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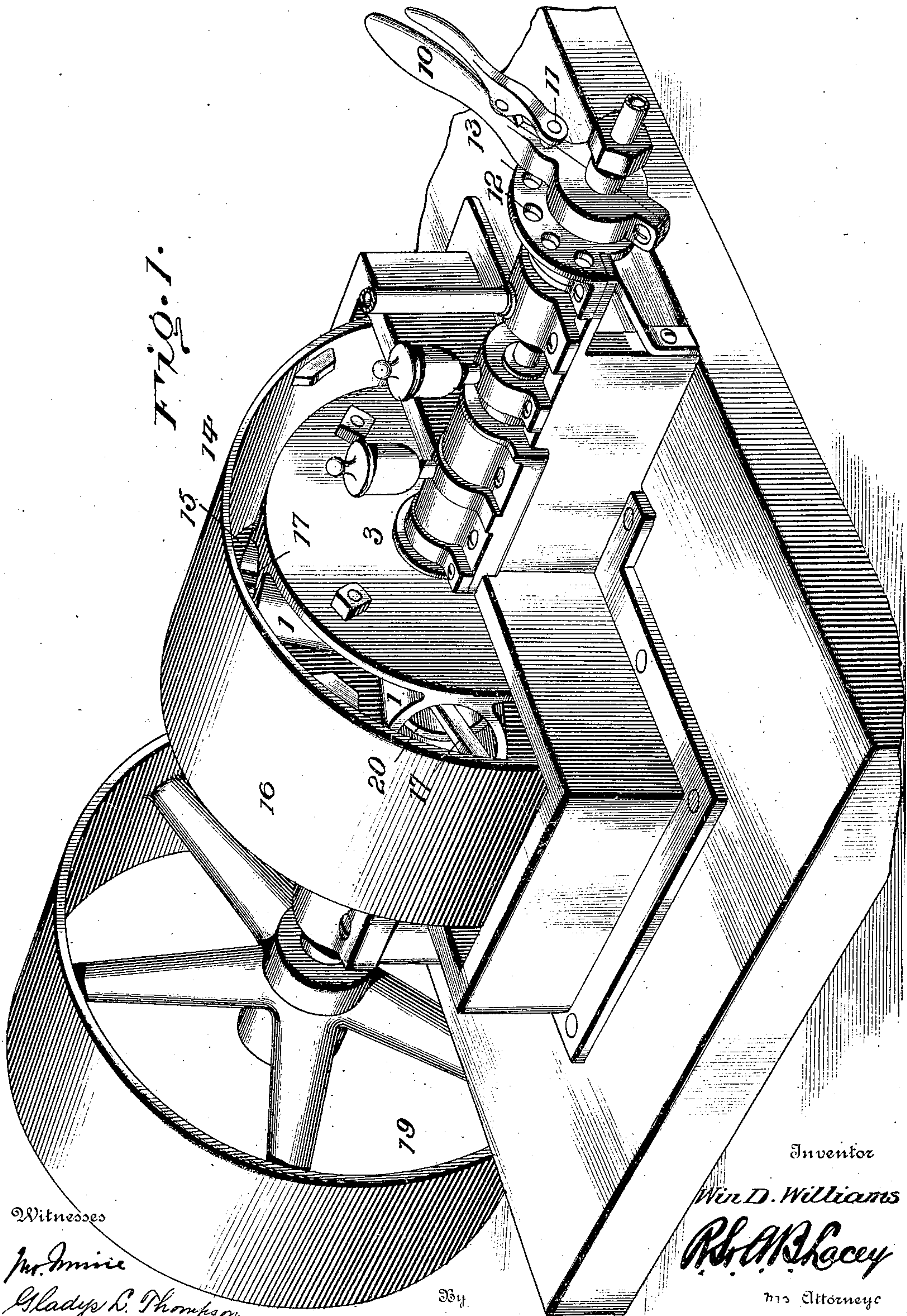
Patented Jan. 22, 1901.

W. D. WILLIAMS.  
ROTARY RECIPROCATING ENGINE.

(Application filed May 17, 1900.)

(No Model.)

