No. 764,464. PATENTED JULY 5, 1904.

C. HENDRICKS.

ROTARY ENGINE.

APPLICATION FILED SEPT. 3, 1902.

NO MODEL.

Fig. 1.

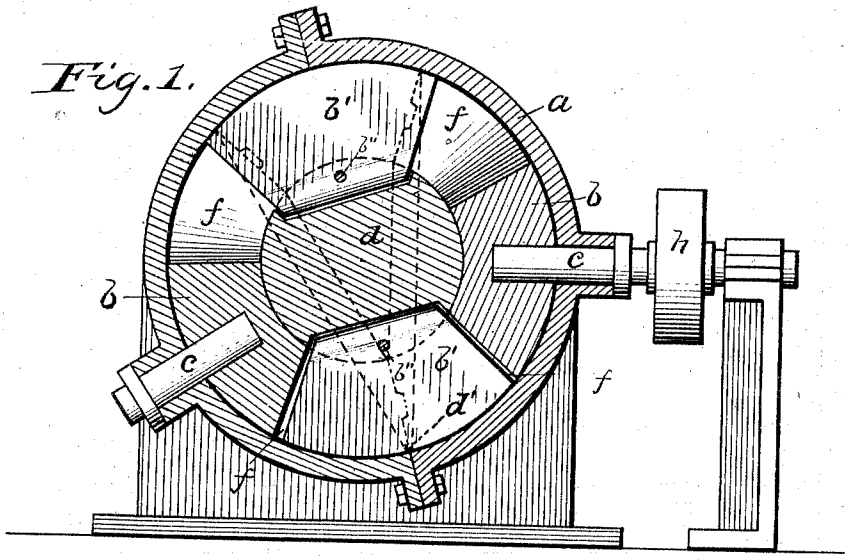


Fig. 2.

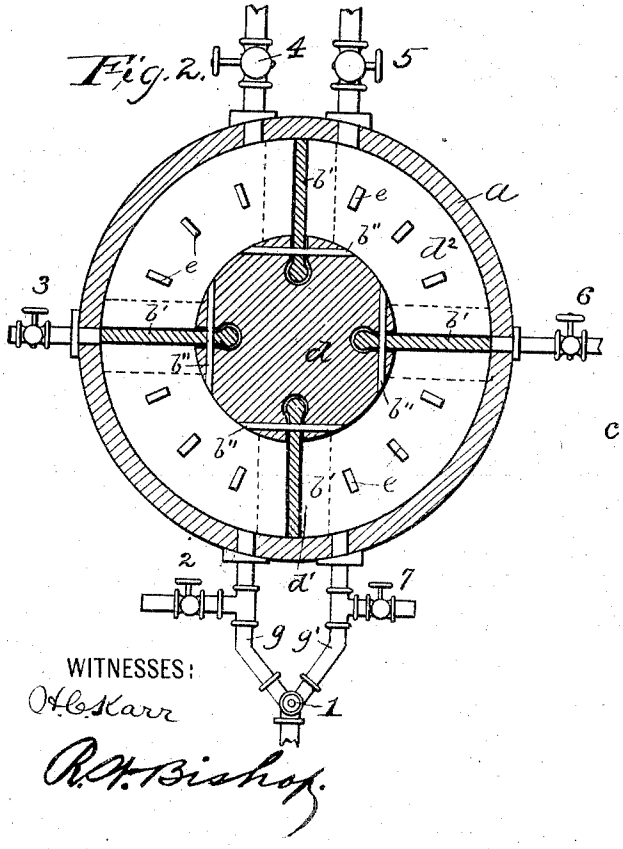
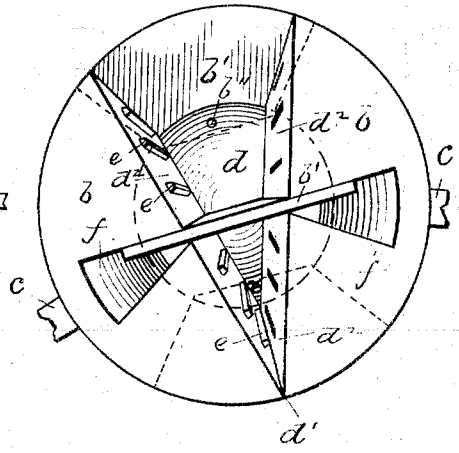


Fig. 3.



WITNESSES:

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No. 764,464. Patented July 5, 1904.

UNITED STATES PATENT OFFICE.

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ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 764,464, dated July 5, 1904.

Application filed September 3, 1902. Serial No. 121,966. (No model.)

