4 Sheets—Sheet 1.

F. W. LINK.

Rotary-Engines.

No. 226,527. **Patented April 13, 1880.**

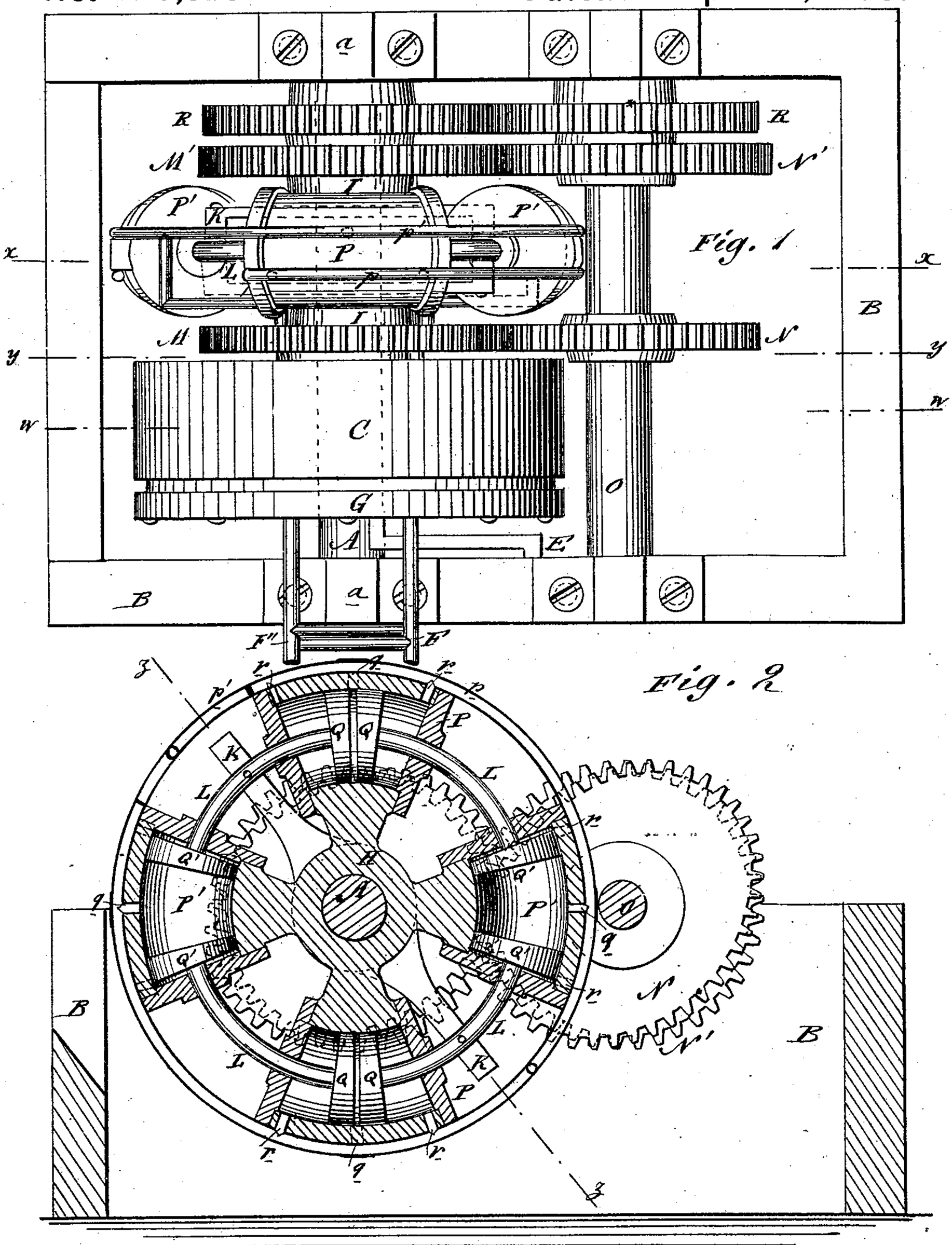

Fig. 1

Fig. 2

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Fig. 5

