

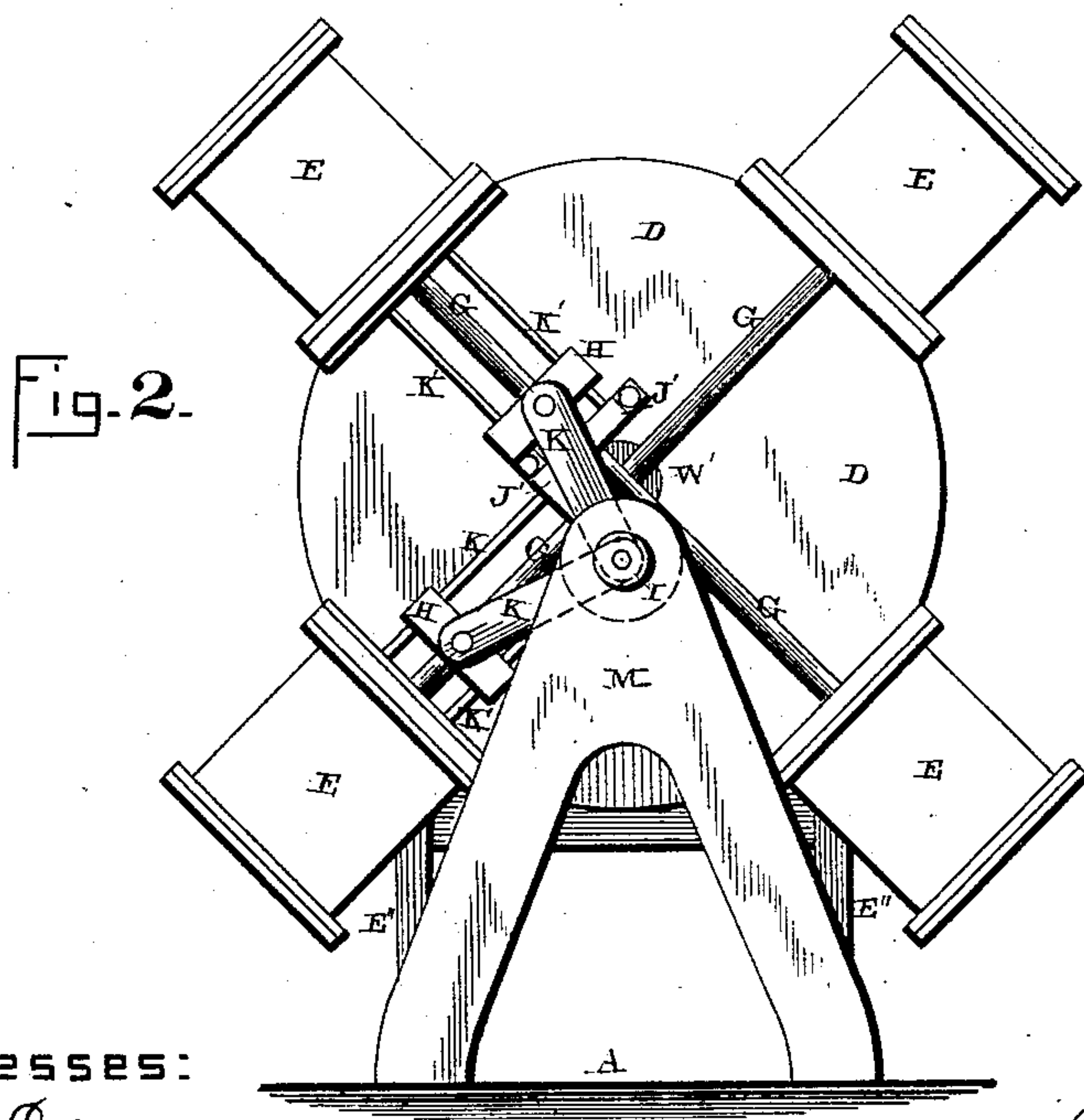
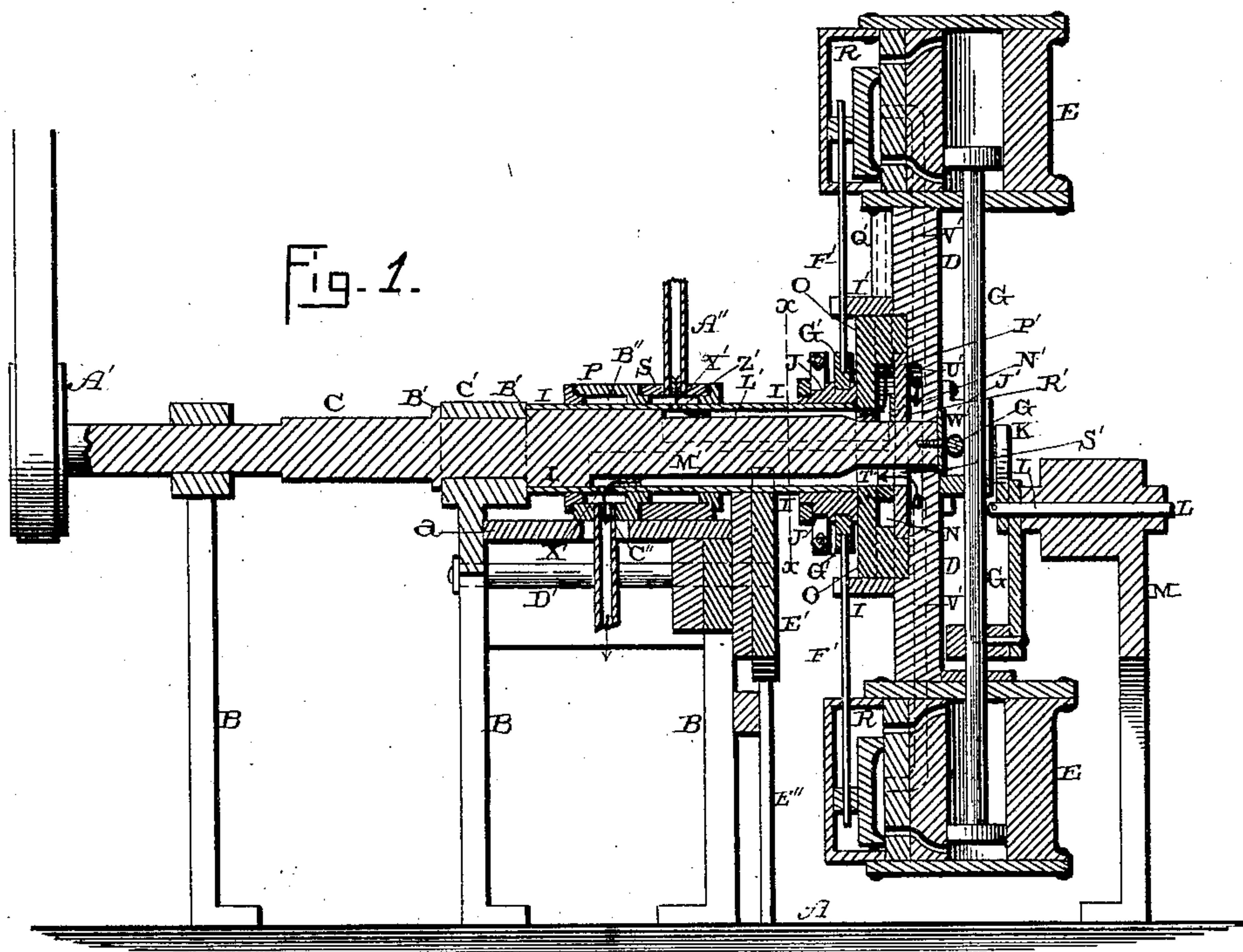
(No Model.)

