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**D E C I S I O N**  
of 1 December 1998

**Case Number:** T 0451/94 - 3.2.5

**Application Number:** 87110670.4

**Publication Number:** 0255043

**IPC:** B29C 47/20

**Language of the proceedings:** EN

**Title of invention:**  
Extrusion head device for thermoplastic polymers

**Patentee:**  
S. T. Soffiaggio Tecnica s.r.l

**Opponent:**  
Krupp Kautex Maschinenbau GmbH  
Battenfeld Fischer Blasformtechnik GmbH

**Headword:**  
-

**Relevant legal provisions:**  
EPC Art. 56

**Keyword:**  
"Inventive step"

**Decisions cited:**  
-

**Catchword:**  
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Case Number: T 0451/94 - 3.2.5

**D E C I S I O N**  
of the Technical Board of Appeal 3.2.5  
of 1 December 1998

**Appellant:**  
(Proprietor of the patent)

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**Respondent:**  
(Opponent)

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**Decision under appeal:**

Decision of the Opposition Division of the  
European Patent Office posted 7 April 1994  
revoking European patent No. 0 255 043 pursuant  
to Article 102(1) EPC.

**Composition of the Board:**

**Chairman:** A. Burkhart  
**Members:** P. Alting van Geusau  
C. Holtz

## Summary of Facts and Submissions

- I. European patent No. 0 255 943 was granted on 9 October 1991 on the basis of European patent application No. 87 110 670.4.

Claim 1 of the patent reads as follows:

"1. Extrusion head device for thermoplastic polymers, for the production of a tubular element comprising at least one lateral inflow channel (20), a central stem (16) extending longitudinally along the extrusion head, said at least one lateral inflow channel (20) being divided into four secondary channels (21, 22, 23, 24), said four secondary channels having an inflow point offset by about 90° with respect to one another in a transverse cross section of the extrusion head; each of said secondary channels extending longitudinally and being provided with a transverse cross section having a passage opening radially decreasing and circumferentially increasing, characterised in that each of said secondary channels increases circumferentially until it occupies a portion of circumference of about 180° in the terminal composition portion of the tubular element; in said terminal portion, the opposite secondary channels (21 and 23; 22 and 24), combining with one other, form two concentric tubular channels (25, 26), said lateral inflow channel being provided with a transverse wedge which divides the flow into two derived channels, the first of said two derived channels feeding two inner of said secondary channels (21 and 13) which cooperate to form an inner tubular channel (25) of said two concentric tubular channels, the second of said two derived channels feeding two outer of said secondary channels (22 and 24) which cooperate to form an outer tubular channel (26) of said two concentric tubular channels."

II. The respondent (opponent) filed a notice of opposition requesting the revocation of the patent on the grounds of Article 100(a) EPC. In respect of an alleged lack of novelty and inventive step the opposition was supported in particular by the documents

E1: GB-A-2 109 740

E2: DE-A-3 000 444 and

E3: FR-A-2 121 565 (corresponds to DE-A-2 100 192 cited in the description of the patent)

A further opposition was withdrawn by letter dated 18 July 1997.

III. By decision dated 7 April 1994 the Opposition Division revoked the patent. The Opposition Division was of the opinion that the subject-matter of claim 1 of the patent in suit was novel but lacked an inventive step when having regard to the prior art disclosed in E3 and the measures disclosed in E1 and E2 for obtaining uniform pressure and flow in an extrusion head.

IV. An appeal was filed against that decision by the appellant (patent proprietor) on 27 May 1994 and the appeal fee was paid at the same time. Together with the statement of grounds of appeal, filed on 25 July 1994, the appellant filed a sample section of the extruded tubular element, so as to confirm the extrusion pattern shown in Figure 25 of the patent.

V. In communications in preparation for oral proceedings and in response to remarks made by the appellant, the Board expressed the provisional opinion that the subject-matter of claim 1 of the patent appeared to be distinguished from that disclosed in E3 only in that the transverse cross section of the secondary channels

radially decreased. Discussions at the oral proceedings should address the question whether an inventive activity was necessary to incorporate such further development in the extrusion head known from E3.

