No. 730,543. PATENTED JUNE 9, 1903.

M. E. KNIGHT.

ROTARY ENGINE.

APPLICATION FILED AUG. 23, 1901.

NO MODEL. 5 SHEETS—SHEET 1.

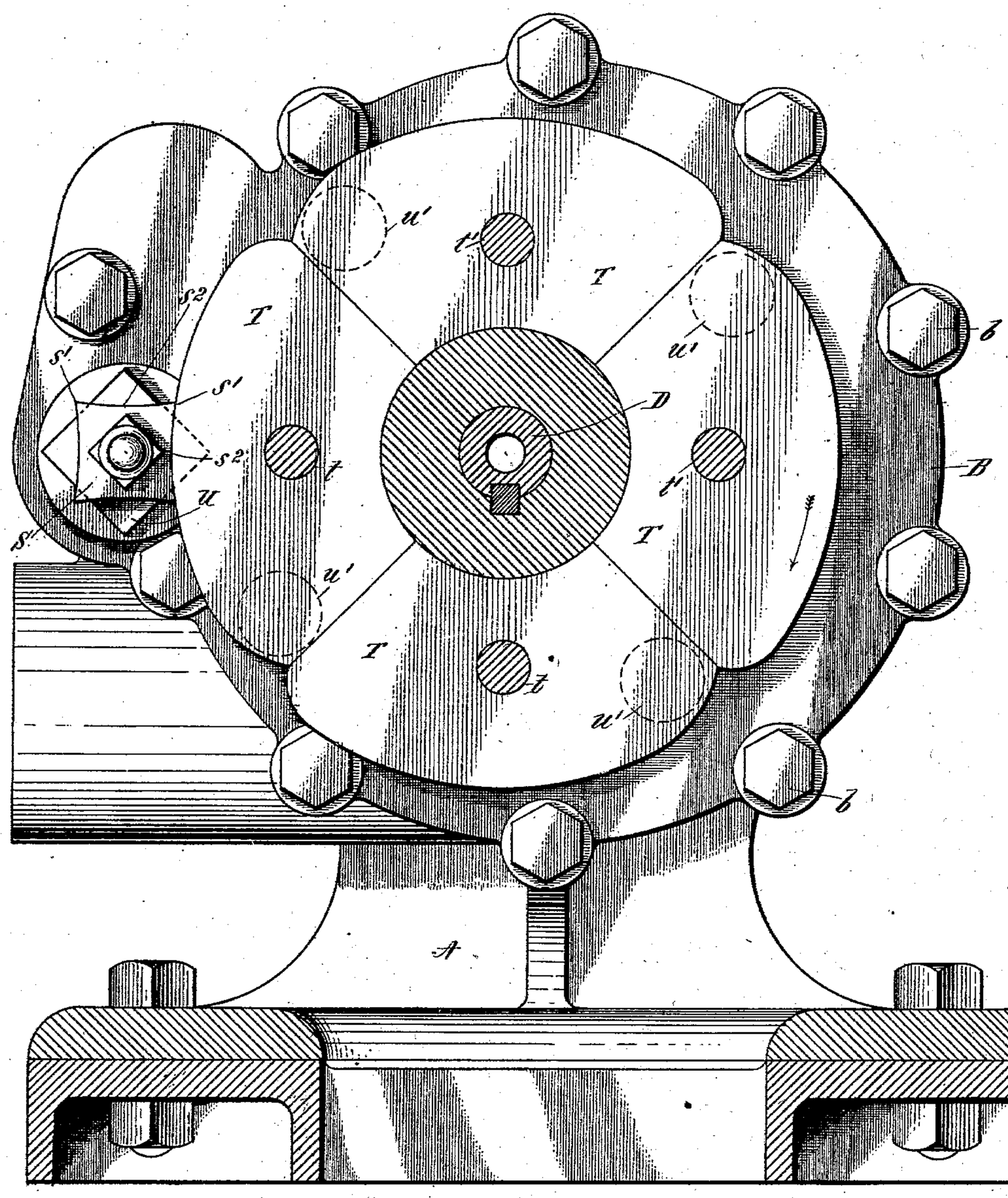

Fig. 1.