3 Sheets—Sheet 1.

C. D. FARMER.
ROTARY ENGINE.

No. 435,293.

Patented Aug. 26, 1890.



Witnesses:

E. P. Ellis
A. J. Patton

Inventor:

C. D. Farmer,
per
J. A. Lehmann
Atty.

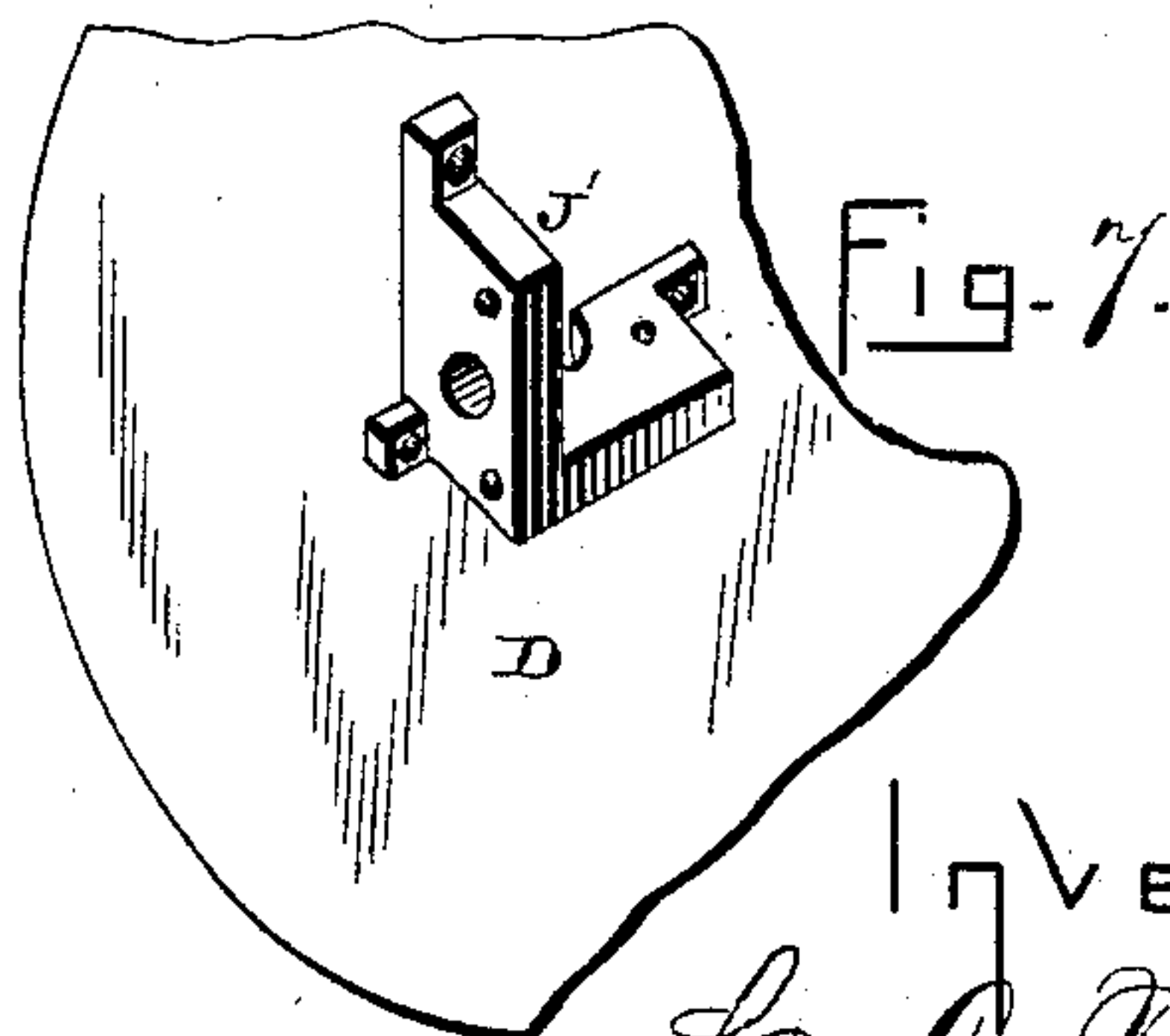
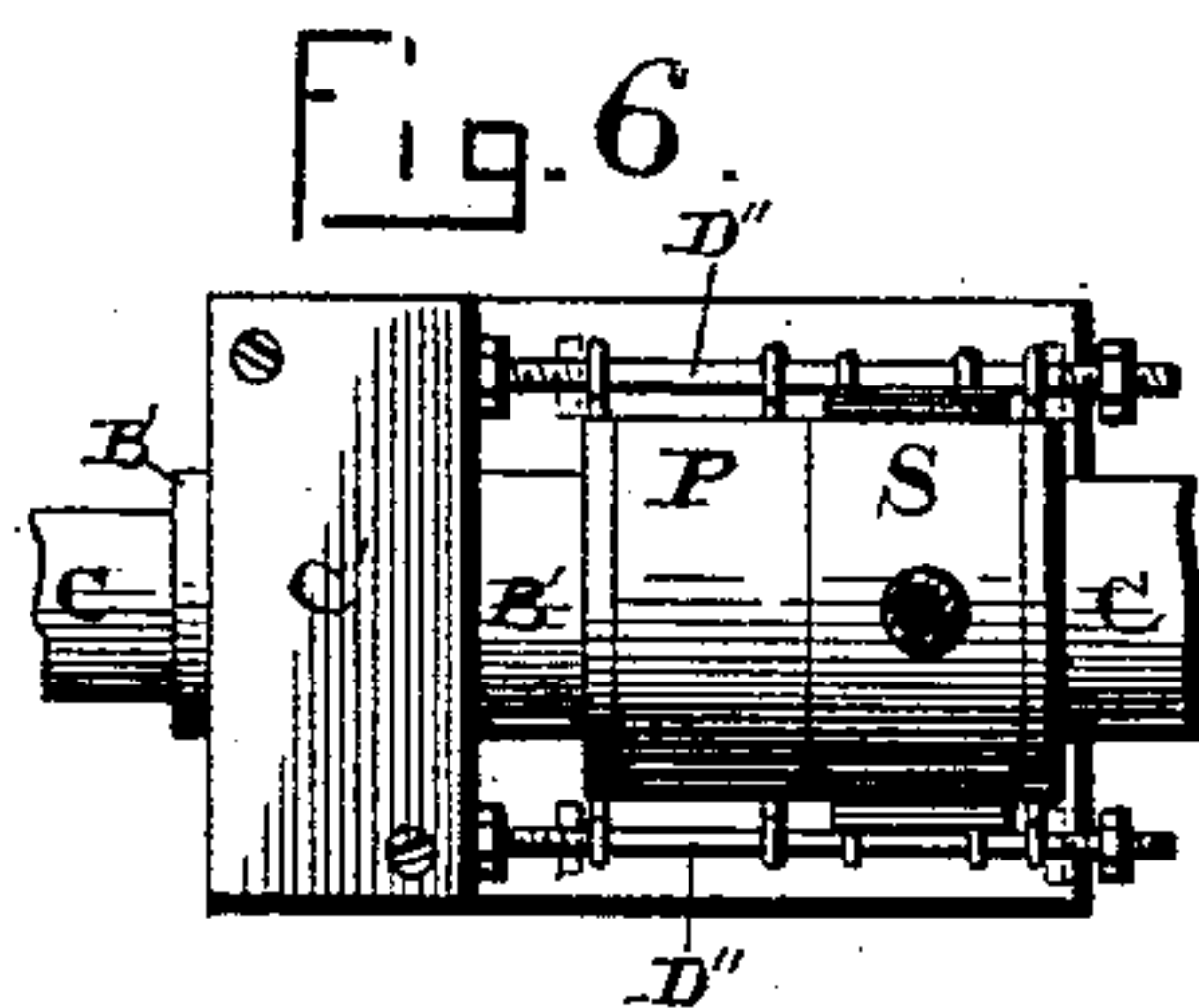
