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THE EUROPEAN PATENT  
OFFICE

49  
CHAMBRES DE RECOURS  
DE L'OFFICE EUROPEEN  
DES BREVETS

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File No.: T 0555/91 - 3.3.2  
Application No.: 85 115 335.3  
Publication No.: 0 185 980  
Classification: C01B 13/02  
Title of invention: Oxygen enriching apparatus

**D E C I S I O N**  
of 5 May 1993

Applicant: Teijin Limited

Proprietor of the patent:

Opponent:

Headword: Oxygen enrichment/TEIJIN

EPC: Articles 56, 83, 84

Keyword: "Clarity - yes"  
"Adequate disclosure - yes"  
"Inventive step - yes - non-obvious modification -  
long-felt need"

**Headnote**  
**Catchwords**



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Beschwerdekammern

Boards of Appeal

Chambres de recours

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Case Number: T 0555/91 - 3.3.2

**D E C I S I O N**  
of the Technical Board of Appeal 3.3.2  
of 5 May 1993

**Appellant:** Teijin Limited  
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**Decision under appeal:** Decision of the Examining Division of the European  
Patent Office dated 5 February 1991 refusing  
European patent application No. 85 115 335.3  
pursuant to Article 97(1) EPC.

**Composition of the Board:**

**Chairman:** P.A.M. Lançon  
**Members:** I.A. Holliday  
E.M.C. Holtz

## Summary of Facts and Submissions

I. European patent application No. 85 115 335.3, filed on 3 December 1985 and published under No. 0 185 980 was refused by a decision of the Examining Division for failure to comply with Articles 84 and 56 EPC.

Claim 1 refused by the Opposition Division concerns an apparatus for enriching air with oxygen. The claim has been modified slightly during the appeal proceedings (see IV below).

II. The grounds for the refusal was that in the absence of any information about the size and the relative position of the casing and of the sound-proof box, the skilled person could not perform the invention (Article 84 EPC).

Moreover, since the only function of each individual feature of Claim 1 was to reduce the noise of the oxygen enriching apparatus and corresponding constructions for silencing were well-known from document (1) US-A-4 174 955, document (2) GB-A-2 104 409 and an article in document (3) "L'isolation acoustique et thermique dans le batiment" by C. Rougeron, Ed. Eyrolles, Paris (1977), it would be obvious to combine the known features in order to deaden the sound more effectively (Article 56 EPC).

Although the description of the application included tests relating to the number of bends in the air exhaust passage and the ratio in length of the air exhaust passage and the air intake passage, in the absence of a definition of the geometrical form of the partition plates in the passages, an inventive step could not be based on the reference to such bends in Claim 1.

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III. The Appellant lodged an appeal against this decision. The arguments of the Appellant, both in the written procedure and at the oral proceedings held on 5 May 1993, may be summarised as follows.

It was not possible to derive from the cited prior art the inventive concept that all moving parts which would generate noise were to be accommodated in a sound-proof box which is solely connected to the outer casing by air intake and air exhaust passages. Document (3) disclosed the possibility of further improving sound insulation by providing a plurality of partition plates in an exhaust shaft. This prior art, however, was concerned with sound insulating techniques in buildings. In contrast to the large dimension of buildings referred to in (3), it was evident from commercial literature - presented during the oral proceedings - concerning products of the present application, eg. the "Mild Sanso" TO 40 and "High Sanso" TO 90 apparatus and products manufactured in accordance with document (1), eg. the "Model OE-3A", that typical physical dimensions of a membrane-type oxygen-enriching apparatus were restricted to dimension of the order of 0.35 x 0.8 x 0.4 meter width x height x depth and of about 50 kg weight. There was a need for such size and weight restrictions in order to operate the apparatus at the patient's bedside and to ensure ease of movement. Moreover, in the light of the prior art, the skilled person would expect a significant sound deadening effect only when drastically increasing the number of bends in an exhaust passage which would inevitably result in an unwanted increase of both size and weight. It was therefore unexpected that the claimed equipment could achieve a sound deadening effect to below 40 dBA starting from the 45 dBA level of the apparatus according to (1) whilst retaining similar dimensions. A graph of the test values of Table 1 of the application documents as originally filed showed the surprising effect that the noise

level could be reduced drastically when increasing the number of corresponding bends from 4 to 6.

In answer to a question during the oral proceedings, the Applicant assured the Board that experiments has been carried out with other configurations of partition plates. In each case a marked diminution of noise was obtained by forming bends at five positions.

Even in 1971, well before the priority date of document (1) and that of the present application, those skilled in the art were aware of the desirability of reducing the noise level of medical instruments below 40 dBA. However, the inventors of (1), faced with the same problem on which the present application is based, could not realize a lower value than 45 dBA. This could also be regarded as a further indication for the presence of an inventive step.

