

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
23 December 2004 (23.12.2004)

PCT

(10) International Publication Number
WO 2004/111455 A1

(51) International Patent Classification⁷: **F04C 2/332**,
15/00

(21) International Application Number:
PCT/IL2004/000448

(22) International Filing Date: 24 May 2004 (24.05.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0314231.2 18 June 2003 (18.06.2003) GB
160096 28 January 2004 (28.01.2004) IL

AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(71) Applicant and
(72) Inventor: CARMELI, Adahan [IL/IL]; 11 Netivei Am, Ramot, 97552 Jerusalem (IL).

(74) Agent: REINHOLD COHN AND PARTNERS; P.O. Box 4060, 61040 Tel Aviv (IL).

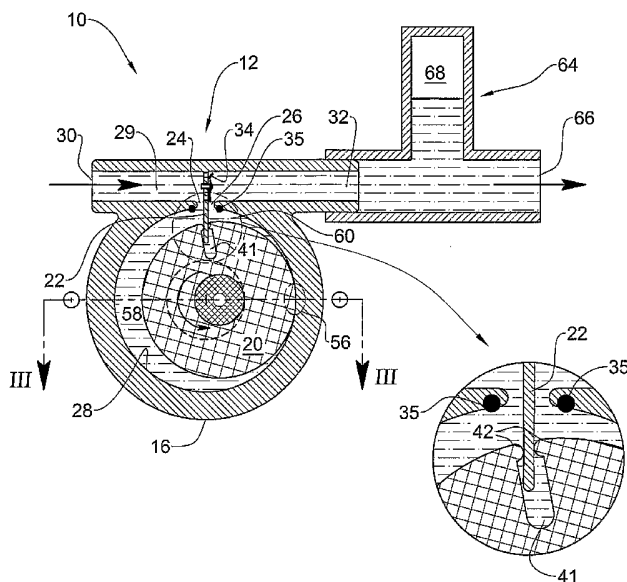
Published:

- with international search report
- with amended claims

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM,

(54) Title: SINGLE-VANE ROTARY PUMP OR MOTOR



(57) Abstract: A rotary vane pump or motor comprising a housing (16) with cylindrical inner peripheral wall defining a cavity, and a rotor (20) with cylindrical peripheral surface and a socket (41) internal to said peripheral surface, eccentrically disposed in the cavity. The rotor (20) is adapted to scroll the inner peripheral wall in close proximity thereto. The inner peripheral wall and the rotor surface define a working chamber between them. The housing (16) has a vane (22) with an end received within the socket (41) so as to enable the vane to slide in the socket maintaining predetermined degree of fluid tightness therebetween, and to enable the rotor (20) to orbit the cavity. The housing (16) has an inlet port (24) adjacent one side of the vane and an outlet port (26) adjacent the other side of the vane, both ports being open to the inner peripheral wall.

SINGLE-VANE ROTARY PUMP OR MOTOR

FIELD OF THE INVENTION

The present invention relates generally to vane pumps and motors and more particularly, to single-vane rotary pumps used for pumping of fluids in the chemical, medical and food industries, where the required process cleanliness
5 necessitates frequent pump cleaning or replacement.

BACKGROUND OF THE INVENTION

The single vane rotary pump/motor is known historically from attempts to build a steam engine with a rotary piston. Later the scheme was applied to compressors/pumps. (It is known in the art that, generally, a rotary piston engine
10 (motor) is convertible into a pump if an external drive is provided, and vice-versa.) Thus, GB 926,495 discloses a rotary pump where the general layout includes a housing with a cylindrical cavity and a cylindrical piston (rotor) of lesser diameter eccentrically disposed therein. The pump drive, by means of an eccentric crank, causes the piston to orbit the cavity scrolling its inner peripheral wall. A pump
15 chamber with crescent shape is thus defined between the piston and the housing. The piston has a radial projection (vane) accommodated in a recess of the housing, which divides the chamber into an expanding chamber and a contracting chamber. The pump further has an inlet port at one side of the vane, connected to the expanding chamber, and an outlet port at the other side of the vane, connected to the
20 contracting chamber. In one embodiment, the vane has a cylindrical tip, while the recess is a radial channel with parallel walls contacting the cylindrical tip and allowing the vane to slide and swivel. In another embodiment, the vane and the recess have triangular shape.

- 2 -

A few examples of single-vane pumps are provided in Japanese publication JP 06-200887. The pump has a single vane connected to the rotor and to the housing across the pump chamber. In one embodiment, the vane is slidably engaged to the housing while hinged to the rotor. In a second embodiment, the vane is also
5 slidably engaged to the housing - however, the vane is not joined to the rotor but is radially urged to the rotor by a spring in the sliding joint so that the vane is in sliding contact with the rotor. In a third embodiment, the vane is integral with the rotor, while sliding through a socket which in its turn is rotatably joined to the housing.

10 In most embodiments, the outlet port is closed by a one-way check valve to prevent backflow of fluid, or pressure loss, when the scrolling zone of the rotor passes over the vane joint, since neither the vane, nor the rotor in that position isolate the inlet port from the outlet port of the pump.

SUMMARY OF THE INVENTION

15 In accordance with the present invention, there is provided a rotary vane pump or motor comprising a housing with cylindrical inner peripheral wall defining a cavity, and a rotor with cylindrical peripheral surface and a socket internal to said peripheral surface, eccentrically disposed in the cavity. The rotor is adapted to scroll the inner peripheral wall in close proximity thereto. The inner peripheral wall and
20 the rotor surface define a working chamber between them. The housing has a vane with an end received within the socket so as to enable the vane to slide in the socket maintaining predetermined degree of fluid tightness therebetween, and to enable the rotor to orbit the cavity. The housing has an inlet port adjacent one side of the vane and an outlet port adjacent the other side of the vane, both ports being open to the
25 inner peripheral wall. The scroll zone of close proximity between the rotor surface and the inner peripheral wall of the housing, and the vane divide the working chamber into a first expanding inlet chamber in fluid communication with the inlet port and a second contracting outlet chamber in fluid communication with the outlet port.

- 3 -

In one embodiment, the socket has parallel walls and the vane has a cylindrical tip received in the socket and providing fluid tightness together with the walls. The vane is rigidly attached to the housing but is thinner than its cylindrical tip, thus allowing for rocking motion within the socket.

