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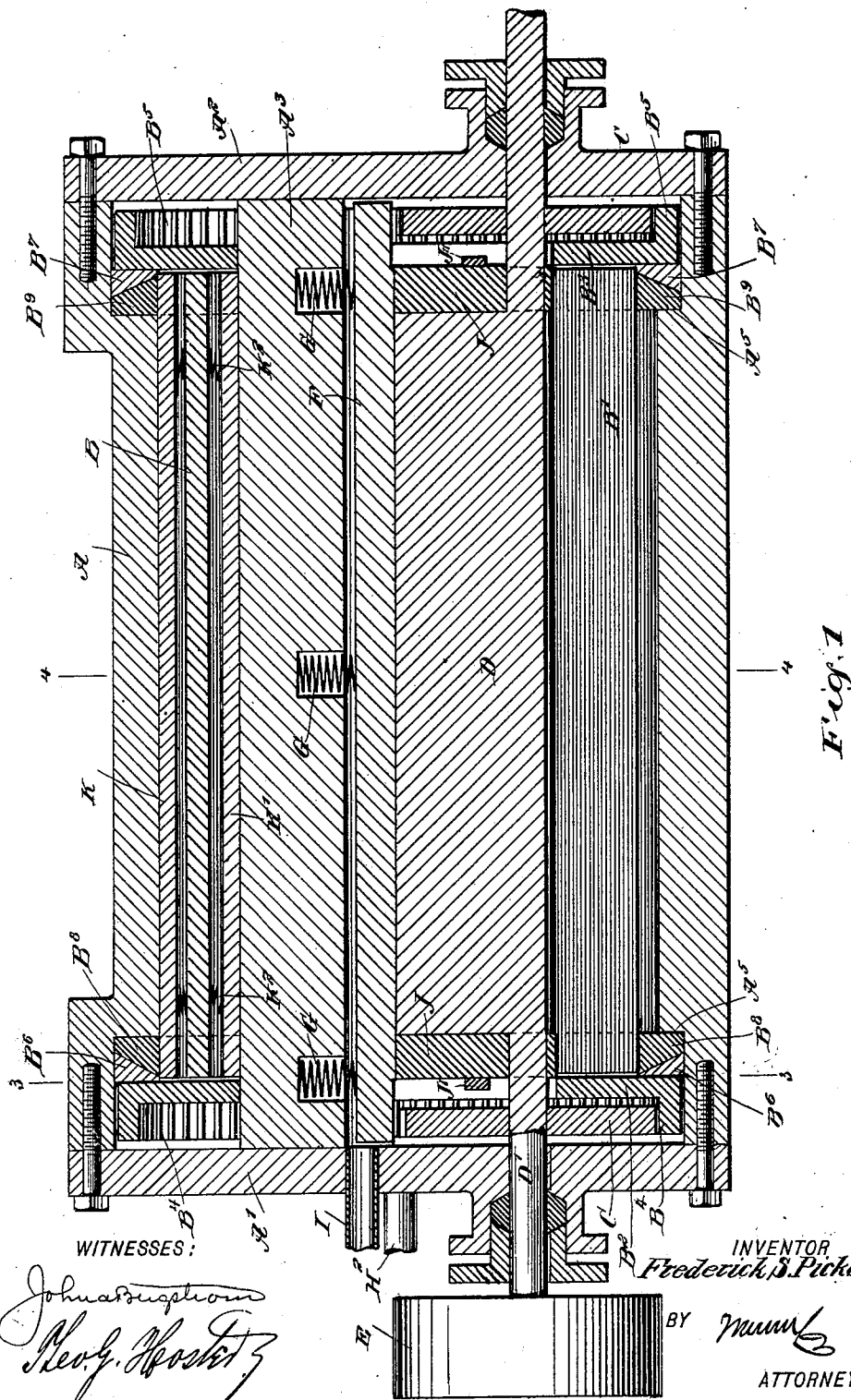
Patented Aug. 6, 1901.

F. S. PICKERING.
ROTARY ENGINE.

(Application filed Oct. 25, 1900.)