It was noted that the appellant placed emphasis on the resulting cross section appearance of the extruded tube, which should have a form as shown in Figure 25 of the patent.

In this respect the pattern of distribution of the extruded material in accordance with the sample provided by the appellant was not in line with that of Figure 25 of the patent in suit but rather lay between that shown in Figure 11 of E3 and Figure 25 of the patent. The difference would appear to be the result of different flow properties of the polymer rather than being caused by different flow properties of the extrusion head.

- VI. By facsimile dated 25 November 1998 the appellant requested that the decision under appeal be set aside and that the patent be maintained as granted (main request) or on the basis of claim 1 as filed with letter dated 17 June 1998 (first auxiliary request) or the latter where the characterising portion consists only of the last paragraph of the claim (second auxiliary request) or claim 1 as filed on 23 November 1998 (third auxiliary request).

The claims in accordance with the first and third auxiliary requests read as follows:

"1. Extrusion head device for thermoplastic polymers, for the production of a tubular element suitable to be processed by blow moulding, comprising: a central stem (16) extending longitudinally along the extrusion head and at least one lateral inflow channel (20) provided

with a transverse wedge which divides the flow into two derived channels (28, 29); each derived channel being divided into two secondary channels (21 and 23 or 23 and 24); so forming four secondary channels having an inflow point offset by about  $90^\circ$  with respect to one another in a transverse cross section of the extrusion head; each of said secondary channels extending longitudinally; characterised in that: the first of said two derived channels feeding two inner of said secondary channels (21 and 23), which cooperate to form an inner tubular channel (25); the second of said two derived channels feeding two outer of said secondary channels (22 and 24) which cooperate to form an outer tubular channel (26); said two derived channels (28, 29) have an inflow point offset by about  $90^\circ$  with respect to one another in a transverse cross section of the extrusion head; each derived channel is divided into two secondary channels (21 and 23 or 22 and 24) having an inflow point offset by about  $180^\circ$  with respect to one another, and offset by about  $90^\circ$  with respect to the inflow point of said derived channel, in a transverse cross section of the extrusion head; each of said secondary channels being provided with a transverse cross section having a passage opening radially decreasing and circumferentially increasing until it occupies a portion of circumference of about  $180^\circ$  in the terminal composition portion of the tubular element; in said terminal portion, the opposite secondary channels (21 and 23; 22 and 24), combining with one other, form two concentric tubular channels (25, 26)."

"1. Extrusion head device for thermoplastic polymers, for the production of a tubular element comprising at least one lateral inflow channel (20), a central stem (16) extending longitudinally along the extrusion head, said at least one lateral inflow channel (20) being divided into four secondary channels (21, 22, 23, 24),

said four secondary channels having an inflow point offset by about 90° with respect to one another in a transverse cross section of the extrusion head; each of said secondary channels increases circumferentially until it occupies a portion of circumference of about 180° in the terminal composition portion of the tubular element; in said terminal portion, the opposite secondary channels (21 and 23; 22 and 24), combining with one other, form two concentric tubular channels (25, 26), said lateral inflow channel being provided with a transverse wedge which divides the flow into two derived channels, the first of said two derived channels feeding two inner of said secondary channels (21 and 13) which cooperate to form an inner tubular channel (25) of said two concentric tubular channels, the second of said two derived channels feeding two outer of said secondary channels (22 and 24) which cooperate to form an outer tubular channel (26) of said two concentric tubular channels; characterised in that each of said secondary channels extending longitudinally and being provided with a transverse cross section having a passage opening radially decreasing and circumferentially increasing."

VII. Oral proceedings were held before the Board on 1 December 1998. The appellant was not present. In accordance with the provisions of Rule 71 (2) EPC the proceedings were continued without it.

