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D E C I S I O N
of 16 September 2003

Case Number: T 0827/01 - 3.2.5

Application Number: 92905872.5

Publication Number: 0584080

IPC: B29C 45/00

Language of the proceedings: EN

Title of invention:

Method and system for injection molding utilizing pressurized fluid source within a chamber in the mold

Patentee:

Melea Limited

Opponents:

Battenfeld GmbH
Cinpres Gas Injection Limited

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56

Keyword:

"Novelty (main request, yes)"
"Inventive step (main request, yes)"

Decisions cited:

-

Catchword:

-



Case Number: T 0827/01 - 3.2.5

D E C I S I O N
of the Technical Board of Appeal 3.2.5
of 16 September 2003

Appellant: Cinpres Gas Injection Limited
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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted
23 May 2001 concerning maintenance of European
patent No. 0584080 in amended form.

Composition of the Board:

Chairman: W. Moser
Members: P. E. Michel
H. M. Schram

Summary of Facts and Submissions

I. The appellant (opponent 02) lodged an appeal against the interlocutory decision of the Opposition Division maintaining European patent No. 0 584 080 in amended form.

In the decision under appeal, it was held that the grounds of opposition submitted by the appellant and the party as of right (opponent 01) under Article 100(a) EPC did not prejudice the maintenance of the patent as amended.

II. The opposition by the party as of right was withdrawn on 27 September 2001.

III. Oral proceedings were held before the Board of Appeal on 16 September 2003.

(i) The appellant requested that the decision under appeal be set aside and that the patent be revoked in its entirety.

(ii) The respondent (patentee) requested as a main request that the appeal be dismissed. As an auxiliary request, he requested that the decision under appeal be set aside and the patent be maintained on the basis of claims 1 to 5 submitted during oral proceedings before the Opposition Division on 9 May 2001.

IV. Independent claims 1 and 6 of the patent in suit as maintained by the Opposition Division (main request of the respondent) read as follows:

"1. A method for the injection molding of plastic articles in an injection molding system including a mold having an injection aperture and a mold cavity for receiving molten resin, the method comprising the steps of:

(a) injecting a quantity of molten plastic through the injection aperture and into the mold cavity, a resin flow path (14) fluidly communicating the injection aperture and the mold cavity within the mold;

(b) communicating a charge of pressurized gas from a source of pressurized gas (10) to a chamber (18) within the mold, an orifice (20) opening from the chamber (18) to the flow path (14);

(c) blocking the orifice (20) so that the charge of pressurized gas is stored within the chamber (18);

(d) unblocking the orifice (20) so that the stored charge of pressurized gas is introduced into the resin flow path (14) from the orifice (20);

(e) containing the gas under pressure within the mold until the article is set up and formed in the mold cavity; and

(f) venting the gas from the mold wherein the mold includes valve means (24) and wherein the step of blocking is accomplished by applying a control pressure to the valve means (24) to block the orifice (20) and the stored charge of pressurized gas causing the valve means (24) to unblock the orifice (20) upon relieving the control pressure."

"6. In an injection molding system for the injection molding of plastic articles, comprising:
an injection molding machine for injecting molten plastic;

a mold having a resin injection aperture, a mold cavity for receiving molten plastic, and a resin flow path (14) fluidly communicating the injection aperture and the mold cavity with the mold, a chamber (18) and an orifice (20) opening from the chamber (18) to the resin flow path (14);

gas receiver means (10) for storing a charge of pressurized fluid;

gas circuit means (12, 26, 30, 48; 34, 36, 38, 40) interconnecting the gas receiver means (10) to the chamber (18),

valve means (24) for selectively fluidly communicating said chamber (18) to said resin flow path (14), characterized by said gas circuit means (12, 26, 30, 48; 34, 36, 38, 40) interconnecting the gas receiver means (10) to the chamber (18) for selectively introducing the charge of pressurized gas into the chamber (18) and control means (28) connected to said valve means (24) and controlling operation thereof by applying a control pressure thereto for causing the valve means (24) to block the orifice (20) to initially store the charge of pressurized gas in the chamber (18) and then causing the valve means (38, 40) to unblock the orifice (20) to communicate said chamber (18) to the flow path (14) to allow the charge to enter the flow path (14)."

