No. 10,075. PATENTED OCT. 4, 1853.

J. C. F. SALOMON.

ROTARY STEAM ENGINE.

Fig: 1.

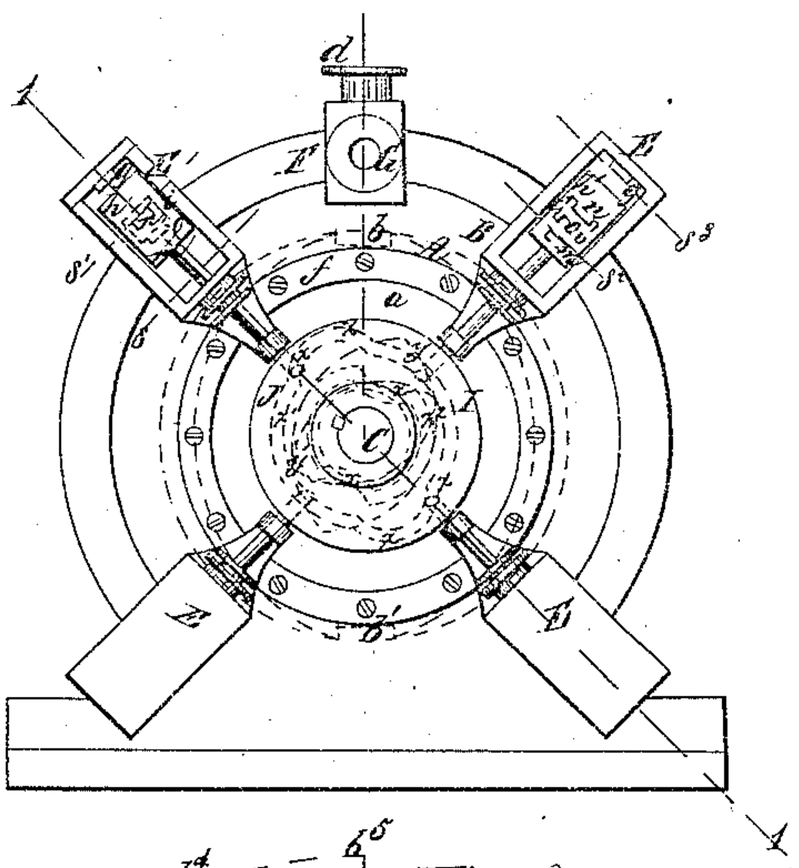


Fig: 2.

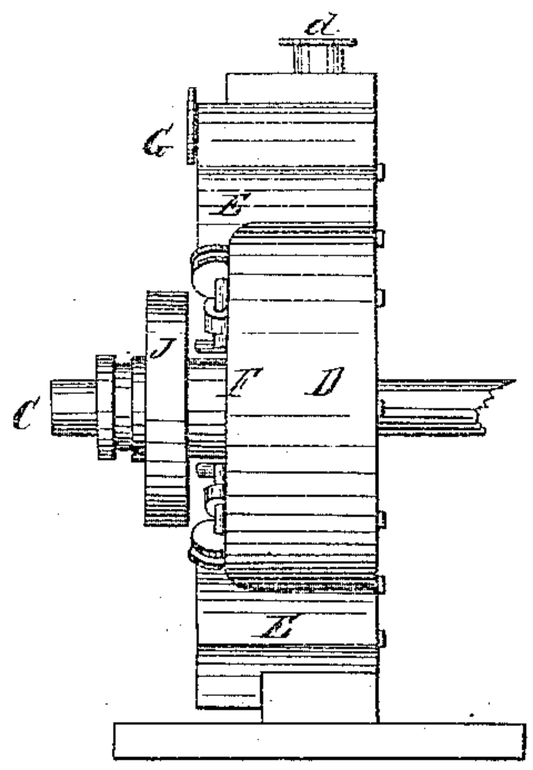


Fig: 3.

