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D E C I S I O N
of 4 October 2000

Case Number: T 0157/98 - 3.2.5

Application Number: 88310583.5

Publication Number: 0317176

IPC: B29C 45/17

Language of the proceedings: EN

Title of invention:
Method for injection molding, apparatus therefor and moldings producted thereby

Patentee:
Ladney, Michael

Opponent:
Battenfeld GmbH
Cinpres Limited

Headword:
-

Relevant legal provisions:
EPC Art. 123(2), 56, 83, 54

Keyword:
"Amendment (main request inadmissible)"
"Sufficiency (yes)"
"Novelty (yes)"
"Inventive step (yes)"

Decisions cited:
-

Catchword:

-

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Case Number: T 0157/98 - 3.2.5

D E C I S I O N
of the Technical Board of Appeal 3.2.5
of 4 October 2000

Appellant: (Opponent 02)
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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 25 November 1997 concerning maintenance of European patent No. 0 317 176 in amended form.**

Composition of the Board:

Chairman: W. Moser
Members: P. E. Michel
C. G. F. Biggio

Summary of Facts and Submissions

I. The appellant (opponent II) lodged an appeal against the interlocutory decision of the Opposition Division maintaining the patent No. 0 317 176 in amended form.

Opponent I did not lodge an appeal, but is a party as of right to the appeal proceedings in view of Article 107 EPC.

In the decision under appeal, it was held that the grounds of opposition submitted by the appellant and the party as of right, i.e Article 100(a), (b) and (c) EPC (lack of novelty and inventive step, insufficiency of disclosure and added subject-matter), did not prejudice the maintenance of the patent as amended having regard to the following documents:

D1: EP-A-0 310 914

D2: JP-A-54-123173

D3: US-A-4 101 617

D4: EP-A-0 250 080

D5: EP-A-0 127 961

D6: JP-A-61-59899

II. Oral Proceedings were held before the Board of Appeal on 4 October 2000.

(i) The appellant and the party as of right requested that the decision under appeal be set aside and

the patent be revoked.

(ii) The respondent (patentee) requested as a main request that the appeal be dismissed, or, as auxiliary requests, that the decision under appeal be set aside and that the patent be maintained on the basis of the following documents:

(a) first auxiliary request: claim 1 filed as first auxiliary request during oral proceedings; or

(b) second auxiliary request: claim 1 filed on 5 October 1998 as auxiliary request; or

(c) third auxiliary request: claim 1 filed as third auxiliary request during oral proceedings.

III. The main request of the respondent includes a single independent claim, which reads as follows:

"1. A process for producing an injection moulded product, comprising: storing a quantity of gas in a storage chamber (28), utilizing gas from a gas supply source (41), introducing a stream of plastics material (8) at a plastics pressure into a mould space (11); introducing the gas into the molten stream of plastics material at a first pressure at least as high as said plastics pressure by pressurizing a quantity of gas from the supply source (41) to said first pressure at a gas inlet passage (6) after said molten material has passed the position at which the gas is introduced, thereby forming a gas cavity (21) in the molten material, the gas exerting pressure on the surrounding

material to urge the material towards the surfaces of said mould space (11); continuing to feed plastics material to said mould space (11); simultaneously continuing to inject gas into said gas cavity (21) during the step of continuing to feed; maintaining the pressure of the quantity of gas at the gas inlet passage (6) during the steps of continuing to feed and continuing to inject; terminating the supply of molten plastics material after a predetermined amount of the molten plastics material has been fed, sufficient to completely cover the surfaces of the mould space (11); maintaining a gas pressure within the gas cavity (21) as the plastics material cools beneath its softening point, venting the gas from the gas cavity (21) in the plastics material wherein the process is characterized by:

pressurizing the gas to said first pressure before the step of introducing said quantity of gas into said molten stream of plastics material;

maintaining said first pressure of the quantity of gas at the gas inlet passage (6) at substantially the first predetermined gas pressure during the steps of continuing to feed and continuing to inject;

reducing the first gas pressure to a second predetermined gas pressure which is lower than the first gas pressure and subsequently maintaining the second gas pressure within the gas cavity (21) as the plastics material cools beneath its softening point;

controlling the rate of venting by means of a metering valve (30) or other flow control valve."

