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Bezeichnung der Erfindung:
Title of invention: Extruder screw
Titre de l'invention :

Klassifikation / Classification / Classement : B29C 47/62

ENTSCHEIDUNG / DECISION

vom / of / du 29 May 1990

Anmelder / Applicant / Demandeur :

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

Crompton & Knowles Corporaton

Einsprechender / Opponent / Opposant :

Maillefer S.A.

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 56

Schlagwort / Keyword / Mot clé : "Inventive step - confirmed"

Leitsatz / Headnote / Sommaire



Case Number : T 637/88 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 29 May 1990

Appellant :
(Opponent) Maillefer S.A.
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Decision under appeal : Decision of Opposition Division of the European
 Patent Office dated 8 March 1988, dispatched
 on 18 September 1988, rejecting the opposition
 filed against European patent No. 46 631
 pursuant to Article 102(2) EPC,

Composition of the Board :

Chairman : G. Szabo
Members : H. Seidenschwarz
 O. Bossung

Summary of Facts and Submissions

I. European patent No. 46 631 comprising seven claims was granted on 22 May 1985 in response to European patent application No. 81 303 122.6 filed on 8 July 1981.

II. Claim 1 as granted reads as follows:

"An extruder screw (10,10') for a thermoplastic extruder, the screw having an inlet end (13) and an outlet end (15) and comprising:

(a) a root (18,18'),

(b) a helical primary flight (20,20') extending about the root having a trailing edge (24,24') and a leading edge (22,22') said flight and said root defining a feed section (12,12') at the inlet end of the screw, a metering section (16,16') at the outlet end of the screw and a melting section (14,14') between the feed section and the metering section, and

(c) a helical barrier flight (26,26') on the root forming a solids channel (28,28') with the trailing edge of the primary flight and a melt channel (30,30') with the leading edge of the primary flight, the width of the solids channel gradually decreasing and the width of the melt channel gradually increasing in a downstream direction, said melting section being divided into at least two lengthwise zones (40,42; 40',42'), wherein the change in width of each of said channels is at a first rate in one of the zones and a second rate in another of the zones."

III. An opposition was filed against the European patent requesting it be revoked due to lack of novelty, lack of

inventive step and insufficiency of disclosure of the specification.

The following documents were referred to:

- (1) US-2 829 399
- (2) FR-2 004 549
- (3) US-3 271 819
- (4) US-4 085 461
- (5) CH-363 149
- (6) DE-B-1 207 074
- (7) Joel Frados: *Plastics Engineering Handbook*, 4th edition, 1975, page 161, Fig. 7-6
- (8) G. Schenkel: *Kunststoff-Extrudertechnik*, 2nd edition, 1963, pages 48 (Abb.3/40a) and 49 (Chapter 3.5.5, 1st paragraph)
- (9) US-A-3 650 652
- (10) CH-A-420 581.

- IV. After considering the Grounds for Opposition, the Opposition Division rejected the opposition at the conclusion of the oral proceedings of 8 March 1988. The written statement of reasons for the decision was dispatched on 18 September 1988.
- V. On 11 October 1988, the Appellant (Opponent) filed an appeal against the decision. The appropriate fee was paid on 14 October 1988 and the Statement of Grounds was received on 10 November 1988.
- VI. In the Statement of Grounds, the Appellant raised the following objections:
- (i) The subject-matter of Claim 1 is not novel having regard to the documents (9) and (10) (Article 54 EPC).

- (ii) The subject-matter of Claim 1 does not involve an inventive step in view of the teachings disclosed in the documents (5), (6), (10) and (8) (Article 56 EPC).
- (iii) The patent does not give a precise rule to the person skilled in the art for performing an experiment to get the optimum result, and does not describe the invention in such a manner that the person skilled in the art can realise it (Article 100(b) EPC).
- (iv) The subject-matter of the patent concerns a technical theory (Article 52(2) EPC).

VII. In his letter of 19 June 1989, the Respondent (Proprietor) contested the view of the Appellant mainly with the argument that varying the widths of melt and solid channels progressively along the screw is known but what was not known prior to the invention was "the changing the width of each of the channels at a first rate in one zone and a second rate in another zone".