WITNESSES:
Reuben L. Roberts.
Robert Cushman

INVENTOR:
Margaret E. Knight.

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NO MODEL. 5 SHEETS—SHEET 2.

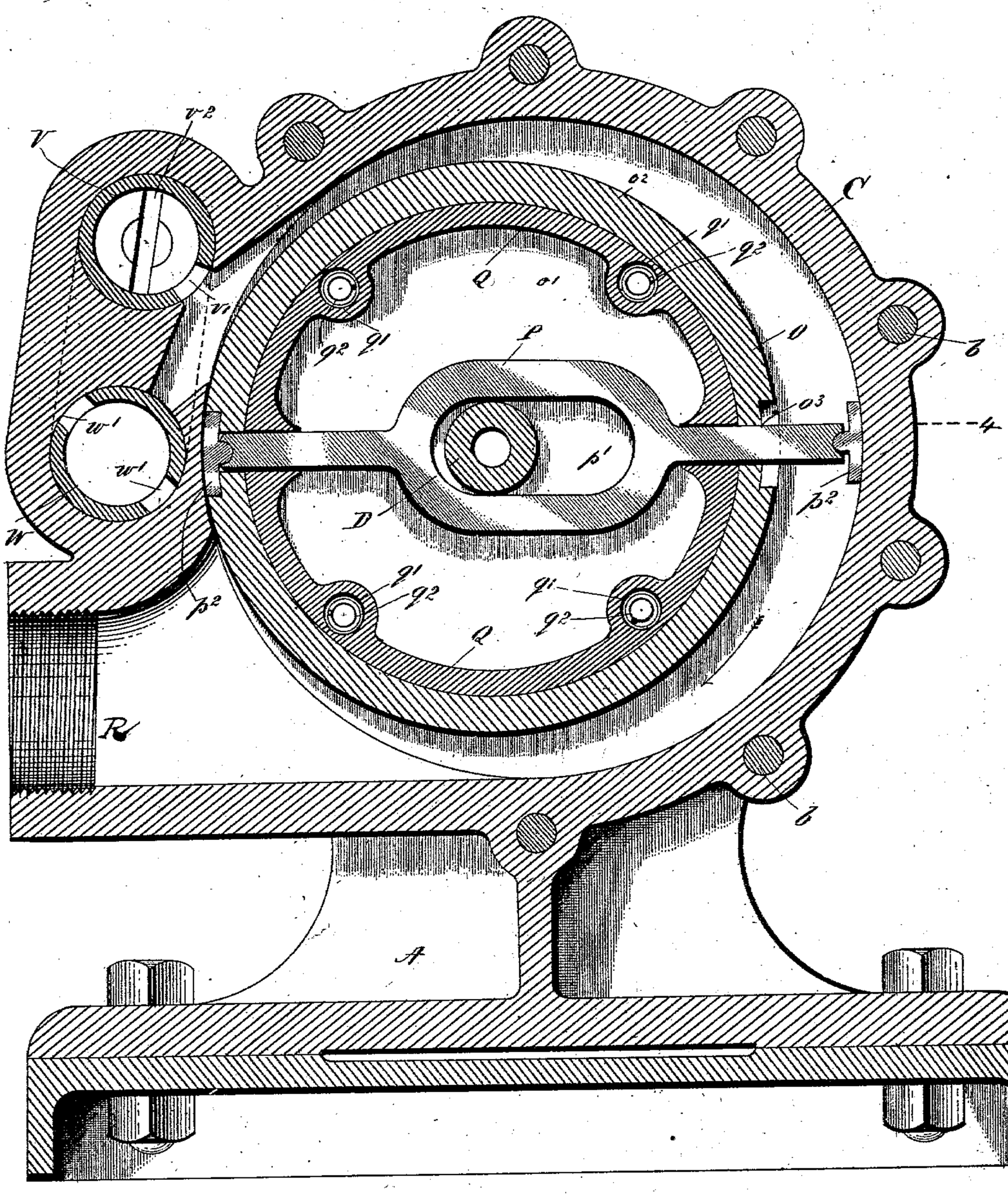

FIG. 2.

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NO MODEL. 6 SHEETS—SHEET 3.

