Internal distribution code:

(A) [-] Publication in OJ
(B) [-] To Chairmen and Members
(C) [-] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 17 July 2019

Case Number: T 1486/14 - 3.2.05

Application Number: 09006138.3

Publication Number: 2080604

IPC: B29C45/27

Language of the proceedings: EN

Title of invention:
Tip assembly having at least three components for hot runner nozzle

Patent Proprietor:
Mold-Masters (2007) Limited

Opponent:
Husky Injection Molding Systems Ltd

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step (yes)

Decisions cited:
T 1546/12, T 0389/86, T 1110/13

This datasheet is not part of the Decision.
It can be changed at any time and without notice.

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 1486/14 - 3.2.05

D E C I S I O N
of Technical Board of Appeal 3.2.05
of 17 July 2019

Appellant: (Opponent)	Husky Injection Molding Systems Ltd 500 Queen Street South Bolton, Ontario, Canada L7E 5S5 (CA)
Representative:	Vossius, Corinna Corinna Vossius IP Group Patent- und Rechtsanwaltskanzlei Widenmayerstrasse 43 80538 München (DE)
Respondent: (Patent Proprietor)	Mold-Masters (2007) Limited 233 Armstrong Avenue Georgetown ON L7G 4X5 (CA)
Representative:	Grünecker Patent- und Rechtsanwälte PartG mbB Leopoldstraße 4 80802 München (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 30 May 2014 concerning maintenance of the European Patent No. 2080604 in amended form.**

Composition of the Board:

Chairman	M. Poock
Members:	T. Vermeulen
	G. Weiss

Summary of Facts and Submissions

I. The opponent lodged an appeal against the interlocutory decision of the opposition division finding that European patent No. 2 080 604 as amended with auxiliary request I met the requirements of the European Patent Convention.

II. The opposition had been filed against the patent as a whole on the basis of Article 100(a) EPC (lack of novelty and lack of inventive step).

III. The opposition division had in particular considered the following documents:

E1	US 6 164 954;
E2	WO 01/28750 A1;
E3	US 5 569 475.

IV. Together with its statement setting out the grounds of appeal, the appellant filed, amongst others, a web page from the Internet database "Matweb" regarding the material "TZM", referred to as document E27, and an excerpt from the textbook "Hot Runners in Injection Moulds" by Frenkler and Zawistowski (2001), referred to as document E29.

V. The oral proceedings before the board of appeal took place on 17 July 2019.

VI. The appellant (opponent) requested that the decision under appeal be set aside and that the patent be revoked.

The respondent (patent proprietor) requested that the decision under appeal be set aside and the patent be maintained in amended form on the basis of the main request or, alternatively, of the auxiliary requests I or II, all filed with letter dated 17 June 2019.

VII. Claim 1 of the main request has the following wording:

"A nozzle (16) for an injection molding apparatus (10), the injection molding apparatus (10) having a mold component (14) defining a mold gate (26) and a mold cavity (24) communicating with the mold gate (26), the nozzle (16) comprising:
a nozzle body (31), said nozzle body (31) defining a nozzle body melt passage (37) therethrough, wherein said nozzle body melt passage (37) is downstream from and in fluid communication with a melt source, and said nozzle body melt passage (37) is upstream from and in fluid communication with the gate (26) into the mold cavity (24);
a heater (32) that is thermally connected to said nozzle body (31) for heating melt in said nozzle body (31);
a tip (33), said tip (33) defining a tip melt passage (38) therethrough, wherein said tip melt passage (38) is downstream from and in fluid communication with the nozzle body melt passage (37), and said tip melt passage (38) is adapted to be upstream from and in fluid communication with said gate (26);
a tip surrounding piece (34) that is connected to said nozzle body (31),
wherein said tip (33) is made from a material which is more wear resistant than said tip surrounding piece (34); and
a mold component contacting piece (35) is located between said mold component (14) and said tip surrounding piece (34), wherein the material of said mold component contacting piece (35) has a thermal

conductivity that is less than the thermal conductivity of the material of the tip surrounding piece (34); **characterized in that** the tip surrounding piece (34) is made from one of beryllium copper, beryllium free copper alloy, aluminum, or aluminum alloys, and the mold component contacting piece (35) is made from titanium, H13, stainless steel, mold steel or chrome steel."