(No Model.)

3 Sheets—Sheet 1.



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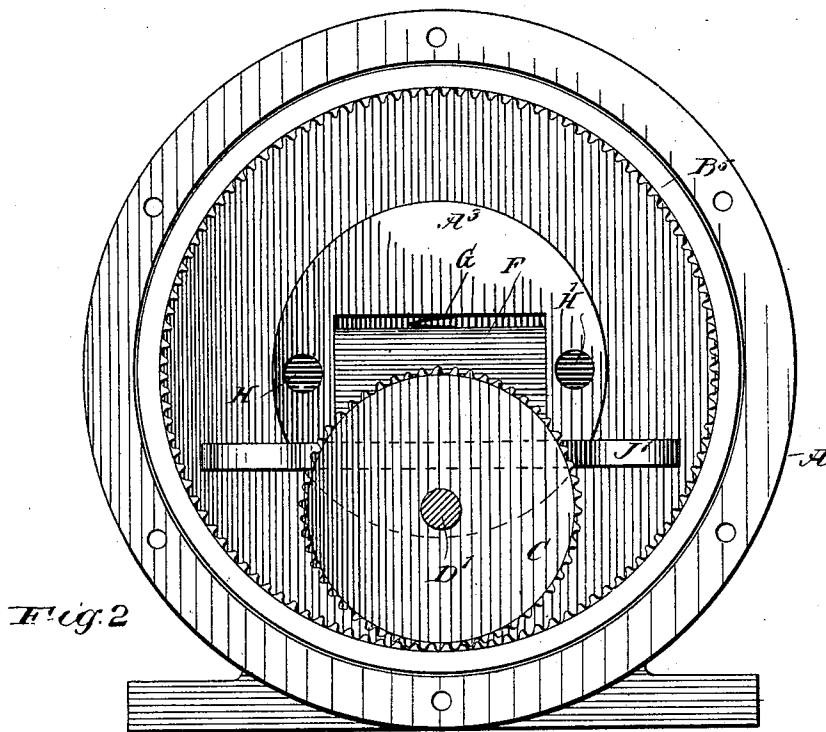
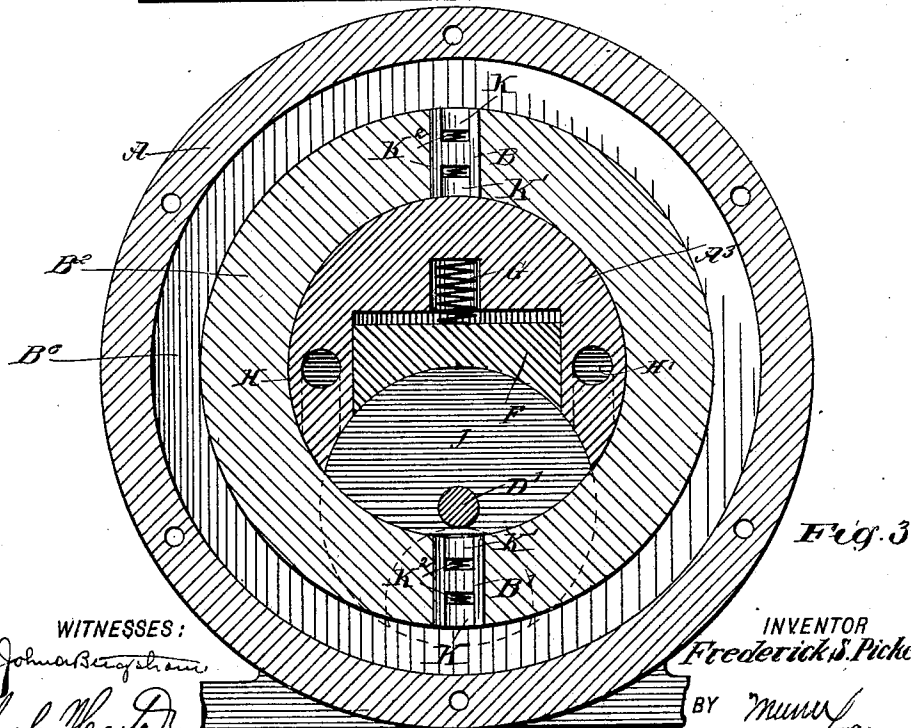
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3 Sheets--Sheet 2.



