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(71) Applicant: **Teikoku Piston Ring Co., Ltd.**
Chuo-ku, Tokyo 103-0028 (JP)

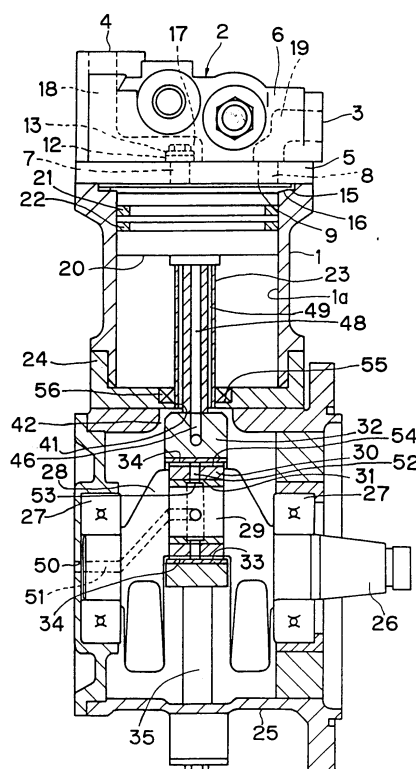
(72) Inventors:
• **Hama, Fujio**
Okaya-shi Nagano-ken 394 (JP)
• **Osaka, Harunobu**
Okaya-shi Nagano-ken 394 (JP)
• **Sakurai, Taketoshi**
Okata-shi Nagano-ken 394 (JP)

(74) Representative: **Davies, Christopher Robert**
Frank B. Dehn & Co.,
European Patent Attorneys,
179 Queen Victoria Street
London EC4V 4EL (GB)

(54) Compressor

(57) In an air compressor of this invention, a piston (20) connects to a crankshaft (26) by means of a cross slider crank mechanism and reciprocates in a cylinder (1). Lubricating oil is supplied to a cooling chamber (60) in the piston by way of oil supply passages (44,45,46,48). Lubricating oil is supplied to the sliding surfaces of the slider (30) and slider frame (32) by way of a crankshaft oil supply passage (51) and a slider oil hole (52). The interior of the cylinder (1) and interior of a crankcase (25) are sealed with an oil seal (56) at the middle section of a piston rod (23). A sliding surface of the slider frame (32) which contacts the slider (30) is chromium plated. The compressor also comprises a suction valve (9) and a discharge valve (12) formed in the cylinder head (2), and additionally a further suction valve (93) and a discharge valve (98) formed in the cylinder base (90) to achieve two suction and discharge strokes per cycle.

FIG.1



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EUROPEAN SEARCH REPORT

Application Number
EP 97 30 7552

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)
Y	US 3 920 098 A (SCHROEDER WALTER) 18 November 1975 * abstract *	1,2,5	F04B39/00
A	* column 2, line 1 - line 14 * * column 2, line 43 - line 64 * * column 3, line 30 - line 55 * * column 4, line 26 - line 42 * * figures 2-4 *	3	
Y	--- US 2 361 316 A (NEWTON JOHN WILLIAM) 24 October 1944 * page 2, column 2, line 51 - page 3, column 1, line 25 * * figure 1 *	1,2,5	
A	--- FR 1 189 751 A (FABIAN HENRI) 6 October 1959 * page 2, column 1, paragraph 10 - page 2, column 2, paragraph 3 * * figures 2-4,7,8 *	1	
X	--- US 2 668 004 A (BROWNE LINDSAY H) 2 February 1954 * column 12, line 55 - column 13, line 2 * * figures 2,8-11 *	4	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	-----	1,3	F04B
-The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 18 February 1999	Examiner Kolby, L
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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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:

1-5



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**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- 5

Combined system for lubrication of guide rods and cooling of piston and Lubrication system for cross slider crank mechanism.

2. Claims: 6-9

Improved cross slider crank mechanism

3. Claims: 10-12

Improved suction/discharge valve

4. Claim : 13

Double acting cylinder

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

EP 97 30 7552

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.

18-02-1999

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3920098 A	18-11-1975	JP 50113805 A	06-09-1975
		DE 2009770 A	16-09-1971
		GB 1320348 A	13-06-1973
		IE 35927 B	07-07-1976
		US 3779672 A	18-12-1973
		DE 2166961 A	23-12-1976
		DE 2166962 A	23-12-1976
		DE 2151566 A	07-09-1972
US 2361316 A	24-10-1944	NONE	
FR 1189751 A	06-10-1959	NONE	
US 2668004 A	02-02-1954	NONE	