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File Number: T 366/89 - 3.2.2
Application No.: 82 305 700.5
Publication No.: 0 078 658
Title of invention: A process for moulding glass shapes

Classification: C03B 11/08, C03B 23/00, C03C 3/12

DECISION
of 12 February 1992

Applicant: CORNING GLASS WORKS

Opponent: SCHOTT GLASWERKE
N.V. PHILIP'S GLOEILAMPENFABRIEKEN

Headword:

EPC Article 56

Keyword: "Isolated old document and a present trend"
"Combination of documents unobvious - Inventive step (yes)"

Headnote



Case Number : T 366/89 - 3.2.2

DECISION
of the Technical Board of Appeal 3.2.2
of 12 February 1992

Appellant :
(Proprietor of the patent)

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Decision under appeal :

Decision of Opposition Division of the European
Patent Office dated 05.04.89 revoking European
patent No. 0 078 658 pursuant to Article 102(1)
EPC.

Composition of the Board :

Chairman : G.S.A. Szabo
Members : J. Du Pouget De Nadaillac
L.C. Mancini

Summary of Facts and Submissions

I. The appeal is directed against the decision of the Opposition Division dated 5 April 1989 revoking the European Patent No.0 078 658 (patent application No. 82 305 700.5) on the ground that the subject-matter of the granted Claim 1 does not involve an inventive step in view of the following patent publications:

D2: DE-A-2 639 259 and D9 : DE-C-501 283

In the Opposition proceedings, in which two Opponents were involved, additional documents were cited, i.e. inter alia,

D1: WO-A- 82/03261

D5: US-A-3 833 347

D6: US-A-3 844 755

D10: GB-A-1 367 335, and

D14: The table "Typische Temperaturen von Glas" published in the German periodical GIT (1963), Vol.12 with an associated legend sheet.

II. The Appellant (Patentee) lodged an appeal on 1 June 1989 and filed on 4 August 1989, together with his Statements of Grounds, a new Claim 1.

III. This Claim 1 reads as follows:

"A process for moulding a precision optical element which does not require grinding or polishing which comprises the following steps:

a) a glass preform (9;26) is prepared having an overall geometry closely similar to that of the desired final product and wherein the glass preform is shaped to

minimise trapping of gas in the cavity in which it will be moulded;

b) a mould (1,2;20,21) is prepared having the precise internal con-figuration to impart the desired geometry to the final product;

c) said preform is exposed to a temperature at which said glass exhibits a viscosity within the range of from 10^8 to 10^{12} poises (10^7 to 10^{11} Pa.s);

d) said mould is exposed to a temperature at or in the vicinity of that of said preform;

e) with said preform in said mould while said preform is within said viscosity range, a load is applied to said mould for a period of time sufficient to bring said mould and said preform, in at least the vicinity of said mould, to approximately the same temperature and to shape said preform into conformity with said mould;

f) said glass shape is removed from said mould at a temperature where said glass exhibits a viscosity of less than 10^{13} poises (10^{12} Pa.s); and thereafter

g) said glass shape is annealed."

- IV. In response to a communication of the Board, the Appellant filed on 9 August 1991 an amendment concerning the description. Respondent 01 sent new arguments.
- V. Oral proceedings were held on 12 February 1992. Respondent 02, duly summoned to these proceedings, had informed the Board on 12 September that he would not attend them.
- VI. The Appellant's arguments set forth in his written and oral statements can be summarised as follows:

Previous to the present invention the only successful attempt to avoid the final step of a method for moulding glas shapes, namely the polishing and grinding steps, consisted in using special mould surfaces and in pressing

a glass blank or preform which is heated to a temperature above the softening point. Document D2 is an example of this prior art. Document D1, published after the filing date of the contested patent, shows another approach, but even there, the preform is heated to above the softening point of the glass. Document D9, which is a very old document, appears to be an isolated attempt, which has been ignored by the state of the art. This approach goes in the opposite direction to the one of document D2. Starting from the teaching of document D2, the skilled man had no incentive to revert to the disclosure of document D9. It is therefore quite inappropriate to combine these two documents. Moreover, document D9 does not teach that the polishing and grinding steps could be avoided, that a preform should be used, and that the removal of the glass shape should take place at a temperature according to feature (f) of Claim 1.

