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**D E C I S I O N**  
of 28 May 2003

**Case Number:** T 0532/01 - 3.2.5

**Application Number:** 96116241.9

**Publication Number:** 0768159

**IPC:** B29C 43/58

**Language of the proceedings:** EN

**Title of invention:**

Method of press-molding thermoplastic resin

**Applicant:**

Sumitomo Chemical Company, Limited

**Opponent:**

-

**Headword:**

-

**Relevant legal provisions:**

EPC Art. 56

**Keyword:**

"Inventive step (yes)"

**Decisions cited:**

-

**Catchword:**

-



Case Number: T 0532/01 - 3.2.5

**D E C I S I O N**  
of the Technical Board of Appeal 3.2.5  
of 28 May 2003

**Appellant:** Sumitomo Chemical Company, Limited  
5-33, Kitahama 4-chome  
Chuo-ku  
Osaka 541-8550 (JP)

**Representative:** VOSSIUS & PARTNER  
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**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted 5 January 2001  
refusing European patent application  
No. 96 116 241.9 pursuant to Article 97(1) EPC.

**Composition of the Board:**

**Chairman:** W. Moser  
**Members:** P. E. Michel  
W. Widmeier

## Summary of Facts and Submissions

- I. The appellant (applicant) lodged an appeal against the decision of the Examining Division refusing European patent application No. 96 116 241.9.

In the decision under appeal, it was held that the subject-matter of claim 1 according to both a main and an auxiliary request lacks an inventive step, the arguments being based on the following documents:

D1: US-A-4 917 840

D2: US-A-5 238 383

D3: US-A-5 057 255

In addition, the following documents were also cited in the examination procedure:

D4: EP-A-0 761 409

D5: US-A-5 059 364

D6: JP-A-6 218 782

- II. The appellant requested that a European patent be granted on the basis of claims 1 to 4 filed on 10 April 2003.

Claim 1, which is identical to claim 1 according to the main request underlying the decision under appeal, reads as follows:

"1. A method of press-molding a thermoplastic resin wherein a thermoplastic resin in a molten state is compressed to flow between a pair of female and male molds so as to be formed into a predetermined shape, wherein a compression rate is controlled so that the following expression (1) is satisfied:

$$0.5 \leq B/A \leq 2$$

wherein A (mm/s<sup>2</sup>) is an acceleration which is realized at a time when the compression rate is 75% of a maximum rate in a compression-acceleration region which is a period of time from a moment when the compression of the molten thermoplastic resin is started to a moment when the compression rate reaches the maximum rate; and B (mm/s<sup>2</sup>) is a deceleration which is realized at a time when the compression rate is 75% of the maximum rate in a compression-deceleration region which is a period of time from a moment when the compression rate reaches the maximum rate to a moment when the closing of the molds is completed."

III. The arguments of the Examining Division regarding the issue of whether or not the subject-matter of claim 1 involves an inventive step may be summarised briefly as follows:

The deceleration/acceleration relationship specified in claim 1 is an operational parameter which is commonly fulfilled during the closing cycle of a compression mould.

In particular, documents D1, Figure 5; D2, Figure 2a; and D3, Figures 4C, 6C all appear to show ratios which could be construed as fulfilling the condition of

claim 1 (cf. point 3 of the Reasons). In addition, a toggle mechanism driven by a shaft rotating at constant speed would give rise to a velocity curve in the form of a sinusoidal curve which is symmetrical about the point of maximum velocity and hence would satisfy the inequality of claim 1, the deceleration/acceleration relationship B/A at 75% of the maximum velocity being 1.

Further, no reason is given for choosing to measure the deceleration/acceleration relationship at a compression rate which is 75% of the maximum. The comparative tests are not convincing, since they are based on subjective comparisons by the human eye. The expression (1) is symmetrical about a B/A ratio of 1, that is, the velocity curve region of most interest to the person skilled in the art. The condition of claim 1 is merely an expression of a desire not to subject the resin shot to undue impulses.