VIII. The submissions of the appellant may be summarised as follows:

The closest prior art for assessing inventive step was the embodiment shown in Figure 8 of document E1. According to column 8, lines 30 to 32 and column 2, lines 42 to 48 of document E1, the materials used for the prior art tip and tip surrounding piece are carbide and TZM, respectively. There seemed to be no dispute that the features of the preamble of claim 1 were considered known from the closest prior art, in particular since no direct contact between the mould component contacting piece and the tip surrounding piece was required by the claim wording. Hence, the respective materials of the tip surrounding piece and the mould component contacting piece constituted the only differences.

The technical effect associated with the material choice for the tip surrounding piece laid in its high thermal conductivity, which substantially improved the heat flow from the heater to the tip melt passage. As to the second differing feature, Figure 8 of document E1 already foresaw a ceramics layer 21a for reducing unwanted heat transfer between the nozzle and the mould component. At the same time, the patent proposed ceramics as an alternative to the thermally insulating materials of claim 1. Therefore, the second differing feature did not have any particular technical effect. As a consequence thereof, the differing features could not lead to any combined effect. The two partial problems had to be defined as: to modify a known nozzle such that heat flow to the tip passage was improved, on the one hand, and to find an alternative thermally insulating material, on the other hand.

A solution to the second partial problem was found in document E3, where the skilled person was taught by the link between the embodiment of Figure 5 and the embodiment of Figures 2 and 3 in column 5, lines 42 to 45 to mount a mould component contacting insulator in a three-layer arrangement on the tip surrounding piece, consisting of an undercoat, an insulating coating and a protective coating made from titanium. Alternatively, the textbook excerpt E29 suggested to use any of the steels listed in the second box of table 4.2 as the material for the mould component contacting piece, all of which had a similar thermal expansion coefficient as the material TZM used for the tip surrounding piece in document E1.

In order to solve the first partial problem the skilled person would revert to the common knowledge derived from document E29. Table 4.2 disclosed that materials with a better thermal conductivity than TZM, such as beryllium copper and aluminium alloys, were commonly used in hot runner systems. The skilled person would thus be incited to replace the TZM material used for the tip surrounding piece in document E1 by beryllium copper. The press-fit method proposed in column 5, lines 56 to 63 of document E1 did not pose any technical obstacles to mount a tip surrounding piece made from beryllium copper onto the prior art tip. In addition, from the passage in column 7, lines 15 to 28 it followed that the requirement of pressure resistance of the tip surrounding piece was irrelevant as long as the ratio of the diameters D1 and D2 was selected appropriately.

IX. The respondent essentially argued as follows:

Starting from document E1 as closest prior art, the differences with the subject-matter of claim 1 would be the specific materials claimed for the tip surrounding piece and the specific materials claimed for the mould component contacting piece. As the mould component contacting piece was mounted directly onto the tip surrounding piece in the embodiment of Figure 8 of document E1, the choice of material for both pieces affected the heat flow through the nozzle. In fact, both differing features improved the heat flow from the heater to the tip melt passage, the first one by providing a high thermal conductivity and the second one by avoiding that a substantial part of the heat flow through the tip surrounding piece was transferred to the mould component. Therefore, a combined technical effect was obtained and the partial problems approach could not be used. The combined objective technical problem was to modify the known nozzle in such a way that the heat flow from the heater to the tip melt passage was improved.

When trying to solve the objective technical problem the skilled person was bound by the context of the entire document E1. It was presented as essential in that prior art document that the materials of the tip and tip surrounding piece had different characteristics for different functions. In particular, the material selected for the outer portion 21 should have a high pressure resistance. Already the fact that not all materials proposed for the tip surrounding piece in claim 1 displayed a high pressure resistance spoke against selecting them to replace the materials proposed in document E1. In addition, document E1 dictated that the materials of the inner and outer portion must be chosen such that their thermal expansion coefficients allowed an interference fit that was still present in the hot condition, keeping in mind that the pressure-fit was just one of three assembly methods proposed by document E1. Therefore, the skilled person would not select beryllium copper as a material for the tip surrounding piece, especially not when the inner portion 22 was already made from beryllium copper. The findings of the board in the inventive step discussion of the similar case T 504/14 were referred to.