VII. The Respondent O1 argued, on the other hand, as follows:

It is well known that there are disadvantages with high pressures, for example the glass breaks. To avoid such pressures and consequently to use low viscosities was the trend solely for economical reasons. The fact that document D2, following this trend, teaches the use of low viscosities and pressures does not necessarily imply that the use of high pressures goes in a different direction. The man skilled in the art knew well that high viscosities could be used and, also, that the glass would not stick to the mould surfaces at the elevated ranges of viscosities, see document D9. However, in this case, only two possibilities are available: either high pressures are used with the above mentioned disadvantage, or, if the pressure cannot be increased, the time for the moulding would have to be prolonged. The present invention follows the second alternative, since, in fact, it discloses a

two-step method: first, (feature a) a preform has to be provided, its shape being as near as possible to that of the wanted lens (it is well known that, if a perfect lens is desired, the surface finish of the lump should almost already have the wanted surface of the finished lens), and, secondly, at a following stage, the moulding method itself according to Claim 1 is applied (features b to g).

The manufacturing of a preform according to feature a) is itself a time-consuming step, so that it is clear that a whole method having this step necessitates a long time. Then, the method according to Claim 1 is only the consequence of logical reasoning, since the object was to reduce the time of the process. This is only possible by reducing the cooling time, which implies that elevated temperatures had to be avoided. Thus, high viscosities were to be used anyway, and the glass shape removed as soon as possible from the mould.

In document D9, the given temperature range for the moulding step corresponds exactly to the claimed viscosity range of the contested patent. The purpose of producing lenses without defects, in particular by reducing the grinding step as far as possible, is clearly mentioned in this prior art (see page 2, lines 62-69), so that the combination of documents D2 and D9 is quite appropriate. Moreover, the removing step is also suggested in document D9 (cf. page 2, lines 55-58). Indeed, no preform appears in the method according to document D9, but this feature was already known from document D2, the nearest prior art. Having regard to the possibility of using a wide range of mould materials, the present invention does not maintain the high requirements of document D2 with respect to the lifetime of the moulds and actually requires higher pressures or longer pressing times, which are then detrimental to the lifetime of the moulds. It is obviously

possible to change processing conditions under such circumstances.

VIII. The Appellant requests that the decision under appeal be set aside and that the patent be maintained on the basis of :

- Claim 1 submitted on 7 August 1989 ;
- Claims 2 to 9 as granted;
- Description as granted, with the exception of column 4, lines 58 to 61, which are partially deleted as submitted on 9 August 1991, and
- Figures as granted.

The Respondent requests that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.
2. Admissibility of amendments (Article 123 EPC)

The present Claim 1 differs from the Claim 1 of the patent as granted,

- firstly by replacing, in the first lines, the words "by moulding a glass shape" by the wording "by moulding a precision optical element which does not require grinding and polishing"; and
- secondly, by complementing feature a) by the following step : "and wherein the glass preform is shaped to minimise trapping of gas in the cavity in which it will be moulded".

The first amendment finds support in the description as filed on page 2, lines 9-13, in combination with page 6, lines 6-12. The second amendment has its basis in said

description on page 7, lines 25-27. The change made in the description results from this second amendment, which claims only one of the two previously described ways of minimising the trapping of gas. Thus, the second one was deleted to avoid a discrepancy between the claim and the description.

There is therefore no objection under Article 123(2) EPC. Since the amendments brought in Claim 1 restrict the scope of the granted Claim 1, the requirements of Article 123(3) are also met.