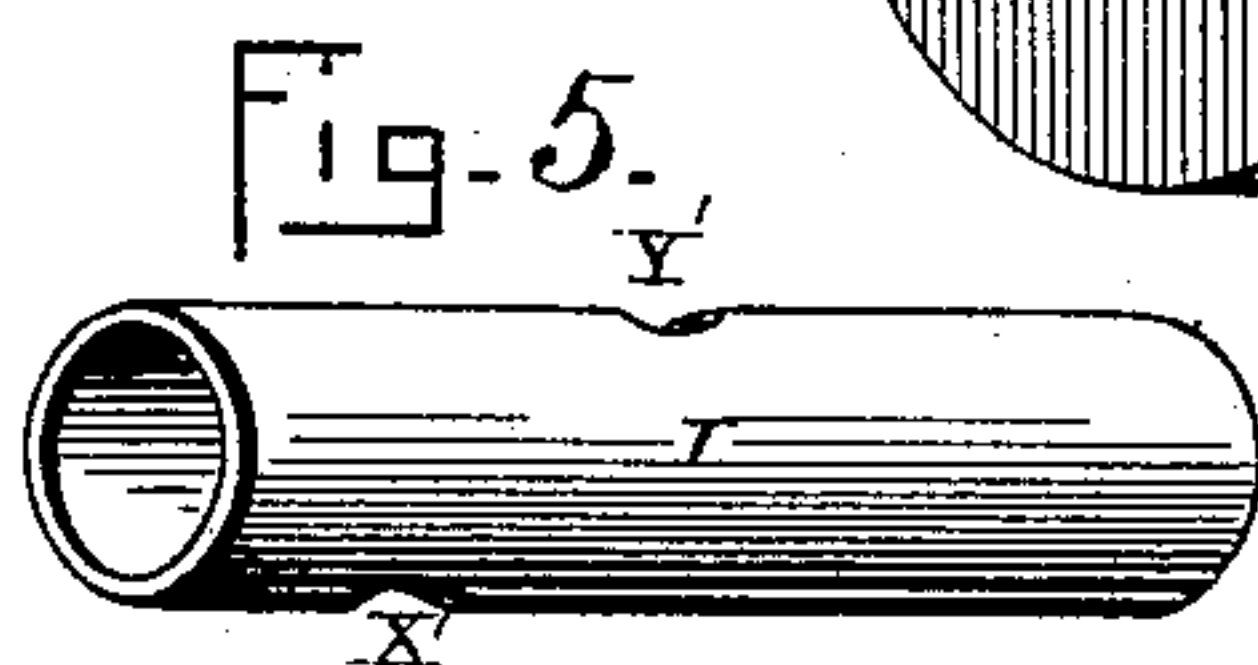
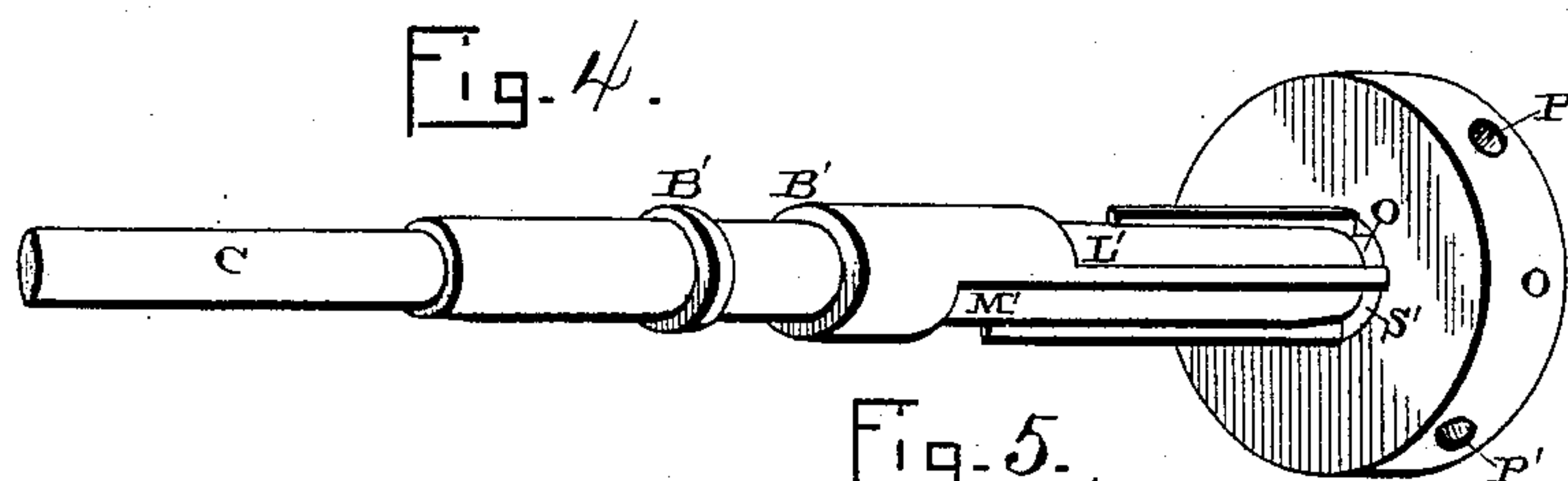
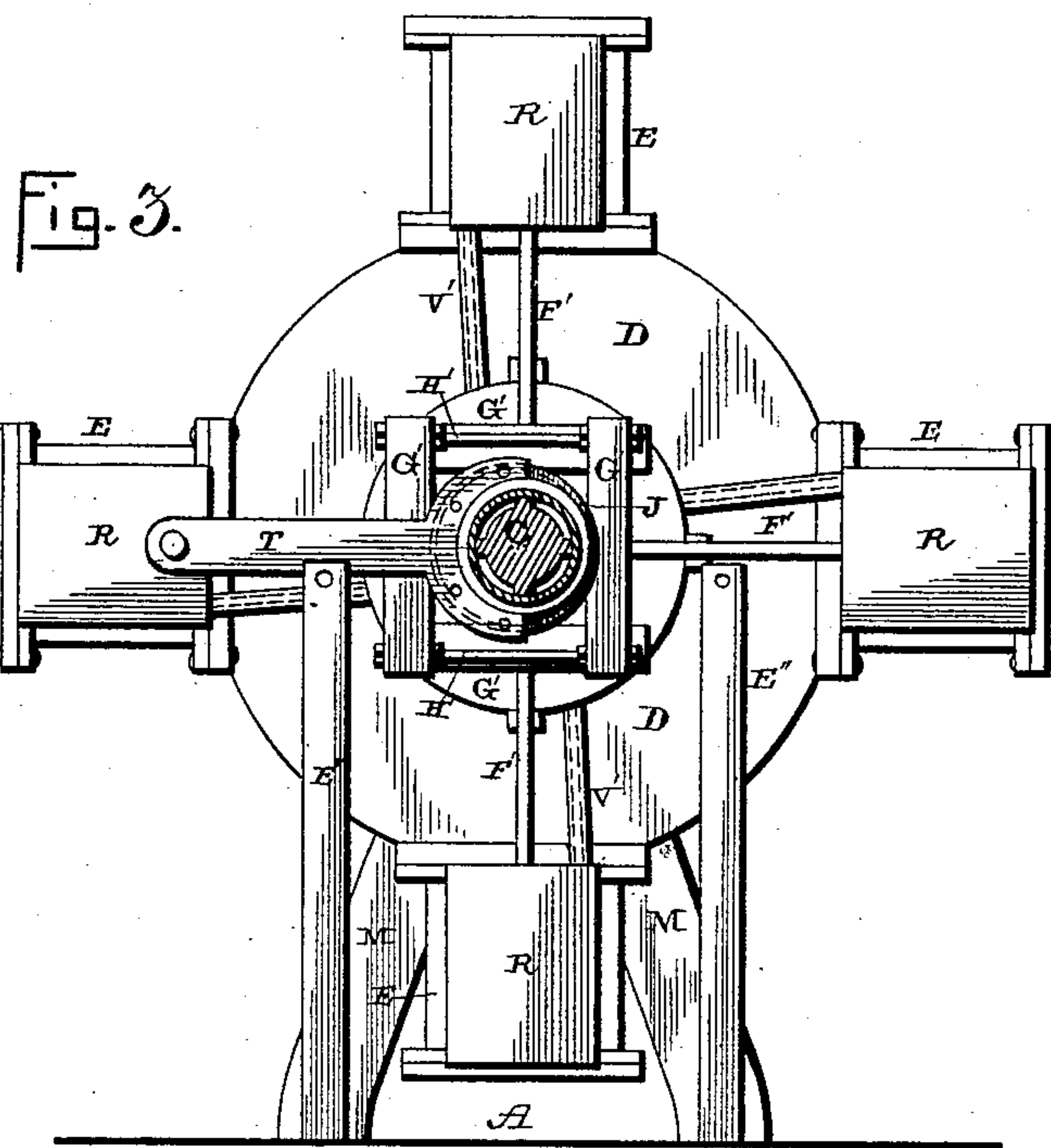
(No Model.)

