(No Model.) 3 Sheets—Sheet 1.

# W. P. AKERS.

## ROTARY ENGINE.

No. 414,359. Patented Nov. 5, 1889.

Fig. 1.

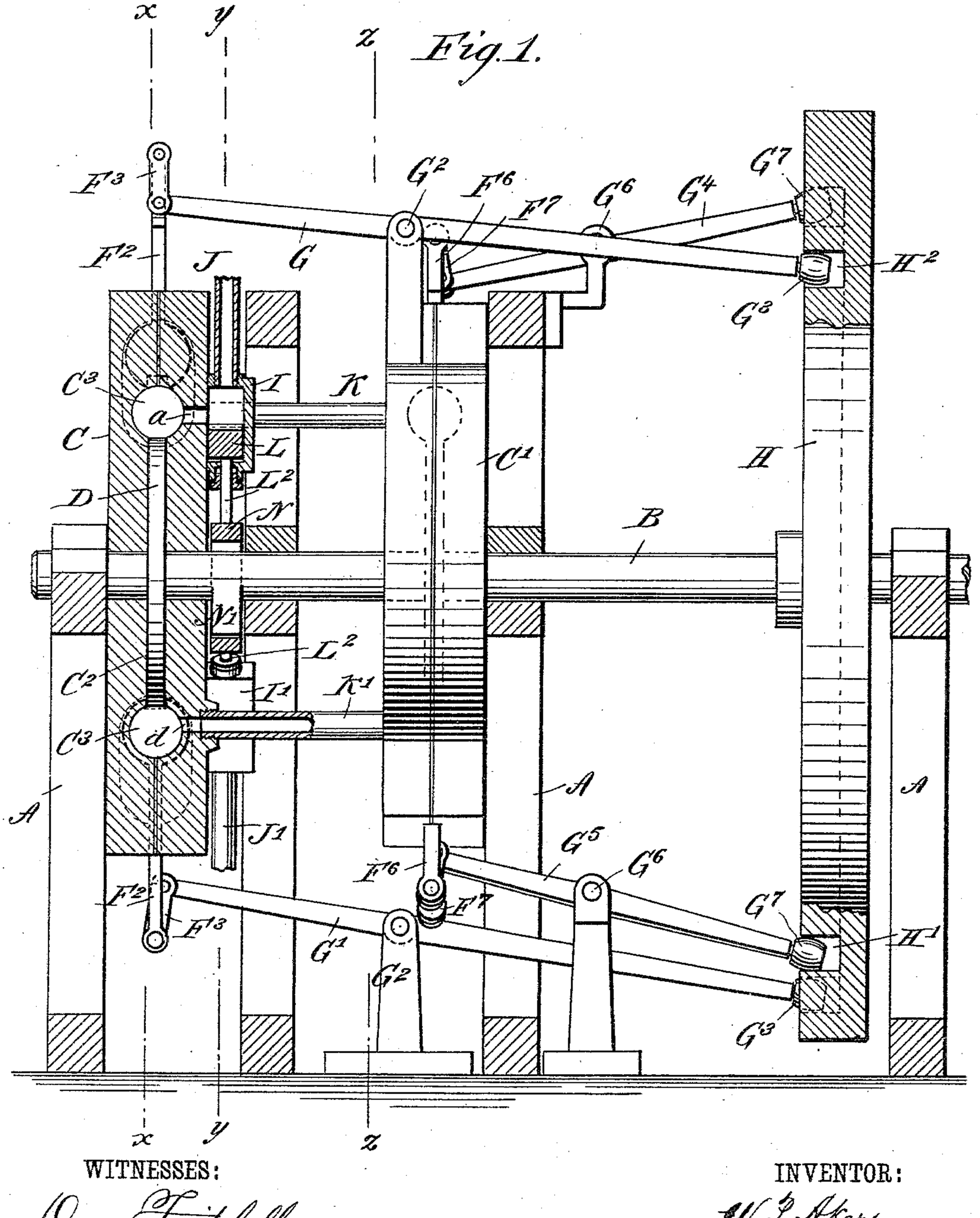


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Fig. 3.

