

No. 664,801.

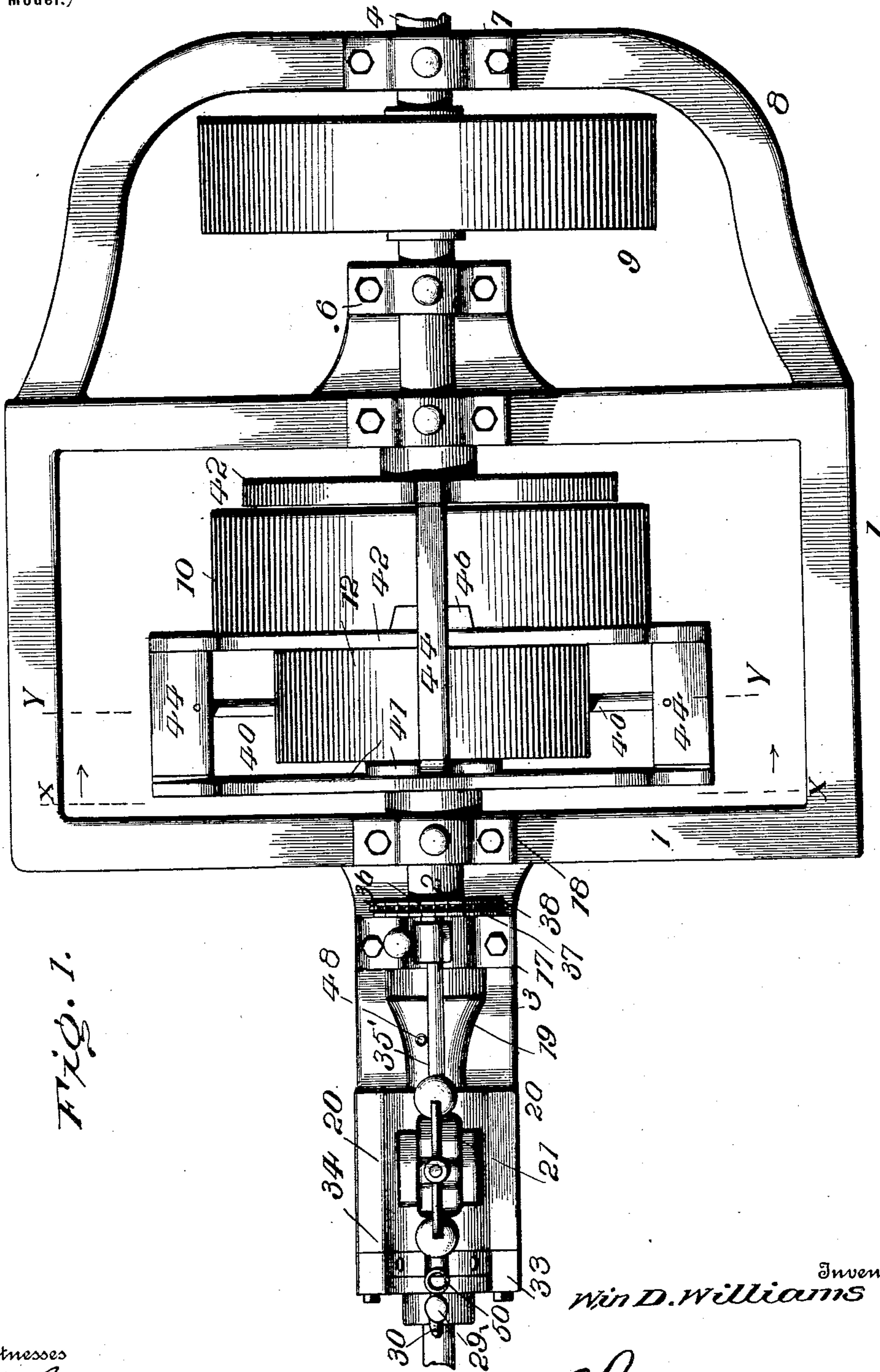
Patented Dec. 25, 1900.

W. D. WILLIAMS.  
ROTARY ENGINE.

(Application filed Mar. 16, 1900.)

