(No Model.) 3 Sheets—Sheet 1.

M. MATSON.

ROTARY ENGINE.

No. 575,124. Patented Jan. 12, 1897.

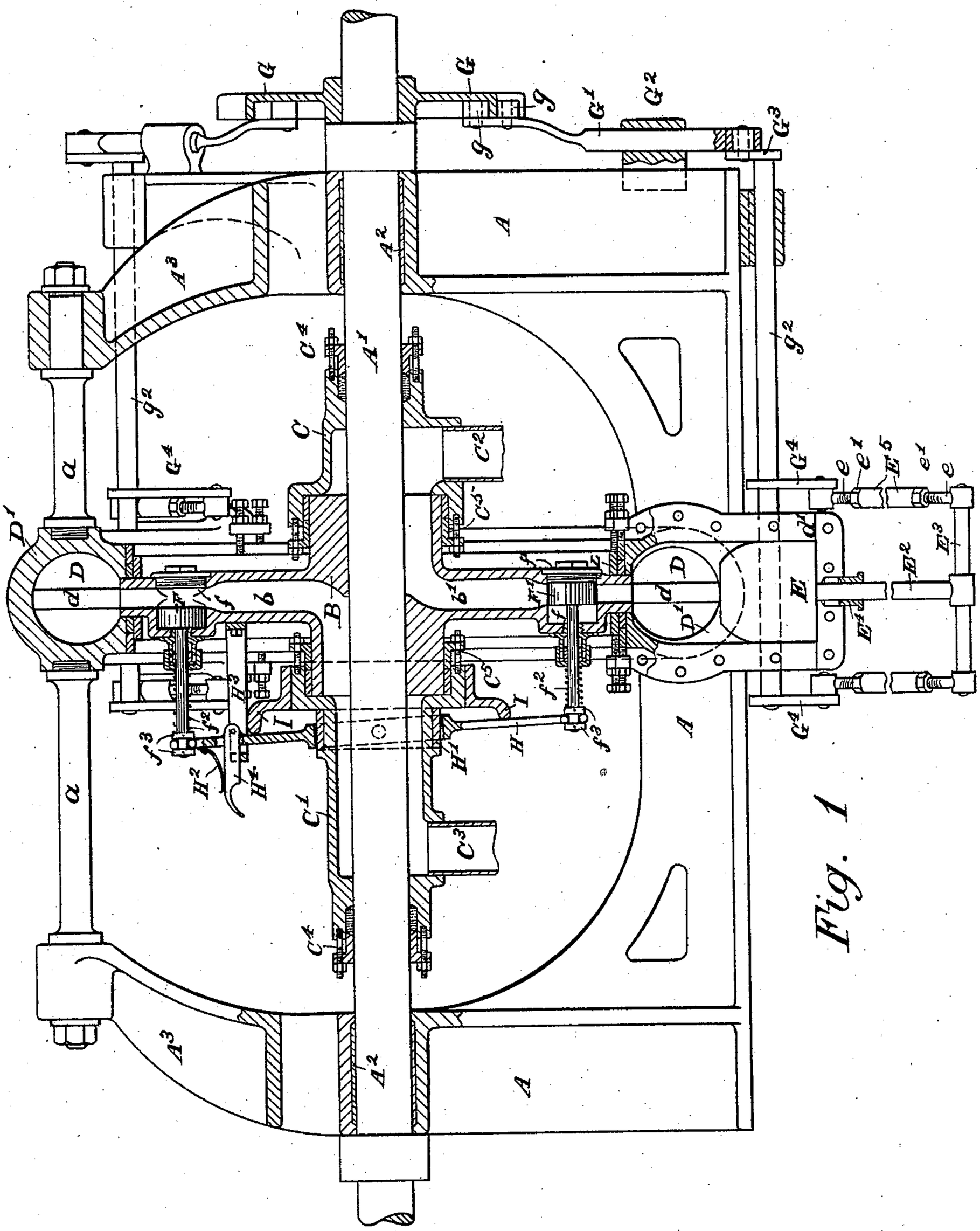

Fig. 1

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(No Model.) 3 Sheets—Sheet 2.

