US 20120237370A1

(19) **United States**

(12) **Patent Application Publication**

Kuzdzal

(10) **Pub. No.: US 2012/0237370 A1**

(43) **Pub. Date: Sep. 20, 2012**

(54) **ENGINE HAVING ROTARY PISTONS**

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(21) Appl. No.: **13/500,219**

(22) PCT Filed: **Oct. 4, 2010**

(86) PCT No.: **PCT/FR2010/052087**

§ 371 (c)(1), (2), (4) Date: **May 24, 2012**

(30) **Foreign Application Priority Data**

Oct. 5, 2009 (FR) 0956912

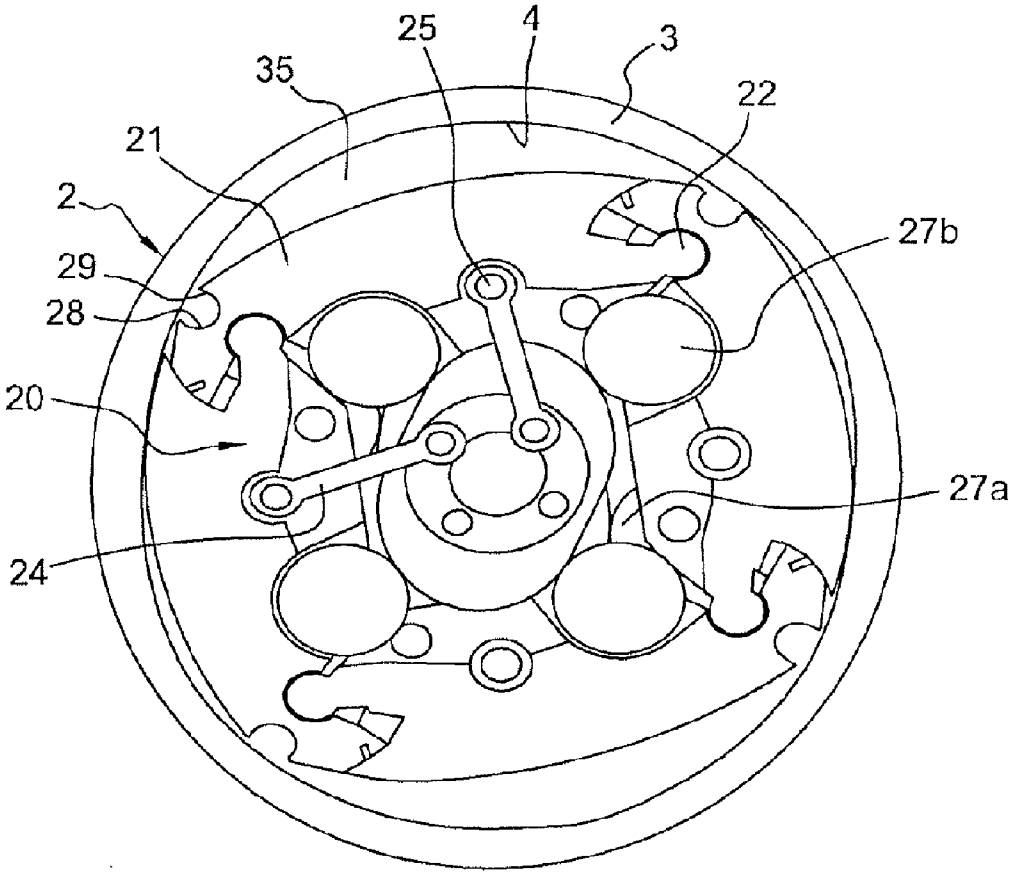
Publication Classification

(51) **Int. Cl.**
F04B 27/08 (2006.01)

(52) **U.S. Cl.** **417/269**

(57) **ABSTRACT**

The present invention relates to a mechanism (**1**) having rotary pistons (**21**), said mechanism comprising an outer enclosure (**2**) forming a stator in which a rotary assembly (**20**) forming a rotor moves, the rotary assembly (**20**) including: a plurality of pistons (**21**) forming a hinged polygon, each piston (**21**) defining a positive-displacement chamber (**35**) with the enclosure (**2**), and first guide (**27**, **27***a*, **27***b*) that are arranged so as to engage with second guide means (**7***a*, **7***b*) comprising rolling surfaces (**10***a*, **10***b*) so as to drive the polygon to carry out a predetermined movement, the mechanism (**1**) being characterized in that it comprises a drawback device (**50**) that maintains contact between the guide means (**27**, **27***a*, **27***b*) and the rolling surfaces (**10***a*, **10***b*). The invention also relates to an engine and a pump including such a mechanism (**1**).