(No Model.)

3 Sheets—Sheet 1.



Witnesses

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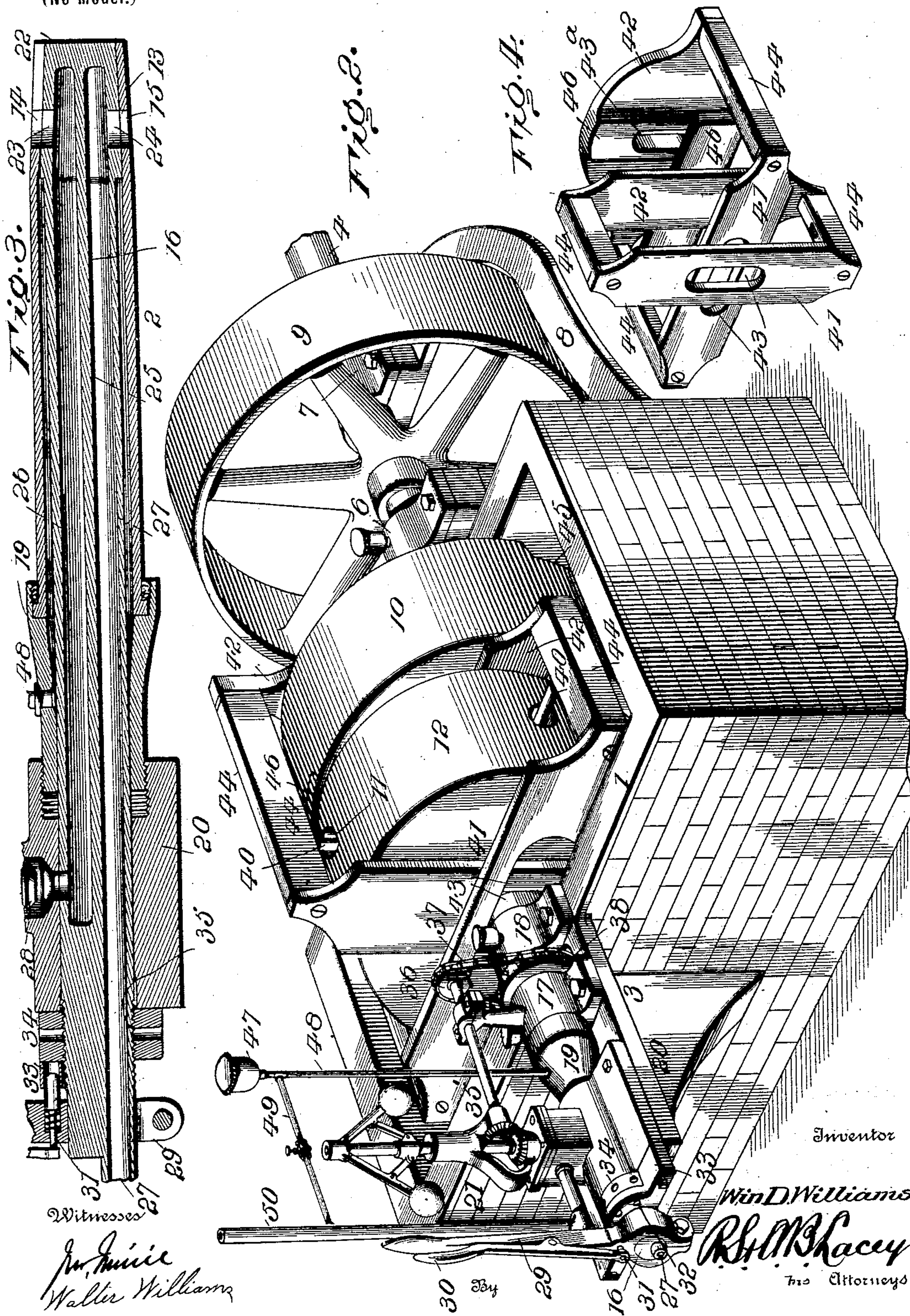
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**3 Sheets—Sheet 2.**

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3 Sheets—Sheet 3.

Fig. 5.