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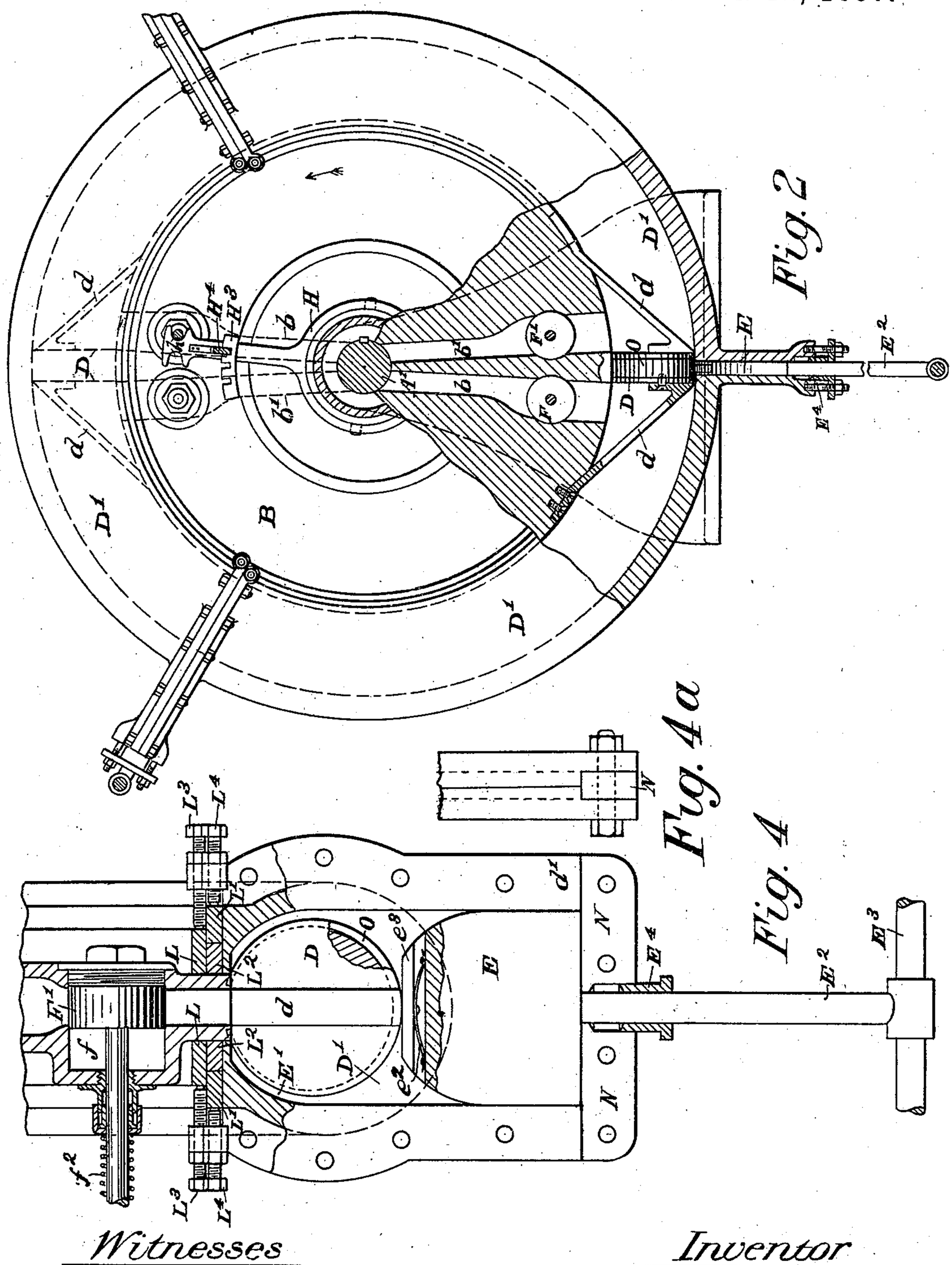

Fig. 2.

Fig. 4a

Fig. 4

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(No Model.) 3 Sheets—Sheet 3.

