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File Number: T 560/91 - 3.2.5

Application No.: 86 108 582.7

Publication No.: 0 209 745

Title of invention: Process for manufacturing twin layer bottoms with filling
of the hollow space

Classification: B23K 20/00

D E C I S I O N
of 26 November 1992

Patent Proprietor: AMC International Alfa Metalcraft Corporation AG

Opponent: WMF Württembergische Metallwarenfabrik AG

Headword:

EPC Article 56

Keyword: "Inventive step (no)"



Case Number : T 560/91 - 3.2.5

D E C I S I O N
of the Technical Board of Appeal 3.2.5
of 26 November 1992

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 dated 29 May 1991 revoking
European patent No. 0 209 745 pursuant to
Article 102(1) EPC.

Composition of the Board :

Chairman : C. Payraudeau
Members : H. Seidenschwarz
A. Burkhart

Summary of Facts and Submissions

- I. By the decision under appeal, the Opposition Division revoked the European patent No. 0 209 745.
- II. The Appellant appealed against the decision requesting the cancellation of said decision and the maintenance of the patent as granted (main request) or the maintenance of the patent on the basis of the new Claim 1 attached to his Statement of Grounds (auxiliary request).
- III. Oral proceedings were held.
 - (i) During these oral proceedings the Appellant withdrew his main request and maintained his former auxiliary request as the only request. Furthermore, he presented a supplement to the description for adapting the description to the new Claim 1.

Said Claim 1 reads as follows:

"A process for manufacturing a twin layer bottom of a stainless steel pot, said pot being formed as an assembly of a stainless steel main part (1) having a bottom (4) and a side wall, an intermediate filling layer (3) of a good heat conducting metal and an external stainless steel covering layer (2) applied to the bottom of said main part, which process comprises the steps of:

- externally locating a plate (3') of said good heat conducting metal onto the bottom (4) of said main part (1), the thickness of said plate being greater than the final thickness of said intermediate filling layer (3), the volume of said plate being equal to that of said intermediate filling layer;

- locating said stainless steel covering layer (2) on said plate (3'), such that a peripheral band (6) thereof extends towards the bottom (4) of the main part (1) and encircles the periphery of said plate;
- heating the bottom of the assembly to a temperature near but lower than the melting point of the metal of said plate (3');
- applying an impact pressure onto said bottom assembly in order to connect said covering layer (2) permanently to the bottom (4) of said main part (1), and to deform the plate (3') to form the intermediate filling layer (3),
c h a r a c t e r i z e d in that:
 - the initial thickness of said plate (3') is at least 20 per cent greater than the final thickness of said intermediate filling layer (3) and a slit (5) is initially formed between the lower edge of the peripheral band (6) of the covering layer (2) and the external surface of the main part (1);
 - in a first phase of deformation of said plate (3') ~~said impact pressure is applied progressively from the center to the periphery of the bottom, wherein the lower edge of the band (6) contacts the surface of the main part (1) simultaneously or just after the metal of the deformed plate (3') has completely filled all the available space; and~~
 - in a second phase the covering layer is externally restrained by a mould (8), the means for the application of said impact pressure are such that either the bottom of the covering layer (2) or at

least the bottom (4) of the main part (1), or both, have in the finished pot a convexity directed towards the filling layer (3), the total camber of the convexity of the covering layer (2) and the bottom (4) of the main part (1) is equal to or greater than 0.25% of the average diameter of the bottom of the pot in its final shape."

- (ii) The following documents cited by the parties during the oral proceedings were included in those referred to in the proceedings before the European Patent Office:

D1: DE-C-2 258 795;

D2: Burkhardt: "Neuartige Fertigungsverfahren in der Feinwerktechnik", Carl Hanser Verlag, Munich 1969, pages 33 and 34;

D3: US-A-3 173 202; and

D5: US-A-2 908 073.

- (iii) The parties agreed that Figures 5 and 6 of document D1 represent the prior art which comes closest to the subject-matter of Claim 1 within the meaning of Rule 29(1)(a).

- (iv) The Appellant's and the Respondent's submissions can be summarised as follows:

According to the Appellant, the parts of a capsular bottom of a stainless steel pot which are most problematic having regard to safe metal coupling between the intermediate filling layer and the twin steel layers (bottom layer of the steel pot; external steel covering layer), are the peripheral edges. Therefore, the problem to be solved is to improve the close coupling of these three layers, in

particular in said peripheral edges. This problem is solved by the synergical effect obtained by the features as specified in the characterising portion of Claim 1. In a first phase, the high kinetic energy of the impact pressure gives rise to a radial flow of the intermediate filling layer from its centre towards its periphery as a consequence of its plastic deformation resulting simultaneously in an expulsion of the gas included in the spaces between the filling layer and the bottom layer and covering layer respectively and to a closing of the slit between the peripheral band of the covering layer and the external surface of the main part of the steel pot. In a second phase, when the intermediate filling layer has completely filled all the available space, the remaining kinetic energy discharges onto the intermediate filling layer and gives rise to a break-up of the oxidised layers between the three layers to be coupled resulting in a safe metal coupling between said layers. Furthermore, the initial thickness of the intermediate filling layer as specified in Claim 1 is necessary for obtaining a sufficient plastic deformation which permits a radial flow for delaying the closing of the slit until all gases are expelled. Such a synergical effect is not obtained by the process known from document D1 since this document clearly teaches the avoidance of any plastic deformation of the layers to be coupled and the prevention of any slit between the steel pot and the mould.