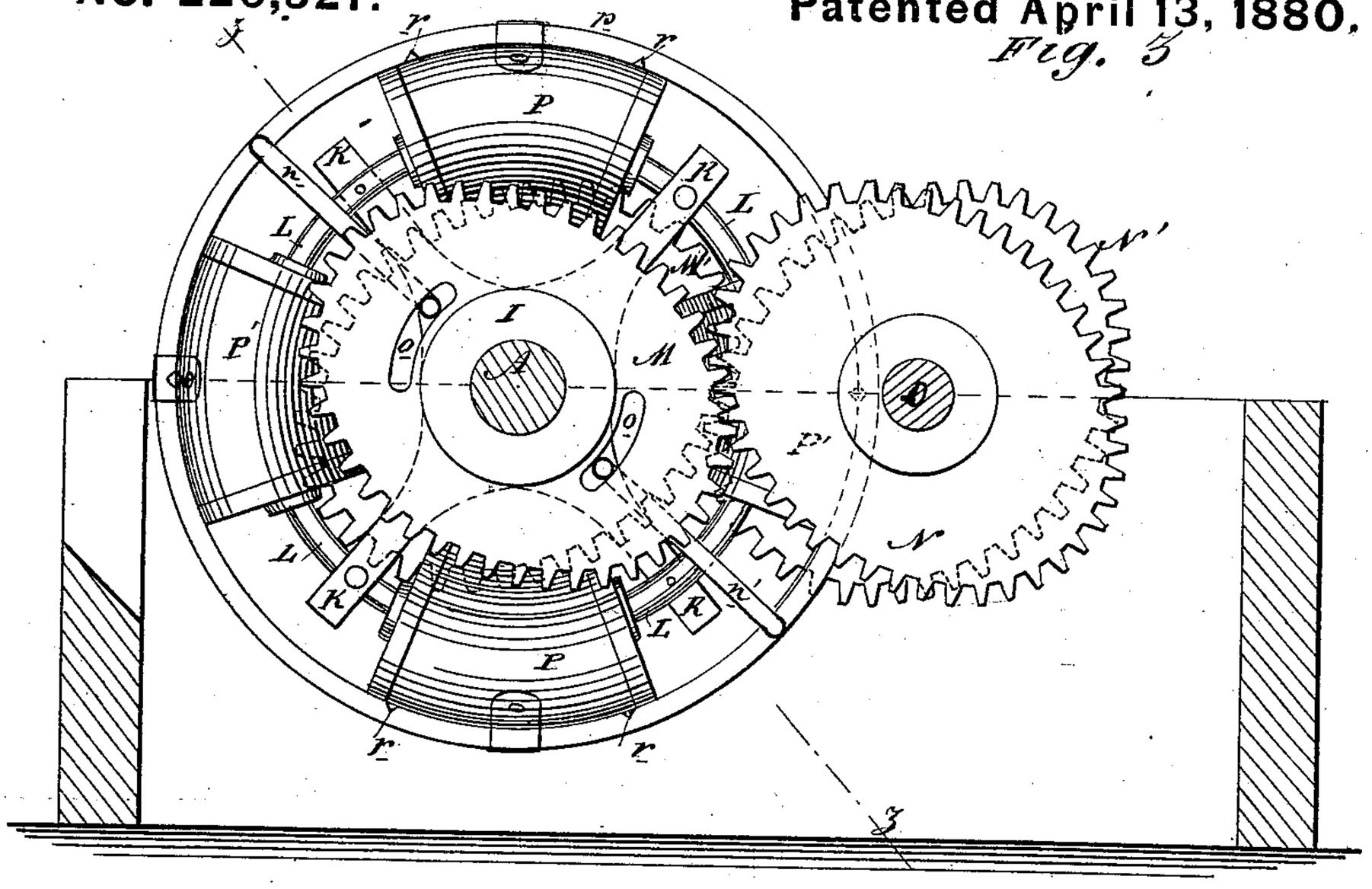
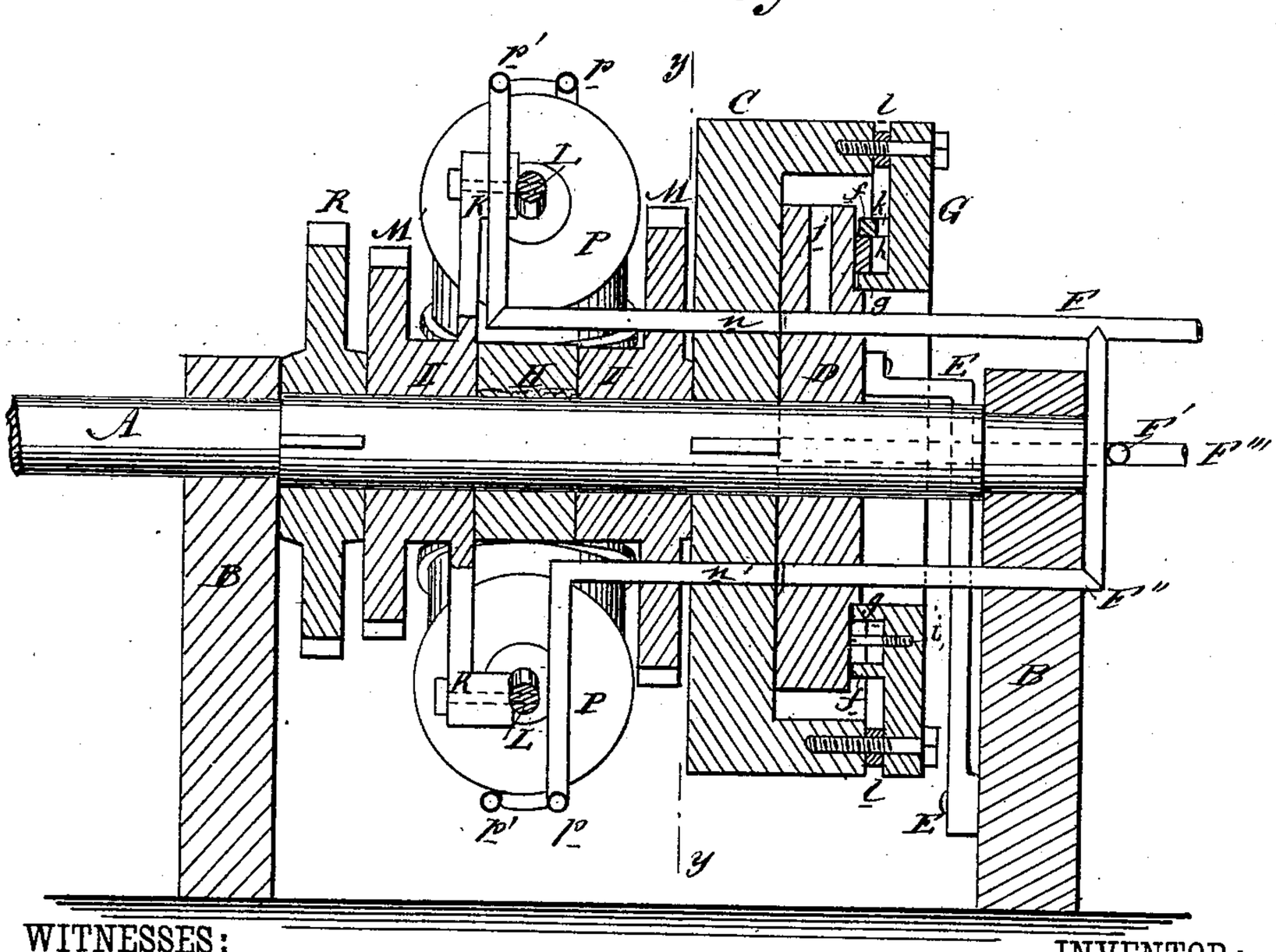


