J. MOORHOUSE.

ROTARY-ENGINES.

No. 195,630. Patented Sept. 25, 1877.

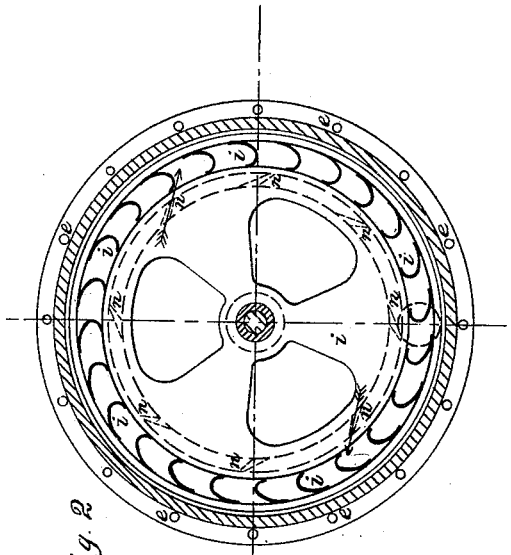

Fig. 2

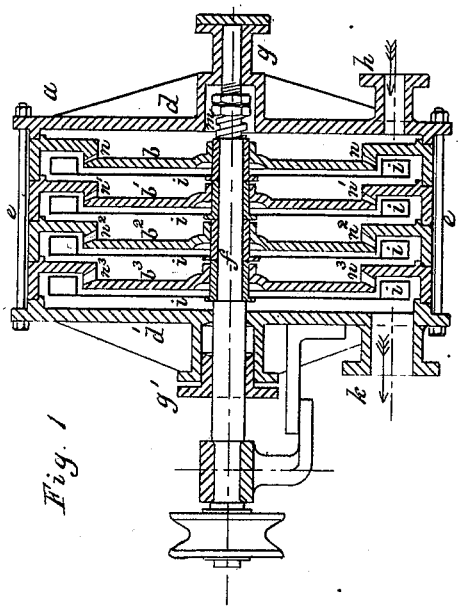

Fig. 1

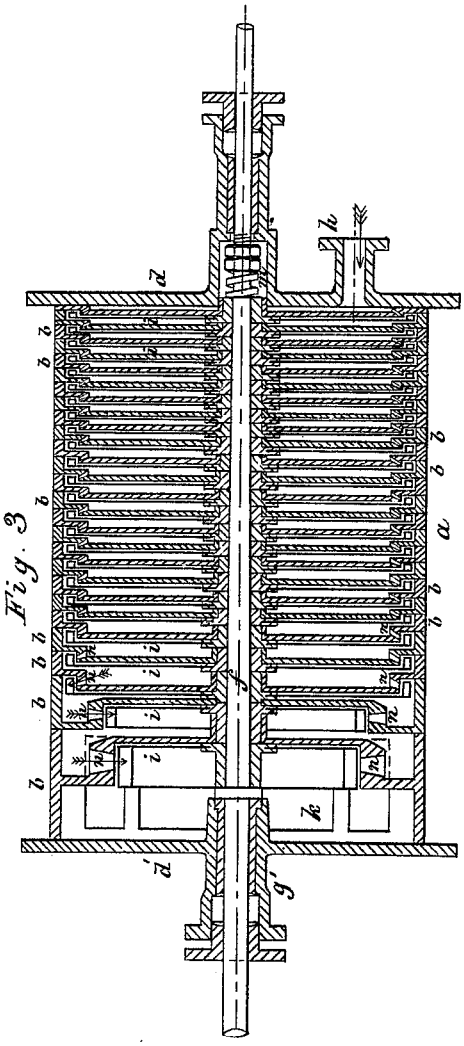

Fig. 3

Witnesses.

Chandler Hall

Thomas E Birch

Inventor.

James Moorhouse

by his Atty.

Edwin H. Brown

UNITED STATES PATENT OFFICE.

JAMES MOORHOUSE, OF MANCHESTER, ENGLAND.

IMPROVEMENT IN ROTARY ENGINES.

Specification forming part of Letters Patent No. **195,630**, dated September 25, 1877; application filed February 7, 1877.

To all whom it may concern:

Be it known that I, JAMES MOORHOUSE, of Manchester, in the county of Lancaster, England, have invented certain new and useful Improvements in Rotary Engines; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawing, making part of this specification, in which—

Figure 1 is a longitudinal section of a rotary engine constructed according to my invention. Fig. 2 is a transverse section of the same. Fig. 3 is a longitudinal section of a larger rotary engine drawn upon a smaller scale.

My invention relates to certain new and useful improvements in rotary engines driven by steam, compressed air, or other elastic fluid, by which the expansive force of the elastic driving-fluid is more completely utilized without working the engine at too high a velocity than in rotary engines as heretofore constructed.

My invention consists of a cylinder, of iron or other suitable material, built up in sections and held together by longitudinal bolts, each section composing a separate compartment, the number of compartments varying according to the pressure of the steam to be used and the amount of expansion required.

Through the center of the cylinder passes a revolving driving-shaft working in stuffing-boxes in ends bolted to the cylinder, the shaft being connected by toothed wheels, friction-gear, pulleys, or other ordinary means to the machinery which is to be driven.