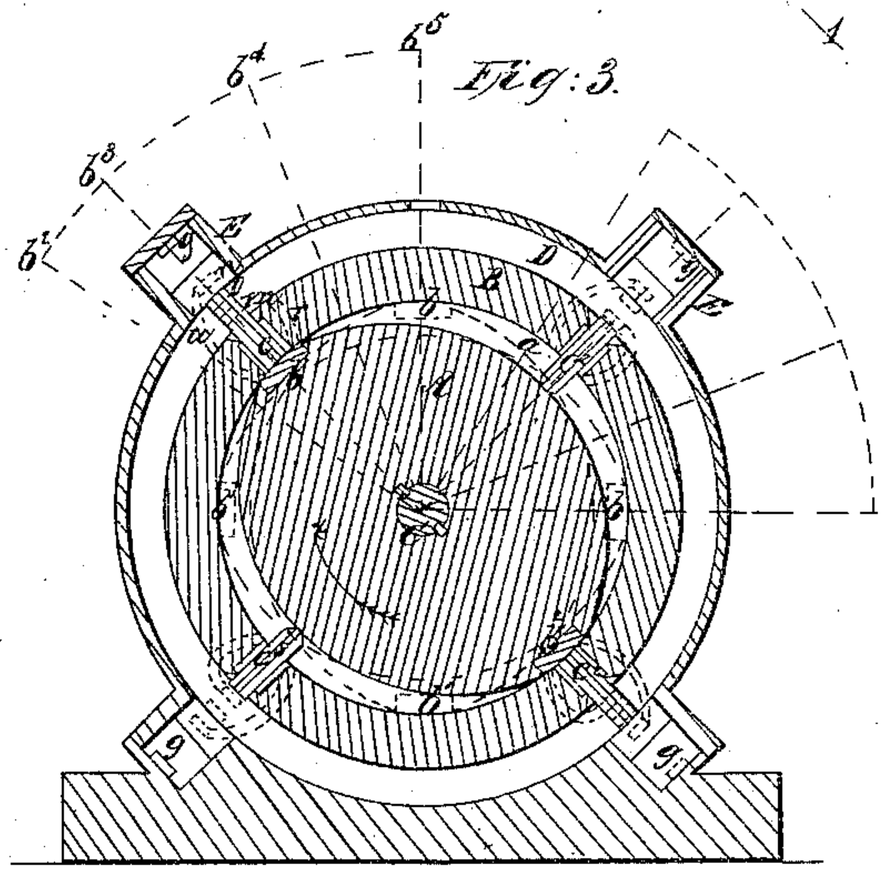


Fig: 4.

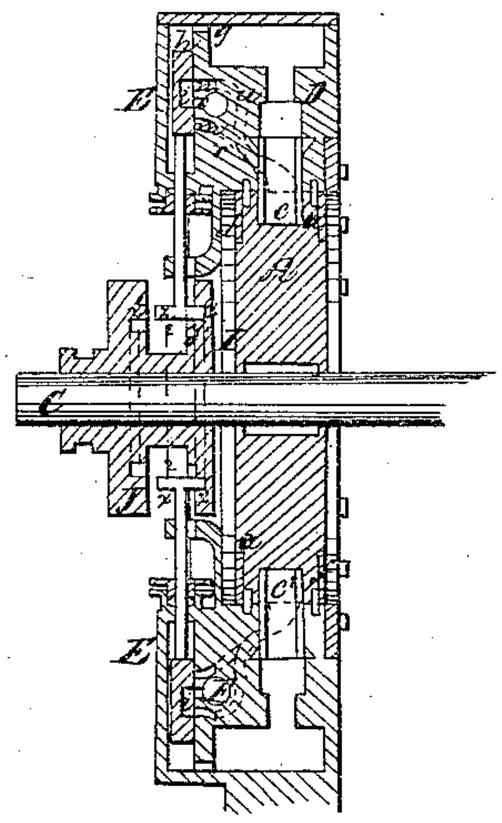
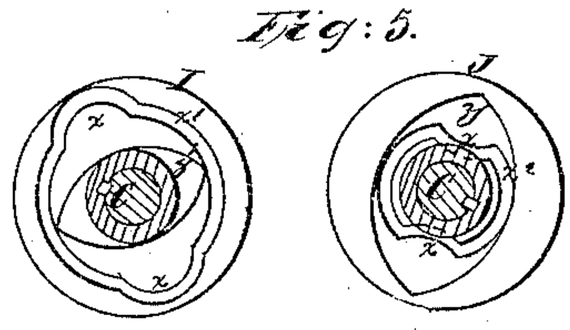


Fig: 5.



UNITED STATES PATENT OFFICE.

JOHN C. F. SALOMON, OF WASHINGTON, DISTRICT OF COLUMBIA.

ROTARY STEAM-ENGINE.

Specification of Letters Patent No. 10,075, dated October 4, 1853.

To all whom it may concern:

Be it known that I, J. C. F. SALOMON, of the city and county of Washington, in the District of Columbia, have invented certain new and useful Improvements in Rotary Engines to be Propelled by Steam, Gas, or other Elastic Fluid or Vapor, of which the following is a full, clear, and exact description, reference being had to the accompanying drawing, which forms part of this specification, and in which—

Figure 1 represents a side elevation of my improved engine; Fig. 2 an end elevation; Fig. 3 a vertical longitudinal section; Fig. 4 a diagonal transverse section through the line 1, 1, of Fig. 1; and Fig. 5 a transverse section through the line 2, 2, in Fig. 4 of the valve cams, detached, showing their grooved inner faces.