4 Sheets—Sheet 1.









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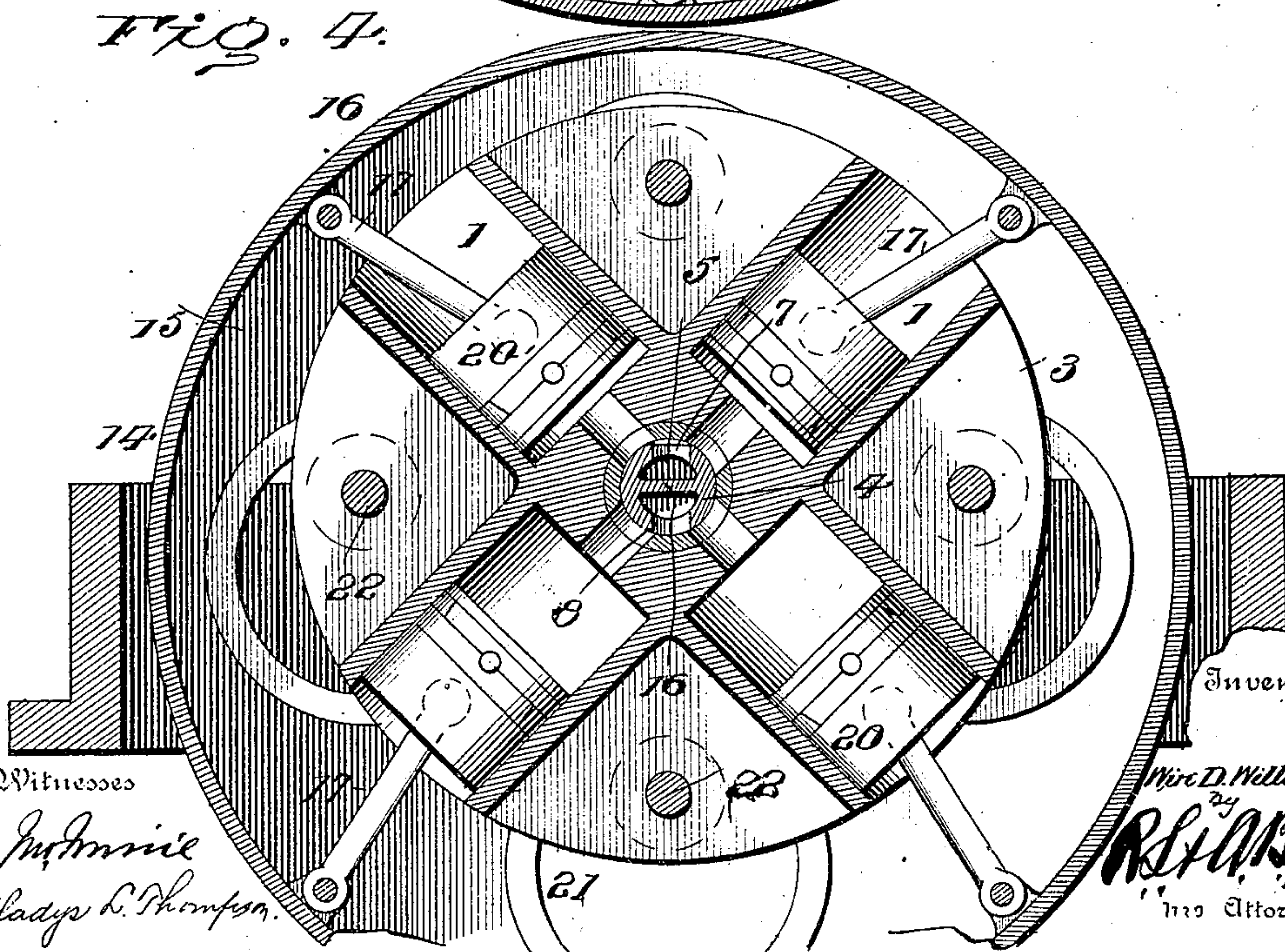
