No. 769,082. PATENTED AUG. 30, 1904.

C. HENDRICKS.

ROTARY ENGINE.

APPLICATION FILED DEC. 16, 1902.

NO MODEL.

Fig. 1.

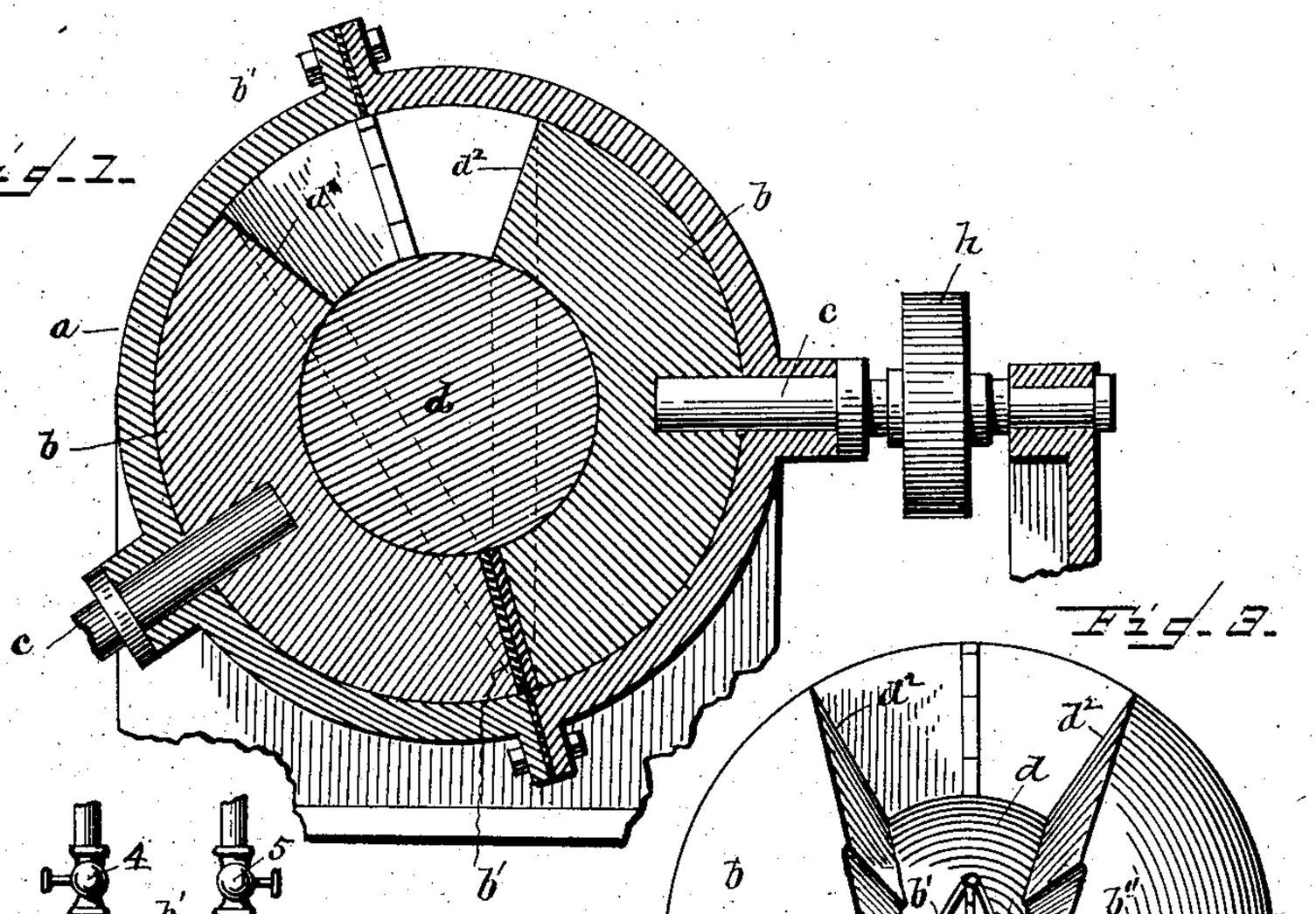


Fig. 2.