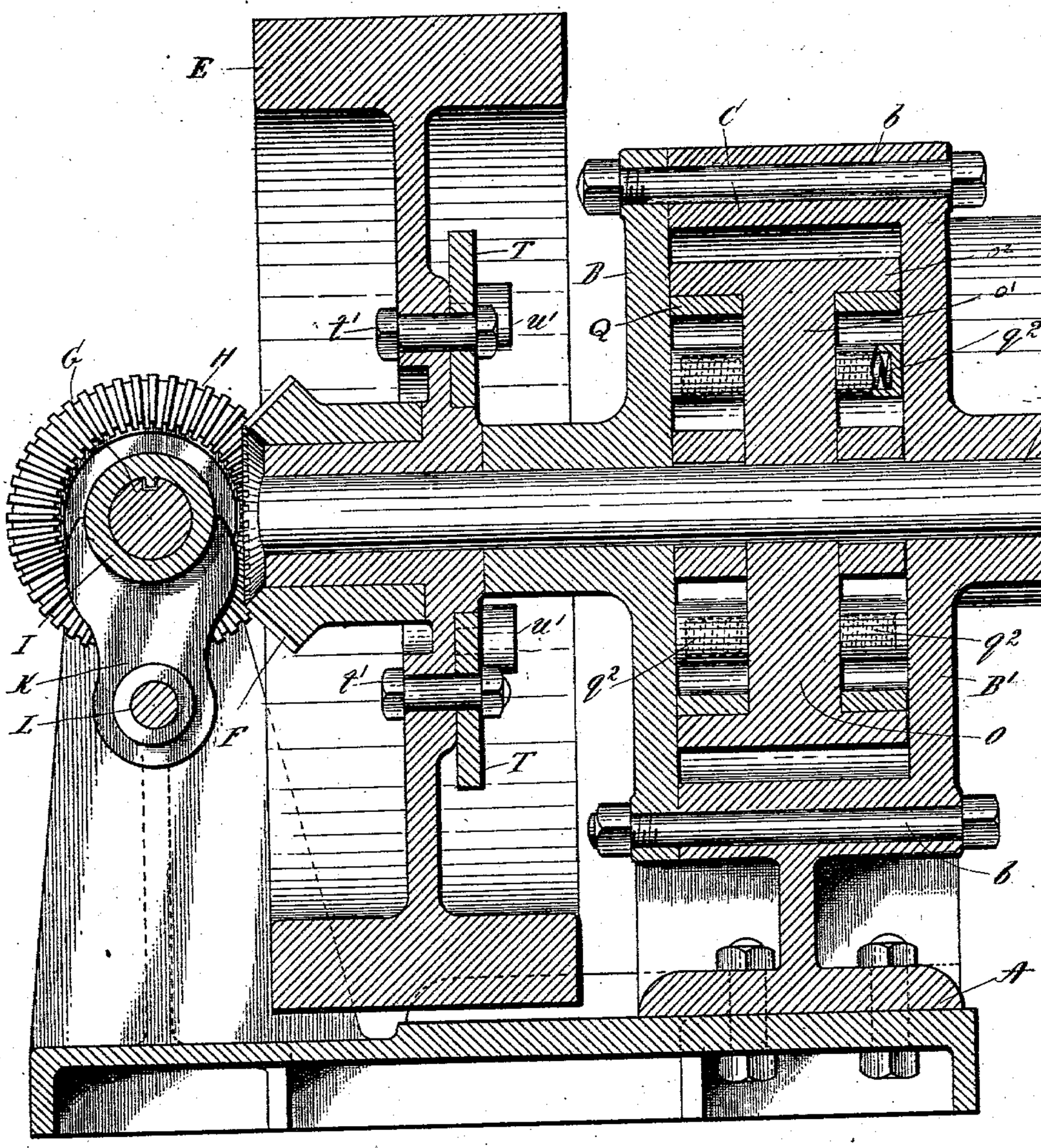

Fig. 3.

