BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

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File Number: T 425/89 - 3.2.2

Application No.: 85 304 257.0

Publication No.: 0 167 316

Title of invention: Glass melter

Classification: C03B 37/08, C03B 5/26, C03B 5/027, C03B 37/09

D E C I S I O N
of 13 October 1992

Applicant: GAF Chemicals Corporation

Headword:

EPC Article 56

Keyword: "Inventive step (no)"

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number : T 425/89 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 13 October 1992

Appellant : GAF Chemicals Corporation
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Decision under appeal : Decision of the Examining Division of the European Patent Office dated 1 February 1989 refusing European patent application No. 85 304 257.0 pursuant to Article 97(1) EPC.

Composition of the Board :

Chairman : G.S.A. Szabo
Members : J. Du Pouget De Nadaillac
J. van Moer

Summary of Facts and Submissions

I. The present appeal lies from a decision dated 1 February 1989 of the Examining Division of the European Patent Office, refusing the European patent application No. 85 304 257.0 (publication number: 0 167 316) on the ground that the subject-matter of each of the independent Claims 1 and 11 of the application, which had been filed on 13 June 1988, did not involve an inventive step having regard to the following documents:

D1: US-A-3 580 976 and
D2: JP-A-57/22 123.

Another document was also considered as relevant in the Search Report:

D3: US-A-4 365 986.

II. The Appellant (Applicant) lodged the appeal on 10 April 1989, the appeal fee being paid on the same day. The Statement of Grounds of Appeal was filed on 8 June 1989.

In response to communications of the Board, the Appellant submitted on 24 June 1991 new claims, new pages of the description and a declaration of the inventor. On 17 September 1991, he filed a new revised page 3 of the description and then, on 27 April 1992, three new sets of claims as bases for three auxiliary requests.

III. The independent Claims 1 and 11 of the main request read as follows:

"1. A glass melter connected to supply molten glass to a plurality of glass fibre-forming bushings with means to interrupt flow to individual bushings, which melter

comprises a melter body (12) defining a containment chamber (14) for receiving raw batch material (16), melting means (28, 30, 32) in said chamber for heating said raw batch material to a molten glass state, an outlet member (44) having an outlet opening (50) of predetermined size, guide means (62) above said outlet member for directing the flow of molten glass to said outlet member, cooling means (82) for cooling the molten glass while passing through the guide means into the outlet member, an electrical power supply (116) connected for heating the outlet member and a temperature control (122, 124) for controlling the amount of heating of said outlet member to control the heating of the molten glass in said outlet member (44) after cooling by said cooling means, characterized in that the outlet member (44) is formed of electrically conductive material, the guide means (62) is insulated from the outlet member (44) to limit heat exchange therebetween, the electrical power supply (116) is connected directly with the outlet member so that the outlet member (44) acts as a resistance heated by the supply of electrical power, and the outlet opening (50) of the outlet member (44) defines a flow path of invariant size and in that the temperature control means (122, 124) is arranged to control the resistive heating of the outlet member and thereby control the outlet flow rate of the molten glass from the melter body without any obstruction of the path of flow of molten glass through the outlet member."

"11. A method of preparing and supplying molten glass comprising continuously melting raw batch material to a first molten glass state, maintaining the molten glass in a containment chamber, guiding the molten glass along a predetermined path through guide means (62) to an outlet member (44) having an outlet opening, cooling the molten glass that has been guided along the predetermined path,

electrically heating the outlet member and the molten glass in the outlet member (44) after cooling the glass, and delivering glass issuing from the outlet opening (50) of the outlet member (44) to a plurality of glass fibre-forming bushings with means to interrupt flow to individual bushings, characterised in that the outlet member (44) is insulated from the guide means (62) and the outlet opening (50) of the outlet member (44) defines a flow path of invariant size, and further characterised by controlling the rate of flow of molten glass from the containment chamber through the invariant flow path defined by the outlet opening (50) without physically obstructing the said flow path by controlling the supply of electrical power to the outlet member (44) and controlling the resistive heating of the outlet member (44) to control the viscosity of the molten glass passing through the outlet opening (50)."

The first and third auxiliary requests are distinguished from the above main request by emphasising the downstream connection to glass fibre-forming bushings, the third auxiliary request being further limited to the method. In addition to the features of the main request, the second auxiliary request specifies in its Claims 1 (apparatus) and 10 (method) that the outlet opening and the outlet member have different cross-sectional areas.