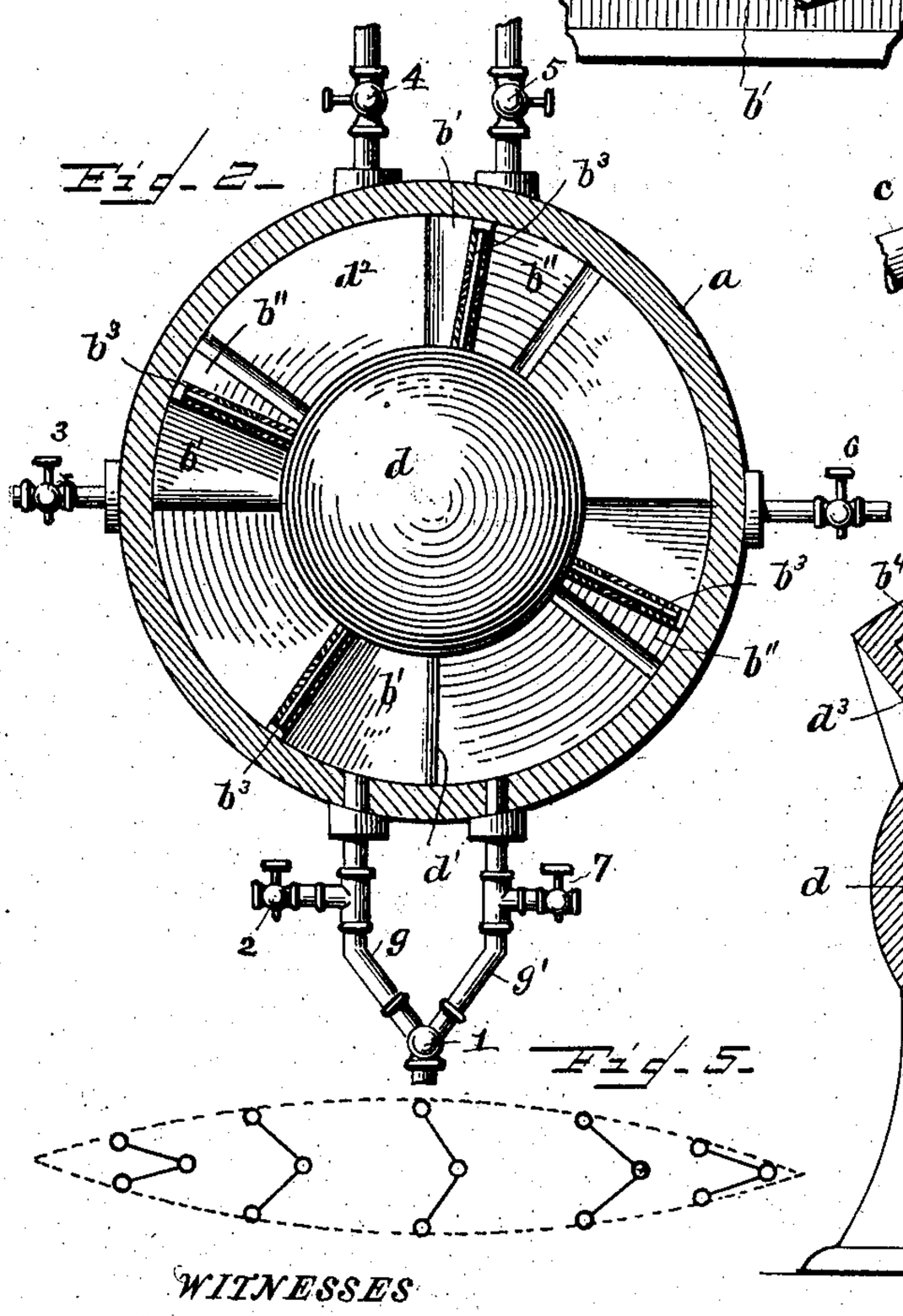


Fig. 3.

