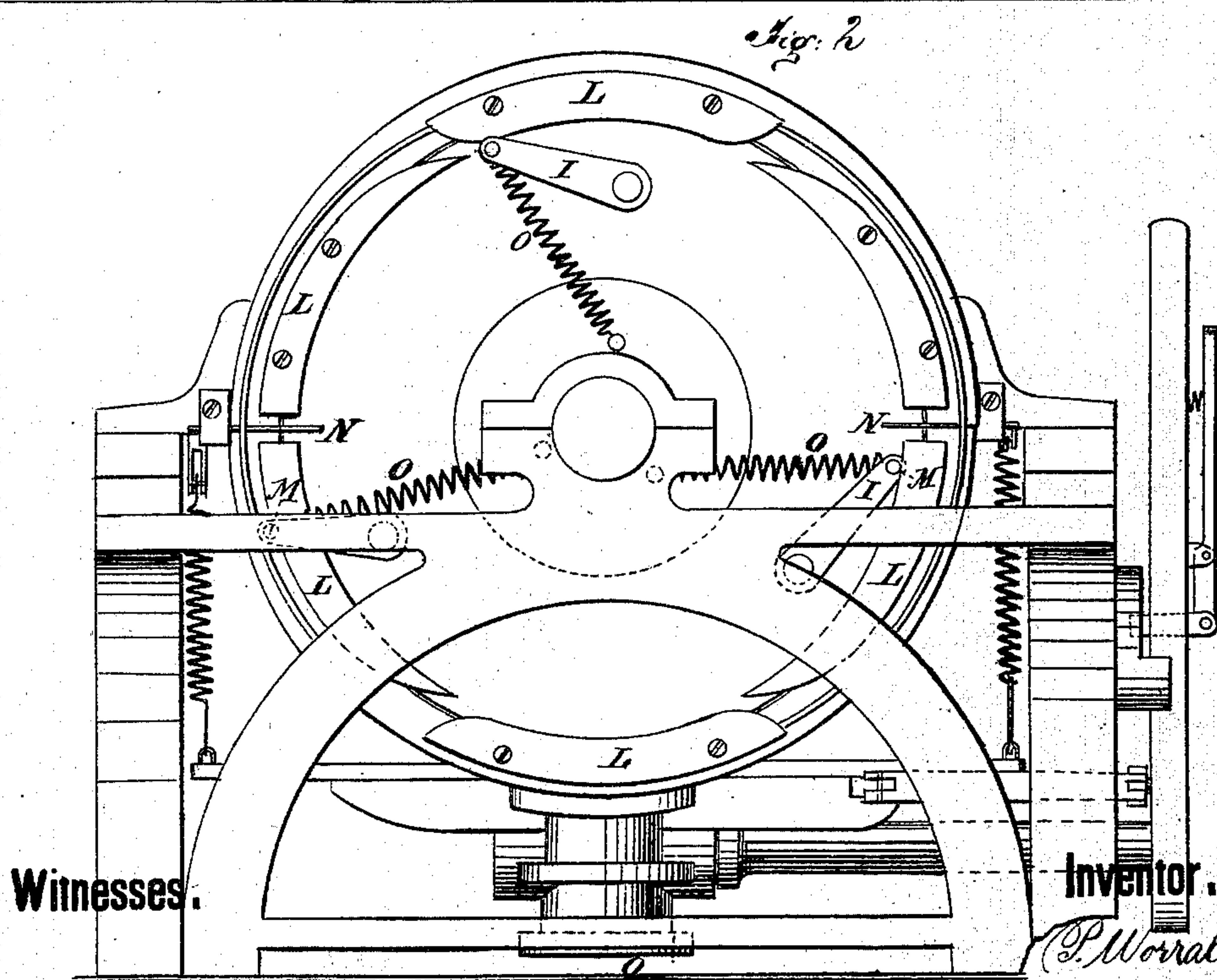