3. Novelty

The novelty of the subject-matter of Claim 1 was not really contested during the oral proceedings. Document D1, which only constitutes a state of the art within the terms of Article 54(3) EPC, discloses a method for moulding a lens, in which the core and the surface layer of said preform are heated to different temperatures and reach consequently different viscosities. Once the glass preform has been pre-heated to a temperature chosen so that it is within a range in which the glass exhibits a viscosity of from 10^{13} to 10^{15} poises, the preform is placed in the mould and only its surface is heated by irradiation, e.g. laser beams, which bring this surface between the temperature already reached and a temperature at which the glass has a viscosity of 10^6 poises. In the patent in suit, the whole glass preform is brought to the claimed range of viscosities.

Moreover, since none of the other cited documents discloses a method according to Claim 1, the subject-matter of this claim is therefore novel within the meaning of Article 54 EPC.

4. Inventive step

4.1 The method disclosed in document D2 represents the closest prior art. This document refers to the documents D5 and D6, expressly indicating that its teaching concerns an improvement of the method for moulding lens, which is disclosed in these other documents. Document D2 is consequently considered as implicitly containing the teaching of these two previous documents. The original known method, from which document D2 starts, had the same object as the present invention, namely the manufacture of perfect glass lens by a moulding operation without the necessity of subsequently grinding or polishing the end product.

In one embodiment, described in document D2, the method uses a blank which is preferably preformed. The blank must be shaped to fit within the moulding chamber of the mould, so that it has the precise configuration imparting the desired geometry to the final product. Once the preform is placed within said chamber, the mould is heated to outgas the moulding chamber and to "soften" the glass, which means that the glass has to exhibit a viscosity of $10^{7,6}$ poises or less. The mould and the glass are brought to the same temperature and a load is applied to said mould for a period of time sufficient to shape said preform into conformity with said mould. The temperature of the mould is then reduced, so that the glass is cooled to below its transformation temperature, which implies a viscosity of more than 10^{13} poises. Finally, the glass shape is removed from the mould. According to document D5, the annealing step is unnecessary, when a preform is used.

Documents D5 and D6 have tried to improve this method by recommending a better material, namely glasslike carbon,

for the internal mould surfaces in order to avoid the usual sticking of the heated glass to them and to eliminate the tendency to reproduce the grain structure of the metal molding surfaces. Document D2 goes further in this direction by teaching the use of other selected materials, namely silicon carbide or silicon nitride.

4.2 It follows from the discussion of the prior art during the oral proceedings that the problem underlying the present invention lies in the provision of a new method which has the same aim as that of document D2, namely to manufacture a perfect precision optical element by moulding without the grinding and polishing step, however in a different manner and irrespective of the use of a material which is known for such moulding surfaces.

4.3 The solution according to the opposed patent consists in heating the preform, so that its viscosity lies within the range of from 10^8 to 10^{12} poises (feature (c) of Claim 1), in removing the glass shape, once moulded, from said mould at a temperature where said glass exhibits a viscosity of less than 10^{13} poises and thereafter in annealing said glass shape (features (f) and (g)).

4.4 In view of the examples given in the patent in suit showing the use of various materials for the mould surfaces, the Board has no reason to doubt that the object of the present invention is achieved. The results given in the description have not been disputed by the Respondents. The objections of Respondent 01, that the present invention could show disadvantages, like the need of high pressures and long times for the moulding, particularly at the upper limit of the viscosity range, or that it is time-consuming in view of its prerequisite of a precise preform, or even that the contested invention does not have the high requirements of the previous prior art

regarding the lifetime of the moulds, are not relevant, since Claim 1 is directed to the moulding method per se and not to what happens before or afterwards and since non-obviousness is not necessarily dependent on advantages. It may be that the claimed method shows disadvantages vis-à-vis the method according to document D2, requiring for example higher pressures or greater pressing times, but these are not circumstances which render the invention obvious. That there is provided a new method of manufacturing lenses having almost the same qualities as those obtained by the method according to document D2, without the grinding step as it is the case there, but with different mould materials, can be inventive.

