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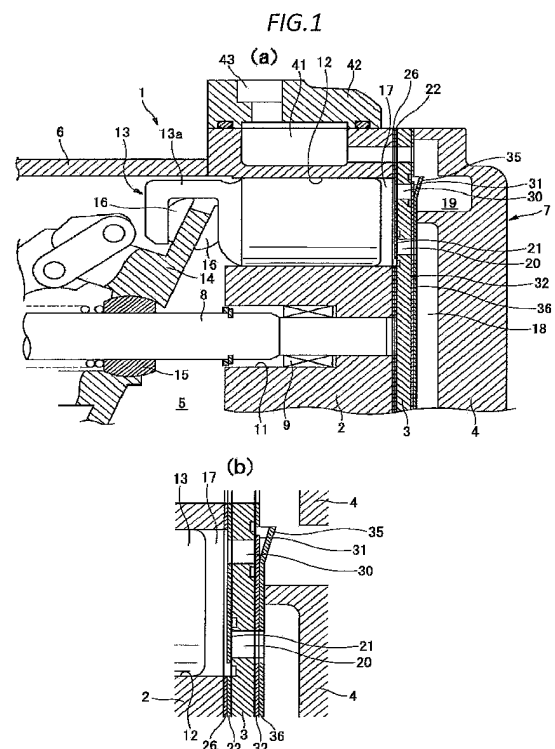
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(54) **RECIPROCATING COMPRESSOR SUCTION VALVE STRUCTURE AND RECIPROCATING COMPRESSOR**

(57) A reed valve used as a suction valve (21) of a reciprocating compressor (1) has a tongue-form arm portion (23), an outer side form of the arm portion (23) is formed of a slit portion (24) provided in a suction valve sheet (22), and an inner side form of the arm portion (23) is formed of an aperture portion (25) provided in the suction valve sheet (23). An outer side reference line (L2) that coincides with the outer side form and an inner side reference line (L3) that coincides with the inner side form are caused to incline so as to intersect with a central line (L4) of the arm portion (23) that passes through both a central point (P2) of a cylinder bore (12) and a central point (P3) of a suction port (20), whereby a width of a base side (24c) of the arm portion (23) is greater than a width of a leading end side (24a). Furthermore, an angle (R1) of inclination of the outer side reference line (L2) from the central line (L4) is a predetermined value or more greater than an angle (R2) of inclination of the inner side reference line (L3) from the central line (L4).





EUROPEAN SEARCH REPORT

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 936 195 A1 (VALEO THERMAL SYS JAPAN CO [JP]) 25 June 2008 (2008-06-25)	1,4,5	INV. F04B27/08 F04B39/10
Y	* paragraphs [0052] - [0057]; figures 1,6,7 *	3	
X	US 4 976 284 A (HOVARTER LEN A [US]) 11 December 1990 (1990-12-11) * column 2, line 11 - column 4, line 30; figures 1,2 *	1	
Y	US 2015/086400 A1 (BAE SANG WOO [KR] ET AL) 26 March 2015 (2015-03-26)	3	
A	* paragraph [0097]; figure 10 *	1,4,5	
			TECHNICAL FIELDS SEARCHED (IPC)
			F04B
<p>The present search report has been drawn up for all claims</p>			
Place of search		Date of completion of the search	Examiner
Munich		9 October 2019	Jurado Orenes, A
<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 & : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03/82 (P04C01)



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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due 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 those claims for which no payment was due.

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:

1, 3-5

☐ The present supplementary 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 (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION
SHEET B**

Application Number

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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, 3-5

A reciprocating compressor suction valve structure in a reciprocating compressor that has a suction port such that an exit end opens on to a compression chamber formed in a cylinder bore and the exit end is blocked so as to be openable and closable by a suction valve, and a discharge port such that an entrance end opens on to the compression chamber and an exit end is blocked so as to be openable and closable by a discharge valve, and a reed valve is used as the suction valve,

characterized in that the suction valve has a tongue-form arm portion, an outer side form of the arm portion is formed by a slit portion formed of one leading end portion, one pair of base portions, and one pair of intermediate portions between the leading end portion and the base portion being provided in a suction valve sheet, an inner side form of the arm portion is formed by an aperture portion of a long hole form extending from a vicinity of a peripheral edge of the suction valve sheet toward a central point side of the cylinder bore being provided between one intermediate portion and base portion of the slit portion of the suction valve sheet and the other intermediate portion and base portion, an outer side reference line that coincides with an intermediate portion of the slit portion of the outer side form and an inner side reference line that coincides with an edge of the aperture portion of the inner side form opposing in a lateral direction are each caused to incline so as to intersect with a central line of the arm portion that passes through both a central point of the cylinder bore and a central point of the suction port, whereby a width of a base side of the arm portion is greater than a width of a leading end side, and furthermore, an angle of inclination of the outer side reference line is a predetermined value or more greater than an angle of inclination of the inner side reference line.

2. claim: 2

A reciprocating compressor suction valve structure in a reciprocating compressor that has a suction port such that an exit end opens on to a compression chamber formed in a cylinder bore and the exit end is blocked so as to be openable and closable by a suction valve, and a discharge port such that an entrance end opens on to the compression chamber and an exit end is blocked so as to be openable and closable by a discharge valve, and a reed valve is used as the suction valve,

characterized in that the suction valve has a tongue-form arm portion, an outer side form of the arm portion is formed



**LACK OF UNITY OF INVENTION
SHEET B**

Application Number

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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:

by a slit portion formed of one leading end portion , one pair of base portions, and one pair of intermediate portions between the leading end portion and the base portion being provided in a suction valve sheet, an inner side form of the arm portion is formed by an aperture portion of a long hole form extending from a vicinity of a peripheral edge of the suction valve sheet toward a central point side of the cylinder bore being provided between one intermediate portion and base portion of the slit portion of the suction valve sheet and the other intermediate portion and base portion, and the arm portion is such that when comparing a width direction dimension (W1) from an end of the base portion of the slit portion on a side opposite to that of the intermediate portion to a central line of the arm portion that passes through both a central point of the cylinder bore and a central point of the suction port and a length direction dimension (W2) from a position in which a reference line that passes through ends of both base portions of the slit portion on the side opposite to that of the intermediate portion and the central line intersect to an end of the central line on a leading end side of the arm portion , the length direction dimension is greater than the width direction dimension, but approximates the width direction dimension.

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

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5 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.

09-10-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1936195 A1	25-06-2008	EP 1936195 A1	25-06-2008
		JP W02007029366 A1	12-03-2009
		WO 2007029366 A1	15-03-2007
US 4976284 A	11-12-1990	NONE	
US 2015086400 A1	26-03-2015	CN 104454464 A	25-03-2015
		EP 2865893 A2	29-04-2015
		US 2015086400 A1	26-03-2015