VIII. With his letter of 6 February 1990 the Appellant informed the Board of Appeal, that he "did not find it useful for them to attend the oral proceedings", which have been scheduled on his request. He now requested the Board of Appeal to take its decision on the basis of the contents of the documents on file. The oral proceedings were, therefore, cancelled.

IX. According to his Notice of Appeal, the Appellant requests that the decision of the Opposition Division be set aside and that the patent in suit be revoked.

The Respondent requests rejection of the appeal.

Reasons for the Decision

1. The appeal is admissible.
2. The objection that the subject-matter of the patent concerns a technical theory (Article 52(2)(a) EPC) is not acceptable because the subject-matter of Claim 1 as granted is defined in terms of tangible technical features within the meaning of Rule 29(1) EPC.
3. **Novelty**
 - 3.1 In the opinion of the Appellant, each of the documents (9) and (10) represents the state of the art which anticipates novelty of the subject-matter of Claim 1.
 - 3.1.1 Document (9) concerns an extruder screw for extruding plastic material, whose main channel (17) or solids channel has a feed section (A) at the inlet end of the screw, a metering section (C) at the outlet end of the screw and a melting section (B) therebetween. In this melting section a second helical land (18) begins from the first helical land (16) and diverges to define an auxiliary channel (20) or melt channel with the first helical land. The melt channel achieves its final helical width (h_C) at a point (19a) in the melting section slightly downstream from the point of beginning of said channel and where the first helical land increases in pitch. From this point downstream to the end of the melting section, the helical width of the solids channel as well as of the melt channel remains constant (cf. column 2, lines 26 to 55 and Figures 1, 2 and 4).

This document, therefore, does not disclose the features according to part (C) of Claim 1 as granted.

3.1.2 In the extruder screw for extruding plastic material known from document (10), the width of the entrance groove (4) or solids channel undergoes a sudden narrowing in a transition zone (9) at the end of a first zone or feed section. That is an abrupt reduction in the width of the solids channel accompanied by an immediate creation of a melt channel (6) by diverging a second flight from a first flight. Said melt channel remains at a constant width from said transition zone over a considerable length of a second zone or melting section to another transition zone (18) at the beginning of a third zone or metering section (cf. Fig. 1). From the figures, especially from the graph of Figure 2, it is also clear that there is no reduction in width of the solids channel (4) between both transition zones, because line 7 runs parallel to the x-axis of said graph.

The passage from document (10) on page 2, lines 31-35 concerns the transition zone at the end of the melting section and the beginning of the metering section. The second flight (2) is sharply angled towards the first flight (1) to eliminate the solids channel (4) in a fraction of a turn of the extruder screw. This is clearly indicated by the line 7 on the left side of the graph, where the line turns down in a slight curve and then runs steeply down to zero.

3.1.3 There is no disclosure of an arrangement in these documents in which the width of the solids channel gradually decreases and the width of the melt channel gradually increases in a downstream direction of the extruder screw, let alone in which the change in width of

each of the channels is at a first rate in one zone of the melting section and at a second rate in another zone of said section.

- 3.2 None of the other documents cited in the proceedings before the European Patent Office discloses an extruder screw according to Claim 1. To give reasons in detail is unnecessary since the Appellant did not dispute the novelty with respect to this state of the art.
- 3.3 Hence, the subject-matter of Claim 1 is novel within the meaning of Article 54 EPC.
4. Closest state of the art, problem and solution
- 4.1 According to the findings of the Board of Appeal, the thermoplastic extruder known from document (8) has an extruder screw which is actually the closest to the subject-matter of Claim 1 as granted. The screw has an inlet end and an outlet end and comprises a root, a helical primary flight extending about the root having a trailing edge and a leading edge, said flight and said root defining a feed section (A-C) at the inlet end of the screw, a metering section (B-D) at the outlet end of the screw and a melting section (C-B) between the feed section and the metering section, and a helical barrier flight on the root forming a solids channel with the trailing edge of the primary flight and a melt channel with the leading edge of the primary flight, the width of the solids channel gradually decreasing and the width of the melt channel gradually increasing in a downstream direction. However, since the width of the solids channel gets narrower and, finally, diminishes to zero when it approaches the metering section, the exposure of the solids to the extruder barrel gets less. In addition the decreasing width of the solids channel is constant once

the initial rate is set. Thus the steady reduced exposure of the solids to the extruder barrel results in a steady reduced melting rate (cf. also EP-B-0 046 631, column 2, lines 20 to 23).

