# United States Patent [19]

**Keplinger et al.**

[11] **3,915,601**

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[54] **DISC TYPE ROTARY ENGINE USABLE AS A MOTOR OR PUMP**


[76] Inventors: **Klaus Keplinger; Friedrich Egger,** both of Mullerstr. 30, 6020 Innsbruck, Austria



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[21] Appl. No.: **448,384**

[30] **Foreign Application Priority Data**

Mar. 12, 1973 Austria ..... 2177/73

[52] **U.S. Cl.** ..... **418/186;** 418/193; 418/215

[51] **Int. Cl.²**.... **F01C 1/08;** F01C 1/00; F04C 1/00; F04C 17/00

[58] **Field of Search** ..... 418/193, 192, 209, 215, 418/218, 183, 186–188, 195



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*Primary Examiner*—John J. Vrablik

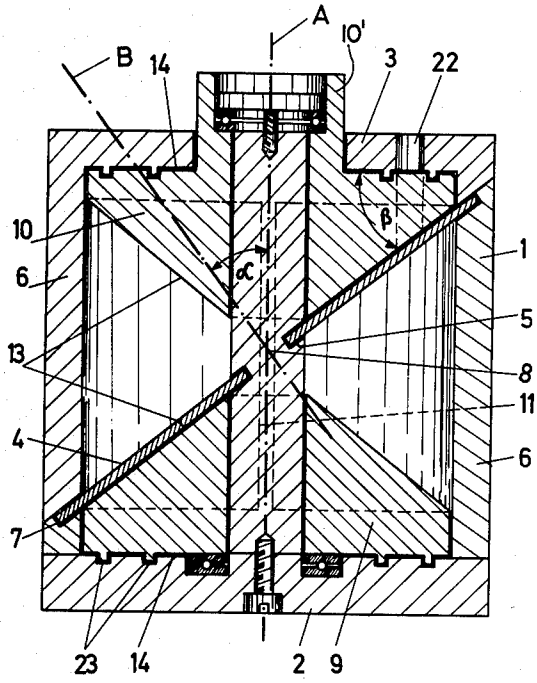
*Attorney, Agent, or Firm*—Wenderoth, Lind & Ponack



[57] **ABSTRACT**

A rotary motor and/or pump includes a housing which is in the form of a hollow body of rotation and which has a main axis and inlet and outlet apertures. A rotor is rotatable about the main axis and comprises rotary members which are fixedly interconnected. A rotary plate is inclined with respect to the main axis and passes through the housing and the rotor. The center points of the rotor, housing and rotary plate coincide. The shaft forming the main axis is rigidly connected to the housing. The rotary members of the rotor and the rotary plate are mounted about the fixed shaft rotatably relative to the housing and to the shaft.


