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(54) **Double diaphragm pump**

(57) An air operated double diaphragm pump 10 is provided with an air valve assembly which allows the valve cup 38 to move in a rectangular pattern which greatly reduces the cost and number of parts required for such an air valve. The main housing 12 of the pump 10 is mounted on a fluid base 20 to which the lines of fluid are attached. This allows removal of the pump for servicing by undoing several basic fasteners such as nuts and bolts 18 without requiring removal of the fluid fittings to the base 20. Thus, in the event of a pump malfunction, the pump may be easily replaced while the fluid fittings remain intact. Provision is also made for additional passages 54, 56 into each air chamber 44, 46 for operation via an externally operated solenoid valve. A one-piece check valve 26 construction is utilised with the part having a central sealing disk 26A having a plurality of radially axially extending guide members 26B extending therefrom wherein each of the guide members has an outer diameter sized to slidingly fit within a cylindrical cavity 28 and each of the guide members 26B having axially opposite the sealing disk 26A a plurality of spring loaded fingers 26D which serve to bias the check valve 26 into a closed position.

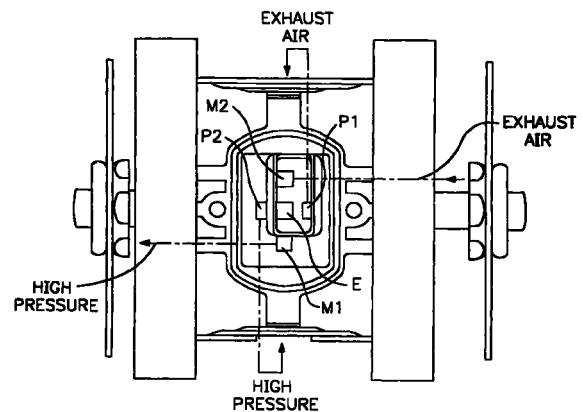


FIG. 5



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 20 1777

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP 0 609 044 A (ARO CORP) 3 August 1994 (1994-08-03) * column 1, line 5 - line 18 * * column 2, line 26 - column 4, line 59; figures 1-8 *	1,2	F04B43/073 F04B9/135 F16K15/02
A	US 4 597 403 A (MILBURN JR WILLIAM W) 1 July 1986 (1986-07-01) * column 2, line 51 - column 7, line 32; figures 1-5 *	1,2	
A	WO 96 08130 A (HUEWEL RALF ;HÜWEL RALF; HUEWEL HEINZ (DE); HÜWEL HEINZ) 21 March 1996 (1996-03-21) * abstract; figure 1 *	1,2	
A	US 4 385 869 A (OMATA KATSUMORI) 31 May 1983 (1983-05-31) * column 2, line 30 - column 5, line 8; figures 1-9 *	1,2	
A	FR 2 372 363 A (BOSCH SIEMENS HAUSGERAETE) 23 June 1978 (1978-06-23) * page 1, line 33 - page 4, line 30; figure 2 *	6	TECHNICAL FIELDS SEARCHED (Int.Cl.6) F04B F01L F16K
A	US 4 766 930 A (PATTI VINCENZO) 30 August 1988 (1988-08-30) * column 2, line 9 - line 65; figures 3-5 *	6	
A	GB 2 258 519 A (BEMA SPORTS COMPANY LIMITED) 10 February 1993 (1993-02-10) * figures 1,2 *	6	
A	DE 11 73 298 B (UNILEVER N.V.) 2 June 1964 (1964-06-02) * claim 1; figures 1-5 *	6	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 9 December 1999	Examiner Ingelbrecht, P
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03 82 (P04C01)

**CLAIMS INCURRING FEES**

The present European patent application comprised at the time of filing more than ten claims.

- Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
1-2, 6
- None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:



The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1-2

reciprocating air pump including air valve with valve block moving in a generally planar rectangular path between four positions, said valve block connecting a main port, a pilot port and the exhaust port

2. Claim : 3

A pump with fluid connections having specific thread (13.16mm major diameter; 12.30 mm pitch; 11.45 mm minor diameter; 1 degree 47 minutes angle; 7.32 threads per centimeter; effective thread 10.21 mm)

3. Claim : 4

pump comprising manifold having inlet and outlet passages located thereon, on which the main body is releasably connected, and which communicates inlet and outlet passages to the main pump body.

4. Claim : 5

Air operated diaphragm pump having externally accessible ports for attachment to externally operated solenoid valves to control operation

5. Claim : 6

A check valve comprising a generally cylindrical cavity, a central sealing disk, a plurality of guide members slidingly fitting within the cylindrical cavity, and a plurality of spring loaded fingers on each guide member to bias said check valve into a closed position

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 20 1777

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

09-12-1999

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