No. 809,054. PATENTED JAN. 2, 1906.

A. HAGER.

ROTARY ENGINE.

APPLICATION FILED SEPT. 21, 1905.

Fig. 1.

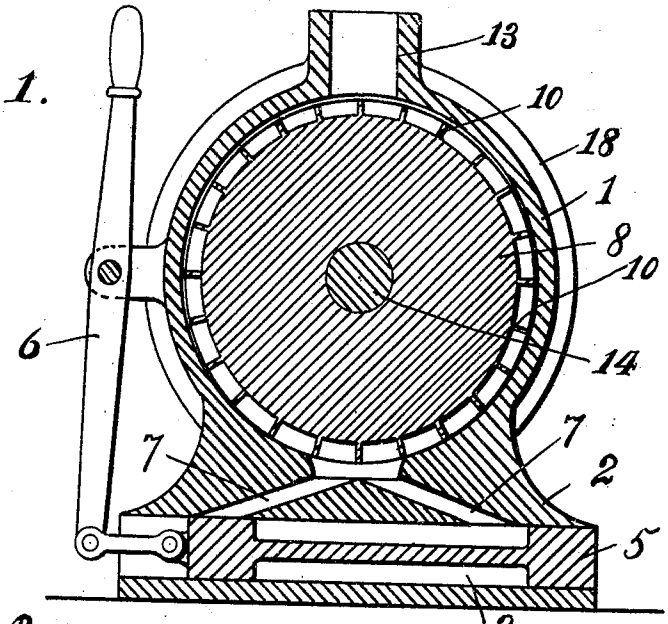


Fig. 2.

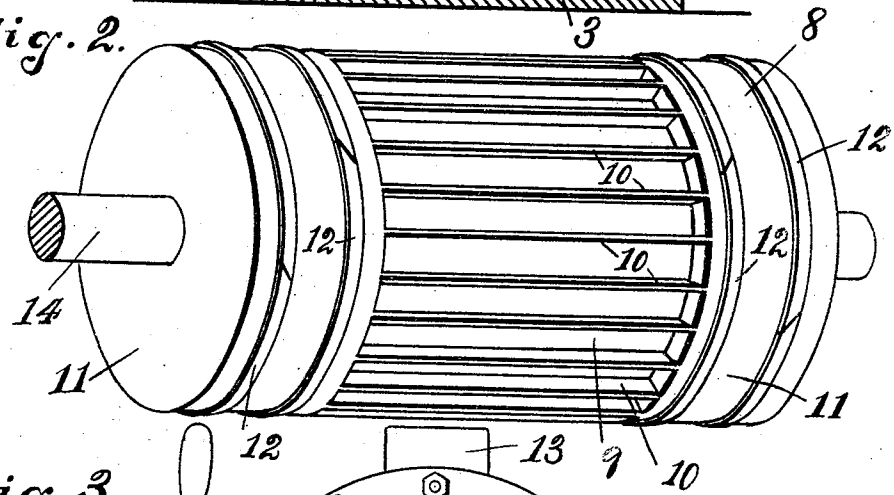
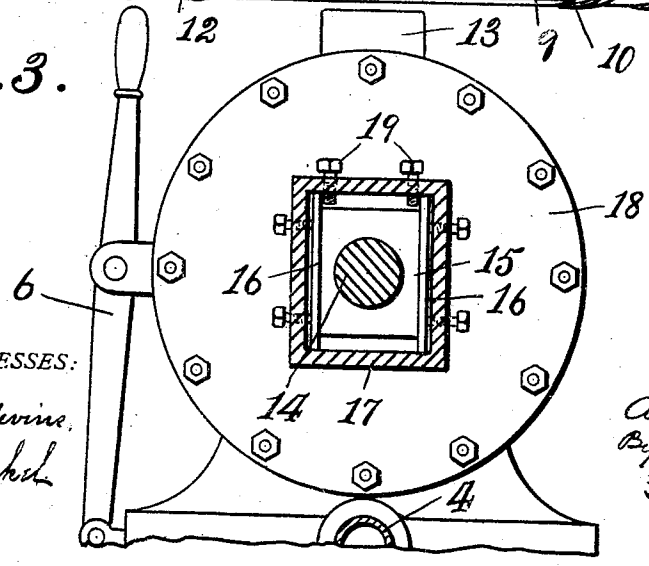


Fig. 3.