5 In another embodiment, the socket has an opening with two rounded lips receiving the vane therebetween and providing therewith the fluid tightness. The socket has a wider cavity behind the lips such that the vane is able to rock in the socket. The vane may have parallel walls providing, at variable angles of rocking, variable fluid tightness. Alternatively, the protrusions may be elastic, or vane
10 thickness may vary along vane length, thereby providing, at variable angles of rocking, approximately uniform fluid tightness.

In a further embodiment, the socket has an opening formed as a swivel cylindrical joint allowing sliding of the vane, of uniform thickness, through the joint and rocking of the vane together with the joint.

15 In still further embodiments, the socket has parallel walls and the end of vane received in the socket matches the clearance between the parallel walls, but the vane is not rigidly attached to the housing. The vane may be attached to said housing by a hinge, or may be made flexible, so as to bend when the rotor orbits within the housing. Preferably, in the latter case, the parallel walls conjoin the
20 peripheral surface along a smooth curve allowing the vane to bend smoothly.

The inventive design affords two major advantages. The first is the ability to position the pump/motor inlet and outlet in closer proximity to each other, and thus reduce the rotational angle at which the rotor and cylinder are not in scrolling contact. The second advantage is that the rotor is balanced when exposed to fluid
25 pressure, as the sealing between the vane and the rotor occurs at the rotor periphery. Thus the fluid pressure applies a force directed through the rotor center, resulting in negligible force between the vane and the rotor socket, as opposed to prior art rotors, where the protruding vane is exposed to pressure, which urges the vane against its socket, creating friction. (Note: This benefit does not apply to structure

– 4 –

shown in Fig. 6). An additional advantage of the vane extending inwards from the housing is the structural compactness obtained with pumps that employ long vanes.

In accordance with an additional embodiment of the present invention, the rotary vane pump or motor comprises a sealing barrier disposed between the rotor periphery and the inner peripheral wall, preferably adjacent to the inlet port or to the outlet port. The barrier is adapted to prevent fluid communication between the inlet port and the outlet port when the scroll zone is over the inlet port or the outlet port or between them. Preferably, a second sealing barrier is disposed adjacent to the other port. The sealing barrier may be made of compliant material and attached to the inner peripheral wall or to the rotor periphery. Alternatively, it may be formed as cooperating teeth on the inner peripheral wall and on the rotor peripheral surface. The sealing barrier may be formed as an integral detail with the lips at the socket opening. Thereby, a single-vane pump or motor is provided, which does not require check-valves to function, but rather employs a barrier, to maintain separation between the pump or motor inlet and outlet.

In accordance with another aspect of the present invention, the rotary vane pump is used in a pumping apparatus, coupled to a drive unit with an eccentric drive member adapted to drive the rotor. The pump is attachable to and detachable from the drive unit, the two units being constructed so that attaching the pump to the drive unit results in engagement of the rotor to the eccentric drive member. Preferably, the pumping apparatus includes attachment means allowing simple manipulation without tools.

Preferably, the rotor has a concentric socket, the eccentric drive member comprises an eccentric crank adapted to fit rotatably, by a bearing, into the concentric socket when the pump is attached to the drive unit, and the housing has a sealed opening allowing the crank to enter the concentric socket. Preferably, the crank has a tapered head with such diameter and eccentricity that it can enter the concentric socket irrespective of the alignment between the socket and the crank before the attaching.

- 5 -

The rotary vane pump is preferably made of materials suitable for its usage as a disposable unit, such as plastic.

Thus, a pumping apparatus constructed of two main components is provided: a permanent drive unit, which contains all the costly components, and a low-cost disposable pump unit, which comes in contact with the pumped media, and is easily and quickly replaceable. The disposable pump unit contains all the pump parts which are subjected to high rate of wear or contamination, such that its replacement results in a complete pumping apparatus which is as good as new with respect to wear and cleanliness.

The rotary vane pump of the present invention may further comprise a bypass channel, preferably integral with the housing, with an inlet in communication with the inlet port, an outlet in communication with the outlet port, and a one-way valve disposed between the inlet and the outlet so as to allow fluid flow bypassing said pump chamber, thereby improving flow uniformity, while the rotary vane pump is pulsating when pumping. The pump may further comprise a pulsation damper with an air chamber, connected to the outlet, adapted for damping the pressure ripple present at the rotary vane pump outlet.

Other objects and features of the present invention will become apparent when viewed in light of the detailed description of the preferred embodiment when taken in conjunction with the attached drawings and appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to understand the invention and its application, preferred embodiments will now be described, by way of non-limiting examples only, with reference to the accompanying drawings, in which:

Fig. 1 is a schematic cross sectional view of a single vane pump in accordance with a preferred embodiment of the present invention, coupled with a pulsation damper and a by-pass valve;

Fig. 2 is a schematic cross sectional view of the single vane pump of Fig. 1, with the rotor in registration with the vicinity of the fluid inlet and outlet ports.

- 6 -

Fig. 3 is a cross sectional view of the single vane pump of Fig. 1, showing the attachment and coupling of the pump to the drive unit and the eccentric drive member;

Fig. 4 is a cross sectional view of the single vane pump of Fig. 3, showing
5 the disassembly and decoupling of the pump from the drive unit and the eccentric drive member;

Figs. 5 and 6 are cross sectional views of the single-vane pump in accordance with alternative embodiments of the present invention;

Fig. 7 is a close-up of an embodiment where lips of the socket and a sealing
10 barrier are integrated in one detail;

Fig. 8 is an embodiment of the present invention with a hinged vane; and

Fig. 9 is an embodiment of the present invention with a flexible vane.

DETAILED DESCRIPTION OF THE INVENTION

With reference to Figs. 1 through 4, there is shown a pumping apparatus 10
15 in accordance with a preferred embodiment of the present invention. The pumping apparatus 10 comprises a single vane pump 12 and a drive unit 14 detachably attached to each other.

The pump 12 includes a housing 16 with a cylindrical cavity, and a
cylindrical rotor 20 disposed eccentrically in the cavity of the housing so as to
20 define a working chamber 18. The housing 16 has an inlet port 24 and an outlet port 26 communicating with the working chamber 18, and a radial vane 22 disposed between the ports 24 and 26. Ports 24 and 26 are opened at the inner peripheral wall 28 of the working chamber. The housing 16 includes a bypass channel 29 with an inlet 30 in communication with the inlet port 24, an outlet 32 in communication
25 with the outlet port 26, and a one-way valve 34 between the inlet and the outlet. Two sealing barriers 35 are disposed at the peripheral wall 28, adjacent the inlet port 24, and the outlet port 26, respectively. The housing 16 has a central opening 36 at its wall 37 and a cover 38 closing the working chamber 18.