**7 Claims, 12 Drawing Figures**



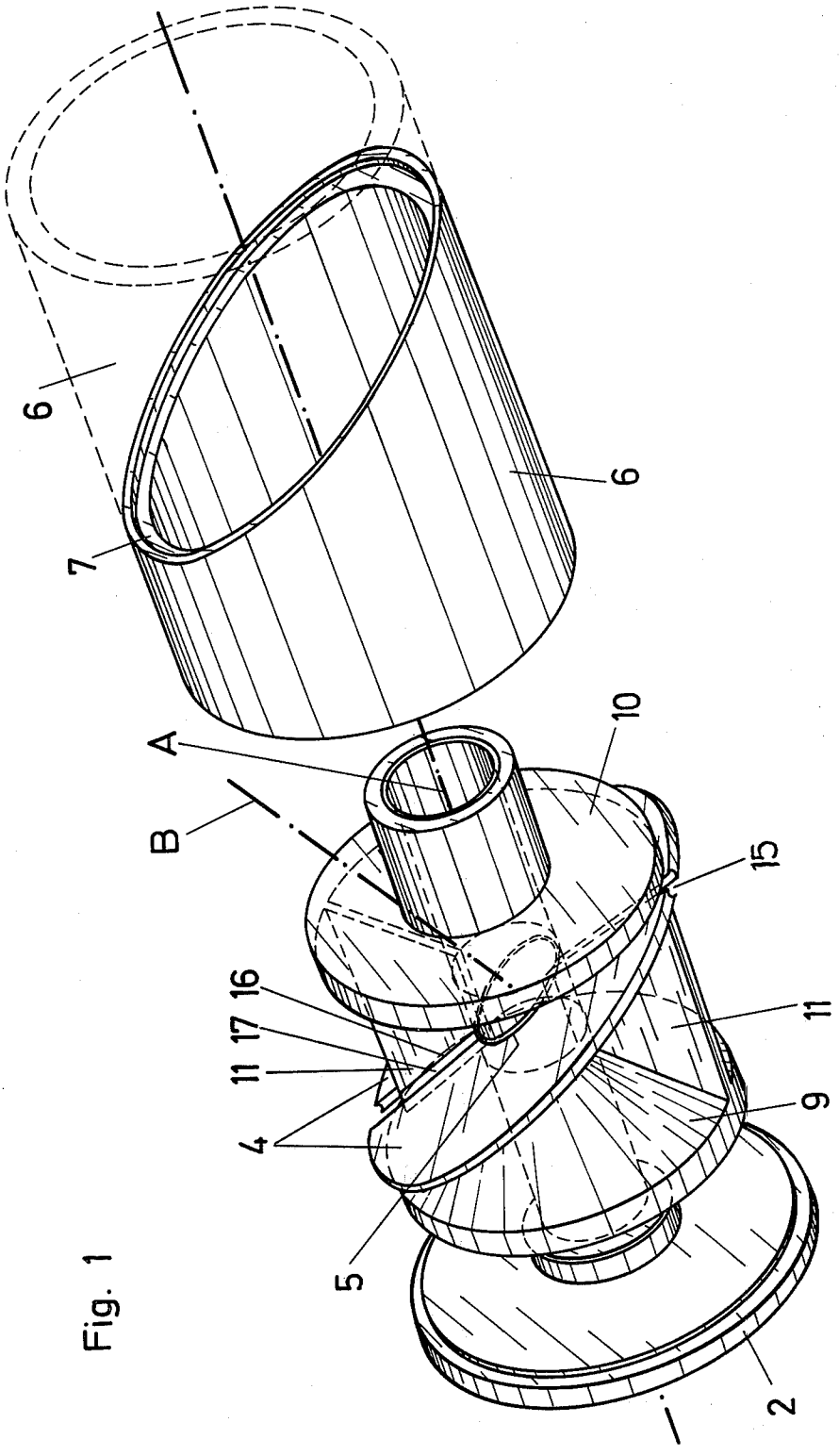



Fig. 1

Fig. 2

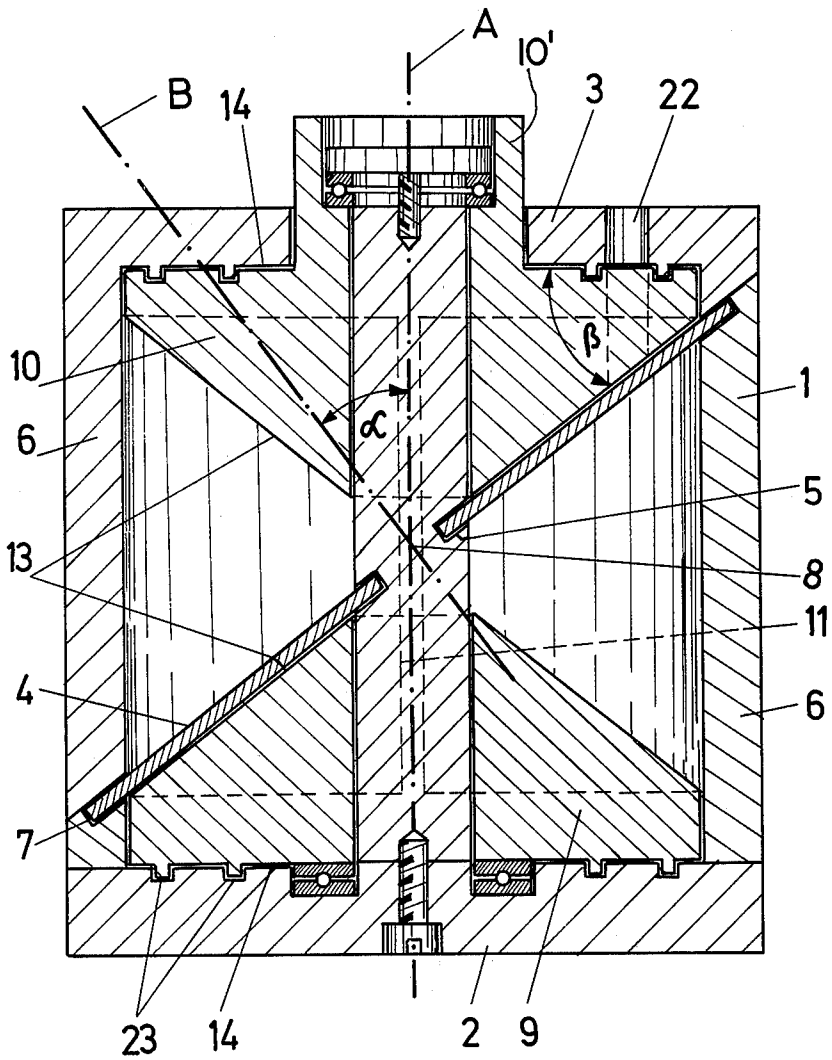


Fig. 3a

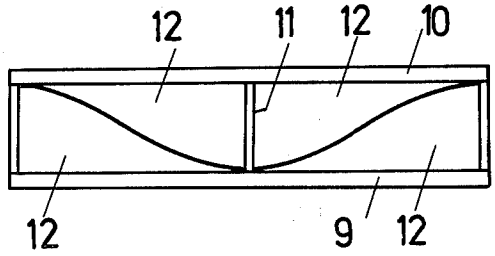



Fig. 3b

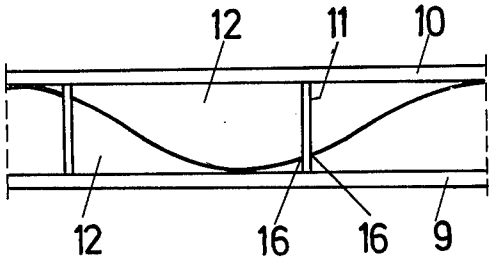



Fig. 3c

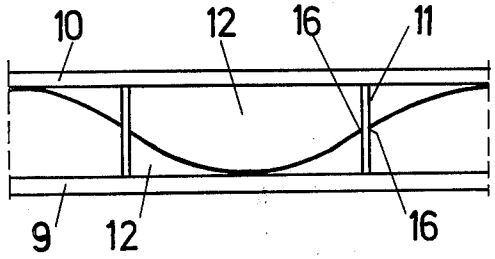



Fig. 3d

