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File Number: T 253/89 - 3.2.4
Application No.: 85 112 696.1
Publication No.: 0 180 788
Title of invention: Gear pump or motor

Classification: F01C1/08, F01C21/10

D E C I S I O N
of 7 February 1991

Applicant: Shimadzu Corporation

Headword

EPC Art. 56

Keyword: "Inventive step (no) - a person skilled in the art is not only led by that part of the teaching of a document which is disclosed by its preferred embodiment"

Headnote



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Boards of Appeal

Chambres de recours

Case Number : T 253/89 - 3.2.4

D E C I S I O N
of the Technical Board of Appeal 3.2.4
of 7 February 1991

Appellant : SHIMADZU CORPORATION
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Representative : TER MEER-MÜLLER - STEINMEISTER
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Decision under appeal : Decision of Examining Division 2.3.01.100 of the
European Patent Office dispatched on 17 November
1988 refusing European patent application
No. 85 112 696.1 pursuant to Article 97(1) EPC.

Composition of the Board :

Chairman : C. Andries
Members : M. Hatherly
J.-C. Saisset

Summary of Facts and Submissions

- I. European patent application No. 85 112 696.1, filed on 7 October 1985 was refused by a decision dispatched on 17 November 1988.

The decision was based on Claims 1 to 5 filed with the letter of 4 June 1987.

- II. The reason given for the refusal was that the subject-matter of Claim 1 did not involve an inventive step having regard in particular to the following prior art documents:

D1: EP-A-109 823

D3: GB-A-2 080 424

- III. On 16 January 1989 the Appellant lodged an appeal against the above decision, paying the appeal fee simultaneously. He filed a Statement of Grounds on 28 March 1989.

- IV. In response to communications of the Board, wherein inter alia attention was drawn to document

D2: US-A-2 519 588,

the Appellant submitted new application documents as follows:

Claims 1 and 2 filed with the letter of 21 January 1991.

Description pages 1, 1a and 2 to 18 filed with the letter of 3 August 1990.

Drawings sheets 1/5 to 5/5 filed with the letter of 3 August 1990.

V. Claim 1 now reads as follows:

"A gear pump or motor comprising a pair of gears (3,4) intermeshing with each other in a peripheral casing (5) accommodating said pair of gears, said casing being provided with a layer (15) formed on an inner surface thereof, said casing having a low pressure port (12) and a high pressure port (13), characterised in that said layer (15) is a hard layer formed from a ceramic coating comprising hard ceramic particles (s) within a soft base (b), the gears have a diameter gradually smaller towards the center portion from both ends thereof to provide the optimum clearance between the gears and the casing when high pressure is present by being ground with the hard layer."

VI. The Appellant's written arguments can be summarised as follows:

The inner wall of the housing (casing) of the gear pump disclosed by the document D3 is coated with a bearing layer of soft material ensuring low friction between the gear tips and the housing. Contrary to the view of the Examining Division, the person skilled in the art would have hesitated to incorporate the teachings of document D1, which discloses an abrasive layer preferably on the rotor, in the gear pump according to document D3 since the concept of the latter document is to avoid friction and wear. Even if the person skilled in the art had ignored this contradiction, he would at least have maintained the basic concept of document D3 to make the housing inner wall softer than the rotor i.e. to provide the abrasive layer on the rotor rather than on the housing.

The present invention teaches that it is not a matter of free choice whether the abrasive layer is provided on the inner surface of the housing or on the rotor. Since the rotor is bent and shifted under different operating conditions, a hard rotor would cut away a soft housing inner wall at different positions resulting in excessive wear and leakage. An abrasive housing inner wall, on the other hand, grinds away the rotor tips but itself remains unchanged. The slight bending of the gears under fluid pressure during running-in results in the gears being ground by the housing inner wall to have a smaller diameter at their centres than at their ends. Under operation at high pressure the gears are again bent and a small and uniform clearance is obtained between them and the housing inner wall.

The ideas in the above paragraph have nothing to do with reducing costs by reducing tolerance requirements as considered by document D1 or the reduction of friction and wear underlying document D3. The combination of documents D1 and D3 would not have been considered as a promising possibility by the person skilled in the art and moreover would not have led to the present invention and its underlying problem and solution.

VII. During oral proceedings held on 7 February 1991 the Representative for the Appellant argued the case in more detail.

He agreed that the feature of Claim 1 that "the gears have a diameter gradually smaller towards the center portion from both ends thereof to provide the optimum clearance between the gears and the casing when high pressure is present by being ground with the hard layer" has to be considered as the result of running-in a pump or motor with the remaining technical features of said Claim.

While admitting that Claim 1 of document D1 covers the possibility of an abrasive layer on the housing inner wall, he explained why the person skilled in the art would not have utilised this possibility.

