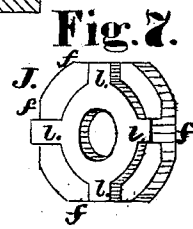
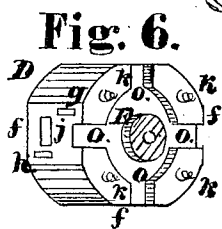
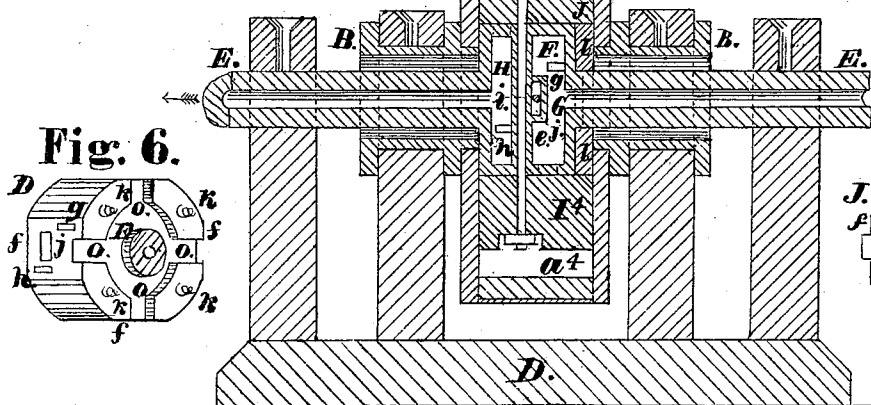
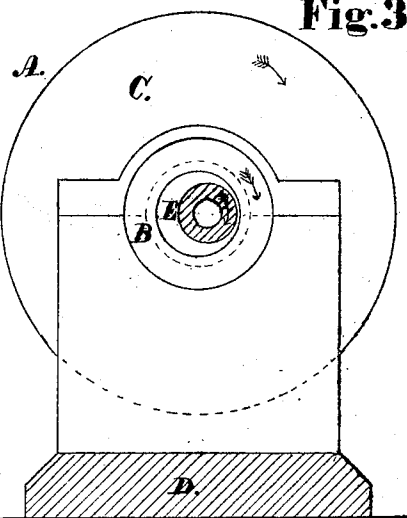
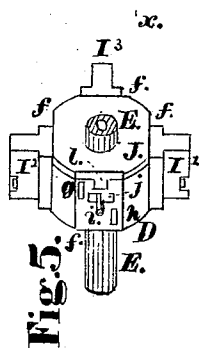
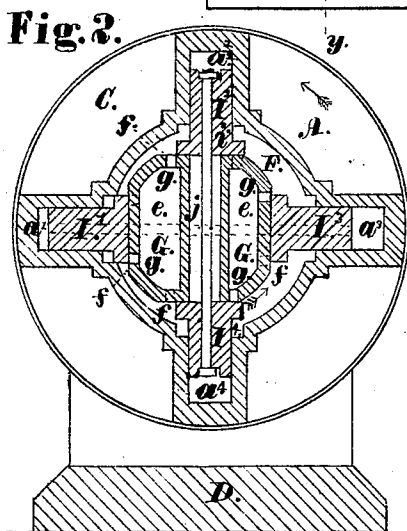
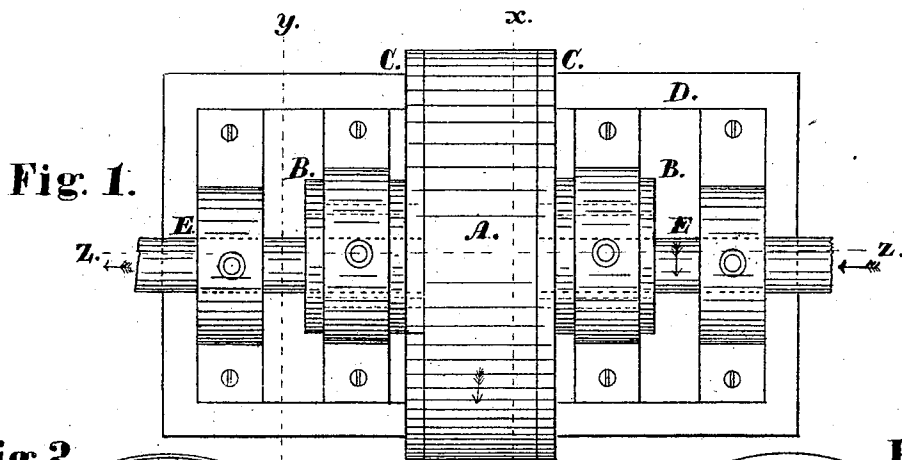


D. D. HARDY.
Rotary Steam-Engines.

No. 141,436.

Patented August 5, 1873.



WITNESSES:

Andrew Martin
Hugh W. Hill.

INVENTOR:

Dexter D. Hardy.
 Per. *Chas. P. Kossum,*
Attorney.

UNITED STATES PATENT OFFICE.