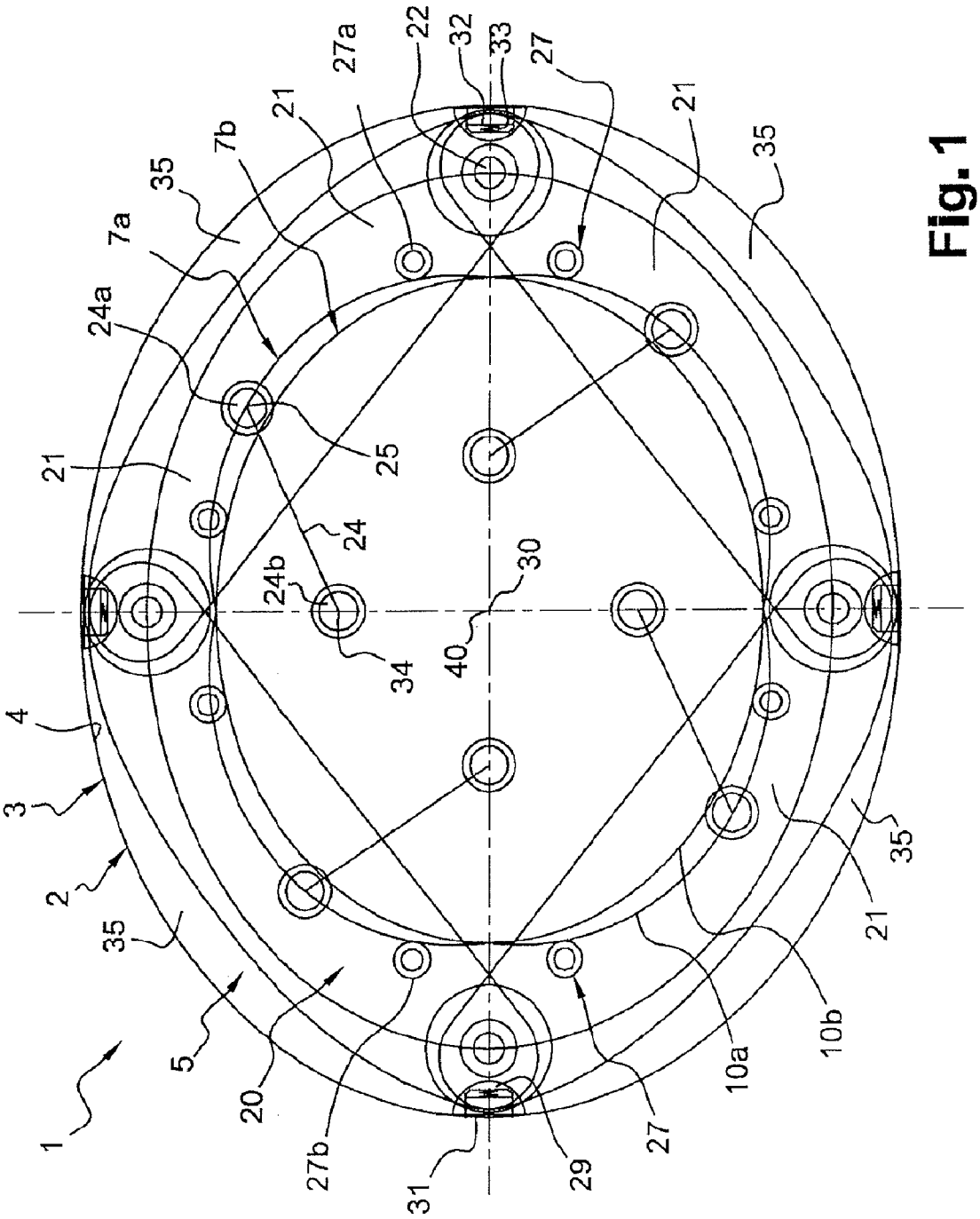

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Fig. 1

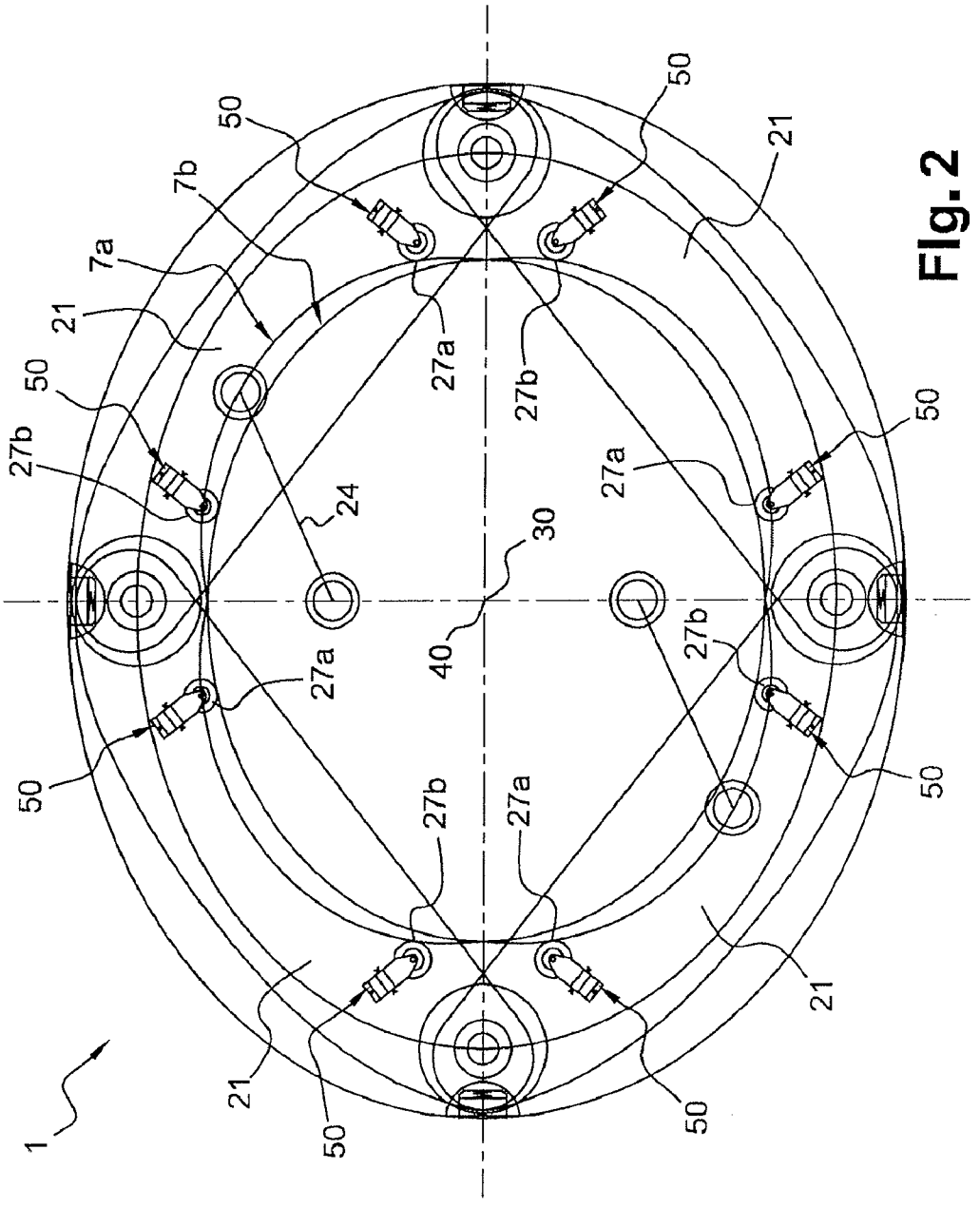
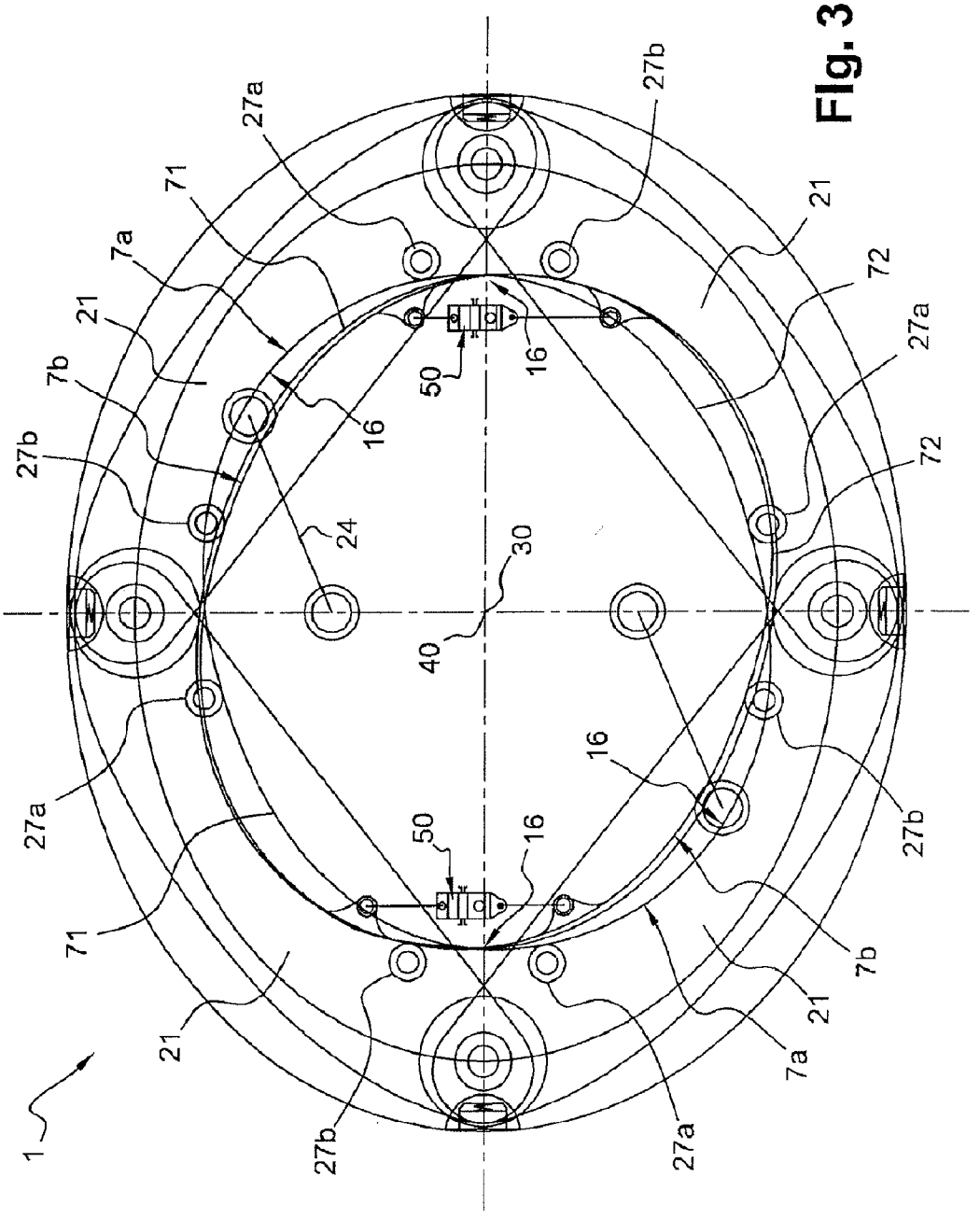
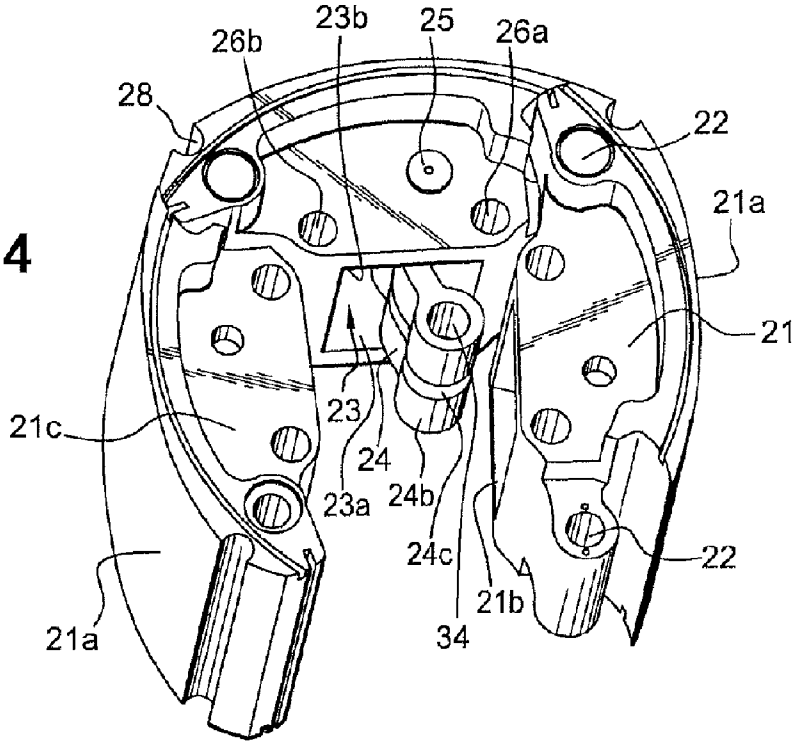