To all whom it may concern:

Be it known that I, CLARK HENDRICKS, a citizen of the United States of America, and a resident of Riverside, county of Riverside, State of California, have invented certain new and useful Improvements in Rotary Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical sectional view of a motor or engine embodying the principle of my invention. Fig. 2 is a vertical sectional view taken centrally through the blades and the casing; and Fig. 3 is a side elevation of the rotative parts, the shell or casing being removed.

The object of this invention is to provide an extremely simple, durable, and efficient rotary engine which may be operated as a rotary pump or compressor, as more fully hereinafter set forth.

Generally the invention in its preferred form consists of a spherical casing in which is rotatably mounted a centrally-arranged sphere and between the sphere and casing a pair of approximately hemispherical pistons or shells which nicely fit the spherical wall of the casing and the exterior of the central sphere and are arranged out of alinement with each other at opposite sides of the sphere, so that their circular edges or plane surfaces shall bear against each other at one point in their circumference, and thereby form a fluid-chamber extending entirely around the casing and tapering in opposite directions from a point opposite the point of contact of the edges, and a series of blades or partitions carried by the sphere and having their side edges engaging and working in slots in the said faces or edges of the hemispherical pistons, and a suitable shaft or shafts centrally attached to the hemispherical pistons and journaled in the casing, whereby when a suitable motive fluid is admitted into the peculiarly-shaped fluid-chamber the pressure of the fluid upon the blades and the inclined edges of the hemispherical pistons will impart a continuous rotary movement to the hemispherical pistons and carry with them the blades and sphere, thereby transmitting said motion of the hemispherical pistons to the shaft or shafts. When the device is used as a pump or an air-compressor, power is applied to one or both of said shafts and as the parts rotate the liquid or air is drawn in at one side of the motor and forced out at the opposite side or some other convenient point, as more fully hereinafter set forth.

Referring to the drawings by letters, *a* designates the spherical casing, which may be suitably supported and may be constructed of two or more parts separably fastened together for convenience.

The letter *b* designates the two approximately hemispherical pistons inclosed within the casing and having their convex surfaces nicely fitting the same, these pistons being attached centrally to shafts *c*, journaled in the casing. The shafts are journaled at an angle to each other, so that their axial lines shall intersect at the center of the casing, whereby the hemispherical pistons shall lie at an angle to each other out of alinement. Supported within and nicely fitting the concavities in the said hemispherical pistons is the rotatable sphere *d*, secured to which in suitable slots by pins *b''* are a series of radial segmental plates or partitions *b'*, whose outer edges are curved, so as to fit nicely against the interior of the casing. These plates are preferably mounted so as to have a slight vibration flatwise, but no appreciable vibration edgewise.

The adjacent faces or edges d^2 of the hemispherical pistons *b* are beveled off outwardly, so that they may fit and bear against each other at one point in their circumference, this point being designated in the drawings by the letter d' and being equidistant from the two shafts *c c*. The bevel-face of one of the pistons may be provided with teeth or projections *e*, which engage in similarly-shaped depressions in the bevel face or edge of the opposite piston in order that the two pistons shall always rotate in unison. Coincident with each blade or partition the edge of each part *b* is provided with a radial slot *f*, into which one side edge of the blade extends and works as the pistons revolve, each of these

slots being of a width to nicely fit the pistons or blades at their outer edges and being widened into a dovetail shape in the direction of their depth, so that as the pistons revolve the blades may slide freely in and out of the slots and permit the bevel-faces d to assume varying angles to the blades as the latter move away from or approach the point of contact d.

If steam or other motive fluid be admitted to the fluid-chamber at one side of the contact-point d', the pressure against the partitions and the inclined faces of the pistons will cause the pistons to rotate, and as each partition passes the inlet-port the motive fluid will be cut off from the preceding compartment and (when the fluid is of an expansive nature) allowed to work by expansion alone or (when of an inexpansive nature) by momentum until exhausted or forced out. It will be seen that the fluid-chamber always remains of the same cubic area and formation, while the superficial pressure area of each of the partitions is constantly increasing until a point in the compartment midway between the partitions is directly opposite the division-line d', where the exhaust begins to take place.

It is obvious that any suitable arrangement of ports may be employed, one possible arrangement being illustrated in Fig. 2. By closing cocks 2 3 4 and opening cocks 5, 6, and 7 and adjusting the three-way valve 1 so that the motive fluid will enter the engine through pipe g the steam or other fluid will enter the fluid-chamber just to the left of the contact-point d' and cause the pistons to revolve, the main exhaust taking place through valve 5 and the auxiliary exhaust through valves 6 and 7, these latter outlets being simply to prevent compression of any of the motive fluid that may remain in the compartments after the rear partition of each compartment passes the main exhaust-point, it being obvious that a free outlet must be provided for each of the compartments during the period it is decreasing in size—that is, while it is moving toward the point d'. To reverse the motor, it is simply necessary to adjust valve 1 so as to direct the motive fluid through pipe g' into the engine in the right side of the contact-point d', close valves 5, 6, and 7, and open valves 2, 3, and 4. To use the engine as a compressor or pump, adjust valve 1 to admit fluid to pipe g, open valves 2, 3, and 4, close valves 5 and 6, and apply power to one or both the shafts, whereupon the air or other fluid will be drawn in and compressed and forced out through valve 7. It will be observed, therefore, that in some cases the ports controlled by valves 3 and 4 serve in the nature of auxiliary inlet-ports and that the ports controlled by valves 6 and 7 serve in the nature of auxiliary exhaust-ports, and vice versa when the engine is reversed.