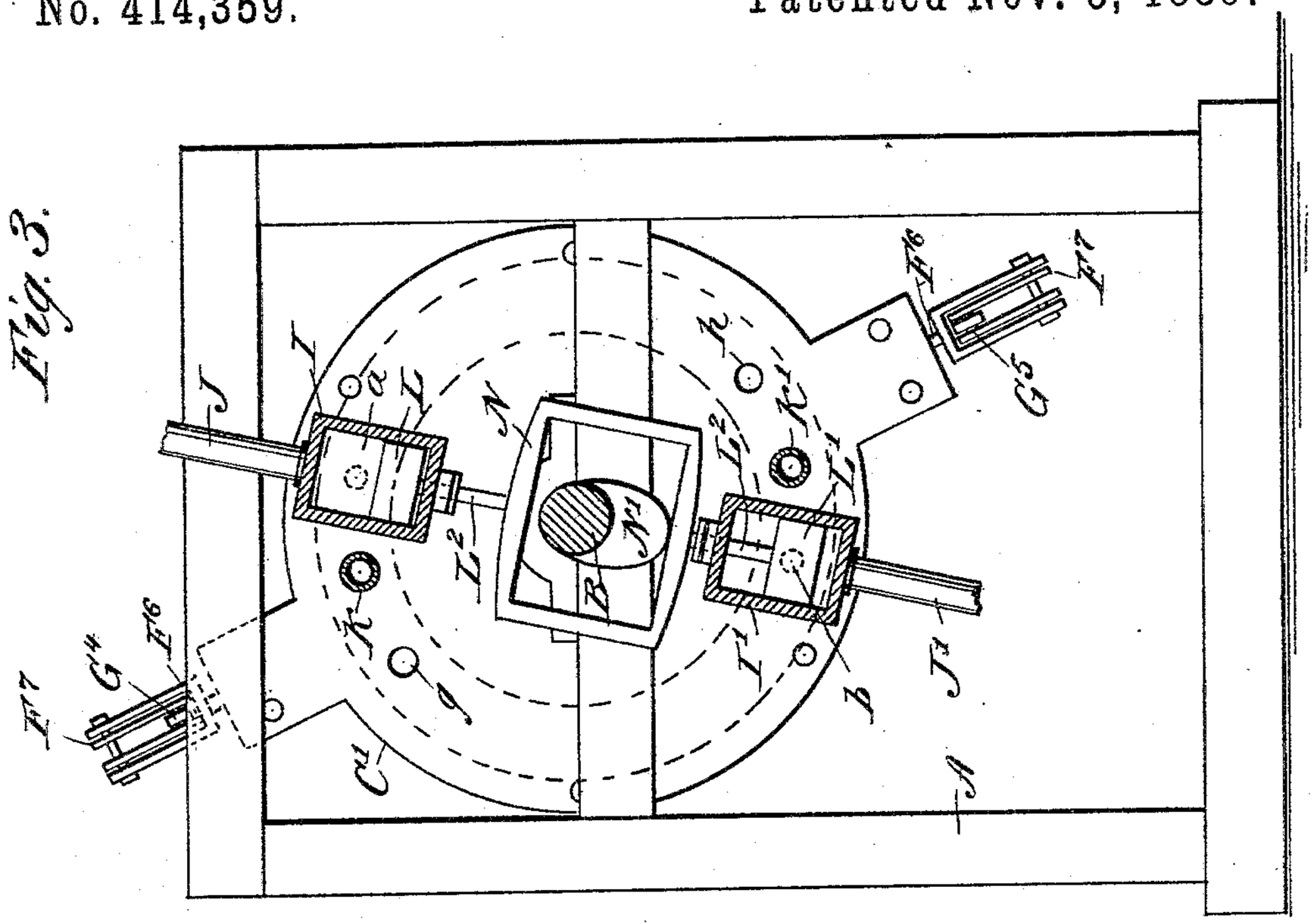