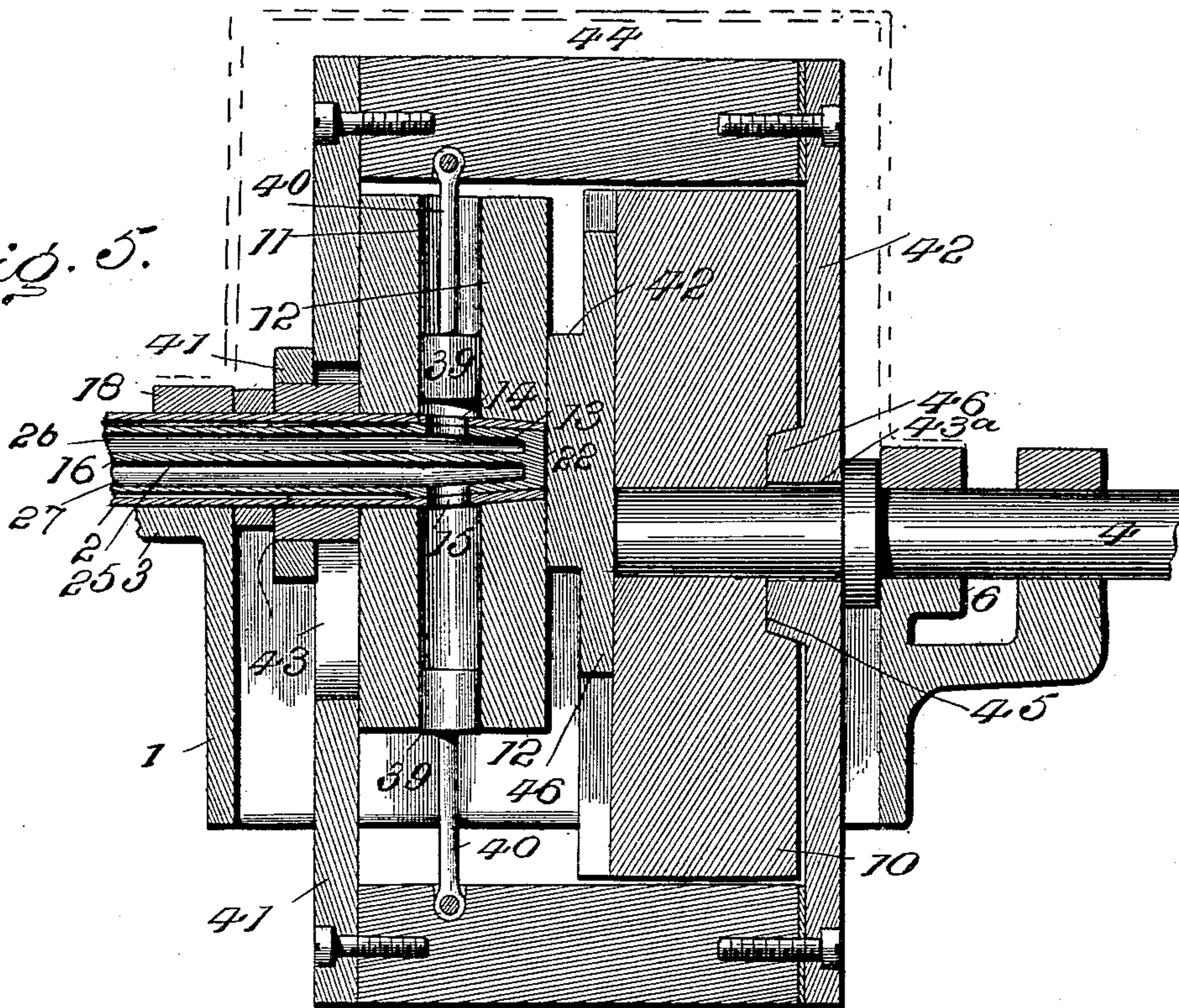


Fig. 6.