It is of course understood that any other suitable arrangement of valves and ports may be used to adapt the apparatus for use as either a reversible or non-reversible engine or compressor or pump and that therefore the arrangement I have shown is only suggestive of the many arrangements I may finally adopt. It is further obvious that the power may be taken off from or applied to one or both the shafts, though I have shown but one shaft provided with a band-wheel h. When but one shaft is to be used as a power-shaft, the other one may simply be a stub-shaft stepped in a bearing formed in or secured to the interior wall of the casing and need not extend out through the same. It is obvious also that a great many other changes in the construction may be made without departing from the spirit of the invention in the least, and I may state that I have in mind a number of modifications and minor changes that may be resorted to to render the apparatus particularly suitable to special uses, and especially with regard to rendering it reversible as well as convertible.

I do not claim in this application anything shown and claimed in my copending application, Serial No. 130,854, filed November 11, 1902, in which the radial blades instead of being carried by and rotated with the central sphere rest loosely upon the same, so that the sphere may rotate independently both of the blades and the pistons.

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

1. In an apparatus of the class described, the combination of a spherical casing, provided with inlet and outlet ports, a pair of hemispherical pistons fitting within the casing and arranged at opposite sides thereof and having their edges or perimeters beveled outward and their inner faces provided with concavities, a sphere fitting and rotating in said concavities and carrying a series of radial plates or partitions working in coincident slots in said beveled perimeters or edges, said perimeters or edges coming in contact at one point in their circumference and being separated throughout the remainder of their circumference, thereby forming an oppositely-tapering fluid-chamber across which the blades or partitions extend and form compartments, and a power-shaft attached to one of said hemispherical pistons and extending out through the casing, for the purposes set forth.

2. In combination with a spherical casing provided with suitable inlet and outlet ports, a pair of rotatable hemispherical pistons fitting within the casing and arranged at opposite sides thereof at an angle to each other, an independent rotatable sphere fitting and working within concavities formed in the inner faces of said hemispherical pistons and provided with a series of spaced radial blades extending across the annular space formed be-

tween the edges of said hemispherical pistons and connecting said edges together and thereby dividing the same into fluid-compartments, a power-shaft connected to one of said hemispherical pistons.

3. In combination with a casing provided with suitable inlet and outlet ports, a pair of rotatable heads or pistons fitting within the casing at opposite sides thereof and having their axes of rotation and their adjacent edges at an angle to each other, a rotatable part connecting said two heads at their centers and being supported thereon, said rotatable part carrying a series of spaced radial blades extending across the annular space formed between the edges of said heads and dividing the same into fluid-compartments, and a rotatable power-shaft connected to one of said heads, substantially as set forth.

4. In combination with a casing provided with suitable inlet and outlet ports, a pair of rotatable heads or pistons fitting within the casing at opposite sides thereof and having their axes of rotation and their adjacent edges at an angle to each other, a rotatable part connecting said two heads at their centers and being supported thereon and rotatable therewith, said rotatable part carrying a series of spaced radial blades extending across the oppositely-tapering annular space formed between the edges of said heads and dividing the same into fluid-compartments, said blades extending into slots in the edges of said heads so as to have a sliding connection therewith, and a power-shaft connected to at least one of said heads, substantially as set forth.

5. In combination, a casing, provided with suitable inlet and outlet ports, a pair of rotatable heads or pistons fitting within the casing at opposite sides thereof and having their axes of rotation at an angle to each other, the adjacent edges of these pistons being beveled and bearing against each other at one point in their circumference, these beveled edges being provided one with a series of projections or teeth and the other with a series of depressions to receive said teeth, a rotatable part fitting between and engaging said heads or pistons and carrying a series of spaced blades extending across the oppositely-inclined chamber formed between the edges or faces of the pistons, for the purposes set forth.

6. In a rotary engine, the combination of a casing, a pair of rotating disks or pistons inclosed in the casing and having bearings at opposite sides of the same, these disks having their axes set at an angle to each other and their adjacent faces made conical, the adjacent faces of the disks abutting on a radial line, thereby forming an annular oppositely-tapering fluid-chamber between said adjacent faces, a shaft connected to one of the disks, ports in the casing, and a series of rigid radial blades extending across said fluid-chamber.