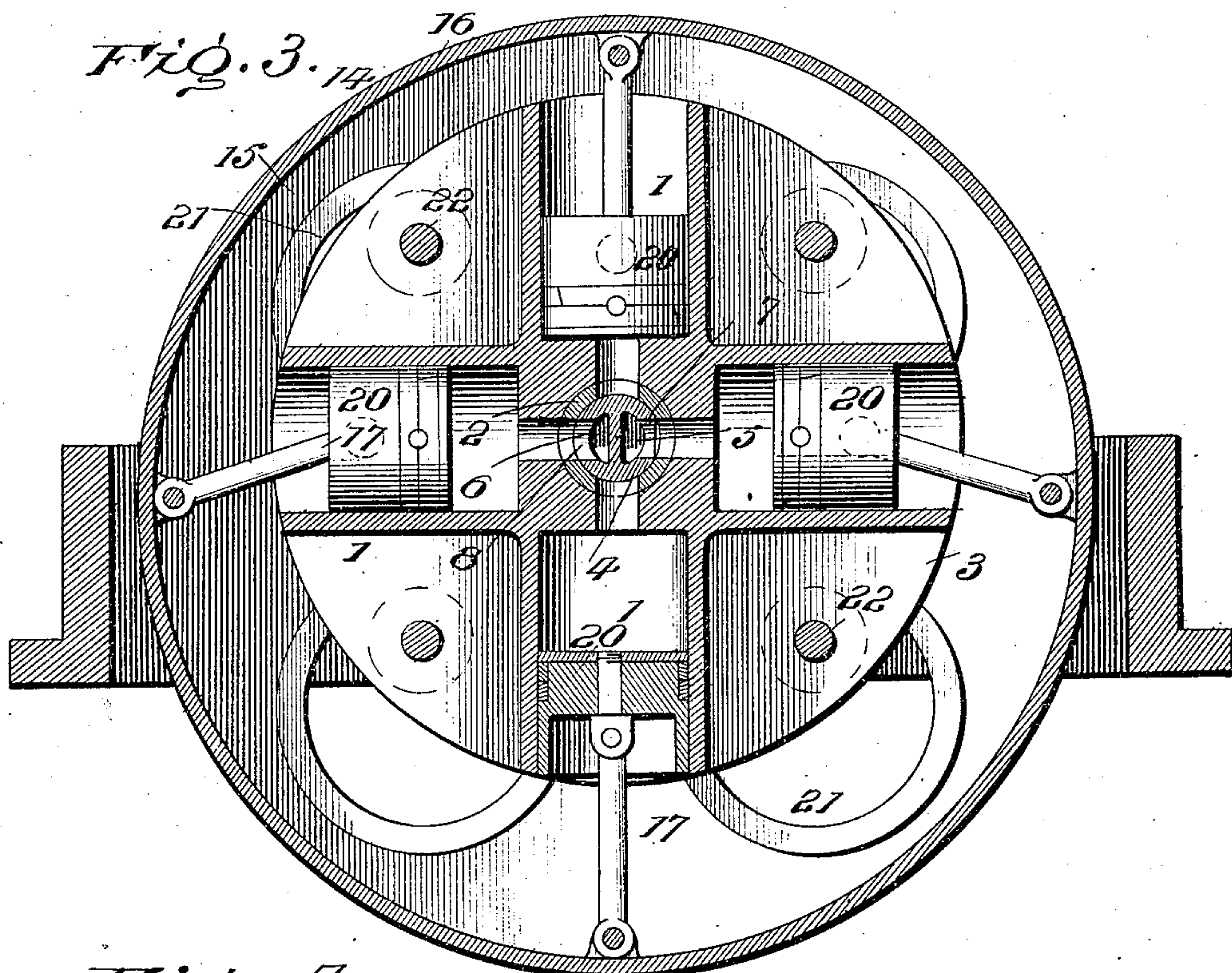
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Witnesses