WITNESSES :

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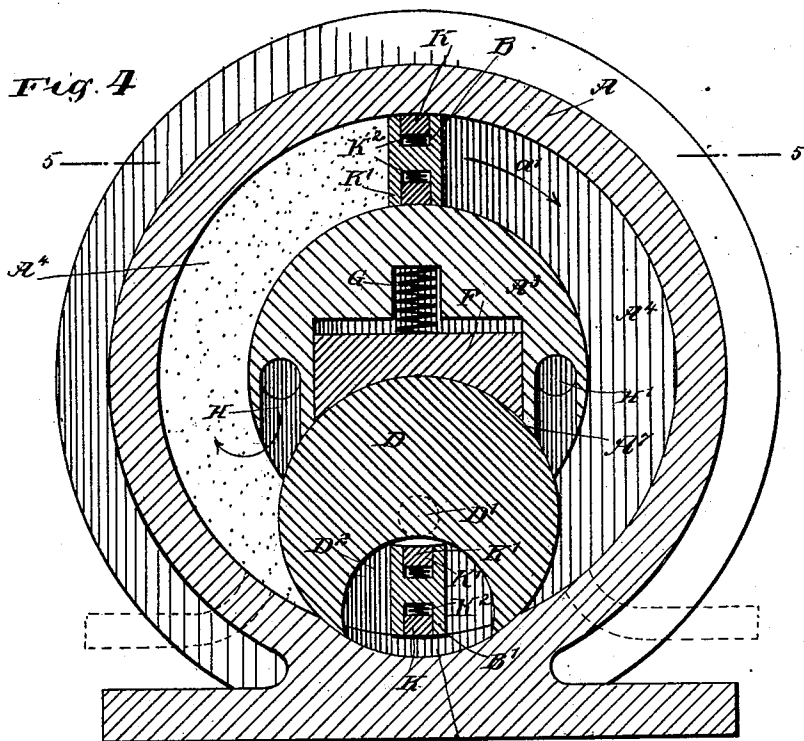
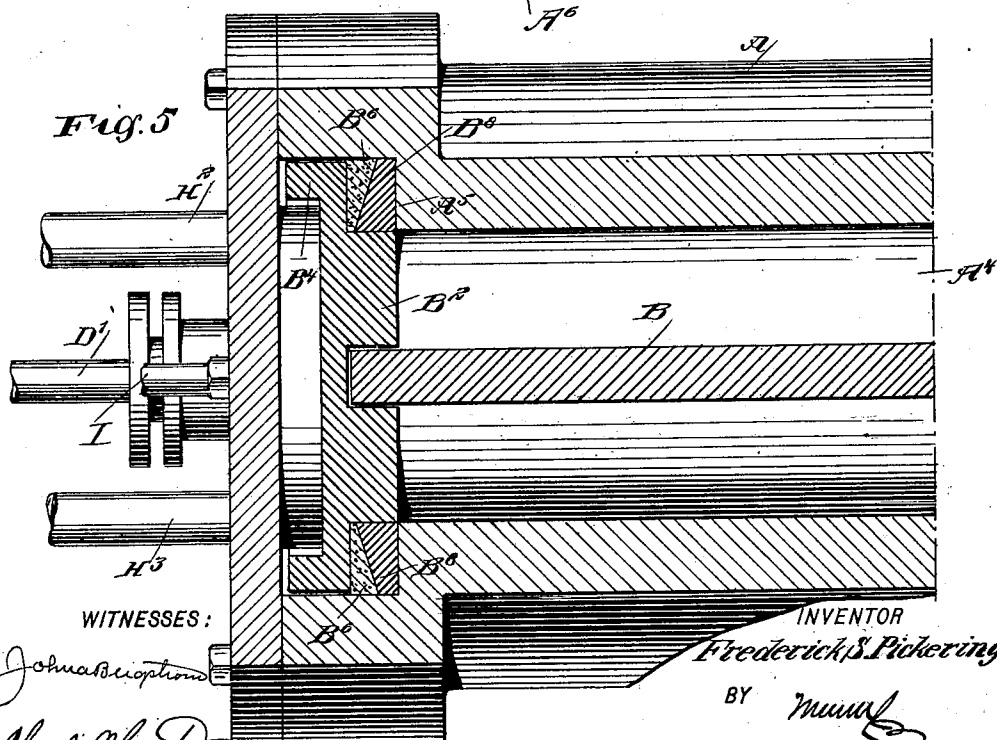
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3 Sheets—Sheet 3.



