

UNITED STATES PATENT OFFICE

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ROTARY ENGINE, PUMP, BLOWER, OR METER

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This invention relates to an improved rotary engine, pump, blower or meter of the kind in which a piston vane carried by a shaft revolves in an annular chamber formed by a fixed casing whose internal surface forms a section of a sphere between conical end walls, the chamber being divided into separate compartments by an oblique disc or diaphragm which rotates with and is slotted to receive the piston vane, inlet and outlet ports to said compartments being provided on opposite sides of the abutments of said disc with the conical walls.

According to my invention, the conical end walls of the chamber are formed by the internal faces of a pair of spaced flanges formed upon a rotor which rotates within the casing and which is carried at one end of a shaft extending through one side only of the casing. The oblique disc or diaphragm revolves with the rotor in a fixed oblique plane so as to bear against one flange at a point diametrically opposite its abutment with the other flange. The diaphragm is slotted to receive the piston vane and controls inlet and outlet ports which are formed in the rotor on opposite sides of the vane. The inlet and outlet ports may be formed in the core of the rotor, or one of the ports may be formed in the rotor core and the other port in one or both flanges of the rotor.

In order that the invention may be readily understood, reference is hereinafter made to the accompanying drawings which illustrate examples of construction of a rotary pump or motor according to my invention.

Fig. 1 is a vertical cross-sectional view of one example.

Fig. 2 is a vertical cross-sectional view of a further example which is similar in all essential features with the construction shown in Fig. 1, except that the runner is built up in sections and the disc is solid.

Fig. 3 is a section on the line 3—3 of Fig. 2.

Fig. 4 is a view similar to Figs. 1 and 2 showing a modification thereof and Fig. 5 is a section on the line 5—5 of Fig. 4.

Referring now to Fig. 1 of the drawings, the engine or pump consists of a runner or rotor 6 having a vane, piston or blade 7 se-

cured between its flanges 8 and 9 which form the annular chamber 10. The rotor 6 and blade 7 revolve in a casing 11 with which they have a good sliding contact around their periphery. Fitted upon the core of the rotor 6 between the flanges 8 and 9 is an oblique disc or diaphragm 12 having a slot 13 which forms a sliding fit around the blade 7. The outer edge of the blade 7 is spherical in shape, and is a sliding fit against the disk 12 in the opening 13. The outer surface 14 of the core of the runner 6 is made spherical so that the disc 12 is also a sliding fit upon the spherical surface 14. The outer edge of the disc 12 revolves in a circumferential groove 15 formed in the inner face of the casing 11. The groove 15 forms a guide for the disc 12 and compels it to revolve in a fixed oblique plane A—B and holds it tightly against the conical inner faces of the flanges 8 and 9 of the runner at the two diametrically opposite points C and D, where the disc abuts against the two flanges. Two ports 16 and 17 are formed in the core of the runner, one in each side of the blade 7. Each port is the full width of the annular chamber 10 where it opens thereinto through the spherical face 14 of the core of the runner, but registers at its other end with one of two circumferential passages 18 and 19 formed in a stationary hub 20 which is fixed to the casing 11 at one side thereof. The passages 18 and 19 communicate with the branch pipes 21 and 22 respectively. The other side of the casing 11 is formed to provide a bearing for a shaft 23 to which the runner 6 is secured. In the construction shown in Fig. 1, the runner 6 is solid and the disc 12 is split to enable it to be fitted around the runner 6. It will however be understood that these are constructional details which can be readily varied. For instance, as shown in Figs. 2 and 3, the runner 6 is made in three sections 6^a, 6^b, and 6^c, secured together by bolts or studs 24, thereby enabling a solid disc 12 to be employed.

