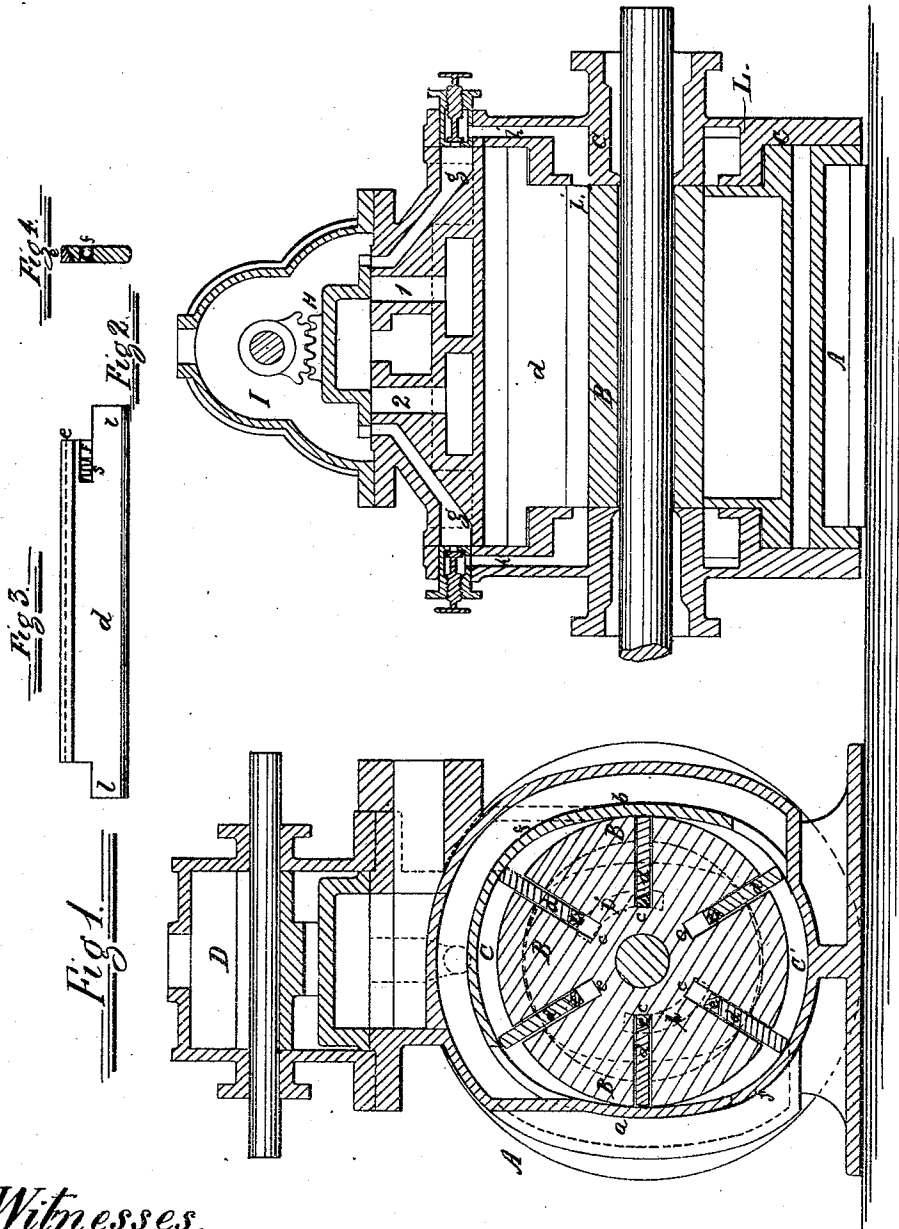


**J. V. BEEKMAN.
Rotary-Engine.**

No. 159,066.

Patented Jan. 26, 1875.



Witnesses.

B. J. Clark.
William Stevenson

Inventor.

John V. Beekman

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Fig 5.