Claim 1 of the respondent's first auxiliary request differs from claim 1 of the respondent's main request in that, in the passage "... by pressurizing a quantity of gas from the supply source (41) to said first

pressure at a gas inlet passage (6)...", the term "a quantity" is replaced by the term "said quantity", and a comma is introduced after the term "said first pressure".

Claim 1 of the respondent's second auxiliary request differs from claim 1 of the respondent's main request in that the feature

"pressurizing the gas to said first pressure before the step of introducing said quantity of gas into said molten stream of plastics material"

is replaced by:

"pressurizing the gas to said first pressure and storing it in the storage chamber (28) at said first pressure before the step of introducing the plastics material and said quantity of gas stored in the storage chamber (28) at the first pressure into said molten stream of plastics material"

and in that the term "or other flow control valve" at the end of the claim is deleted.

IV. The appellant and the party as of right argued essentially as follows:

Claim 1 according to the respondent's main request contravenes Article 123(2) EPC. In the application as filed, it is consistently taught that the gas is pressurized and then stored in the storage chamber before the step of introducing the molten stream of plastics material into the mould space. These features are described as being essential, or "imperative" (column 7, line 33 of the application as filed), in order to make the gas instantly available for use. There is no suggestion in the application as filed of any other possibility.

On the other hand, in claim 1 according to the respondent's main request, whilst the claim refers to "storing a quantity of gas in a storage chamber", there is no other reference to the storage chamber and no indications as to its function. In particular, there is no indication that the gas is pressurised in the storage chamber. On the contrary, the claim specifies that the gas is pressurised at the inlet passage. Thus, not only has an essential feature been omitted from the claim, but also something new has been introduced which was not foreshadowed in the application as filed.

During the course of prosecution of the application, features were voluntarily taken out of the claim. There must therefore be a good reason why this was done.

As regards the respondent's first auxiliary request, the proposed amendments do not improve the position of the respondent. Insofar as the claim is clear, it has the same meaning as claim 1 of the main request.

As regards the respondent's second auxiliary request, the claim specifies that pressurizing occurs at two locations, firstly at the storage chamber and secondly at the inlet passage. It would not be possible to amend the claim to delete any references to pressurizing at the inlet passage in view of Article 123(3) EPC, so that the respondent is caught in the well-known inescapable trap.

Further, the claim specifies that plastics is introduced into the stream of plastics material. The amendments have merely introduced more confusion into the claim.

It is not possible to inject gas into molten plastics material as it is fed into the mould. It must be done after introduction of the plastics material into the mould. Reference is made to the set of four drawings filed with a letter dated 5 February 1999, and the transcript of evidence by Mr Hendry before the British Patent Office, showing that either the gas breaks through the plastics melt front, or will prevent introduction of the melt. As described in the patent in suit, the valve (29) is opened when the plastics melt reaches the end of the sprue (column 8, lines 30 to 37). It is then not possible for the melt to reach the ends of the mould before the gas.

As shown in the patent in suit, the gas is injected into the sprue, where the plastics pressure is higher than at the melt front. It is possible to introduce the gas after introduction of plastics material is complete either using a "short shot" in which the volume of plastics melt is less than that of the mould, or using a "full shot" in which the volume of plastics melt is the same as that of the mould, since polymers shrink considerably during solidification. It is necessary to introduce the gas after introduction of plastics material is complete, since there is a very big difference in viscosity between the gas and the melt, the gas speeding up exponentially as it passes through the increasingly less viscous melt.

It is impossible to introduce gas and melt simultaneously owing to mutual exclusivity, that is, if the gas pressure is sufficient to enter the melt, the melt cannot pass the point of entry of the gas, causing discontinuous flow and creating bubbles of gas at high pressure which are damaging to the finished product.

Claim 1 of the respondent's second auxiliary request is not new in view of the disclosure of document D4. It is accepted by the respondent that the only difference between the subject-matter of this claim 1 and the disclosure of document D4 is the reference in the claim to a "metering valve". This term, however, merely describes a valve which controls, but is not necessarily capable of varying, the flowrate therethrough. In document D4, the pressure reducing valve (31) acts to control venting. The flowrate is unspecified, but then the patent in suit also does not disclose a value for the flowrate.