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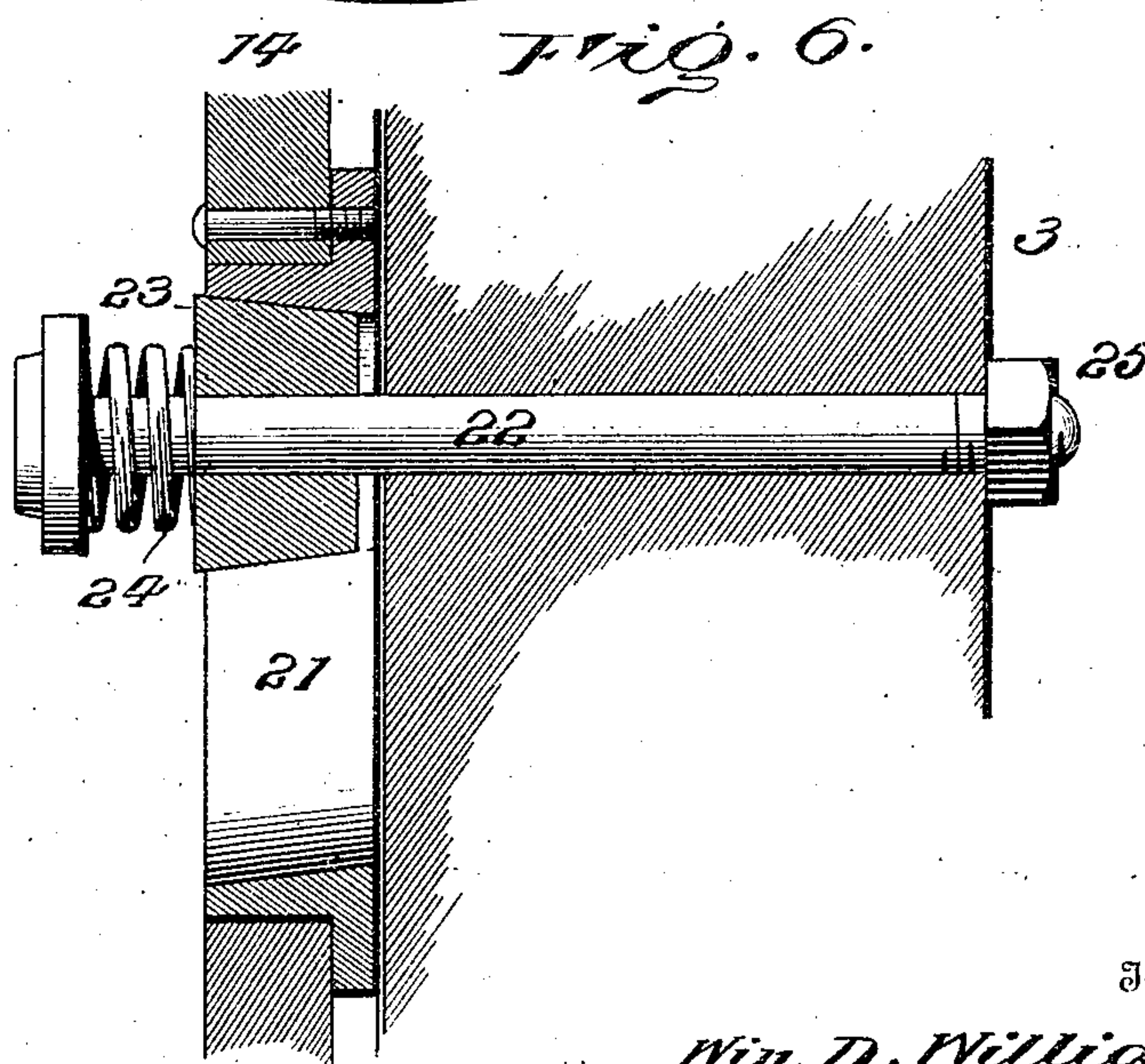
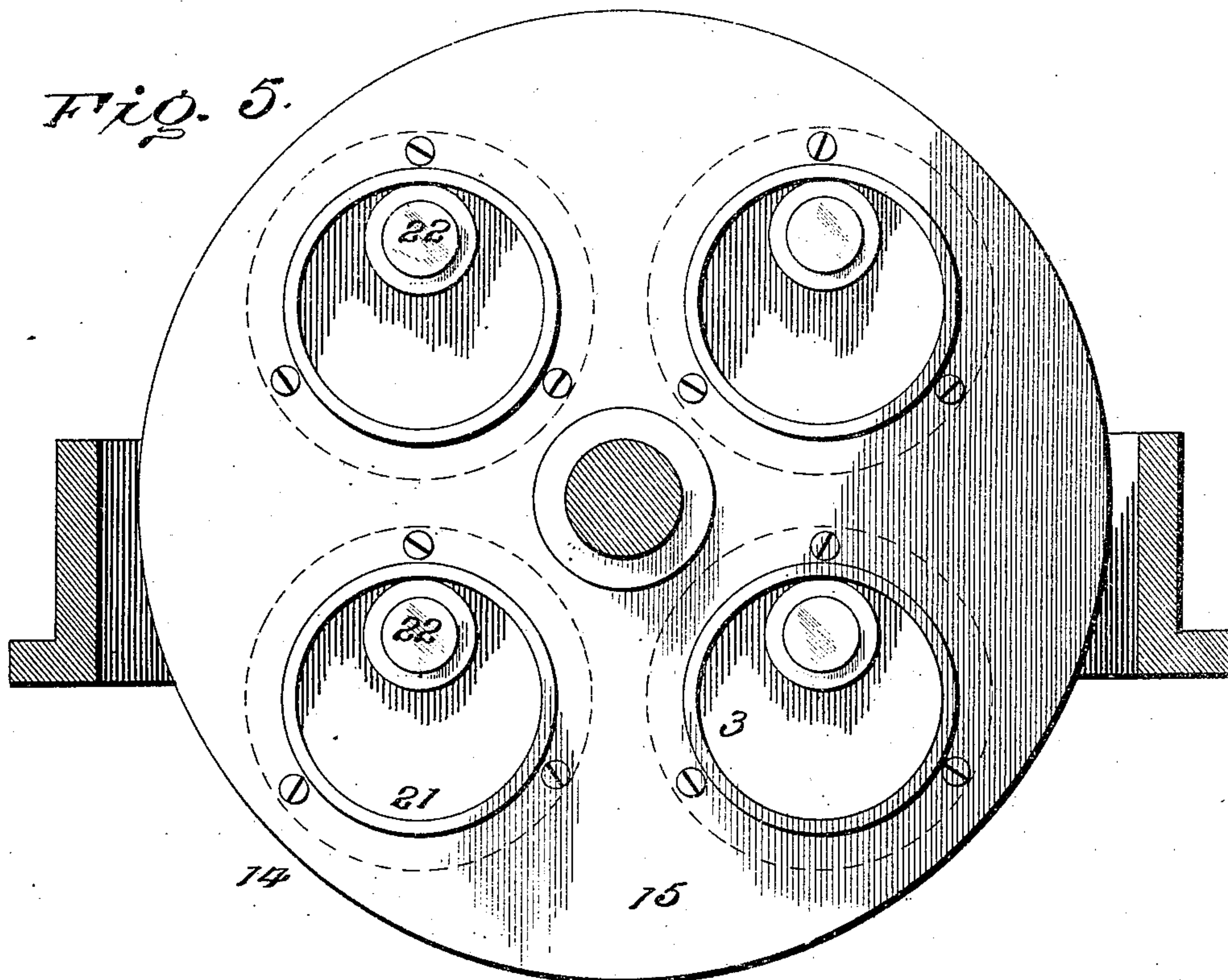
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# UNITED STATES PATENT OFFICE.