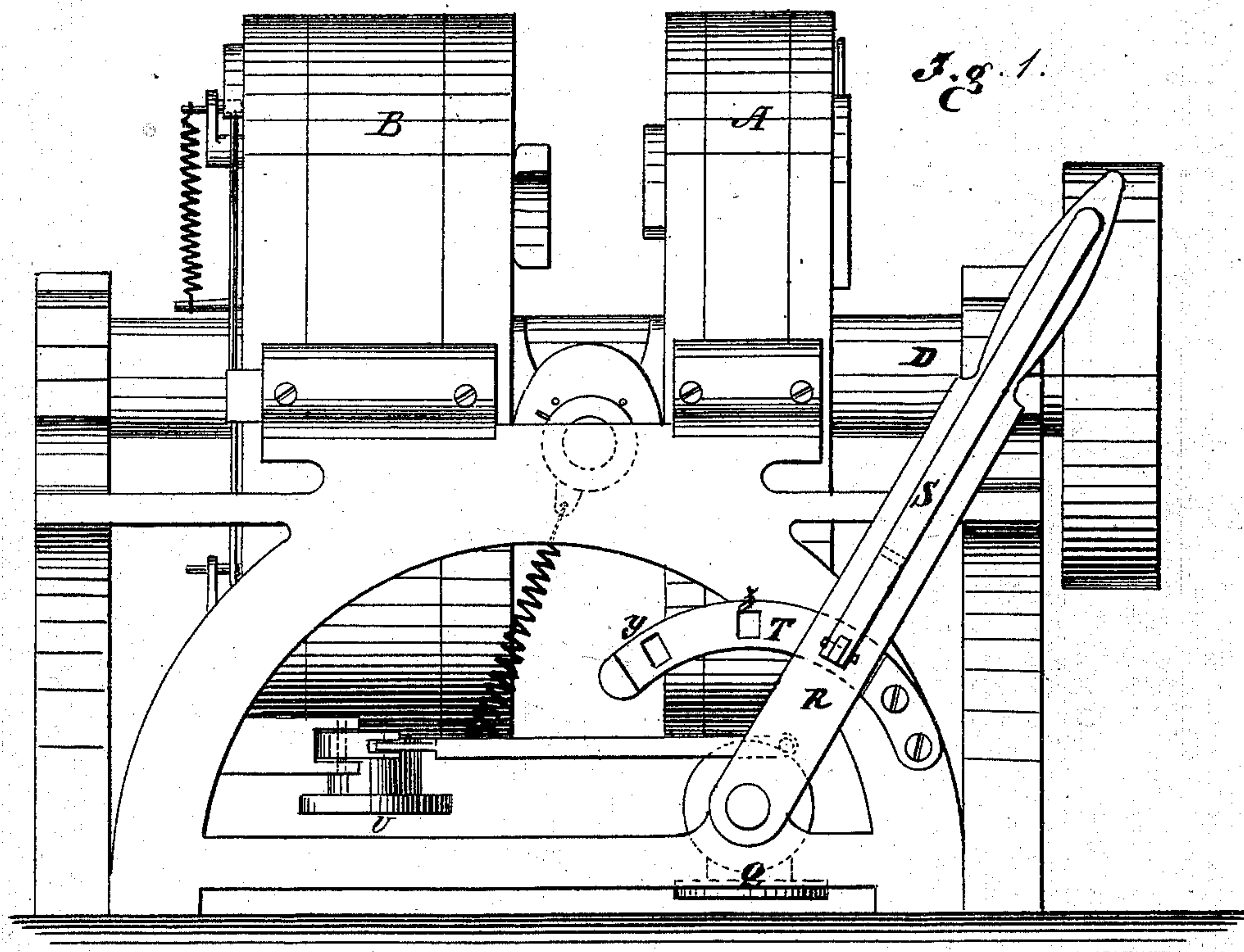