IV. Oral proceedings were held on 13 October 1992.

V. In his submissions and during the oral proceedings, the Appellant substantially argued as follows:

The Examining Division has taken the view that document D1 disclosed an outlet member of invariant size because the valve member, which obstructs the outlet member, is only claimed in the dependent Claim 5 of this prior art and

should therefore be considered as optional. Such a reasoning is wrong for two main reasons: First, a feature cannot be presumed to be optional for the sole reason that it is contained in a sub-claim, and secondly, the whole description of this prior art shows that, in fact, the presence of this valve is essential to obtain a coarse adjustment of the flow rate of the glass. Indeed, it can be said that this prior art uses for the control of the flow rate of the glass two adjusting means, a valve and a temperature control of the outlet member, but it is clear from the whole description that this prior art relies only on the mechanical means, namely the valve, when a substantial change in the flow rate is wanted. This is emphasised by the fact that this document gives no indication about the range on which the temperature control can work, since it is not the purpose of this control to adjust the flow rate. Its purpose is to regulate the temperature, to hold the temperature of the glass stable, see column 4, lines 9-14, which mentions a reference temperature set by means of a regulator and a control circuit at the outlet of the melter. It is to be assumed, although not mentioned in this document, that the valve can be fully opened so that the whole amount of glass can flow without hindrance. How it is possible to make use in this case of the temperature control is, however, not shown and, therefore, it is apparent that there is little or no reliance on this kind of control in this prior art.

The cross-sectional size of the outlet member or tube of this prior art is not mentioned, but Figure 1 of document D1 shows a conical shaped outlet opening of this tube which co-operates with a corresponding shape of the valve. This conical restriction is the source of the problem relating to the present invention, namely the quick wear of this conical shaped part and of the valve itself. Both

wear quite irregularly, so that it becomes more and more difficult to adjust them to each other, and thus it becomes necessary to shut down the melter for several days to replace the whole tube and the valve.

The present invention is faced with this problem and solves it by making two main changes. First, the mechanical means, the valve, is removed and, then, its function, namely the control of the outlet flow rate of the molten glass, is taken over by a temperature control means.

Until the present invention, these kinds of melters provided with control means for the glass flow were all fitted with a movable valve. However, the inventor in its declaration has indicated that the valve itself was not the main problem, since it was quickly replaced each week without shut-down of the melter. The problem was lying in the matching outlet orifice tube, which co-operates with the valve, since its renewal, four times a year, requires an expensive shut-down of the furnace for 1 to 3 days. Thus, the problem itself would not lead the skilled person to throw away the valve, but rather to try to improve the outlet tube, for example by using a platinum coating. In fact, this was the first approach of the inventor. Document D1, which concerns a ten-year old invention, contains no overt suggestion that the valve member could be dispensed with. It is not even shown that this should be desirable. If it was immediately apparent that it should be eliminated, then there was ten years' time to do so. Such first step was therefore not obvious since the use of a valve was a clearly established trend.

Even if the skilled person wanted to replace somehow the valve, he was nevertheless not told how he could achieve this. Document D1 only discloses an automatic system

giving stabilisation of temperature and, thus, of flow, with the primary control of flow being provided by the valve. There is no suggestion in document D1 of using temperature regulation as the sole control of flow rate to accommodate changes in the apparatus downstream. This function is clearly taught as being done only by means of the valve member, see lines 49-52 in column 4. Thus, the ability of the temperature means to control a wide range of flow rates was not yet suggested, so that the person skilled in the art would not have considered the use of these means for the required purpose in the absence of any expected advantageous effect. Although there was no sound reason to deviate from the teaching of document D1, even if the person skilled in the art had been thinking of simplifying the system of control by using only one of the two control systems of said prior art, he would rather have omitted in this case the fine adjusting system, namely the temperature control, and not the coarse control means, namely the valve, since this would have resulted in a much restricted range of operation, making the whole apparatus inoperative.

Document D1 gives no indication that the outlet opening has or should have a flow path of invariant size. As seen above, Figure 1 shows the opposite. This prior art does not disclose to insulate the guide means from the outlet member either, or to employ a direct resistance heating of the outlet member.

The Japanese document D2 is not in the same field, since it is concerned with processing high level radioactive waste into a glass. The glass melter of this prior art, further, does not operate continuously and achieves only a simple on/off function which either permits flow into a given container or shuts flow off entirely. To achieve this, the outlet nozzle disclosed therein is alternatively

heated to allow the flow of the glass and cooled to stop it. There is no teaching that the heating can be used to control a flow rate to provide various intermediate flow levels.

In document D3, the glass flow is controlled downstream of the glass melter so that this document is not relevant.

