M. Hanford,

Rotary Steam Engine.

No. 67,978. Patented Aug. 20, 1867.

Fig 3.

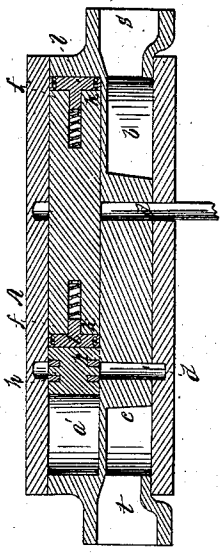


Fig 4.
on line a. b. of Fig. 1

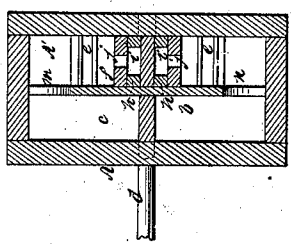


Fig 6.

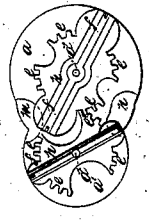


Fig 5.

Fig 1.

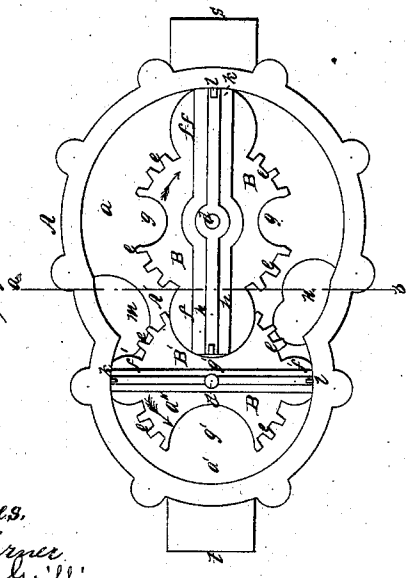
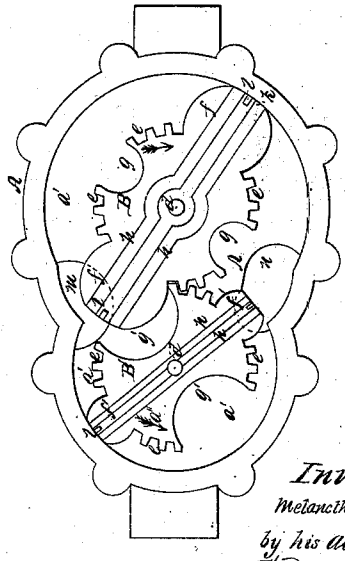


Fig 2.



Witnesses.
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MELANCTHON HANFORD, OF BOSTON, MASSACHUSETTS.

Letters Patent No. 67,978, *dated August* 20, 1867.

IMPROVEMENT IN ROTARY ENGINES.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, MELANCTHON HANFORD, of Boston, in the county of Suffolk, and State of Massachusetts, have invented an Improvement in Rotary Steam Engines; and do hereby declare the following to be a full, clear, and exact description thereof, due reference being had to the accompanying drawings, making part of this specification, and in which—

Figures 1 and 2 are side views of the said engine with cap-plate removed.

Figure 3 is a longitudinal and horizontal section, and

Figure 4 a transverse section of it.

Figure 5 is a vertical section of its induction and exhaust-chambers, and

Figure 6 a representation of its two pistons.

The object of this invention, which is an improvement in that class of steam engines known as "rotary" engines, or those in which two pistons, revolving in opposite directions and geared together, are employed, is to increase the leverage or power of the engine as a motor, by increasing the length of steam-bearing and propelling surface of the pistons, this being accomplished by making projections or arms upon the circumference of the pistons which mesh into notches or recesses formed in the other, the projections serving to partially rotate the pistons when in contact, and to form a steam-bearing surface or leverage to aid in propelling them, the two pistons being further connected together by a quadrangular series of sectional gears formed upon or making part of the circumference of the piston, as hereinafter explained.