Fig. 2



Flg. 3

Fig. 4


23b
25
26a
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21a
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21c
23
24
23a
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24c
22
21b
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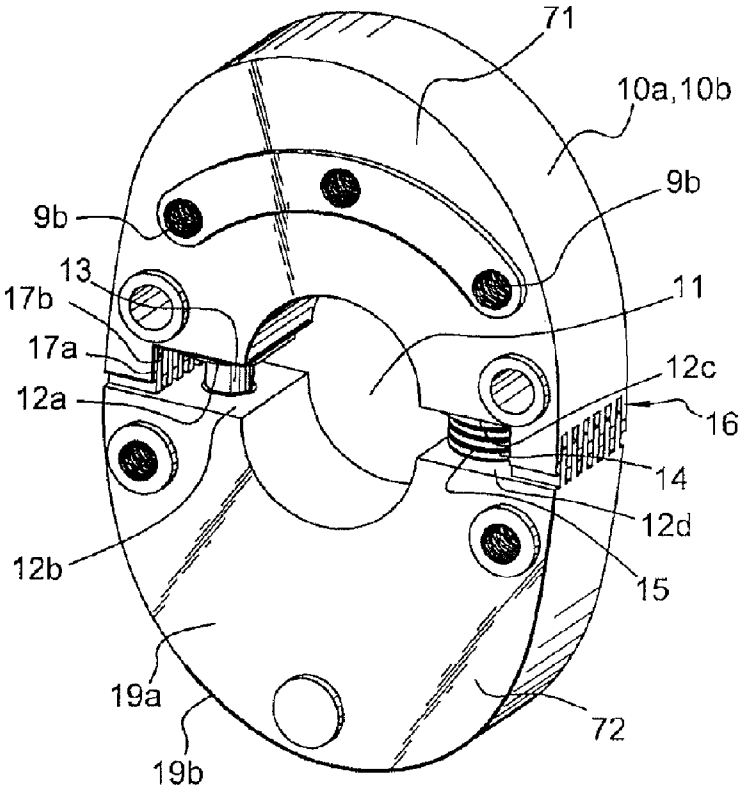
Fig. 5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10a,10b
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19b