3 Sheets—Sheet 2.

C. D. FARMER.
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No. 435,293.

Patented Aug. 26, 1890.



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(No Model.)

3 Sheets—Sheet 3.

C. D. FARMER.
ROTARY ENGINE.

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Fig. 8.

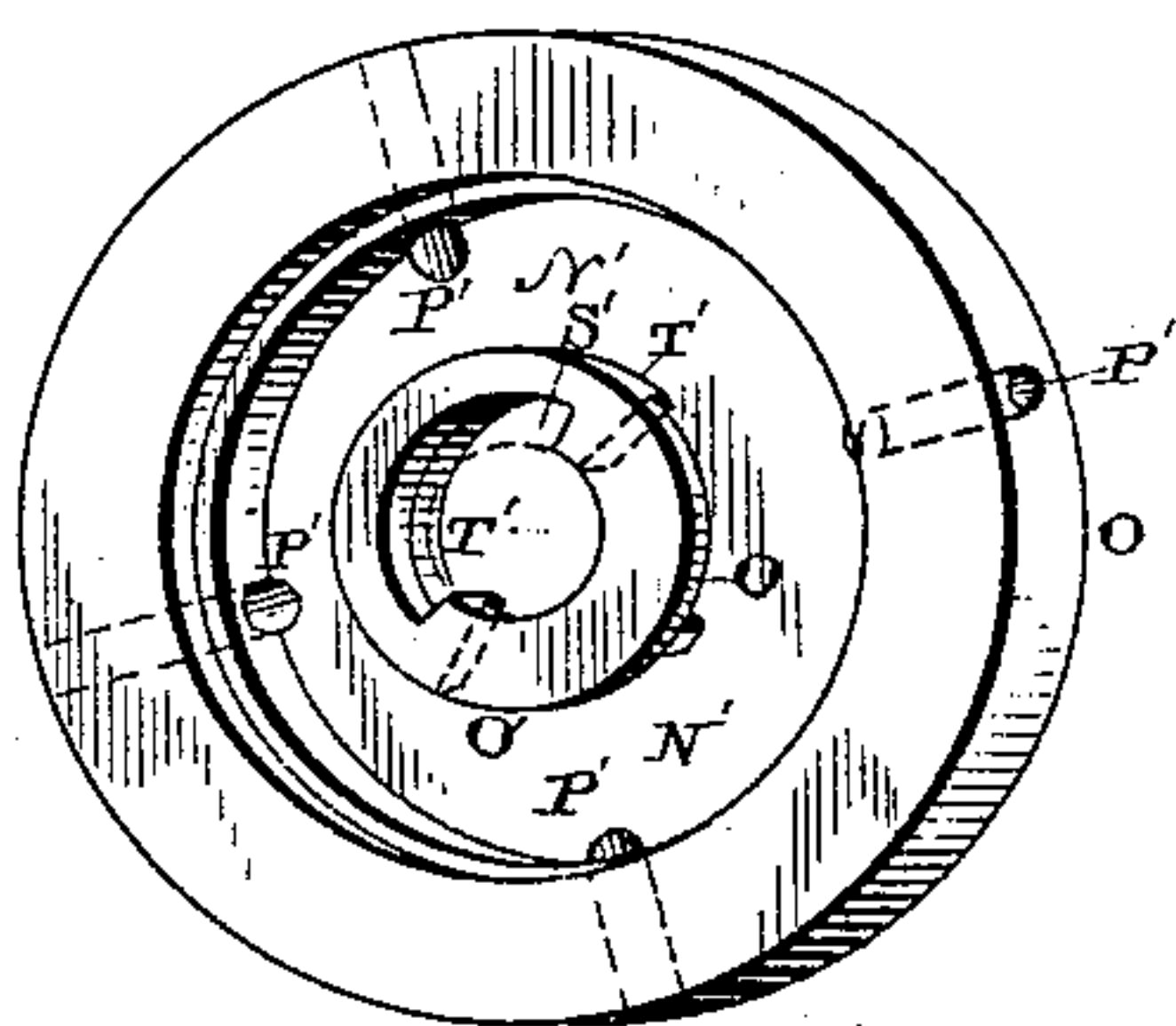


Fig. 9.

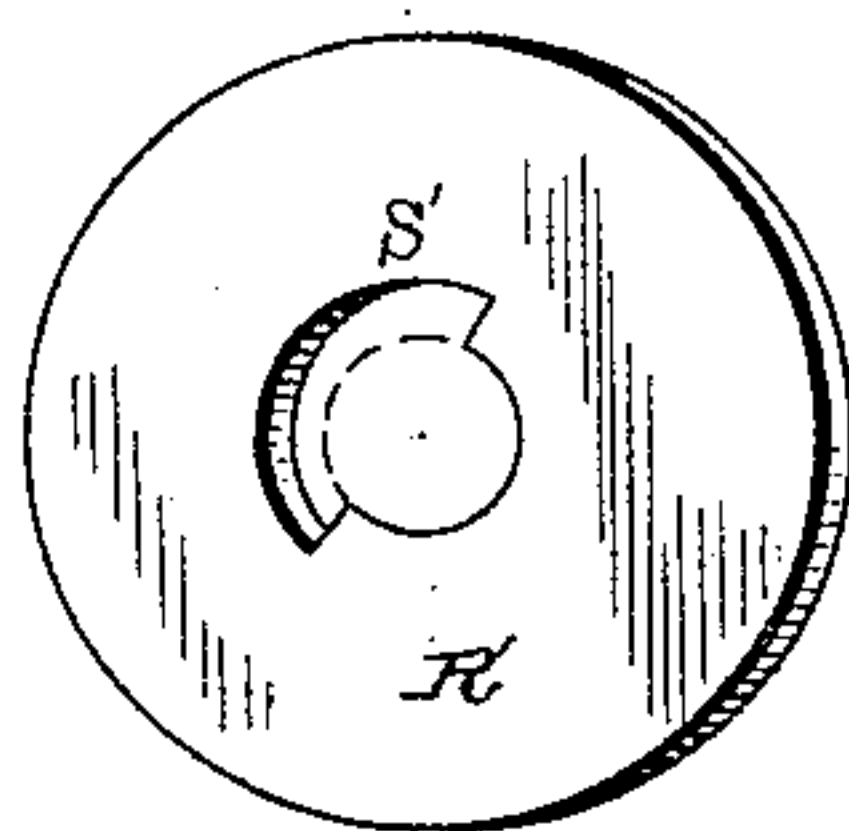


Fig. 10.

