevent the steam escaping by the other two ways (*g* and *g*) or (*g′* and *g′*) that communicate with the exhaust side of the pistons, and thus keeps the pistons pressed up to their bearings on the cylinder and the abutments (E E). The radial abutment slides (D D′) are similarly acted upon by the curved faces of the saddles (E E), and by pistons (K K) acted upon by steam from the back, and supplied by pipes (*h h*), the steam on the back of the pistons serving to keep the slides (D′ D′) up to their bearing against the cylinder (B) and saddles (E E); thus it will be seen, that the pistons (D D) and abutment slides (D′ D′) are protruded radially into the steam space in opposite directions during the travel of the pistons over the abutments, whereby, the requisite length of radial motion is divided between the pistons and abutment slides passing over the several projecting saddles and abutments, by which arrangement the sliding pistons perform only half the radial movement that they would, were the slides in the stationary abutments dispensed with, and the latter extended to meet the periphery of the revolving cylinder (B), and thus the rapid and sudden radial motion of the piston slides is diminished one half during the rapid rotary motion of the engine, and consequently, the wear and tear, are proportionally diminished.

In order more fully to economize the steam, supplemental exhaust valves (L L′) (shown in red lines Fig. 2) are employed for the purpose of more rapidly freeing the steam space of its exhaust steam, than could be done simply by the valves (G or G′) and (H or H′) except by enlarging the parts of the latter, which would entail a corresponding consumption of the entry steam: these valves (L L′) are of ordinary double slide form; they are secured to the face of one or both of the cylinder covers, and communicate by ways (*i i′* and *k k′*) through the cylinder cover with the steam spaces (W) on either side of the abutment slides (D′ D′): these valves (L L′) are moved on their seats when necessary by rods connected with the valve gear of the engine already described or in any convenient manner, and are so adjusted in relation to the valves (G G′) and (H H′) as that the ways (*i* and *i′*) or (*k* and *k*) (according to the direction the engine travels) are opened during the same time as the two first described exhaust valves (G or G′) and (H or H′,) the ways (*i* and *i′*) being open when the valves (G′ and H′) exhaust, while the other two ways (*k* and *k′*) are kept closed; or the ways (*k* and *k′*) opened to exhaust, and the ways (*i* and *i′*) shut, when the valves (G and H) are made the exhaust, and (G′ and H′) the entry valves, according as before observed, to the direction the engine is turning.

Pipes (*l*, *l*,) serve to convey the exhaust steam passing through the ways (*k* and *k′*) (*i* and *i′*) from the valves (L L′) to the chamber (I) for the purposes before specified, and the exhaust steam passes from the upper to the lower part of the exhaust steam chamber (I) on its way to the exhaust pipe (*f*) through the pipes (*l l*,): the supplementary ways (*i*, *i′* and *k k′*) are of large area so as (in conjunction with the ordinary exhaust valves) to free the cylinder rapidly of its steam, and thereby prevent the retardation of the pistons that would be produced by a slow escape of the exhaust steam when the engine is in rapid motion, while the consumption of steam by these supplemental exhaust valves is only what is lost, or remains inactive in the ways (*i* or *i′* and *k* or *k′*) which will be but trifling, as these ways are not deeper than the thickness of the cylinder cover.

In addition to the packing along the edges of the piston and abutment slides packing (*m*) is inserted in the saddles and abutments to prevent the escape of steam along the faces of the slides, the cylinder (B) is also fitted on either side with annular packing (M) which is pressed out, by springs or otherwise, against the interior face of either cylinder cover (U) which has a concentric plate or disk, secured to it, to cover the central opening of the heads (U) by which construction the packing (M) and interior of the cylinder (B) are readily accessible for adjustment, or repairs by simply taking off the disk (*n*) which being made in two or more pieces, can be easily removed, thereby obviating the necessity of removing the ponderous annular heads (U) and breaking its joint with the

cylinder, which it is more desirable should be a permanent joint, as it is fully exposed to the action of the steam, than the joint formed by the disk (*n*) which has only to resist steam leaking, past the packing (M). Around the main shaft (A) a stuffing box (*r*) is fitted into the eye of the disk (*n*) on either side. To insure the easy and smooth working of the engine, and prevent the pistons or slides from bending, the cylinder (C) and its appendages are supported or hung by trunnions (P P) in bearings on the frame (R R): this arrangement admits of the cylinder swaying to either side, and thereby accommodating itself to any lateral pressure of the pistons against it, which will have the effect of materially reducing the friction. The steam pistons (K) before described, for forcing up the abutment slides are situated (as represented in Fig. 5) within the trunnions (P) and the steam to act upon them, is obtained from the boilers, through the pipes (*h*) as represented.

It is obvious that a rotary engine upon this principle, may be made with a single piston, or any number more than one, for which room can be made; it is likewise obvious that instead of the variety of valves and valve gear herein described, and represented, any others that are suitable may be employed, and the method of insulating the periphery of the cylinder from contact with the air, by exhaust steam may be applied to the insulation of any or all other parts of the engine to which it is applicable at the discretion of the constructor.

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

1. The passages for the exhaust steam so arranged that they shall cover and encirle the entire periphery of the stationary cylinder and have their ingress and egress openings so arranged as to cause the exhaust steam as it escapes to envelop the whole surface of the cylinder as described.

2. In combination with the ordinary valves and parts which form a passage for the steam, to and from the engine. I claim the supplemental exhaust parts and valves which act in conjunction with the ordinary exhaust valves, whereby a free egress for the exhaust steam is afforded, without leaving large open passages for the steam to waste in.

3. I also claim the combination of the sliding pistons with self adjusting valves and steam ways, which admit a portion of the steam that propels the piston, behind its inner end to act as a spring to press it out into the steam space, whichever way the engine may be turning.

4. I also claim mounting or hanging the two cylinders on radial and axial journals respectively arranged in a common plane, and at right angles to each other, whereby the two cylinders can accommodate themselves to each other, so as to avoid binding, substantially as herein set forth.

In testimony whereof I have hereunto subscribed my name.

JAS. McKAY.

Witnesses:
A. S. Smith,
P. B. Bell.