No. 791,302. PATENTED MAY 30, 1905.

L. T. STEWART.

ROTARY ENGINE.

APPLICATION FILED SEPT. 29, 1904.

4 SHEETS—SHEET 1.

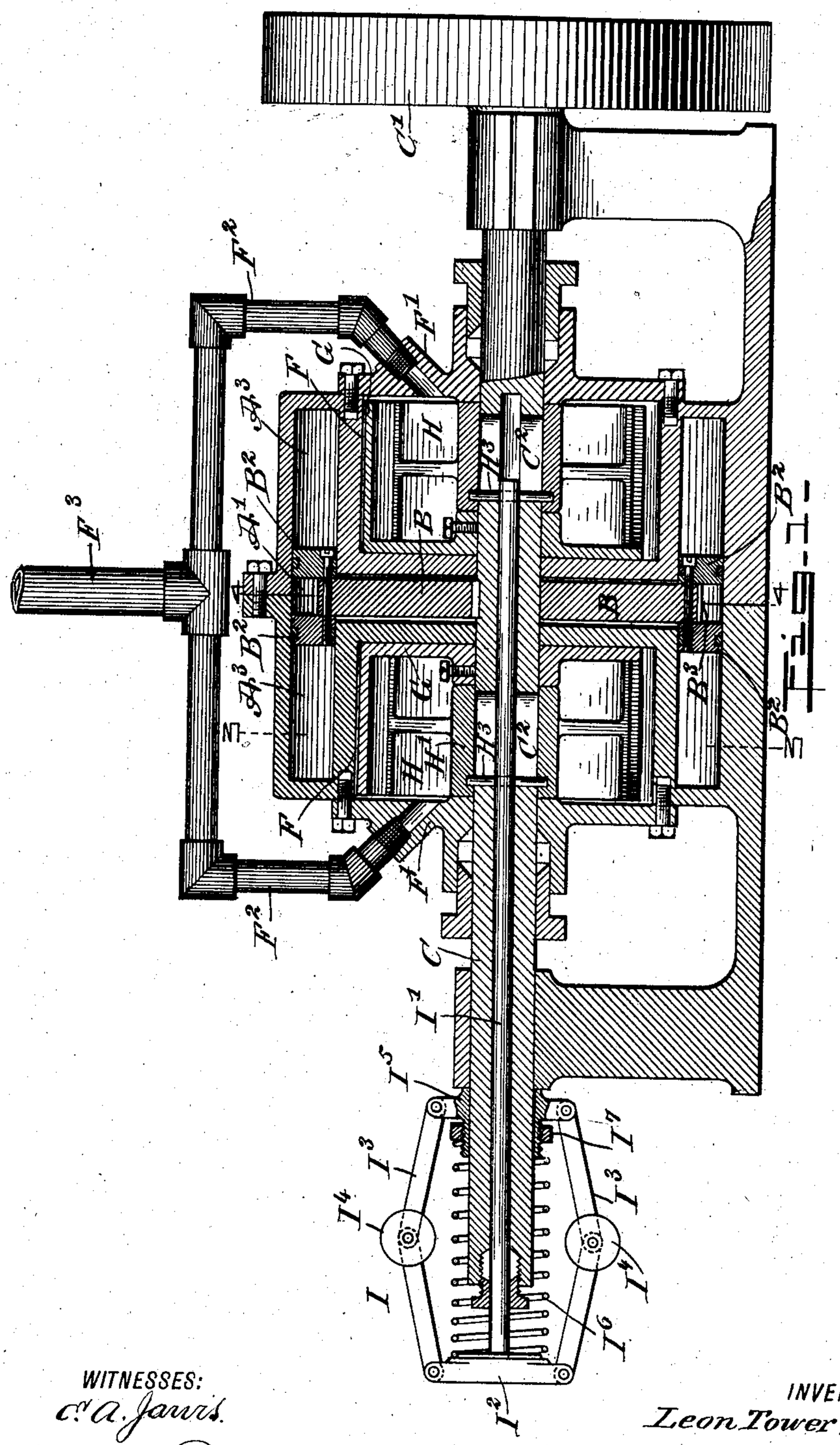

Fig. 1.

