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D E C I S I O N
of 20 June 1995

Case Number: T 0483/92 - 3.2.5

Application Number: 84114561.8

Publication Number: 0144932

IPC: B29C 47/50, B29C 47/64, B29C 47/84

Language of the proceedings: EN

Title of invention:
Method for extruding thermoplastic material

Patentee:
Luwa Corporation

Opponent:
HERMANN BERSTORFF Maschinenbau GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 100(a)

Keyword:
"Inventive step (no)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0483/92 - 3.2.5

D E C I S I O N
of the Technical Board of Appeal 3.2.5
of 20 June 1995

Appellant: (Proprietor of the patent)
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Respondent: (Opponent)
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Representative:
-

Decision under appeal:
Decision of the Opposition Division of the European Patent Office dated 30 March 1992 revoking European patent No. 0 144 932 pursuant to Article 102(1) EPC.

Composition of the Board:

Chairman: C. V. Payraudeau
Members: W. D. Weiß
H. P. Ostertag

Summary of Facts and Submissions

I. An opposition based on Article 100(a) (lack of inventive step) was filed against the European patent No. 0 144 932.

The Opposition Division has revoked the patent on the ground that, starting from document

E5: ASME Publication 80-Pet-2; W.T. Rice, "Conservation of Energy and Raw Materials by Utilisation of Gear Pumps in Conjunction with Extruder Processes", November 1980, it lacked an inventive step in view of document

E1: DE-A-2 431 891.

II. Claim 1 as granted reads as follows:

"1. Method of extruding thermoplastic material comprising passing said material successively through an extruder (10) having internally heated rotating conveying screw means (22) and a rotary pump (16), characterised by operating said extruder (10) and said pump (16) at selected compatible speeds respectively - the discharge pressure of the conveying screw means (22) being in the range of 690 kPa to 4830 kPa (100 psi to 700 psi) and approximately 10% to 25% of the discharge pressure of said rotary gear pump (16) - to convey said thermoplastic material through said extruder (10) with relatively little material pressurization in said extruder (10) at said gear pump (16) for relatively little heat generating mechanical working thereof while primarily heating said material by conduction from said screw (22) means to melt said material in said extruder

primarily by heat transfer and to convey said melted material by said gear pump under pressure to a subsequent working station."

III. The Proprietor appealed against this decision.

The Appellant, in his grounds of appeal, essentially submitted the view that the decision of the Opposition Division was based on a blatant misunderstanding of the disclosure of document E5 insofar as it suggested that this document disclosed "that the thermoplastic material is being conveyed through the extruder with relatively little material pressurization". According to the Appellant, the document E5 only suggested to release the the extruder from its pumping function but did not disclose nor even remotely suggest to take away the melting function from the extruder. Thus the subject-matter of the patent in suit did not simply involve a combination of the features of documents E5 and E1, but additionally and more importantly involved a particular method for effectively and advantageously operating such a combination. Specifically, the invention contemplated the provision of the extruder with an internally heated screw along with the particular system of controlling the respective speeds of the extruder screw and of the gear pump so that relatively little material pressurization and mechanical working occured in the extruder with the material being primarily heated by conduction outwardly from the internal heating means within the screw. The molten material within the extruder was only pressurized up to a minimal amount sufficient to mix the material and to maintain a continuous supply of material to the gear pump, while the latter provides the necessary pressurization to force the melt through the downstream die.

IV. The Appellant requests that the impugned decision be set aside and the European patent No. 0 144 932 be maintained as granted.

V. The Respondent did not file any statement during appeal proceedings.

Reasons for the Decision

1. None of the cited documents discloses a method which comprises all the features of Claim 1 of the patent in suit. Since novelty has not been disputed, no detailed explanation needs to be given in this respect.

2.

2.1 In its introductory part, the patent in suit (cf. EP-B-0 144 932, page 2, lines 16 to 63) discusses the conventional extrusion method for thermoplastic material which uses a single screw extruder. This conventional method is also discussed in the review document E5 (cf. page 3, left column, paragraphs 5 and 6).

The single screw extruder, in this conventional method, inseparably combines the three basic functions: melting, mixing and pumping. The heat required to transform the thermoplastic material from a solid at room temperature to a molten material at the desired extrudate temperature is derived from two sources. First heating elements affixed to the extruder barrel generate heat which flows by conduction and convection into the thermoplastic material. Second, the motion of the thermoplastic material through the screw channel generates frictional heat.