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## ROTARY RECIPROCATING ENGINE.

SPECIFICATION forming part of Letters Patent No. 666,630, dated January 22, 1901.

Application filed May 17, 1900. Serial No. 17,016. (No model.)

*To all whom it may concern:*

Be it known that I, WIN D. WILLIAMS, a citizen of the United States, residing at Fredericksburg, in the county of Spottsylvania and State of Virginia, have invented certain new and useful Improvements in Rotary Reciprocating 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.

This invention has relation to the type of engines combining rotary and reciprocating movements in one structure, the purpose being to combine the working elements in such relation as to convert a maximum percentage of force into available form for the performance of work, to economize in the consumption of fuel, to obviate jar and vibration, to equalize the working elements and overcome dead-center, whereby it is possible to start the engine from any point by turning on the steam or motive medium, to dispose the parts in compact form, to reduce the working elements to the fewest number of parts, to minimize the friction by a reduction of the wearing-surfaces as compared with like engines of equal capacity, and to produce an engine that is durable, light-running, and at all times under control, so as to be reversed and stopped without requiring operation of the throttle.

The engine comprises two shafts arranged out of line, an engine mounted to rotate about one of the shafts and comprising a connected series of cylinders and pistons, a ring-yoke secured to the other shaft and rotatable therewith and having the pistons connected thereto, and a plurality of planetary connections between the engine and the ring-yoke to cause them to rotate at a uniform speed and to prevent the oscillatory piston-rods from striking the sides of the cylinders.

For a full description of the invention and the merits thereof and also to acquire a knowledge of the details of construction of the means for effecting the result reference is to be had to the appended description and drawings hereto attached.

While the essential and characteristic features of the invention are necessarily susceptible of modification, still the preferred

embodiment of the invention is illustrated in the accompanying drawings, in which—

Figure 1 is a perspective view of an engine embodying the invention. Fig. 2 is a central section parallel with the shafts. Fig. 3 is a section on the line X X of Fig. 2, showing the relation of the parts when the engine is taking steam. Fig. 4 is a view similar to Fig. 3, showing the disposition of the parts when the valve is turned to neutralize the steam on adjacent opposite pistons, whereby the engine is brought to a full stop. Fig. 5 is a detail view in elevation of the ring-yoke, the shaft and support therefor being shown in section. Fig. 6 is a sectional detail of a planetary connection.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

The engine comprises oppositely-arranged cylinders 1, secured to the hollow shaft 2 so as to rotate therewith. There are by preference two pairs of cylinders arranged relatively at a right angle to each other, the cylinders of the respective pairs being located at diametrically opposite points. The cylinders constitute bores of a drum or hub 3, which forms the body of the engine.