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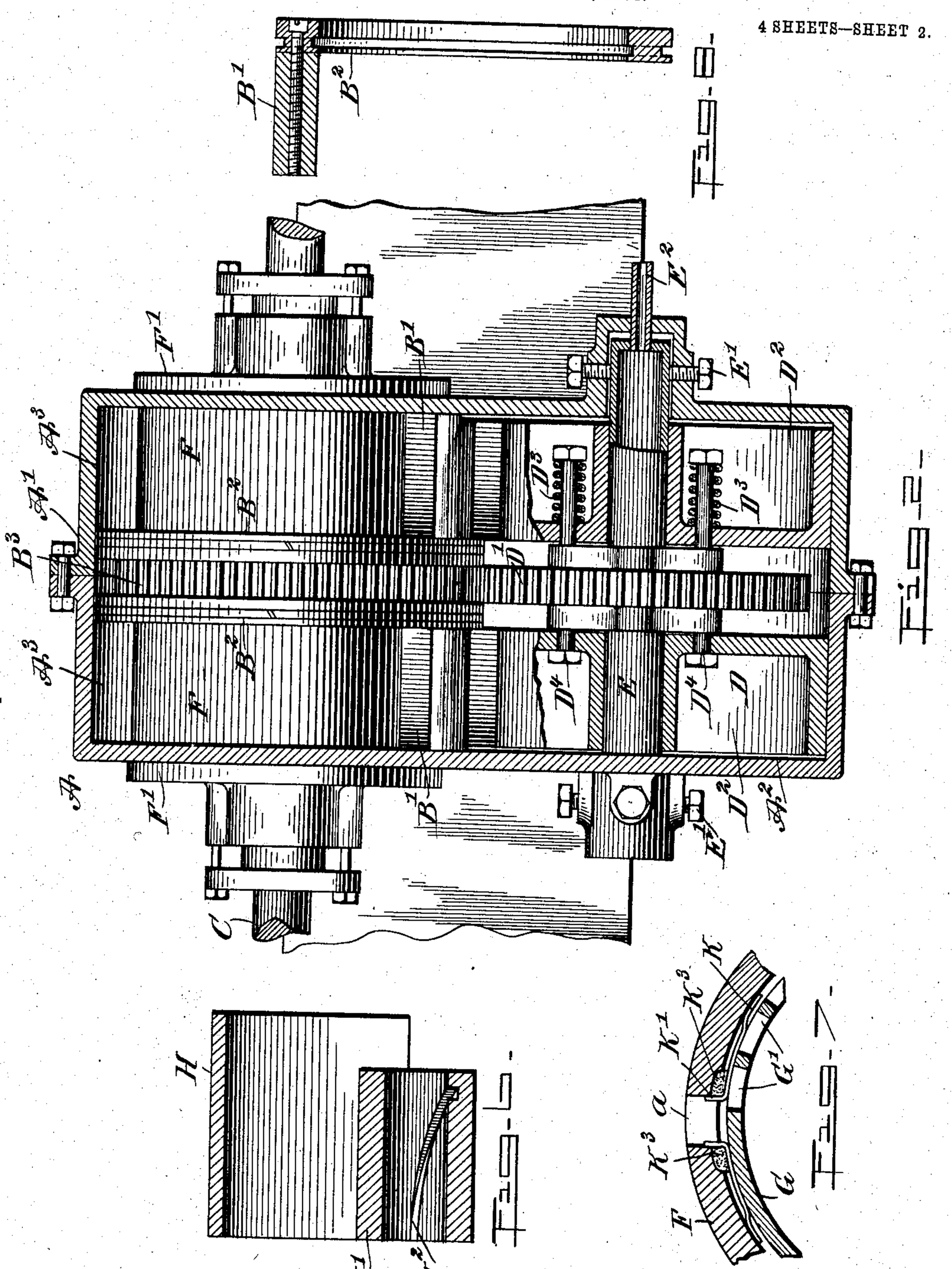

WITNESSES:

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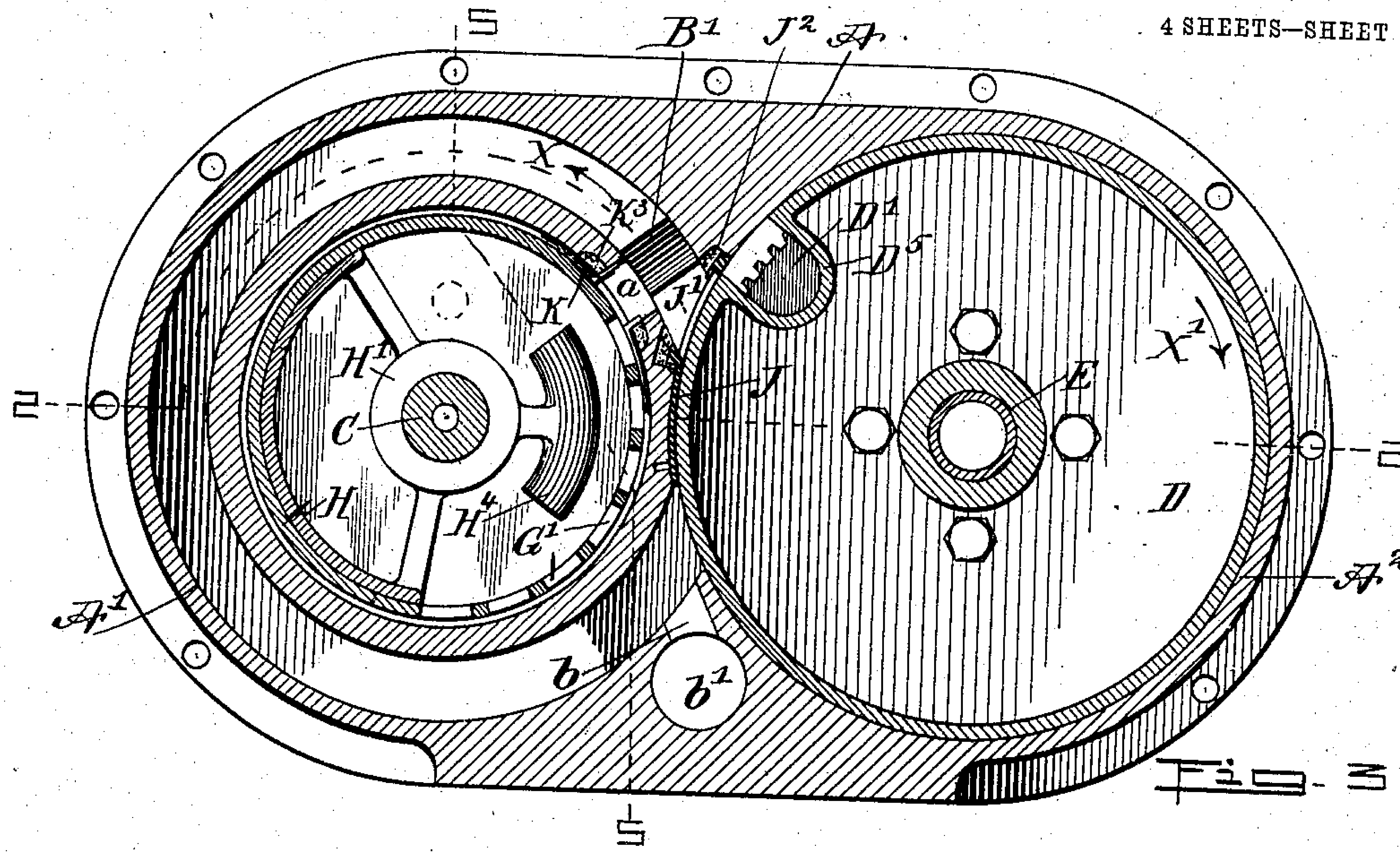