The different cross-sectional areas of the outlet member mentioned in the second auxiliary request improve the temperature regulation by the heating means, which takes place in a larger area, compared with the area of the outlet opening.

VI. The Appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of

- as main request: the claims filed on 24 June 1991; or
- as an auxiliary request: the claims filed on 27 April 1992.

Reasons for the Decision

1. The appeal is admissible.

2. Claim 1 has been amended to specify that the outlet opening of the outlet member and not the outlet member itself, as it was previously claimed, defines the flow path of invariant size. This feature is directly derivable from the original Figure 2. The expression "over a range of flow rates", which was considered by the Board as having no clear distinguishing meaning, has been removed and replaced by a feature according to which the glass melter is connected to supply molten glass to a plurality of glass-forming bushings with means to interrupt flow to

individual bushings. This amendment intends to specify the range of operation of the claimed invention and is based on page 2, lines 13-15, and page 17, lines 16-22 of the description as filed. The amendments made to Claim 1 are therefore in conformity with Article 123(2) EPC. The same applies to the independent method Claim 11, which contains corresponding amendments.

3. The only issue to be examined is the question of inventive step, since none of the documents disclose all the features of Claims 1 or 11.

4. The glass melter shown in Figure 1 of document D1 comprises a delivery conduit in the form of a vertical bored rod disposed on the central axis of the containment chamber (or furnace) of the melter body. The main object of this delivery system is to deliver to a feeder or to other apparatuses a glass stream at a predetermined, relatively low temperature (1350°C) when compared to the glass temperature inside the melter body (1600°-2000°C), in order to avoid a deterioration of the refractory material of the downstream located feeder. The upper part of the rod can be considered as "guide means" for the flow of molten glass, when the lower part constitutes the outlet member. Both parts are surrounded by distinct cooling and heating means, the heating means being in the form of coiled resistances. The lower section of the outlet member has a venturi-like concave shape, so that the outlet opening of this outlet member matches the shape of a conical valve member, which is adjustable in height and defines thereby the adjustable size of this opening. This valve member is provided with a thermocouple, which is an essential element of an automatic control circuit of the heating means, said control circuit being provided with a regulator by means of which a predetermined reference temperature is set.

The melted glass, leaving the containment chamber at a very high temperature, is first cooled in the first part of the delivery tube, so that a temperature slightly below the predetermined reference temperature is reached. The valve member is adjusted in height to reach a normal flow, depending on the capacity of the feeder and of the characteristics of the melted glass. Then, at the level of the outlet, the control circuit, reading the data given by the thermocouple, adjusts the heating means so as to obtain the desired temperature at the outlet. This adjustment permits to regulate more precisely the flow of glass, since it is well known, according to this prior art, that the temperature of the glass governs its viscosity and consequently its flow through a passage of given size. Therefore, this prior art teaches a manually adjustable valve to obtain the normal glass flow and an additional automatic device for regulating the temperature, and thus the final rate of the flow, at the outlet.

5. With the glass melter according to this closest prior art, a problem arises because of the valve arrangement, which wears away and requires a shut-down of the melter in order to replace the outlet member and the valve. Thus, the object underlying the present invention is to provide a glass melter having a flow control system, which permits to deliver glass at a variety of different flow rates, while avoiding the above-mentioned deficiency without increasing costs. Accordingly, the use of more durable, but expensive materials for the valve and outlet member should be excluded.

6. The solution according to the contested Claim 1 resides in first removing any obstruction, namely the valve, from the path of flow of molten glass through the outlet member,

the outlet opening of the outlet member therefore defining a path of invariant size, and secondly in controlling the outlet flow rate of the molten glass by adjusting electrically the resistive heating of the outlet member, which is formed of electrically conductive material and is insulated from the guide means to limit heat exchange therebetween. An apparatus (Claim 1) and a method (Claim 11) corresponding to this solution are claimed.

7. In this respect, the Board cannot follow the view of the Examining Division, which has based its decision on the assumption that the valve member is an optional feature of this prior art, due to the fact that this element appears only in a dependent claim, and not in Claim 1 of this document. Reading the whole document, it appears clearly that, if this element is only mentioned in a dependent claim, the reason is to be found in the primary object of the particular embodiments of this prior art, which is to provide a device for regulating the temperature of the glass stream at the outlet of the glass melter. For this regulating device, the valve member is not essential, but nevertheless for the glass melter itself it becomes essential. The valve is defined as an additional feature of the invention disclosed (column 2, line 28-33) which is being provided with a thermocouple of the control loop, said control loop being the main element of the regulating device, whilst the flow control with the valve is a secondary subject. Further, the delivery or discharge system of the glass melter according to this document, could not operate without the valve member, which defines the outlet passage, see column 3, last lines, and column 4, lines 49-52.