- 7 -

The rotor 20 is disposed in the housing cavity in sliding contact with the cover 38 and the wall 37, sealing the opening 36 by means of a ring seal 40. The rotor 20 has a radial socket 41 with two rounded lips 42 at its opening engaging the vane 22 so that it can slide within radial socket 41. Lips 42 are at all times in contact with both sides of vane 22, in a sealing fit. Vane 22 has varying thickness, for maintaining contact with both lips 42, yet allowing for free movement of rotor 20. Vane 22 and the socket 41 thus constitute a joint providing both sliding and rocking. Rotor 20 further has a central socket 44 facing the opening 36.

Drive unit 14 has a rotary shaft 50 with an eccentric crank 52 equipped with a bearing 54. When pump 12 is attached to drive unit 14, crank 52 is received by central socket 44 and shaft 50 is coaxial with the cylindrical cavity of the housing 16.

The radial geometrical relationship between drive unit 14, eccentric crank 52, rotor 20 and diameter of the cylinder pump chamber 18 is such that rotation of rotary shaft 50, via the crank 52, causes rotor 20 to scroll the inner peripheral wall 28, maintaining contact or near-contact with the wall at scroll zone 56. Due to the vane-and-socket joint of rotor 20 to the housing 16, where rotor 20 is confined to vane 22 by means of vane socket 41, the rotor performs simultaneously a reciprocating motion parallel to the vane socket, and a transverse rocking motion (an orbital motion).

During this orbital motion, rotor 20 and housing 16 define two separate and variable volumes: an expanding inlet chamber 58 and a contracting outlet chamber 60. Expanding chamber 58 is defined between the inlet side of the vane 22, a portion of the peripheral wall 28 between the inlet port 24 and the scroll zone 56, and an adjacent portion of the rotor's periphery. Contracting chamber 60 is defined between outlet side of the vane 22, the remaining portion of the peripheral wall 28 between the outlet port 26 and the scroll zone 56, and the remaining portion of the rotor's periphery.

When the eccentric crank 52 rotates counterclockwise (see Fig. 1), scroll zone 56 also travels counterclockwise, and expanding chamber 58 expands, thereby

- 8 -

drawing or suctioning fluid from inlet 30, through inlet port 24. At the same time, contracting chamber 60 contracts, discharging the fluid through outlet port 26 to outlet 32. In the position shown in Fig. 2, scroll zone 56 is in registration with vane 22 so that contracting chamber 60 has vanished while expanding chamber 58 has attained its maximal volume, after which it starts contracting and becomes the contracting chamber, while at the same time a "new" expanding chamber is born.

In the position of Fig. 2, rotor 20 is in contact with the sealing barriers 35, thereby sealing off possible communication between inlet port 24 and outlet port 26 around rotor 20. Barriers 35 are made of elastic material, such as rubber, such that they are deflected by rotor 20 as it scrolls by them. In the absence of barriers 35, when the rotor 20 is in the illustrated position, or rather in any position where scroll zone 56 is in registration with either inlet port 24 or outlet port 26, or between them, pressurized fluid from outlet port 26 could flow around rotor 20 back to inlet port 24. This undesirable reverse flow is traditionally prevented by use of a one-way valve at the outlet port. Sealing barriers 35 perform an equivalent function, preventing fluid back flow from the outlet port 26 to the inlet port 24, without the negative effects, which valves introduce.

Notably, fluid backflow may be prevented also by a single sealing barrier 35. In such case, the single barrier should provide the sealing of a slightly wider gap. For example, if the left barrier in Fig. 2 is removed, the remaining right barrier 35 must keep the gap between the rotor 20 and the inner wall 28 sealed until the scroll zone 56 reaches a point to the left of the inlet port 24.

It would be obvious to those skilled in the art that any barrier, suitably disposed between the rotor 20 and the inner peripheral wall 28, may perform the function of blocking off the backflow path from outlet port 26 to inlet port 24. For example, the barriers may be disposed on the rotor periphery opposite ports 24 and 26, as shown in Fig. 5. Alternatively, a labyrinth barrier 43, shown in the close-up of Fig. 2, may be formed as cooperating teeth on the inner peripheral wall and on the rotor peripheral surface.

– 9 –

The bypass one-way valve 34 is optional. It is made of resilient material, such as rubber, which may deflect under pressure differential applied thereto, permitting fluid to flow from inlet 30 to outlet 32. Thus, continuous flow of fluid may be maintained also at the time when expanding chamber 58 and contracting chamber 60 are not displacing fluid.

In the illustrated preferred embodiment of Fig. 1, the single vane pump 10 is shown assembled with an additional pulsation damper 64 which in this embodiment is a trapped air reservoir with fluid outlet 66. Damper 64 absorbs and dampens pressure ripple or fluctuations resultant from the cyclic nature of the fluid displacement in the single vane pump 10. Trapped air 68 expands and contracts in response to pressure fluctuations of the fluid at outlet 32, enhancing, together with by-pass valve 34, stable and uniform flow and pressure of the pumped fluid at outlet 66.

Fig. 3 illustrates pump 12 of the pumping apparatus 10, attached to the drive unit 14, with the rotor 20 coupled to eccentric crank 52, via bearing 54. The pump is retained in place by wing nuts 70, which are manually screwed and tightened on threaded studs 72 anchored in drive unit 14. Drive unit 14 has a protrusion 74 mated to recess 76 in housing 16 such that pump 12 is keyed in proper relation to drive unit 14.

Fig. 4 illustrates pump 12 detached from drive unit 14, with wing nuts 70 removed from threaded studs 72. Cover 38 may be an integral part of pump 12 permanently attached to housing 16, or it may be separate from housing 16. In the illustrated embodiment, it functions both as a cover for the housing 16 as well as a retaining plate for retaining pump 12 engaged to drive unit 14. It will be appreciated that there are other simple and fast means for manual attaching the pump to the drive unit, for example, a bayonet lock or a threaded collar.

Eccentric crank 52 has a tapered head 78 facilitating the insertion of the crank 52 into the socket 44 of rotor 20. The diameter of tapered head 78 and eccentricity of the crank 52 are selected so that tapered head 78 can enter into crank socket 44 while the pump is being attached to the drive unit, irrespective of the

– 10 –

alignment of the socket 44 and crank 52. For this purpose, the crank eccentricity is preferably less than one-fourth of the crank head diameter (the latter is presumed equal to the socket 44 diameter).