V. The following documents were referred to in the appeal proceedings:

D3: US-A-4,101,617

D4: US-A-4,943,407

D5: US-A-4,935,191

VI. In written and oral proceedings, the appellant argued essentially as follows:

The subject-matter of claim 6 lacks novelty in view of the disclosure of documents D3 and D4.

As regards document D3, the gas inlet tube 18 constitutes a chamber as required by claim 6, in which a charge of pressurised gas is stored when the valve 19 is closed. In addition, the injection nozzle 13 forms part of the mould. The control means of the patent in suit is not connected to the valve means, so that this feature of claim 6 must be ignored.

As regards document D4, the embodiment of Figures 20 to 22 includes a needle valve which is controlled by means of a gas supply and directional valves which does not differ from the arrangement for controlling valve 24 in the patent in suit. The feature of applying a control pressure for causing the valve means to block the orifice to initially store the charge of pressurized gas in the chamber is not an apparatus feature, but merely a step of the method. Claim 6 does not claim the apparatus with the gas under pressure.

The subject-matter of claims 1 and 6 lacks an inventive step. The sole feature which distinguishes the subject-matter of claim 1 from the method disclosed with reference to Figures 20 to 22 of document D4 is that a charge of pressurised gas is stored in the chamber of the needle valve immediately before unblocking the orifice to the resin flow path by opening the valve.

The object of the invention is to reduce the presence of sink marks on the plastic articles formed in the moulding operation.

Document D5 is also concerned with the solution of this problem, and proposes that the gas should be introduced into the molten stream of plastics material immediately after the molten material has passed the point at which the gas is introduced. The person skilled in the art would thus apply this teaching to the method of document D4 and would accordingly turn on valve 35'''' earlier than disclosed in document D4. This modification does not require an inventive step.

The methods of operation disclosed for the embodiments of Figures 9 to 19 of D4 involve sequential operation in which gas in line 26 is first blocked at port 30, whereafter the port is opened. This method permits flexibility of operation in that a higher gas pressure or different timing of gas supply may be obtained. On the other hand, the method of operation disclosed for the embodiment of Figures 20 to 22 requires simultaneous opening of valves 35'''' and 41'''', so that gas is supplied to the chamber simultaneously with the opening of the valve means. The flexibility of operation of the previous embodiments is thus lost. It would, however, be obvious to the person skilled in the art that this lost flexibility could be restored by opening the control valve 35'''' at an earlier point in the operating cycle at which the shuttle valve is closed.

This would lead to the adoption of the method of claim 1, so that the subject-matter of claim 1 does not involve an inventive step in view of a consideration of document D4 alone.

The subject-matter of claim 6 does not involve an inventive step for the same reasons.

VII. In written and oral proceedings, the respondent argued essentially as follows:

The line 18 of document D3 cannot be equated with the chamber 18 required by claim 6, since it does not store a charge of pressurised gas.

Document D4 does not disclose control means as specified in claim 6 which operates so as to store gas in the chamber while the valve means blocks the orifice 20.

The subject-matter of claim 6 is thus novel.

The prior art does not give any indication to the person skilled in the art that the valves shown in Figures 20 to 22 of document D4 should be operated in any other way than that disclosed in document D4.

In particular, document D5 only discloses a gas storage chamber outside the mould, connected to the mould via valves. Whilst the disclosure of document D5 suggests to the person skilled in the art that the opening of the valves should be advanced in order to reduce the delay in introducing the pressurised gas, there is no suggestion that the orifice should be blocked, thereby

storing a charge of pressurised gas in the chamber before the orifice is unblocked to allow the charge to enter the resin flow path.

Document D4 is concerned with the problem of preventing contamination of molten resin by the gas (column 1, lines 54 to 59). Three alternative approaches to the solution of this problem are disclosed. In the embodiment of Figures 2 to 6, gas pressure is high enough and the orifice small enough to prevent resin from entering the orifice. In the embodiments of Figures 9 to 19, mechanical means which slide or rotate are provided. There is no indication as to the timing of the gas supply. In the embodiment of Figures 20 to 22, gas is supplied from a remote location simultaneously with the opening of the needle valve 33''''.