VIII. In support of its requests the appellant relied essentially on the following written submissions:

When extruding high molecular weight polymers the distribution of flow in commonly used extrusion heads was negatively affected, mainly resulting from the fact that the flow properties of the polymer was correlated to speed, viscosity and temperature in a quadratic manner. Therefore, any change of one of these

parameters resulted in a loss of equilibrium of the separate flows in the extrusion head and consequently in deformations of the extruded tubular element. Such a tubular product was not suitable for blow moulding. It was found that the tubular element manufactured with the help of the extrusion head in accordance with the now claimed embodiment of the invention performed much better than that manufactured with the extrusion head shown in the embodiment of Figures 4 to 10 of the patent.

The improved flow properties of the claimed extrusion head resulted not only from the feature that each of the secondary channels was provided with a transverse cross section having a passage opening radially decreasing and circumferentially increasing but were linked to the specific combination of features claimed. Only when applying them in combination could a tubular element without any radial weldings, or at least radial weldings of reduced length, be manufactured and because of the improved homogeneity and reduction of the extent of the radial welding lines a tubular element particularly suitable for blow-moulding was produced. The prior art represented by E1 and E2, themselves not relating to double walled tubular elements, disclosed material feed channels with a passage opening radially decreasing and circumferentially increasing but the tubular element extruded with this head showed a welding along all the thickness of its wall. In E3 the extruded tubular element had a welding along half of the thickness of the wall. The combination of E1, E2, and D3 could not, therefore, lead to the manufacture of a tubular element without any such radial welding or at least substantially reduced radial weldings.

Actually, because of the symmetrical flow properties the tubular element produced with the extrusion head claimed remained straight even if the flow was unbalanced. In view of such unexpected advantages, the

selection of channel shape and relative arrangement with respect to each other in the manner as defined in the claims of the present requests involved an inventive step.

IX. The respondent disputed the appellant's findings and argued mainly as follows:

Starting from the prior art disclosed in E3, the single feature in the extrusion head of the patent not explicitly mentioned in E3 was that each of the secondary longitudinally extending channels were provided with a transverse cross section having a passage opening radially decreasing and circumferentially increasing. However, such channel configuration was well known to the skilled person and commonly used in extrusion heads because its throttling function and resulting pressure rise were necessary for controlled flowing together of the separate material flows to form a closed ring of material. In particular E1, but also E2, taught such measures of throttling and pressure rise for combining four sub-branch flows into a cylindrical flow and therefore the skilled person was led in an obvious manner to include this feature in the extrusion head known from E3 if problems of unifying the separate flows would occur.

The appellant considered the flow pattern shown in Figure 25 of the patent significant because this pattern did not show radial weldings. However, since the extrusion head of E3 or of the patent were principally identical except for the throttling measures, the flow pattern was immediately dependent upon the flow properties of the extruded material. The pattern of Figure 25 was typical when extruding material with high internal friction and was not suitable to prove alleged constructional differences between the known extrusion heads and the head disclosed in the patent in suit.

The respondent requested that the appeal be dismissed.

**Reasons for the Decision**

1. The appeal is admissible.

2. *Novelty*

2.1 Novelty was not in dispute anymore in the appeal proceedings and the Board finds no reason to discuss novelty in detail.

3. *Inventive step*

3.1 The closest prior art is represented by E3, which discloses extrusion heads for forming preforms for blow molding (see page 1, lines 1 to 5 and lines 28 to 30 of E3).

The Board follows the detailed analysis of this document by the Opposition Division in point 3 of the decision under appeal and in particular supports the interpretation of the arrangement of flow channels in the embodiment of an extrusion head which is not explicitly described in every detail but leads to the material distribution pattern as shown in Figure 11 of E3.

3.2 The extrusion head in accordance with claim 1 of the patent as granted (the appellant's main request) differs from this known extrusion head only in that the transverse cross section of the secondary channels is radially decreasing.

3.3 The appellant argued that the embodiment of E3 concerned (Figure 11) did not disclose that the first derived channel fed two inner secondary channels which cooperated to form the inner tubular channel and the second derived channel fed two outer secondary channels which cooperated to form the outer tubular channel. E3 therefore also covered the example disclosed in the patent in suit in relation to Figures 4 to 10, which embodiment was not claimed and led to disadvantageous asymmetric flow properties.