The rotary vane pump of the present invention can be easily adapted for
5 disposable use in the chemical, medical and food industries, where the required process cleanliness necessitates frequent pump cleaning or replacement. For this purpose, the pump is made of low-cost materials suitable for its usage as a disposable unit, such as plastic. The described structure of the vane-and-socket connection allows simple pump fabrication from molded components. Thus, the
10 pump parts which come in contact with the pumped media are cheap and easily and quickly replaceable by a simple manipulation, without using any tools. The disposable pump unit advantageously contains all the pump parts that are subject to high rate of wear and contamination, while the permanent drive unit, including the eccentric crank with the bearing, contains all costly components. Thus, the
15 replacement of the disposable pump unit results in a complete pumping apparatus which is as good as new with respect to wear and cleanliness.

The vane-and-socket joint in the pump or motor of the present invention may be designed in a number of various ways, as shown in Figs. 5 and 6. In an alternative embodiment of Fig. 5, the vane 22 is made flat, while socket 41 is
20 equipped with swivel jaws 82 forming a swivel joint at the opening of the socket. Swivel jaws 82 form a channel of uniform width, mated to vane 22 so that the vane can slide across the swivel while rotor 20 orbits.

As shown in Fig. 6, vane 22 may be made with an enlarged cylindrical tip 80, while the vane socket 41 has parallel walls allowing sliding of tip 80 and
25 rocking of rotor 20.

Although a description of specific embodiments has been presented, it is contemplated that various changes could be made without deviating from the scope of the present invention. For example, vane 22 in the embodiment shown in Fig. 1 may be simplified to have parallel walls if a high degree of fluid tightness is not
30 required. Alternatively, lips 42 may be made of elastic material. As shown in Fig. 7,

– 11 –

the lips may be integrated in one detail 82 with the sealing barrier. Figs. 8 and 9 show other possible embodiments of the present invention – vane 84 with hinge 86, and flexible vane 88 with rounded socket entrance 90. Such vanes may be made only to slide in a narrow socket 91, without rocking therein, for better fluid
5 tightness. Accordingly, it is intended that the invention be limited only in terms of the appended claims.

While the performance of the pump embodiment was described, the same embodiment will perform the motor function, when fluid pressure is applied at the inlet port, with lower pressure at the outlet port, applying torque to the rotor, which
10 will result in the rotor's rotation.

- 12 -

CLAIMS:

1. A rotary vane pump or motor comprising a housing with a cylindrical inner peripheral wall defining a cavity, a rotor with a cylindrical peripheral surface and a socket internal to said peripheral surface, said rotor being disposed eccentrically in
5 said cavity and being adapted to scroll said inner peripheral wall in close proximity thereto, said inner peripheral wall and the rotor peripheral surface defining between them a working chamber, said housing having a vane with an end received in said socket so as to enable said vane to slide within said socket maintaining predetermined fluid tightness therebetween, and to enable said rotor to orbit within
10 said cavity, said housing having an inlet port adjacent to one side of said vane and an outlet port adjacent to the other side of said vane, both ports being in fluid communication with said cavity via said inner peripheral wall.
2. The rotary vane pump or motor according to Claim 1, wherein said socket has parallel walls and the end of said vane received in said socket is cylindrical and
15 matches the clearance between said parallel walls.
3. The rotary vane pump or motor according to Claim 1, wherein said vane is attached to said housing by a hinge.
4. The rotary vane pump or motor according to Claim 1, wherein said vane is flexible so as to bend when said rotor orbits within said housing.
- 20 5. The rotary vane pump or motor according to Claim 4, wherein said parallel walls conjoin said peripheral surface along a smooth curve allowing said vane to bend smoothly.
6. The rotary vane pump or motor according to Claim 1, wherein said vane is rigidly attached to said housing.
- 25 7. The rotary vane pump or motor according to Claim 6, wherein said socket has parallel walls, said vane has a cylindrical tip received in said socket and providing, in cooperation with said walls, said fluid tightness, said vane being thinner than said tip, such that said vane is able to rock within said socket.

- 13 -

8. The rotary vane pump or motor according to Claim 6, wherein said socket has an opening defined by two lips receiving said vane therebetween and providing therewith said fluid tightness, said socket further having a wider cavity behind said opening such that said vane is able to rock within said socket.

5 9. The rotary vane pump or motor according to Claim 8, wherein said vane has parallel walls providing, at variable angles of rocking, variable fluid tightness.

10. The rotary vane pump or motor according to Claim 8, wherein said vane has parallel walls while said protrusions are elastic, thereby providing, at variable angles of rocking, approximately uniform fluid tightness.

10 11. The rotary vane pump or motor according to Claim 8, wherein said vane has variable thickness along its length such that, at variable angles of rocking, approximately uniform fluid tightness is provided.

12. The rotary vane pump or motor according to Claim 6, wherein said socket has an opening with swivel jaws, said vane has uniform thickness, and said vane is
15 received between said jaws so as to form a swivel joint allowing sliding of said vane through said joint and rocking of the vane together with said joint, while maintaining fluid tightness.

13. The rotary vane pump or motor according to Claim 1, further comprising a sealing barrier disposed between said rotor surface and said inner peripheral wall
20 and adapted to prevent fluid communication between said inlet port and said outlet port when said rotor is in scroll registration with said inlet port or said outlet port, or any point therebetween.

14. The rotary vane pump or motor according to Claim 13, wherein said sealing barrier is disposed adjacent to one of said inlet or outlet ports.

25 15. The rotary vane pump or motor according to Claim 14, wherein a second sealing barrier is disposed adjacent to the other of said inlet or outlet ports.

16. The rotary vane pump or motor according to Claim 13, wherein said sealing barrier is attached to said housing.

17. The rotary vane pump or motor according to Claim 13, wherein said
30 sealing barrier is attached to said rotor.

– 14 –

18. The rotary vane pump or motor according to Claim 13, wherein said sealing barrier is made of elastic material.

19. The rotary vane pump or motor according to Claim 13, wherein said sealing barrier is formed as cooperating teeth on said inner peripheral wall and on
5 said rotor peripheral surface.

20. A rotary vane pump according to Claim 1, further comprising a bypass channel with an inlet in communication with said inlet port, an outlet in communication with said outlet port, and a one-way valve disposed between said inlet and said outlet so as to allow fluid flow from said inlet to said outlet bypassing
10 said pump chamber.

21. The rotary vane pump according to Claim 19, wherein said bypass channel is integral with said housing.

22. A rotary vane pump according to Claim 1, further comprising a pulsation damper connected to said outlet port.

15 23. A rotary vane pump according to Claim 1, in a pumping apparatus further comprising a drive unit adapted to rotate said rotor by means of an eccentric drive member.