A problem associated with such remote gas storage is that a gas pressure drop can occur, giving rise to hesitation marks in the surface of the plastic article, which occur as a result of plastic flow in the mould pausing before resuming flow under increased gas pressure. The solution to this problem offered by the patent in suit is to store gas under pressure adjacent the resin flow path. This solution is not suggested in document D4.

Reasons for the Decision

Novelty

1. *Document D3*

1.1 Document D3 discloses an injection moulding system in which a sliding valve 19 is located in a core portion 16 of an injection nozzle 13 in order to permit compressed gas to enter the mould from an inlet tube 18. The inlet tube is supplied with compressed gas from a source which is not further described. Directional valves 22,23 are provided which permit gas to be supplied or vented to atmosphere so as to move the sliding valve between its open and closed positions.

1.2 It is argued on behalf of the appellant that the inlet tube 18 constitutes a chamber as required by claim 6 of the main request. This cannot be accepted. Claim 6 specifies the presence of a "mold having ... a chamber (18)", "gas circuit means (12, 26, 30, 48; 34, 36, 38, 40) interconnecting the gas receiver means (10) to the chamber (18) for selectively introducing the charge of pressurized gas into the chamber (18)" and "control means (28) ... for causing the valve means (24) to block the orifice (20) to initially store the charge of pressurized gas in the chamber (18)". Thus, the claim specifies that the chamber is situated within the mould and is capable of storing a charge of pressurized gas when the valve is closed.

1.3 Even if the nozzle 13 of document D3 is regarded as forming part of the mould, the portion of the inlet tube within the nozzle cannot be regarded as a chamber which is capable of storing a charge of pressurized gas.

2. *Document D4*

2.1 Document D4 discloses at column 10, line 34 to column 11, line 29, and Figures 20 to 22, an injection moulding system in which a sliding needle valve 33'''' is located in the sprue bushing in order to prevent molten plastic material from entering the gas flow path during plastic injection. Directional valves 35'''', 37'''', 39'''', 41'''' are provided, which permit gas to be supplied from a source 43'''' or vented to atmosphere so as to move the needle valve between its open and closed positions (Figures 21 and 20 respectively). During plastic injection, the needle valve is closed to prevent passage of plastic, and when the plastic injection is substantially finished, the needle valve is opened to permit gas to flow through the port 28'''', the fluid passage 26'''' and the orifice 30'''' into the plastic flow path (column 10, lines 64 to 66).

2.2 There is no point in time at which the charge of pressurised gas required for the plastic article is retained in a chamber from which an orifice opens to the resin flow path by virtue of the orifice being blocked by valve means, the orifice subsequently being unblocked to allow the charge to enter the resin flow path. Instead, when the needle valve of document D4 is opened, gas is allowed to flow from the source 43'''', through the directional valve 35'''', the port 28'''',

the passage 26'''' and the orifice 30'''' into the plastic flow path.

- 2.3 The system disclosed in document D4 thus does not possess "control means (28) connected to said valve means (24) and controlling operation thereof by applying a control pressure thereto for causing the valve means (24) to block the orifice (20) to initially store the charge of pressurized gas in the chamber (18) and then causing the valve means (38, 40) to unblock the orifice (20) to communicate said chamber (18) to the flow path (14) to allow the charge to enter the flow path (14)" as specified in claim 6 of the main request. It cannot be accepted that, as suggested by the appellant, in the preferred embodiment of the patent in suit, the control means are not connected to the valve means, so that this feature must be ignored in claim 6 of the main request. Claim 6 of the main request specifies the presence of "control means (28) connected to said valve means (24) and controlling operation thereof by applying a control pressure thereto". The control means of the preferred embodiment of the patent in suit thus comprises the controller 28 together with the associated directional valves which are connected to the valve means as shown in Figure 1 of the patent in suit and apply a control pressure thereto so as to cause the valve to block and unblock the orifice. Whilst the apparatus of Figures 20 to 22 of document D4 thus includes control means connected to the valve means and controlling operation thereof by applying a control pressure thereto, these control means are not such as to cause the valve means to operate in the manner specified in claim 6 of the main request. The presence of such control means is a

feature of the apparatus which is present whether or not the apparatus is in use.

3. The subject-matter of claim 6 of the main request is thus novel over documents D3 and D4 and satisfies the requirement of Article 54 EPC.