P. WORRALL.
Rotary-Engines.

No. 144,722.

Patented Nov. 18, 1873.



Witnesses:

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Alfred Luncett

Inventor.

P. Worrall.

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Fig. 3

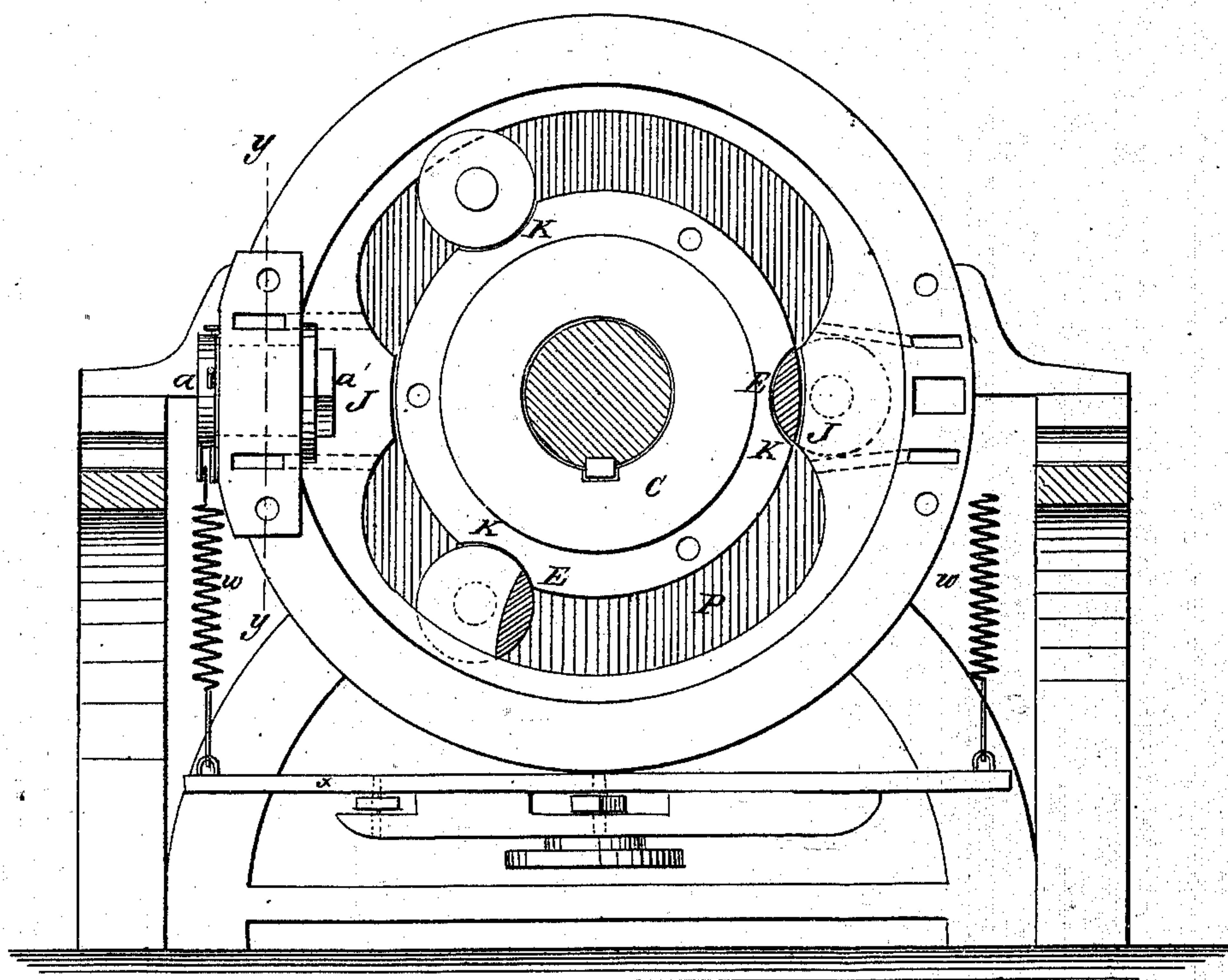


Fig. 4.