24. The pump according to Claim 23, wherein said pump is attachable to and detachable from said drive unit.

20 25. The pump according to Claim 24, wherein said pump and said drive unit are constructed so that attaching said pump to said drive unit results in engagement of the rotor to the eccentric drive member.

26. The pump according to Claim 25, including attachment means allowing for said attaching by simple manipulation without tools.

25 27. The pump according to Claim 25, wherein said rotor has a concentric socket, said eccentric drive member comprises an eccentric crank adapted to fit rotatably into said concentric socket when said pump unit is attached to said drive unit thereby providing said engagement, and said housing has an opening allowing said crank to enter said concentric socket.

– 15 –

28. The pump according to Claim 27, wherein said crank comprises a bearing permanently affixed thereto, said bearing providing the rotatable fit of said crank to said concentric socket.

29. The pump according to Claim 28, wherein said crank has a tapered head
5 and has such diameter and eccentricity that said tapered head can enter said concentric socket during said attaching irrespective of the alignment between said concentric socket and said crank before said attaching.

30. The pump according to Claim 24, wherein said pump is made of materials suitable for its usage as a disposable unit.

10 **31.** The rotary vane pump or motor according to Claim 17, wherein said socket has an opening defined by two lips receiving said vane therebetween, said socket further having a wider cavity behind said opening such that said vane is able to rock within said socket, said lips being made of elastic material formed so as to provide said fluid tightness between the vane and the socket and to constitute said sealing
15 barrier.

AMENDED CLAIMS

[Received by the International Bureau on 15 Novembre 2004(15.11.04)
original claims 1-31 replaced by amended claims 1-25]

1. A rotary vane pump or motor comprising a housing with a cylindrical inner peripheral wall defining a cavity, a rotor with a cylindrical peripheral surface and a socket internal to said peripheral surface, said rotor being disposed eccentrically in
5 said cavity and being adapted to scroll said inner peripheral wall in close proximity thereto, said inner peripheral wall and the rotor peripheral surface defining between them a working chamber, said housing having a vane with an end received in said socket so as to enable said vane to slide within said socket maintaining predetermined fluid tightness therebetween, and to enable said rotor to orbit within
10 said cavity, said housing having an inlet port adjacent to one side of said vane and an outlet port adjacent to the other side of said vane, both ports being in fluid communication with said cavity via said inner peripheral wall,

wherein

said socket has an opening with swivel jaws, said vane has uniform
15 thickness, is rigidly attached to said housing, and is received between said jaws so as to form a swivel joint allowing sliding of said vane through said joint and rocking of the vane together with said joint, while maintaining said fluid tightness

2. The rotary vane pump or motor according to Claim 1, further comprising a sealing barrier disposed between said rotor surface and said inner peripheral wall
20 and adapted to prevent fluid communication between said inlet port and said outlet port when said rotor is in scroll registration with said inlet port or said outlet port, or any point therebetween.

3. The rotary vane pump or motor according to Claim 2, wherein said sealing barrier is disposed adjacent to one of said inlet or outlet ports.

25 4. The rotary vane pump or motor according to Claim 3, wherein a second sealing barrier is disposed adjacent to the other of said inlet or outlet ports.

5. The rotary vane pump or motor according to Claim 2, wherein said sealing barrier is attached to said housing.

6. The rotary vane pump or motor according to Claim 2, wherein said sealing barrier is attached to said rotor.

7. The rotary vane pump or motor according to Claim 2, wherein said sealing barrier is made of elastic material.

5 8. The rotary vane pump or motor according to Claim 2, wherein said sealing barrier is formed as cooperating teeth on said inner peripheral wall and on said rotor peripheral surface.

9. A rotary vane pump according to Claim 1, further comprising a bypass channel with an inlet in communication with said inlet port, an outlet in
10 communication with said outlet port, and a one-way valve disposed between said inlet and said outlet so as to allow fluid flow from said inlet to said outlet bypassing said pump chamber.

10. The rotary vane pump according to Claim 9, wherein said bypass channel is integral with said housing.

15 11. A rotary vane pump according to Claim 1, further comprising a pulsation damper connected to said outlet port.

12. A rotary vane pump according to Claim 1, in a pumping apparatus further comprising a drive unit adapted to rotate said rotor by means of an eccentric drive member.

20 13. The pump according to Claim 12, wherein said pump is attachable to and detachable from said drive unit.

14. The pump according to Claim 13, wherein said pump and said drive unit are constructed so that attaching said pump to said drive unit results in simultaneous engagement of the rotor to the eccentric drive member.

25 15. The pump according to Claim 14, including attachment means allowing for said attaching by simple manipulation without tools.

16. The pump according to Claim 14, wherein said rotor has a concentric socket, said eccentric drive member comprises an eccentric crank adapted to fit rotatably into said concentric socket when said pump unit is attached to said drive

unit thereby providing said engagement, and said housing has an opening allowing said crank to enter said concentric socket.

17. The pump according to Claim 16, wherein said crank comprises a bearing permanently affixed thereto, said bearing providing the rotatable fit of said crank to
5 said concentric socket.

18. The pump according to Claim 17, wherein said crank has a tapered head and has such diameter and eccentricity that said tapered head can enter said concentric socket during said attaching irrespective of the alignment between said concentric socket and said crank before said attaching.

19. The pump according to Claim 13, wherein said pump is made of materials
10 suitable for its usage as a disposable unit.

20. A rotary vane pump comprising a housing and a rotor, said housing being attachable and detachable to a drive unit adapted to rotate said rotor by means of an eccentric drive member, wherein said drive unit and said pump are constructed so
15 that attaching said housing to said drive unit results in simultaneous engagement of the rotor to the eccentric drive member.

21. A rotary vane pump according to Claim 20, wherein said pump further includes attachment means allowing for said attaching by simple manipulation without tools.

22. The pump according to Claim 20, wherein said rotor has a concentric socket, said eccentric drive member comprises an eccentric crank adapted to fit rotatably into said concentric socket when said pump unit is attached to said drive unit thereby providing said engagement, and said housing has an opening allowing
20 said crank to enter said concentric socket.