Fig-3-

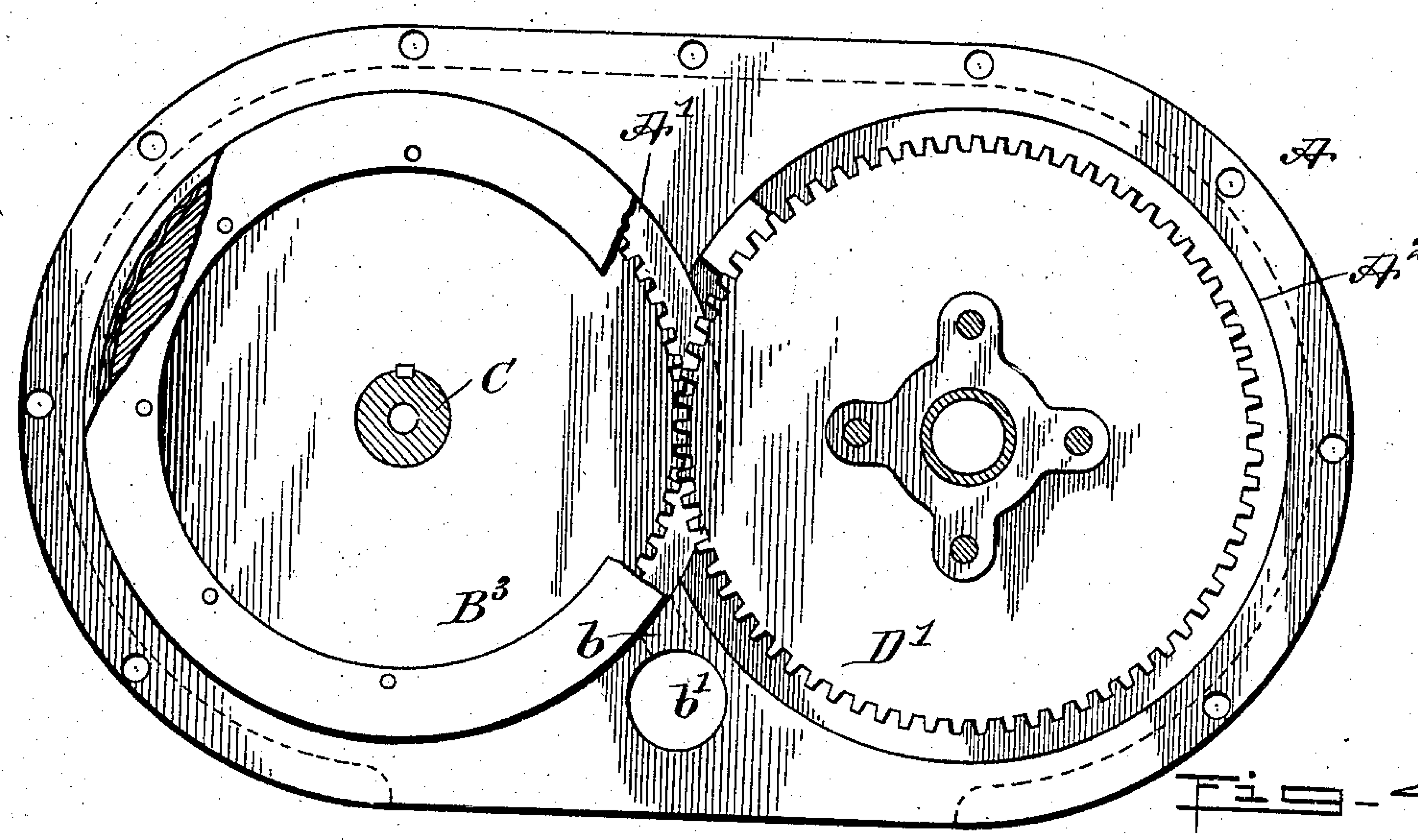

Fig-4.