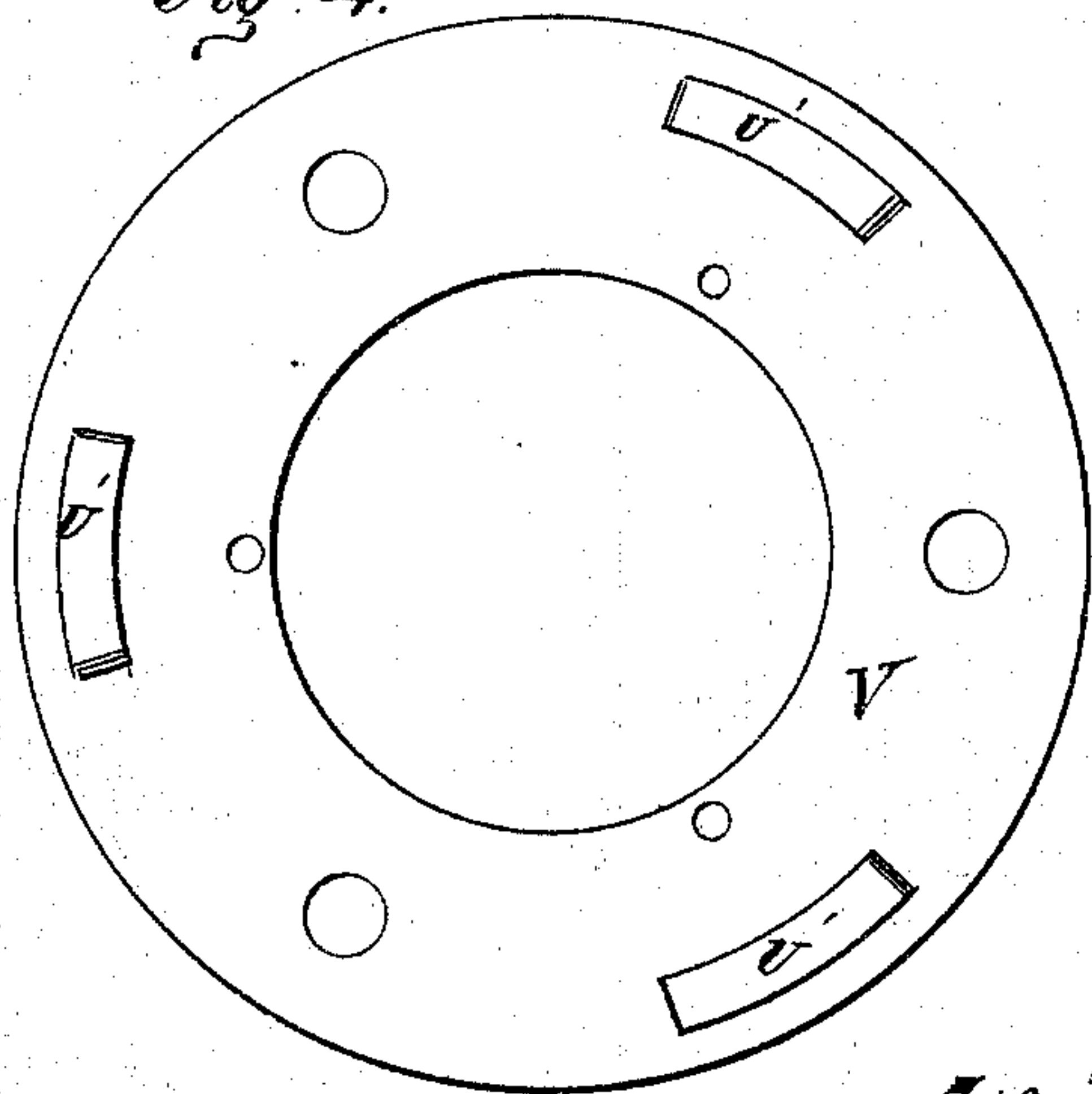


Fig. 5.