Fig. 4



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4 Sheets—Sheet 3.

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Rotary-Engines.

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Fig. 5

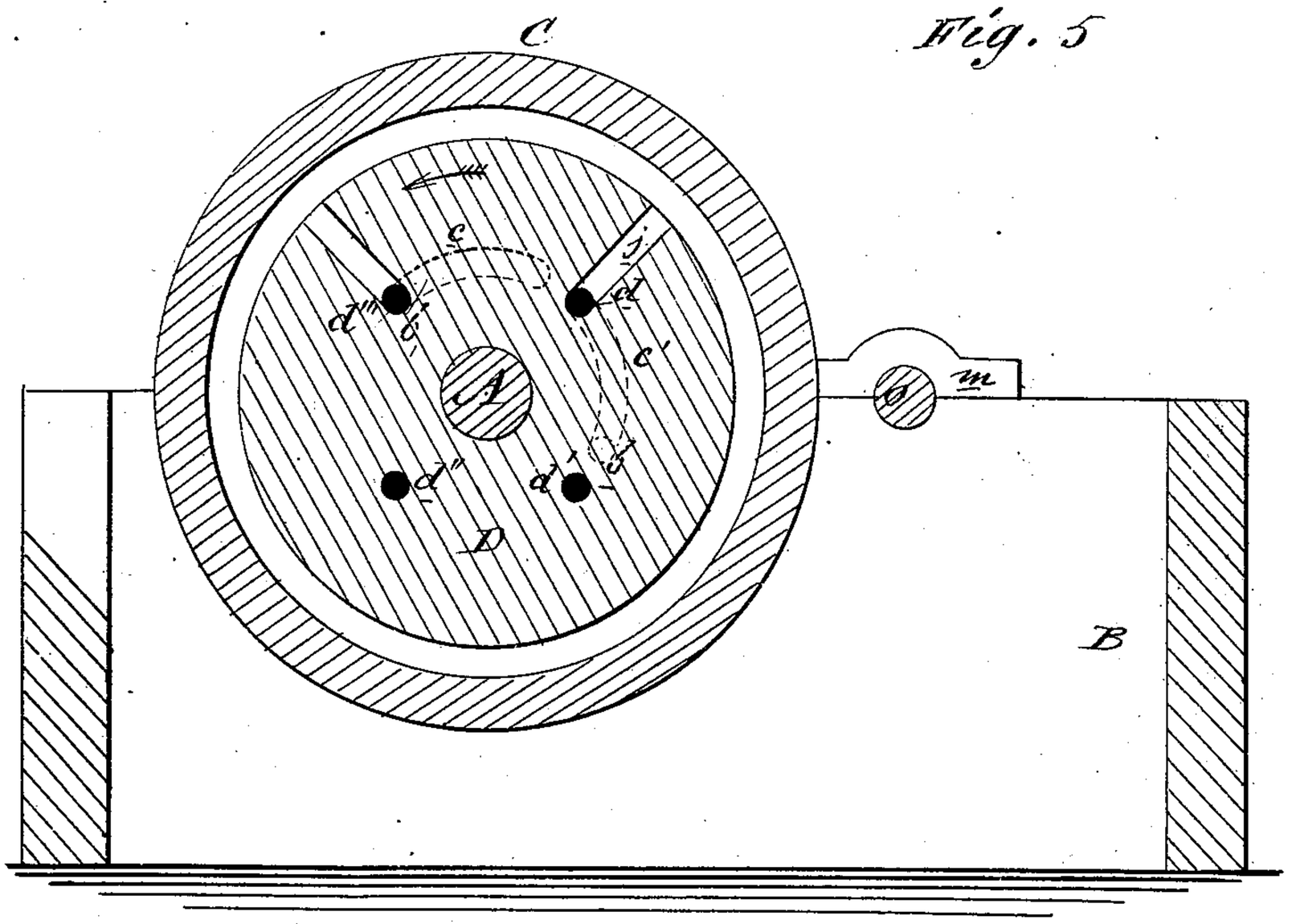


Fig. 6

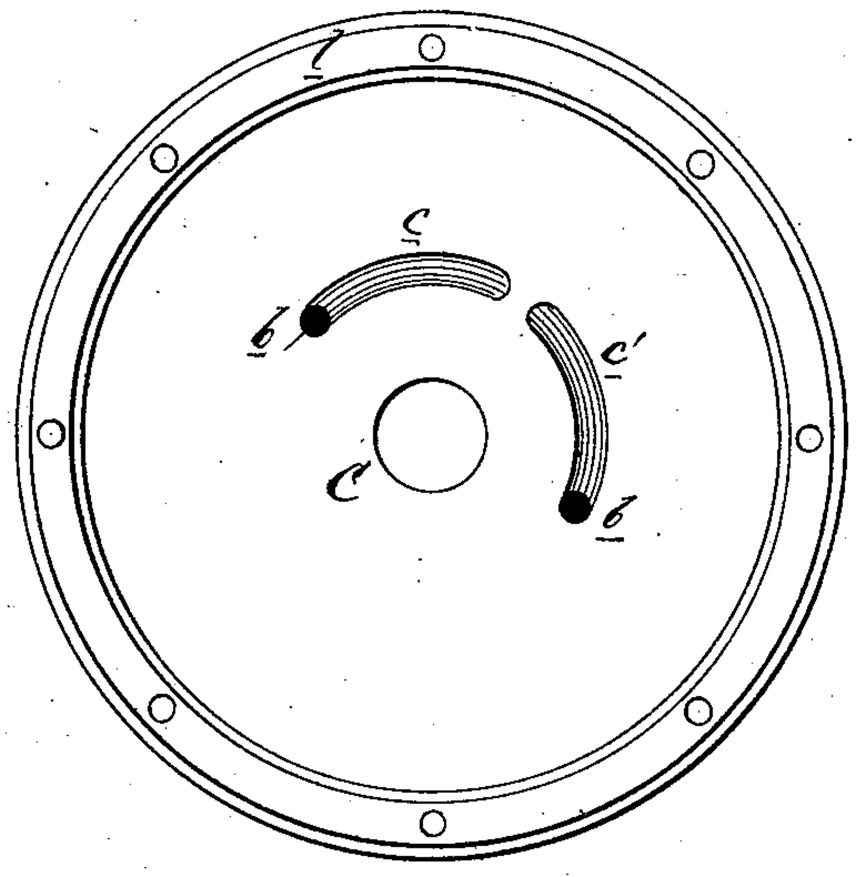
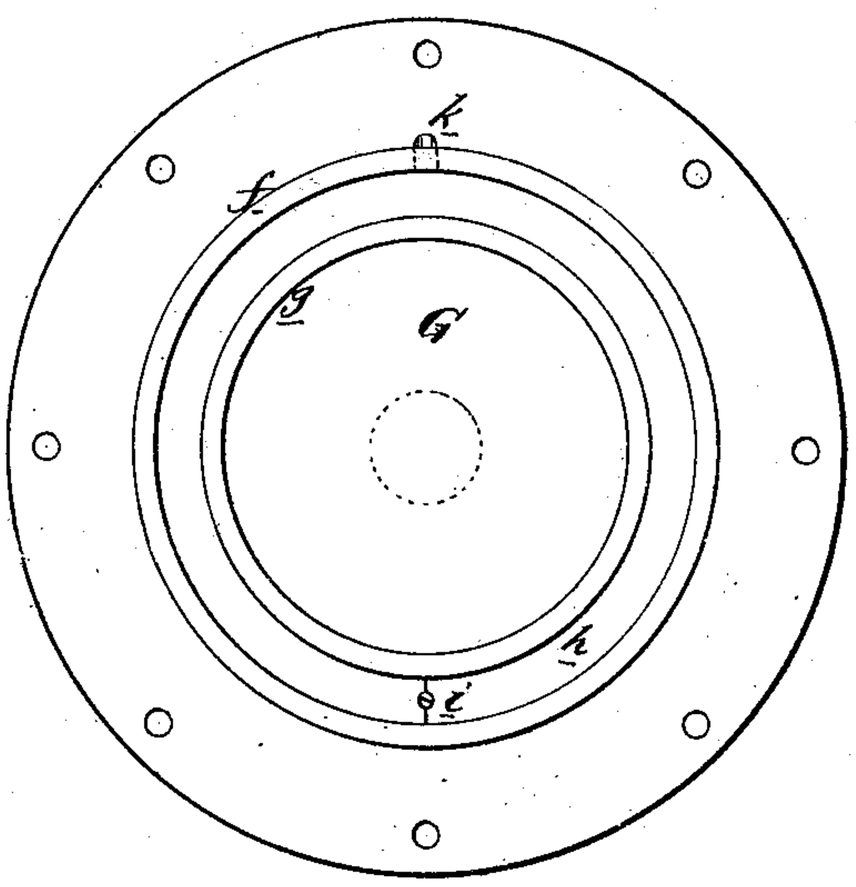