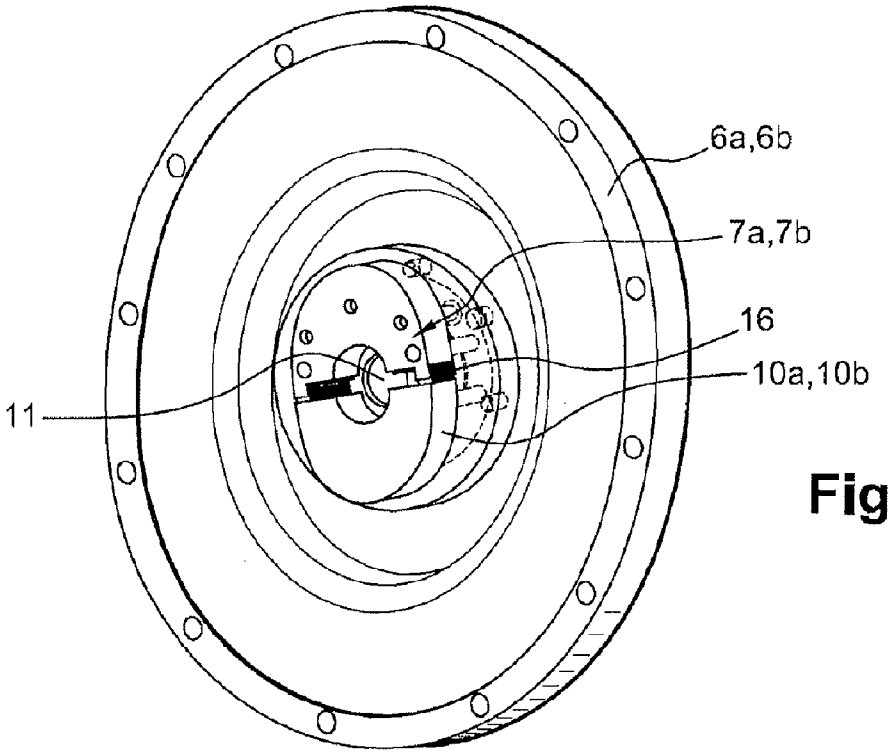

Fig. 6

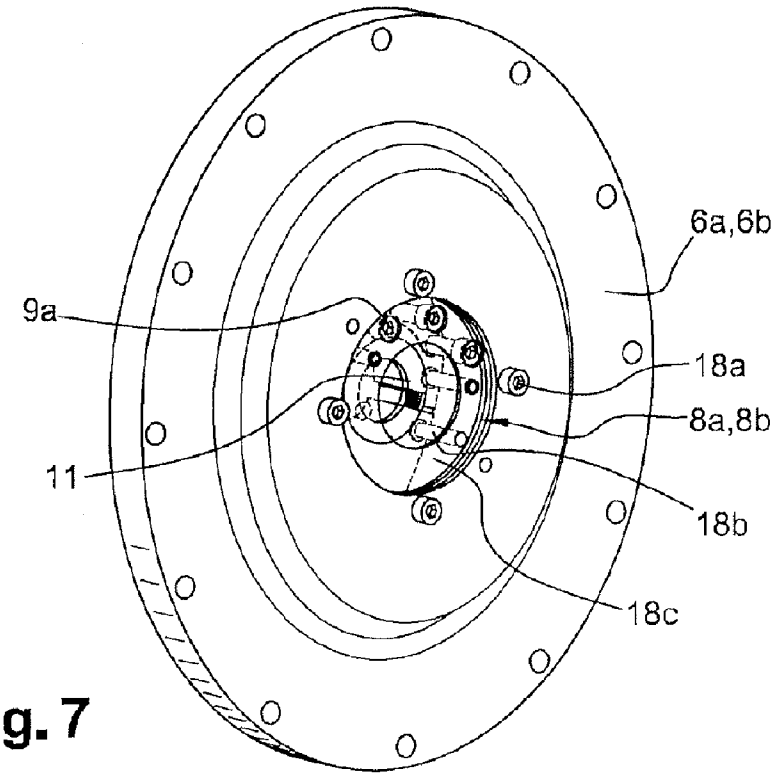

Fig. 7

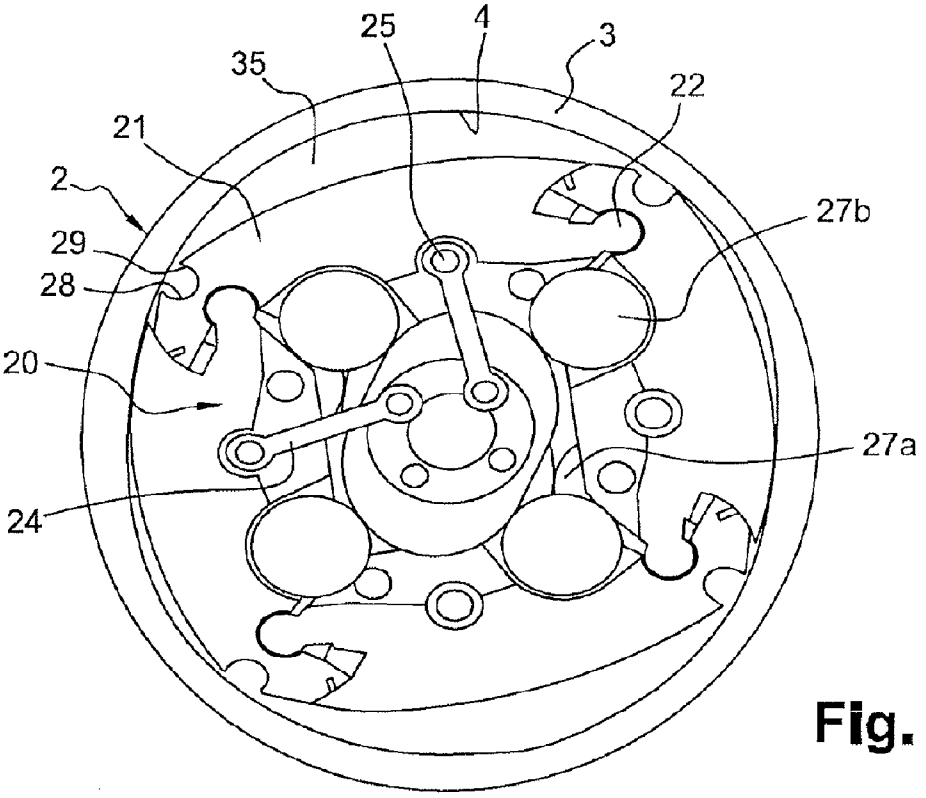

Fig. 8

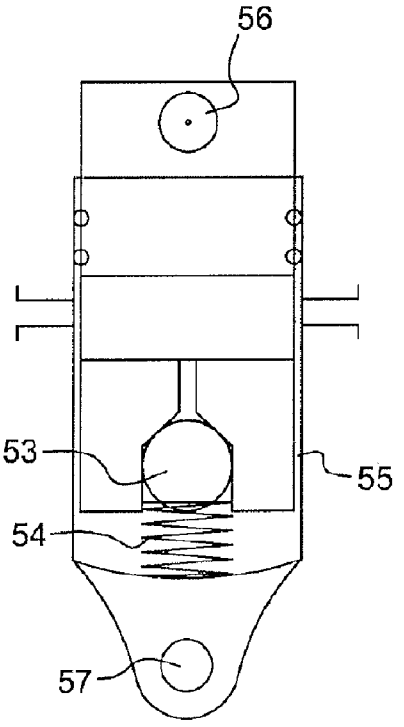

Fig. 9

ENGINE HAVING ROTARY PISTONS

TECHNICAL FIELD

[0001] The present invention relates to a rotary piston mechanism as well as an engine and pump using such a mechanism.

