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D E C I S I O N
of 16 July 2002

Case Number: T 0272/00 - 3.4.1

Application Number: 91918254.3

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IPC: H01C 7/10

Language of the proceedings: EN

Title of invention:

Self-regulating PTC devices having shaped laminar conductive terminals

Patentee:

RAYCHEM CORPORATION

Opponent:

Bourns Inc.

Headword:

Self-regulating PTC devices shaped laminar conductive terminals/RAYCHEM CORPORATION

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (no)"

Decisions cited:

-

Catchword:

-



Case Number: T 0272/00 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 16 July 2002

Appellant: Bourns Inc.
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 17 December 1999
rejecting the opposition filed against European
patent No. 0 551 384 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: G. Davies
Members: H. K. Wolfrum
R. Q. Bekkering

Summary of Facts and Submissions

- I. In a decision, dispatched on 17 December 1999, the opposition division decided to reject the (sole) opposition against European patent No. 0 551 384. According to the cover page of the decision, an additional decision was given : "The opposition of the opponent(s) Bourns Inc is rejected as inadmissible." However, according to point (1) of the reasons for the decision, the opposition was held admissible because it had been found to meet all the requirements of Articles 99(1) and 100 EPC and of Rules 1(1) and 55(c) EPC.
- II. The appellant (opponent) lodged an appeal against the decision rejecting the opposition. The notice of appeal was received on 21 February 2000, the prescribed fee being paid on the same day. The statement setting out the grounds of appeal was received on 27 April 2000.
- III. Opposition had been filed against the patent as a whole, based on Article 100(a) EPC and substantiated on the ground of lack of inventive step (Articles 52(1) and 56 EPC).
- IV. In response to a communication of the Board summoning the parties to oral proceedings and setting out the essential points to be discussed, the respondent (patent proprietor) filed observations by letter dated 17 June 2002 and announced by letter dated 9 July 2002 that they would not attend the oral proceedings.
- V. In accordance with Rule 71(2) EPC, oral proceedings were held on 16 July 2002 in the absence of the respondent.

VI. The appellant requested that the decision of the opposition division be set aside and the patent revoked. Reference was *inter alia* made to the following documents cited in opposition :

A13: US-A-4 937 551 and

A14: EP-A-0 143 607.

VII. The respondent requested in writing that the appeal be dismissed and that the patent be maintained as granted.

VIII. Other requests of both parties relating to the introduction into the proceedings of late-filed documents were not addressed since they were not pertinent to the decision of the Board.

IX. **Claim 1** of the patent as granted reads as follows:

"1. *An electrical device (1) which comprises*

(A) a laminar resistive element (19) which

(a) is composed of a first material having a first resistivity at 23°C, and

(b) has a first periphery;

(B) a laminar conductive element (21) which

(a) is secured to a face of the resistive element (19),

(b) is composed of a second material selected

from inks, pastes, epoxies or solder having a second resistivity at 23°C which is at least ten times lower than the first resistivity, and

(c) has a second periphery which does not extend beyond the first periphery; and

(C) a conductive terminal (3) comprising a laminar portion which

(a) is secured to a face of the conductive element (21) remote from the resistive element (19),

(b) is composed of a third material having a third resistivity at 23°C which is at least ten times lower than the first resistivity, and

(c) has a third periphery a majority of which lies within the first periphery, so that reservoirs are provided, into which excess of said second material can be collected."

- X. The opposition division considered document A13 as the most relevant prior art, from which the subject-matter of claim 1 as granted was distinguished by feature (C)(c). The objective problem of the invention was seen as providing solder reservoirs for excess solder by avoiding or limiting, at the same time, any thermal effect on the device. The teaching offered by document A14 did not correspond to the solution according to the invention. In particular, A14 did not disclose two layers to be soldered in such a way that the majority of the periphery of one of them was kept

within the periphery of the other, but two layers shifted with respect to each other in such a way that the periphery of one of them lay partially inside and partially outside the periphery of the other. In the opposition division's opinion, it resulted that, according to the solution proposed by A14, solder reservoirs were provided at only one edge of the layers whilst, at the opposed edge, excess solder could flow over with the risk that solder bridges could still be formed on said edge.