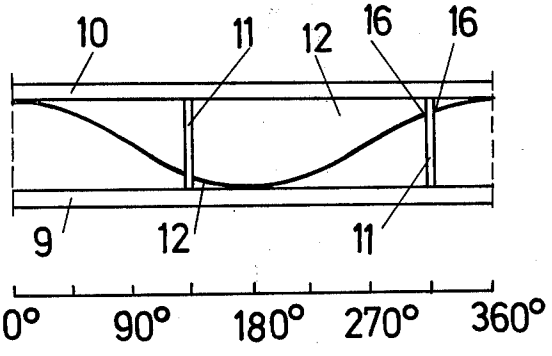


Fig. 4a

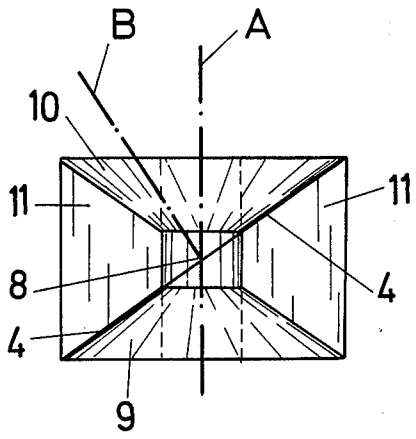



Fig. 4b

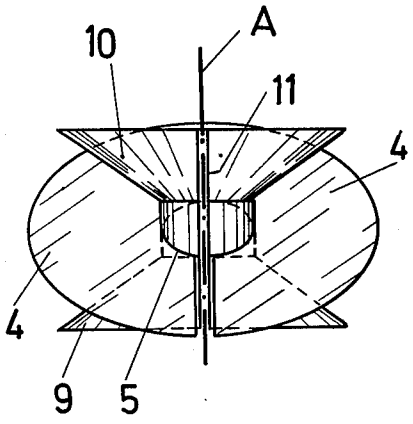



Fig. 4c

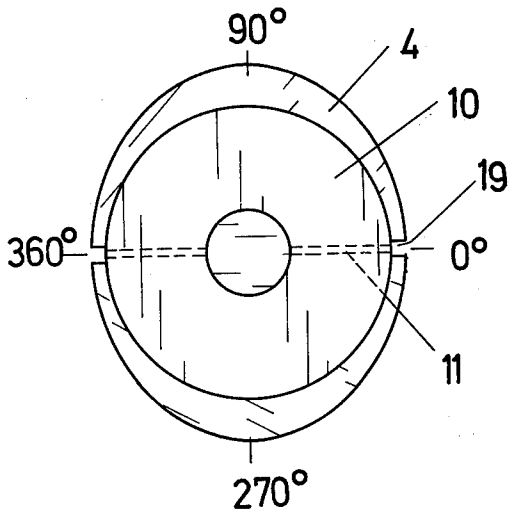


Fig. 5

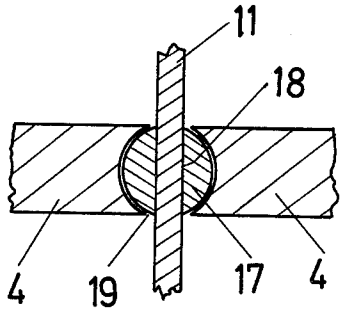



Fig. 6

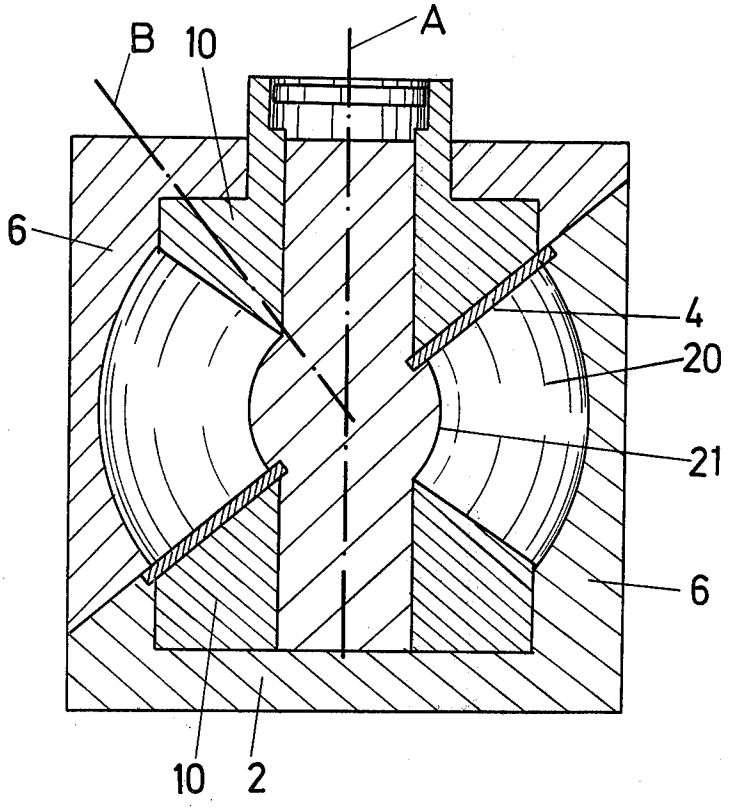