The valve (30) is controlled by means of an activating cylinder (24) both in document D4 and in the patent in suit. There is thus no difference between the two valves. An adjustable metering valve is not disclosed. The term "control" does not necessarily mean variable. Every valve, including an on-off valve, is a flow resistance and therefore serves to control the flowrate.

Claim 1 of the patent in suit claims priority from a United States application (United States Serial No. 121908) which is the last of a series of continuation-in-part applications from which priority had been claimed, so that rights were outstanding from the previous applications, even though the applications themselves had been abandoned. The claim to the priority date of 17 November 1987 is thus not valid in view of the provisions of Article 87(4) EPC.

United States Serial No. 121908 does not disclose pressurization of the gas in the inlet passage. Since this is a feature of claim 1 of the respondent's second

auxiliary request, the claim to priority is invalid.

Document D6 is the closest prior art, even though it teaches the consecutive introduction of plastics and gas. As previously argued, simultaneous introduction is, in any case, not possible. Since this cannot occur in real life, this feature does not constitute a real distinction.

As disclosed at page 7 of document D6, the discharge velocity of the gas is controlled. Since the person skilled in the art knows that disadvantages are incurred when maintaining a high pressure during cooling, but that some pressure is desirable to maintain the form of the article, it does not require an inventive step to lower the pressure to a second predetermined gas pressure and maintain this pressure within the gas cavity as the plastics material cools beneath its softening point. A problem with maintaining a high gas pressure in the cavity during cooling is that there is a risk that gas will be forced into thinner sections of the mould where it is not required. Nevertheless, a lower pressure will be of assistance in maintaining the form of the article during cooling. The least possible pressure which is capable of doing this should be used.

It would be possible to hold the valve (V-2) of document D6 closed while the plastics in the mould solidifies so as to achieve this aim.

In the process of document D5, gas pressure drops during moulding as compared with the initial value, so that the suggestion to increase the pressure does not result in an increase as compared with the initial

value. The additional gas is required to take up shrinkage in the plastics material and does not result in an increased pressure. In any case, it is not necessary to rely on document D5, since the invention lacks an inventive step in view of the disclosure of document D6 alone.

Although the patent in suit teaches reducing the first gas pressure to a second predetermined gas pressure which is lower than the first gas pressure and subsequently maintaining the second gas pressure within the gas cavity as the plastics material cools beneath its softening point, there is nothing to indicate why this is done or what problem is solved by performing these steps.

V. The respondent argued essentially as follows:

Claim 1 of the respondent's main request must be interpreted in the light of the description in accordance with Article 69 EPC. Whilst it is accepted that the claim is semantically awkward, the technically skilled reader will resolve contradictions in the claim by a reading of the description. The term "pressurizing" is not related to the inlet passage. It is clear that pressurizing must occur before the gas is introduced into the storage chamber, since no other interpretation makes sense. In addition, the passage in the description of the application as filed at column 3, line 51 to column 4, line 9 does not contain a limitation as to when the gas is pressurized.

As regards the respondent's first auxiliary request, the amendments make it clear that pressurizing does not occur in the inlet passage.

As regards the respondent's second auxiliary request, whilst it is accepted that the wording of claim 1 of this request is not entirely clear, the skilled reader would be capable of a correct interpretation of the claim. The characterising feature of the claim, "pressurizing the gas to said first pressure and storing it in the storage chamber (28) at said first pressure before the step of introducing the plastics material and said quantity of gas stored in the storage chamber (28) at the first pressure into said molten stream of plastics material", clarifies the meaning of the feature "introducing the gas into the molten stream of plastics material at a first pressure at least as high as said plastics pressure by pressurizing a quantity of gas from the supply source (41) to said first pressure at a gas inlet passage (6) after said molten material has passed the position at which the gas is introduced, thereby forming a gas cavity (21) in the molten material, the gas exerting pressure on the surrounding material to urge the material towards the surfaces of said mould space (11)" . It is clear that further plastics material would not be introduced into the stream of plastics.