7. In a rotary engine, the combination of a casing, a pair of rotating disks inclosed in the casing and having bearings at opposite sides of the same, these disks having fixed axes set at an angle to each other and their adjacent faces abutting at one point on a radial line, thereby forming an annular oppositely-tapering fluid-chamber between said adjacent faces, a rotatable part centrally arranged between said disks, rigid radial blades carried by said rotatable part and working in slots in said disks, said slots being widened in the direction of their depth, ports in the casing, and a shaft carried by one of said disks.

8. In a rotary engine, the combination of a casing, a pair of rotating disks or pistons inclosed in the casing and having bearings at opposite sides of the same, these disks having fixed axes set at an angle to each other, the adjacent faces of the disks abutting on a radial line, thereby forming an annular oppositely-tapering fluid-chamber between said adjacent faces, a shaft connected to one of the disks, ports in the casing, and a series of rigid radial blades extending across said fluid-chamber, the adjacent faces of said disks being provided with intermeshing teeth and recesses, for the purposes set forth.

9. In a rotary engine the combination of a casing, provided with ports, a pair of rotating disks inclosed in the casing and having bearings at opposite sides of the same, the axes and adjacent faces of these disks being set at an angle to each other, said adjacent faces abutting at one point on a radial line, a rotatable sphere centrally supported between said disks, blades attached to said sphere and having their outer edges fitting the interior of the casing, and their side edges working in slots in the disks, and a shaft connected to one of the disks.

10. In a rotary engine, the combination of a casing provided with ports, a pair of rotating disks inclosed in the casing and having bearings at opposite sides of the same, the axes of these disks being fixed and their adjacent faces being set at an angle to each other, a shaft connected to one of the disks, a rotatable part supported between the disks and carrying a series of radial blades having their side edges constantly in engagement with both pistons.

11. In a rotary engine, the combination of a casing provided with ports, a pair of rotating disks inclosed therein and having bearings at opposite sides of the casing, the adjacent faces of the disks and their axes being set at an angle to each other and the adjacent faces contacting at one point on a radial line, said disks being provided with radial slots arranged in coincident pairs, each slot being widened in the direction of its depth, a rotatable part supported between the pistons and carrying a series of blades whose side edges slide and vibrate in said slots.

12. In combination, a casing, provided with

suitable inlet and outlet ports, a pair of rotatable heads or pistons fitting within the casing at opposite sides thereof and having their axes of rotation at an angle to each other, the adjacent edges of these pistons being beveled and bearing against each other at one point in their circumference, these beveled edges being provided with a series of intermeshing projections or teeth, a rotatable part fitting between and engaging said heads or pistons, and a series of blades extending across the oppositely-inclined chamber formed between the edges or faces of the pistons, for the purposes set forth.

13. In combination with a casing provided with suitable inlet and outlet ports, a pair of rotatable pistons fitting within the casing at opposite sides thereof and having their axes of rotation and their adjacent edges at an angle to each other, these pistons being provided with coincident slots in their edges, these slots widening in the direction of their depth, a rotatable part connecting said two pistons at their centers and being supported thereon, a series of radial blades extending across the space between the edges of said pistons, the edges of said blades extending into the slots in the edges of the pistons and having a sliding connection therewith, and a power-shaft connected to at least one of said pistons.

14. In a rotary engine, the combination of a casing, having a main inlet-port and an exhaust-port, a pair of rotating disks or pistons inclosed in the casing and abutting on a radial line, forming an annular fluid-chamber between their adjacent faces, a series of blades connecting the pistons, and a valve-controlled supplemental inlet-port beyond the main inlet-port.

15. In a rotary engine, the combination of a casing, having a main inlet-port and an exhaust-port, a pair of rotating disks or pistons inclosed in the casing and abutting on a radial line, forming an annular fluid-chamber between their adjacent faces, a series of blades connecting the pistons, and a supplemental exhaust port or ports beyond the main exhaust-port.

16. In a rotary engine, the combination of a casing, having a main inlet-port and an exhaust-port, a pair of rotating disks or pistons inclosed in the casing and abutting on a radial line, forming an annular fluid-chamber between their adjacent faces, a series of blades connecting the pistons, a plurality of inlet-ports beyond the main inlet-port, and a plurality of exhaust-ports beyond the main exhaust-port, for the purposes set forth.

In testimony whereof I hereunto affix my signature, in the presence of two witnesses, this 27th day of August, 1902.

CLARK HENDRICKS.

Witnesses:
JNO. JAHN, Jr.,
WM. STUDABECKER.