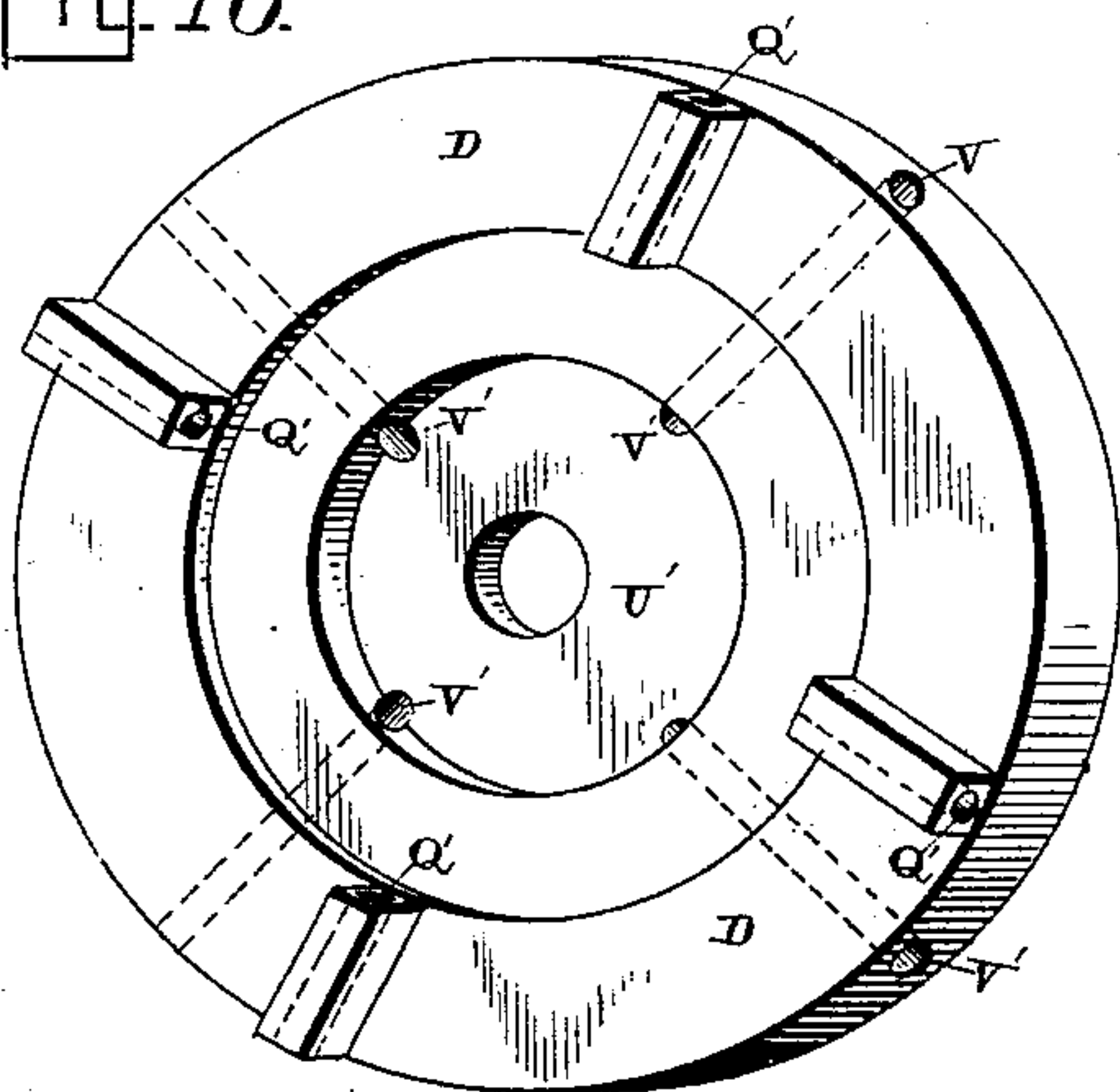
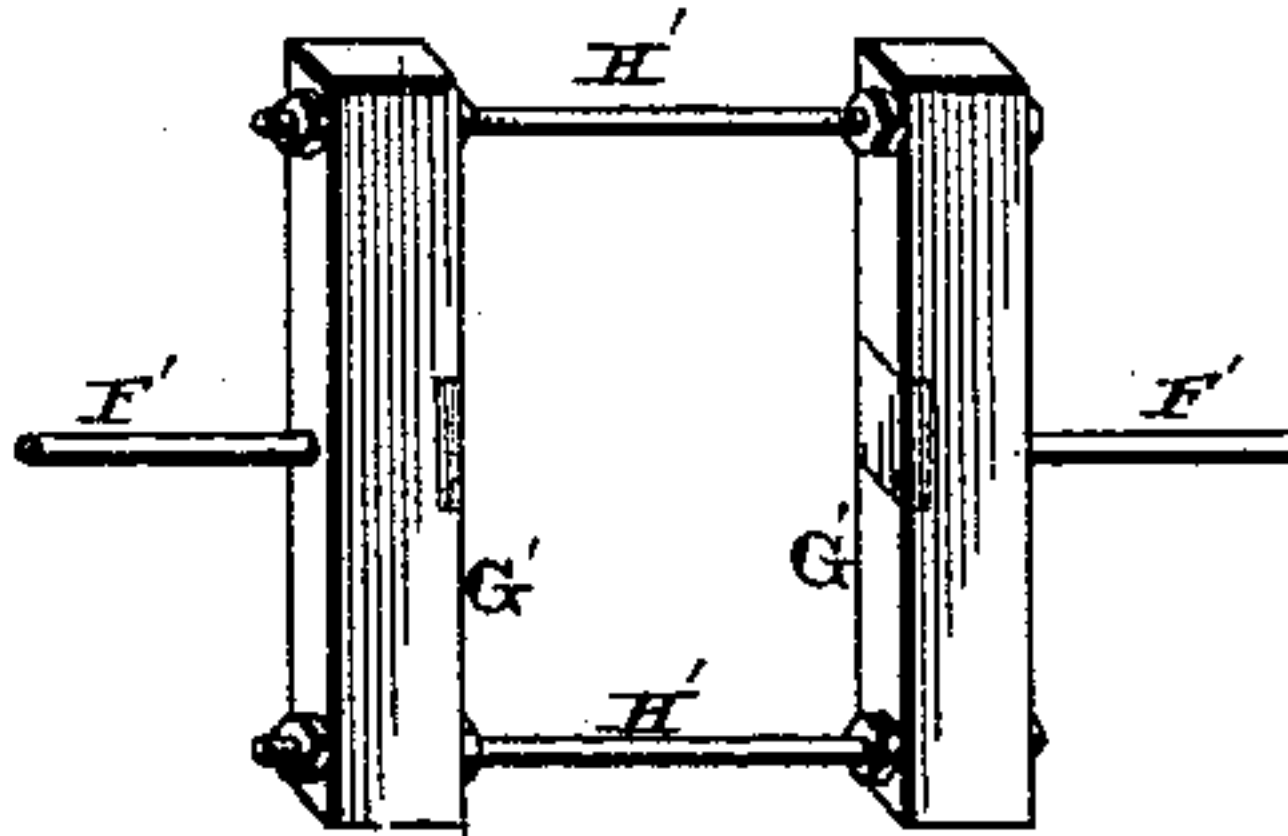


Fig. 11.