In the transcript, Mr Hendry is discussing the process of document D5, where the piston (20) moves slowly to modulate gas pressure. There are a number of ways to overcome the problems associated with simultaneous introduction of gas and plastics melt. The gas could, for example, be introduced further downstream of the melt, where the plastics pressure is lower. The skilled person would know which parameters to vary in order to avoid the problems. In addition, Mr Hendry indicates that, under some circumstances, simultaneous introduction of gas and melt is possible (page 8 of the

transcript). Further, it is possible to accept the presence of bubbles, since the article is removed from the mould when it is self-supporting and any bubbles will tend to flow together in the molten core of the article.

In document D4, venting occurs through an on-off valve (30) followed by a pressure reducing valve (31). These valves are not capable of controlling the rate of venting. The valve (31) opens as soon as a predetermined pressure is reached and then permits flow until the pressure drops back to the predetermined value. It is thus either closed or open and does not control the rate of venting.

United States Serial No. 121908, from which the patent in suit claims priority, constitutes the first application for the combination claimed in the patent in suit including the metering valve, so that priority is validly claimed.

None of the cited prior art documents suggests reducing the first gas pressure to a second predetermined gas pressure which is lower than the first gas pressure and subsequently maintaining the second gas pressure within the gas cavity as the plastics material cools beneath its softening point. The suggestions that it would be obvious to the person skilled in the art to do this must be regarded as being merely speculative in the absence of a hint in a document to do this. On the contrary, document D5 suggests increasing the holding pressure. As stated at page 11, lines 5 to 7 of document D5, the gas pressure may be increased after the mould is full. A reduction of pressure only occurs when the article is fully self-supporting. Document D6

does not contain any discussion of gas pressure during cooling.

Reasons for the Decision

1. *Main Request*

1.1 Amendments

The patent in suit relates to a process for producing injection moulded products, in which a gas under pressure exerts pressure on the molten plastics material in order to urge it into contact with the mould surfaces. Such methods were known before the priority date of the patent in suit, and enable a high quality product to be moulded in which the product conforms closely to the mould surfaces and the plastics material fills even narrow parts of the mould.

The invention is concerned with the problems associated with attempting to simultaneously inject a pressurized fluid and a molten plastics material into a mould cavity at high pressures (column 1, lines 28 to 35 of the application as filed). As stated in the application as filed, it is not possible to use a pump in view of the slow response time. In addition, commercially available pressurized gas cylinders having a sufficiently high pressure were not generally available. In order to overcome these problems, it is necessary to have gas at high pressure immediately available for use and this is achieved by providing a storage chamber for the gas at a pressure at least as high as the plastics pressure (see the application as filed at, for example, column 4, lines 30 to 36, "the

gas is introduced ... as quickly as possible"; column 4, lines 55 to 58, "pressurized gas" is "instantaneously available"; as well as numerous passages in the description of the two illustrated embodiments of the invention).

According to the description of the application as filed, "the gas is introduced into the molten stream of plastic material immediately after the stream has passed the position at which the gas is introduced to form the gas cavity in the molten material as quickly as possible" (column 4, lines 30 to 36). In order to make the gas immediately available at high pressure, a storage chamber is provided, in which the gas is stored at a pressure, referred to as the first pressure, which is at least as high as the plastics pressure at the point at which the plastics material is introduced into the mould space. These features are repeated consistently throughout the description. Nowhere is it suggested that it is not essential to have the gas at the first pressure immediately available for injection into the plastics melt or that this could be achieved in any other way than by storing the gas at the first pressure in a storage chamber before the step of introducing the plastics material into the mould space.

This is confirmed by the claims of the application as filed. Claim 1, directed to a process for producing an injection moulded product, specifies "storing the quantity of gas in a storage chamber at the first predetermined gas pressure which is at least as high as said plastic pressure" before the step of introducing the molten stream of a plastic material into the mould space. Claim 4, directed to an apparatus for producing an injection moulded product made of plastic material,

specifies the presence of "a storage chamber for storing gas at said first predetermined gas pressure so that the gas is immediately available for use".