XI. The appellant's submission may be summarised as follows.

The subject-matter of claim 1 of the patent as granted was suggested by a combination of the teachings of documents A13 and A14.

Based on feature (C)(c) being the sole difference between the claimed subject-matter and the electrical device, the objective problem was to avoid excess solder flowing over the edge of the device, thus forming solder bridges causing electrical shorts. The problem as well as the claimed solution according to feature (C)(c) were known from document A14, which taught that two laminar elements were soldered together so as to offset their edges with respect to each other such that solder reservoirs were provided. When applied to the electrical device known from document A13, this teaching led straightforwardly to removing the periphery of the laminar portion of the terminal element at least partly from the periphery of the resistive element such that solder reservoirs were provided.

XII. The respondent disputed the appellant's view, relying on the following arguments:

The terminals in the device known from A13 were mounting brackets, from the shape of which it could be inferred that the disclosed device was not a surface mounted device. Consequently, problems of solder shorting during solder re-flow could not arise.

Document A14, on the other hand, disclosed a structure which was very different from the devices of the present invention. A14 did not teach the relationship between the two peripheries that was central to the invention but showed instead a staggered arrangement of two metal layers shifted with respect to each other. Hence, apart from the fact that the appellant had not shown that it would have been obvious to select from amongst the multitude of features disclosed in A14 the offset peripheries, and then apply that feature to A13, even with perfect hindsight the present requirement regarding the two peripheries could not be conjured out of a combination of A13 and A14.

A further difference with respect to the structure according to A14 was to be seen in the fact that the edges of the various layers in A14 were located in different planes. Considering metallisation layer 20 of A14 to be equivalent to the conductive terminal, the third periphery was equivalent to the edge of item 20, which was that of a metallisation extending on a side surface of a ceramic cap in a direction perpendicular to the extension of the laminar portion. The edge of layer 20 thus was located in a different plane from that of the laminar portion. In distinction thereto, it was clear from a proper interpretation of present

claim 1 in the light of the description at column 7, lines 40 to 41, that the third periphery was equivalent to the edge of the conductive terminal. In the present invention, the first, second and third peripheries could all be mapped to a single plane, which allowed one to refer to one periphery being within another periphery. Moreover, another distinction could be seen in the fact that in the device of A14 the solder had to be expressly collected at the side metallisation. This teaching was in considerable contrast to that of the present invention, the aim of which was to provide a design where excess solder would not be collected preferentially on the sides of the conductive terminal, where it would have a greater probability of flowing over the edge of the resistive terminal to cause a solder bridge, but would be confined to reservoirs as defined in the present claims.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is therefore admissible.

2. *Admissibility of the opposition*

In view of the opposition division's explicit finding in point (1) of the reasons of the contested decision that the opposition met all the requirements of Articles 99(1) and 100 EPC and of Rules 1(1) and 55(c) EPC, as well as the fact that admissibility of the opposition was not an issue discussed in the opposition procedure, the Board considers the "additional decision" indicated on the front page of the decision to be a mistake which presumably originated from an

error in the use of a computer program employed for generating the front page.

Moreover, the Board has no doubt that the requirements for a valid opposition had been met.

3. *Inventive step (Articles 52(1) and 56 EPC)*

3.1 Document A13 (see in particular Figures 1, 3 and 4 with the corresponding description) shows a laminar electrical device comprising a resistive element (PTC polymer layer 10) and a conductive terminal (eg terminal 14a) secured to the resistive element via a conductive element (ie solder between terminal 14a and an additional conductive foil 12a which is provided on the resistive element 10). It is noted that the presence of an additional conductive foil (such as item 12a) in the known device provided between the resistive element and the conductive element does not constitute a distinguishing feature with respect to the claimed subject-matter under consideration since claim 1 as granted does not exclude the provision of further conductive layers and dependent claim 2 of the patent as granted explicitly defines such an additional layer (item "15") in direct contact with the resistive element. In the sole embodiment shown in document A13 the resistive element has the shape of a rectangle and a majority of the periphery of the conductive terminal as well as the periphery of the conductive element coincide with the periphery of the resistive element.