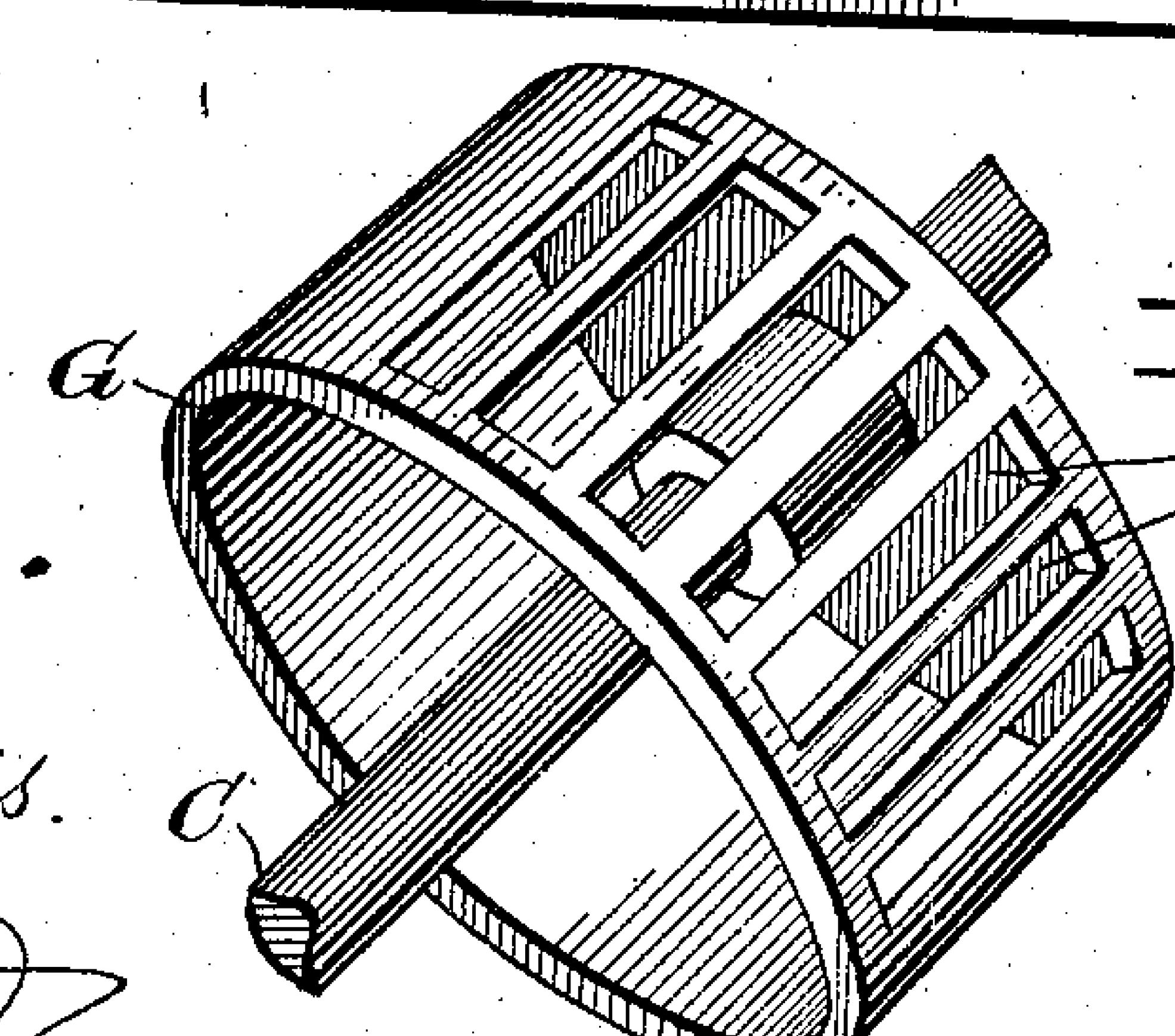

Fig-7-

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4 SHEETS—SHEET 4.