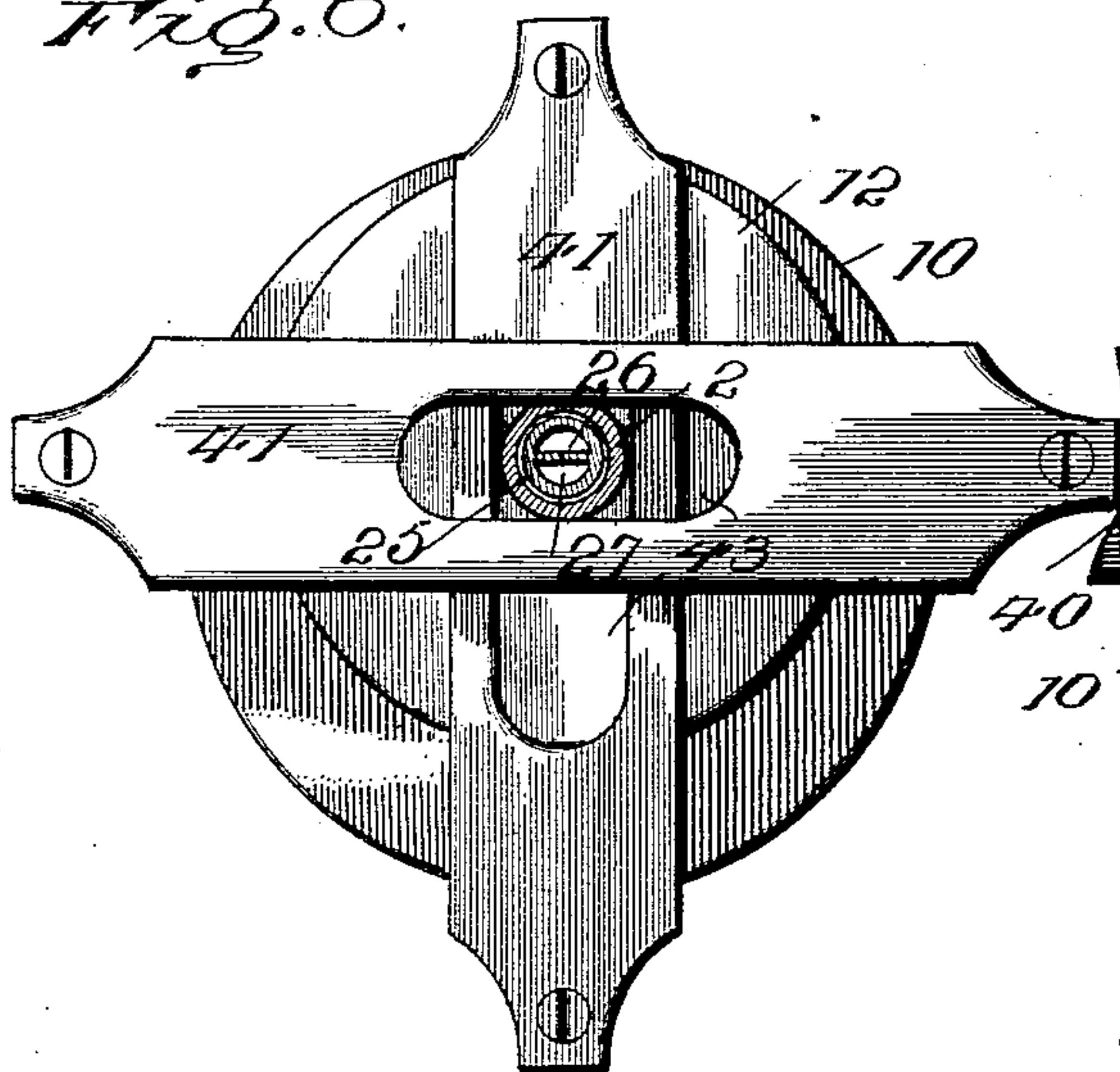