Inventive step

4. *Claim 1 of the main request*

- 4.1 The closest prior art is document D4, and, in particular, the embodiment of Figures 20 to 22, which comprises a sliding needle valve capable of blocking and unblocking the orifice through which pressurized gas is supplied to the plastic flow path. In the method disclosed in this embodiment, when plastic injection is substantially finished, directional valves 35'''' and 41'''' are energized and the directional valve 39'''' is deenergized (column 10, lines 58 and 59). Thus, at the moment at which gas from source 43'''' is permitted to flow through the valve 35'''' towards the resin flow path, valve 33'''' is also opened. The charge of gas is accordingly supplied from a remote location through gas lines. This may give rise to the gas not being immediately supplied to the plastic flow path at the desired pressure at the desired point in time, thus giving rise to the presence of sink marks or hesitation marks on the surface of the plastic articles.

- 4.2 The object of the invention is thus to reduce the presence of sink marks or hesitation marks on the surface of the plastic articles.

4.3 According to claim 1, this is achieved by storing a charge of pressurized gas in the chamber of the valve means immediately before unblocking the orifice, thus allowing the gas to enter the plastic flow path at the moment the needle valve is opened.

4.4 This solution is not suggested by the prior art. Document D4 itself proposes admitting gas "simultaneously with or after the step of injecting" (column 2, lines 10 and 11), or "when the plastic injection is substantially finished" (column 10, line 57). At column 4, lines 39 to 43, referring to the flow chart of Figure 1, and at column 6, lines 25 to 29, it is noted that the pressure of the molten plastic prevents entry of the gas into the plastic flow until the injection stroke of the moulding machine is substantially completed. Further, at column 6, lines 50 to 52, it is stated that an unnecessarily high fluid (i.e. gas) pressure within the plastic article should be avoided while it is setting up in the mould cavity. The general teaching of document D4 is thus that a rapid injection of the charge of gas at a high pressure at an early point during the injection of the plastic should be avoided.

Turning to the preferred embodiments of the apparatus described in document D4 with reference to the drawings, Figures 2 to 6 show an apparatus in which the gas enters the resin flow path through an orifice 30, which is sufficiently small to resist the entry of resin therein, even though the gas pressure is less than the nominal plastic injection pressure (column 6, lines 15 to 25). Entry of gas commences when the

plastic injection pressure drops sufficiently towards the end of the plastic injection stroke.

The embodiments of Figures 9 to 19 possess a cylindrical pin 15' which is either rotatable or slidable, so that, in a first control position, plastic injection is permitted while plastic is prevented from entering the gas orifice 30', and, in a second control position, gas is permitted to enter the resin flow path. There is, however, no disclosure of the point in time at which gas is supplied to the orifice 30'. This could occur either before or at the same time as the second control position is adopted.

The remainder of document D4 thus does not contain any inducement for the person skilled in the art to utilize the sliding needle valve of the embodiment of Figures 20 to 22 so as to store a charge of pressurized gas within the chamber.

It is pointed out on behalf of the appellant that document D5 at column 2, lines 22 to 31, discusses the surface faults which can occur on the plastic articles if plastic flow in the mould is allowed to stop before being compelled to flow again by gas entering the mould. This document does not, however, suggest the solution to this problem offered by the patent in suit, the charge of gas also being supplied from a remote storage tank 28.

Document D3 also discloses an arrangement in which gas is supplied from a remote location and thus does not suggest the provision of a chamber, from which an orifice opens into the resin flow path.

5. *Claim 6 of the main request*

As set out under point 2.3 above, claim 6 of the main request requires the presence of control means which are such as to cause the valve means to store a charge of pressurized gas in the chamber of the valve means immediately before unblocking the orifice, thus allowing the gas to enter the plastic flow path at the moment the needle valve is opened. The subject-matter of claim 6 thus involves an inventive step for the reasons set out above in respect of claim 1.

6. Claims 2 to 5 and 7 to 14 of the main request are directly or indirectly appendant to claims 1 and 6 of the main request respectively. They relate to preferred embodiments of the subject-matter of the independent claims 1 and 6 of the main request and thus similarly involve an inventive step.

7. The patent can accordingly be maintained in the form as maintained by the Opposition Division in accordance with the main request of the respondent, and it is not necessary to consider the auxiliary request of the respondent.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

R. Schumacher

W. Moser