Fig. 7



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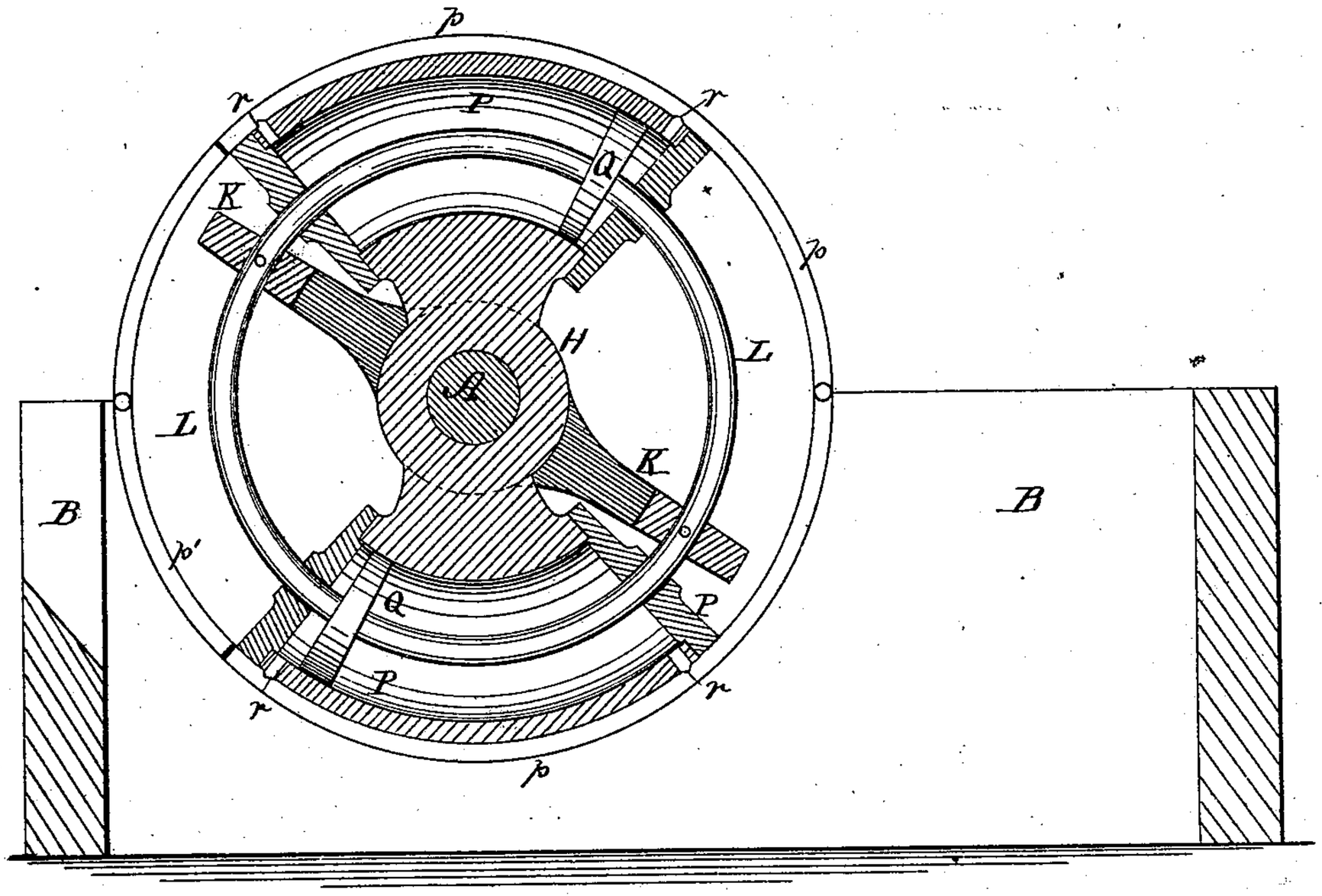
Rotary-Engines.

No. 226,527. **Patented April 13, 1880.**

Fig. 8.



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UNITED STATES PATENT OFFICE.

FREDERIC W. LINK, OF BELMONT, OHIO, ASSIGNOR TO HIMSELF AND NATHAN HOLLOWAY, OF SAME PLACE.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 226,527, dated April 13, 1880.