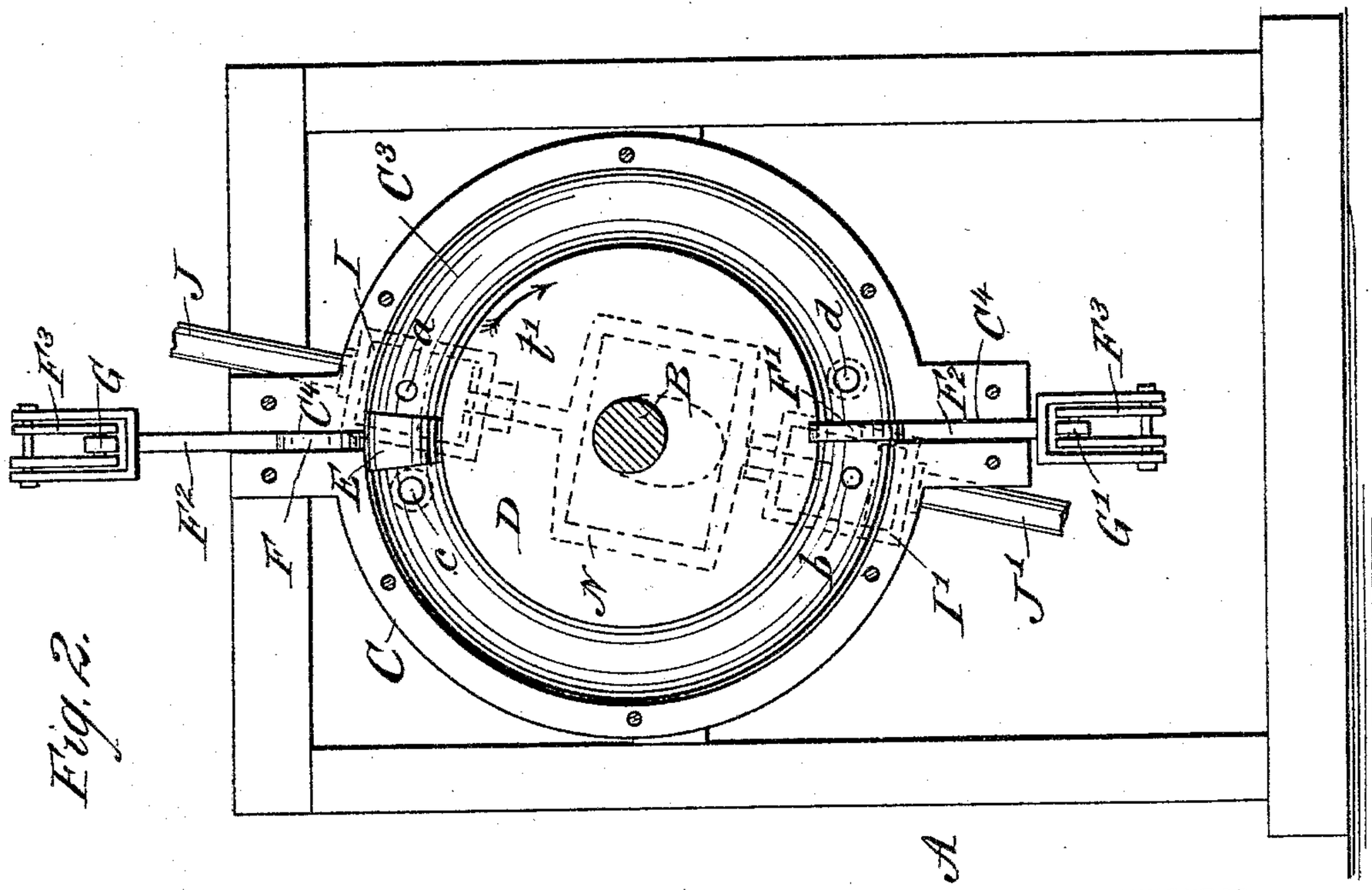