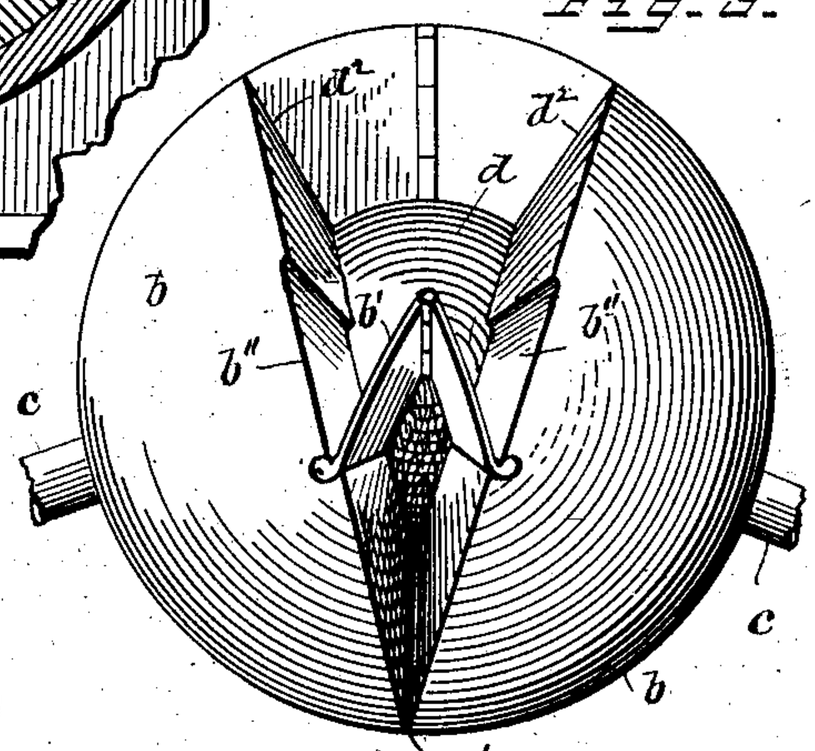


Fig. 4.