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UNITED STATES PATENT OFFICE.

FREDERICK SCOTT PICKERING, OF OLATHE, KANSAS.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 680,068, dated August 6, 1901.

Application filed October 25, 1900. Serial No. 34,312. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK SCOTT PICKERING, a citizen of the United States, and a resident of Olathe, in the county of Johnson and State of Kansas, 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, very effective in operation, and arranged to utilize the motive agent to the fullest advantage and to permit the operator to conveniently reverse the engine.

The invention consists of novel features and parts and combinations of the same, as will be 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 an end view of the same with a cylinder-head removed. Fig. 3 is a cross-section of the same on the line 3 3 in Fig. 1. Fig. 4 is a like view of the same on the line 4 4 in Fig. 1, and Fig. 5 is a sectional plan view of the same on the line 5 5 in Fig. 4.

The improved rotary engine is provided with a cylinder A, having cylinder-heads A¹ A², and a horizontally-disposed core A³, held in position by said heads and forming with the cylinder an annular working chamber A⁴, as is plainly illustrated in Fig. 4. Within the working chamber A⁴ are mounted to travel radially-disposed and longitudinally-extending piston-heads B B', carried at their ends on piston-disks B² B³, formed on or carried by internal gear-wheels B⁴ B⁵, respectively in mesh with gear-wheels C, secured on the shaft D' of a revoluble abutment D, made cylindrical and having a cut-out portion D² for the passage of the piston-heads B B', as the same pass through the annular working chamber A⁴ from one side of the abutment to the other. The piston-disks B² B³ are formed with central apertures for the passage of the core A³, and the inner faces of said disks fit against packing-rings B⁶ B⁷,

having their faces beveled and in engagement with the beveled faces of the retaining-rings B⁸ B⁹, respectively seated on annular shoulders A⁵, forming part of the cylinder A and located at the ends of the working chamber A⁴. The packing-rings B⁶ B⁷ prevent leakage of motive agent from the working chamber A⁴ at the piston-disks, and the retaining-rings B⁸ B⁹, besides acting as packing-rings, embrace the ends of the piston-heads B B' to hold the same in place in the piston-disks at the time said heads pass the recess A⁶ in the bottom of the cylinder A. The abutment D extends in the annular working chamber A⁴ and is seated with a portion of its peripheral surface in the recess A⁶ in the inner surface of the cylinder and in a corresponding recess A⁷ in the core A³, as is plainly indicated in Fig. 4. The close contact of the peripheral surface of the abutment D against its seats in the recesses A⁶ A⁷ forms a closed working chamber and a perfect abutment for the back pressure of the motive agent during the passage of the piston-heads from one side of the abutment to the other, as well as at all other times, so that there is no dead-point. The abutment also has the additional function of transmitting the power of the engine to other machinery, and for this purpose the shaft D' of the abutment carries a pulley E, adapted to be connected by belt with other machinery for driving the same.

In order to prevent leakage of steam from one side of the working chamber A⁴ to the other side—that is, from the working chamber to the exhaust-chamber—the core A³ is provided with a movable packing F in contact with the peripheral surface of the revoluble abutment D. Suitable springs G, in conjunction with the balance-pressure of steam, press the packing F in contact with said abutment, and in turn press the opposite side of said abutment against its seat in the recess in the inner surface of the cylinder A. It is understood that the various parts are so proportioned that the surfaces of contact of the abutment D against the packing F and against its seat in the recess in the inner surface of the cylinder A are in each case greater than the cut-out portion of the cylindrical surface of said abutment, as is plainly shown in Fig. 4.