The Appellant also refuted the clarity objection raised by the Examining Division.

IV. Claim 1 submitted during the oral proceedings before the Board reads as follows:

"1. An apparatus for enriching air with oxygen comprising:

an outer casing having an intake opening and an exhaust opening for the atmospheric air;

an oxygen enriching system accommodated in said outer casing for supplying oxygen enriched air to a predetermined outlet port, said oxygen enriching system including oxygen enriching means, a motor-driven pumping means causing said oxygen enriched air to be conveyed out of said oxygen enriching means and via pipe means toward said predetermined outlet port, and fan means for causing a flow of

said atmospheric air generally directed from said intake opening toward said exhaust opening;

a soundproof box for defining an impervious-to-sound chamber in which said motor-driven pumping means and said fan means are accommodated and having an inlet port and a separate outlet port for permitting said atmospheric air to flow through said box and thereby cool said motor-driven pumping means and said fan means;

an air intake passage formed within and extended in said outer casing for restrictively permitting said atmospheric air to flow from said intake opening to said inlet port, said intake passage being subjected to bending at at least five positions lined with a sound absorbing member; and

an air exhaust passage formed within and extended in said outer casing for restrictively permitting said atmospheric air to flow from said outlet port of said soundproof box to said exhaust opening, said air exhaust passage being defined by a plurality of partition plates arranged to form bends at at least five positions, each of said partition plates being lined with a sound absorbing material."

- V. The Appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of Claims 1 to 16 as submitted during the oral proceedings.

**Reasons for the Decision**

- 1. The appeal is admissible.
- 2. There are no formal objections to the present claims under Article 123(2) EPC since they are supported by the original disclosure. Thus, Claim 1 represents a

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combination of Claim 1 as originally filed and the description on page 11, lines 32 to 34 as well as on page 14, line 35 up to page 15, line 1; dependent Claims 2 to 15 correspond to dependent Claims 2 to 15 as originally filed and dependent Claim 16 is based on the description on page 8, lines 25 to 32 and on page 14, line 35 up to page 15, line 1 as well as Figure 1 as originally filed.

3. The claims as amended are clear, concise and supported by the description and no objection under Article 84 EPC arises.
4. However, the objection put forward by the Examining Division that the skilled person could not perform the invention, although mentioned under Article 84 EPC, raises a question of whether the requirements of Article 83 EPC, that the invention must be disclosed in a manner sufficiently clear and complete to be carried out by a person skilled in the art, have been complied with.
  - 4.1 For the purpose of Article 83 EPC the European patent application - in other words the description **and** the claims - must be considered as a whole. In the present case, the Board is convinced that with reference to the description, in particular page 4, line 34 up to page 5, line 8, "SUMMARY OF THE INVENTION" and the drawings showing preferred embodiments of the invention, there is no doubt for a person skilled in the art that the subject-matter presently claimed relates to an oxygen enriching apparatus suitable for medical purposes which apparatus can be operated at the patient's bedside. Furthermore, having regard to the commercial literature referred to above, it is clear that the physical dimensions, in other words, the order of magnitude of size and weight of such an apparatus would be known for those skilled in the art. Taking into account this common general knowledge concerning the special conditions for the medical use of the oxygen enriching apparatus, Figures 1 and 5 in particular of the present patent

application disclose in a clear and complete manner as required by Article 83 EPC the arrangement of the oxygen enriching system, the sound-proof box as well as the air intake and air exhaust passages in relationship to the outer casing. Accordingly, there is no need for further definitions or an additional explicit description to enable those skilled in the art to construct the claimed apparatus.

5. None of the prior art documents cited in the European Search Report discloses all the features of present Claim 1 of the application. Novelty of the subject-matter can accordingly be acknowledged. In any event, the Examining Division did not dispute novelty.
6. The application concerns an oxygen enriching apparatus suitable for medical purposes. The preferred embodiment of the invention is a membrane separation type oxygen enriching apparatus.
  - 6.1 The closest state of the art is document (1) which is also concerned with an membrane oxygen enricher apparatus. It is to be noted that (1) discloses all the structural features of Claim 1 of the present application except that the circulating fan for causing the flow of nitrogen-rich air through the exhaust passage is located in an outlet slot in the top of a housing forming a kind of soundproof box for the vacuum pump, and that the exiting sound waves undergo right angle turns in an exhaust passage formed only by the special arrangement of the membrane stack box and said housing for the vacuum pump. The arrangement requires "any exiting sound waves from the vacuum pump to undergo at least two right angle turns and to travel in non-planar directions prior to exiting from the apparatus". It is furthermore clearly indicated that the "airborne pump and fan noise must go through sound absorbing 180° turns both in the inlet and exhaust without the addition of sound baffles" and that "the long airway paths and 180° turns accomplished by the cabinet configuration effectively isolate both the vacuum