4.5 One of the aims of the present invention, namely the possibility of using various kinds of moulds, already deviates from the trend of search followed in this technical field at the priority date of the contested patent. Documents D2, D5 and D6 put a strong emphasis on the selection of new materials for the moulds and the search and development during the years before the patent in suit was therefore directed to find specific materials for the moulds for the reason mentioned in paragraph 4.1. Thus, this object of the present invention is itself somewhat unexpected.

4.6 Among the prior art documents cited by the Respondents, all those published during the last thirty years show that customary glass processes always involved the use of high temperatures during moulding, namely of temperatures above the softening point of the glass, which corresponds to a viscosity of $10^{7,6}$ poises. The table in document D14 gives a working range for the glass between viscosities from 10^2 to 10^8 poises and, since the removal of the preform is indicated as occurring between viscosities of

10⁸ and 10⁹ poises, a lower viscosity for the moulding step itself, namely under 10⁸ poises, was the logical consequence. As already seen, documents D2, D5 and D6 teach viscosities under the softening point. Viscosities within the range claimed by the present invention are mentioned in document D10, but they are only those which are obtained at the end of the moulding step. However, this moulding step itself takes place within a much lower viscosity range for the glass (see column 13, lines 91 and ff.).

Thus, both high temperatures and particular mould materials were regularly used for moulding glass lenses during this long period preceding the filing of the patent. This is a fact supported by all the documents and is not a mere arbitrary show of a trend, as alleged by Respondent 01.

4.7 In contrast, document D9, filed in 1927, teaches that optical glasses can be moulded in a pressing process with a moulding temperature between the annealing point and the softening point of the glass, namely inside the claimed viscosity range. The process is conducted under isotherm conditions and the grinding and polishing step is said to be greatly reduced. Moreover, this document also points out that, at lower temperatures with a moderate viscosity, the surface tension of the glass is high enough to prevent the glass to penetrate into the irregularities of the mould surfaces, apparently avoiding thereby the disadvantages mentioned in document D2.

4.8 However, the disclosure of this document does not appear to have been influential on the development of the technique ever since or to have found any practical use during the fifty years period preceding the present invention, although all the other documents show that a long felt want had existed for a long time to overcome the

problem created by the sticking or reproducing effect of the molten glass surface and that a lot of research work was involved in consequence. Normally the skilled person would try to follow a trend, which prevails for many years, unless he has good reasons to the contrary. No such reasons can be recognised in the present case and the Board does not see how this old document could convincingly show that the moulding technique according to document D2 represents a development in a wrong direction, as argued by the Opposition Division, especially when lenses of good quality are obtained by this technique.

4.9 The methods according to documents D2 and D9 go in quite different directions, since one needs special mould materials, high temperatures and, thus, low viscosities, whereas the other uses low temperatures, thus high viscosities, and no special mould material. The man skilled in the art, starting from the teaching of document D2 which teaches him to use a special mould surface to avoid defects in the glass surfaces and trying to improve this prior art, is unlikely to adopt features which go in a completely different direction. Respondent 01 seems to confirm this, when he admits in his letter dated 23 August 1991, page 8, lines 8-11, that the high requirements of document D2 about the mould material with respect to precision and reproductibility should divert from manufacturing lenses according to the method of document D9.

4.10 Indeed, having regard to the aim of the present patent, the man skilled in the art would not likely turn back to an old technique of more than fifty years old, since at that time the requirements for the quality of optical surfaces were considerably lower than today. Document D9, moreover, although it teaches a possible reduction of the grinding and polishing steps, does not guarantee a direct

and complete success in this respect, so that a main requirement of the present invention could not be expected to be fulfilled in view of the whole background.

4.11 For these reasons, the combination of documents D2 and D9 would not have been an obvious step and, since no other document raised in the proceedings teaches the critical range of viscosities for moulding, the subject-matter of Claim 1 cannot be derived in an obvious manner from the cited prior art and accordingly involves an inventive step as required by Articles 52 and 56 EPC.

Order

For these reasons, it is decided that:

The decision of the first instance is set aside.

The case is remitted to the first instance with the order to maintain the patent with the amendments as requested.

The Registrar:



S. Fabiani

The Chairman:


G. Szabo