The valve 4 is tubular and fitted within the hollow shaft 2 and is divided longitudinally to form independent passages 5 and 6 to admit a motive agent into the cylinders and to carry off the exhaust or spent medium. The inner end of the valve is tapering to fit a corresponding seat and is provided with lateral ports 7 and 8. A nut 9 is mounted upon a threaded portion of the valve to adjust the latter longitudinally to properly seat the valve at its inner end and to take up wear. The live-port 7 is of such extent as to communicate with the ports of adjacent cylinders in an intermediate position of the valve, whereby the motive agent is simultaneously admitted to oppositely-disposed cylinders, and neutralizes itself upon the pistons thereof in such a manner as to bring the engine to a full stop with steam on. This is best shown in Fig. 4. The valve is mounted to be turned for reversing the engine, and a lever 10 is secured thereto and carries a locking-pin 11 to



engage with one of a series of openings 12, provided in a segment 13, attached to the bed or frame of the engine, so as to secure the valve in the desired position. The valve  
5 is connected with the source of supply for the motive agent and with the pipe for carrying off the exhaust or spent agent.

A ring-yoke 14 is mounted eccentrically with reference to the engine and consists of  
10 a disk or plate 15 and a ring or band 16, the latter encircling the drum or hub 3, and having the piston-rods 17 pivotally attached at their outer ends thereto. This yoke is attached to a shaft 18, arranged out of line with  
15 the engine-shaft 2 and having the fly-wheel or belt-pulley 19 keyed thereto. The rods 17 are oscillatory and have pivotal connection at their inner ends with the pistons 20.

The yoke and engine are connected for simultaneous rotation by the oscillatory piston-rods 17, which would be sufficient if it were not for the pounding of the said rods against the walls of the cylinders and the tendency of the yoke to gain and lose under variable  
25 loads. These difficulties are overcome by positive connections between the yoke and engine, said connections being of the planetary type and necessary by reason of the eccentric relation of the yoke to the engine.

A guide 21 of the yoke cooperates with a pin 22 projecting from the engine. This guide is orbital and consists of a circular opening in the disk or plate 15 and is reinforced by a hardened ring to resist wear. A roller  
35 23 is mounted upon the pin 22 and travels upon the guide 21 to reduce the friction to the smallest amount possible. The roller is tapering and the surface of the guide is of corresponding inclination, so as to take up wear.  
40 The roller is adapted to slide on the pin, a spring 24 acting thereon and held in place by a nut 25, threaded on the outer end of the pin 22. The tension of the spring can be varied by adjusting the said nut. There will be a  
45 planetary connection between the engine and

yoke for each cylinder and each will be located about midway between adjacent cylinders, this arrangement being found to give the best results. The engine may be housed either by a cover fitted over the upper half  
50 thereof or by a plate secured to the open side of the yoke parallel with the disk 15.

Having thus described the invention, what is claimed as new is—

1. In a rotary engine, oppositely-disposed  
55 cylinders and pistons working therein, a ring-yoke arranged eccentrically to the axis of the engine, oscillating rods connecting the pistons with the said ring-yoke, and planetary connections between the engine and yoke,  
60 each connection comprising an orbital guide, a pin, and a tapering roller adjustably mounted upon the pin and cooperating with the orbital guide, substantially as set forth.

2. In a rotary engine, oppositely-disposed  
65 cylinders and pistons working therein, a ring-yoke arranged eccentrically to the axis of the engine, oscillating rods connecting the pistons with the said ring-yoke, and independent self-compensating planetary connections  
70 between the engine and yoke, substantially as specified.

3. In a rotary engine, oppositely-disposed cylinders and pistons working therein, a ring-yoke arranged eccentrically to the axis of the  
75 engine, oscillating rods connecting the pistons with the said ring-yoke, an orbital guide-and-pin connection between the engine and yoke, and a spring-pressed roller mounted upon the pin and adapted to travel upon the  
80 guide, the engaging surfaces of the roller and guide being oppositely inclined to take up wear, substantially as described.

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

WIN D. WILLIAMS. [L. s.]

Witnesses:

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