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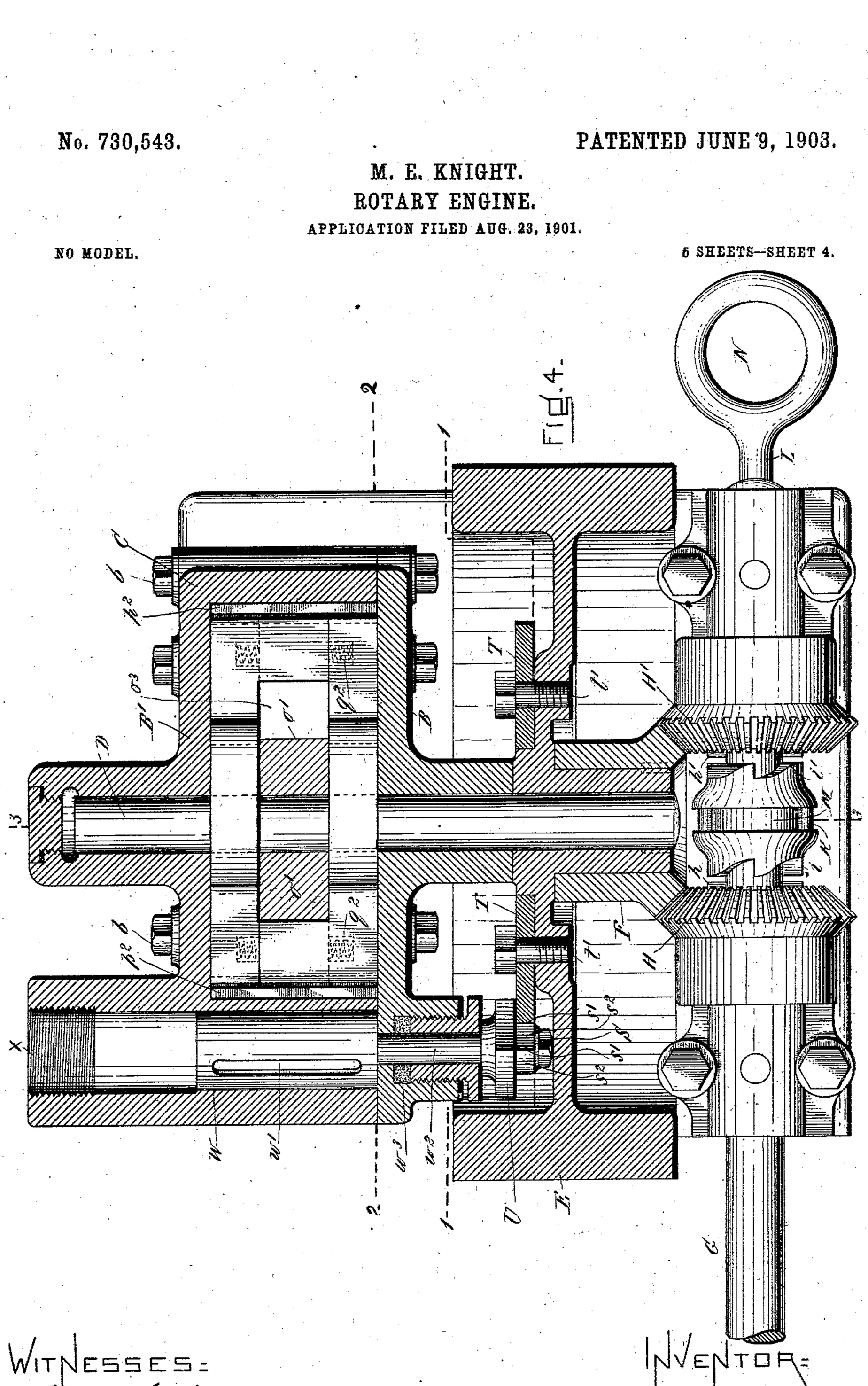
NO MODEL. 6 SHEETS—SHEET 4.

FIG. 4.



WITNESSES:

Reuben L. Roberts.

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NO MODEL. 5 SHEETS—SHEET 5.