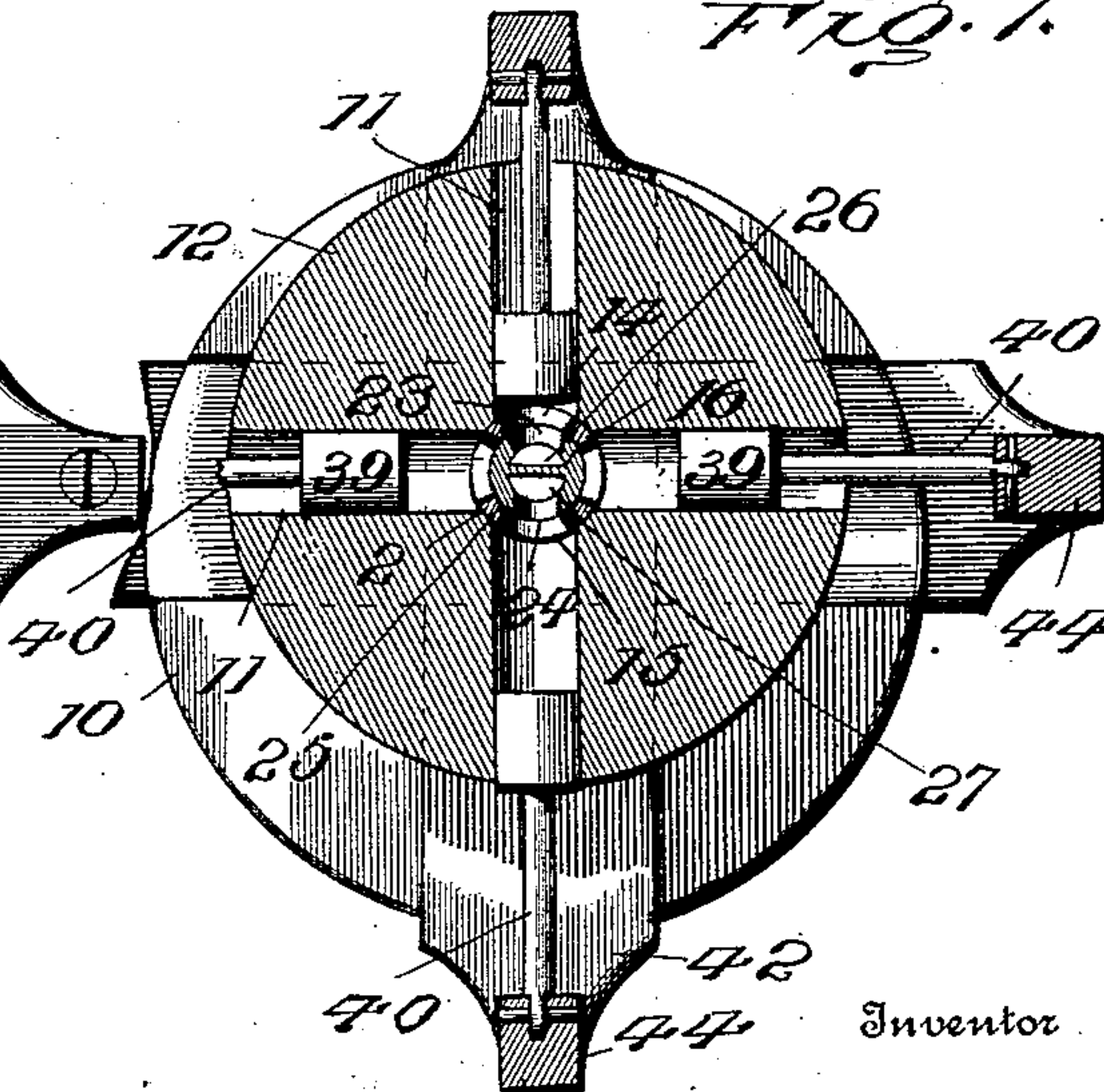