- 4.2 The technical problem to be solved by the invention is, therefore, to maintain a high melting efficiency right up to the end of the melting section.
- 4.3 According to the teaching of Claim 1 this problem is solved by dividing the melting section into at least two lengthwise zones, wherein the change in width of each of said channels is at a first rate in one of the zones and a second rate in another of the zones. This permits the adjusting of the rate of change in the widths of both channels in accordance with the melting rate of thermoplastic material along the melting section in the extruder screw.

5. Inventive step

- 5.1 Document (5) or document (6), which is the German version of the Swiss document (5), shows an embodiment of an extruder screw for a thermoplastic extruder (see Fig. 4), in which screw the width of a solids channel (22) is practically gradually reduced to zero, whereas the width of a melt channel (23) gradually increases starting from zero (document (5): page 2, lines 23 to 28, Claim 4; and document (6): column 8, lines 33 to 38, Claim 4). This arrangement of channels corresponds to that in the melting section of the extruder screw according to the closest prior art (cf. document (8) and above point 4.1).

Since in former extruder screws the melting of the solid material to be treated did not occur uniformly, which leads to non-uniformity of delivery from the extruder, the

purpose of the design of the extruder screw known from the documents (5) or (6) is to reduce the resistance to feed the thermoplastic material through the screw, to improve the heat exchange between the solid material and the barrel as well as between each particle of the solid material, and to accelerate the melting (cf. document (5): page 1, lines 8 to 20 and 44 to 49; and document (6): column 6, lines 3 to 7).

In the documents (5) and (6) - as well as in document (8) - there is, however, no hint to solve the aforementioned problem by varying the change in width of the two channels at two different rates over two different zones of the extruder screw.

- 5.2 Document (10) teaches to keep constant the width of the melt channel in the melting section and to decrease gradually the cross-section of the solids channel in the downstream direction of the melting section by reducing the depth of said channel in said direction (cf. page 2, lines 46 to 61; Fig. 2). No further details concerning both channels in the melting section can be derived from the disclosure of document (10); cf. also above point 3.2.
- 5.3 Consequently, from the aforementioned documents, the teaching of Claim 1 of the patent in suit, namely, to take into account that the rate of melting up to break up of the solids to be treated was not linear, cannot be derived. This is to say, by adjusting the rate of change in the width of the solids and melt channels to different values, in accordance with the melting rate of the thermoplastic in the extruder screw, the change in volume of each of the channels nearly matches the actual conversion of the thermoplastic material from the solid state to the molten state thus preventing the possibility

of decomposition when extruding thermally unstable materials, which results in a high melting efficiency and a uniformity of delivery from the extruder.

5.4 The other documents cited in the proceedings before the European Patent Office give likewise no hint of the subject-matter of Claim 1. Their teaching could, therefore, neither alone nor in combination with the teachings of the documents discussed in the foregoing paragraphs lead the person skilled in the art to an extruder screw according to Claim 1.

5.5 Therefore, the subject-matter of Claim 1 involves an inventive step within the meaning of Article 56 EPC.

6. Sufficiency

With respect to the Appellant's objection that the person skilled in the art can not perform an experiment how to get the best result, and realise the invention in consequence of insufficient disclosure (pursuant to Article 100(b) EPC), the following is set forth:

The person skilled in the art understands from the description of the invention in combination with the drawings that the change in width of the solids and melt channels should be set out in two rates along the length of the extruder screw, the rates being determined by experiment to suit the melt rate of the particular extrudate. It does not matter whether there is mentioned in the description more detailed information having regard to the factors which influence the wanted solution of the technical problem to be solved. The person skilled in the art does not need more detailed information because it is well within the scope of his knowledge to choose the adequate conditions dependent on the specific situation. Therefore, with the directions given in the description

the invention is disclosed in a manner sufficiently clear and complete, so he has no difficulty in producing a suitable extruder screw design according to the invention. Thus the disclosure enables the skilled person to carry out the invention, and no ground for insufficiency under Art. 100(b) EPC arises.

7. In view of the above the patent can be maintained as granted.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar:



S. Fabiani

The Chairman:



G. Szabo