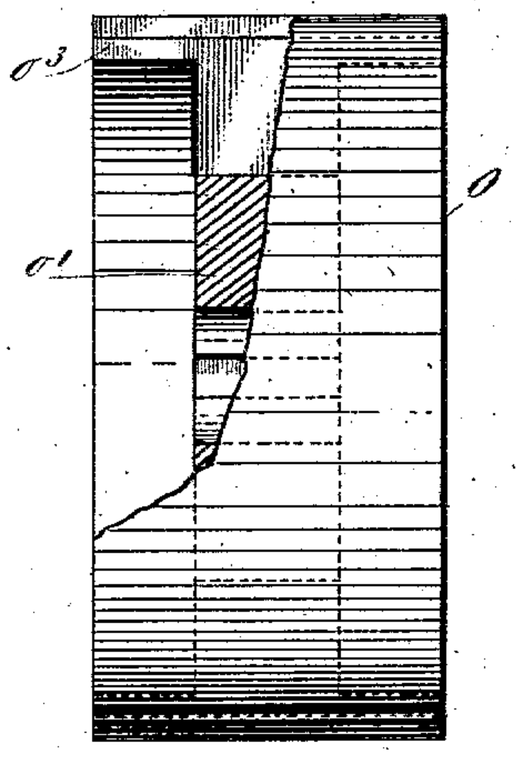

Fig. 5.

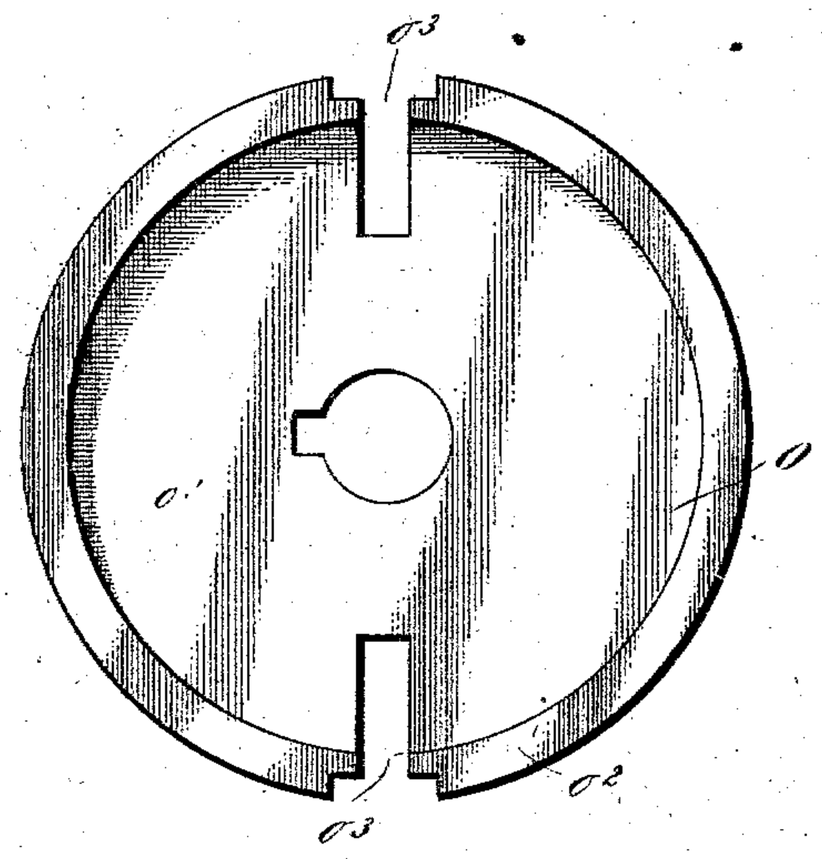

Fig. 6.

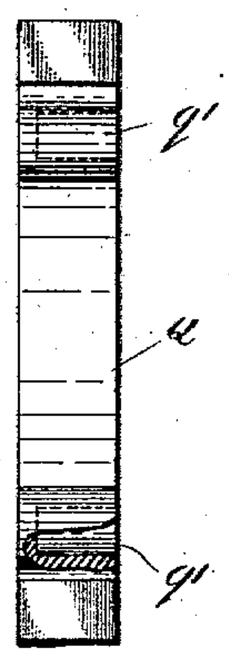

Fig. 7.