8. Nevertheless, the Board comes to the same final conclusion as the Examining Division that the subject-matter of both independent Claims 1 and 11 of the main request lack an

inventive step in view of the teaching of document D1 together with the general knowledge of the person skilled in the art.

8.1 The first aim of the present invention, namely to provide a glass melter having a flow control system which permits to deliver glass at a variety of flow rates, is already achieved by the melter according to document D1, but this prior art device uses two controls, a coarse control and a fine control.

The coarse control, the mechanical valve, brings about problems which on the face of it could only be eliminated by the use of very expensive materials. The person skilled in the art, looking for a different solution to deal with the deficiency brought about by this valve, has consequently no other choice but to remove the cause of the problem altogether, namely the valve itself. There is no reason or prejudice which would prevent the expert from doing so.

8.2 The second step follows logically the first one. Once the valve is removed, which constitutes only one of both flow controls of document D1, the skilled person has to provide the same function by different kinds of means. He will, consequently, inform himself about how it is possible to control the glass flow in the field of glass melters. With its fine control, that is to say the resistance heating, document D1 already gives him a hint which may stimulate him to consider the possibility of using heating means also as an alternative to the valve.

Indeed, whilst document D1 does not explicitly indicate that the resistance heating can be used to control the glass flow over a wide range of flow rates, it does not deny such possibility either. At the filing date of the

present application, the person skilled in the art knew as a matter of general knowledge (see for example documents D2 and D3) that a glass melter can be controlled without mechanical means, only by heating and cooling means. Document D2 teaches that containers can be filled up successively in a simple on/off process achieved by either cooling means to interrupt the flow or heating means to permit flow. The skilled person was also aware that the control means available for this kind of continuously working glass melters are only of two kinds, i.e. either being mechanical, or relying on the effect of temperature changes, i.e. cooling and heating devices. Thus, he could be expected to envisage the heating means also as the main control and to investigate by mere routine tests whether it was possible to modify the resistance heating of document D1 to achieve the aim of the present invention. No prejudice that might have prevented a skilled person from doing so can be seen by the Board and the Applicant did not bring forward any evidence in support of such a prejudice.

8.3 Moreover, the physical effect is clearly disclosed by document D1 already in connection with the fine control, so that there is an obvious case for considering trying out a quantitively modified manner. It is only a question of scale, the result being otherwise the same or at least predictable. The heating means of document D1 are, in fact, equivalent to the mechanical means, since they achieve the same function by controlling the flow. Document D1 uses resistance heating means in the form of coiled resistances, but document D2, for the same function, discloses an outlet member acting directly as an electrical resistor. Both are equivalent means and it is in the ability of the expert to chose between them according to the circumstances. Thus, the particular heating means cited in Claims 1 and 11 cannot be seen as inventive in relation to their function.

8.4 The feature relating to the insulation of the guide means relative to the outlet member is a logical consequence and even a necessity, as shown by the application itself in page 15 of the original description. It is widely known that, when different voltages are applied to parts of a device closely located to one another, insulation means is a necessity between these parts.

The feature of the independent claims, that the outlet member is of invariant size, i.e. it is fixed, is a direct consequence of the throwing away of the valve, since there is no need to keep a corresponding co-operating part of the outlet member. Documents D2 and D3 confirm this by showing outlet members of invariant size in the absence of a valve. This feature is quite usual and commonly known for its purpose.

8.5 To summarise, the Board concludes that the skilled person being confronted with the above-mentioned problem would arrive in an obvious manner at the apparatus and method defined respectively in the present Claims 1 and 11 by using the heating means disclosed in document D1 as flow control means, of course appropriately modified to work on a wider scale.

9. Auxiliary requests

Since the independent claims of the first and third auxiliary requests merely emphasise the connection of the glass melter to a plurality of glass fibre-forming bushings, which are considered in these claims as parts of the whole device, the subject-matter of these claims does not differ in any essential respect from the corresponding claims of the main request. Therefore, the same grounds

apply, so that these claims do not involve an inventive step either.

The different cross-sectional areas of the outlet opening and outlet opening of the outlet member in Claim 1 of the second auxiliary request represent an obvious constructional possibility, when the skilled person wishes to increase the effect of the direct resistance heating of the outlet member on the glass material remaining in said member for a longer time. This limitation does not change the nature of the invention. Therefore, for the same reasons, this auxiliary request is not allowable either.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

S. Fabiani G.S.A. Szabo

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