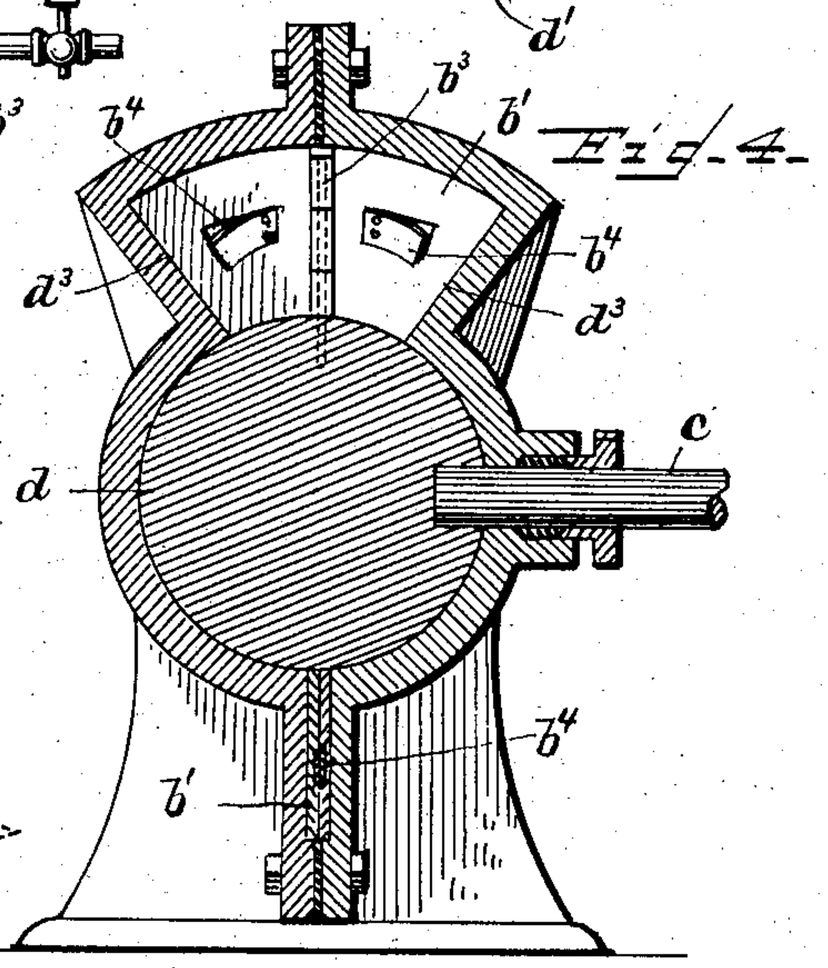
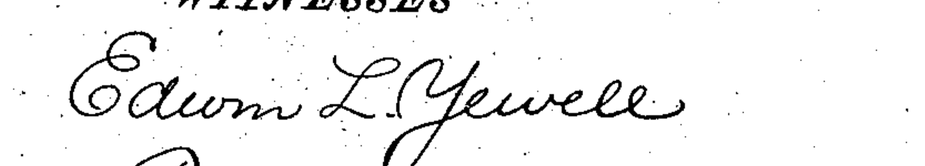


Fig. 5.



WITNESSES

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No. 769,082. Patented August 30, 1904.

UNITED STATES PATENT OFFICE.

CLARK HENDRICKS, OF RIVERSIDE, CALIFORNIA, ASSIGNOR TO JOHN JAHN, JR., OF RIVERSIDE, CALIFORNIA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 769,082, dated August 30, 1904.

Application filed December 16, 1902. Serial No. 135,433. (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. Fig. 3 is a side elevation of the rotative parts, the shell or casing being removed. Fig. 4 is a vertical sectional view showing another form of the invention, and Fig. 5 a diagram showing the successive positions of the folding blades as they travel around the fluid-chamber.

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 folding blades or partitions resting on the sphere and having their side edges hinged to 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, 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 Figs. 1, 2, and 3 of 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*, and resting loosely on this sphere 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 and whose inner edges are curved to nicely fit the surface of the sphere. 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*. Each blade is provided with a hinge-joint at its middle, the axial line of the pintle b^3 of the hinge-joint being exactly radial, so that as the pistons rotate the blades will fold and unfold to permit the bevel-faces to assume varying angles to the blades as the latter move away from or toward the point of contact *d'*. This hinge-joint and the hinge con-

nection to the pistons are constructed in any suitable manner that will permit the two sections of the blade to fold sufficiently to pass the contact-point d'. To permit each leaf or section to fold into the adjacent face of the piston when it passes the contact-point d', the face of the piston is recessed at b''. It is understood that packing and stuffing boxes are to be used whenever found necessary. 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 toward a point directly opposite the division-line d', where the exhaust begins to take place. As the pistons revolve the blades successively unfold after they pass the contact-point d' until they reach the exhaust-port, when they begin to fold and continue to gradually fold until they reach the contact-point d'. It will also be seen that the blades are each greater in length than the fluid-chamber at its widest point, so that the blades shall all fold in the same direction, as shown in the diagram in Fig. 5.