3.2 Given the fact that the resistivity of PTC materials is much higher, even at room temperature, than that of metals used for solders and conductive terminals, it follows that the subject-matter of claim 1 of the

patent as granted differs from the known electrical device in that a majority of the periphery of the conductive terminal lies within the periphery of the resistive element, so that reservoirs are provided into which excess solder can be collected (feature "(C)(c)" of claim 1).

- 3.3 In view of this difference, the objective problem to be solved by the subject-matter of claim 1 of the patent is to be seen in the desire to avoid conductive bridges being formed by excess solder during the soldering of a terminal to the resistive element, as is correctly indicated in column 2, lines 4 to 9 of the patent description.

The Board disagrees with the formulation of the problem relied on by the opposition division because no basis for the additional aspect of avoiding "thermal effects" on the device can be found in the definitions comprised in claim 1 of the patent. In this respect, it is quite clear from the indication : *"We have now discovered that if the edges of the terminals of a device are notched or otherwise indented, and the indentations on one of the terminals are staggered with respect to the indentations on the other terminal, this has relatively little thermal effect on the device, but yet provides reservoirs along the periphery of the device into which excess solder or other conductive paste can flow."*, given in column 2, lines 32 to 39, of the patent description, that advantageous thermal effects are achieved, if at all, by specific measures which are only the subject of dependent claim 5 of the patent.

Moreover, the Board cannot accept the respondent's allegation that the device known from document A13 was

not a surface-mounted device so that problems of solder shorting during solder re-flow could not arise. Apart from the fact that claim 1 under consideration is not limited to surface mounting devices, the problem addressed by the present patent does not arise during (surface) mounting of the electrical device to another electrical circuit structure (such as for instance a printed circuit board) but occurs in a device having a structure as known from A13 during soldering of the terminal element to the resistive element, as is apparent from column 1, line 56 to column 2, line 7, of the patent description.

- 3.4 The objective problem identified above is considered a common problem to be observed in any electrical device involving solder connections so that its recognition would not involve in itself the exercise of inventive skill.

Moreover, said problem is explicitly addressed in document A14 (see page 2, lines 20 to 25 stating : "*The object of the present invention is to provide a semiconductor device ... in which the soldering of the insulating base to the insulating cap is effected with reduced flow or flight of excess solder.*").

Document A14 (see in particular Figures 1, 5 and 6 with the corresponding description) refers to a semiconductor package including a ceramic cap 10 soldered to a ceramic base 2, 42 thus forming a cavity for housing a semiconductor element. The soldered connection consists of a laminar structure of a metallisation layer 22 formed on the base and a corresponding metallisation layer 20 formed on the cap. From Figures 1, 5 and 6 and the statement: "*As in the*

figures, the outer edges of the metallization pattern 22 of the base 2 preferably extend slightly more outward than the cap 10. This allows formation of a meniscus by excess solder at the corners formed by the metallized top surface of the base 2 and the metallized side surfaces of the cap 10.", given at page 5, lines 12 to 17, it is evident that the outer periphery of metallisation layer 20 on the cap lies within the outer periphery of the metallisation layer 22 and that due to this measure a reservoir for excess solder is formed.

- 3.5 It follows that document A14 does not only address the problem underlying the claimed subject-matter under consideration but teaches also the principle of the claimed solution, ie the provision of solder reservoirs by offsetting the peripheries of laminar elements to be soldered together.