As to the mould component contacting piece, the skilled person would not be prompted to replace the ceramic plasma-sprayed thermal insulating coating of document E1 by a piece made from titanium, H13, stainless steel, mould steel or chrome steel. Document E2 did not disclose a mould component contacting piece, whereas the thermal insulator in document E3 was made from a ceramic material sprayed onto the nozzle body. The steel materials for hot runners proposed in document E29 had a thermal conductivity substantially higher than that of ceramics, dissuading the skilled person from the solution proposed by claim 1.

Reasons for the Decision

Main Request - Inventive Step

1. Starting point

The appellant considers the embodiment shown in Figure 8 of document E1 to be the most appropriate starting point. This is not disputed by the respondent. The board is satisfied that none of the other embodiments of document E1 or none of the other cited prior art documents discloses a nozzle that has more structural similarities with the nozzle of claim 1.

Figure 8 of document E1 is reproduced alongside and shows a nozzle tip ("inner portion 22") and a tip surrounding piece ("outer portion 21") with a threaded portion 24 through which the tip is connected to a nozzle body 25. This is illustrated in Figures 1 and 4, where the heater 27 can also be seen in thermal connection with the nozzle body for heating the melt flowing through the tip melt passage 28. A thermally insulating coating 21a surrounds the lower half portion of the tip surrounding piece 21 so that its lower rim may come into contact with a mould component in the vicinity of the mould gate (also suggested by claims 17, 39 and 58 of document E1). In view of the broad meaning given in

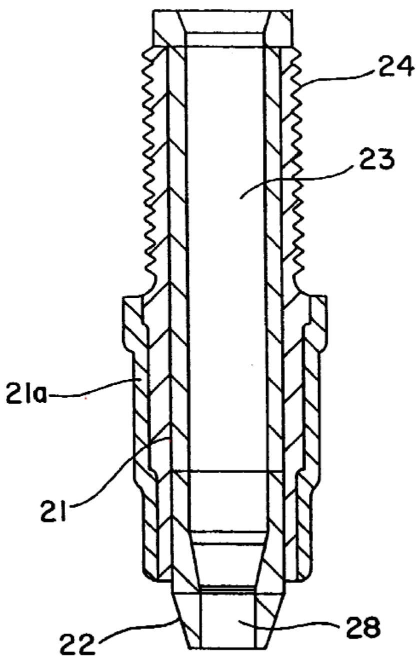

FIG. 8

paragraph [0027] of the patent to the term "piece", the thermally insulating coating 21a is regarded as a mould component contacting piece.

Although the description of the embodiment shown in Figure 8 does not mention any materials for the tip 22 or for the tip surrounding piece 21, the expression "*As in the other embodiments*" in column 8, lines 30 and 31 must also refer to column 2, lines 43 and 44 and to column 5, lines 23 and 24, where it is implied that the tip material is more wear resistant than the material the tip surrounding piece.

The features of the pre-characterising part of claim 1 are therefore known from the embodiment shown in Figure 8 of document E1.

2. Differences

The subject-matter of claim 1 differs from the embodiment shown in Figure 8 of document E1 in that

(i) the tip surrounding piece is made from one of beryllium copper, beryllium free copper alloy, aluminum, or aluminum alloys, and in that

(ii) the mould component contacting piece is made from titanium, H13, stainless steel, mould steel or chrome steel.

3. Objective technical problem

3.1 It is common ground between the parties that feature (i) results in a tip surrounding piece with a high thermal conductivity, which substantially improves the heat flow from the heater to the tip melt passage.

On the other hand, no particular advantage is apparent when using one of the metals listed in feature (ii) instead of the ceramic materials given in column 8, lines 36 to 41 of document E1, nor can any advantage be derived from the patent. On the contrary, in paragraph [0026] of the patent the metals are presented on a par with both ceramics and plastics. The board therefore concludes that feature (ii) merely provides alternative materials that avoid heat loss to the mould component.