The application as filed thus consistently presents the features of pressurizing the gas to a first pressure and storing it in a storage chamber at the first pressure before the step of introducing the plastics material, and introducing the quantity of gas stored in the storage chamber at the first pressure into the molten stream of plastics material as being essential features of the invention. Not only are these features specified in the independent claims of the application as filed, they are also described as being essential, and the skilled reader is taught that they are, indeed, essential in order to achieve the stated object of the invention. As decided in decision T 260/85 (OJ EPO 1989, 105) and subsequently confirmed in a number of decisions, the deletion of such features from an independent claim constitutes a breach of Article 123(2) EPC.

The amendments made to claim 1 of the main request involving the omission of these essential features thus do not satisfy the requirements of Article 123(2) EPC, and the main request is accordingly not allowable.

2. *First auxiliary request*

2.1 Amendments

The features referred to above in connection with the main request as being consistently described in the application as filed as being essential are also absent from claim 1 of the first auxiliary request.

The amendments made to claim 1 of the first auxiliary request thus do not satisfy the requirements of Article 123(2) EPC, and the first auxiliary request is similarly not allowable.

3. *Second auxiliary request*

3.1 Amendments

In addition to the wording of the preamble of claim 1, which contains the passage:

"introducing the gas into the molten stream of plastics material at a first pressure at least as high as said plastics pressure by pressurizing a quantity of gas from the supply source (41) to said first pressure at a gas inlet passage (6) after said molten material has passed the position at which the gas is introduced",

claim 1 of the second auxiliary request contains the following passage in the characterising portion of the claim:

"pressurizing the gas to said first pressure and storing it in the storage chamber (28) at said first pressure before the step of introducing the plastics material and said quantity of gas stored in the storage chamber (28) at the first pressure into said molten stream of plastics material."

The features of pressurizing the gas to a first pressure and storing it in a storage chamber at a first pressure before the step of introducing the plastics material into the mould space and introducing the quantity of gas stored in the storage chamber at the

first pressure into the molten stream of plastics, omitted in claim 1 according to the main request and first auxiliary request, have thus been reintroduced into claim 1 of the second auxiliary request.

It was argued on behalf of the appellant that the wording of claim 1 as amended requires the gas to be pressurized twice, firstly before storage of the gas in the storage chamber and secondly at the gas inlet passage. This interpretation of the claim cannot be accepted by the Board.

The wording of the pre-characterising portion of claim 1 is not understood as requiring that pressurization occurs "at the inlet passage" or "after said molten material has passed the position at which the gas is introduced". Rather, it is interpreted to mean that the gas is introduced into the molten stream of plastics material at a first pressure at least as high as the plastics pressure at a gas inlet passage (6) after said molten material has passed the position at which the gas is introduced, the first pressure being achieved by pressurizing a quantity of gas from the supply source (41) to said first pressure. Thus, this wording does not indicate the exact location or the point in time at which pressurization takes place, and, in particular, it does not specify that the pressurization occurs at the inlet passage or after the molten material has passed the position at which the gas is introduced. The wording of the characterising clause is, however, regarded as providing the information missing from the preamble of the claim as to the location where pressurization takes place and the time at which pressurization takes place. That is, prior to storage of the quantity of gas in the storage

chamber and before the step of introducing the plastics material into the mould space.

It was further argued that the wording of the characterising portion of claim 1 requires plastics material to be introduced into the molten stream of plastics material. Whilst it is true that this interpretation would result from a literal reading of the claim, it is, in the Board's judgement, inconceivable that the skilled technical reader of the claim, reading the claim in the light of his common general knowledge and the description of the patent in suit, would come to this conclusion, which does not make technical sense. Thus, the above wording of the characterising portion of the claim would be interpreted by the intended addressee of the patent in suit to mean that the gas is pressurized to the first pressure and stored in the storage chamber (28) at the first pressure before the step of introducing the plastics material and that the quantity of gas stored in the storage chamber (28) is introduced at the first pressure into the molten stream of plastics material.

The amendments made to claim 1 of the second auxiliary request thus satisfy the requirements of Article 123(2) EPC.