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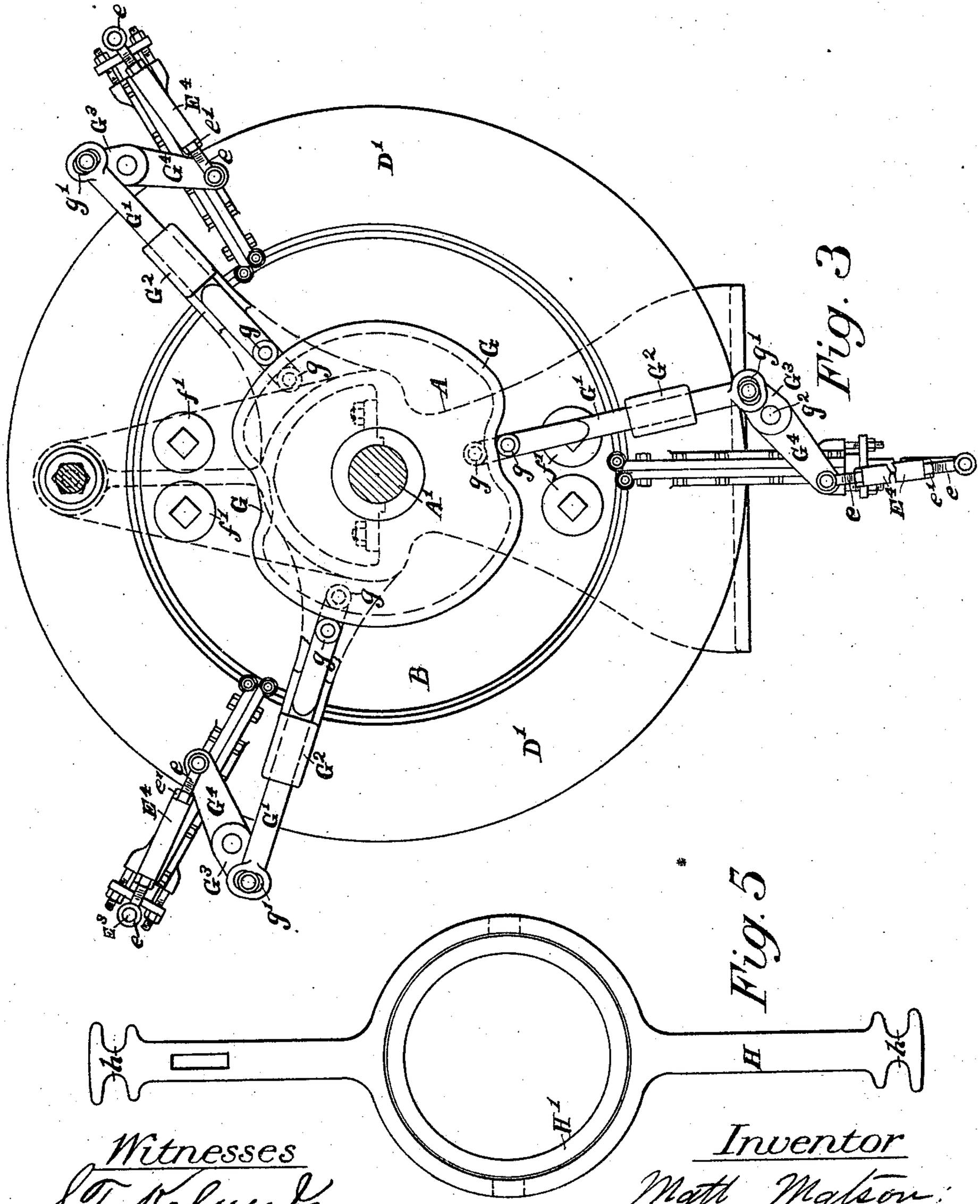

Fig. 3

Fig. 5

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UNITED STATES PATENT OFFICE.

MATT MATSON, OF SEDRO, WASHINGTON.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 575,124, dated January 12, 1897.

Application filed January 20, 1896. Serial No. 576,127. (No model.)

To all whom it may concern:

Be it known that I, MATT MATSON, a citizen of the United States, residing at Sedro, in the county of Skagit, State of Washington, have invented certain new and useful Improvements in Rotary Engines; 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.

My invention relates to rotary steam-engines; and it consists, essentially, of a cylinder in the form of a ring surrounding the shaft, which ring is circular in cross-section and has a slot in its inner surface, within which revolves a disk upon the shaft. This disk carries two circular pistons fitting the cylinder. The valves which resist the pressure of the steam in one direction are gate-valves, operated by cams, which raise them to permit the pistons to pass. There are three of these. The steam admission and exhaust is from about the shaft through passages in the revolving disk.

Figure 1 shows a vertical longitudinal section. Fig. 2 is a partial end and partial sectional view. Fig. 3 is an end view from the opposite direction of Fig. 2. Fig. 4 is an enlarged detail of the back-pressure gates in the cylinder. Fig. 4ª is an edge view of the gate-valve casing. Fig. 5 is a detail of the cam-operated lever for working the admission and exhaust valves.

The shaft A′ is mounted in suitable bearings A^2 in the frame A. It carries between these bearings the disk B, which is keyed to the shaft. This disk has admission passages or ports *b* and exhaust passages or ports *b′* formed within it and running from the ends of the hub of the disk to its outer edge or rim. The admission-ports *b* open to one end of the hub and the exhaust-ports to the others. When the engine is reversed, the function of these ports is also reversed, ports *b* then being the exhaust-ports and *b′* being the admission-ports, and what was the steam-supply pipe becoming the exhaust-pipe.