BRIEF SUMMARY OF RELATED ART

[0002] Rotary piston mechanisms, and in particular in their motor application, have been described in many documents, which define the geometric principles of the movement of a polygon articulated at the apices of the sides making it up; each of the sides all having the same length and each of the apices being in geometric contact with a stator shape.

[0003] In particular, documents WO 01/88341 A1, EP 1 295 012 B1 and US 2004/0089251 A1 propose different solutions for resolving the problems of sealing at the apices of the polygon, and transmission of the non-constant continuous movement of the pistons formed by the straight segments defined by the adjacent apices of the polygon.

[0004] All of these proposals more or less appropriately resolved all or some of the theoretical operating principles of this type of mechanism.

[0005] However, the feedback from tests done has shown difficulties for which no technical solution has yet been proposed.

[0006] The difficulties encountered during the exploitation of this type of mechanism first relate to mechanical tightening problems when it is hot as well as during assembly of the mechanism. The symptoms are blockages of the hinge assembly, which, despite a careful production, cannot pivot freely around the various axes making up its mechanism.

[0007] Possible compensations by excess play create knocking at the connecting rod assemblies, and pronounced wear of certain points of the mechanism, thereby limiting the lifetime of the pieces thus embrittled.

[0008] During analyses, it was also observed that the geometric and algebraic solutions were describing the ideal geometric locations, but with very small dimensions, i.e. solutions that are not very compatible with mechanical play tolerance accumulation phenomena.

[0009] Among the cited patents, some propose solutions that separate the sealing functions at the apices from the movement functions specific to the polygonal structure.

[0010] Thus, they propose a device having a movement specific to the polygon, independent of the profile of the stator enclosure inside which the apices of the polygon are in constant sliding contact.

[0011] This mechanical approach appears correct and therefore consists of determining the movement of the articulations of the polygons without action by the stator on the apex of the polygon.

[0012] In fact, one of the origins of tightening problems comes from imprecise machining of the stator profile. The decision to make the articulations of the rotary assembly independent of the stator shape helps resolve some of the defect problems.

[0013] Patent WO 01/88341 A1 proposes a solution describing the chaining of four pistons to one another using connecting rods also performing the appropriate transfer function between the pistons and the transmission shaft, as well as several mechanical solutions resolving the transfer function between the tangential speed variations of the pistons toward the central transmission shaft rotating at a constant speed, in particular using rollers traveling over a rolling surface installed on the lateral flanges.

[0014] However, after analysis, it was identified that the project as described was proposing a hyperstatic configuration that did not allow any play tolerance. In fact, the trapezoid described by the two connecting rods of the two adjacent pistons, the connecting point of the pistons and the connecting point on the driveshaft builds a hyperstatic connection. This trapezoid is undeformable and cannot allow any variation of the length of any one of its sides, as will be the case during the use of the mechanism, which will display expansion phenomena. The bearings of the articulations will be the embrittled members. These parts will wear prematurely while having created internal friction making the mechanism unsuitable for its purpose.

[0015] Furthermore, the shape of the connection between pistons does not appear capable of sustainably bearing the intense pulling, thrust, and centrifugal forces to which it will be subjected. These bowed collaborating movable interlocking forms are complex in terms of expansions, buttress formation, friction distribution, and their use is as difficult as it is unreliable. The sealing of such pieces is also more complex to achieve than the sealing of traditional axles and not very effective inasmuch as the stressed orientation of the sealing segment does not correspond to the forces undergone by that piece.

[0016] In case of expansion, in cases of temperature variation, this geometric solution is no longer respected, which results in a mechanical stress on the connection of the apex of the diamond without the possibility of absorbing that stress, which will result in a rupture of the connection between pistons, as well as stresses on the connecting rod assemblies, the latter not being able to transmit the expansions. This will irreversibly cause problems such as, for example, a rupture of a connecting rod bearing, or the destruction of the segment support device or the segment itself, which is already working in a cantilever, which may also result in deterioration of the stator profile by burring of its inner surface.

[0017] A machining anomaly, on the rolling surfaces, will result in a positioning error of the apex of the diamond, the sealing piece of which will be the only one to react this additional force. This piece will be stressed in its degree of freedom and may no longer pivot and will break; this stress may potentially be passed on to the connection between the pistons.

[0018] Patent EP 1 295 012 B1 and part of patent US 2004/0089251 A1 also propose determining the deformation of the polygon without bearing on the stator enclosure. This proposed solution uses a set of gears.

[0019] However, the sealing problem at the apices of the polygon does not appear to have been resolved.

[0020] Lastly, patent US 2004/0089251 A1 proposes a geometric solution accumulating the sealing function and a geometric function.

[0021] However, this solution does not resolve the problems of machining imprecisions and wear of certain parts of the mechanism as it is used.

BRIEF SUMMARY

[0022] The invention therefore aims to propose a technical solution making it possible to do away with these operating

difficulties due to machining imprecisions, expansion phenomena due to the temperature or other factors, and wear phenomena of the pieces.

[0023] To that end, the present invention relates to a rotary piston mechanism comprising an outer enclosure forming a stator inside which a rotary assembly forming a rotor moves, the rotary assembly comprising a plurality of pistons forming an articulated polygon, each piston delimiting a volume chamber with the enclosure, and first guide means arranged to cooperate with second guide means comprising rolling surfaces, so as to stress the polygon to perform a predetermined movement, wherein the mechanism comprises a return device maintaining contact between the guide means and the rolling surfaces.

[0024] The first and second guide means allow the pistons to follow a predetermined direction so as to limit the action of the enclosure on the apices of the polygon while the return device makes it possible to offset the machining defects of the guide means as well as the expansion and wear of those elements occurring during operation of the mechanism.

[0025] According to one embodiment, the return device is supported by the rotary assembly.

[0026] According to one embodiment, the return device comprises a plurality of dampers positioned between a stationary point of each piston and a movable fastening point of each of the first guide means, such as the guide roller axis of rotation.

[0027] This arrangement makes it possible to offset the wear of each of the guide rollers individually.

[0028] Using several rollers makes it possible to distribute the forces applied on the guide surfaces. Furthermore, these rollers have a small bulk and limit the friction on the guide surfaces due to their degree of rotational freedom.

[0029] According to one embodiment, the guide rollers are conical.

[0030] It is easier to design guide rollers whereof the surfaces are parallel; however, a conical configuration of the guide rollers makes it possible to increase the bearing surface of the rollers relative to a flat configuration and prevents the guide rollers from deviating from their path.

[0031] According to this same embodiment, the second guide means are rolling surfaces with an equal slope.

[0032] According to another embodiment, the return device is supported by the outer enclosure.

[0033] This arrangement makes it possible to place the return device at stationary points and limit the number thereof.