Conventionally, the extruder screw is constructed to define a helical channel of decreasing cross-sectional area whereby, in steady operation, the forces generated by the rotation of the extruder screw to force the thermoplastic material through the channel generate hydrostatic pressure in the thermoplastic material. This pressure causes the forward flow of the material to be diminished by the so-called backflow, which is a major source of frictional heat and which has been conventionally considered advantageous in insuring complete melting and homogeneity of the melted thermoplastic material.

Moreover, certain disadvantages of the single screw extruders were generally known before the priority date of the patent in suit (cf. E5, page 3, last complete paragraph).

In particular, it was known that the single screw extruder is an inefficient pump and wastes energy in the form of frictional heat. The rate at which mechanical heating is generated in conventional extruding apparatus increases rapidly with increasing screw speed. Thus, mechanical heat generation and extrudate temperature limit the speed and hence the productive capacity of the extruding apparatus. Moreover, the backflow increases with increasing screw speed thus defining an unsatisfactorily low upper limit of the pumping capacity.

2.2 It was further known before the priority date of the patent in suit (cf. E5, page 3, left column, penultimate line, to right column Figure 6) to segregate the "mixing and melting" functions of the extruder from the "pumping function" by adding a gear pump to the prior device.

Since then the screw needed only deliver the melted material to the gear pump, the way was free to modify the construction of the screw to optimise its melting/mixing functions and to further increase its capacity (cf. E5, page 4, left column, first paragraph).

2.3 Document E5 (cf. page 4, left column, second paragraph) goes on showing the direction of the possible modification to be applied to the extruder screw by stating: "It is generally felt in the industry that extruders must build some appreciable pressure to create frictional resistance necessary for homogeneous melting. This is basically untrue. With proper design a screw can be developed to rely on virtually no back pressure whatsoever to adequately melt." Since the "back pressure" is known to be the backwardly directed component of the hydrostatic pressure (cf. EP-B-0 144 932, page 2. lines 34 to 39), the above statement is a clear suggestion to modify the construction such as to reduce the hydrostatic pressure to a level optimised with respect to the melting/mixing function and high enough to warrant the delivery of material to the gear pump.

The Board is convinced that the ranges for the pressure parameters indicated in Claim 1 are the mere consequence of this optimisation suggested in document E5.

2.4 As stated in point 2.1. above, conventional single screw extruders derive a major part of the heat required to transform the thermoplastic material from a solid at room temperature to a melt at extrusion temperature from the frictional heat originating from the backflow which is the consequence of a hydrostatic pressure built up by the particular construction of the extruder screw.

The person skilled in the art would be guided by the teaching of document E5 to modify the construction of the extruder screw in a manner to obtain a reduced hydrostatic pressure (cf. point 2.3. above). He would consquently be confronted with the problem of having lost his major source of heat, the conventional heating elements affixed to the extruder barrel (cf. EP-B-0 144 932, page 2, lines 20 to 22) being no more able to deliver the necessary amount of heat.

Consequently, document E5 left the skilled person with the problem to search for a more efficient heating method for the thermoplastic material to be extruded.

2.5 The skilled person, when performing this search in the technical field of plastics extrusion would have come upon document E1 disclosing the measure to melt thermoplastic material in an extrusion barrel primarily by heat transfer from an internally heated screw the primary function of which is to convey and not to pressurise the heated thermoplastic material (cf. page 6, second paragraph, to page 7, first paragraph; the paragraph bridging pages 8 and 9; the paragraph bridging pages 9 and 10; Figure 1).

2.6 The subject-matter of Claim 1 is thus the non-inventive result of a combination of the teaching derived from documents E5 and E1, and Claim 1 does not meet one of the prerequisites of patentability enumerated in Article 52(1) EPC. Claim 1 is, therefore, not allowable.

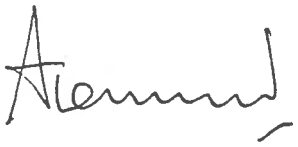
3. The patent, therefore, does not meet the requirements of Article 100(a) EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:



A. Townend

The Chairman:

C. V. Payraudeau