pump and the circulating fan and naturally attenuate their noise". The air intake passage has bends in at least four positions whereas the air exhaust passage defined by the membrane stack box and the housing for the pump is arranged such as to form at least two bends. This prior art apparatus provides a unit which operates at a noise level about 45 dbA (cf. col. 2, lines 18 to 24, lines 50 to 54 and 62 to 64; col. 5, lines 10 to 17 and 32 to 34; col. 7, lines 33 to 48 and col. 8, lines 12 to 17 as well as Figures 4 and 5 in combination with the corresponding explanations in the description and Claim 12).

- 6.2 According to the Appellant's submissions in course of the proceedings supported by the above mentioned trade literature presented during the oral proceedings, from the medical point of view the 45 dbA noise level is still too high and a noise reduction below 40 dbA at the patient's bedside is desirable.
  
- 6.3 In the light of the said prior art, taking into account in particular the necessity to operate the apparatus at the patient's bedside and to ensure ease of movement, the technical problem to be solved by the application can be seen in providing an apparatus having a significantly reduced noise level whilst maintaining a size and weight of the same order (cf. also description of the application page 4, line 35 up to page 5, line 8).
  
- 6.4 The problem is solved by the apparatus defined in present Claim 1. Having regard to the test results according to **Table 1** of the application and the above mentioned commercial literature showing operating noise specifications of 35 dBA and 38 dBA for the "Mild Sanso" TO-40 and "High Sanso" TO-90 respectively, each apparatus as presently claimed, the Board is satisfied that the problem has been plausibly solved.

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7. It remains to consider whether or not the said solution satisfies the requirements of Article 56 EPC in respect of inventive step.

7.1 As indicated above, one of the technical problems underlying (1) is also to reduce the noise level of the vacuum pump for the oxygen enriched air stream and the fan for the nitrogen enriched air stream supplied by an oxygen enricher system of the membrane type. Having regard to the teaching of this prior art, it is clear to those skilled in the art that the attenuation of sound waves travelling through passages defined by fixed walls depends *inter alia* on the fact whether or not such waves undergo reflections and absorption. It is furthermore common general knowledge that the attenuation of sound waves depends on the absolute distance from the noise source and thus the noise level decreases when the length of a defined passage is increased. Having regard to the fact that the physical dimensions of an oxygen enricher apparatus as described in (1) is predetermined to make the unit suitable for bedside medical use, a further reduction of noise appears to be only possible by modifying the existing air passages such that the absolute length of the passage is maintained. Although document (1) mentions the possible use of sound baffles, it is stated to be one of the advantages of the claimed apparatus that noise attenuation is achieved without baffles and "excessive sound coating" (col. 8, lines 12 to 17).

7.1.1 *Prima facie* it appears that by merely providing a plurality of partition plates forming a zigzag flow path the envisaged reduction of the noise level could be easily achieved. Taking into account, however, that the attenuation of noise follows a logarithmic scale, the skilled person would immediately recognize that a considerable number of additional plates would be required. Even if the resulting increase of weight of the apparatus were acceptable to the skilled person, it is also generally known that the desired attenuation effect

would inevitably be accompanied by an increase of the flow resistance of air in the passages which, as a further consequence, would require the provision of a more powerful fan. Apart from the fact that the inclusion of a bigger fan is also detrimental to the weight restrictions of a portable apparatus for medical use, the heat dissipated by a fan normally depends on the input power of the motor. Increased heat would have a negative influence on the oxygen enriching rate of the membrane system. On the basis of simple thermodynamical calculations, it is evident that any temperature increase in the oxygen enriching system results in a much lower oxygen concentration (cf. present application page 3, lines 14 to 18).

7.1.2 On the basis of the disclosure of document (1) the skilled person could have envisaged the installation of partition plates in the exhaust passage to further reduce the noise generated from the moving parts of the apparatus, i.e. the pump, and the fan. However, in the light of the above mentioned cumulative disadvantages, he would have had no good reason to adopt such measures. It must therefore be concluded that he would not have done so in the present circumstances. The above discussed technical background could well explain why the inventors of (1) solved the sound attenuation problem without the use of baffles in the air passages.

7.1.3 Analogous reasoning applies to the question whether or not it would have been obvious to accommodate both a high power fan and the pump of the air enriching apparatus described in (1) together in the same soundproof box when simultaneously modifying the air exhaust passage in such a way that the flow resistance of the air stream is increased. Considered in isolation it could be argued that the absorption of sound energy by surrounding the noise source with impervious-to-sound walls must be regarded within the scope of the common general knowledge even to the public and that the corresponding feature in present Claim 1 appears to be a trivial and self evident

measure. However, having regard to the serious heat dissipation problems in a housing with soundproof coating means and taking into account the sensitivity of the oxygen enriching system to increased temperature and a consequent risk of the malfunction of a life-preserving system for the patient, there would have been no good reason for the skilled person to adopt such a measure.