[0034] According to one embodiment, the second guide means are supported by lateral flanges positioned coaxially to the outer enclosure and serving to close the latter part.

[0035] This arrangement makes it possible to take advantage of the ease of assembling and disassembling the flanges used to close the outer enclosure so as to position the second guide means therein. It is also possible to consider manually pre-adjusting the orientation of said second adjustment means using a suitable device before closing of the enclosure by the flanges.

[0036] According to one embodiment, the second guide means comprise two sectors, the first of which is secured to the stator enclosure and the second of which is translationally movable relative to the first, a return device being positioned between a stationary point of the first sector and a movable point of the second sector of each of the second guide means.

[0037] This arrangement makes it possible to be able to modify the eccentricity of the guide surfaces, which assume a substantially ellipsoidal form, and thus makes it possible to offset the general wear of the guide surfaces as well as their machining defects.

[0038] According to one embodiment, a segment support device is pivotably mounted along a single axis on each of the apices of the polygon.

[0039] This arrangement allows the segment support device to adapt to the shape of the enclosure and to present the segments at all times in a direction transverse to the wall of the stator in which they evolve, which reduces the wear of the segments and imparts better sealing to the volume chambers.

[0040] Advantageously, a segment support device comprises a device for pressing segments on the stator enclosure.

[0041] The purpose of this arrangement is to produce a continuous sliding contact of the segments on the inner surface of the single-piece body so as to offset the machining defects thereof and therefore further improve the sealing between the volume chambers.

[0042] According to one embodiment, at least one piston is connected by a single connecting rod (**24**) or by several connecting rods (**241**, **242**) having the same hinge pins as the transmission shaft (**40**).

[0043] The use of connecting rods is geometrically easier to design than a set of gears, for example, and will be a source of less play due to the reduced number of elements and connections.

[0044] In this embodiment with connecting rods, the invention consists of keeping only one connecting rod per piston, for example that defined as rear in patent WO 01/88341 A1 in the case of rotation in the indirect trigonometric direction or in the clockwise direction.

[0045] The transfer function between the pistons and the engine shaft is kept; the expansions are no longer problematic, as an expansion will only create an imperceptible rotation of the rotary assembly relative to a reference position.

[0046] According to one embodiment, two adjacent pistons are connected to one another by a pivot link with an axis parallel to the axis of rotation of the rotary assembly.

[0047] This configuration makes it possible to obtain a connection of two adjacent pistons that is both very solid and flexible, and is also easy to produce, as it only comprises a single pin fitted into both ends of the two pistons.

[0048] According to one embodiment, the rolling surfaces are turned toward the axis of rotation of the rotary body.

[0049] According to one embodiment, the rotary assembly comprises a lubrication circuit mounted in a closed circuit.

[0050] This arrangement makes it possible to use a so-called "dry sump" lubrication system with all of the advantages thereof, in particular more significant and targeted lubrication at the critical locations, a lowered center of gravity of the mechanism due to the lack of an oil pan under the mechanism, a reservoir outside the mechanism that is not very bulky, and the possibility of incorporating a heat exchanger for cooling oil in the lubrication circuit.

[0051] According to one embodiment, the distance between the connecting pin between two adjacent pistons and the hinge pin of the segment support device is constant.

[0052] This arrangement makes it possible to define a particular stator profile corresponding to this geometric constraint that will only give the segment holders and segments their sealing function between volume chambers.

[0053] According to one embodiment, the distance between the connecting pin between pistons and the hinge pin of the segment support device is variable.

[0054] This arrangement makes it possible to obtain maximal volume ratios between chambers to the extent that the segment support devices and segments still perform their sealing function.

[0055] According to this embodiment, the segment support device comprises a complementary device for pressing segments on the stator, such as a hydraulic piston.

[0056] This arrangement offers the possibility of being able to still further increase the volume ratios between chambers by offering the segment supports and segments the possibility of ensuring sealing of the volume chambers despite substantial spacing of the wall of the stator for certain positions of the pistons.

[0057] The present invention also relates to a pump comprising a mechanism as described above as well as an engine using the same mechanism in its use for producing mechanical energy.

BRIEF DESCRIPTION OF THE DRAWINGS

[0058] In any event, the invention will be well understood using the following description, done in reference to the appended diagrammatic drawings, showing, as non-limiting examples, several embodiments of a mechanism according to the invention.

[0059] FIG. **1** shows a summary projection diagram of the profile of the mechanism according to the invention.

[0060] FIG. **2** shows a summary projection diagram of the profile of the mechanism with a first embodiment of the arrangement of the play compensating device.

[0061] FIG. **3** shows a summary projection diagram of the profile of the mechanism with a second embodiment of the arrangement of the play compensating device.

[0062] FIG. **4** shows the arrangement of three pistons in perspective view positioned outside the stator enclosure.

[0063] FIG. **5** is a perspective view of a second guide means with its play compensating device according to the embodiment illustrated in FIG. **3**.

[0064] FIG. **6** is a perspective view of the inner portion of a flange incorporating the second guide means with its play compensating device illustrated in FIG. **5**.

[0065] FIG. **7** is a perspective view of the outer portion of the flange illustrated in FIG. **6**.

[0066] FIG. **8** shows a cross-sectional and profile view of the mechanism according to the invention.

[0067] FIG. **9** shows a cross-sectional view of a hydraulic damper of the mechanism according to the invention.

DETAILED DESCRIPTION

[0068] As illustrated in FIGS. **1**, **2**, **3** and **8**, a rotary piston **21** mechanism **1** includes an outer enclosure **2** forming a stator inside which a rotary assembly **20** forming a rotor moves.

[0069] All of the reasoning described hereafter is valid for a polygon with n apices. The following reasoning is based on an embodiment with a polygon having four apices, or with four pistons forming an articulated deformable diamond, this example not being limiting.

[0070] The outer enclosure **2** in the embodiment illustrated in FIGS. **1**, **2**, **3** and **8** includes a single-piece body **3** generally made from steel, forming a volume with two identical ellipsoidal bases, in which an ellipsoid-shaped through cavity **5** is bored. The inner surface **4** of said cavity **5** is advantageously glazed so as to give it a surface state satisfactory for the applications of the mechanism **1**.

[0071] The outer enclosure **2** also includes two lateral ellipsoid-shaped flanges **6***a*, **6***b*, shown in FIGS. **6** and **7**, closing the through cavity **5** at each of the two ellipsoidal bases of the single-piece body **3**. Each of said flanges **6***a*, **6***b* is screwed to the single-piece body **3** of the enclosure **2** and incorporates sealing means such as an O-ring positioned in a groove situated on the joint of the flanges **6***a*, **6***b* with the single-piece body **3**.

[0072] Each of the flanges **6***a*, **6***b* comprises a bearing **8***a*, **8***b* centered to allow the rotation of the transmission shaft **40** along the axis **30** of the bearings **8***a*, **8***b*.