By referring to the accompanying drawings illustrating my invention, the box or casing of the engine is shown at A, having parallel cylindrical bores or chambers *a a'* intersecting each other and uniting to form one large chamber, A'; and further, having steam-induction and exhaust-chambers *b c* below the chambers *a a'*. The revolving pistons are shown at B B' as applied within the chambers *a a'* respectively, and so as to rotate in close proximity to opposite sides of the chambers, the pistons being supported by parallel shafts *d d* sustained by the walls of the casing A. The pistons are circular in form, and have quadrangularly-arranged sectoral gears *e e e e* cut upon their peripheries, the teeth of one piston meshing into those of the other, and each piston being also formed with two projections *f f f' f'* and notches or recesses *g g g' g'* on its opposite sides, and approximating to a semicircle in form, and between the sectoral gears *e e e e*, as represented in figs. 1 and 2 of the drawings. The two pistons are grooved longitudinally on opposite sides, for receiving steam-packing plates *h h*, a small chamber, *i*, being formed in each end of the piston and between the two plates, and having a lateral opening, *j*, to allow steam to enter the chambers *i i* and force the plates against the interior faces of the chambers *a a'*, thus preserving a steam-tight joint between the faces of the pistons and their case. Additional chambers *k k* are formed vertically in each end of the projections or teeth *f f f' f'* of the pistons for receiving packing-plates *l l*, secured therein in any suitable manner, and supplied with springs to force them outward and in contact with the inner periphery of the case A, by this means preserving a steam-tight joint about the ends of the pistons, in the same manner that the plates *h h* effect their object, the steam being admitted to contact with the last-mentioned chambers *k k* by a port leading from the chambers *i i*, before mentioned. The steam-induction port leading into the piston-chamber A' is shown at *m*, and the eduction or exhaust-port at *n*, the port *m* leading from the steam-supply chamber *b*, and the port *n* opening into the exhaust-chamber *c*, the chambers *b* and *c* being provided with suitable inlet and outlet passages *s t*.

In the operation of the above-described engine, when used as a motive power, and supposing the two pistons to be in the position shown in fig. 2 of the accompanying drawings, the steam entering the induction-port *m* impinges against the tooth or projection *f* or *f* of the piston B and rotates it in the direction indicated by the arrow thereon, the sectoral gears *e* at this time meshing into one of those of the piston B' and aiding in rotating the said piston B' in an opposite direction, or that indicated by its arrow *a''*, the rotation of this piston being also aided by the pressure of the steam upon its tooth *f'* and upon the upper portion of its recess *g'*, the steam being prevented from passing between the pistons when in this position by the teeth of the gears *e e*, and when in the position shown in fig. 1, by the steam-packing plates *l l* operating upon the interior of the recesses *g g*. Under the conjoint action above described the two pistons will be rotated until the gears are out of engagement and one of the teeth *f'* of the piston B' takes into the notch *g* of the piston B, the action of the tooth *f'* and

notch *g* serving, in conjunction with the pressure of the steam, to bring the two pistons into the position to allow the two next adjacent gears *e e* to mesh into each other and complete, with the aid of the steam, a semi-revolution of the two pistons on their axes, or into the position shown in fig. 1 of the drawings, when the exhaust steam will pass through the port *n* and into the exhaust-chamber *c*, and from thence into the atmosphere.

The action of the packing-plates *h h* and *l l* during the different positions of the pistons will readily manifest themselves to persons conversant with steam, as their construction and operation has been before explained. The advantage gained in power by my construction and arrangement of the pistons is dependent on the length of the teeth *f f* of the piston B, the excess of length of these teeth beyond the periphery of the circular portions of the pistons determining the extent of the gain. When the two pistons are in the position shown in fig. 1 the advantage gained is not so great, as the increase in power gained by the action of the steam on the outer end of the piston A is to some extent lost in acting as a motive power upon the piston A′, although the steam comes in at this point to act upon this piston and serve as an auxiliary to counteract this loss. But the full advantage of the increased length of the piston, by means of its teeth *f f*, is gained when the positions of the pistons are changing from that shown in fig. 6 to that shown in fig. 1, as the periphery of the gears is equidistant from their centres, while the tooth *f* of the piston B is projected beyond the circumference of these gears, the increase in the leverage or power of the steam upon the tooth increasing very rapidly as it departs from the circumference of the piston. By the arrangement of the recesses *g′ g′* of the piston B′ room is made for disposing of the teeth *f f*, while the teeth act at the same time as motors to the said piston. By the mode of connecting or gearing the two pistons together, as described, while gaining other and important advantages, I dispense with gears outside of the case A, and apply the machinery to be driven by the engine directly to the shaft of the said piston A.

I would remark that the above-described engine, although referred to in the specification as a motor, may be employed to excellent advantage as a water-meter.

In this case I have contemplated constructing the pistons of hard rubber in place of metal, and make the slightly elastic properties of the rubber perform the office of packing the joints in place of the metallic bars before described.

I do not claim broadly the combination in rotary engines of cog-pistons, for I am aware that the same is described and claimed in the patent of B. Holley, February 6, 1855; but what I claim as my invention, and desire to secure by Letters Patent, is—

The herein-described arrangement of the smaller piston B′ and larger piston B, provided with projections *f*, as and for the purposes set forth.

MELANCTHON HANFORD.

Witnesses:

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FREDERICK CURTIS.