DEXTER D. HARDY, OF DELAVAN, ILLINOIS, ASSIGNOR OF ONE-HALF HIS
RIGHT TO HENRY R. GREENE, OF SAME PLACE.

IMPROVEMENT IN ROTARY STEAM-ENGINES.

Specification forming part of Letters Patent No. 141,436, dated August 5, 1873; application filed
January 15, 1873.

To all whom it may concern:

Be it known that I, DEXTER D. HARDY, of Delavan, in the county of Tazewell and State of Illinois, have invented certain Improvements in Rotary Steam-Engines, of which the following is a specification:

My invention relates to an improvement in rotary engines; and consists in so arranging and constructing the several parts as to obtain a uniformity of wear throughout the machine. First, in placing the exterior cylinder with its bearings concentric with the same, the bearings being tubular journals. Second, an interior shaft having a drum near the center, said shaft being placed within the tubular journals referred to, and placed eccentrically thereto and confined within journal-boxes to retain it in its eccentric position to the exterior cylinder.

Figure 1 is a plan of a rotary engine embodying my invention. Fig. 2 is a vertical transverse section on the dotted lines *x x*, Fig. 1; Fig. 3, a vertical transverse section on the dotted lines *y y*, Fig. 1; Fig. 4, a vertical longitudinal section on the dotted lines *z z*, Fig. 1; Fig. 5, a perspective view of drum, shafts, the pistons or valves, and packing-ring; Fig. 6, a perspective view of drum with packing-ring removed; and Fig. 7, a perspective view of packing-ring.

A represents the exterior cylinder, which is constructed as follows: Four equidistant radial slots, *a¹ a² a³ a⁴*, terminating near the periphery of the cylinder, said slots with shoulders or offsets on the interior of the cylinder; two tubular journals, B B, one at either side and connected to the cylinder-heads C C. Said tubular journals have bearings to support the same on the bed-plate D. E represents the interior shaft, and is made hollow at either end and divided by a transverse partition, *e*, through the drum F. (See Fig. 4.) The openings at either end communicate with cavities G H on either side of the partition. Each of said cavities have four ports, *g* and *h*, communicating with the space between the exterior of the drum and the interior of the cylinder A, said ports, at the will of the engineer, serving for either the supply or exhaust. Said drum has four planes, *f f f f*, equidistant, and

upon which the pistons or valves I¹ I² I³ I⁴ traverse. Said pistons or valves are placed in the slots *a¹ a² a³ a⁴*, and are kept in contact with the planes on the drum by rods *i i* passing through the drum, in or through elongated openings *j j* sufficient for the movement of said pistons or valves on their respective planes. The rods referred to are made to fit the holes in the piston or valves snugly, and loose in the elongated openings, said rods having nuts at one or either end for the purpose of adjusting said pistons or valves with reference to their contact-surfaces on the drum. Said drum has a packing-ring, J, at one end of the same, constructed in the same manner as the drum in reference to its periphery. The ring fits the shaft snugly and presses against one of the cylinder-heads by means of steam or the springs *k k*, or any elastic substance placed between said ring and said drum. Said ring has pieces *l l* attached, which fit into grooves *o o* at or near the center of the planes on the drum, for the purpose of breaking the joint, and preventing the steam from passing from the receiving to the exhaust side of the engine through the space thus created between the packing-ring and the drum. (See Figs. 6 and 7.) The steam-pipes leading to the shaft at either end are inserted in the same, of a sufficient depth to admit of packing in the ordinary way, and said pipes secured to the bed-plate.

The operation of this rotary engine is as follows: The steam enters the shaft (at either end, optional with the engineer,) and passes into the cavity G; thence through the ports *g g* into the space between the exterior of the drum and the interior of the cylinder A, exerting its force upon the pistons I¹ and I² simultaneously, carrying them before it, and consequently the exterior cylinder and the drum, the latter moving with the former. It will be seen that the steam acts thus by its constant effect in expanding to arrive at the largest part of the steam-space along the continually-opening curves of the steam-space until the ports *h h* are opened to exhaust. There are thus always two ports open to receive steam and two open to exhaust the same. The pistons or valves traverse on their respective planes on the drum

in making the circuit. Each pair of pistons or valves being connected by the rods *i i* sliding in the elongated openings through the drum, keep them in close contact with the drum, and their contact-surfaces (with the planes of said drum) traverse a space on said planes identical with the eccentricity of the exterior cylinder, opening and closing the ports, and this contact of the pistons or valves with the planes on the drum is the means by which the latter is rotated in unison with the exterior cylinder.

I claim as my invention—

1. The drum F having its shafts E E con-

centric thereto and placed eccentrically to the exterior cylinder A, and revolving in the same direction and at uniform speed.

2. The drum F with partition *e*, cavities G H, and ports *g h*, in combination with the pistons or valves I¹ I² I³ I⁴.

3. The combination of the packing-ring J, drum F, shaft E, and cylinder A, substantially as and for the purpose set forth.

DEXTER D. HARDY.

Witnesses:

CHARLES P. HOUSUM,
JACOB I. BEAR.