[0073] Each of these bearings **8***a*, **8***b* is respectively secured by screws **18***a* to each of the flanges **6***a*, **6***b* and comprises two cushions on the inner contour **18***b* thereof as well as an oil seal flush on the outer surface **18***c* of each of the bearings **8***a*, **8***b* so as to perform oil sealing between the barriers **8***a*, **8***b* in the transmission shaft **40**.

[0074] As illustrated in FIG. **6**, guide means **7***a*, **7***b* having a volume shape with substantially ellipsoidal bases **19***a* generating a first rolling surface **10***a* and a second rolling surface **10***b* of revolution on the outer contour **19***b* of these same substantially ellipsoidal bases **19***a*, are positioned coaxially to the alignment axis **30** of the two flanges **6***a*, **6***b* and oriented towards the inside of the enclosure **2**. They are fastened using screws **9***a* passing through each of the bearings **8***a*, **8***b* from the outside towards the inside of the flanges **6***a*, **6***b* and being screwed on threaded bores **9***b* positioned opposite the screws **9***a* on each of the guide means **7***a*, **7***b*.

[0075] The substantially ellipsoidal guide means **7***a*, **7***b* are coaxial and have a slight rotational offset along their axis **30**. Each of said guide means **7***a*, **7***b* has an ellipsoidal central opening **11** whereof the small axis has a size larger than the diameter of the bearings **8***a*, **8***b* so as not to bother the rotation of the transmission shaft **40**.

[0076] According to one embodiment, these guide means **7***a*, **7***b* are made in a single piece having a predefined shape not evolving during use of the mechanism **1**.

[0077] According to another embodiment illustrated in FIG. **5**, these guide means **7***a*, **7***b* comprise two sectors **71** and **72** separating the substantially ellipsoidal volume into two volumes at the small axis thereof, thereby creating four coplanar and distinct cutting surfaces **12***a*, **12***b*, **12***c* and **12***d* on each of the sectors **71** and **72**, each of the surfaces of a same sector **71** being opposite a surface of the other sectors **72** while being parallel thereto.

[0078] The sector **71** is fastened to the bearings **8***a*, **8***b* using screws **9***a* tightening in the threaded bores **9***b*, the second sector **72** is slidingly mounted in translation relative to the sector **71**. The two sectors **71** and **72** have a first mechanical link **13** formed by a pin positioned between two first surfaces **12***a*, **12***b* opposite the sectors **71** and **72**. This pin **13** is secured on the surface **12***a* and slides translationally in a bore positioned on the surface **12***b*.

[0079] A second mechanical link **14** is formed in the same way between the other two opposite surfaces **12***c*, **12***d*. However, the axis **14** of this link is surrounded by conical washers **15** acting in compression, such as a spring, and acting as a play compensating device **50**.

[0080] In order to ensure the continuity of the deformable rolling surfaces **10***a* and **10***b* to adapt to the relative transla-

tional movements of the two adjacent edges of the two sectors **71** and **72**, positioned on each of the edges of the two sectors **71** and **72** of each of the guide means **7***a* and **7***b* is a joint **16** of the cantilever comb expansion type. These joints **16** are made up of a set of identical parallelepiped teeth **17***a*, spaced apart by a same distance and coming transversely from the cutting surfaces **12***a*, **12***c* of the sector **71**, and by another set of teeth **17***a* coming transversely from the cutting surfaces **12***b*, **12***d* of the sector **72** respectively located opposite the cutting surfaces **12***a*, **12***c* of the sector **71**, each set of teeth **17***a* fitting into the spaces **17***b* between teeth **17***a* created by the other set of teeth **17***a*.

[0081] The rotary assembly **20** forming a rotor is made up of four pistons **21** forming a deformable diamond. The pistons **21** have a convex shape on the outer surface **21** a thereof and a planar shape on the inner surface **21** b thereof.

[0082] Each of the adjacent pistons **21** is solidly connected using a pivot link made up of a pin **22** passing transversely through the ends of two adjacent pistons **21**.

[0083] Each piston **21** has a parallelepiped recess **23** whereof two walls **23***a*, **23***b* are positioned transversely to the pins **22** ensuring the connection of the adjacent pistons **21**.

[0084] In this recess **23** and between these two walls **23***a*, **23***b*, a connecting rod **24** is positioned here made up of two connecting rods **241**, **242** positioned side-by-side and separated by a space **24***c*. These two connecting rods **241**, **242** are maintained by a pivot link formed by a pin **25** passing transversely through the two walls **23***a*, **23***b* as well as the head **24***a* of each of the two cylindrical connecting rods **241**, **242**. This pin **25** is thus positioned parallel to the pins **22**, linking the adjacent pistons **21** to one another.

[0085] Each of the pistons **21** also comprises two through openings **26***a*, **26***b*, which are also parallel to the axes **22**, and made on the lower portion of the piston **21** on either side of the recess **23**. These two openings **26***a*, **26***b* are intended each to receive a first guide means **27**, illustrated in FIGS. **1**, **2**, **3** and **8** by rollers **27**.

[0086] Each of the pistons **21** only comprises two rollers **27** each positioned on the lateral surfaces **21***c*, **21***d* of the piston **21**. In the direction of rotation of the rotary assembly **20**, a front guide roller **27***a* and a rear guide roller **27***b* are distinguished whereof the axes of rotation are on either side of the recess **23** coaxial to each the openings **26***a*, **26***b*. The piston **21** has a suitable profile on either side allowing the rotation of each of said two rollers **27***a* and **27***b*.

[0087] On the same end of their outer surface **21***a*, each piston **21** has a semicircular transverse notch **28** on the width of the piston **21**. Inside that notch **28**, there is a segment support device **29** having, like the notch **28**, a semicircular shape allowing it pivot in the notch **28** along the hinge pin **32** of the segment support device **29**.

[0088] On said segment support device **29**, two radial segments **31** are positioned protruding from the convex surface **21** a of the piston **21**. Each of these segments **31** is pushed toward the outside of the device **29** by the action of a spring **33** positioned in the device **29**.

[0089] In the embodiment illustrated in FIGS. **1**, **2**, **3** and **8**, the distance between the linking pin **22** of two adjacent pistons **21** and the hinge pin **32** of the segment support device **29** is constant.

[0090] As illustrated more precisely in FIG. **8**, each of the connecting rods **24** is, as already mentioned above, made up of two connecting rods **241**, **242** positioned side-by-side and separated by a space **24***c*. Each of these two connecting rods **241**, **242** is connected to a transmission shaft **40** by means of the pivot link made by a pin **34** passing transversely through the foot **24***b* of each of the cylindrical connecting rods **241**, **242** on the one hand, and on the other hand, a hub **41** of the transmission shaft **40** passing in the space **24***c* positioned between the feet **24***b* of the two connecting rods **241**, **242**.

[0091] It is understood that these two connecting rods **241**, **242** could be connected to one another to form a single mechanical part.