Possible amendments to Claim 1 were discussed in outline, concerning reintroducing the feature of the originally filed Claim 1 of the housing inner wall layer being so hard as not to be cut by the gear tips, deleting the description of the shape of the gears, and restriction to a high pressure gear pump or motor running at different speeds. While formally remaining with Claim 1 filed with the letter of 21 January 1991, the Board agreed to bear these possible amendments in mind when deciding the Appeal.

VIII. The Appellant requested that the decision under appeal be set aside and that a patent should be granted on the basis of the documents as specified in above point IV.

IX. At the end of the oral proceedings, the decision of the Board was announced.

Reasons for the Decision

1. The appeal satisfies Articles 106 to 108 and Rule 64 EPC and is therefore admissible.
2. **Amendments**

The question arose whether the subject-matter of the application has been extended by the present Claim 1 omitting the feature of the originally filed Claim 1 of the "hard layer being made of a material to be as hard as

not to be cut by cog tips of said pair of gears". However this question need not be further considered by the Board since the answer thereto would not affect the finding set out in section 7 below that the subject-matter of the present Claim 1, even if amended to include said feature, lacks an inventive step.

3. **Novelty**

The Board is satisfied that none of the cited documents discloses a gear-type pump or motor having all the features set out in Claim 1, in particular none of them discloses a gear-type pump or motor whose casing is provided on an inner surface thereof with a hard layer formed from a ceramic coating comprising hard ceramic particles within a soft base. Thus the subject-matter set forth in Claim 1 is to be considered as novel within the meaning of Article 54 EPC.

4. **Closest prior art**

The Board considers the most relevant state of the art to be a conventional rotary-piston gear-type machine (pump or motor) comprising a pair of gears intermeshing with each other in a peripheral casing accommodating said pair of gears, said casing having a low pressure port and a high pressure port.

5. **Problem and solution**

5.1 In the technical field of rotary-piston machines the problems of efficiency and sealing are well known and are related to the clearances existing between the rotors and the casing. According to the present description, the problem to be solved by the claimed invention is to provide an improved gear-type pump or motor with a high capacity and a good oil sealing efficiency.

6. Inventive step

6.1 In examining whether the subject-matter of Claim 1 involves an inventive step the question to be answered is whether the prior art would give the skilled person any indication as to how the sealing of the commonly known gear-type rotary piston machine should be made such as to arrive at the subject-matter claimed in Claim 1.

6.2 Document D1 discloses clearance-controlling means in a rotary piston machine having a housing with a circumferential surface and a rotor with radial lobes cooperating with said circumferential surface.

According to Claim 1 of this document D1, as well as according to page 2, lines 10 to 17 of the description the means which define cooperatively the interface with a single, uniform clearance between the cooperating elements consist of a pair of layers, one layer comprising an abradable material and one layer comprising an abrasive material (silicon carbide abrasive particles in a polymer base), one of that pair of layers is fixed to said lobe, whereas the other is fixed to said surface.

Document D1 therefore teaches a machining of a coating (layer) on one of two confronting surfaces to achieve an optimum clearance therebetween (cf. page 7, lines 17 to 19). This teaching clearly includes, according to the Board, a first possibility of providing an abrasive layer on the housing surface with an abradable layer on the lobes, as well as a second possibility of providing an abrasive layer on the lobes and an abradable layer on the surface.

Although it is true, as put forward by the Appellant, that the Figures and their corresponding description only disclose a machine having abrasive materials on the rotors and abradable material on the housing, the Board nevertheless considers that the teaching of document D1 as a whole is sufficiently clear for a skilled person and covers both the above defined possibilities. Moreover, for a person skilled in the art there was no technical prejudice to overcome when taking into consideration the possibility which was not shown in the drawings, since in the same technical field it was already known, in order to obtain a minimum of clearance, to use blades (rotor) having a hardness less than the hardness of liner plates (stator), disposed inwardly of the side and end housing walls, so that the surfaces of the rotor coming into contact with the liner plates are cut or worn away by these abrading housing walls (document D2, column 1, lines 9 to 12 and 18 to 35; Claim 1).

- 6.3 The Representative agreed during the oral proceedings that the possibility of an abrasive layer on the housing is covered by Claim 1 of document D1 but argued that the person skilled in the art would not have been led to this possibility. Firstly he stressed that the preferred member to carry the abrasive layer is the rotor, see e.g. the abstract, page 5, line 29, 30, page 7, line 21 and Fig. 1. Secondly the object of document D1 is to overcome the disadvantage set out in paragraph 2 of page 1 of said document of the rotary element being soft. Moreover Fig. 1 shows part of the periphery of each rotor 16, 18 as being abrasive and part as being abradable. He maintained that various passages in the document D1, which would otherwise seem to have led the person skilled in the art towards providing an abrasive layer on the housing, had to be read in the light of the above arguments.