3.2 The absence of a clear technical effect of distinguishing feature (ii) is already an indication that the features (i) and (ii) cannot result in a synergistic effect and are functionally independent of each other. Of course, the heat transfer from the heater to the tip melt passage is also improved by reducing the heat loss to the mould component in contact with the nozzle tip. Yet titanium and steel are generally worse thermal insulators than ceramics. The material choice of feature (ii) would therefore increase rather than reduce the heat loss to the mould component when compared to the nozzle shown in Figure 8 of document E1.

Furthermore, the board is not convinced that a relationship in which one feature contributes to achieving the purpose of a second feature is sufficient to establish a synergy between those features. A synergistic combination requires functional reciprocity, not just dependency (cf. T 1546/12, Reasons 3.9). The different features must interact such that the combined effect goes beyond the sum of the individual effects produced by each feature. No such interaction between the materials of feature (i) and feature (ii) is apparent to the board.

Therefore, a possible inventive contribution has to be assessed independently for each of the distinguishing features (i) and (ii). For the subject-matter of the claim to be inventive, it suffices if one of these features is (cf. T 389/86, OJ EPO 1988, page 87, Reasons 4.3).

3.3 The first partial technical problem, relating to feature (i), is to modify the known nozzle in such a way that the heat flow from the heater to the tip melt passage is improved.

The second partial technical problem, relating to feature (ii), is to provide an alternative material that reduces unwanted heat transfer between the nozzle and a mould component.

4. Obviousness

4.1 In order to solve the first partial technical problem, the person skilled in the art will be urged to consider the content of document E1 in its entirety and look for possible solutions in the other embodiments disclosed therein.

Several passages of document E1 emphasize the importance of using materials having different characteristics for the tip and the tip surrounding piece. The reasons behind this lie in the different roles these components play in the prior art nozzle: the tip is exposed to the abrasive high temperature environment in the melt passage, whereas the tip surrounding piece must resist the harsh mechanical conditions exerted between the nozzle body and the tip while preserving the preload with the tip also at high temperatures. Consequently, the tip or inner portion 22 must have a high wear resistance and an excellent thermal conductivity, whereas the tip surrounding piece or outer portion 21 is required to be a good thermally conductive material that must exhibit a high pressure resistance. The materials proposed in document E1 for the tip 22 are carbide, tungsten carbide and beryllium copper (BeCu), while the tip surrounding piece 21 is preferably made from steel, Ti/ZR-carbide (TZM), AerMet 100, Inconel 600 or Inconel 690. In none of the embodiments, however, beryllium copper, beryllium free copper alloy, aluminum, or aluminum alloys are disclosed in conjunction with the tip surrounding piece.

4.2 The appellant cites document E29 as evidence of the common general knowledge in regard of materials used in hot runner systems. It is an excerpt of a textbook published in English translation in 2001. Its availability to the public before the earliest priority date of the patent (3 October 2001) is not questioned by the respondent. The board is satisfied that the document provides indirect evidence for the common general knowledge existing in the technical field of injection moulding well before 2001. Such a document does not stand or fall merely by its publication date (cf. T 1110/03, OJ EPO 2005, pages 302-311, Reasons 2).

Table 4.2 on page 83 of document E29 gives an overview of the thermal properties of materials used in hot runner systems. The top box of the table, reproduced below, contains some materials with a very high thermal conductivity, including BeCu ("CuBe"), aluminium alloys and sintered molybdenum (TZM).

Table 4.2 Thermal properties of materials used in HR systems

Material	Coefficient of thermal expansion	Thermal conductivity	Specific heat
	α (10^{-6}/K)	λ (W/mK)	c (kJ/kg K)
Technical Cu	18.5	~350	0.39
CuCoBe (Hasco)	17	225	
CuBe (ELMET HA)	17	209	0.42
Al alloys	23	130-170	
CuAl		50	
Mo sinter (TZM)		115	

In the absence of any indication for which of the nozzle parts or the manifold components the materials listed in Table 4.2 would be suited, the board finds it difficult to conclude from document E29 alone whether one of these materials would be an appropriate candidate for the tip surrounding piece of document E1.