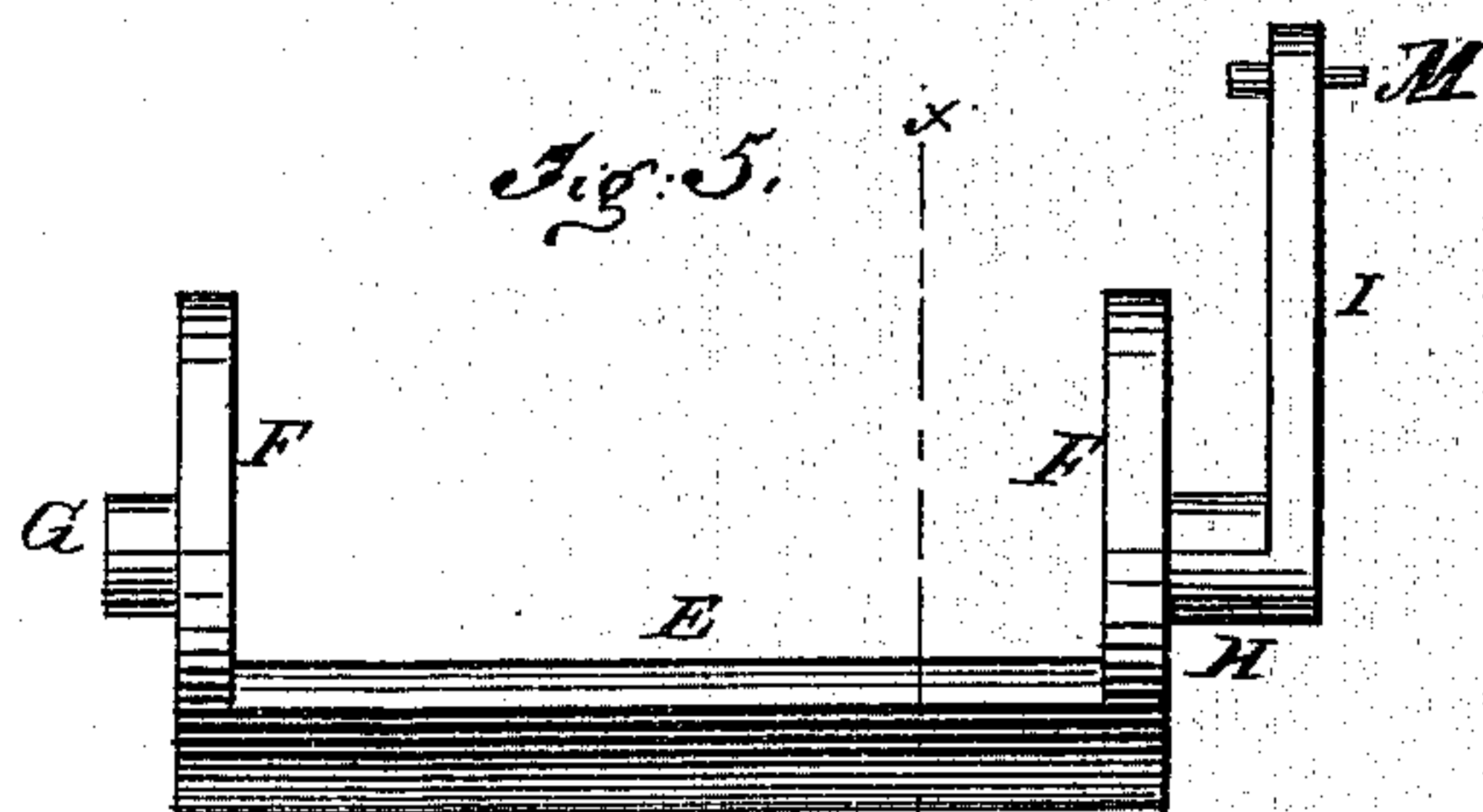


Fig. 6

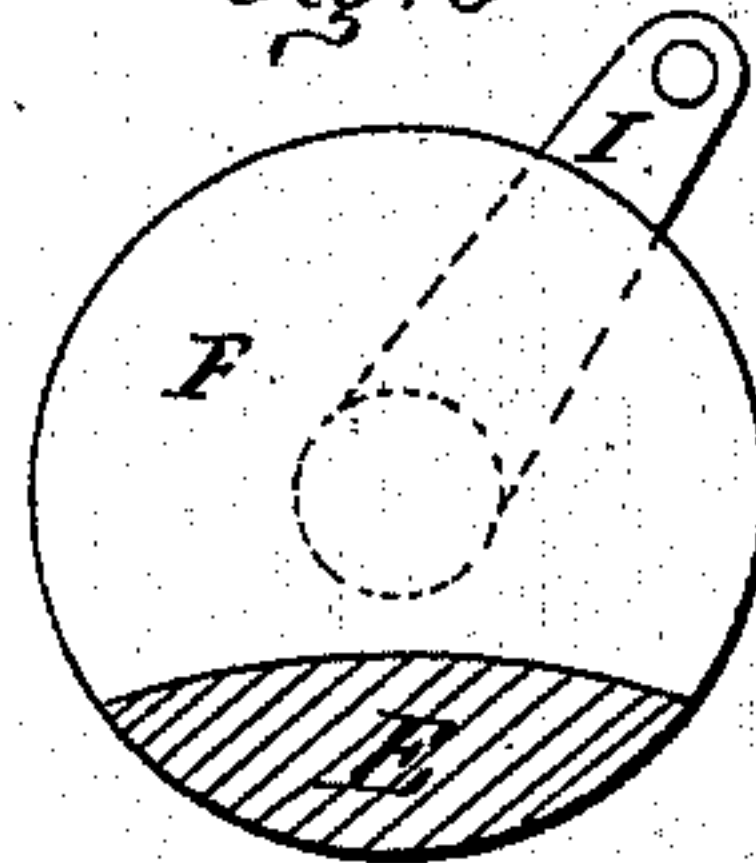
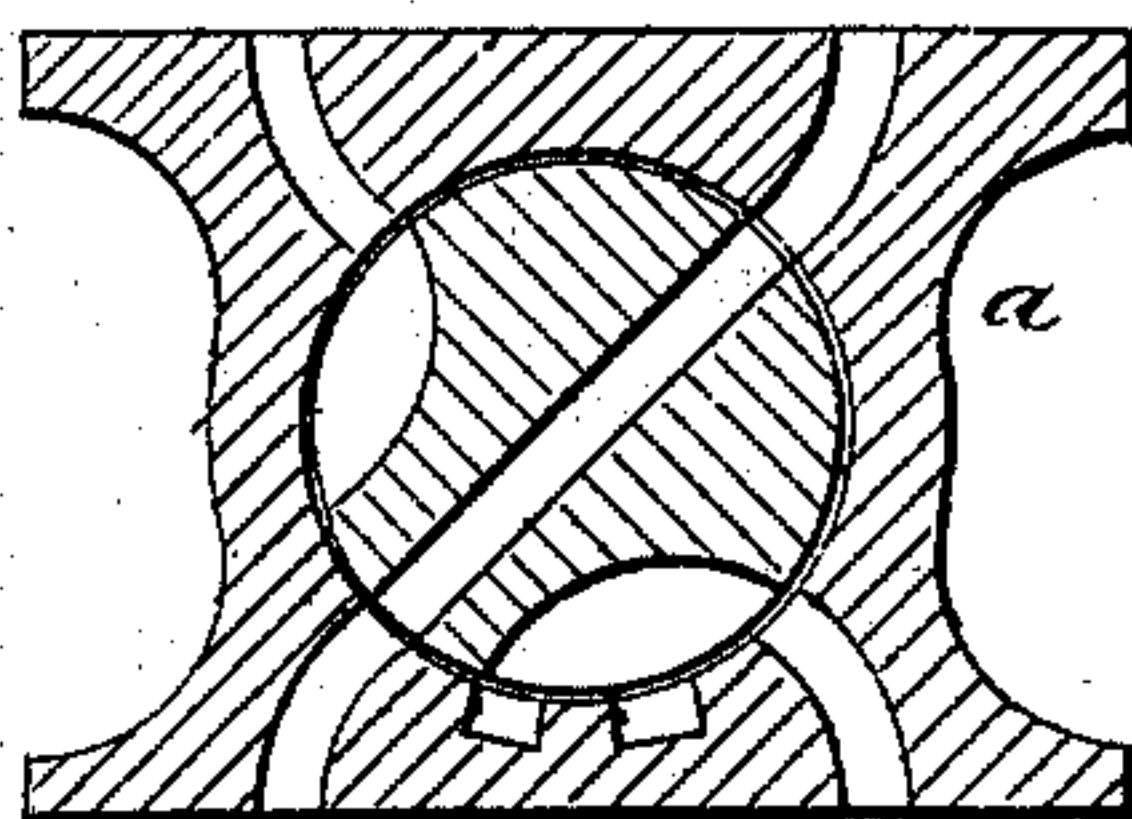


Fig. 7



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UNITED STATES PATENT OFFICE.