Fig. 7.



Witnesses

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# UNITED STATES PATENT OFFICE.

WIN D. WILLIAMS, OF FREDERICKSBURG, VIRGINIA, ASSIGNOR TO  
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## ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 664,801, dated December 25, 1900.

Application filed March 16, 1900. Serial No. 8,988. (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 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 belongs to the class of engines of the rotary reciprocating type comprising independent disaligned shafts, an engine mounted upon one of the shafts and having pairs of oppositely-disposed cylinders and coöperating pistons reciprocating therein in inverse order, means for admitting a motive medium into the cylinders and exhausting it therefrom in alternation to compel a positive reciprocation of the pistons, and connecting means between opposite coacting pistons and the other shaft to transform the reciprocating movement of the pistons into rotary movement.

In engines of the type aforesaid a maximum percentage of the motive medium is converted into available energy for driving machinery; but great difficulty is experienced in combining durability with the other resultant features, the chief difficulty being met with in the connections between the two disaligning shafts and which are short-lived and require constant attention to repair and replace. The present invention deals particularly with the means whereby the pistons are connected in pairs for simultaneous actuation in opposite directions and with the shafts to change their reciprocatory movement into a rotary motion of the two shafts, the connections being such as to obviate a dead-center of the engine in any position, to preclude jar or appreciable vibration, and to secure durability without detracting from the speed or power of the engine.

The invention also consists of the novel features, details of construction, and combination of the parts, which hereinafter will be more fully disclosed and finally claimed, and

for this purpose and also to acquire a knowledge of the merits of the invention and the structural details of the means whereby the results are attained reference is to be had to the appended description and the 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 top plan view of a rotary engine constructed in accordance with and embodying the vital features of this invention. Fig. 2 is a perspective view thereof. Fig. 3 is a central longitudinal section of the engine-shaft, valve, and adjunctive parts. Fig. 4 is a detail view in perspective of the coupling means between the respective oppositely-disposed pistons and the disaligned shafts. Fig. 5 is a sectional detail showing the relation of opposite cylinders, the pistons working therein, the engine-shaft, the valve, the coupling device, and the guide coöperating therewith. Fig. 6 is a section on the line X X of Fig. 1, as indicated by the arrows. Fig. 7 is a section on the line Y Y of Fig. 1.

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 frame 1 for supporting the operating parts is preferably of rectangular outline in plan elevation and is a single casting to obviate the formation of joints. However, the precise construction of the frame or base is unimportant and will depend for its manner of formation upon the caprice of the designer or constructor. The engine-shaft is indicated at 2 and is hollow or tubular and is mounted in bearings applied to a bracket or extension 3 of the frame or base. The driven shaft 4 is mounted in bearings 6 and 7, the former springing directly from the base 1 and the latter being applied to a bracket 8, projecting from the said base and preferably integral therewith. A band-pulley 9 is attached to the shaft 4, and power is taken therefrom in the usual manner for driving machinery of any



kind. The shafts 2 and 4 are arranged out of line, and a disk or plate 10 is secured to the inner end of the shaft 4, so as to rotate therewith. Oppositely-disposed pairs of cylinders 11 are attached to the inner ends of the shaft 2 and are rotatable therewith and are formed, preferably, by boring a disk or head 12, which is secured in any substantial manner to the shaft 2. The head 12 and the disk or plate 10 have a subjacent disposition and are located within the space circumscribed by the end and side walls of the frame or base 1. The inner end of the shaft 2 is made tapering, as indicated at 13, and is closed by the solid end of the valve, ports 14 and 15 being provided in its sides at diametrically-opposite points to afford ingress and egress for the motive medium employed for driving the engine. One of the ports, as 14, constitutes an inlet, and the other port 15 the outlet, for the spent motive medium. These ports are adapted to register in alternation with corresponding ports 23 and 24 in a valve 16. As shown, the cylinders are intersected by the tapering end 13 of the shaft, which in effect constitutes a seat for the tapering end of the valve 16, and the ports 14 and 15 communicate directly with the inner ends of the cylinders and alternately register with the ports 23 and 24 as the cylinders rotate to admit and exhaust the motive medium.