WITNESSES:

K. Lockwood Nevins.

Bruce Crosby

INVENTOR.

Andrew Hager

By F. W. Wright

ATTORNEY.

UNITED STATES PATENT OFFICE.

ANDREW HAGER, OF SAN FRANCISCO, CALIFORNIA.

ROTARY ENGINE.

No. 809,054. Specification of Letters Patent. Patented Jan. 2, 1906.

Application filed September 21, 1905. Serial No. 279,554.

To all whom it may concern:

Be it known that I, ANDREW HAGER, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

This invention relates to rotary engines adapted to be operated by steam or any compressed fluid, the object of the invention being to provide an engine which will be simple in construction, effective in operation, and which can be driven equally well in either direction.

In the accompanying drawings, Figure 1 is a transverse section of the engine. Fig. 2 is a perspective view of the cylinder removed. Fig. 3 is a sectional view through the end of the engine.

Referring to the drawings, 1 represents a suitable casing, which is of a general cylindrical form, but is extended at the bottom to form a base 2. Within said base is formed the steam-chest 3, supplied by a steam-pipe 4, in which chest reciprocates a reversing-valve 5, controlled by a lever 6, said valve being adapted to close one or the other of two steam-ports 7, one of said ports being open, while the other is closed. Within the casing rotates a cylinder 8, which comprises a central working portion 9, formed with radial vanes 10 and terminal portions 11, between which said vanes extend, said terminal portions being cylindrical and having in grooves therein packing-rings 12, which rings confine the steam to the central portion of the cylinder and prevent it escaping except by means of the exhaust-port 13. Said exhaust-port is located at the top of the cylinder diametrically opposite to the entrance from the steam-ports.

The shaft 14, to which the rotating cylinder is secured, revolves in boxes 15, which slide vertically between guides 16, adjustably secured within cages 17, formed on the heads 18 of the cylinder, the upward movement of the boxes being limited by the screws 19 through the tops of said cages.

It is an important feature of the present invention that the rotating cylinder is not supported by the shaft thereof resting upon bearings, as is common in rotary engines; but the cylinder itself rests when stationary in the bottom of the casing, and when in action the pressure of the steam which is introduced at the bottom of the casing counterbalances more or less the weight of the cylinder. The reason for this construction is as follows: It will be observed that the steam flows through the steam-ports and strikes the vanes substantially tangentially to the circumference of the cylinder and is then in the rotation of the cylinder confined between the vanes, the body of the cylinder, and the inner wall of the casing. Now if the cylinder fits tightly in the casing at the bottom where the steam enters, so that absolutely no steam can escape past the vanes in a forward direction, then the steam exerts a pressure forward upon the vane and backward upon the succeeding vane, and therefore from the steam confined within each of the chambers so formed between the two adjacent vanes, the body of the cylinder, and the casing we obtain, not a force or momentum to impel the cylinder, but a substantially equal pressure in all directions which has no propelling force upon the cylinder. If, on the other hand, the cylinder does not fit so tightly within the casing as to entirely prevent the forward escape of the steam, then the momentum of the steam is not all converted into pressure, but remains as momentum, passing the edges of the vanes on its forward motion, but at the same time imparting to each vane that it passes some of its momentum. There is then substantially no back pressure upon the succeeding vanes. In this way the momentum of the steam in passing from the steam-port to the exhaust-port can be utilized to transmit momentum to the cylinder without causing back pressure thereon. The construction is such that the operation of the steam is automatic or self-controlling, as will be readily seen from contemplating the operation from the point when the steam is admitted to the cylinder. At that time the cylinder is stationary and opposes its inertia to the pressure of the steam, so that the steam admitted is absolutely confined by the weight of the cylinder and cannot escape. The pressure resulting from the momentum of the confined steam then increases to its maximum, while the momentum of the steam diminishes to zero, because the steam cannot escape; but because of this maximum pressure of the steam, since this pressure is upward against the bottom of the cylinder, the cylinder is at once raised, allowing the steam to escape, which it naturally does in the direction of its initial momentum. The pressure is then reduced, and the cylinder drops again, since the upward pressure has

