(No Model.)

T. W. KINKAID.

ROTARY ENGINE.

No. 444,938. Patented Jan. 20, 1891.

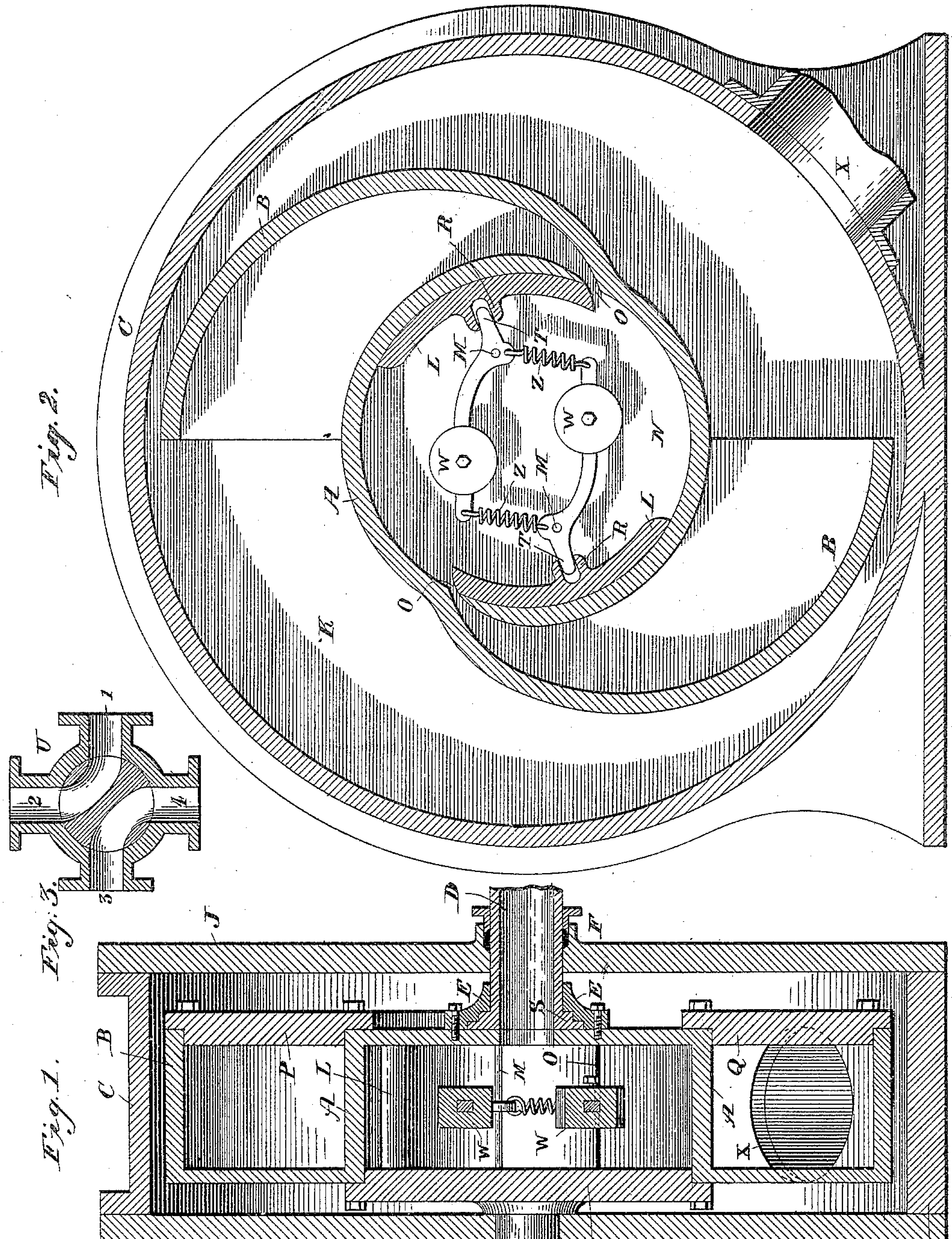

Fig. 2.

Fig. 3.

Fig. 1.

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THOMAS W. KINKAID, OF THE UNITED STATES NAVY.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 444,938, dated January 20, 1891.

Application filed August 26, 1890. Serial No. 363,085. (No model.)

To all whom it may concern:

Be it known that I, THOMAS W. KINKAID, an officer of the U. S. Navy, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Rotary Engines Operated by a Flow of Fluid Under Pressure; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to rotary engines operated by a flow of fluid under pressure; and it consists substantially in such features of improvement as will hereinafter be more particularly described and claimed.

The improvements relate to the familiar form of engine known as "Hero's engine" or "Barker's mill," as will appear from the following description, taken in connection with the accompanying drawings, in which—

Figure 1 is an elevation in section taken perpendicularly to the axis of the driven shaft. Fig. 2 is a vertical sectional elevation through the axis of said shaft. Fig. 3 is a sectional view in detail.