As previously stated, the shaft 2 is hollow and is mounted in bearings 17 and 18, and its outer end terminates a short distance from the outermost bearing 17 and is provided with a stuffing-box 19 to make a steam-tight joint between it, the valve 16, and the frame 20 of the governor 21. The valve 16 is concentric with the shaft 2, and its inner end is made tapering, as shown at 22, and is provided with ports 23 and 24 to register with the ports 14 and 15 of the shaft 2 and corresponding with oppositely-disposed cylinders 11. The valve 16 is subdivided by a partition 25 into longitudinal passages 26 and 27, the former constituting the live-steam duct and the latter the exhaust-duct. The steam or motive medium is admitted into the duct or passage 26 by means of the valve 28 of the governor 21 and is exhausted through the duct or passage 27 and is conveyed to any suitable point of discharge. The valve 16 is relatively fixed, but is adjustable longitudinally and angularly, the longitudinal adjustment taking up wear between the tapering end of the valve and its seat 13, and the angular or rotary adjustment enabling the engine to be reversed or the motive medium to be cut off at any desired point in the stroke of the pistons. A lever 29 is clamped to the outer end of the valve 16 and is the means provided for turning said valve either to the right or to the left, and this lever is provided with a hand-latch 30, connected with a pin 31, which is adapted to enter any one of a series of openings 32 in a bearing 33, so as to hold the lever 29 in an adjusted position. When once ad-

justed, the valve 16 remains fixed. The bearing 33 is transversely slotted, and a nut 34 is rotatably fitted in the slot and is mounted upon a threaded portion 35 of the valve. This nut 34 is adapted to be turned either to the right or to the left in any desired manner to effect a longitudinal movement of the valve in the required direction. As shown, the nut 34 is provided with a series of openings to receive a rod, (not shown,) by means of which it is positively turned in one direction or the other to attain the desired end.

The governor 21 may be of any type, and the motive medium is controlled thereby. The shaft 35, controlling the speed of the governor-arms, is provided at its outer end with a sprocket-wheel 36, which is driven by means of a sprocket-chain 37 from a sprocket-wheel 38, secured to the shaft 2 between the bearings 17 and 18. It will thus be seen that the governor has direct connection with the engine-shaft, and the speed of the latter controls the speed of the governor, which latter in turn regulates the admission of the motive medium to the engine to prevent an abnormal speed when the load is diminished.

It is highly important that two pairs of cylinders 11 be provided and that the cylinders of each pair be located at diametrically opposite points and radially with reference to the engine. Each pair of cylinders is disposed relatively at a right angle to the other pair, so as to preclude the possibility of the engine stopping on a dead-center. The pistons 39, arranged to work in the cylinders 11, have their rods 40 connected in such a manner as to cause corresponding oppositely-disposed pistons to reciprocate synchronously in opposite directions, whereby when one piston is moving outward under the influence of the motive medium the diametrically opposite piston is at the same time moving inward to a starting position. Coöperating pistons have their rods connected in substantially the same manner. The connecting means are of a floating character—that is, they are devoid of any fixed fulcrum or support, which will be apparent when it is remembered that they serve not only to connect the pistons, but likewise the disaligned shafts 2 and 4. For the sake of simplicity and perspicuity a detailed description of one set of connections only will be given, the other set being substantially the same, with the exception of a variation in form and dimensional extent. Companion bars or elements 41 and 42, disposed in parallel relation, are provided with slots 43 and 43<sup>a</sup> and are connected by transverse bars 44, to which the rods 40 are attached at their outer ends. The slots 43 and 43<sup>a</sup> receive the respective shafts 2 and 4 and enable the frames to reciprocate with the attached pistons. The bars 41 are slidably fulcrumed upon the engine-shaft 2, which is essential in order to provide for their changed relation incident to the eccentric disposition



of the parts 10 and 12 and the rotation thereof. Cross heads, bars, or parts 46 are attached to or formed with the bars 42 and extend at a right angle to the plane of the respective frames and cooperate with guideways formed with or applied to the part 10. The opposite edges of the parts or cross-heads 46 are beveled and outwardly flared, whereby provision is had for taking up wear between them and the seats or guideways formed in the opposite faces of the disk or plate 10. A channel or seat 45 is formed in each face of the disk 10, and the seat in one face is arranged at a right angle to the seat in the opposite face to accommodate the right-angular disposition of the bars 46 of the connecting-frames. Obviously any well-known form of guideway between the cross-heads 46 and the part 10 may be provided, so as to positively direct the frames in their reciprocating movements. When in operation, the motive medium—steam, compressed air, or the like—is admitted into the cylinders successively through the port 23 of the valve 16 and is exhausted in succession from the cylinders through the ports communicating with their inner ends. As the pistons are forced outward the cylinders, shafts, and cooperating parts receive a rotary motion by means of the eccentric disposition of the parts 12 and 10 and the disaligning of the shafts 2 and 4. As the cylinders rotate the connecting-frames receive a combined rotary and reciprocating movement by reason of their ever changing relation with reference to the parts 12 and 10. Hence oppositely-disposed pistons are caused to reciprocate simultaneously in reverse directions, and when one set of pistons is on a dead-center the other set is off a dead-center and in position to receive the impulse of the motive medium. Therefore it is practically impossible to stop the engine on a dead-center.