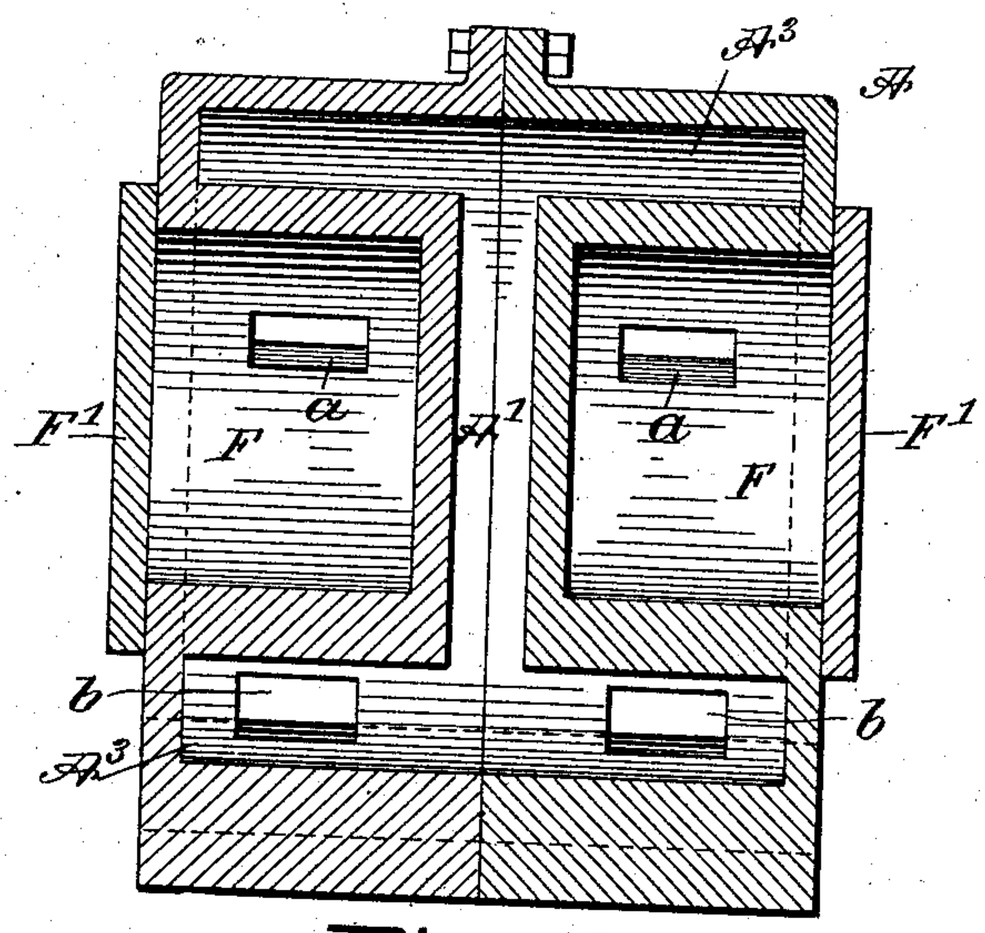


Fig. 5.

Fig. 13

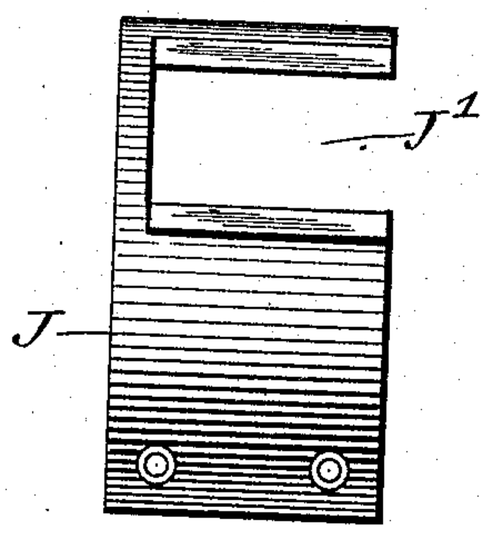


Fig. 14.

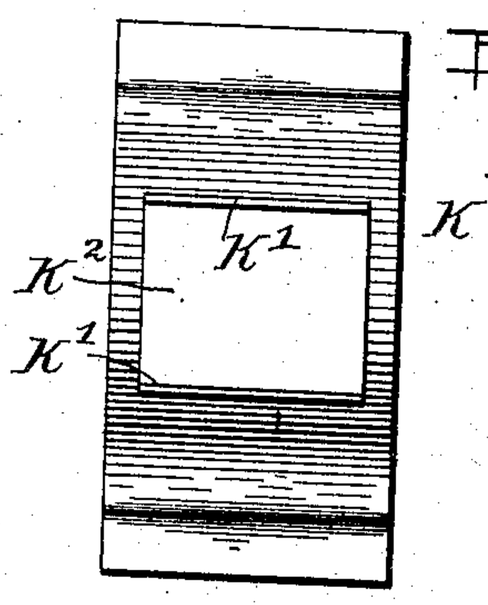
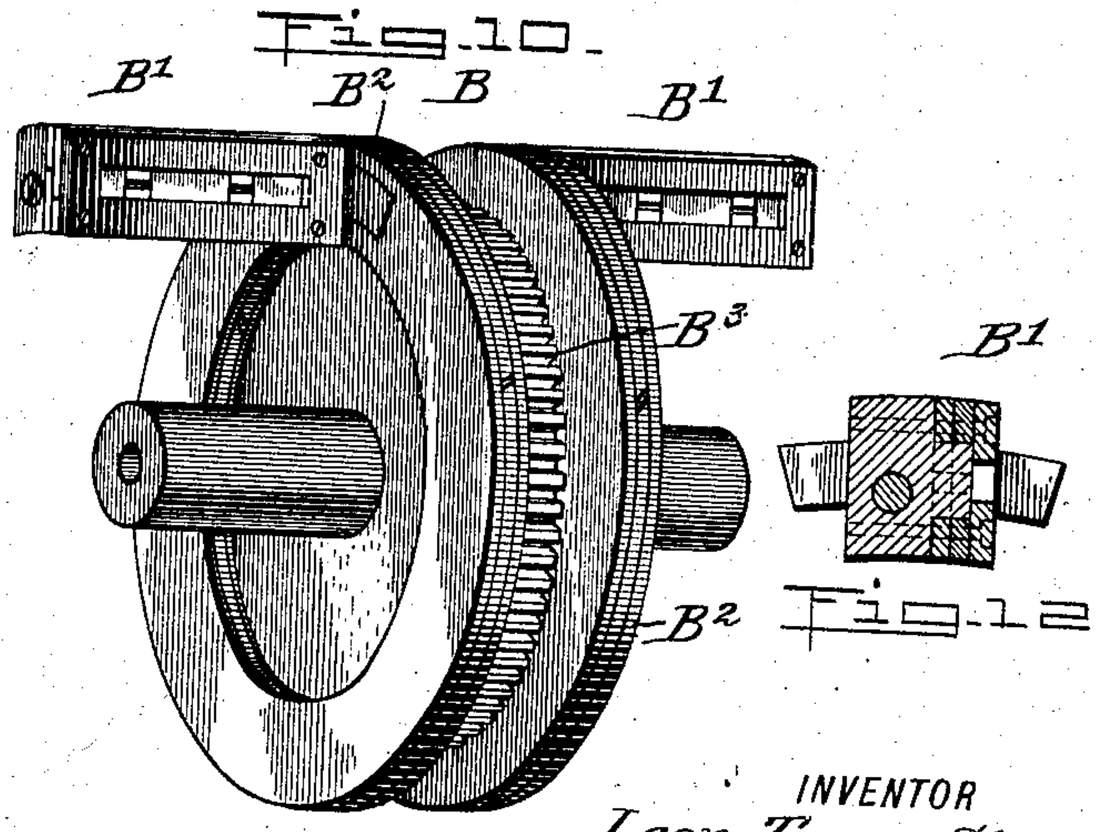


Fig. 10.