Upon the shaft inside the cylinder are fitted a series of turbine wheels, each having at or near its circumference a sufficient number of vanes, chambers, or buckets resembling those ordinarily used in turbines driven in the usual way by water. These turbine wheels are as many in number as the compartments into which the cylinder is divided, and each compartment, with its contained turbine wheel, is separated from the adjoining compartments by means of a dividing-plate or diaphragm formed upon each separate section of the cylinder, or fitted upon the driving-shaft and held between the said sections when the cylinder is put together. The position of the dividing-plates is preferably such that each succeeding compartment is of greater capacity than the one preceding it.

The elastic driving-fluid is admitted at or near one end of the cylinder into the smallest compartment, and is discharged, at or near the other end of the cylinder, into the open air; or, if steam is used, it may be discharged into a condenser connected with an air-pump operated by the engine itself in the usual way. In its passage through the cylinder the elastic driving-fluid passes through each compartment in succession, and actuates, in the manner hereinafter described, the turbine wheel contained in each such compartment, thus causing the revolution of the driving-shaft.

Openings are made in the dividing-plates which separate each compartment from the adjoining ones, and the area of these openings is proportioned to the pressure of the steam or other driving-fluid, and to the number of compartments and of turbine wheels, and to the extent to which it is desired that the driving-fluid should be expanded before being finally discharged from the engine. By this means the driving fluid, admitted at its highest pressure into the smallest compartment, passes into the second compartment through openings of such area that it expands to a calculated extent. The same process is repeated in its passage from the second to the third compartment, and so on through all the compartments until from the last it is discharged, as already described.

The openings in the dividing-plates between the several compartments are arranged so that the driving-fluid, in its passage through them, operates upon the vanes or buckets upon the turbine wheel in the compartment into which it is passing, and the turbine wheel is thus driven with a force proportioned to the difference in pressure of the driving-fluid in the two compartments.

By the novel arrangement described the difference of pressure between each two adjoining compartments is comparatively small, and it is thus possible to actuate the turbine wheels and the driving-shaft at a moderate speed, which is impracticable where high-pressure steam is used to drive a single turbine wheel.

In the drawing, in Figs. 1 and 2, *a* is the cylinder, built up in sections *b* b^1 b^2 b^3, provided with ends *d* *d'*, and held together by the longitudinal bolts *e*. The central driving-shaft *f* passes through stuffing-boxes *g* *g'*, and has keyed upon it turbine wheels *i i i i*, each of which revolves in one of the compartments into which the cylinder is divided, as shown. The steam is admitted through the inlet-pipe *h*, and is discharged through the pipe K. The turbine wheels are shown firmly held together upon the shaft *f* by the spring and nuts *m*. Openings of area, properly proportioned as above described, are made in the dividing-plate between each compartment at *n n n n*, through which the driving-fluid passes, as shown by the arrows, and its passage actuates the vanes or buckets at the circumference of the turbine wheels *i i i i*.

Where a low initial pressure of the elastic driving-fluid is used, and the cylinder is divided into only a small number of compartments, the latter may be made of equal size, the gradual expansion and reduction in pressure being effected entirely by the increasing area of the openings *n n n n*.

Fig. 3 represents a steam-engine in which the cylinder is divided into twenty-four compartments. *a* is the cylinder, built up in sections *b b b b b b*, &c. The shaft *f* has keyed upon it the turbine wheels *i i i i i*, fitting and revolving in compartments of gradually-increasing capacity, separated by dividing-plates having openings of properly-proportioned area, through which the steam passes, actuating the turbine wheels *i i i i i*, &c., in its passage. If steam of ninety-six pounds per square inch is admitted through the inlet-pipe *h* the openings in the first dividing-plate are of such area that its pressure is reduced to ninety-two pounds in the second compartment; and in its passage it drives the first turbine wheel with an effective pressure of four pounds per square inch only. In the same way it passes through all the other compartments in succession, its pressure being reduced four pounds per square inch in each, but its volume being increased proportionally by expansion. In the twenty-fourth compartment there will therefore be a pressure of four pounds to the square inch only; and the steam may then be discharged into the open air, or it passes into another compartment (actuating a turbine wheel in its passage) through openings of area sufficient to retain a pressure of two pounds per square inch, and may then be discharged (actuating a last turbine wheel) into the open air or a condenser.

In the last two compartments, where the effective pressure is only two pounds per square inch, and the velocity of the turbine wheels should be less in the proper proportion, the latter are shown of less diameter; and they are shown actuated by the steam from the outside instead of the inside.

The openings may be cast in the dividing-plates, or they may be bored; but instead of the arrangement shown the steam may be made to pass from each compartment to the next through a passage or pipe regulated by a cock or valve, so that the pressure in each compartment may be more accurately fixed.

The driving-shaft has keys fitted into it where the centers of the turbine wheels fit upon it; and the latter have corresponding keyways cut in them, so that they can be slipped upon the shaft one after another, and kept firmly in their position by the spring and nuts, as described and shown. Various forms of turbine wheels may be used, and the steam may be made to pass from the outside of one to the inside of the next, and from the inside of the latter to the outside of the succeeding one, and so on.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In combination with a rotary engine, the dividing-plates between the compartments provided with openings forming communications, respectively, of varying area between said compartments, the turbine wheels in such compartments, and a driving-shaft, substantially as and for the purpose set forth.

2. In combination with a rotary engine, the cylinder *a*, composed of separate sections *b*, ends *g* *g'*, held together by bolts *c*, and forming separate compartments, the turbine-wheels *i*, driving-shaft *f*, and openings *n* through the dividing-plates between the compartments, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JAMES MOORHOUSE.

Witnesses:

JOHN BOON,

ALEXANDER KARG.