The valve is lubricated by means of an oil-cup 47, connected with the stuffing-box 19 by means of a pipe 48. The lubricant is forcibly fed by means of the motive medium which is supplied to the pipe 48 by means of a pipe 49, connecting the supply-pipe 50 therewith and having a controlling-valve in its length. Having thus described the invention, what is claimed as new is—

1. In a rotary engine, two shafts arranged out of line, pairs of cylinders having an angular disposition and mounted to rotate about one of the shafts, and pistons arranged to work in the said cylinders, a plate secured to the other shaft to rotate therewith, and separate connections joining the respective pairs of pistons and having independent sliding attachment with the said plate, and acting jointly therewith and with the pistons and cylinders to cause the engine and plate-carrying shaft to rotate together, substantially as described.

2. In a rotary engine, two shafts arranged out of line, pairs of cylinders having an angular disposition and mounted to rotate about

one of the shafts, and pistons arranged to work in the said cylinders, a plate secured to the other shaft to rotate therewith, and separate connections joining the respective pairs of pistons and having independent sliding attachment with the said plate and the shaft bearing the engine and directed in their movements thereby and serving to cause simultaneous rotation of the engine and plate-carrying shaft, substantially as specified.

3. In a rotary engine, two shafts arranged out of line, pairs of cylinders having an angular disposition and mounted to rotate about one of the shafts, and pistons arranged to work in the said cylinders, a plate secured to the other shaft to rotate therewith, and having guides at its opposite sides, and separate connections joining the respective pairs of pistons and having independent sliding attachment with the respective guides of the said plate and with the shaft of the engine and directed in their movements thereby and serving to cause simultaneous rotation of the engine and plate-carrying shaft, substantially as specified.

4. In a rotary engine, the combination with oppositely-disposed cylinders and pistons working therein, of a plate or disk eccentrically disposed with reference to the engine-shaft and having a transverse guideway, of a frame connecting the pistons and having one of its bars longitudinally slotted to receive the engine-shaft, and a cross-head applied to the said frame and operating in the guideway of the aforesaid plate or disk, substantially as set forth.

5. In a rotary engine, pairs of oppositely-disposed cylinders arranged relatively at a right angle to each other, pistons working in said cylinders, and a plate or disk eccentrically disposed with reference to the engine-shaft and having guideways in opposite faces, arranged relatively at a right angle to each other, of independent connections disposed at a right angle to each other and connecting corresponding pistons for simultaneous operation and having independent slidable connection with the respective guideways of the aforesaid plate or disk, substantially as set forth.

6. In a rotary engine, pairs of cylinders right-angularly disposed, pistons working therein and a plate or disk having guideways upon its opposite faces and arranged at a right angle to each other, of independent frames connecting cooperating pistons for simultaneous action and provided with cross-heads to operate in the respective guideways of the said plate or disk, substantially as set forth.

7. In a rotary engine, and in combination with pairs of cylinders disposed relatively at a right angle to each other, pistons working therein and a plate or disk having grooves or channels in opposite faces and extending at a right angle to each other with their side walls outwardly flaring, of independent frames connecting cooperating pistons and having their



side bars longitudinally slotted to receive the  
respective shafts of the engine and plate or  
disk, and cross-heads secured to a bar or mem-  
ber of the frames and operating in the guide-  
5 ways of the said plate or disk and having  
their edges beveled and outwardly flared, sub-  
stantially as set forth.

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

WIN D. WILLIAMS. [L. S.]

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