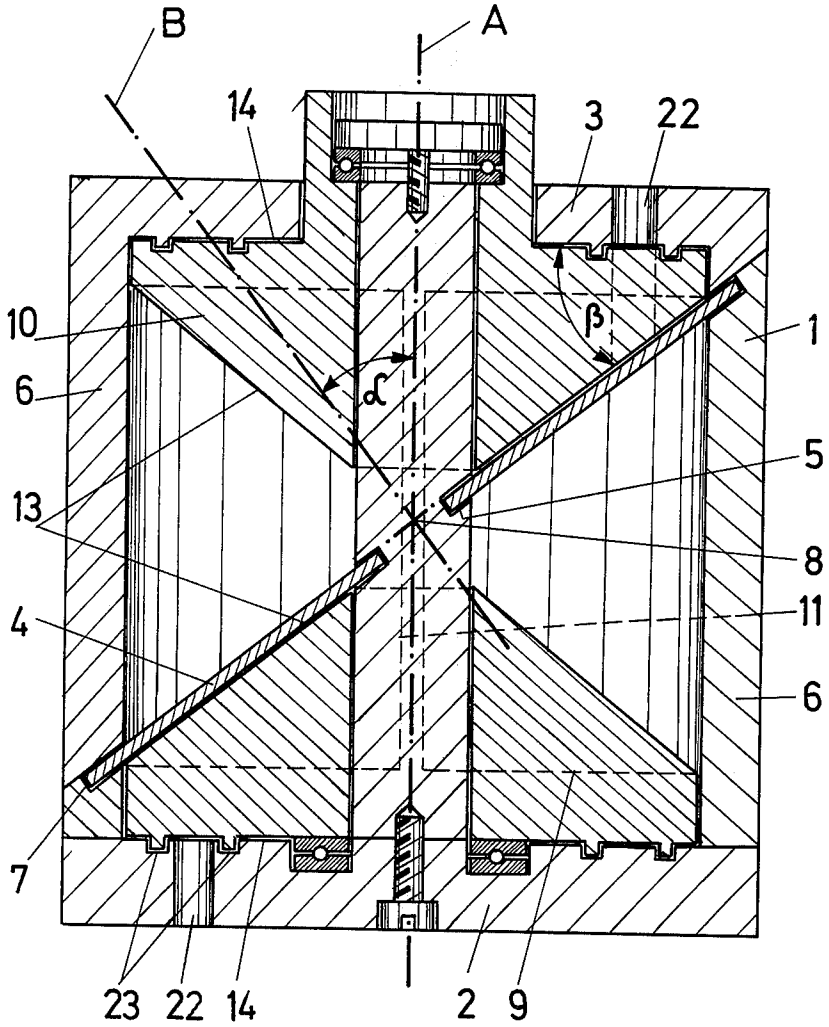


Fig. 7



# DISC TYPE ROTARY ENGINE USABLE AS A MOTOR OR PUMP

## BACKGROUND OF THE INVENTION

This invention relates to a rotary motor and/or pump, having a housing which is in the form of a hollow body of rotation and which has inlet and outlet apertures, a rotor which is rotatable about the main axis of the housing and which comprises rotory members which are fixedly interconnected, and a rotary plate which is inclined with respect to the main axis and which passes through the housing and the rotor, the centre points of the rotor, housing and rotary plate coinciding.