In the core A^3 , on opposite sides of the abutment, are arranged ports H H' for admitting and exhausting the steam to and from the annular chamber A^4 , the outer ends of said ports being connected with a suitable steam-inlet pipe H^2 and an exhaust-pipe H^3 , respectively, as is plainly indicated in the drawings. Either of the ports H or H' can be used as the inlet-port to drive the engine in either a forward or reverse direction, as desired by the operator.

In order to balance the packing F and the piston-disks B^2 B^3 , I prefer to admit steam into the spaces containing said parts, and for this purpose I lead a pipe I into said spaces, the pipe being connected with a boiler or other source of steam-supply. A packing-plate J (see Figs. 1 and 3) is held against each end of the abutment D by a spring J' (see Fig. 2) and by the pressure of counterbalancing steam to prevent steam from passing around the abutment from the working chamber into the exhaust-chamber. The said packing-plates also prevent the steam from escaping from the balance-pressure chamber into the exhaust-chamber, as will be readily understood by reference to Fig. 1. Each packing J has parallel plane faces and two faces at right angles thereto, formed by two intersecting cylindrical surfaces, one of which is coincident with the cylindrical surface of the core A^3 at the cut-out portion and the other face of which is coincident with the cylindrical surface of the recess A^7 in the core A^3 and having a radius of curvature exactly equal to that of the cylindrical surface of the abutment D .

The piston-heads B B' are provided with suitable spring-packings K K' , of which the packing K is in engagement with the inner surface of the cylinder A , and the other packing K' is engaged with the peripheral surface of the core A^3 , as shown in Fig. 4.

The piston-disks B^2 B^3 are pressed against the ends of the abutment D and also against the yielding packing by the pressure of counterbalancing steam, said piston-disks B^2 B^3 having a larger surface exposed to the pressure of counterbalancing steam than is exposed to the pressure of working steam, and hence no springs will be employed for the purpose of holding the piston-disks B^2 B^3 in position unless it should be found necessary to prevent vibration, when the spring J or other proper springs may be used for this purpose.

Instead of the sole use of strong springs for counterbalancing the pressure of steam in the working chamber A^4 , adapted to resist heavy as well as light pressure of working steam, I prefer to use comparatively weak springs to insure a balance of power and pressure in the proper direction and to admit steam of the same pressure as that of the working steam into the spaces outside of the working chamber A^4 and containing the parts to be counterbalanced, and to thus oppose the pres-

sure of the working steam with the pressure of the counterbalancing steam. Thus the parts to be counterbalanced on account of having a greater surface exposed to the pressure of the counterbalancing steam than is exposed to the pressure of the working steam will always have a balance of power and pressure exerted in the proper direction and never any great excess, whether the pressure of the steam be light or heavy. For this purpose the pipe I is led into the balance-pressure spaces, the pipe being connected with the source of steam-supply.

The operation is as follows: When the several parts are in the position shown in Fig. 4, the motive agent enters the working chamber A^4 through the port H to exert its pressure against the piston-head B and to drive the same in the direction of the arrow a' , and as the piston-head moves in this direction it rotates the piston-disks, so that the internal gear-wheels B^4 B^5 rotate the gear-wheels C to rotate the abutment D and to transmit the power of the engine to other machinery, as above explained. At the same time the abutment D , while constantly maintaining a closed working steam-chamber by its cut-out portion D^2 , allows the passage of the other piston-head B' from one side of the chamber to the other and from one side of the abutment to the other, while the motive agent still continues to exert its pressure against the piston-head B , driving it, as above stated, until the piston-head B' has passed the port H , when the motive agent then exerts its pressure against the piston-head B' to drive it in the direction of the arrow a' and in turn through the piston-head B' to rotate the piston-disks with the result above explained. The exhaust-port H' in this direction of revolution is constantly open, and steam is exhausted in the space from the abutment to the nearest piston in a direction contrary to the direction of revolution of said piston-heads.