3.2 Sufficiency of disclosure

It was argued on behalf of the appellant that it is not possible to inject gas into molten plastics material as it flows into the mould. It is thus not possible to carry out the process as defined in claim 1, so that the invention is not disclosed in a manner sufficiently clear and complete for it to be carried out by a person

skilled in the art. This assertion cannot be accepted by the Board.

It can be accepted that there are a number of difficulties associated with injecting gas into molten plastics material as it flows into the mould in an injection moulding process. Thus, if the gas is introduced too soon after the melt front has passed the point at which the gas is injected, there is a danger that the gas will not remain enclosed by the melt, but will burst through the melt front. Additionally, a high gas pressure may prevent the melt from passing the point of gas injection. On the other hand, at least for some forms of mould, it is possible to inject gas into molten plastics material as it flows into the mould, as stated by Mr Hendry during cross-examination in a procedure before the Superintending Examiner of the British Patent Office. According to the transcript of this procedure filed during the opposition procedure,

"it is the belief of the whole industry now (that is, in 1996) that it is not possible to simultaneously inject plastic and gas *unless* you fill the cavity say 70% or 80% and it (is) a very, very, very thick section like a dagger board" (emphasis added).

The Board is thus of the opinion that it is possible for the person skilled in the art of injection moulding, having read the description of the patent in suit and without the exercise of inventive activity, at least in the case of mouldings having a comparatively thick section, and possibly after a certain amount of trial and error as far as the timing of the gas injection, the selection of a suitable amount of plastics material and the selection of suitable gas and

plastics pressures are concerned, to inject gas into a flowing plastics melt without encountering the problems described by the appellant.

3.3 Novelty

It was alleged on behalf of the appellant that the subject-matter of claim 1 is not new having regard to the disclosure of document D4. The only point at issue between the parties is the question of whether or not document D4 discloses controlling the rate of venting by means of a metering valve.

In the arrangement of document D4, venting takes place through two valves, an on-off valve (30) and a pressure reducing valve (31).

According to the patent in suit, the valve (30) is a metering valve which controls the rate of venting (column 10, lines 17 to 19). It is not accepted that the valve (30) of document D4 similarly controls the rate of venting and can therefore be described as a metering valve in the terms of the patent in suit. In the arrangement of document D4, it is not possible to control the rate of venting. Provided that the gas is at a pressure above that required to open the valve (31), gas is vented in an unrestricted manner through the two valves (30,31). It is not possible to vary the flowrate by means of either of the valves.

Whilst it is true that Figure 1 of the drawing of the patent in suit shows a valve (30) activated by a cylinder (24), identical to that of document D4, the illustrated arrangement is that as described in the application as filed in which the valve (30) is a "two

way directional valve" (column 9, line 7), that is, an on-off valve. In the application as filed, the use of a metering valve in place of the illustrated two way directional valve was an optional feature as described at column 9, lines 11 and 12. During prosecution of the application, however, the reference in the description to the two way directional valve was deleted, and the presence of a metering valve became an essential feature of the invention. Figure 1 of the drawings thus does not attempt to show a metering valve.

The subject-matter of claim 1 is thus novel with respect to the disclosure of document D4.

The remaining documents are less relevant to the subject-matter of claim 1 and, in fact, the novelty of claim 1 was only disputed by the appellant and the party as of right on the basis of the disclosure of document D4.

Claims 2 to 9 are appendant to claim 1 and are similarly novel.

3.4 Inventive step

3.4.1 State of the art to be considered

United States Serial No. 121908, from which the patent in suit claims priority, is one of a series of continuation-in-part applications. It is, however, the first of these applications to contain the feature "the valve 30 can be a metering valve to control the rate of exhaust" (page 14, lines 7 and 8). Since claim 1 is limited to the feature of "controlling the rate of venting by means of a metering valve (30)", United

States Serial No. 121908 represents the first application for protection of the invention forming the subject-matter of claim 1.

It is, of course, correct that, as alleged by the appellant, United States Serial No. 121908 does not disclose pressurization of the gas in the inlet passage. However, as discussed above, claim 1 is not to be construed as requiring such a second pressurisation step.

The claim is thus entitled to the priority date of 17 November 1987, so that documents D1 and D4 are prior art under Article 54(3) EPC and are thus to be disregarded when assessing inventive step in accordance with Article 56 EPC.