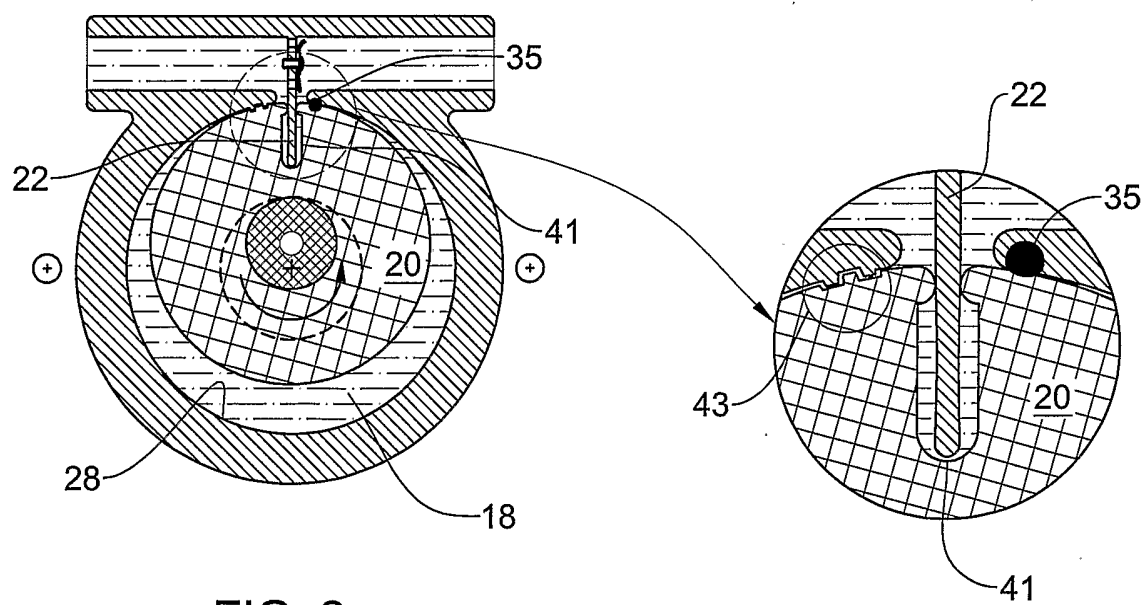
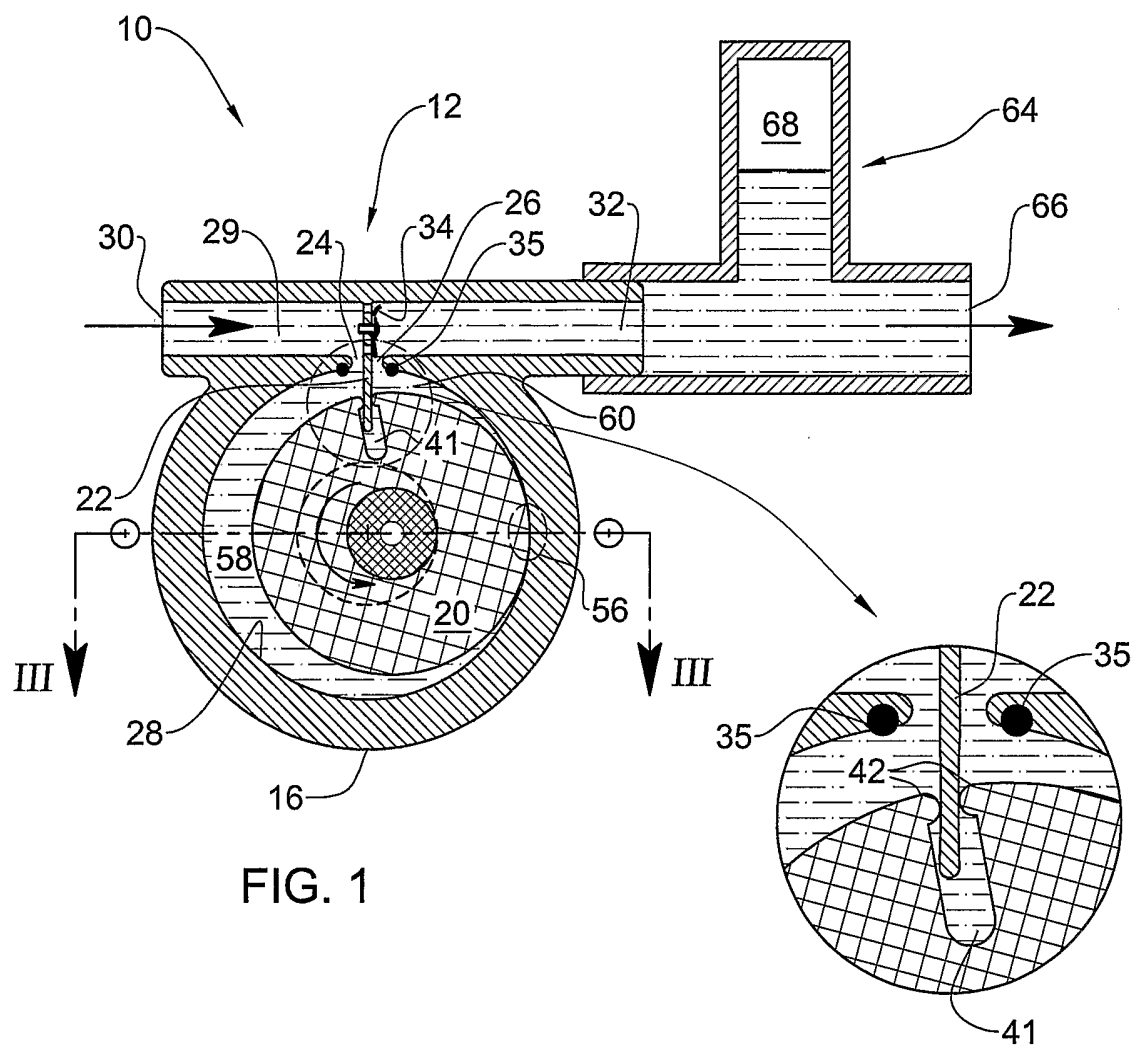
23. The pump according to Claim 22, wherein said crank comprises a bearing permanently affixed thereto, said bearing providing the rotatable fit of said crank to
25 said concentric socket.

24. The pump according to Claim 23, wherein said crank has a tapered head and has such diameter and eccentricity that said tapered head can enter said

concentric socket during said attaching irrespective of the alignment between said concentric socket and said crank before said attaching.