Each end of the hub is surrounded by hollow castings C and C′, which are connected, respectively, to the exhaust and the steam-supply pipes and do not rotate with the shaft A′. Suitable steam-packing devices C^4 and C^5 are supplied to make these joints tight.

In line with the partitions between the parts *b* and *b′* on opposite sides of the disk are attached the circular pistons D. These are braced upon each side by the braces *d d*. These, besides acting as braces, are a safeguard against wrecking of the engine in case the back-pressure valve-operating mechanism should fail. In this case the back-pressure valve would be raised by the slope of the brace and no damage would result. These pistons fit snugly the annular circular cylinder D′. This cylinder is made in three parts, each covering one hundred and twenty degrees, and is directly attached to the frame at the bottom of the circle and at the upper part, by means of the rods *a*, to the upright arms A^3 of the frame.

At the points of juncture of the three sections of the cylinder are formed seats for the gates or back-pressure valves E. These valves or gates are flat plates, which are a little wider than the diameter of the cylinder-bore and slide in a flat chamber formed between the two adjoining sections of the cylinder. The construction of these is very similar to that of an ordinary gate-valve. A slight groove or ledge E′ is formed in the side of the cylinder, so as to form a firm seat for the valve to seat upon. A flange *d′*, which surrounds the gate or valve chamber, serves to fasten together the two sections of the cylinder and makes the valve accessible. These gates or back-pressure valves are operated through a stem E^2, which extends through the packing device E^4 to the outside of the cylinder and is connected to a cross-bar E^3. These valves are operated from the cam G, which is fixed upon the shaft A′ and revolves therewith. This cam is a disk having a side projecting flange, which in the main is of a circular outline, but has two depressions or cam-hollows in it and opposite each other. Bars G′, sliding in guides G^2, carry rollers *g g*, which engage opposite sides of the cam-flange and are given a reciprocating motion thereby. These, through the levers G^3 G^4 and rock-shaft g^2, transmit the reciprocating motion to the links E^5, which act upon the cross-bar E^3 and the stem E^2 of the back-pres-

sure valve. This link E^2 is composed of eyes *e* at each end whose stems are screw-threaded, one being threaded right-handed and the other left-handed. These screw into the central hollow cylinder or pipe E^5, which is similarly threaded, and are each provided with a lock-nut *e'*. This permits of an accurate adjustment of the movement of the gates or back-pressure valves D.

In the admission and exhaust ports *b* and *b'* of the disk B are formed the valve-seats *f*, which receive circular or cylindrical valves F and F'. The stems of these valves pass out through suitable stuffing-boxes and upon the outside are surrounded by the spring f^2, which would, if unrestrained, hold the valve constantly open. Between the collars f^3 on the outer end of the stem fits one side of the notched ends *h* of the lever H. This lever surrounds the cylinder C', which admits steam to the disk B, and is pivoted to the ring H', which also surrounds the cylinder C' and turns thereon between shoulders.

Attached to the inner end of the piece C' is the face-cam I. This cam bears at opposite points against the lever H and oscillates it, so as to alternately open and close the two opposite valves to which it is attached. This lever would be attached to and operate two diagonally opposite valves only, the other two being held open by their springs f^2. The ports in which the two inoperative valves are placed are the ones which act as exhaust-ports, while the others act as admission-ports. With the disk revolving in the direction of the arrow in Fig. 2 the ports *b b* are the admission-ports and the ports *b' b'* are the exhaust-ports. The exhaust-ports are constantly open and are exhausting the steam from in front of the piston.

The cam G is so designed that the gates or back-pressure valves E, of which there are three at one hundred and twenty degrees apart, will begin to open thirty degrees before the piston reaches it and will not close until the piston has passed thirty degrees beyond it, being open through an angle of rotation of sixty degrees. From the fact that the gates or back-pressure valves are one hundred and twenty degrees apart, pistons one hundred and eighty degrees apart, and the back-pressure valves require sixty degrees of travel of the piston to open and close, it follows that one back-pressure valve is just commencing the opening movement as the one ahead of it has finished its closing movement.

As a back-pressure valve has closed after the passage of the piston, the cam I opens the admission-valve and holds it open for a period of sixty degrees travel, when it is closed again, and for the next sixty degrees of travel the steam acts by expansion. There is thus at all times steam-pressure on the piston, half of the time direct pressure from the boiler and half the time the expanding pressure of the entrapped steam. The cam I is formed so as to cause the valves F or F', whichever are being operated thereby, to open and close three times during each revolution.