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UNITED STATES PATENT OFFICE.

CHARLES D. FARMER, OF CHEBOYGAN, MICHIGAN.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 435,293, dated August 26, 1890.

Application filed November 5, 1889. Serial No. 329,315. (No model.)

To all whom it may concern:

Be it known that I, CHARLES D. FARMER, of Cheboygan, in the county of Cheboygan and State of Michigan, 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 pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to an improvement in rotary engines, and is intended as an improvement upon Patent No. 412,079, of October 1, 1889; and it relates to that class of engines which consist of an operating-shaft having secured to one end a disk carrying a number of cylinders which have their piston-rods suitably connected by means of pivoted rods to a stationary point outside of the center of said disk.

The objects of my invention are to add strength and durability to the operating-shaft by using a solid instead of a hollow one, by providing said solid shaft with exterior grooves for the inlet of live steam and the outlet of the exhaust-steam, and surrounding the shaft with a sleeve or provide the sleeve with grooves; to provide the revolving disk with two chambers—one for the live steam and the other for the exhaust—and also with inlet and outlet ports which connect the said chambers with the steam-chests; to reduce the cost of manufacture by casting the disk and the cylinders integral; to connect the piston-heads of each pair of cylinders to a single piston-rod; to so construct the yokes which surround the reverse-cam that the valve-rods of each pair of steam-chests are connected to a single yoke, so as to produce a parallel motion of the rods; and, finally, to so arrange and combine the parts that the friction is reduced to a minimum, and that only a few steam-joints are necessary.

Figure 1 is a vertical section of a steam-engine which embodies my invention. Fig. 2 is an end view looking in the direction of the outside of the disk. Fig. 3 is a vertical cross-section taken upon the dotted line X X of Fig. 1, which shows the construction of the cam-yokes and the reverse-lever. Fig. 4 is a detached perspective of the shaft, showing the inlet and outlet channels formed in the exte-

rior surface thereof. Fig. 5 is a detached perspective of the sleeve. Fig. 6 is a detached plan view of the inlet and exhaust chests or hoods P S. Fig. 7 is a detached perspective of a portion of the disk D, showing the guides J attached thereto. Fig. 8 is a detached perspective of the flange O. Fig. 9 is a detached perspective of the perforated plate R'. Fig. 10 is a detached perspective of the disk D. Fig. 11 is a detached perspective of one of the yokes.

The operating-shaft C is supported in bearings which are secured to the upper ends of the vertical supports B, which have their lower ends secured to the floor of a building or to a supporting-platform in any suitable manner. Secured to the outer end of the operating-shaft C is the circular disk D, to the periphery of which may be secured the cylinders E in any suitable manner, but which are preferably cast integral with the said disk for the purpose of reducing its cost of manufacture. Secured to the opposite end of the shaft is a drive-pulley A', which communicates motion by means of a belt to any desired point. The shaft C is provided with the flanges B' at each side of the bearing C', and which hold the shaft in its proper position against any endwise movement. Secured to the outer ends of the shafts D' are the friction-rollers E', upon which rests the operating-shaft C at its outer end. Placed loosely around the operating-shaft and through which it freely revolves is the reversing-cam J, which is provided with a reverse-lever T, by means of which the said cam is given a half-revolution for the purpose of shifting the valve-rods which are attached thereto, and causing the live steam which is in the steam-chests to enter the opposite ends of the cylinders, and thus reverse the motion of the engine.

The cylinders E and steam-chests R are of the ordinary construction, and are provided with inlet and outlet ports of the usual form, and do not therefore need any further description in this connection. The valve-rods F' of each pair of chests R have their inner ends connected to a yoke. These yokes consist of the parallel bearing-surfaces G', which have their outer ends connected by means of the screw-rods H', which are provided with nuts placed upon the outer and inner sides of the

said bearing-surfaces G' , and by means of which they are adjusted in relation to each other and to the cam J . Projecting outward from the disk D are the guides I' , which guide the inner ends of the valve-rods adjacent to the yokes. By forming these yokes of the construction here shown and connecting the valve-rods of each pair of steam-chests to a single yoke, as here shown, the valve-rods are given a uniform and parallel motion at all times. The piston-rods G extend entirely across the outer face of the disk D , and have their opposite ends fastened to the piston-heads of opposite cylinders, as here shown, and have secured to them the cross-heads H , to which are pivoted at their inner ends the connecting rods or links K , which have their outer ends pivoted upon a stationary pin L , which is adjustably secured in the upper end of the vertical support M . This bearing-point L is placed beyond or outside of the center of the disk D , preferably one-half the distance traveled by the said piston-rods.

Extending outward from the disk D upon its outer face are the supports J' , through which the piston-rods G freely move, and to which the inner ends of the guiding-rods K' are secured, and which have their outer ends fastened to the inner ends of the cylinders E . The cross-heads H , which are secured to the piston-rods G , slide upon and are guided by these rods K' . It will be readily understood that the pin L being placed outside or beyond the center of the disk D , when steam is admitted to the cylinders and the piston-rods H reciprocate the disk D is revolved through the medium of the connecting rods or links K , which are attached at opposite ends to the cross-heads of the piston-rods and to the said pin L .

Either the operating-shaft C or the sleeve I is provided at its inner end with the channels or grooves L' M' , through which live steam is admitted to the cylinders and the exhaust-steam withdrawn therefrom, in the manner hereinafter described. Surrounding this portion of the shaft C is the sleeve I , which has upon its inner end the flange or disk O , into and through which the operating-shaft C passes, and which flange is preferably formed integral with the sleeve I .

Formed in the inner face of the flange O is a chamber N' , into which live steam passes through the channel or groove L' , made in the operating-shaft C , and through the opening O' , made in the flange O . Extending radially through the flange O and connecting at their inner ends with the chamber N' are the live-steam channels or openings P' , which connect at their upper ends with the openings Q' , made in the disk D , and which connect at their outer ends with the steam-chests R . The inner wall of the chamber N' is formed by the circular plate R' , which is placed within an annular recess formed in the inner face of the flange O , and secured therein in any suitable manner; also made

through the flange O is an opening S' , through which steam passes from the exhaust-channel M' , which is formed in the shaft C , and this opening is closed against communication with the chamber N' by means of the annular flange T' , which extends outward from the inner wall of the said chamber. This opening S' is continued on through the plate R' , which forms the outer wall of the chamber N' , and connects at its inner end with the exhaust-chamber U' , made in the inner face of the disk D . Connecting with the chamber U' at their inner ends are the radial channels or openings V' , which have their upper ends connecting with the steam-chests R . The flange O fits into a recess formed in the inner face of the disk D outside of the exhaust-chamber U' and provided with a packing of any suitable substance, and which flange is bolted to the disk D . Suitable packing is also provided between the plate R' and the flange O and around the inner end of the operating-shaft, which passes through the flange O and the disk D , and has a cap W' secured to its outer end by means of a screw, and which assists in holding the said shaft in its proper position in the flange O and the disk D .