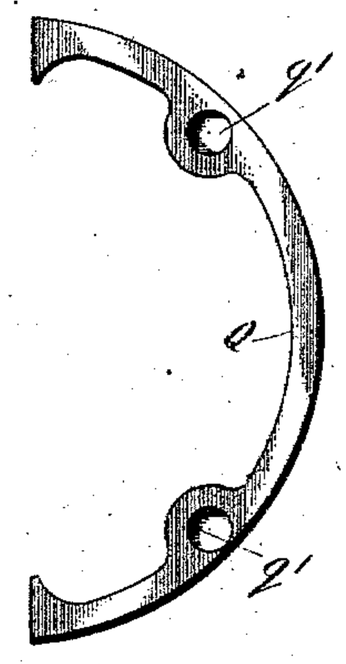

Fig. 8.

WITNESSES:

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INVENTOR:

Margaret E. Knight.

No. 730,543. Patented June 9, 1903.

UNITED STATES PATENT OFFICE.

MARGARET E. KNIGHT, OF SOUTH FRAMINGHAM, MASSACHUSETTS.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 730,543, dated June 9, 1903.

Application filed August 23, 1901. Serial No. 73,092. (No model.)

To all whom it may concern:

Be it known that I, MARGARET E. KNIGHT, of South Framingham, in the county of Middlesex and Commonwealth of Massachusetts, have invented certain Improvements in Rotary Engines, of which the following is a specification.

The invention relates to certain improvements in rotary engines of the type in which the piston is caused to reciprocate in a hub within the cylinder when the hub revolves; and it consists, chiefly, in the improved mechanism by which the steam-valve is operated and in the packing between the ends of the hub and the cylinder-heads.

The construction of the improved parts and their operation in the engine will be readily understood from the following description, with reference, by designating letters, to the accompanying drawings, wherein—

Figure 1 is a sectional elevation of the engine on line 1 1, Fig. 4, viewed from the right. Fig. 2 is a sectional elevation of the engine on line 2 2, Fig. 4, viewed from the right. Figs. 1 and 2 are drawn upon a somewhat larger scale than the other figures of the drawings. Fig. 3 is a longitudinal sectional elevation of the engine on line 3 3, Fig. 4, viewed from the right or top of that sheet. Fig. 4 is a horizontal section of the engine on line 4 4, Fig. 2, viewed from above. Fig. 5 is a side elevation of the cylindrical hub which supports the sliding piston within the engine-cylinder. A portion of the rim of the hub on the left is broken away. Fig. 6 is an end elevation of said hub. Fig. 7 is a side elevation of a semicylindrical metallic packing, two of which pieces are inserted within the rim of the hub on each side of the sliding piston, as shown in Fig. 2. Fig. 8 is an end or edge view of such a semicylindrical packing-piece.

Referring to the drawings by designating letters, A is the base and support of the engine; B B′, the heads of the steam-cylinder, and for economy of construction in small engines the cylindrical shell and the support for the engine may be cast integral with the head B′, as illustrated in Fig. 3. The two heads B B′ and the cylinder C are held securely together by the usual bolts *b b*. D is the shaft, which has a bearing in each head B B′. On the outer end of the shaft D a balance-wheel E is secured, and a beveled gear F is keyed upon the outer end of the hub of the wheel E. Upon a counter-shaft G are two loosely-running bevel-gears H H′, which are in mesh with the gear F. Upon the shaft G, between the gears H H′, is a clutch-wheel I, which is adapted to slide upon said shaft, but is caused to revolve with it by means of a spline and groove. The clutch I is provided with teeth *i i′* upon the respective ends, and in the face of the hub of the gears H H′ are teeth *h h′*, which are the counterpart of the teeth *i i′* of the clutch-wheel. (See Fig. 4.) A yoke K, which is supported upon a rod L, engages an annular groove M in the clutch I, and by means of a handle N the rod L, with the yoke K, may be moved back and forth, and by the engagement of the said yoke with the clutch I that clutch is reciprocated upon the shaft G, and thereby may be caused to engage either with the gear H or the gear H′, and thus rotate the shaft G in either direction, as desired.

Attached to the shaft D, within the cylinder C, is a cylindrical hub O, constructed like a belt-pulley, with a central web *o′* to support the rim o^2. Through this rim o^2 and a short distance into the web *o′* slots o^3 are cut upon diametrically opposite sides of the hub and parallel with the axis of the shaft D.