decreased. It will readily be seen that the weight of the cylinder can be so proportioned to the upward force produced by the pressure of the steam that it will be substantially balanced and the exact amount of clearance can be given which will permit of the steam having its maximum effect. It is for this reason that the cylinder is made solid and with the heavy terminal portions, or in place thereof heavy fly-wheels may be used, the object being to balance the upward pressure of the steam in a greater or less degree, so as to permit theforward escape of steam, but only under a given pressure.

It will be observed that the steam-inlet space of either inlet-port is of a width in a circumferential direction substantially equal to twice the distance between adjacent vanes, the consequence of which is that the initial force of the steam is exerted in a forward direction always upon two opposite vanes, thus utilizing the propulsive force of the steam to the greatest advantage.

I claim—

1. In a rotary engine, the combination of a cylindrical casing, a cylinder rotating therein, the casing being provided at its lowest point with a steam-inlet substantially tangential to the cylinder, and guides for the shaft of the cylinder permitting the cylinder to rest in the bottom of the casing, said guides permitting the shaft to rise when steam is admitted to counterbalance the weight of the cylinder, substantially as described.

2. In a rotary engine, the combination of a substantially cylindrical casing, a cylinder rotating therein having longitudinal vanes and terminal cylindrical portions, packing-rings around said cylindrical portions, the casing being provided at the bottom with oppositely-directed inlet-ports substantially tangential to the cylinder, means for controlling said ports whereby they may be used alternately for reversing the direction of the cylinder, boxes for the shaft of the cylinder, and vertical slideways for said boxes, whereby the upward pressure of the live steam counterbalances more or less the weight of the cylinder, substantially as described.

3. In a rotary engine, the combination of a substantially cylindrical casing, a cylinder rotating therein having longitudinal vanes and terminal cylindrical portions, packing-rings around said cylindrical portions, the casing being provided at the bottom with oppositely-directed inlet-ports substantially tangential to the cylinder, means for controlling said ports whereby they may be used alternately for reversing the direction of the cylinder, boxes for the shaft of the cylinder, and vertical slideways for said boxes, whereby the upward pressure of the live steam couterbalances more or less the weight of the cylinder, and means for laterally adjusting said slideways, substantially as described.

4. In a rotary engine, the combination of a substantially cylindrical casing, a cylinder rotating therein having longitudinal vanes and terminal cylindrical portions, packing-rings around said cylindrical portions, the casing being provided at the bottom with oppositely-directed inlet-ports substantially tangential to the cylinder, means for controlling said ports whereby they may be used alternately for reversing the direction of the cylinder, boxes for the shaft of the cylinder, vertical slideways for said boxes, whereby the upward pressure of the live steam counterbalances more or less the weight of the cylinder, and screws limiting the upward movement of the boxes, substantially as described.

5. In a rotary engine, the combination of a substantially cylindrical casing, a cylinder rotating therein having longitudinal vanes and terminal cylindrical portions, packing-rings around said cylindrical portions, the casing being provided at the bottom with oppositely-directed inlet-ports substantially tangential to the cylinder, and each extending circumferentially about twice the distance between the vanes, means for controlling said ports whereby they may be used alternately for reversing the direction of the cylinder, boxes for the shaft of the cylinder, and vertical slideways for said boxes, whereby the upward pressure of the live steam counterbalances more or less the weight of the cylinder, substantially as described.

In witness whereof I have hereunto set my hand in the presence of two subscribing witnesses.

ANDREW HAGER.

Witnesses:
E. WOODWARD,
BESSIE GORFINKEL.