Document A14 has to be considered to relate to the relevant technical field of electrical devices comprising soldered laminar elements since claim 1 under consideration encompasses any electrical device including soldered laminar elements of different electrical resistivity, such as for instance semiconductor elements (a circumstance which, in the Board's view, was not properly taken into consideration in the proceedings before the first instance, including classification and search).

- 3.6 The skilled person, facing the problem of solder bridges in the electrical device known from document A13 and searching the corresponding technical field for useful hints, would have found in document A14 a viable solution, which, when applied to the structure of the

device according to A13, would have led him to form solder reservoirs by recessing the terminal's periphery with respect to the periphery of the resistive element. By such a straightforward modification to the structure of the device known from A13, the skilled person would have devised an electrical device falling under the terms of claim 1 of the patent as granted without having to exercise inventive skills.

- 3.7 The respondent's arguments relating to alleged fundamental differences as regards the structure and effects of solder reservoirs between the claimed device and that known from document A14 are not convincing.

With respect to the question as to what in the device according to A14 would be the true edge or periphery of the conductive terminal and its location, the teaching of A14 leaves no doubt that the effect according to which the known structure acts as a reservoir for excess solder is attributed to the fact that the metallisations on the base and the cap form a corner, with one side of the corner being constituted by the vertical extension of metallisation 20 on the sidewall of the cap and the other side of the corner being formed by that portion of metallisation 22 on the base which extends laterally outside from the area of overlap between the two metallisations. Clearly, without the laterally offset portion of metallisation 22 being uncovered by metallisation 20 on the cap, no such corner would be formed. The Board notes that a similar corner is inevitably formed in the claimed device by the (vertical) sidewall of the conductive terminal and the laterally extending portion of the laminar resistive element which is not covered by the conductive terminal. Hence, the peripheries of the

solder layer and metallisations of the device known from A14 can be "mapped to a single plane" inasmuch as this can be done for the claimed elements and terminals. It follows that, in the known device, metallisation 20 on the cap has an outer periphery which lies (completely) within the periphery of metallisation 22 on the base in the meaning of the corresponding terms used in claim 1 under consideration.

The respondent correctly points to the fact that the side metallisation on the cap, to which in the device according to A14 solder is attracted by wetting, is instrumental in avoiding a spreading of excess solder. However, the function of the solder reservoirs provided in the device according to the present patent is based on exactly the same physical principles, as excess solder would wet the vertical sidewalls of the conductive terminal in the specific embodiment according to Figures 1 and 2 of the patent and, due to the attractive forces involved in such wetting, be prevented from flowing over the adjacent periphery of the resistive element. Consequently, the alleged difference between the object of A14 and the aim of the present invention, as seen by the respondent, does not exist.

- 3.8 Finally, with respect to the opposition division's view that A14 only showed two layers shifted with respect to each other so that, according to the solution proposed by A14, solder reservoirs were provided at only one edge of the layers whilst solder bridges could still be formed at the opposed edge, the Board notes that claim 1 under consideration requires only that the majority of a periphery of the laminar portion of the

conductive terminal lies within a (first) periphery of the resistive element. In the examples of Figures 1, 5 and 6, of A14, both the inner and the outer peripheries of the conductive "terminal" 20 lie completely "within" the (outer) periphery of the "element" 22 onto which it is soldered. Furthermore, the opposition division's finding misses the points that A14 discloses the principle of the claimed solution at any rate for the outer peripheries of the two laminar elements and, moreover, that due to the shifting of the inner peripheries of metallisations 20 and 22 with respect to each other solder reservoirs are formed at the staggered inner peripheries as well.

- 3.9 For the above reasons, the respondent's request does not comply with the requirements of Articles 52(1) and 56 EPC having regard to inventive step.

Thus, the ground of opposition under Article 100(a) EPC in combination with Articles 52(1) and 56 EPC prejudices the maintenance of the patent.

Order

For these reasons it is decided that:

The decision of the opposition division is set aside.

The patent is revoked.

The Registrar:

The Chairman:

R. Schumacher

G. Davies