However, the Board draws attention to the fact that the text on page 9, lines 30 to 35 of E3 clearly indicates that instead of an arrangement in which each flow occupies a portion of circumference of  $360^\circ$ , each such flow could be subdivided further into two flow portions occupying portions of circumference of about  $180^\circ$  and which unite to form each of the inner and outer tubular flows. Since each subdivided flow itself feeds the flow portions of circumference that unite to a tubular flow of  $360^\circ$  it follows immediately in terms of claim 1 of the patent in suit that the first derived channel feeds two inner secondary channels which cooperate to form the inner tubular channel, and the second derived channel feeds two outer secondary channels which cooperate to form the outer tubular channel.

3.4 The object of the patent is to achieve an extrusion head device which allows the use of high molecular weight polymers for the manufacture of tubular elements having improved properties. In particular constancy of wall cross section, straight linear shape, the possibility of high deformation and high level mechanical characteristics of the tubular element should be achieved (see column 2, lines 36 to 49 of the patent in suit).

These objects are achieved by use of the extrusion head defined in claim 1 of the patent in suit. In accordance with the explanations given by the appellant, the flow distribution for the extrusion as shown in the embodiments of Figures 11 to 17 and 18 to 24 led to the flow pattern as shown in Figure 25. Not only was the resulting flow essentially symmetric and therefore the risk of sideward deformation of the tubular element reduced, the flow pattern derivable from the sample also showed that the extent of the radial weldings was reduced when compared to the distribution pattern shown in Figure 11 of E3. The radial weldings shown in Figure 11 of E3 represented lines of weakness and the reduction of their extent led to positive consequences for the mechanical properties of the tubular element, in particular in case of further processing of the extruded tubular element by blow molding.

- 3.5 When considering improvement of the extrusion head device known from E3, in particular when focussing on the homogeneity and mechanical properties of the extruded product, it would be immediately apparent to the skilled person that in particular the properties for uniting the flows to a tubular element are concerned.

The Board supports the conclusions arrived at by the Opposition Division in that the feature distinguishing the subject-matter of claim 1 of the patent in suit (see point 3.2) from the prior art extrusion head known from E3 is a mere conventional feature for arriving at a uniform pressure distribution which results in uniform flow and consequently in uniform wall thickness of the tubular preform, the feature being readily available to the skilled person and known from for example E1 or E2.

Document E1 does not concern the extrusion of a tubular element as such but rather addresses tubular coating(s) about an elongated article such as an electric conductor. However, just as in the patent, also here the circumferential pressure distribution of the extruded material is essential when combining four sub-branch flows into a cylindrical flow while avoiding eccentric deformations.

E1 teaches that for equalizing the circumferential pressure distribution of the molten material in the die, the cross sectional area of the secondary channels gradually decreases as the circumferential extent of the latter increases (see page 2, lines 42 to 44 and page 3, lines 1 to 3 and lines 30 to 34 of E1).

A similar teaching in respect of even pressure distribution is derivable from E2, page 13, first paragraph. It is thus the throttling function of the reduced cross section area that gives rise to a pressure build-up in the area of welding together of the material flowing out of the secondary channels and which pressure build-up, together with the other extrusion parameters influencing the flow, determines the material distribution pattern and the extent of the radial weldings.

Therefore, when searching for a solution to the stated problem, the skilled person would apply the teachings of the prior art disclosed in E1 or E2 and use the known throttling measures to improve the quality of the extruded product. Since the skilled person would thereby arrive in an obvious manner at the extrusion head in accordance with claim 1 of the patent in suit, no inventive activity as required by Article 56 EPC is involved.

3.6 The appellant submitted that, even when combining the teachings of E3 with those of E1 or E2, the material distribution shown in Figure 25 of the patent was not achieved, because this prior art exclusively showed distribution patterns with substantial radial welds whereas there were none in Figure 25 and only very small ones in the distribution pattern in accordance with the sample.

The Board observes that the obvious combination of features of the disclosures E3 and E1 immediately leads to the totality of the combination of features of the extrusion head defined in claim 1 of the patent in suit. Therefore the claimed subject-matter lacks an inventive step.