Application filed October 27, 1879.

To all whom it may concern:

Be it known that I, FREDERIC W. LINK, of Belmont, in the county of Belmont and State of Ohio, have invented a new and Improved Rotary Engine, of which the following is a specification.

Figure 1 is a plan of the engine. Fig. 2 is a vertical sectional elevation on line *x x*, Fig. 1. Fig. 3 is a vertical sectional elevation on line *y y*, Fig. 1. Fig. 4 is a sectional elevation on line *z z*, Figs. 2 and 3. Fig. 5 is a vertical sectional elevation on line W W, Fig. 1. Fig. 6 is an end elevation, showing the inside of the steam-chest. Fig. 7 is an elevation showing the inner face of the steam-chest head. Fig. 8 is a vertical section, showing a modified construction of the cylinders and pistons.

Similar letters of reference indicate corresponding parts.

The object of this invention is to provide an improved valveless engine that when in operation shall move continuously in one direction, and shall transmit its motion by means of elliptic cog-wheels.

The invention consists of a rotary engine composed essentially of one or two pairs of curved cylinders fixed at equal distances apart on the outer ends of the arms of a radiating solid spider that is keyed upon a driving-shaft; of one or two pistons—according as there is one or two pairs of cylinders—in each cylinder; of one circular piston-rod when there is but one pair of cylinders, or four curved piston-rods when there are two pairs of cylinders; of radial arms rigidly attached to the piston rod or rods, the arms being attached to elliptical gears that by their novel arrangement control the motion and transmit the power of the engine, and of a steam chest and pipes to regulate the supply and discharge of the steam.

In the drawings, A represents the main shaft of the engine, journaled in boxes *a* on the frame B,

C is the steam-chest, keyed upon the shaft A and provided with two steam-ports, *b*, cut through its head, about one hundred and eighty degrees apart; and communicating with each of these steam-ports *b* is a curved groove, *c c′*, cut in the seat of the steam-chest C, each groove *c c′* being somewhat less than ninety degrees in length.

D is a stationary disk that is held centrally within the steam-chest C by the arm or brace E, that is fastened to the frame B, as shown in Figs. 1 and 4, and this disk D is provided with four ports, *d d′ d″ d‴*, ninety degrees apart, through which steam enters by the pipes F F′ F″ F‴ into the steam-chest C.

G is the steam-chest head, with two flanges, *f g*, fastened on its inner face, between which flanges *f g* is set a packing-ring, *h*, that is kept from rotating by the pin *i*, and is pressed out against the disk D to form a tight joint at point of contact by steam that passes through the radial channel *j* in the disk D and enters through the passage *k* behind the said packing.

l represents a packing-ring inserted between the steam-chest C and its head G.

Set loosely on the shaft A, one on each side of the spider H, are the hubs or collars I, from each of which radially project the arms K, whose ends are rigidly connected with the piston-rods L at their centers; and keyed to these collars I are the elliptic cog-wheels M M′, that mesh into the corresponding elliptic wheels N N′, which are keyed on the shaft O, that is journaled in the boxes *m* on the frame B.

The spider H is firmly keyed to the shaft A, and carries on the end of each arm a steam-cylinder, P P′. These cylinders P P′ are four in number, of equal dimensions, set at equal distances apart, having ends sloping on lines converging to the longitudinal axis of the shaft A, and they form, in connection with the piston-rods L, a complete circle about the shaft A.

Connecting with the steam-ports *b* of the steam-chest C are the pipes *n n′*, that pass through the slots *o* in the cog-wheel M, and bend upward, and unite, one with the circular pipe *p*, and the other with the pipe *p′*. Both of these pipes *p* and *p′* connect with the upper surface of each cylinder P P′, each pipe *p p′* connecting alternately by a single pipe with the central port, *q*, of the cylinder, and in the next instance with the two end ports, *r*, and where the pipe *p* connects with the cen-

tral chamber of a cylinder the pipe p' connects with the end chambers, and vice versa, so that the two sets of pipes p p' serve alternately as supply and exhaust pipes, and this change from supply to exhaust occurs at every quarter of a revolution of the cylinders P P'.