Fig. 2.

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## ROTARY ENGINE.

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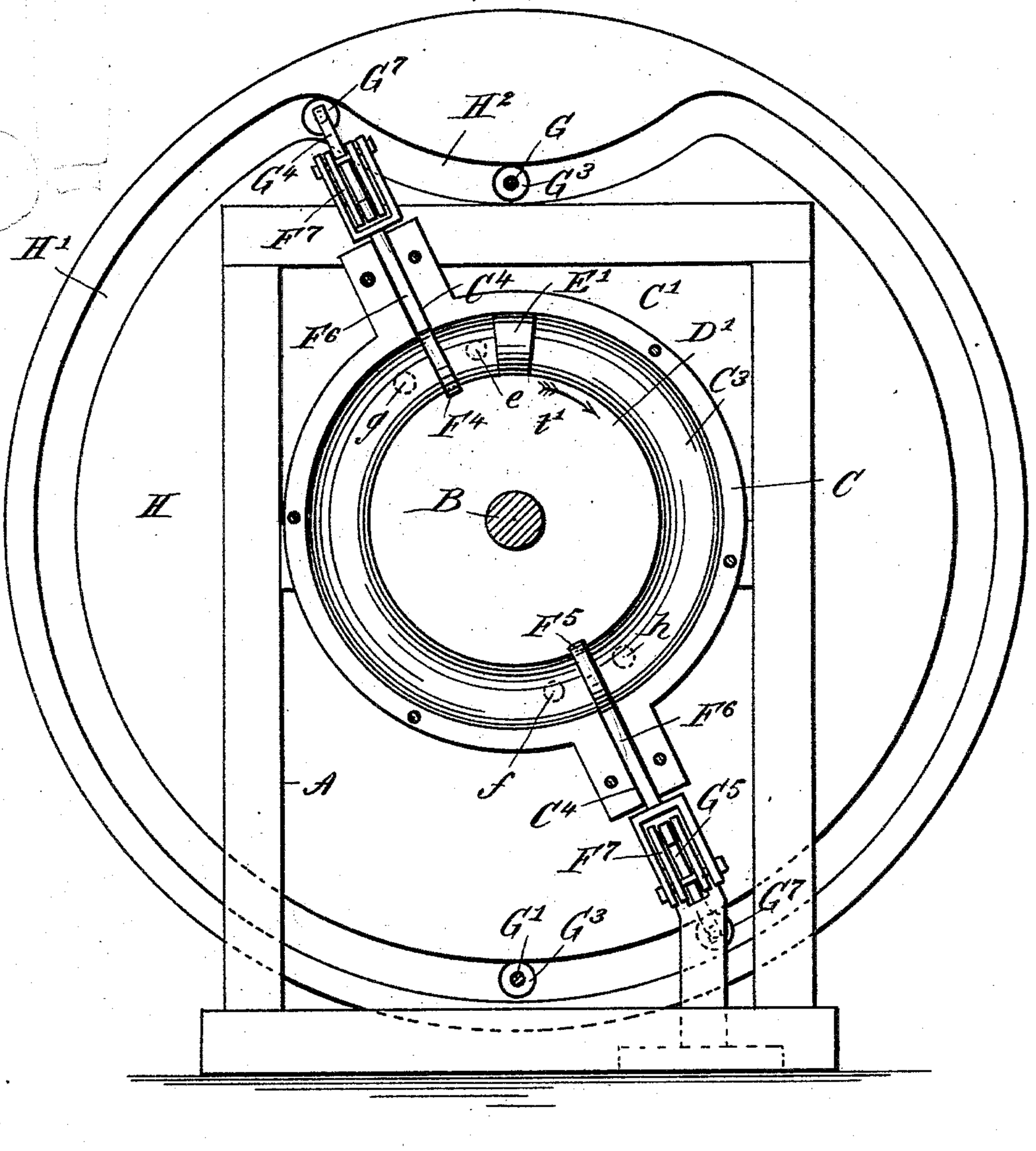
*Fig. 4.*

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# UNITED STATES PATENT OFFICE.