The subject-matter of claim 1 thus does not involve an inventive step.

IV. The appellant argues essentially as follows:

The object of the invention is to provide a method of press-molding a thermoplastic resin which results in articles having an improved surface appearance. This is achieved by controlling the compression rate so that the inequality of claim 1 is satisfied. This relationship is not suggested by the prior art cited by the Examining Division.

The surface appearance can be judged by eye better than by quantitative measurements. The examples and comparative examples thus demonstrate the improvement in surface appearance resulting from the method according to the invention.

The subject-matter of claim 1 thus involves an inventive step.

### **Reasons for the Decision**

#### *Main request*

#### *Amendments*

1. Claims 1 to 3 correspond to claims 1 to 3 as filed. The subject-matter of claim 4 does not extend beyond the disclosure of the application as filed. The detection of a starting point of resin compression and measuring acceleration and deceleration of the moving mould are necessary in order to carry out the method of claim 1 and are discussed at page 3, lines 28 to 58 of the published version of the application as filed. Cooling the resin and extracting the moulded article from the mould are referred to at page 3, lines 5 and 6 of the published version of the application as filed. The introduction of claim 4 thus complies with the requirement of Article 123(2) EPC.

*Inventive step*

2. The decision under appeal is to a large extent based on the assumption that "the condition laid down in claim 1, and in particular in the region where the deceleration/acceleration relationship  $B/A$  at 75% of the maximum velocity is approximately equal to 1, is an operational parameter commonly fulfilled during the closing cycle of a compression mould. As examples of this, attention was drawn to the fact that document D1, Figure 5; document D2, Figure 2a; and document D3, Figures 4C, 6C all appear to show ratios which could be construed as fulfilling the condition of claim 1 (cf. point 3 of the Reasons).

In the opinion of the Board, this represents an assumption which is not justified by the disclosure of the cited documents.

Figure 5 of document D1 is a chart plotting instructed velocity against the compression gap between the mould halves. Assuming that the distance  $X1-X2$  is the same as the distance  $X3-X4$ , the deceleration from velocity  $V3$  to  $V4$ , which occurs in the distance  $X3-X4$ , is greater than the acceleration from velocity  $V2$  to  $V3$ , which occurs in the distance  $X1-X2$ , since the velocity  $V2$  is greater than the velocity  $V4$ . Thus, all that can be said with certainty is that the ratio  $B/A$  is greater than 1. It is not clear whether or not the ratio  $B/A$  is greater or less than 2.

Figure 2(a) of document D2 is a graphical representation of mould closure. The movable mould part accelerates according to a function  $f(a)$ , remains at a constant maximum velocity  $V_{max}$ , and then decelerates

according to a function  $f(b)$ . As stated at column 3, line 57 to column 4, line 23, it is preferred for the accelerating function  $f(a)$  to be constant, whilst the deceleration function  $f(b)$  decreases towards the end of the motion in order to avoid shocks to the mould opening/closing apparatus (column 4, line 58 to column 5, line 5). There is no disclosure of the acceleration and deceleration at the regions referred to in claim 1, although Fig. 2(a) of document D2 appears to show an initial deceleration which is more rapid than the acceleration. This is thus also an indication that the deceleration/acceleration relationship  $B/A$  at 75% of the maximum velocity is greater than 1.

Figures 4C and 6C of document D3 are charts of mould opening and closing, showing velocity plotted against time and screw stroke, respectively. The figures show an initial acceleration to a velocity  $C1$  which is maintained for a period before a further acceleration to the maximum velocity  $C2$ . Deceleration occurs in two phases, the second phase being more rapid than the first. Insofar as anything can be derived from these figures, they appear to show an acceleration in the later part of the acceleration phase which is greater than the deceleration in the first part of the deceleration phase. This would appear to imply that the deceleration/acceleration relationship  $B/A$  at 75% of the maximum velocity is less than 1, although whether the deceleration/acceleration relationship  $B/A$  at 75% of the maximum velocity is greater or less than 0.5 remains unclear.