Of the many forms of rotary steam engines heretofore proposed and in use, those of the revolving piston kind are generally acknowledged to be the most economical and best, as, in this description of engines the steam is confined in a close and rigid chamber, and acts only on a solid and inflexible surface and makes its escape by confined passages so that its full effect may be obtained in useful work.

My present improvement has reference to this class of engines and is designed to remove many defects which have characterized both those of concentric arrangement having radial or other revolving sliders moving in circular or oval chambers, to which double action of the sliders there are many well known objections, and those of eccentric construction also having revolving radial sliders, and others employing smooth cams with sliding abutments whereby the abruptness of the radial action is reduced, but in most of which either the propelling power is caused materially to vary throughout each revolution or a large amount of "center pressure" or irregular and lateral strain is thrown upon the driving shaft, while the capacity of all such engines to employ the steam economically by "cutting it off" or working it expansively is exceedingly limited without destroying or materially affecting the required uniformity of the propelling action.

To remove these and other defects and to improve generally the economical and smooth working of the engine in a simple and practicable manner is the object of my invention.

For the better elucidation by comparison of my improvements, the following description is confined to the employment of steam as the propelling agent, though gas or other elastic fluid or vapor is designed to be used.

In the accompanying drawing, the revolving piston or wheel (A) is circular at its sides (*a*) and of the same diameter as the cylinder (B) in which it moves, but is made with a steam groove or channel between either side so as to give to it the shape of a conic section resembling an ellipse the extremities of the transverse diameter of which are formed by packings (*b b'*) of the same exterior curvature as the interior rotundity of the cylinder. This elliptic piston (A) is firmly keyed to a center driving shaft (C) and is caused to revolve by the pressure of steam on its edge as will be presently explained. Four sliding radial abutments (*c*, c^1, c^2, c^3,) are arranged around the stationary cylinder (B) and severally act in their turn as stops in the elliptic groove to confine the steam in between them. These abutments are packed to prevent the passage of steam by or around them and are forced inward by a pressure of steam on their back or outer ends and radiated outward by the elliptic piston as it revolves.

Steam is introduced by a nozzle (*d*) to a jacket (D) which encompasses the cylinder and conducts the steam to the several valve boxes (E) and to the outer ends or backs of the abutments. The valve boxes (E) are four in number and are arranged around the cylinder in the same radial lines as the abutments. A circular groove is cut around the periphery of either circular side (*a*) of the piston. In this groove a packing (*e*) is inserted and is caused to project into a groove in the cylinder to prevent leakage of steam from either side of the revolving piston, an outer ring (*f*) made adjustable by screws serving to tighten up either packing as occasion requires; both this packing (*e*), the packings of the piston and those of the abutments, I design to make of an elastic vegetable and metallic compound which it is my intention to secure by Letters Patent and on which a caveat has been filed; or the

said packings may be made of any ordinary well known substance suitable for such purpose.

The valve boxes (E) are openly exposed to the steam so as to be constantly filled with it, the communication between the steam jacket and the valve boxes being established by passages (g) from a chamber at the back of the valve boxes. These valve boxes are provided with slide valves (h h') the motions of which are radial to the driving shaft as indicated by the lines s s' for the travel of the engine in the one direction and lines s^2 s^3 for its travel in the opposite direction, the said lines representing the position of the forward and back edges of either valve at a relative position of the piston to them. These valves are of the D-shaped kind, having a cavity (i) within them which serves to conduct the steam from the cylinder by upper and lower inlets and outlets (m n) to the exhaust pipe (F) by a central outlet (o). The ports (m n) of the valves communicate by extension passages (r u) with the interior of the steam cylinder on either side of the abutments. Only one of these ports in either valve acts as an inlet and the other as an outlet, either one of such so operating according to the direction of the engine's travel. The sliding of the ends of the valves and of the edges of the exhaust cavities over the several ports serves to admit, shut off and exhaust the steam much in like manner to the ordinary action of slide valves. The exhaust pipe (F) connects with the several valve boxes and is furnished with an escape branch (G).