7.2 Document (2) also describes a machine for concentrating the oxygen in air, especially for medical purposes utilizing a pressure swing adsorption (PSA) technique. The said machine includes a combination of features to provide an extremely lightweight reliable and compact device, which operates at a low noise level and is especially suited for home use.

7.2.1 As a general teaching reference is made to sound deadening by a tuned effect from pipes of predetermined length and diameter and the special arrangement of the parts such that there is no straight line or line-of-sight exit of the sound to the outside. In other words, the sound is required to make many bounces which absorb sound energy before it reaches an opening in the cabinet of the apparatus. Particular attention is drawn to the air compressor accommodated in a soundproof housing. Thus, the process air inlet passage is formed by a relatively small hose located in a separate chamber which hose is joined to a larger diameter hose extending to the compressor inlet.

7.2.2 The fan which drives the cooling air in a tortuous path around the various paths of the equipment through the machine and in particular over the compressor is accommodated in a separate chamber mounted on a vertical wall belonging jointly to said compressor housing and said separate chamber. It is further indicated that this special arrangement of the fan is a substantial blockage to sound from the compressor exiting through louvres.

7.2.3 There is not the slightest hint in this document that the air exhaust passage might be defined by partition plates arranged to form bends or that the fan together with the compressor might be accommodated in the same soundproof box. The preferred embodiments show a flow path of the exhaust passage behind the fan such that the cooling air, without any bending exits the cabinet of the apparatus through louvres, cf. page 1, lines 28 to 33, lines 49 to 56; page 2, lines 26 to 62; page 4, lines 8 to 26 and page 5, lines 29 to 66 as well as Figures 3, 6 and 7. Accordingly, this prior art does not contain any technical information extending beyond the disclosure of document (1).

7.3 Document (3) merely relates to common general knowledge about the physics of sound attenuation and its application to buildings. The equations on pages 204 and 205 represent a quantitative approach to the effectiveness of noise reducing means such as irregular paths having several right angle turns or bouncing of sound waves and allow on the basis of a simplified model a calculation of the expected attenuation in the decibel scale. Figure 13.6 on page 207 shows a ventilation system for buildings; baffle plates "chicanes" are arranged in the air passages. The overall physical dimensions of this system and the specific arrangement of the parts of the equipment - in particular the air intake passage, ventilator and exhaust shaft do not form an integrated system [unit] as presently claimed - make it in no way obvious to arrange partition plates in the air exhaust passage of an oxygen enriching system as disclosed in (1) or (2) having a totally different function. This prior art comprises therefore no specific link to the particular problems associated with medical equipment.

7.4 In summary, although the individual features of Claim 1 of the application may seem trivial and obvious, the prior art as represented by (1), (2) and (3), gives the skilled person no incentive to combine the said features to arrive at the claimed solution to the problem defined

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above. The Appellant has made it credible that the feature distinguishing the presently claimed subject-matter from the prior art, namely the reduction of noise generated in particular by the pump and fan to a value below 40 dBA achieved by a critical number of bends at five positions defined by a plurality of partition plates, does not depend on the absolute geometrical arrangement of the air passages within the apparatus.

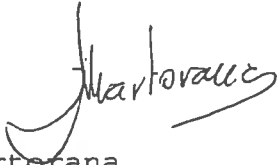
- 7.5 It is also pertinent to consider the fact that even in 1971, a long period before the priority date of document (1) and that of the present application, those skilled in the art recognized the necessity of reducing the noise level of medical instruments to below 40 dBA. However, the inventors of (1), faced with the same problem as that underlying the present application, were not able to achieve a lower value than 45 dbA. The satisfaction of such a long felt need is further evidence in favour of inventive step.
  
8. It is accordingly the Board's view that the subject-matter of Claim 1 would not be obvious from either citation taken singly or in combination. Thus, the required inventive step is not lacking and Claim 1 together with dependent Claims 2 to 16 satisfy the requirements of Article 56 EPC.

Order

For these reasons, it is decided that:

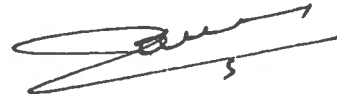
- 1. The decision under appeal is set aside.
- 2. The case is remitted to the Examining Division with the order to grant the patent on the basis of Claims 1 to 16 as submitted during the oral proceedings and an adapted description.

The Registrar:



P. Martorana

The Chairman:



P.A.M. Lançon