Within the hub O is a piston P, with its middle portion cut away to receive the portion of the web *o′* which remains below the slot o^3 in the rim. This piston is as wide as the length of the cylinder and is thickened through its middle portion to accommodate a slot *p′*, through which the shaft D may pass. The width of this slot *p′* is equal to the diameter of said shaft, and its length is equal to the maximum distance which the piston moves diametrically across the shaft and through the hub. The piston is made in two parts, so that it may be inserted into the hub upon each side of the web. Projecting portions at the outer ends of the piston extend across the width of the web in the slot made therein and in the rim of the hub, and the outer ends of the piston are provided with tilting packing-plates p^2. For the purpose of maintaining a steam-tight joint between the edges of the piston and the heads of the

cylinder semicylindrical pieces Q, of metal, (See Figs. 2, 7, and 8,) are placed within each end of the hub and upon both sides of the piston. These packing-pieces have sockets q' tapped in their sides next to the web o', and springs q^2 are placed therein, so that they bear against the web o', and thus constantly press the said packing-pieces against the heads of the cylinder (see Figs. 3, 7, and 8) and make a steam-tight joint.

Referring to Fig. 2, V is a steam-valve provided with a port v' and is operated with the hand by means of a key inserted in a slot v^2 for the purpose of starting the engine and running it constantly with full steam-pressure when desired, and W is an automatically-operated valve provided with ports w' w', which are opened to admit steam during alternate quarter-turns of the engine and are closed during the periods of the intermediate quarter-turns of the engine. In the periods when the valve is closed the steam is used expansively. R is the exhaust-port of the engine.

The automatic operation of the valve W is effected by the mechanism which is best shown in Figs. 1 and 4. The stem w^2 of the cylindrical valve W has a packing w^3 to prevent the leaking of steam, and on the outer end of said stem is a pinion or gear S, provided, as illustrated, with four teeth s'. The surfaces s^2 between each two of said teeth are formed in a concave curve which accurately fits the surfaces of a series of cam-plates T, which are secured to the web or spokes of the fly-wheel E by bolts t', as shown in said Figs. 1 and 4.

For the purpose of insuring a quarter-turn of the gear S and the valve W at each quarter-revolution of the piston P an additional rectangular four-toothed gear U is secured to the stem w^2 of the valve W, and projecting bosses u', Figs. 1 and 3, are attached to the faces of the cam-plates T in positions to engage the teeth of the gear U at the proper time to turn that gear, and with it the gear S and the valve W, at each quarter-revolution of the engine, and to accommodate the teeth of the gear S when it is turned the cam-plates are cut away in reëntrant angles to receive the points of the teeth s' at the location where the gear S is to be turned. The surfaces of the alternate cam-plates T may vary in length, so as to vary the extent of the periods during which direct steam is used and during which it is used expansively.

The operation of the engine is as follows: Steam is conducted to the valve-chamber through a pipe connected at X, Fig. 4. To start the engine, a key is inserted in the slot v^2 and the valve V turned until its port v' is opened. This admits steam to the cylinder C and back of one end of the piston P, which causes the piston and the hub O to revolve in the direction indicated by the arrow in Fig. 2. The fly-wheel E and cams T revolve with the piston, and therefore the bosses u' engage the gear U and turn the valve W at each quarter-revolution, opening it during one period and closing it during the next, thus automatically operating the steam-valve to open and close it.

The length of any given period during which the valve remains open or closed will depend upon the length of the curved surfaces of the cam-plates T, which bear upon the concave faces of the gear S. In the drawings all the cam-surfaces T are shown of equal length, so that the steam is shut off and acts expansively during one-half of each revolution of the engine; but the relative extent of these cam-surfaces may be varied to suit the requirements of the engine in each instance.

If it is desired to run the engine with a full pressure of steam continuously, the starting-valve V should be left open, and then the automatic operation of the other valve W will not cut off the steam-pressure at any time. The two valves are supplied with steam from the same inlet-chamber.

I claim—

In a rotary engine, the combination of a rotary steam-valve, a gear upon the stem of said valve, an engine-shaft, a multiple cam-gear thereon which directly engages the valve-gear and alternately opens and closes the valve by the successive operations upon the valve-gear, when the cam-gear rotates.

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Witnesses:

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ROBERT CUSHMAN.