Such motors or pumps are already known from various publications, but hitherto have not achieved widespread use in practice.

Thus, there exist for example motors or pumps which comprise two main parts, a stationary housing and a rotary internal part which comprises a shaft and vanes secured thereto. Passing through the vanes is a plate which is set at an angle to the shaft, thereby producing variable chambers of different sizes.

These known systems commonly have the disadvantage that the vanes are only held in the shaft at one side, while the other three sides of the vanes are free and are exposed to loadings which have an alternating action thereon, when pressure differences occur in the individual chambers or due to the displaced mounting in the rotary plates. In addition, the use of a two-part construction, as referred to above, gives rise to very severe sealing problems as between the rotary vanes and the stationary housing, and it is scarcely possible to find a technical solution for such problems.

Complicated systems have been developed in order to overcome the above-mentioned disadvantages, as are known for example from U.S. Pat. No. **2 908 224.**

Described in this specification is a motor or a pump which, in addition to the two main parts referred to above, includes two rotary members which are in form of spherical surfaces and which are connected together by the vanes and which together are secured on the main shaft. The rotary plate is of a conical configuration on both sides, and is arranged at the end of a further shaft which is inclined relative to the main shaft, the angle of inclination of the further shaft being adjustable. As the rotary components which are inclined at an angle to each other, namely the rotary members and the rotary plate, engage into each other, it is not possible to use a central mounting. The mounting can therefore only be outside, in the housing. This means that the masses of the rotary plate and its shaft are relatively large in relation to the mass of the rotor, and the imbalance which occurs due to the continuously varying angular speed of the rotary plate is further increased as a result. This has a very detrimental effect on the running smoothness of the system and the load on the outside mounting.

Moreover, the system described in U.S. Pat. No. 2,908,224 has four vanes, which are each arranged at 90° relative to each other. There is no provision for compensating for the angular variations which occur, due to the inclined rotary plate, in one revolution.

## SUMMARY OF THE INVENTION

It is the object of the present invention to provide a motor or a pump in which the disadvantages of the previously known systems are eliminated, and a simple and operationally more reliable construction is possible.



In accordance with the invention, this is achieved in that the main shaft is rigidly connected to the housing, and that the rotary members of the rotor and the rotary plate are mounted on the main shaft fixed to the housing, rotatably relative to the housing and the main shaft.

By virtue of the rotor and the rotary plate which is inclined relative to the main shaft, being arranged in accordance with the invention so as to be rotatable about the main shaft which is fixed to the housing, so that the hollow body is divided into variable chambers, it is possible, simply by rotating the rotor-plate sysetm, to provide the necessary, successive, continuous increase and reduction in volume of the individual chambers.

In one embodiment of the invention, the rotary members of the rotor are truncated cone portions of a right double cone.

The fixed connection between the two rotary members is advantageously effected in accordance with the invention by a single pair of per se known partition walls which lie diametrally opposite to each other and which extend radially from the main shaft and which are oriented parallel thereto.

In the motor according to the invention, it is in fact possible to provide further partition walls, but in practical production this involves a considerable additional cost as the angle to the existing partition walls must be variable.

A further construction of the invention is characterised in that the angle of the axis of the rotary plate to the main shaft is determined by annular grooves which serve to receive the rotary plate and which are milled into the main shaft and into the two-part casing of the housing, concentrically to the axis.

In a further preferred construction in accordance with the invention, the rotary plate lies sealingly against a generating line of the double cone.

Another construction according to the invention provides that at least one of the two rotary members has an inlet aperture.

In the actual construction in accordance with the invention, the drive medium can be supplied through an aperture in the cover plate of the housing and a passage through the rotary member. The drive medium can be taken off in a similar manner through a further outlet through the rotary member and the cover plate of the housing, however, this can also be done through apertures in the casing of the housing.

If now rotation of the rotor-rotary plate system is begun from a given point, for example **0°**, at which the rotary plate is in contact with the rotary member at one partition wall, it will be seen that continuing rotation provides a chamber which continuously increases in size and tends towards a maximum value.