WILLIAM P. AKERS, OF JACKSBOROUGH, TEXAS, ASSIGNOR OF ONE-HALF TO JOHN C. LINDSEY, JR., OF SAME PLACE.

## ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 414,359, dated November 5, 1889.

Application filed January 4, 1889. Serial No. 295,444. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM P. AKERS, of Jacksborough, in the county of Jack and State of Texas, have invented a new and Improved Rotary Engine, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved rotary engine which is simple and durable in construction and very effective in operation, using the steam expansively to the fullest advantage, at the same time being adapted to compound engines.

The invention consists of certain parts and details and combinations of the same, as will be hereinafter fully described, and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a sectional end elevation of the improvement as applied to a two-cylinder compound engine. Fig. 2 is a sectional side elevation of the same on the line *x x* of Fig. 1. Fig. 3 is a like view of the same on the line *y y* of Fig. 1, and Fig. 4 is a sectional side elevation of the improvement on the line *z z* of Fig. 1.

The improvement may be applied to engines with one, two, three, or more cylinders. As illustrated in the drawings it is applied to a compound engine with two cylinders.

On a suitably-constructed frame A is mounted to rotate in suitable bearings the main driving-shaft B, passing centrally through the cylinders C and C′, secured to the main frame A. In each of the cylinders C and C′ is held a piston-disk D or D′, respectively, secured to the main driving-shaft B, and each provided at one point of its periphery with a piston-plug E or E′, respectively, fitting into a correspondingly-shaped annular chamber $C^8$, formed in the cylinder C or C′. As shown in the drawings, the plugs E and E′ are circular in cross-section. The disks D and D′ fit snugly into a recess $C^2$, formed in each of the cylinders C and C′, and their piston-plugs E and E′ are in line with each other.

Gates F and F′ are held transversely in the cylinder C, and are arranged to slide vertically diametrically opposite each other in a suitable chamber $C^4$, formed in the cylinder C. Each of the gates F and F′ is secured on a stem $F^2$, extending outward, being pivotally connected at its outer end by links $F^3$ with the levers G and G′, respectively, fulcrumed at $G^2$ by suitable pivots secured to the main frame A. The inner ends of the levers G and G′ each carry a friction-roller $G^3$, traveling in a groove H′, formed in one face of the fly-wheel H, secured on the main driving-shaft B. The groove H′ is annular, with the exception of the part $H^2$, which is curved inward slightly toward the center of the wheel, as is plainly shown in Fig. 4.

The cylinder C′ is provided with gates $F^4$ and $F^5$, similar in construction and arrangement to the gates F and F′ in the cylinder C. The stems $F^6$ of the gates $F^4$ and $F^5$ are pivotally connected by links $F^7$ with the levers $G^4$ and $G^5$, respectively, fulcrumed at $G^6$ on the main frame A, and located alongside the levers G and G′, before mentioned. The inner ends of the levers $G^4$ and $G^5$ also carry friction-rollers $G^7$, traveling in the groove H′ of the wheel H, alongside the other friction-rollers $G^3$. The gates F and F′ stand vertically, while the gates $F^4$ and $F^5$ are inclined, as is plainly shown in Fig. 4, and for the purpose hereinafter more fully explained. While the fly-wheel H revolves, the friction-rollers $G^3$ and $G^7$ of the levers G G′ and $G^4$ $G^5$ pass alternately through the inwardly-bent part $H^2$ of the groove H′, so that the levers G G′ and $G^4$ $G^5$ are swung up and down. During the time the friction-rollers $G^3$ and $G^7$ of the said levers pass through the annular part of the groove H′ the levers remain stationary and the gates F F′ and $F^4$ $F^5$ remain in an innermost closed position.