It will be observed that there is no dead-point, and also that the power of the steam to rotate the piston-heads is always at its maximum, both in respect to the lever-arm through which it acts or its turning moment and in respect to the constant area of the piston-heads exposed to the pressure of the working steam.

It is understood that the gearing is so proportioned that the abutment D makes exactly two revolutions to one revolution of the piston-heads, and consequently the cut-out portion D^2 moves in unison with the piston-heads to allow the same to pass from one side of the abutment to the other.

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

1. A rotary engine, comprising a cylinder having a central core spaced from the wall of the cylinder to form an annular working chamber, a piston mounted to turn in said

cylinder and having a plurality of piston-heads traveling in said working chamber, a revoluble abutment mounted to turn in fixed bearings and extending in said annular working chamber, the said abutment having a cut-out portion for the passage of the piston-heads, peripheral seats for said abutment formed by a recess in the inner surface of the cylinder and a recess in the core, the core being provided at said recess with a packing forming part of the said seat, the surfaces of contact of the abutment against its seats in the cylinder and core being greater than the cut-out portion of the cylindrical surface of the abutment, the peripheral surface of the abutment contacting closely with its seats in the said recesses, thereby forming a closed working chamber and a perfect abutment for the back pressure of the motive agent at all times, and means for driving said abutment from said piston, as set forth.

2. A rotary engine, comprising a cylinder having a central core to form an annular working chamber, a piston mounted to turn in said cylinder and having a plurality of piston-heads traveling in said working chamber, an abutment mounted to turn in fixed bearings, and extending in said annular chamber, the said abutment having a cut-out portion in its surface for the passage of the piston-heads, the said cylinder and core being provided with recesses forming peripheral seats for the abutment, the surfaces of contact of the abutment against its seats being greater than its cut-out portion, the peripheral surface of the abutment contacting closely with its seats, thereby forming a closed working chamber, and a perfect abutment for the back pressure of the motive agent at all times, means for driving said abutment from said piston and a movable packing carried by the core and forming part of the seat for said abutment and holding said abutment against its seat in the recess in the cylinder, and means for pressing said packing against the abutment, as set forth.

3. A rotary engine, comprising a cylinder having a central core to form an annular working chamber, a piston mounted to turn in said cylinder and having a plurality of piston-heads traveling in said working chamber, an abutment mounted to turn in fixed bearings and extending in said annular chamber and having peripheral seats in said cylinder and core, means for driving said abutment from said piston, a packing carried by the core and engaging the peripheral surface of the abutment, means for subjecting said packing to steam-pressure for counterbalancing purposes, and springs engaging the said packing and acting in conjunction with the steam-pressure to insure a constant excess of pressure in direction of the abutment and constant contact therewith, as set forth.

4. A rotary engine comprising a cylinder having a central core to form an annular working chamber, a piston mounted to turn in said

cylinder, a revoluble abutment for said piston and driven from the latter, a movable packing in the core and engaging the peripheral surface of said abutment an inlet-pipe for conducting the motive agent to a space in said core behind the packing to counterbalance the latter, and ports arranged in said core on opposite sides of the abutment for admitting and exhausting the motive agent to and from said working chamber, as set forth.

5. A rotary engine, comprising a cylinder having a central core to form an annular working chamber, a piston mounted to turn in said cylinder, a revoluble abutment for said piston and driven from the latter, a movable packing in the core and engaging the peripheral surface of said abutment, means for conducting the motive agent to the core to exert pressure on the packing to press it in contact with the abutment, ports in said core and opening into the working chamber on opposite sides of the abutment for admitting and exhausting the motive agent to and from said chamber and means for transmitting the rotary motion of the abutment to other machinery, as set forth.