As a preferred construction according to the invention provides equal phase-displaced working cycles or strokes on both sides of the rotary plate, this machine can be referred to as self-distributing, in the same sense as a two-stroke engine is self-distributing.

In accordance with the invention it is also provided that an outlet aperture is disposed in the casing of the housing.

## BRIEF DESCRIPTION OF THE DRAWINGS

A number of embodiments of the invention are de-

scribed in greater detail hereinafter with reference to the attached drawings, but the invention is not intended to be limited to only these possible constructions.

FIG. 1 shows a perspective view of an embodiment of the motor or pump according to the invention,

FIG. 2 is a cross-section taken along the main axis through the motor or pump according to the invention, in the position thereof as shown in FIG. 3*c*,

FIGS. 3*a* to 3*d* show phases in the movement of the motor or pump, in the form of a developed image,

FIGS. 4*a* to 4*c* diagrammatically shows the manner in which the rotary plate extends through or is superimposed on the rotor, as viewed in FIG. 3*a*, FIG. 4*a* being an elevational view, FIG. 4*b* being a side elevation and 4*c* being a front cross-sectional view,

FIG. 5 shows a detail of the rotor extending through the rotary plate,

FIGS. 6 and 7 show two further embodiments, viewed in cross-section as in FIG. 2.

## DETAILED DESCRIPTION OF THE INVENTION

The hollow body 1 of rotation is preferably in the form of a hollow cylinder and is closed by a lower cover plate 2 and an upper cover plate 3. In accordance with the invention however, any other rotationally symmetrical hollow body can be used.

The main axis A of the body 1 is at the same time also the main axis of the rotor. An axis B around which a rotary plate 4 rotates extends at an angle $\alpha$ to the main axis A. The rotary plate 4 is mounted rotatably in the shaft forming the main axis A, in an annular groove 5 which is arranged concentrically to the axis B, and also in a two-part casing 6 forming the hollow body 1, in a further annular groove 7 which is also disposed concentrically to the axis B. Thus, the position of the axis B and the angle of the two axes relative to each other is fixed by this arrangement. It will be noted that the two axes A and B intersect at the centre point 8 of the hollow body 1, and this is also the centre point of the rotary plate 4.

The rotor comprises two rotary members 9 and 10 which are arranged symmetrically relative to a plane which extends perpendicularly to the main axis A, through the centre point 8. The rotary members 9 and 10 are connected by a pair of partition walls 11 which lie diametrally opposite to each other. A portion 10' of rotary member 10 extends outwardly of the housing and forms a motion transfer shaft, i.e. drive or driven shaft, of the device.

The partition walls 11 are arranged parallel to the main axis A and extend radially thereof, and interconnect the individual, independently rotatable rotary members 9 and 10 so as to form a unit, so that two closed chambers are formed by the rotary members 9 and 10, the partition walls 11, the shaft forming main axis A and the casing 6 of the hollow body 1.

In the embodiments illustrated, the rotary members 9 and 10 of the rotor are in the form of truncated cone portions of a double cone. The angle of inclination $\beta$ of the conical surface 13 of the truncated cone portion, relative to the base surface 14 of the truncated cone portion, corresponds to the angle $\alpha$ between the two axes A and B, so that the rotary plate 4 lies parallel to the surface 13.

The rotatable plate 4 which is rotatably mounted in the annular grooves 5 and 7 has radial slots 15 for receiving the partition walls 11. The plate 4 is fixedly connected by the partition walls 11 to the rotary members 9 and 10, and necessarily performs all rotary movements performed by the rotor, the truncated cone surface 13 rolling against the rotary plate 4. The hollow body is divided by the rotary plate 4 into two closed spaces. Due to the movement of the spaces formed by the partitions 11 and the rotary plate 4, there are produced chambers 12 the volumes of which are variable by rotation of the rotor. In one revolution of the rotor, the lines of engagement 16 of the rotary plate 4 with the partition walls 11 move along the partition walls 11.