PETER WORRALL, OF SUGARTOWN, PENNSYLVANIA.

IMPROVEMENT IN ROTARY ENGINES.

Specification forming part of Letters Patent No. 144,722, dated November 18, 1873; application filed September 6, 1873.

To all whom it may concern:

Be it known that I, PETER WORRALL, of Sugartown, in the county of Chester and State of Pennsylvania, have invented a new and useful Improvement in Compound Rotary Engines, of which the following is a specification:

The invention will first be fully described, and then pointed out in the claims.

In the accompanying sheets of drawing, Figure 1, Sheet 1, represents a side elevation. Fig. 2, Sheet 1, is an end elevation, showing the cams on the outside for governing the traveling pistons. Fig. 3, Sheet 2, is an inside view, showing cross-sections of the pistons, with one valve in place, and one removed. Fig. 4, Sheet 2, is a view of one of the annular plates of the piston-wheels at the inner ends of the pistons. Fig. 5 is a view of one of the pistons with the crank attached. Fig. 6 is a section of Fig. 5 on the line *x x*. Fig. 7 is a section of Fig. 3, taken on the line *y y*, showing the valve through which the steam is conducted from one cylinder to the other.

Similar letters of reference indicate corresponding parts.

A is the cylinder into which the steam is first introduced. B is the cylinder into which the cylinder A exhausts. C is a piston-wheel in each cylinder, which are fast on the main shaft D. E represents the pistons which revolve or travel with the wheels C. Each wheel has three pistons, so that two are always under steam-pressure when the third one is taking steam.

The pistons are of peculiar construction, being longitudinal sections of a cylinder, with a circular head, F, at each end, upon which are journals G H, to the latter of which a crank, I, is attached.

J J are abutments in each cylinder. The piston-wheel runs so as to just clear these abutments. K represents cavities or arcs of circles corresponding with the size of the piston C in the periphery of the piston-wheels. The pistons, while being carried round in the cavities K with the wheels, are turned on their own axes, so as to present no obstacle to the abutments, by means of a system of stationary cams, L, and a guiding-

pin, M, the latter on the ends of the cranks I. N are springs between the cams, opposite the abutments, which the pins M strike, and which turn the pin from the outside to the inside of the cams. O is a spiral spring, connected with each crank to aid in the motion.

When the pistons reach the abutments they are turned so as to fit into the cavities K. One of the pistons is seen in this position in Fig. 3. As it leaves the cavity K it is directly turned so that its broad and more flattened sides take steam, thus making the steam surface or area of the piston greater than the area of the cylinder P.

The steam is introduced into the cylinder A at Q, the valve being operated by means of the lever R, which is held in position by means of the spring-lever S and circle T.

U is the exhaust-aperture. The intermediate valves *a*, between cylinder, are placed back of the abutments J, and are operated by means of the ribs U' on the plates V of the piston-wheels. The ends of the valves *a'* project inward, and are triangular in cross-section.

As the wheels revolve, the end of the ribs strikes one of the angles, and turns the valve so that the ports admit and exhaust steam. The seat and valve are seen in Fig. 7. The back motion of the valve is produced by means of the spiral spring *w* attached to the lever X. The action of the engine is reversed by changing the lever R to the aperture Y in the circle T. When the lever stands upright, or at the aperture Z, the steam is shut off, and the engine stands still.

It will be seen that the steam, after doing work, and, consequently, losing a portion of heat and pressure in the first cylinder, is exhausted into the second cylinder, where it acts upon the pistons in the same manner, doing more work, and parting with a large portion of its remaining heat and pressure. The boiler heat and pressure of the steam is, therefore, utilized in this engine to a much greater extent than it is in ordinary reciprocating engines.

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

1. The cylinders A B, having recessed wheels C K on the same shaft D, and the former exhausting into the latter, in combination with are sectional pistons E, having the circular head F, constructed and arranged to operate substantially as and for the purpose set forth.
2. The valve *a*, with the triangular ends *a'*, springs *w*, and bar X, arranged in combination with the cylinders A B, as and for the purposes described.

PETER WORRALL.

Witnesses:

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ALEX. F. ROBERTS.