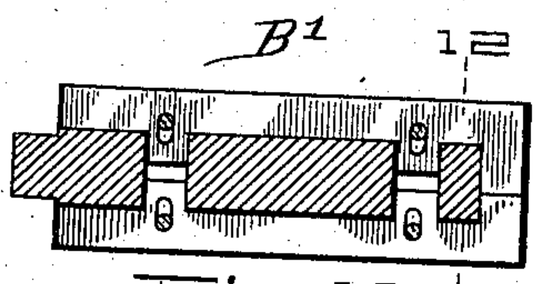


Fig. 11.

Fig. 12

WITNESSES:
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ATTORNEYS

No. 791,302. Patented May 30, 1905.

UNITED STATES PATENT OFFICE.

LEON TOWER STEWART, OF SOUTH PLYMOUTH, NEW YORK.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 791,302, dated May 30, 1905.

Application filed September 29, 1904. Serial No. 226,464.

To all whom it may concern:

Be it known that I, LEON TOWER STEWART, a citizen of the United States, and a resident of South Plymouth, in the county of Chenango and State of New York, 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 arranged to utilize the motive agent economically and to the fullest extent, to automatically cut off the motive agent according to the load, to allow running the engine at a high rate of speed and without causing undue vibration or noise, and to reduce wear and leakage to a minimum.

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

A practical embodiment of the invention is represented in the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a longitudinal sectional elevation of the improvement. Fig. 2 is a sectional plan view of the same on the line 2 2 of Fig. 3. Fig. 3 is a transverse section of the improvement on the line 3.3 of Fig. 1. Fig. 4 is a like view of the same on the line 4 4 of Fig. 1. Fig. 5 is a longitudinal sectional elevation of the steam-chest and cylinder, the section being on the line 5 5 of Fig. 3. Fig. 6 is a sectional side elevation of the cut-off valve. Fig. 7 is a cross-section of the packing between the rotary admission-valve and the steam-chest at the admission-port to the cylinder. Fig. 8 is an enlarged sectional side elevation of one of the piston-heads and its supporting-ring. Fig. 9 is a perspective view of the rotary admission-valve. Fig. 10 is a perspective view of the piston. Fig. 11 is a vertical section of one of the piston-heads. Fig. 12 is a cross-section of the same on the line 12 12 of Fig. 11. Fig. 13 is a face view of the packing for the rotary abutment, and Fig. 14 is a similar view of the packing between the rotary admission-valve and the steam-chest.

The cylinder A is preferably made in two parts bolted or otherwise fastened together, and the said cylinder is provided with a piston-bore A′ and an abutment-bore A^2, the bores intersecting each other, as plainly indicated in Figs. 3 and 4. The piston-bore A′ is provided with two annular working chambers A^3, into which extend the piston-heads B′, secured to the outer faces of the piston-rings B^2 of a piston B in the form of a disk and secured to the main shaft C, provided at one end with a pulley C′, connected by belt with other machinery for transmitting the rotary motion of the shaft C to other machinery.

On the peripheral face of the piston B between the rings B^2 is secured or formed a gear-wheel B^3, in mesh with a similar gear-wheel D′, forming part of the rotary abutment D, mounted to turn in the abutment-bore A^2 and rotating loosely on a hollow shaft E, secured by set-screws E′ in the heads of the bore A^2, as plainly shown in Fig. 2. A pipe E^2 is connected with the hollow shaft E to supply the latter with a suitable lubricant.

The abutment D is preferably made of three parts—namely, the central gear-wheel D′ and the side parts D^2, pressed on by springs D^3, held on bolts D^4, connecting the three parts D′ D^2 D^2 with each other, the springs serving to press the inner faces of the abutment parts D^2 against the outer faces of the piston-rings B^2 to prevent leakage of steam at this point. In the peripheral faces of the abutment parts D^2 are formed recesses or cavities D^5 (see Fig. 3) for the passage of the piston-heads B′ when the machine is in operation, and the piston B and abutment D rotate in unison with each other, owing to the gear-wheels B^3 and D′.

In the cylinder A and concentric with the annular working chambers A^3 are formed the steam-chests F, each closed at its outer end by a suitable steam-chest cover F′, connected by a branch pipe F^2 with a steam-supply pipe F^3, leading to the boiler or other suitable source of motive-agent supply. Each of the steam-chests is provided in its rim with an admission-port *a*, leading to the corresponding annular working chamber A^3, and from each annular working chamber leads an exhaust-port

b to an exhaust-port *b'* for carrying the exhaust to the outside of the machine. In each of the steam-chests F is mounted to rotate an admission-valve G, secured at its hub to the main shaft C, so as to rotate with the latter, and in the rim of the said valve G are formed a plurality of spaced ports G', adapted to register with the admission-port *a*, so as to allow the steam or other motive agent in the steam-chest F to pass by way of the ports G' and *a* into the corresponding annular working chamber A^3 to act on the piston-head B' therein to turn the piston in the direction of the arrow *x*, and consequently to turn the abutment D in the direction of the arrow *x'*. (See Fig. 3.)