Documents D1, D2 and D3 thus do not direct the person skilled in the art to utilise a deceleration/acceleration relationship B/A at 75% of the maximum velocity of between 0.5 and 2.

Document D4 is concerned with simulating flow behaviour of a resin. Document D5 suggests varying the injection speed and flow rate of the molten resin to achieve uniform filling of the mould. Document D6 discloses an arrangement for controlling mould opening and closing, but does not suggest the deceleration/acceleration relationship specified in claim 1. These documents thus also do not lead the person skilled in the art to adopt a deceleration/acceleration relationship B/A at 75% of the maximum velocity of between 0.5 and 2.

3. As regards the three aspects set out at point 4 of the Reasons of the decision under appeal, the following comments are made:
  - a. In the grounds of appeal, the appellant has provided an explanation of the reason for choosing to measure acceleration/deceleration at a compression rate (or mould velocity) which is 75% of the maximum in the written statement of 4 May 2001. It is noted that the term "stable" is used to mean a constant acceleration or deceleration and the term "unstable" is used to mean a changing acceleration or deceleration. The table provided by the appellant indicates that the selected time represents a transition region between a period of constant acceleration or deceleration and a period of varying acceleration or deceleration.

- b. It is noted that the object of the invention is to improve surface appearance. It can be accepted that evenness of gloss or surface regularity can be judged by the human eye, for example by looking at a reflection of straight fluorescent tubes in the surface. The comparative tests can therefore be accepted as demonstrating, for example, an improvement in Examples 1 and 2 as compared with Comparative Examples 1 and 2.
- c. It is correct that a toggle mechanism driven by a shaft rotating at constant speed would give rise to a velocity curve in the form of a sinusoidal curve which is symmetrical about the point of maximum velocity and hence would satisfy the inequality of claim 1, the deceleration/acceleration relationship  $B/A$  at 75% of the maximum velocity being 1. However, the cited prior art does not contain a suggestion to use a toggle mechanism driven by a shaft rotating at constant speed. Indeed, the cited art shows that the person skilled in the art will tend to provide control mechanisms enabling precise control of mould closing velocity and use this control to obtain a desired velocity profile.
4. As regards point 5 of the Reasons of the decision under appeal, the passage at column 1, lines 26 to 37, of document D1 suggests avoiding velocity fluctuations and velocities which are too high or too low. This is not relevant to the deceleration/acceleration relationship which forms the basis for claim 1.

It may also be noted that document D2 suggests avoiding undue shocks, but concentrates on reducing deceleration in the final stage of the deceleration phase during opening and closing of the mould (cf. Lb of Figure 2(a) and Ld of Figure 2(b)).

5. The cited prior art thus does not lead the skilled reader to control the compression rate in a method of press-moulding a thermoplastic resin so that expression (1) as set out in claim 1 of the main request of the appellant is satisfied.

The subject-matter of claim 1 thus involves an inventive step. Claims 2 to 4 are dependent from claim 1 and relate to preferred embodiments of the invention. The subject-matter of these claims thus also involves 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 grant a patent on the basis of the following documents:

Description: pages 1 to 13 as originally filed;

Claims: Claims 1 to 4 as filed on 10 April 2003;  
and

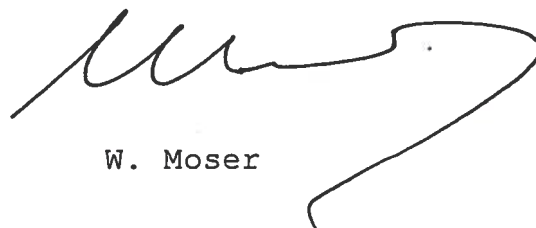
Drawings: Sheets 1/3, 2/3 and 3/3 as originally  
filed.

The Registrar:



M. Dainese

The Chairman:



W. Moser