25. The pump according to Claim 20, wherein said pump is made of materials suitable for its usage as a disposable unit.

1/4



2/4

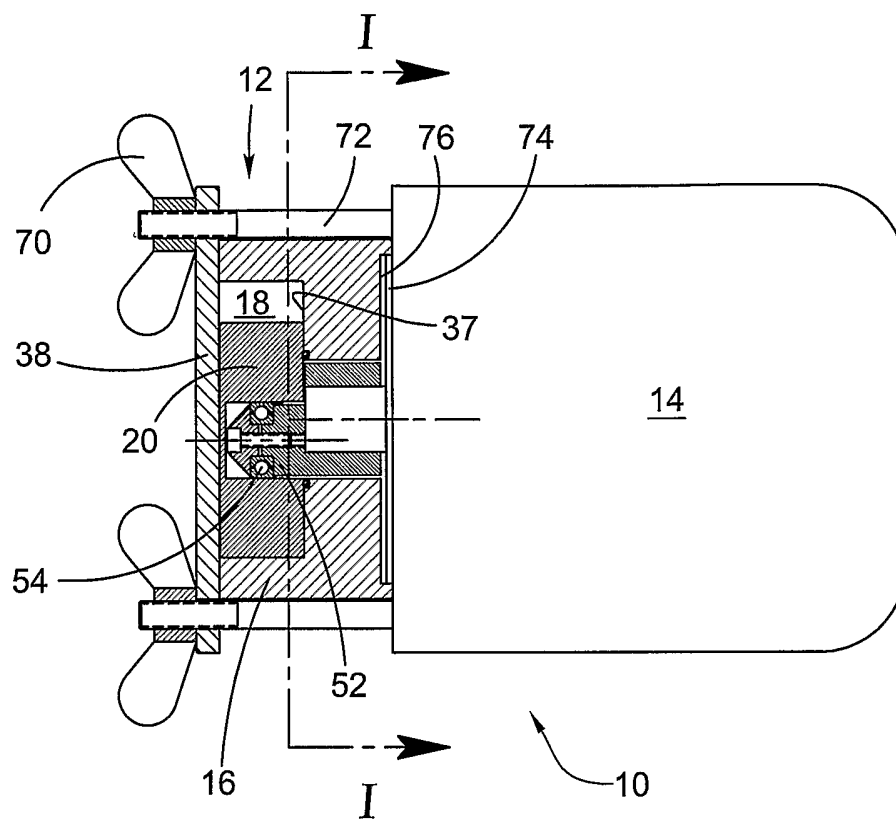


FIG. 3

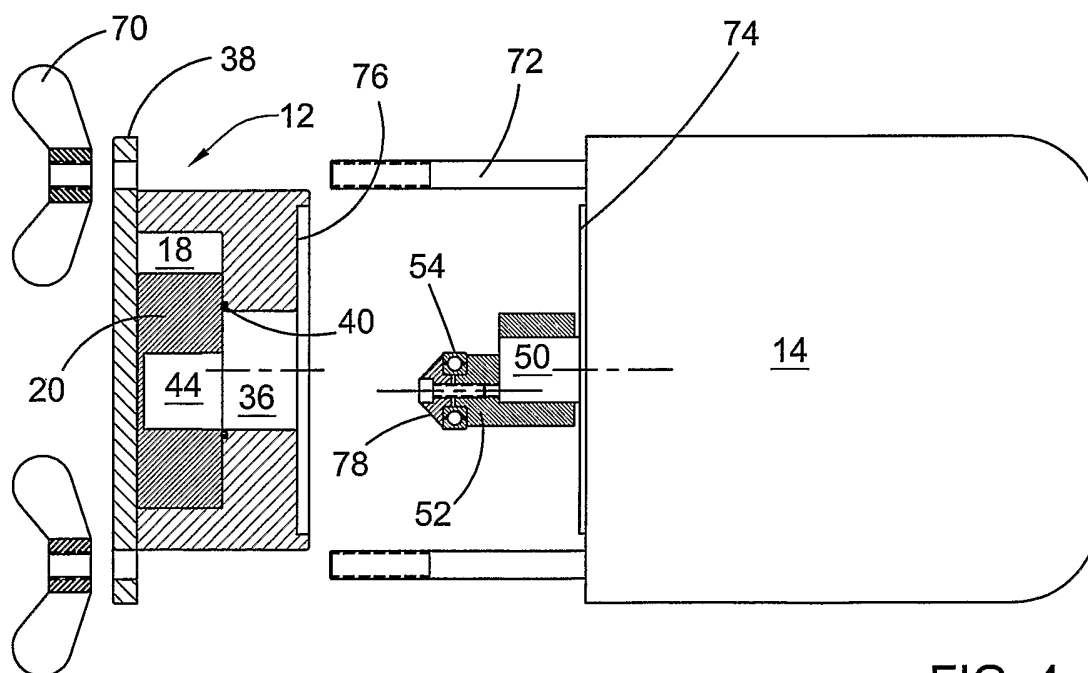


FIG. 4

3/4

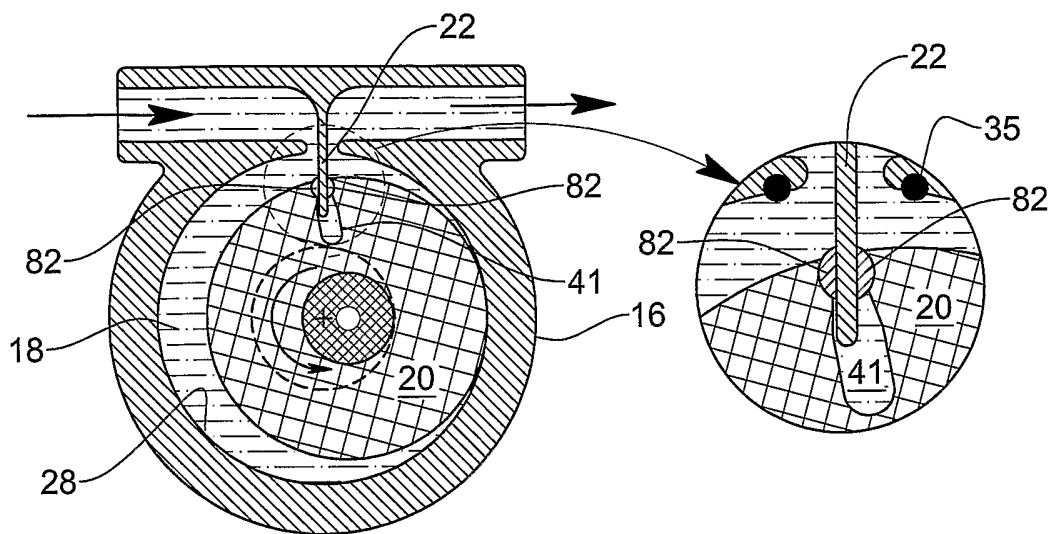


FIG. 5

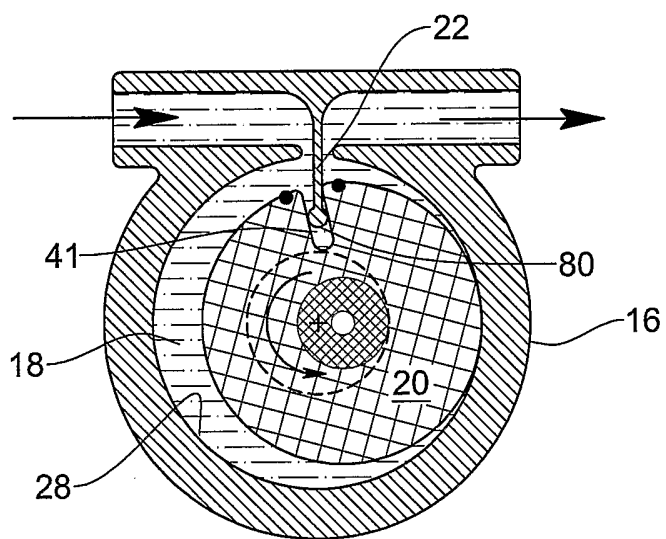


FIG. 6

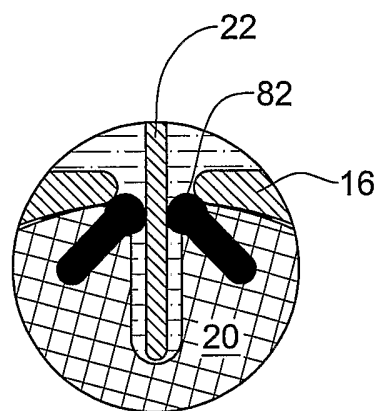


FIG. 7

4/4

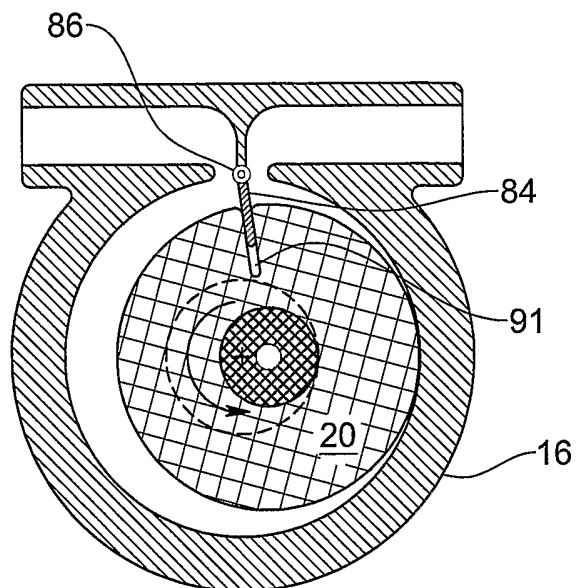


FIG. 8

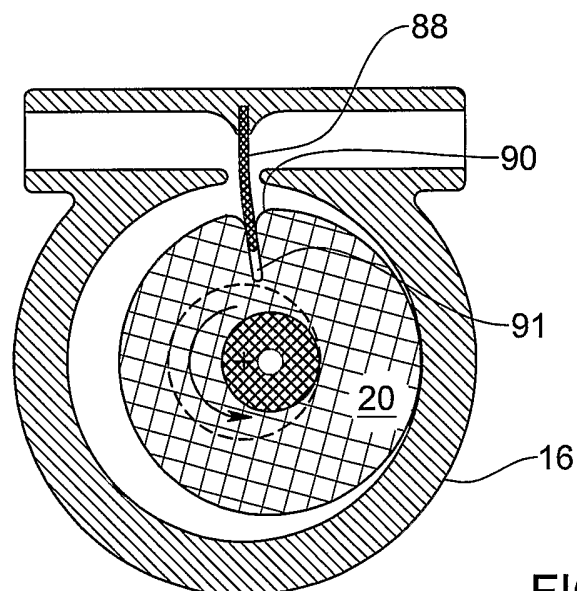


FIG. 9

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IL2004/000448

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F04C2/332 F04C15/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F04C F01C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 980 766 A (VROLIX ALBERT-SYLVAIN-TOUSS) 17 May 1951 (1951-05-17)	1-3
Y	the whole document	13,14, 17,18,25
X	FR 656 320 A (A MARTY ET E CAUVET ETS) 6 May 1929 (1929-05-06)	1,6,8, 10,23,24
X	DE 22 62 574 A (THEISEN ALOIS) 27 June 1974 (1974-06-27) page 3, line 19 -page 4, line 10; figures 3,4	1,6,8, 11,23,24
X	FR 1 478 849 A (RUEBEL GERHARD) 28 April 1967 (1967-04-28) the whole document	1,2,23, 24
	--- -/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search

10 September 2004