Within the cylindrical admission-valve G is arranged a segmental cut-off valve H, having its hub H' mounted to rotate loosely on the main shaft C, and in the wall of the bore of the said hub H' is formed a cam-groove H^2, (see Fig. 6,) engaged by a pin H^3, secured to the governor-stem I' of a governor I. The stem I' is fitted loosely in a central bore in the main shaft C, and one end of the said stem I' extends through a stuffing-box in the end of the shaft C to the outside thereof, and on the outer end of the stem I' is fastened a cross-head I^2, connected by toggle-levers I^3, carrying the weights I^4, with a cross-head I^5, secured to the main shaft C, so as to rotate with the same. The toggle-levers I^3 of the governor I are normally held in an open position by a spring I^6 pressing with one end on the cross-head I^2 and resting with its other end on the face of a nut I^7, screwing on the cross-head I^5 to allow the operator to regulate the tension of the spring I^6 to set the governor to a desired speed. It is evident that when the shaft C runs at a speed in excess of that for which the engine is set then the weights I^4 fly outward, and in doing so the cross-head I^2 imparts an inward sliding motion to the stem I' to cause the pins H^3 to simultaneously turn the cut-off valves H to move the rims thereof over some of the ports G' to cut off steam from the port *a*, and when the engine runs at a lower rate of speed then the spring I^6 forces the cross-head I^2 outward, and consequently the cut-off valves H are rotated in the reverse direction to uncover the ports G' to admit more steam to the port *a* during each revolution of the admission-valve G. The cut-off valve H is provided at its hub H' with a counterweight H^4 to balance the cut-off valve with a view to reduce undue vibration to a minimum.

In order to prevent leakage of steam between the peripheral face of the corresponding abutment part D^2 and the inner wall of the annular working chamber A^3 a packing-plate J is interposed between the said surfaces, as plainly shown in Fig. 3, the packing-plate J being secured to the inner annular chamber-wall by screws or rivets, and the said plate is provided with a cut-out portion J' (see Figs. 3 and 13) for the passage of the corresponding piston-head B'. A packing-plate K is interposed between the rotary admission-valve G and the wall of the steam-chest F at the admission-port *a*, and this plate K is provided with turned-up prongs K', engaging the walls of the port *a* to hold the plate K against movement, and the said plate K is formed with an aperture K^2, registering with the port *a* for the passage of the steam through the port. The ends of the plate K are resilient and press against the steam-chest wall to hold the body portion of the plate in frictional contact with the peripheral face of the admission-valve G. (See Figs. 3 and 14.) The packing-plates J and K abut against flexible packings J^2 and K^3, respectively, set in recesses in the cylinder A and serving to prevent the steam from leaking past the said plates. The piston-head-supporting rings B^2 are provided at their inner and outer faces with suitable packing-rings, and each piston-head B' is provided with a packing made in parts pressed on by springs to prevent leakage of steam from one side of the piston-head to the other. (See Figs. 10, 11, and 12.)

The operation is as follows: Steam entering the steam-chests F by way of the pipes F^2 passes through the ports G' into the port A and into the inner working chambers A^3 to act on the piston-heads B' therein to rotate the piston B in the direction of the arrow *x*, thus turning the shaft C in the same direction and by the gear-wheels B^3 and D' rotating the abutment D in the direction of the arrow *x'*. Now as the shaft C rotates the valve G rotates with it, and consequently the last port G' finally passes the small port *a*, so that the steam is cut off during the remainder of the revolution of the shaft C, the piston B, and valve G. In case the engine runs at an excessive rate of speed then the cut-off valve H is shifted by the governor I, as previously explained, so that a lesser number of apertures G' move in register with the port *a* during each revolution, and consequently less steam is admitted to the annular working chamber A^3. As illustrated in Fig. 3, the cut-off valve H is in such a position as to allow all the ports G' in the valve G to register with the port *a* during each revolution of the valve G.

The rotary engine shown and described is very simple and durable in construction, is not liable to get out of order, and the motive agent is utilized economically and to the fullest advantage, especially as the operator is enabled to set the governor to a desired speed, and consequently the cut-off valve H to such a position as to cut off the steam sooner or later, and in addition the governor automatically cuts off the steam in case the engine runs at an excessive speed.

Although I have shown and described a ro-

tary engine driven by steam, it is evident that other motive agents may be used—such, for instance, as compressed air—or the engine may be run as a pump by driving the piston B in the reverse direction.

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

1. A rotary engine comprising a cylinder having intersecting bores, a piston revolving in one of the bores, an abutment rotating in the other bore and geared with the said piston, the said piston-bore having an annular working chamber, a steam-chest concentric with the piston and having an admission-port leading into the working chamber, a rotary admission-valve rotating in unison with the said piston and provided in its rim with ports, the said valve controlling the motive agent to the said admission-port, and a governor-controlled cut-off valve for the said admission-valve and arranged in the said steam-chest, the said cut-off valve being provided with a counterweight.

2. A rotary engine comprising a cylinder having intersecting bores, a piston revolving in one of the bores, an abutment rotating in the other bore and geared with the said piston, a steam-chest concentric with the piston and having an admission-port leading into the piston-bore, a rotary admission-valve rotating in unison with the said piston and provided in its rim with spaced ports controlling the motive agent to the said admission-port, a governor-controlled cut-off valve for the said admission-valve and arranged in the said steam-chest the cut-off valve being provided with a counterweight, and a governor driven in unison with the said piston and connected with the said cut-off valve.