To give the requisite action to the valves, as will be presently described, they are made with lap so as to shut the exhaust passage previously to the opening of the steam port as the extremity of the transverse diameter of the elliptic piston approaches or arrives opposite the valve; thus upon the packing b of the piston arriving centrally opposite the line b^2 (Fig. 3), when the engine travels as indicated by the arrow (z), the port (n) communicating with the exhaust passage (u) on the rear side of the abutment c is shut to retain the steam in the cylinder on the rear side of the said abutment while the piston passes and to assist it in passing the abutment, and when the said packing of the piston arrives directly opposite the abutment c, and opposite the line b^3, steam is admitted by the port m through the passage r and presses on the piston packing b till the packing moves beyond the passage when the steam from the passage r acts upon the wheel to propel it, the steam port being full open when the piston packing arrives opposite the next dotted line b^4 and closed on arriving opposite the line b^5 when the piston occupies the position represented in red lines, and simultaneously with the shutting off of the steam through the inlet r the exhaust passage u of the valve h is opened to admit of the escape of the steam in rear of the abutment c, as its further retention would cause it to press upon the wheel in an opposite direction to its motion. A similar action takes place with the next valve (h^1) as the packing b of the piston approaches and passes it, the steam admitted by the passage r of the previous valve h being retained to act expansively in propelling the piston from the point at which the steam was shut off by the valve h till the arrival of the piston at the position represented in blue lines when steam has been admitted by the next valve h^1 to continue the propulsion, and so on for each valve in succession, each two, opposite, valves being similarly operated simultaneously so as to avoid "center pressure" on the driving shaft and obtain a large propelling area on opposite sides of the one wheel whereby space is economized and irregular or lateral strain avoided. Instead of the steam port m being opened as described when the piston packing covers the inlet r, it may not be opened until after the said packing has passed it so as to prevent the steam acting on the packing to press it inward. This it will be readily understood may be effected by slightly increasing the lap of the valve.

By the specified arrangement and operation of the valves, the steam it will be observed is worked to a large degree expansively without materially affecting the uniformity of the propelling power of the engine, as, upon the steam commencing its expansion, the propelling area of the piston exposed to it begins to increase, and, upon the steam becoming considerably expanded and at the point when the piston area exposed to the expanding steam is beginning to diminish, the next inlet valve is opened to the admission of fresh steam at full pressure and until a sufficient area of the piston is exposed to the steam furnished by that inlet to insure uniformity of action, the expanding steam in rear of the abutment continues to assist the wheel as it previously did, but to a greater degree, when the piston packings were passing the abutments. The gradual and slight radial action of the abutments which the elliptic form of wheel produces will obviate the jar and uncertainty consequent upon the general abrupt action of such devices while as the abutments form the only radial sliders they are less liable to stick or wear than if having a revolving in addition to a radial action. The contrivances by which the valves are operated as described consist of revolving cams (I and J) united on their inner faces and fitted on a feather sliding key on the engine shaft

which should be supported in suitable plumber blocks or bearings on either side. These cams are grooved on their inner faces and the valve stems are made with a projecting stud (x), on either side, which fits into the groove of either cam according to the direction the engine is designed to travel, risers or set-offs (α) in the grooves (x^1 x^2) serving to rise and fall the several valves at the required points to produce the specified opening and closing action of the valves. The one cam (I) has its groove and risers at such a distance from the center of the shaft as to cause the inner part of the several valves to be the inlet for the steam whereby the engine will run as indicated by the arrow z, while the other cam (J) has its groove and risers pitched to make the outer port the inlet for the steam, the radial set or distance of the valves from the center of the shaft thus being altered accordingly as the valve rods are in gear with either cam, and as the two cams are united, the engine may be reversed by simply sliding the double cam, by clutch or otherwise, so as to throw either cam into gear with the valves as required, and to facilitate the transfer of the valve-stem-studs to the grooves of their respective cams, the one cam (J) is made with an elliptic recess (y) while the other cam (I) has a raised ellipse (y^1). The edges of this recess and ellipse serve to guide the studs of the valve stems into either of the cam grooves (x^1 x^2) accordingly as the said recess or ellipse is thrown into gear with the stem studs by sliding the double cam on the driving shaft. Any other arrangement however of operating gear for the valves may be used and any other suitable form of valves employed.

What I claim as new and useful, and desire to secure by Letters Patent, is—

1. The combination of the elliptic wheel and its cylinder with the sliding abutments or stops arranged in such manner that a continuous propelling force may be communicated to the wheel without exposing it to unequal pressure of the fluid on opposite sides of its axis throughout the entire revolution in either direction, substantially as specified.

2. I further claim, in combination with the revolving wheel or piston, the arrangement and operation of the valves herein described in such a manner that, as the effective propelling area of piston surface exposed to the impelling fluid, between either two abutments, diminishes, the wheel is assisted by an increasing area of piston surface exposed to the action of the fluid on the opposite sides of the abutments as specified, whereby the propelling fluid may be worked expansively without impairing the uniformity of the active power of the engine, as herein set forth.

In testimony whereof, I have hereunto subscribed my name.

JOHN C. F. SALOMON.

Witnesses:
SAML. GRUBB,
ALFD. GREGORY.