The operation of the mechanism is as follows: Assuming the shaft 23 to be rotated clockwise in the direction of the arrow shown in Fig. 1, the following cycle of operations takes place during each revolution on the

right-hand side of the disc 12 (looking on Fig. 1):—In the position shown the blade or piston 7 is situated at the point of abutment C, so that both ports 16 and 17 are covered at one side by the disc 12. As the rotor 6 rotates, it revolves the blade 7 with the ports 16 and 17 on either side of it. At the same time, the blade 7 revolves the disc 12 until that portion of the disc 12 which covers the ports 16 and 17 has moved away from the abutment C. At the same time, the slot 13 in the disc 12 will allow the disc to move across the blade 7, thereby causing the disc to gradually uncover the right hand end of the port 16 which is in advance of the blade 7 and allow any fluid on the right hand side of the disc 12 and in front of the blade 7 to be swept out of the annular chamber 10 through the port 16 into the branch pipe 21. During the same period, the inlet port 17 remains covered by the disc 12 until the port 17 is clear of the abutment C, when the disc 12 commences to uncover the port 17 and admission takes place from the branch pipe 22 through the passage 19 and port 17. Admission continues until the blade 7 again reaches the abutment C or until cut-off by the provision of a cut-off valve, so that fluid is admitted to the annular chamber 10 behind the blade 7 on the right hand side of the disc 12.

A similar series of operations takes place on the left hand side of the disc 12 for each revolution of the blade 7 from the abutment D. The ports 16 and 17 serve as delivery and admission ports for the annular chamber on both sides of the disc 12.

Reversing the direction of rotation of the shaft 23, reverses the flow of the fluid through the annular chamber 10, so that the port 16 now becomes the admission port and the port 17 becomes the delivery port.

It will be understood that the apparatus will operate as a motor if a pressure fluid is admitted to one of the branch pipes 21 or 22 and the admission may be suitably controlled to enable the pressure fluid to be used expansively in the annular chamber 10.

The apparatus may also be used as a positive type of meter and may be constructed to operate with low pressures.

Two or more runners and discs may be incorporated in a single casing and the capacities of the annular chamber 10 may be proportioned to enable the unit to be used as a compound or multi-stage engine or pump, the first runner delivering to the annular chamber of the next runner and so on.

Suitable packing may be provided for the flanges of the runner, for the blade 7, for the disc 12 and for its slot 13 and the disc 12 may be either solid or laminated. The inner surfaces of the flanges 8 and 9 or the faces of the disc 12 may be provided with a resilient

facing in order to obtain better contact of the point of abutment C and D.

The construction illustrated in Figures 4 and 5 is substantially the same as that already described except that the port 16 is not formed in the core of the runner 6, but in each of the side flanges 8 and 9 and communicates with an outer passage 18^a leading to a branch 21^a formed in the casing 11, so that the hub member 20 has only one branch pipe 22 and passage 19 leading to the port 17.

Having now described my invention what I claim as new, and desire to secure by Letters Patent is:—

1. In a rotary device of the character described, a casing provided with inlet and outlet ports, one of the said ports being formed on the axis of the casing, a rotor journaled in the casing on the axis thereof and comprising a core, side flanges which form a conical annular chamber around the core, and a blade extending between the side flanges, the said core and blade being provided with spherical surfaces; and a rotary oblique disk guided by the said casing and slidable on the spherical surfaces of the said core and blade and having a slot which fits over the said blade, the said disk being arranged in contact with the opposite sides of the said chamber at two diametrically opposite points, and the said rotor having also ports arranged one on each side of the said blade and communicating directly with the two ports in the casing at predetermined intervals.

2. A rotary device as set forth in claim 1, the axial port of the said casing being formed by a hub portion which is secured to the casing and which is provided with an axial passage communicating with the said port.

3. A rotary device as set forth in claim 1, the said casing being provided with an internal circumferential groove in which the periphery of the said disk is rotatable.

4. A rotary device as set forth in claim 1, the said rotor having its two ports formed in its core, and the two ports of the said casing being provided with passages arranged one in line with and the other crosswise of the axis of the casing.

In witness whereof I affix my signature.
ANDREW THOMSON MACLEAY.