In order to provide suitable sealing of the chambers at the transition from the partition wall 11 to the rotary plate 4, roller seals 17 are provided in known manner. The radial slots 15 in the rotary plate 4 are constructed with concave, circularly curved side walls, whereby the roller seal 17 is rotatably mounted in the radial slot and is prevented from displacement in the direction of the partition wall.

The roller seals 17 themselves have a longitudinal slot 18 through which the partition walls 11 are slidingly guided. When the rotor is rotated, the roller seals which are mounted rotatably in the rotary plate 4 are displaced parallel to the lines of engagement 16 and at the same time reciprocatingly rotate in their mounting in the radial slot 15, so that a good sealing action is provided in every position.

In a further embodiment of the invention (FIG. 6), there is a hollow body with a spherical internal chamber 20. In this embodiment the main shaft has a spherically formed enlarged portion 21 disposed around the centre point of the hollow body. This substantially simplifies the solution to the problem of sealing.

For the intake and exhaust of the drive medium into and out of the chambers of the hollow body, the hollow body has inlet and outlet apertures 22 (FIGS. 2 and 7) which are advantageously arranged in a known manner in the lower and/or upper cover plates 2 and/or 3. It would also be readily possible however for the apertures 22 to be provided in the casing 6 of the hollow body.

Labyrinth seals 23 for example are provided for sealing between the rotary members 9 or 10 and the cover plates 2 or 3.

FIGS. 3*a* to 3*d* show individual phases of the movement of the rotor, in the form of a developed representation, along the inside wall of the hollow cylinder. It can be seen that the rotary plate 4 follows a cosine curve, the partition walls 11 of the rotor appear as vertical interruptions, and the rotary members 9 and 10 appear in the form of horizontal beam members. The degree scale relates to the representations of FIGS. 4*a* to 4*c*.

The machine according to the invention can be used both as a power producing engine and as a working machine. The possibility, due to the construction of the machine being symmetrical relative to the rotary plate, of using the machine as a simultaneous working machine and a power producing engine, has been found particularly advantageous.

We claim:

1. A rotary motor and/or pump comprising:

a housing in the form of a hollow body of rotation and having a main axis and a main shaft fixed to said housing and extending substantially therethrough, and inlet and outlet apertures extending

into said housing, the axis of said main shaft coinciding with said main axis of said housing;

a rotor rotatably mounted about and supported on said main shaft coaxial to said main axis and comprising rotary members which are fixedly interconnected, a portion of said rotor extending from said housing and forming a motion transfer shaft of said motor and/or pump;

a rotary plate mounted at an angle about and supported on said main shaft and inclined with respect to said main axis and passing through said housing and said rotor, the center points of said rotor, housing and rotary plate coinciding; and

said rotary members of said rotor and said rotary plate being mounted about said main shaft rotatably relative to said housing and to said main shaft.

**2.** A rotary motor and/or pump as claimed in claim **1,** wherein said rotary members are connected by a single pair of partition walls which lie diametrally opposite to each other and which extend radially from said main shaft and which are oriented parallel thereto.

**3.** A rotary motor and/or pump as claimed in claim **1,** wherein the angle of the axis of said rotary plate to said main shaft is determined by first and second annular grooves which receive said rotary plate and which are respectively formed in said main shaft and in said housing concentrically to said axis of said rotary plate.

**4.** A rotary motor and/or pump as claimed in claim **1,** wherein at least one of said two rotary members has therein an inlet aperture.

**5.** A rotary motor and/or pump as claimed in claim **1,** further comprising an outlet aperture arranged in a casing forming said housing.

**6.** A rotary motor and/or pump as claimed in claim **1,** wherein said rotary members are truncated cone portions of a right double cone.

**7.** A rotary motor and/or pump as claimed in claim **6,** wherein said rotary plate lies sealingly against a generatrix of said double cone.

* * * * *