On one face of the cylinder C are held diametrically opposite to each other the steam-chests I and I′, provided with the steam-inlet pipes J and J′, respectively, connected in the usual manner with the boiler to supply the necessary steam for running the engine. From the steam-chests I and I′ lead the steam-inlet ports *a* and *b*, respectively, into the annular chamber $C^3$ at one side of the respect-

ive gate F or F′ in the cylinder C. From the annular chamber $C^3$, at the other side of the respective gate F or F′, lead the exhaust-ports *c* and *d*, connecting with the pipes K and K′, extending to the other cylinder C′ and discharging into the ports *e* and *f*, leading to the annular chamber $C^3$ at one side of each gate $F^4$ and $F^5$. From the other sides of the gates $F^4$ and $F^5$ lead the exhaust-ports *g* and *h*, extending to the outside. The port *a* stands diametrically opposite the port *b*, and in a similar manner the exhaust-port *c* stands opposite the port *d* in the cylinder C. In the other cylinder C′ the arrangement is similar, as the inlet-port *e* stands diametrically opposite the inlet-port *f*, and the exhaust-ports *g* and *h* likewise stand opposite each other.

The pipes K and K′ serve to carry the exhaust-steam from the cylinder C into the cylinder C′, so that the latter is supplied and its piston-plug E′ is actuated by the exhaust-steam from the cylinder C.

Over the inlet-ports *a* and *b* in the steam-chests I and I′ travel the valves L and L′, respectively, secured on valve-rods $L^2$, fastened to an eccentric-yoke N, having a sliding motion, by means of a crank-arm N′, secured to the main driving-shaft B. When the shaft B is rotated, the yoke N receives a sliding motion, so that the valves L and L′ alternately open and close the ports *a* and *b*—that is, when the port *a* is open, as illustrated in Fig. 3, the other port is closed, and vice versa.

The operation is as follows: The piston-plugs E and E′ are located in relation to the fly-wheel H, in such a manner that when the said piston-plugs are near one of the gates F or F′ the groove H′ with its inwardly-bent part $H^2$ operates on the corresponding lever G $G^4$ or G′ $G^5$, so that the respective gates F $F^4$ or F′ $F^5$ are drawn outward, so as to permit the piston-plugs E and E′ to pass the respective gates. The moment the piston has passed the gates the levers G $G^4$ or G′ $G^5$ are again actuated by the remaining half of the part $H^2$ of the groove H′, whereby the corresponding gates F $F^4$ or F′ $F^5$ again pass inward into the annular chamber $C^3$. As the gates $F^4$ and $F^5$ are placed in an inclined position relative to the gates F and F′, the said gates $F^4$ and $F^5$ are actuated somewhat sooner than the gates F and F′. In consequence of this the gate $F^4$ in the cylinder C′ will be closed at the time when the piston-plug E of the cylinder C has passed the exhaust-port *c*, and the gate $F^5$ will be closed at the time the piston-plug E has passed the exhaust-port *d* in the cylinder C. When the piston-plugs E and E′ stand in their uppermost position, as shown in Figs. 2 and 4, then the gate $F^4$ is closed, and the exhaust from the cylinder C passes through the port *c*, the pipe K, and the port *e* into the cylinder C′, between the gate $F^4$ and the plug E′, so that the latter by the force of the exhaust-steam is propelled in the direction of the arrow *t′* toward the gate $F^5$. As soon as the piston-plug E has passed the steam-inlet port *a* the valves L and L′ shift, so that the steam is admitted into the cylinder C through the port *a*, thereby forcing the piston-plug E in the direction of the arrow *t′*. As both plugs E and E′ are secured on the main shaft B, the latter is turned by the full force of the live steam acting on the plug E, and by the somewhat-reduced pressure of the exhaust-steam pressing on the plug E′, as above described. As soon as the piston-plug E′ has passed the exhaust-port *h* in the cylinder C′ the steam in the rear of it will exhaust through the said port into the open air. When the piston-plug E passes the exhaust-port *d*, the exhaust-steam will pass through it and the connecting-pipe K′ into the cylinder C′ at the port *f*. The gates $F^4$ $F^5$ and F F′ have now shifted, as well as the valves L and L′, so that the exhaust-steam entering at the port *f* passes between the closed gate $F^5$ and the plug E′ and urges the latter forward in the direction of the arrow *t′*. As soon as the plug E passes the port *b* the valves L and L′ shift and the live steam now enters the steam-chest I′ through the pipe J′, and passes through the port *b* into the cylinder C between the gate F′ and the plug E, so that the latter is propelled forward in the direction of the arrow *t′*. The valve L is now closed and the valve L′ remains open until the plug E passes over the port *a*. The valves L and L′ then shift and the above-described operation is repeated. Steam is shut off before the plug E reaches the end of its stroke in either cylinder C or C′, and consequently the steam thus confined between said plug and the closed gate works expansively. It is understood that as soon as the plug E′ has passed the port *h* the steam in the rear of the plug E′ will exhaust into the open air through the said port. The valves L and L′ shift simultaneously whenever the plug E has passed the inlet-port *a* or *b*, and the gates F $F^4$ and F′ $F^5$ respectively shift at about the same time, one after the other, as before described. It will be observed that when the plug E passes the gate F a residue of exhaust-steam will be left between the gates F and F′. This steam will now exhaust ahead of the plug E through the port *d* into connecting-pipe K′ and into the cylinder C′ through the port *f* and out into the open air through the port *g*. All these ports are open at this time. Likewise, when the plug E passes the gate F′, the balance of unexhausted steam will pass through port *c*, connecting-pipe K, and into the cylinder C′, at the port *e*, thence through part of the annular chamber $C^3$ and out into the open air through the port *h*.