The channel M' , which conducts the exhaust-steam from the exhaust-chamber U' , formed in the inner face of the disk D , is made longer than the channel L' , which conducts the live steam to the live-steam chamber N' , and the sleeve I , which is preferably formed as a part of the flange O , and which surrounds the shaft C , is provided with the opening X' , which communicates with the exhaust channel or groove M' and with the opening Y' , which connects with the channel or groove L' , which conducts live steam to the cylinder.

Secured to and supported upon the platform A , fastened to the upper ends of the vertical supports B , is the stationary inlet chest or hood S , which surrounds the sleeve I , and which is provided with an annular chamber Z' and with an inlet-opening A'' . This chest or hood S is provided with the ordinary stuffing-box at its outer end, by means of which a steam-tight joint is made around the sleeve I at this point; also supported upon this platform is a movable hood or chest P , which surrounds the sleeve I , and is provided with an interior annular chamber B'' , and at its outer end with the ordinary stuffing-box for forming a steam-tight joint at this point. Formed, preferably, in the under-side of this hood or chest P is an exhaust-outlet C'' . Thus it will be seen that the opening X' , formed in the sleeve I , communicates with the annular chamber B'' , formed in the chest P , and with the groove M' , made in the exterior surface of the shaft C , and that the opening Y' , also made in the sleeve I , communicates with the annular chamber formed in the chest or hood S , and with the groove L' , formed in the shaft C . The inner end of the hood or chest S is provided with an annular groove,

and the adjacent end of the hood or chest P with a projecting flange which fits into the said groove, and a packing placed between them, whereby a steam-tight joint is formed around the sleeve I at this point. Extending inward adjacent to the outer sides of the hoods P and S are the horizontal rods D'', which have their inner ends suitably secured to the bearings C'. The hoods P and S are provided with suitable loops or eyelets through which these rods pass, and placed upon the rods are screw-nuts by means of which the hood P and the stuffing-boxes at each end of the said hoods are securely clamped and held in their proper relation to each other. By means of this construction the hollow shaft which is used in the patent above referred to is done away with and a solid shaft placed in its stead, whereby the said shaft is much stronger and much more durable than a hollow shaft. This construction also does away with a great many of the steam-joints and packings which are necessary where a hollow shaft is used for conducting the steam to the cylinders, and the heating of boxes thereby greatly reduced. Extending upward from the supports B or the floor A are the rods E'', which are provided at their upper ends with projecting pins which form stops for the reverse-lever T when it is thrown to either side for the purpose of reversing the motion of the engine.

Live steam is admitted through the pipe A'', which is provided with an ordinary throttle or valve for regulating the amount of steam passing through it into the chest or hood S, through the live-steam channel or groove L', formed in the shaft C, through the opening O', made in the flange O, into the live-steam chamber N', and thence through the openings P' Q' to the steam-chests. The exhaust-steam passes from the steam-chests through the opening V' into the exhaust-chamber U', made in the inner face of the disk D, through the opening T', made in the flange O, to the exhaust groove or channel M', made in the shaft C, and thence to the annular chamber formed in the hood or chest P, and out through the exhaust-pipe connected therewith.

Having thus described my invention, I claim—

1. In a rotary engine, the combination of a rotary shaft having longitudinal external live and exhaust steam channels, a sleeve surrounding the said shaft and revolving therewith, which forms the outer walls of said channels, the said sleeve having inlet and outlet ports for live and exhaust steam, a disk secured to the said shaft having channels which connect with said channels in the shaft, ordinary cylinders and steam-chests connected to the said disk, and piston and cut-off rods, substantially as shown and described.

2. In a rotary engine, the combination of the operating-shaft provided with live-steam channels, the sleeve which surrounds it and

which is provided with an inlet-opening, the disk secured to the outer end of the shaft carrying ordinary cylinders and provided with live-steam channels, the piston-heads, and two piston-rods which connect at their outer ends, respectively, to the piston-heads of opposite cylinders, the stationary pin placed outside or beyond the center of the disk, and the connecting links or rods which are connected at opposite ends, respectively, to the said piston-rods, substantially as shown.

3. In a rotary engine, the combination of the operating-shaft provided with live-steam channels, a sleeve which surrounds it and which is provided with an inlet-opening, the disk secured to the outer end thereof carrying ordinary cylinders and provided with channels which conduct the steam from the said groove made in the operating-shaft to the cylinders, the piston-rods which extend entirely across the outer face of the disk and connected at opposite ends to the piston-heads, the guiding-rods which are supported adjacent thereto, the cross-heads secured to the piston-rods, the pin which is supported outside of the center of the disk, and connecting-rods which are connected at opposite ends of the said cross-heads and to the pin, substantially as described.

4. In a rotary engine, the combination of the operating-shaft provided with inlet and outlet channels, the sleeve which surrounds it, and which is provided with inlet and outlet ports, the disk secured to the outer end thereof carrying ordinary operating-cylinders and provided with channels which connect with the steam-chest of said cylinders and with the exhaust-steam grooves of the shaft, the flange secured to the said disk provided with a chamber which connects with the live-steam channels of the shaft, the disk provided with an exhaust-chamber, and a plate which is placed around the shaft and in between the said exhaust and live steam chambers, substantially as specified.

5. The combination, in a rotary engine, of the operating-shaft provided with a live-steam channel, a sleeve surrounding the said shaft, the disk secured to its outer end carrying operating-cylinders and steam-chests and provided with channels which connect said live-steam channel of the shaft and with the steam-chests, the reverse-cam which is placed loosely around the said sleeve, the yokes provided with two bearing-surfaces, the rods which connect them at opposite ends, and the valve-rods of opposite chests connected, respectively, to the said operating-surfaces, whereby the rods are given a parallel and uniform movement, substantially as specified.

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

CHARLES D. FARMER.

Witnesses:

WM. P. DE KLYNE.

R. ROBINSON.