3.4.2 Closest prior art

It was argued on behalf of the appellant that document D6 constitutes the closest prior art. This cannot, however, be accepted. This document does not disclose the features of "introducing the gas into the molten stream of plastics material ...; continuing to feed plastics material to said mould space (11); simultaneously continuing to inject gas into said gas cavity (21) during the step of continuing to feed", as specified in the preamble of claim 1.

As stated above under point 3.2 above, the Board does not accept the argument that an injection moulding process in which gas is introduced into a stream of flowing plastics material is impossible under all conditions. It is accordingly not possible to ignore this feature when assessing the closest prior art.

The closest prior art is represented by document D5, which discloses a process having all the features of the preamble of claim 1, including the introduction of the gas into the stream of flowing plastics material, and, in addition, the feature of "pressurizing the gas to said first pressure before the step of introducing said quantity of gas into said molten stream of plastics material".

3.4.3 Object of the invention

The object of the invention can be regarded as being to improve the surface quality of the moulded article whilst maintaining the accuracy of moulding.

3.4.4 Solution

According to claim 1, the above problem is solved by "reducing the first gas pressure to a second predetermined gas pressure which is lower than the first gas pressure and subsequently maintaining the second gas pressure within the gas cavity (21) as the plastics material cools beneath its softening point".

The maintenance of the second pressure as the plastics material cools beneath its softening point enables the gas to assist in maintaining contact of the moulded article with the surfaces of the mould during cooling, so that the article has the desired form, yet avoids the dangers of maintaining a pressure as high as the first pressure, which could result in the gas continuing to expand into thinner zones of the mould, resulting in an undesirable reduction in surface quality.

Whilst the venting valve arrangement of document D6 would enable the process according to the present invention to be carried out, there is no teaching that the valves should be operated so as to maintain a second, lower gas pressure within the gas cavity as the plastics material cools beneath its softening point.

The solution according to the invention is not suggested by any of the cited prior art documents, neither separately nor in a combination with each other. It was, however, argued on behalf of the appellant that the person skilled in the art knows that disadvantages are incurred when maintaining a high pressure during cooling, but that some, lower pressure is desirable to maintain the form of the article. In the absence of any document either indicating that this problem is known or pointing to the solution according to the invention, these arguments are seen as involving an unacceptable degree of ex post facto analysis.

On the contrary, document D5 teaches at page 9, lines 5 to 11 and at page 11, lines 5 to 7, that the pressure of the nitrogen in the mass 38 can be increased after the mould space is full. Thus, whilst there is a realisation in the prior art that it is necessary to maintain a high gas pressure during cooling of the article in order to improve the surface definition of the article, there is no appreciation of the possible dangers of maintaining such a pressure up until the moment at which the plastics material is self-supporting (document D5, page 3, lines 3 to 11).

As regards document D2, although this document suggests venting gas from the mould through a variable restriction valve (C-1), there is similarly no

suggestion of reducing the first gas pressure to a second predetermined gas pressure which is lower than the first gas pressure and subsequently maintaining the second gas pressure within the gas cavity as the plastics material cools beneath its softening point.

Document D3 also does not suggest reducing the first gas pressure to a second predetermined gas pressure which is lower than the first gas pressure and subsequently maintaining the second gas pressure within the gas cavity as the plastics material cools beneath its softening point. Pressurised gas within the gas cavity is simply vented to the ambient atmosphere (document D3, column 2, line 61 to column 3, line 6).

The subject-matter of claim 1 according to the second auxiliary request thus involves an inventive step. Claims 2 to 9 are appendant to claim 1 and similarly involve an inventive step.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent on the basis of the following documents:

   (a) claim 1 filed on 5 October 1998 as auxiliary request and claims 2 to 9 as granted;

   (b) description as granted with the following

amendments:

(i) the text on page 3, column 4, lines 18 to 57 is to be replaced by the following text: "uct as claimed in claim 1"; and

(ii) the words "can be" on page 6, column 10, line 18 are to be replaced by the word "is"; and

(c) drawings 1/1 as granted.

The Registrar: The Chairman:

M. Dainese W. Moser