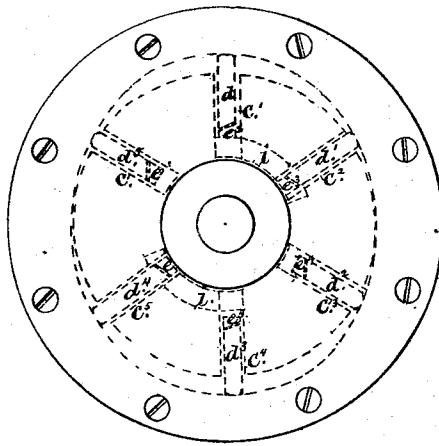
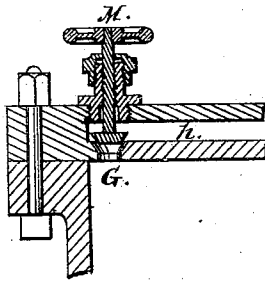


Fig 6.



Witnesses:

B. H. Clark.
William Stevenson.

Inventor:

John V. Beekman.

UNITED STATES PATENT OFFICE.

JOHN V. BEEKMAN, OF BROOKLYN, NEW YORK, ASSIGNOR TO LIDGERWOOD MANUFACTURING COMPANY, OF NEW YORK CITY.

IMPROVEMENT IN ROTARY ENGINES.

Specification forming part of Letters Patent No. **159,066**, dated January 26, 1875; application filed September 15, 1874.

To all whom it may concern:

Be it known that I, JOHN V. BEEKMAN, of the city of Brooklyn, Kings county, State of New York, have invented an Improvement in Rotary Steam-Engines, reference being had to the accompanying drawings forming part of the specification, in which—

Figure 1 is a central vertical sectional view of a rotary engine embodying my improvements, and Fig. 2 a similar view at right angles to Fig. 1. Fig. 3 is a side view of one of the pistons, and Fig. 4 is a cross-section of the same on line *x x*, Fig. 3; and Fig. 5 is a central sectional view, and Fig. 6 an inner face view, of one of the cylinder-heads.

My invention relates, first, to the packing of the pistons in the revolving cylinder by steam; and consists in the devices, hereinafter described, for conducting live steam as packing behind the pistons, and letting it on at the moment when the pistons, respectively, commence to slide outward in their recesses in the revolving cylinder, and cutting it off at the moment when the pistons, respectively, reach their outward limit. It relates, second, to the construction of the pistons, whereby they are pressed laterally against the side walls of their recesses in the revolving cylinder, and these form steam-tight joints; and consists, first, in combining with the inner edge of pistons packing-bars, the adjacent edge of the pistons of said bars being beveled to match each other, so that when the said bars are forced against the pistons by the pressure of the steam the bars will be pressed against one side of the respective recesses, and the pistons against the other side; and, second, in a sliding packing-block at the end of each piston, which, by a spring, is forced against the cylinder-head, thereby making a steam-tight joint between the ends of the pistons and the said cylinder-heads.

The general construction of the rotary engine to which I have applied my improvements is not new, consisting of a steam-cylinder, the cross-section of the interior surface of which presents the form of an ellipse, produced by two curved segmental abutments, *a b*, placed opposite each other, which contract the horizontal diameter of the cylinder

to the diameter of the rotary cylinder B, leaving steam-spaces *C C'* at the top and bottom. In this cylinder B are the recesses *e*, in which work the sliding pistons *d*. The steam is introduced into the cylinder, in the usual way, through a steam-chest, D, and ports leading therefrom through the slides of the cylinder. If the cylinder is to be revolved from left to right the steam enters on the left-hand side, just above the center of the left-hand abutment, and escapes, and if in the opposite direction it enters just above the abutment on the right-hand side, and escapes at the point diametrically opposite. The steam is let on or cut off in either direction at pleasure by the valve H in the steam-chest, operated by a lever or segmental rack, as shown.

The further description will relate to those devices and combinations which I regard as novel.