[0092] According to the embodiment illustrated in FIG. **2**, the two guide rollers **27***a* and **27***b* present on the lateral surfaces **21***c*, **21***d* of each piston **21** are connected thereto by means of a return device **50** or play compensating device such as hydraulic dampers **50**, illustrated in FIG. **9**.

[0093] A hydraulic damper **50** is made up of a piston-cylinder assembly whereof the internal leaks are calibrated. The piston **51** is pierced at the center thereof with a calibrated diameter and the ball **53**, provided with a spring **54** acting as a check valve, imposes the passage direction of the oil through the calibrated space **55** between the piston **51** and the cylinder **52**.

[0094] In this embodiment, a stationary connection by means of a screw (not shown) is made between the piston **21** and the first fastener **56** of the hydraulic damper **50** and a pivot link is made by means of a pin (not shown) between the second link **57** of the hydraulic damper **50** and the axis of rotation **27***c* of a roller **27**.

[0095] Once the rotary assembly **20** is assembled, it is inserted inside the single-piece body **3** and enclosed inside the stator enclosure **2** during mounting of the lateral flanges **6***a*, **6***b*.

[0096] Once mounted, the rotary assembly **20** delimits, with the stator enclosure **2**, volume chambers **35**.

[0097] A closed oil circuit (not shown) is arranged in the various parts of the rotary assembly **20** so as to lubricate the contact areas between the different moving pieces relative to one another, as is the case for the pins **25** and **34** respectively maintaining the head **24***a* and the foot **24***b* of the connecting rods **24**. This so-called dry sump circuit includes an oil pump as well as an oil reservoir, which are both positioned outside the stator enclosure **2**. A heat exchanger is also arranged in the oil circuit so as to cool it.

[0098] It should be noted that the embodiment comprising arranging a hydraulic damper **50** between each piston **21** and roller **27** of the rotary assembly **20** and positioning guide means **7***a*, **7***b* in two sectors **71** and **72** capable of moving in translation relative to one another does not prohibit embodiments comprising using only the hydraulic dampers **50** between each piston **51** and roller **27** of the rotary assembly **20** or the guide means **7***a*, **7***b*.

[0099] Once the mechanism **1** is mounted, it can be used as an engine so as to produce torque on its transmission shaft **40**, or as a pump by driving that same transmission shaft **40** using a coupling connecting it to an external engine.

[0100] Of course, both of these applications require developments of the single-piece body **3** so as to create intake and exhaust pathways therein for pump, external combustion engine, or steam expansion engine applications, as well as lighting for internal combustion engine applications.

[0101] During the rotation of the rotary assembly **20** inside the stator enclosure **2**, the front rollers **27***a* of each of the pistons **21** follow the trajectory of the rolling surface **10***a* of

the guide means **7***a*, while the rear rollers **27***b* of each of the pistons **21** follow the trajectory of the rolling surface **10***b* of the guide means **7***b*.

[0102] The apices of the diamond formed by the four pistons **21** thus follow the trajectory of the inner surface **4** of the single-piece body **3** of the stator enclosure **2** without bearing on that same surface **4**.

[0103] The segments **31** by means of the spring **33** present in the segment support device **29** ensure continuous sliding contact on the inner surface **4** of the single-piece body **3** of the stator enclosure **2**.

[0104] The connection of the segment support device **29** in its notch **28** guarantees the segments **31** radial contact with the inner surface **4** of the single-piece body **3** of the stator enclosure **2**, which makes it possible to reduce the wear thereof and preserve good sealing of the volume chambers **35**.

[0105] During the operation of the mechanism **1**, expansion phenomena may appear, the transfer function between the pistons **21** and the transmission shaft **40** is preserved and the expansions will only create an imperceptible rotation of the transmission shaft **40** relative to a reference position.

[0106] During extended operation with poor lubrication capable of causing wear of one of the rolling surfaces **10***a*, **10***b* or several rollers **27**, the hydraulic dampers **50** arranged on each of the rollers **27** will offset that wear at all times by providing continuous contacts between the rollers **27** and the two rolling surfaces **10***a* and **10***b*.

[0107] In the case of overall wear of the rollers **27**, the rolling surfaces **10***a* and **10***b* in the embodiment thereof with two sectors **71** and **72** will increase the perimeter of their rolling surface **10***a*, **10***b* so as to compensate the wear of the rollers **27**.

[0108] The invention is of course not limited to only the embodiments of this mechanism **1** described above as examples, but on the contrary encompasses all alternatives thereof. The segment support device **29** can comprise a complementary device for pressing the segments **31** on the inner surface **4** of the single-piece body **3** of the outer stator enclosure **2** so as to make it possible to use a different stator profile and increase the volume ratio between the volume chambers **35**, and the return device **50** illustrated here by the dampers **50** may be of any type, on the condition it provides contact between the guide means (**27**, **27***a*, **27***b*) and the rolling surfaces (**10***a*, **10***b*).

1. A rotary piston mechanism comprising;

an outer enclosure forming a stator inside which a rotary assembly forming a rotor moves, the rotary assembly comprising:

a plurality of pistons forming an articulated polygon, each piston delimiting a volume chamber with the enclosure, and

first guide means arranged to cooperate with second guide means comprising rolling surfaces, so as to stress the polygon to perform a predetermined movement, and

wherein the mechanism comprises a return device maintaining contact between the guide means and the rolling surfaces.

2. The mechanism according to claim **1**, wherein the return device is supported by the rotary assembly.

3. The mechanism according to claim **1**, wherein the return device comprises a plurality of dampers positioned between a stationary point of each piston and a movable fastening point of each of the first guide means comprising a guide roller axis of rotation.

4. The mechanism according to claim **1**, wherein the return device is supported by the outer enclosure.

5. The mechanism according to claim **1**, wherein the second guide means are supported by lateral flanges positioned coaxially to the outer enclosure and serving to close the latter part.

6. The mechanism according to claim **1**, wherein the second guide means comprise two sectors, a first of which is secured to the stator enclosure and a second of which is translationally movable relative to the first, a return device being positioned between a stationary point of the first sector and a movable point of the second sector of each of the second guide means.

7. The mechanism according to claim **1**, wherein a segment support device is pivotably mounted along a single axis on each apice of the polygon.

8. The mechanism according to claim **7**, wherein the segment support device comprises a device for pressing segments on the stator enclosure.

9. The mechanism according to claim **7**, wherein the segment support device comprises a complementary device for pressing segments on the stator.

10. The mechanism according to claim **1**, wherein at least one piston is connected by a single connecting rod or by several connecting rods having same hinge pins as the transmission shaft.

11. The mechanism according to claim **1**, wherein two adjacent pistons are connected to one another by a pivot link with an axis parallel to an axis of rotation of the rotary assembly.

12. The mechanism according to claim **1**, wherein the second guide means are turned toward a axis of rotation of the rotary assembly.

13. The mechanism according to claim **1**, wherein the rotary assembly comprises a lubrication circuit mounted in a closed circuit.

14. A pump comprising a mechanism according to claim **1**.

15. An engine comprising a mechanism according to claim **1**.

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