When it is desired to reverse the engine, the lever H is shifted, so as to disengage from the set of valves F or F' previously engaged and so as to engage the other set. This is done by shifting the locking-lever H^4 from one to the opposite end notch in the bar H^3, which is attached to the side of the disk. This leaves the former admission-valves constantly open as exhaust-valves and operates the former exhaust-valves by the lever H. At the same time it is necessary, through proper valves and pipes, to make such changes outside of the engine that the pipes C^2 and C^3 change their function, the steam being admitted to and exhausted from the opposite sides of the disk to that previously used. This involves nothing but an arrangement of pipes and valves, which would be obvious to any engineer and is not herein illustrated.

To prevent leakage between the sides of the disk and the sides of the containing-slot in the cylinder, packing-rings L L' are provided. L is a ring which forms a complete circle and, being confined on the outside, will resist deformation by pressure from any point toward the center. The ring L' may be formed of sections and is a follower-ring used to compress the packing material L^2, which is placed between the ring L and the cylinder. Set-screws L^3 and L^4, working in lugs on the cylinder, adjust these rings to the proper pressure.

To secure a tight joint and prevent leakage between the back-pressure valve and the edge of the revolving disk, I groove the edge of the valve which comes in contact with the disk and place therein a small bar e^3, which is held out by the spring e^2. This is attached to the spring, and the spring to the valve, so that they cannot become separated. This secures an easy but certain contact between the two and prevents leakage.

To enable the gate or back-pressure valves to be readily removed, the sections N of Figs. 4 and 4^a, which consist of two blocks of iron of the same width as the valve-chamber, are bolted between the flanges of the valve-chamber at their ends. These blocks form the outer end of the valve-chamber, and when they are removed, which can be done by removing four bolts, the valve can be withdrawn.

To pack the piston and prevent leakage by it, I use a spring packing-ring O. This spring is of metal and surrounds the piston, lying in a groove in its surface. It is sufficiently broad, so that it will overlap the groove containing the back-pressure valves. Its ends, which come on each side of the disk at its point of juncture with the piston, fit in notches cut in the edge of the disk. Its action is the same as the packing-rings of an ordinary engine-piston.

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

1. In a rotary engine the combination with

an annular cylinder having a slot in its inner periphery, back-pressure gates and means for operating them, of a rotatable disk fitting the slot in said cylinder and having admission and exhaust ports extending from its center to its edge and opening into the cylinder, of valves for closing said ports having stems which extend without the disk, springs which unrestrained will keep said valves open, and means which may be attached to the valves of either set to open and close them at predetermined intervals, substantially as shown and described.

2. In a rotary engine, the combination with an annular cylinder having a slot in its inner periphery, back-pressure gates and means for operating them, of a rotatable disk fitting the slot in said cylinder and having admission and exhaust ports extending from its center to its edge and opening into the cylinder, of valves for closing said ports having stems which extend without the disk, springs which when unrestrained will keep said valves open, a fixed cam, a pivoted lever revolving with the disk and engaging said cam, and means for attaching it to and detaching it from the stems of either set of admission-valves, substantially as shown and described.

3. In a rotary engine, the combination with an annular cylinder having a slot in its inner periphery, back-pressure gates and means for operating them, of a rotatable disk fitting the slot in said cylinder and having admission and exhaust ports extending from its center to its edge and opening into the cylinder, of valves for closing said ports having stems which extend without the disk, springs which when unrestrained will keep said valves open, a lever surrounding the shaft and pivoted on a central axis so as to revolve with the disk, a central fixed face-cam engaging said lever to oscillate it, and means for attaching the ends of the lever to the opposite valves of either set of admission-valves, substantially as shown and described.

4. In a rotary engine, the combination with an annular cylinder having a slot in its inner periphery, back-pressure gates and means for operating them, of a rotatable disk fitting the slot in said cylinder and having admission and exhaust ports extending from its center to its edge and opening into the cylinder, of valves for closing said ports having stems which extend without the disk, springs which when unrestrained will keep said valves open, a lever surrounding the shaft and pivoted on a central axis so as to revolve with the disk and having side notches at each end adapted to engage the stems of either set of valves, a central fixed face-cam engaging said lever to oscillate it, a notched arm fixed to the disk, and a spring-held latch engaging said notched arm and holding the oscillating lever in engagement with either set of valve-stems or with neither, substantially as shown and described.

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

MATT MATSON.

Witnesses:

GEORGE HOSKINSON,

P. J. DUVANTPORT.