Having regard to documents D2, D3 and D5, these documents do not disclose processes for manufacturing capsular bottoms of steel pots, since in these processes the layers are not coupled to

each other by a plastic deformation of one layer in a first phase of the impact pressure and by the break up of oxidised layers on the metal layers to be bonded in a second phase. Therefore, none of the cited documents gives any hint to a solution as claimed.

The Respondent contested the arguments with reference to document D1 (column 10, lines 19 to 21; Figures 5 and 6). He emphasised that document D1 discloses a process having two phases within the meaning of Claim 1 as expressly acknowledged by the Appellant's representative in a letter dated 9 December 1986 (E1), and also clearly discloses the use of an intermediate layer having a thickness as specified in the patent in suit. He also argued that document D3 teaches the use of convexity for the means for the application of the impact pressure for removing the gas lying between two metal layers to be coupled; and he referred to documents D2 and D5 as representing the general knowledge of the person skilled in the art.

- (v) At the end of the oral proceedings, the Appellant requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of the patent as granted with amended Claim 1 and corresponding amendments in the description as filed during the oral proceedings (main request). If document E1 were to be considered by the Board then he requested that the case should be remitted to the first instance.

The Respondent requested that the appeal be dismissed.

Reasons for the Decision

1. Closest state of the art

Document D1 discloses a process for manufacturing a twin layer bottom of a stainless pot, which comprises the features and steps as specified in the precharacterising portion of Claim 1: cf. column 9, line 31 to column 10, line 32; Claims 5 and 6, Figures 5 and 6. Figure 6 shows a partial cross section of the pot which is provided with the bottom, the intermediate filling layer (B) of a good heat conducting metal and the external covering layer (C), and which is located in the die press before applying an impact pressure. The peripheral band (C2) projecting over the intermediate filling layer (B) can extend towards the peripheral edge (A4) of the pot thus forming a slit between said edge and the covering layer. Figure 5 is a cross section of the pot and shows that after the application of an impact pressure the intermediate filling layer (B) fills the whole cavity between the bottom (A1) of the pot and the covering layer, and that the lower edge of the peripheral band (C2) is in contact with the peripheral edge (A4) of the pot.

According to Claim 1 of document D1 and the description of the embodiment shown in Figures 1 to 4, the intermediate filling layer (B) is restrained without any clearance by the mould (D2) of the die press thus avoiding any deformation of said layer when an impact pressure is applied onto the assembly. The application of this teaching to the embodiment having a covering layer (C) with a sloping peripheral band (C2) necessarily results in that only said layer is externally restrained by the mould (D2), whereas some free space is left between the mould (D2) and the sloping peripheral band (C2) on the one

side and the intermediate filling layer (B) on the other side.

These facts clearly reveal that, when an impact pressure is applied onto the assembly comprising the mould (D2), the covering layer (C), the intermediate filling layer (B), the steel main part (A) with the bottom and the punch (D1), then in the course of the impact pressure firstly the intermediate filling layer is deformed in such a manner that its metal spreads out towards the periphery of said layer and comes into contact with the parts of the bottom and covering layer projecting over the intermediate filling layer thus filling the whole cavity between the steel main part and the covering layer, and expelling the gases or other materials which are occluded between the three metallic layers from the cavity into the space left between the mould, the covering layer and the main part - due to the fact that the diameter of said layer is smaller than the diameter of the bottom of the steel pot and the cover layer. Secondly, after the metal of the deformed layer has completely filled all available space, said layer is closely coupled to the bottom and covering layer, since a coupling by molecular co-penetration between the three layers as known in the state of the art referred to by the Appellant (cf. EP-B-0 209 735: column 4, lines 23 to 26) is only possible when the flow of the metal has been stopped.

Furthermore, during the first phase of the impact pressure, the slit initially formed between the lower edge of the peripheral band (C2) of the covering layer and the external surface of the main part of the steel pot is closed synchronously with the flow of the metal of the deformed intermediate filling layer into the free space since Figure 5 clearly shows a close contact between the lower edge of said peripheral band and the surface (A4) of

the steel pot without any metal outside the filled cavity.

Consequently, the Figures 5 and 6 of document D1 in fact reflect the prior art which is closest to the subject-matter of Claim 1 of the patent in suit.

2. Differences between the closest prior art and the subject-matter of Claim 1

The subject-matter of Claim 1 differs therefrom only in that:

- the initial thickness of the intermediate filling layer is at least 20 per cent greater than its final thickness, and
- the means for the application of an impact pressure are such that either the bottom of the covering layer or at least the bottom of the main part, or both, have in the finished pot a convexity directed towards the filling layer, the total camber of the convexity of the covering layer and the bottom of the main part being equal to or greater than 0.25% of the average diameter of the bottom of the pot in its final shape.