Date of mailing of the international search report

17/09/2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Descoubes, P

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IL2004/000448

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 1 346 509 A (MAZILLE PHILIBERT JULIEN) 20 December 1963 (1963-12-20) the whole document ----	1,3,23, 24
X	BE 350 273 A (LAHAUSSOIS RENE) 10 April 1928 (1928-04-10) page 3, line 32 -page 4, line 5; figure 2 ----	1,3,23, 24
Y	US 3 081 022 A (AUN MICHIE AMANDA) 12 March 1963 (1963-03-12) column 3, line 58 - line 68; figure 3 ----	13,14, 17,18
Y	US 5 762 480 A (ADAHAN CARMELI) 9 June 1998 (1998-06-09) column 4, line 13 - line 42; figures 1,5 -----	25

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IL2004/000448

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
FR 980766	A	17-05-1951	NONE	
FR 656320	A	06-05-1929	NONE	
DE 2262574	A	27-06-1974	DE 2262574 A1	27-06-1974
FR 1478849	A	28-04-1967	NONE	
FR 1346509	A	20-12-1963	NONE	
BE 350273	A		NONE	
US 3081022	A	12-03-1963	NONE	
US 5762480	A	09-06-1998	AU 720027 B2	18-05-2000
			AU 2175797 A	07-11-1997
			CA 2228092 A1	23-10-1997
			CN 1195391 A ,B	07-10-1998
			EA 159 B1	29-10-1998
			EP 0846226 A1	10-06-1998
			WO 9739241 A1	23-10-1997