Moreover, considering the different flow distribution patterns (Figure 11 of E3, Figure 25 of the patent and that of the sample), it is to be noted that such differences depend to a large extent upon the operation of the extrusion head. In particular, when extruding thermoplastic polymers with a high friction component, such as is the case when using polymers with high molecular weight, the flow of the polymer from the inflow channel to the ends of the 180° range is more difficult than from directly below the inflow opening and the resulting higher pressure at those areas with a shorter path leads to the extrusion of more material at those areas. Consequently, the extent of radial welds is dependent upon the flow properties of the extruded material and the throttling properties of the extrusion head and apparently may lead to a cross section image approaching that of the sample provided by the appellant. Therefore, the alleged improvement of a reduction of the width of the welding lines is to a great extent dependent on the properties of the plastics material and operation parameters in the process for extruding the tubular element.

For these reasons the appellant cannot be followed where contending that the extrusion head claimed in claim 1 of the patent in suit leads to an unexpected dramatic improvement of the quality of the tubular elements or that the extrusion head resulting from the obvious combination of teachings of E3 and E1 or E2 cannot lead to an extruded tubular element having a material distribution pattern as shown in Figure 25 of the patent.

3.7 Considering the subject-matter of the auxiliary requests the Board notes that claim 1 in accordance with the first auxiliary request differs from claim 1 as granted essentially in that it is further specified that

- (a) the tubular element produced is suitable for blow-molding and
- (b) the two derived channels (28, 29) have an inflow point offset by about  $90^\circ$  with respect to one another in a transverse cross section of the extrusion head; each derived channel is divided into two secondary channels (21 and 23 or 22 and 24) having an inflow point offset by about  $180^\circ$  with respect to one another, and offset by about  $90^\circ$  with respect to the inflow point of said derived channel; in a transverse cross section of the extrusion head.

3.8 Since the tubular element produced with the extrusion head known from E3 is also intended for being processed by blow molding (see page 1, lines 28 to 30 of E3), feature (a) does not add inventive subject-matter to the granted claim 1.

It was already stated in point 3.3 above that, in the channel arrangement disclosed in E3, each subdivided flow itself feeds the flow portions of circumference that unite to a tubular flow of 360° and that the first derived channel feeds two inner secondary channels which cooperate to form the inner tubular channel and the second derived channel feeds two outer secondary channels which cooperate to form the outer tubular channel and that therefore the inflow points are offset by 90° (see also the decision under appeal page 6, 4th paragraph). In view of the fact that the inner and outer distribution of extruded material - each consisting of two circumferential parts of 180° united to a cylindrical tube - is offset by 90°, for reasons of symmetry of feed the skilled person consequently implies also inflow points with 90° offset of the two derived channels feeding the four secondary channels.

Therefore, when applying the teaching of E3 in respect of the distribution of extruded material shown in Figure 11 and taking into account the explanations in the description in respect of this embodiment of E3, the skilled person would arrive in an obvious manner at the distribution and angular arrangement of the channels defined in (b) above.

Consequently, the subject-matter of claim 1 in accordance with the first auxiliary request does not give rise to a different situation in respect of the assessment of inventive step from the main request. For the same reasons as explained in point 3.4 above with respect to the subject-matter of claim 1 of the main request also the subject-matter of claim 1 of the first auxiliary request fails to add inventive subject-matter to the obvious combination of teachings of the prior art disclosed in E3 and E1 or E2.

3.9 It is to be noted that claim 1 in accordance with the second auxiliary requests differ from claim 1 in accordance with the first auxiliary request only in that the division in the precharacterising part and characterising part is different. This means that the subject-matter claimed in the second auxiliary request does not differ in substance from that of the first auxiliary request and consequently the second auxiliary request must fail for the same reasons for finding a lack of inventive step.

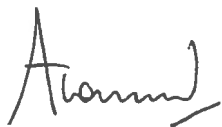
The same applies when comparing the subject-matter of claim 1 of the third auxiliary request and that of claim 1 of the main request.

#### Order

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:



A. Townend

The Chairman:



A. Burkhart