It will be seen that the exhaust-steam from the cylinder C exerts no back-pressure on plug E, as the latter is always shut off in time from the exhaust-steam by the gates F and F′. It will further be seen that the steam in the cylinder C′ is operated and controlled without any valves on the said cylinder.

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

1. In a rotary engine, the combination of two separate cylinders arranged side by side and each having an annular chamber, pipes K K′, which connect the said cylinders and ports *c d* and *e f*, the steam-chests I and I′, having inlet-ports *a* and *b*, the disks D D′, carrying piston-plugs E E′, which work in said annular chambers, the sliding gates F F′, arranged opposite each other, and means for operating them, all as shown and described, whereby steam is admitted and cut off and allowed to exhaust from one cylinder to the other, wherein it is worked expansively, in the manner specified.

2. In a rotary engine, the combination, with two cylinders, each having an annular chamber provided with two exhaust-ports, of pistons traveling in such annular chambers in the said cylinders, a main shaft passing through the said cylinders and carrying the said pistons, gates adapted to slide diametrically opposite each other in each of the said cylinders, levers pivotally connected with the said gates and operated from the main driving-shaft, steam-chests located diametrically opposite each other on the first cylinder, and provided with inlet-ports leading into the annular chamber in the first cylinder, valves adapted to slide in the said steam-chests and operated from the main driving-shaft, and exhaust-pipes leading from the said exhaust-ports of the first cylinder to inlet-ports on the other cylinder, substantially as shown and described.

3. In a rotary engine, the combination, with two cylinders, each having an annular chamber provided with two exhaust-ports, of pistons traveling in such annular chambers in the said cylinders, a main shaft passing through the said cylinders and carrying the said pistons, gates adapted to slide diametrically opposite each other in each of the said cylinders, levers pivotally connected with the said gates, steam-chests located diametrically opposite each other on the said first cylinder, and provided with inlet-ports leading into the said annular chamber in the first cylinder, valves adapted to slide in the said steam-chests and operated from the main driving-shaft, exhaust-pipes leading from the exhaust-ports of the first cylinder to the inlet-ports of the other cylinder, and a fly-wheel secured on the said main driving-shaft, and provided with a cam-groove for operating the said levers alternately, substantially as shown and described.

WILLIAM P. AKERS.

Witnesses:
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T. D. JONES.