6.4 Reading one of these passages, namely paragraph 2 of page 2, with Fig. 1 in mind, the person skilled in the art would have learnt, in the view of the Appellant, to provide:

- as a first alternative, abradable material on the stationary housing surface with abrasive material on the mating, engaging or confronting surfaces i.e. on the rotors, and
- as a second alternative, abradable material on the rotating surface with abrasive material on the surfaces mating, engaging or confronting the abradable material, this abrasive material being provided on part of the periphery of each rotor to coact with the abradable material on part of the periphery of the other rotor, there thus being no abrasive material on the housing surface.

What is shown in Fig. 1 corresponds to this second alternative, there is abradable material on the stationary surface and part of the rotating surface i.e. on both the rotating surface and the stationary surface.

The paragraph under consideration however states that the abradable material is provided "on one of the surfaces, either the rotating or the stationary one" and does not state that the abradable material is provided on both the rotating and stationary surfaces. The Board considers that, because of these words "one", "either" and "or" and because of the absence of the word "both", the person skilled in the art would not have interpreted the second alternative in the way argued by the Appellant but instead in the more straightforward way of abradable material on the rotating surface (rotor) and abrasive material on the

stationary surface (housing) or vice versa. This interpretation is furthermore clearly supported by the wording of Claim 1.

- 6.5 If a claim of a prior art document were to cover a large number of possibilities in rather vague terms with only one of these possibilities being the subject of a preferred, clearly defined, embodiment, then it might well be unreasonable to expect a person skilled in the art, without needing to use inventive skill, to utilise one of the other possibilities. However the Board considers that each of the two possibilities covered in Claim 1 of document D1 would have been immediately understandable to a person skilled in the art, and that accordingly he would have been led to try both these possibilities, even though only one possibility is described in concrete terms in the document. The Board furthermore cannot see technical difficulties when putting that possibility into practical application. The person skilled in the art thus would not need to exercise inventive skill to use the second possibility of a layer of abradable material on the lobe and a layer of abrasive material on the housing.
- 6.6 The clearance controlling concept of document D1 is applicable in general to a machine having a rotary element in general and in particular to a pump or motor, see page 2, line 4.
- 6.7 In the opinion of the Board, the person skilled in the art, looking to improve efficiency and sealing of a conventional gear-type pump or motor (cf. section 4 above) and knowing that efficiency and sealing are dependent on the clearances existing between housing and rotors, would have considered the teaching of document D1. For the reasons set out above, he would have found it obvious for

clearance control to provide a known layer of abrasive silicon carbide in a polymer base on the housing of the pump or motor. Operation of the resultant gear-type pump or motor would cause the gears to be ground by the abrasive housing layer. The pressure difference during high pressure operation from one side of each gear to the other side causes the centre of the rotational axis of the gear to move towards the low pressure port. Necessarily the result is that a greater amount of material is ground from the centre portion of the gear than from the end portions thus making each gear have a diameter gradually smaller towards the center portion from both ends thereof to provide the optimum clearance between the gears and the casing when high pressure is present.

While it is true that the pump or motor according to Claim 1 avoids the disadvantage of a hard rotor cutting away a soft housing inner wall at different positions, due to the rotor being bent and shifted under different operating conditions, this avoidance is the necessary and logical result of the obvious application of the teaching of document D1 in a conventional gear-type pump or motor. The fact that the Appellant recognised that one known possibility is better than the other known possibility does not make the better possibility a non-obvious one. The Board has therefore concluded that said application of the teaching of document D1 was obvious to the person skilled in the art and finds that the avoidance - consequent on said application - of a disadvantage cannot change said conclusion of obviousness.

- 6.8 Thus the subject-matter of Claim 1 does not involve an inventive step in the sense of Article 56 EPC and therefore is not patentable.

7. Amending Claim 1 as discussed in outline in the oral proceedings - see section VII above - would not result in it having inventive subject-matter since the housing inner wall layer of silicon carbide disclosed in document D1 is also so hard as not to be cut by the gear tips, the shape of the gears is merely the necessary result of running-in a pump or motor with the remaining technical features of the Claim, and the teachings of document D1 were obviously applicable to known high pressure gear pumps running at different speeds.

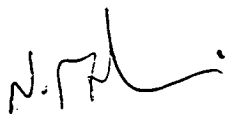
8. Since Claim 1 is unallowable, the sole request by the Appellant on file has to be rejected. Therefore the Board sees no need to examine the other claim (cf. Decision T 162/88 of 9 July 1990, unpublished, second paragraph of point 5 and first paragraph of point 6).

Order

For these reasons, it is decided that:

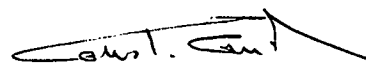
The appeal is dismissed.

The Registrar:



N. Maslin

The Chairman:



C. Andries