3. Inventive step

3.1 Having regard to the feature concerning the "convexity" of the means for the application of the impact pressure, reference is made to the description of the patent in suit: column 3, lines 33 to 42, 51 to 60, and column 3, line 61 to column 4, line 4.

According to these passages of the description, said means have a suitable predetermined convexity which causes,

during the application of the impact pressure, an expulsion of the gases by exerting an effect of centrifugal expansion on the metal of the intermediate filling layer since, at the beginning of the deformation phase of said layer, pressure is applied only on the central part of this layer due to the convexity of the above-mentioned means.

It is, however, already known from document D3 (cf. column 3, lines 65 to 68, column 5, lines 36 to 55) to provide the mould, used to apply high energy pressure to the layer of a good heat conducting metal, with a slight bulge towards the centre of the mould. This convexity having a camber of about 0.254 mm (0.010") ensures that any air which might lie between this layer of a good heat conducting metal and the different metal would be squeezed out before the full force of the high energy pressure is applied to the combination. Furthermore, the pressure used must be such that it will cause some radial flow of the good heat conducting metal and reduce the thickness of said metal layer in a range of from 1 to 8%. This reduction causes good bonding between the metal layers (cf. column 4, lines 20 to 24; column 5, lines 2 to 8; column 10, lines 67 to 69).

The person skilled in the art who wants to improve the process known from document D1 (cf. description of the patent in suit: column 1, lines 39 to 54) by expelling still more gases or other materials occluded between the three layers of the capsular bottom would realise without employing any inventive skill that the application of the teaching disclosed in document D3 - the high energy pressure applied must be such that it causes lateral flow and simultaneously reduction of the thickness of the layer of good heat conducting metal - results in a pressure which is progressively applied from the centre to the

periphery of the capsular bottom. It would be obvious to the person skilled in the art that this teaching from document D3 is applicable for a so-called capsular bottom of a stainless steel pot to give rise to the same effect.

A further consequence of the application of the known teaching to the closest prior art is that the metal of the intermediate filling layer is pressed with a high flow rate towards the peripheral band of the covering layer due to the high energy applied onto this covering layer thus providing a safe metal coupling in the peripheral edges of the capsular bottom.

3.2 As far as the parameters specifying the initial thickness of the intermediate filling layer and the camber of the convexity of the covering layer are concerned the Board comments as follows:

3.2.1 According to the description of the patent in suit (cf. column 2, line 65 to column 3, line 2; column 4, lines 6 to 9), the purpose of the first parameter - the initial thickness of the intermediate filling layer is at least 20% greater than its final thickness - is to obtain a radial flow of the metal of said layer sufficient for filling all free space and to permit the closure of the slit between the lower edge of the peripheral band of the covering layer and the external surface of the main part synchronously with said flow. The size and particularly the thickness of the intermediate filling layer are determined by the final result to be obtained so that its volume which is necessary to fill the whole cavity between the main part and the covering layer can be suitably calculated.

It is, however, already known in the art of metal bonding, in particular in that of manufacturing a twin layer bottom

of a steel pot having an intermediate filling layer of a good heat conducting metal by an impact pressure, that said layer must undergo a reduction in thickness of at least 1% up to 60% for obtaining the requisite metal flow and tenacity of strength (cf. document D3, above point 3.1; document D2: page 33, lines 9 to 22; page 34, lines 15 to 18 and 23 to 30; document D5: column 6, lines 21 to 27).

- 3.2.2 The camber of the convexity is equal to or greater than 0.25% and is selected upon the diameter of the bottom of the pot in its final stage according to Claim 1 and to the description of the patent in suit (column 3, lines 37 to 42). From document D3 (cf. above point 3.1) it is, however, also known that the total convexity depends on the thickness of the metal layers to be bonded.
- 3.2.3 From the above it follows that the size of the initial thickness of the intermediate filling layer and the camber of the convexity of the mould depend only on parameters (e.g. kind of metal layers to be bonded; diameter and thickness of these layers in the initial and final stages of the manufactured steel pot, the kind of high energy pressure applied onto said layers) which are generally known to the person skilled in the art as basic requirements for the manufacturing of steel pots having capsular bottoms. Furthermore, the parameters as specified in Claim 1 do not produce any effect which can be considered as essential for the solution of the problem underlying the subject-matter of Claim 1, namely to improve the coupling of the metal layers forming the capsular bottom, in particular the coupling between the intermediate filling layer and the both steel layers in the peripheral edges of the capsular bottom. These parameters, in combination with the other features, cannot support the patentability of the subject-matter in suit.

3.3 For the foregoing reasons, the subject-matter of Claim 1 lacks an inventive step as required by Article 56 EPC.

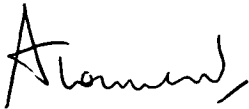
4. Consequently, the patent in suit cannot be maintained on the basis of Claim 1 as filed during the oral proceedings and of dependent Claim 2 of the patent as granted, having regard to Article 52(1) EPC.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar:



A. Townsend

The Chairman:



C. Payraudeau