3. A rotary engine comprising a cylinder having intersecting bores, a piston revolving in one of the bores, an abutment rotating in the other bore and geared with the said piston, a steam-chest concentric with the piston and having an admission-port leading into the piston-bore, a rotary admission-valve rotating in unison with the said piston and controlling the motive agent to the said port the rim of the said valve being provided with spaced ports for successive register with the said admission-port, a governor-controlled and counterweighted cut-off valve for the said admission-valve and arranged in the said steam-chest, and a governor driven in unison with the said piston and connected with the said cut-off valve by a pin in the governor-stem engaging a cam-groove on the hub of the cut-off valve.

4. A rotary engine provided with a cylinder having a piston-bore and an abutment-bore, the bores intersecting one the other, and the piston-bore having annular working chambers, a piston mounted to turn in the said piston-bore and provided on opposite faces with piston-heads extending into the said working chambers, a cylindrical abutment revolving in the said abutment-bore and having in its peripheral face recesses for the passages of the piston-heads, steam-chests concentric with the said working chambers and connected therewith by admission-ports, and valves rotating in unison with the said piston and controlling the motive agent passing from the said valve-chests by way of the said ports into the working chambers.

5. A rotary engine provided with a cylinder having a piston-bore and an abutment-bore, the bores intersecting one the other, and the piston-bore having annular working chambers, a piston mounted to turn in the said piston-bore and provided on opposite faces with piston-heads extending into the said working chambers, a cylindrical abutment revolving in the said abutment-bore and having in its peripheral face recesses for the passages of the piston-heads, steam-chests concentric with the said working chambers and connected therewith by admission-ports, valves rotating in unison with the said piston and controlling the motive agent passing from the said valve-chests by way of the said ports into the working chambers, and gear-wheels on the said piston and abutment within the said bores and in mesh with each other.

6. A rotary engine provided with a cylinder having a piston-bore and an abutment-bore, the bores intersecting one the other, and the piston-bore having annular working chambers, a piston mounted to turn in the said piston-bore and provided on opposite faces with piston-heads extending into the said working chambers, a cylindrical abutment revolving in the said abutment-bore and having in its peripheral face recesses for the passages of the piston-heads, steam-chests concentric with the said working chambers and connected therewith by admission-ports, and valves rotating in unison with the said piston and controlling the motive agent passing from the said valve-chests by way of the said ports into the working chambers, a governor and a cut-off valve controlled by the governor and acting in conjunction with the said rotary valve.

7. A rotary engine provided with a cylinder having a piston-bore and an abutment-bore, the bores intersecting one the other, and the piston-bore having annular working chambers, a piston mounted to turn in the said piston-bore and provided on opposite faces with piston-heads extending into the said working chambers, a cylindrical abutment revolving in the said abutment-bore and having in its peripheral face recesses for the passages of the piston-heads, the said abutment having a central section and side sections pressed by springs toward the central section and against the piston-faces, steam-chests concentric with the said working chambers and connected therewith by admission-ports, and valves rotating in unison with the said piston and con-

trolling the motive agent passing from the said valve-chests by way of the said ports into the working chambers.

8. A rotary engine provided with a cylinder having a piston-bore and an abutment-bore, the bores intersecting, and the piston-bore having annular working chambers, a piston mounted to turn in the piston-bore and provided with piston-rings, piston-heads connected with the outer faces of the piston-rings and extending into the said working chambers, a gear-wheel on the peripheral face of the piston between the rings, a cylindrical abutment mounted to turn in the said abutment-bore and comprising a central gear-wheel in mesh with the gear-wheel on the piston, and side parts connected with the central part and having in their peripheral faces recesses for the passage of the piston-heads, steam-chests concentric with the said working chambers and connected therewith by admission-ports, and valves for controlling the passage of the motive agent from the valve-chests to the working chambers.

9. A rotary engine provided with a cylinder having intersecting bores, one of the bores having an annular working chamber, a steam-chest formed integrally in the cylinder and concentric with the said annular chamber, the said steam-chest being connected by an admission-port with the annular working chamber, a cylindrical admission-valve rotating in the steam-chest in unison with the piston, the rim of the said valve being provided with spaced ports for successive register with the said admission-port and a cut-off valve within the said admission-valve and acting in conjunction therewith.

10. A rotary engine provided with a cylinder having intersecting bores, one of the bores having an annular working chamber, a piston mounted to turn in the bore having the working chamber, and provided on its face with a piston-head extending into the working chamber, an abutment revolving in the other bore and having in its peripheral face a recess for the passage of the piston-head, a steam-chest formed integrally in the cylinder and concentric with the said annular chamber, the said steam-chest being connected by an admission-port with the annular working chamber for conducting the steam from the steam-chest to the said working chamber, and the latter having an exhaust-port for conducting the exhaust-steam from the annular working chamber to the outside, a rotary admission-valve within the steam-chest and provided in its rim with spaced ports for successive register with the said admission-port, a cut-off valve for the said admission-valve and arranged within the same, and means for controlling the cut-off valve.

11. A rotary engine comprising a cylinder having an annular working chamber, a piston rotating therein, a steam-chest formed in the cylinder concentric with the said working chamber and provided with an admission-port for connecting the steam-chest with the said annular working chamber, a cylindrical admission-valve rotating in the said steam-chest in unison with the said piston, the rim of the said valve being provided with spaced ports for successive register with the said admission-port, a cut-off valve within the said admission-valve for covering or uncovering the ports thereof, the cut-off valve rotating with the said admission-valve, and a governor for imparting a separate additional rotary motion to the said cut-off valve.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

LEON TOWER STEWART.

Witnesses:

E. P. TRACY,

H. A. DIMMICK.