Referring to the several figures of the drawings by the letters marked thereon, A represents a cylindrical drum, having coaxial with it an entrance for a supply of fluid through the supply-pipe D, and having an exit or exits O in the periphery. The said drum A is coaxial with the shaft H, to which it is secured, and is also coaxial with the supply D, communicating with the same from one side, as shown. That end of the supply-pipe D which abuts against the head of the drum A is formed with a conical stepped flange or head S, which engages with a conical stepped collar E, the latter being secured to the drum coaxially. The joint between the parts S and E is made fluid-tight, and is kept tight by the excess of fluid-pressure existing inside the drum above any fluid-pressure existing immediately without the drum.

To each exit or port O of the drum A is attached a nozzle B, the sectional area of which gradually increases so as to permit of gradual expansion of the issuing fluid and a gradual reduction of its velocity of exit, the said nozzle being conformed to the surface of the drum in such manner that the final direction of outflow of the fluid must be approximately at right angles to a radius from the drum's center to issuing-point and in a plane at right angles to the drum's axis. A casing C surrounds the drum and its attachments, and stuffing-boxes F and G are provided in the casing to permit of the passage through said casing of the shaft H and the supply-pipe D without leakage of fluid.

For each port O is provided a governing-valve L, consisting of a piece fitted to the internal cylindrical surface of the drum A, and having dimensions somewhat more than sufficient to cover the said port O. A notch or tooth-space R in the valve L is so situated as to engage with one end of a lever T, pivoting on a spindle M, parallel to the axis of the shaft H, a weight W being adjustable on the lever. The end of the said valve-plate L adjacent to the port O is so curved as to present, when the port is wide open, a continuation of one of the bounding surfaces of the tapering nozzle B. The end of the lever most distant from its corresponding valve-plate is constrained by a spiral spring Z, one end of said spring being secured to the said end of the lever and the other end of the spring being attached to any convenient point within the drum A.

The casing C has an exhaust opening or openings, as at X, from which the exhaust-fluid may be carried to any desired point.

The action of the engine is as follows: Fluid under pressure enters through the pipe D, this pipe being secured to prevent rotation, but being capable of a slight motion to and fro in the direction of its axis. The fluid thus supplied to the interior of the drum A escapes through the ports O into the tapering nozzles B. The escaping fluid suffers change of direction in such manner that its reaction on the nozzle surfaces produces a turning effort, which is transmitted to the shaft H by virtue of the rigid connection of said shaft with drum A. If the fluid used be inelastic, its course after leaving the ports O will lie along that portion of the interior surface of the nozzle most distant from the center of the drum, and a proper regulation of the rotational speed of the engine will cause said fluid to leave the nozzle with but a small proportion of kinetic energy remaining. In the case of an elastic fluid the increasing sectional area of the nozzle will cause a gradual expansion of volume of said fluid accompanied by a corresponding loss of its velocity and kinetic energy, the loss of kinetic energy of the fluid being taken up as useful energy of rotation by the nozzles and the drum to which they are attached. The tapering form of the nozzles insures a gradual expansion of the escaping fluid without the formation of wasteful eddies. The weights W, levers T, pivots M, springs Z, and valve-plates L being disposed as hereinbefore described, the rotation of drum A produces rotation of the weights W about the axis of the drum, and a consequent centrifugal force tending to throw said weights away from the drum's axis with an accompanying extension of the springs Z. According as the spring-tension or the centrifugal force of the weights is greater, the weights will move toward or from the drum's axis. Such motion of the weights, being transmitted by the levers T, pivoted at M, to the valve-plates L, opens or closes the ports O, thereby regulating the speed of the engine. When the number of ports is more than one, it follows from the symmetrical disposition about the drum's axis of the parts having similar offices that the engine is perfectly balanced about said axis. The curved shape of the ends of the valve-plates L, as hereinbefore described, tends to obviate, even during part closure of the ports O, the formation of wasteful eddies within the propelling-fluid.

When it is desired that the engine be reversible, a four-way valve may be employed, such as is shown at U, Fig. 3. Thus let pipe D be connected with branch 1 of the four-way valve and let exhaust-opening X be connected with the opposite branch 3, then let branch 4 be connected with the final receptacle of the exhaust. Now, if the parts of the four-way valve be disposed as shown in Fig. 3 the reversal of the engine's motion may be accomplished by turning thecock through one-quarter of a revolution.

Having thus described my invention, I claim—

1. In a rotary engine, the combination, with a central revolving drum, of a supply-pipe coaxial with said drum and having upon the end adjacent to said drum a step-shaped conical head, and a step-shaped conical collar fitted to said conical head and secured to the drum, the conical collar being capable of continuous rotation about the conical head, the conical stepped surfaces of said collar and head being in continuous contact, substantially as shown and described.

2. In a rotary engine, the combination, with a central revolving drum having ports in its periphery, of pieces called "valve-plates," shaped to conform to the inner cylindrical surface of said drum and capable of motion in contact with said surface, said pieces having a form at the ends nearest the respective ports approximately in continuation of one of the nozzle surfaces, and revolving weights the varying centrifugal force of which moves said valve-plates so as to effect an opening of said ports suitable for maintaining a rotative speed, for which said revolving weights may be adjusted, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

THOMAS W. KINKAID.

Witnesses:

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