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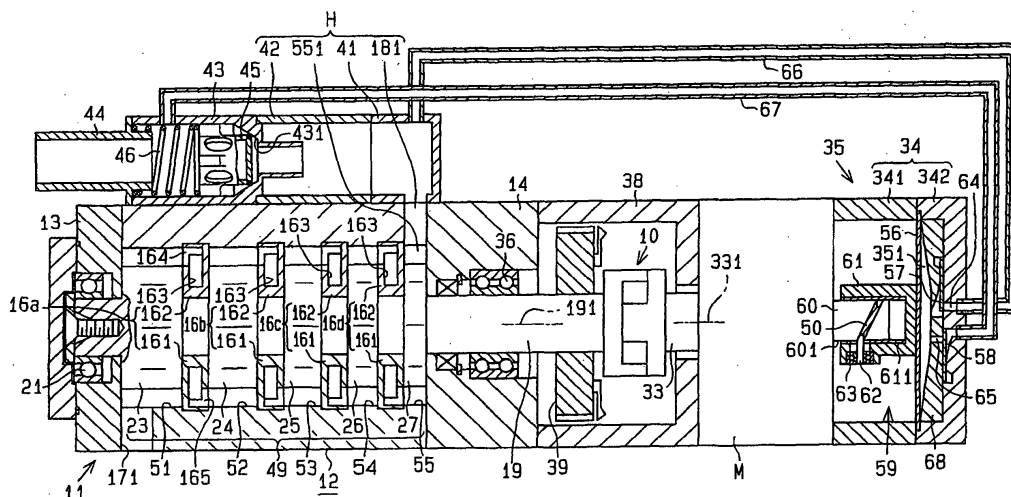
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(54) **Reciprocating pump and vacuum pump**

(57) A reciprocating pump has an action chamber, a diaphragm, a drive shaft, and a roller. The diaphragm is displaced for changing the volume of the action chamber. A groove is formed on a circumference of the drive shaft. The roller is engaged with the groove and is con-

nected to the diaphragm. When the drive shaft is rotated, the roller is guided by the groove to reciprocate along the axis of the drive shaft. When the roller reciprocates, the diaphragm is displaced along the axis of the drive shaft.

**Fig.1**





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# EUROPEAN SEARCH REPORT

Application Number  
EP 03 02 1301

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The present search report has been drawn up for all claims			
Place of search <b>Munich</b>		Date of completion of the search <b>5 July 2005</b>	Examiner <b>Olona Laglera, C</b>
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			

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# EUROPEAN SEARCH REPORT

Application Number  
EP 03 02 1301

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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Place of search Munich		Date of completion of the search 5 July 2005	Examiner Olona Laglera, C
<p>CATEGORY OF CITED DOCUMENTS</p> <p>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</p> <p>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 &amp; : member of the same patent family, corresponding document</p>			

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### 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:
- ☐ 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:



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LACK OF UNITY OF INVENTION  
SHEET B

Application Number  
EP 03 02 1301

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: 1-7

Independent claim 1 refers to a reciprocating pump having a diaphragm, which is displaced by the action of a guide body. The guide body is connected to a movable body that follows an annular slot formed on the drive shaft surface, which is slanting relative to the shaft axis. When the drive shaft rotates, the guide body and thereby the diaphragm reciprocate. The guide body is connected to the pump housing without using the diaphragm to prevent the pin from rotating relative to the pump housing. Dependent claims 2-7 refer to further details of the driving mechanism described in claim 1.

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2. claims: 8-10

Independent claim 8 refers to a vacuum pump, which is a combination of a main pump and an auxiliary pump. The auxiliary pump having the features of the reciprocating pump described in claim 1. Dependent claims 9 and 10 refer to further details of the pumping arrangement.

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

EP 03 02 1301

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  
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05-07-2005

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