4.3 In view of what is disclosed in the description and the claims of document E1, however, the person skilled in the art would be prompted to select TZM as the material for the tip surrounding piece. Not only is TZM lauded in document E1 because of its high pressure resistance (cf. column 2, lines 47 to 48 and the paragraph bridging columns 4 and 5), its high thermal conductivity of 115 W/mK would make it more suitable than the other materials mentioned in conjunction with the tip surrounding piece, i.e. steel, AerMet and Inconel, to transfer heat from the heater to the tip melt passage.

4.4 The appellant makes a case for the obvious selection of BeCu as a material for the tip surrounding piece. It is true that Table 4.2 of document E29 confirms the excellent thermal conductivity of beryllium copper alloys (209 W/mK), well above that of TZM. Still, the board is not convinced that the skilled person would be incited to make the tip surrounding piece from BeCu rather than from TZM, for the following reasons.

In the embodiments described in the fourth paragraph of column 6 and in the second paragraph of column 8 of document E1, BeCu is proposed as the preferred material for the *inner* body 22, i.e. the nozzle tip. Further down the respective paragraphs the outer body or tip surrounding piece 21 is presented as being made from a high pressure resistant material (lines 47 to 48 of column 6 resp. lines 12 to 13 of column 8). This implies that the former material (BeCu) is not a high pressure resistant material, so that it would be disregarded as a suitable material for the tip surrounding piece. In addition, the board holds that the person skilled in the art would be deterred from selecting BeCu as the material for the tip and for the tip surrounding piece in the context of a document that emphasizes the use of materials having different characteristics (cf. column 2, lines 26 to 28).

Furthermore, in a nozzle where the tip and the tip surrounding piece are assembled by an interference fit (column 5, line 38 to column 6, line 16 of document E1), the thermal expansion of the components becomes critical to the functioning of the nozzle with increasing operational temperature. The wrong choice of material for a tip surrounding piece assembled onto a tip by a press-fit or a shrink-fit may negatively affect the preload between the components and even undo the interference fit in the hot condition. According to documents E27 and E29, BeCu has a thermal expansion coefficient roughly three times higher than that of TZM (17 $x10^{-6}$/K vs. 5.30 $x10^{-6}$/K). Selecting BeCu instead of TZM for the tip surrounding piece 21 of the embodiment shown in Figure 8 of document E1 therefore risks to become perilous for the nozzle.

In this respect, the appellant also argued that an appropriate selection of the ratio of the outer diameter D1 of the inner portion and the inner diameter D2 of the outer portion would make up for a substantial difference in thermal expansion behaviour. The board however notes that the word "also" in the first sentence of the third paragraph in column 7 of document E1 indicates that adapting the ratio of the diameters D1 and D2 is ancillary to the material constraints discussed in the preceding paragraphs.

Above findings also apply to the alternative materials proposed by feature (i), i.e. beryllium-free copper alloy, aluminium and aluminium alloys. According to document E29, each of them has an excellent thermal conductivity but also a very high thermal expansion rate that would potentially undo the interference fit between the tip and the tip surrounding piece in the hot condition.

4.5 None of the other prior art documents cited during the appeal proceedings disclose a solution to the first partial technical problem along the lines of feature (i).

In document E2 an alignment member 16 surrounding the nozzle tip 14 combines the functions of tip surrounding piece and mould component contacting piece. The preferred materials suggested for the alignment member are titanium and H13 (cf. page 6, lines 29 and 30).

In document E3 no specific material other than steel is mentioned in conjunction with the conductive part of the nozzle assembly (cf. column 3, lines 25 and 63).

4.6 In conclusion, the first distinguishing feature (i) is not obvious to the person skilled in the art having regard to the state of the art.

Therefore, even if the solution to the second partial technical problem were obvious, the claimed solution involves an inventive step (Article 56 EPC).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to maintain the patent as amended in the following version:

   - claims 1 to 12 filed with letter dated 17 June 2019 as main request;

   - description, pages 1 to 13 submitted during the oral proceedings at the Board;

   - Figures 1 to 14 of the patent specification.

The Registrar: The Chairman:

I. Aperribay M. Poock

Decision electronically authenticated