6. A rotary engine, comprising a cylinder having a central core to form an annular working chamber, a piston mounted to turn in said cylinder and comprising piston-disks and piston-heads carried by said disks and arranged to travel in the annular working chamber, a revoluble abutment for the passage of said piston-heads and driven from the said piston, a packing in said core for said abutment, means for subjecting the said packing and the piston-disks to steam-pressure for counterbalancing purposes, and ports arranged in the said core on opposite sides of the abutment for admitting and exhausting the motive agent to and from the working chamber, the said ports being connected respectively with a steam-inlet pipe and an exhaust-pipe as set forth.

7. A rotary engine, comprising a cylinder having a central core to form an annular working chamber, a piston mounted to turn in said cylinder, and comprising radial piston-heads and piston-disks carrying said heads for the latter to travel in the annular working chamber, a revoluble abutment driven from said piston-disks, and arranged to transmit the rotary motion of the engine to other machinery, and means for counterbalancing the piston-disks by steam-pressure, as set forth.

8. A rotary engine, comprising a cylinder having a central core to form an annular working chamber, a piston mounted to turn in said cylinder and having a plurality of piston-heads traveling in said working chamber, piston-disks carrying said piston-heads, an abutment mounted to turn in fixed bearings and extending in said annular working chamber and having peripheral seats in said cylinder and core, means for driving said abutment from said cylinder, and a packing carried by the shaft of said revoluble abutment and en-

gaging a portion of the surface of the end of said abutment, and also a portion of the inner cylindrical surface of said piston-disks, as set forth.

5 9. A rotary engine, comprising a cylinder having a central core to form an annular working chamber, a piston mounted to turn in said cylinder, and comprising a plurality of piston-heads and piston-disks carrying said heads
10 for the latter to turn in the annular working chamber, an abutment mounted to turn in fixed bearings and extending in said annular working chamber and having peripheral seats in said cylinder and core, means for driving
15 said abutment from said cylinder, and a packing carried by the shaft of said revoluble abutment and engaging a portion of the surface of the end of said abutment and a portion of the inner cylindrical surface of the
20 piston-disks, and holding said radial piston-heads in their perfect circle of revolution in said working chamber about said central core, as set forth.

10. A rotary engine, comprising a cylinder
25 having a central core to form an annular working chamber, a piston mounted to turn in said cylinder, and comprising piston-heads and piston-disks carrying said heads for the latter to turn in said annular working chamber,
30 a revoluble abutment mounted to turn in fixed bearings and extending in said annular working chamber and having peripheral seats in said cylinder and core, means for driving said abutment from said cylinder, and packing-rings
35 engaging a portion of the outer cylindrical surface of said piston-disks and a crescent-shaped portion of the surface of the end of said abutment, preventing the fall of the piston-heads into the peripheral seat of the
40 abutment in said cylinder and holding said piston-heads in their perfect circle of revolution in said working chamber, as set forth.

11. A rotary engine, comprising a cylinder

having a central core to form an annular working chamber, a piston mounted to turn in said
45 cylinder, and comprising radial piston-heads and piston-disks carrying said heads for the latter to travel in the annular working chamber, a revoluble abutment for the passage of
50 said piston-heads and driven from said piston-disks and arranged to transmit the rotary motion of said abutment to other machinery, a packing in said core for said abutment, a packing carried by the shaft of said revoluble
55 abutment, and means for subjecting said piston-disks and said packing to steam-pressure for counterbalancing purposes, as set forth.

12. A rotary engine, comprising a cylinder having a central core to form an annular work-
60 ing chamber, a piston mounted to turn in said cylinder and comprising radial piston-heads and piston-disks carrying said heads for the latter to travel in the annular working chamber, a revoluble abutment for the passage of
65 said piston-heads and extending in said annular working chamber, having peripheral seats in said cylinder and core, mounted to turn in fixed bearings and driven from said piston-disks, means for transmitting the rotary
70 motion of said abutment to other machinery, means for admitting the motive agent for counterbalancing purposes, and means for admitting and exhausting the motive
75 agent to and from said working chamber by way of said core on opposite sides of said abutment, substantially as shown and described.

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

FREDERICK SCOTT PICKERING.

Witnesses:

I. O. PICKERING,
L. W. SNEPP.