In order more clearly to describe the operation of this device, we will suppose that the engine is in the position shown in Figs. 1, 2, 3, and 4, in which it appears that the two cylinders P are in a horizontal and the two P' in a vertical position. In this position the pistons Q of the upper cylinder P and those of the lower cylinder P will be at their nearest approach to each other, while the pistons Q' of the side vertical cylinders, P', will be at their farthest point apart. If, now, steam is introduced into the central chambers of the horizontal cylinders P, between the pistons Q, and into the end chambers of the vertical cylinders P', the effect will be to drive apart the pistons Q of the horizontal cylinders P, and to bring toward each other the pistons Q' of the vertical cylinders P', and these motions of the pistons Q and Q' are communicated through the piston-rods L and arms K to the collars I, to which are keyed the elliptic cog-wheels M M', and hence it will be seen that the tendency of these cog-wheels M M' is to move with an alternate forward and backward rotary motion; but this tendency is overcome by the difference in the diameters of the said wheels. To bring about this result steam must flow into the cylinders P through the pipes p, and exhaust through the pipe p' and a steam-port, b, into the steam-chest C, and thence through one of the pipes F. It will be seen that the elliptical cog-wheel M now acts with its short diameter meshing into the long diameter of its corresponding wheel N, and hence, for the moment, moves through a greater distance and exerts greater power or leverage than does the cog-wheel M', that at this time meshes with its long diameter in the short diameter of the corresponding wheel N'; hence the cog-wheel M overpowers and moves faster than the cog-wheel M', and forces the latter around until the cylinder P' becomes horizontal. Then the pipe p' becomes the steam-supply pipe, and the pipe p the exhaust-pipe, and the movement of the pistons Q Q' is reversed, and the then superior leverage of the cog-wheel M' overpowers that of the cog-wheel M and continues the revolution of the engine.

The circular cog-wheels R are intended by their meshing together to insure the regularity of the engine's motion and to keep the cylinders in a central position between the approaching and receding arms K.

As the cylinders P P' revolve the steam-chest C also revolves. Now, if the ports d' d''' be the steam-supply ports and the ports d d'' the exhaust-ports, as the groove c passes over the port d''' in the direction of the arrow steam will flow in through the pipe F''', that communicates with the groove c, and will continue to flow until the port d''' covers the space between c and c'.

When d''' communicates with the groove c' the other set of pipes become the suppliers, and d'' having made connection with c, the pipe F'', that opens into the port d'', becomes the exhaust-pipe, and continues to be so until d'' again comes opposite the space between c and c', when d' will next open communication with c, and the pipes will again change their functions, the pipes p p' and n n' also changing from supply to discharge pipes and back again in correspondence therewith.

I do not confine myself to the use of two pairs of cylinders, as herein shown, for it is obvious that one pair of cylinders can be so arranged as to transmit power on the same principle, as may be seen in Fig. 8, where the pistons are reduced to one on each cylinder, and where the piston-rod is one continuous circular rod, L, to which are attached the pistons Q and the radial arm K, the motion being regulated and the power transmitted by a similar cog-gearing, as hereinbefore shown, and the steam being supplied by a similar steam chest and pipes.

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

1. In a rotary engine, the revolving cylinders placed diametrically opposite each other and connected through their piston-rods to loose collars having an alternate slow and fast movement in one direction upon the shaft on which the cylinders are placed, as and for the purpose set forth.

2. In a rotary engine, the combination, with the rotary shaft A O, spider H, collars I, having arms K, and the piston-rods L, of the elliptic cog-wheels M M' and N N', constructed and arranged substantially as herein shown and described.

3. The within-described shaft A, steam-chest C, stationary disk D, spider H, collars I, arms K, piston-rods L, elliptical cog-wheels M M' N N', cylinders P P', pistons Q Q', and steam-pipes herein shown, in combination with gears R, substantially as and for the purpose described.

4. The cog-wheels R, elliptical gears M M' N N', and shafts A O, in combination, substantially as herein shown and described, for the purpose of regulating the motion of a rotary engine.

5. In a rotary engine, the combination of the segment-cylinders fixed to a shaft by a solid spider, and connected to each other by means of piston-rods, with the pipes p p' and n n', for supplying and exhausting steam to and from the chest, as and for the purpose set forth.

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Witnesses:
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