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 partitions of each compartment pass 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 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. One such modification is shown in Fig. 4, in which a shaft is attached rigidly to the central sphere, and the blades are also attached thereto by the pintles b^3 of their hinge-joint. The rotary pistons are done away with, and the casing is shaped so as to fit directly against the sphere and to provide a fluid-chamber of the same shape as in the other form of the engine, the inclined faces d^2 of the rotary pistons being replaced by the stationary inclined faces d^3 of the casing. The blades are of course not hinged to the inclined faces of the fluid-chamber, but bear and slide upon the same as the sphere rotates, the pressure of the motive fluid serving to keep the leaves of the blades pressed tightly against the respective inclined faces, as is obvious. To insure the blades opening immediately after they pass the inlet port, the contacting faces of the leaves are provided with flat springs b^4, which are adapted to be compressed into recesses in the leaves when the same fold together in passing the narrowest part or throat of the fluid-chamber. It will probably be essential in this form of the engine in view of the fact that the inclined walls of the fluid-chamber do not rotate to space the blades closely enough to each other to insure the forward end of each succeeding blade entering the throat before the motive fluid is let in behind the preceding blade to prevent the motive fluid passing directly to the exhaust side.

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

1. The combination of means forming an annular closed fluid-chamber, this chamber being tapered in opposite directions, an exhaust-port at one side of the widest part of this

chamber and an inlet-port at the opposite side thereof, rotary means carrying a series of two-part folding blades extending across the fluid-chamber and dividing the same into compartments and having a pivotal connection with the rotary means, and a shaft attached to the rotary means.

2. The combination of means forming an annular closed fluid-chamber, this chamber being tapered in opposite directions, an exhaust-port at one side of the widest part of this chamber and an inlet-port at the opposite side thereof, rotary means carrying a series of folding blades extending across the fluid-chamber and dividing the same into compartments, and a shaft attached to the rotary means, said blades being longer than the widest part of the fluid-chamber and each consisting of a pair of leaves hinged together and adapted to fold flat against each other and to unfold as they rotate.

3. 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 and 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 a series of folding radial blades extending across the annular space formed between the edges of said hemispherical pistons and thereby dividing the same into fluid-compartments, said blades being pivotally connected to the pistons, and a power-shaft connected to one of said hemispherical pistons.

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, a series of folding radial blades extending across the annular space formed between the edges of said heads and dividing the same into fluid-compartments, said blades each consisting of two parts each of which has a pivotal connection with one of the pistons, and a rotatable power-shaft connected to one of said heads, substantially as set forth.

5. 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, a series of radial blades constructed of hinged leaves and extending across the oppositely-tapering annular space formed between the edges of said heads and dividing the same into fluid-compartments, said blades being hinged at their edges to the edges of said heads so as to fold and unfold as the parts rotate, and a power-shaft connected to at least one of said heads, substantially as set forth.

6. 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 recesses, a rotatable part fitting between and engaging said heads or pistons, and a series of folding blades extending across the oppositely-inclined chamber formed between the edges or faces of the pistons and adapted to fold into said recesses, for the purposes set forth.

7. In a rotary engine, the combination of a rotary part, a shaft attached thereto, a casing inclosing said rotary part and forming an annular fluid-chamber tapering in opposite directions, inlet and exhaust ports in the casing, and a series of two-part folding blades carried by the rotary part and adapted to fold flat against each other and to unfold as the rotary part rotates.

8. In a device of the class described, the combination of means forming an annular closed concentric fluid-chamber tapering in opposite directions, an exhaust-port at one side of the widest part of this chamber and an inlet-port at the opposite side thereof, rotary means forming part of said fluid-chamber and carrying a series of blades extending across the fluid-chamber and dividing the same into compartments, each of said blades consisting of hinged parts adjustable with respect to each other and adapted to fold flat against each other as the blades rotate for the purpose set forth, and a shaft attached to the rotary means.

In testimony whereof I hereunto affix my signature, in the presence of two witnesses, this 11th day of December, 1902.

CLARK HENDRICKS.

Witnesses:

WM. STUDABECKER,

D. C. MILAN.