I am aware that I am not the first to introduce steam as a packing agent behind the pistons in this class of engines. I limit myself therefore to the particular devices by which that object is effected. From the steam-chest two steam-passages, *g g'*, lead, one to each end of the steam-cylinder A, with which, respectively, connect passages *h h'*, made through the substance of the cylinder-heads, leading to small chambers in the said-head, from which segmental ports *i i'*, one at each head, lead into the interior of the steam-cylinder. These ports are so placed that the bottom of the piston-recesses *e* in their turn will pass over them, and the steam be delivered through them into the said recesses behind the pistons just as the pistons successively pass the abutments *a b*, and commence to slide outward in their recesses, and will cut off the steam from the recesses just as the pistons reach their outer limit, and commence their reverse movement back into their recesses, as is shown in Fig. 1, the outlines of the segmental ports *i i'* being indicated by dotted lines. *d d' d² d³ d⁴ d⁵* indicate the pistons, and *e* the recesses in the revolving cylinder B, in which the pistons are carried. The inner edges of the pistons are beveled, as shown in the drawings. *e* indicates the packing-bars, beveled on their outer edge to match the bevel on the pistons. It

is evident that pressure upon the inner edge of these bars will force the bars against one side of the recesses, and the piston against the other, making a tight joint on each side. *f* indicates a packing-block held in a slot cut in the end of the piston, which is pressed outward against the cylinder-head by the spiral spring *s*. One end of each of the pistons is supplied with this packing-block. The spring *s* is evident, in forcing the block *f* against the adjacent cylinder-head, will force the opposite ends of the pistons themselves against the opposite cylinder-heads, thus making steam-tight joints between the ends of the pistons and the cylinder-heads at both ends of the cylinder. *K K'* are stop-valves, by which the ports *g g'* may be closed or opened at pleasure. *L L* are cams formed on the interior faces of the cylinder-heads *C C*. They project into circular recesses in the ends of the cylinder *B*. Their peripheries are elliptical in form, corresponding in curvature to the interior surface of the cross-section of the steam-cylinder, with its curved abutments *a b*, leaving a space between them, respectively, and the said surface equal to the width of the projecting ends *l l*, Fig. 3, of the pistons. These ends of the pistons project onto the peripheral surfaces of the said cams, and in revolving slide around upon them, and are thereby forced outward in their recesses while passing from the center of the abutments into the open spaces *C*.

The operation of the engine with the improvements described is as follows, assuming that Fig. 1 represents the left hand: If it is desired to revolve the cylinder *B* from right to left, the steam is let on by sliding the valve *H* to the left, opening the port 1 for the introduction of steam, and the port 2 for its escape underneath the said valve, in the usual way. The steam will enter the steam-cylinder at *f* and *f'*, and escape at the diametrically-opposite points, respectively. The valve *H* will, by the same movement, open the port *g* a little in advance of the port 1, and the stop-valve *K* being open, the steam is let in to the channel *h*, and through the port *g''* behind the pistons *d¹ d²*, the ends of which, at the moment, are resting over the said port, these pis-

tons being thereby forced outward against the steam-cylinder *A*, so that when the port 1 is opened, the steam passing through it into the space *C* in the rear of the piston will find a steam-tight joint between the said pistons and the steam-cylinder. The pressure of the steam in the recesses *c* behind the pistons *d¹ d²* continues until they respectively reach a point in the spaces *C C'* midway between the abutments *a b*, when it is cut off by their recesses passing off from the ports *g g'*. At the same moment the opposite ends of the said recesses pass into the corresponding ports at the opposite end of the steam-cylinder, though the confined steam in the recesses behind the pistons *d¹ d²* may expand into the channel *h'* and condense, the stop-valves being closed, thereby relieving the pressure behind the said pistons, and while forming an elastic cushion under the pistons, which keeps them in contact with the steam cylinder, and causes them to revolve smoothly without clattering, enables them, nevertheless, to be forced back into their recesses in riding up onto the abutments without much friction. When the valve *H* is thrown to the opposite or right-hand side, all the movements are reversed, as will be apparent without further description.

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

1. The combination, in a rotary steam-engine, of the curved segmental abutments *a b*, the rotary cylinder *B*, recesses *c*, pistons *d*, the steam-channels *h h'*, and ports *g g'* in the cylinder-heads *C C'*, whereby live steam used for packing is let in behind the pistons immediately after they, respectively, in revolving, pass the centers of the abutments, and is cut off just as they pass onto the said abutments, as and for the purpose specified.

2. The combination, in a rotary steam-engine, of the recesses *c*, the pistons *d*, beveled on their inner edges, and the beveled packing-bars *e*, as and for the purposes specified.

Witness my hand this 11th day of September, A. D. 1874.

JOHN V. BEEKMAN.

Witnesses:

B. S. CLARK,

WILLIAM STEVENSON.