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D E C I S I O N
of 25 October 2005

Case Number: T 0362/03 - 3.2.06

Application Number: 96113502.7

Publication Number: 0761370

IPC: B23K 20/10

Language of the proceedings: EN

Title of invention:
Ultrasonic bonding machine and resonator thereof

Patentee:
Ultex Corporation

Opponent:
Schunk Ultraschalltechnik GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 123(2), 54, 56

Keyword:
"Amendments (allowable)"
"Inventive step (yes)"

Decisions cited:
T 0284/94

Catchword:
-

Case Number: T 0362/03 **-** 3.2.06

D E C I S I O N
of the Technical Board of Appeal 3.2.06
of 25 October 2005

Appellant: (Proprietor of the patent)
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Decision under appeal:
Decision of the Opposition Division of the European Patent Office posted 16 January 2003 revoking European patent No. 0761370 pursuant to Article 102(1) EPC.

Composition of the Board:

Chairman: P. Alting van Geusau
Members: G. De Crignis
R. Menapace

Summary of Facts and Submissions

I. European patent No. 0 761 370 granted on application No. 96 113 502.7 was maintained in amended form by decision of the opposition division posted on 16 January 2003.

The opposition division held that the subject-matter of the independent claims 1 and 2 in accordance with the patent proprietor's third auxiliary request filed during oral proceedings on 2 December 2002 complied with the requirements of the EPC. However, the subject-matter of independent claim 3 of this request was not considered to involve an inventive step when compared to the prior art disclosed in documents

E1 US-A-3,752,380 and

E5 US-A-4,842,671 or

E6 US-A-4,647,336.

Furthermore, the opposition division found that the feature introduced into the granted independent claim 3 lacked clarity (Article 84 EPC). Therefore, the requests comprising this claim were not considered allowable.

II. The appellant (patent proprietor) filed a notice of appeal against this decision and paid the appeal fee, both on 26 March 2003. On 15 April 2003 the statement of grounds of appeal was filed, together with an amended claim 3 and a new claim 4 and with the request to maintain the decision of the opposition division

with regard to claims 1 and 2, but to set aside the decision of the opposition division with regard to claim 3. It was requested to maintain claims 3 and 4 which were said to overcome the objections raised by the opposition division in respect to former claim 3.

III. In a communication accompanying the summons to oral proceedings pursuant to Article 11(1) of the Rules of Procedure of the Boards of Appeal, the Board raised the question of whether there was support for the amendments made in claims 3 and 4 in the application as originally filed. As a further point to be addressed during the oral proceedings the determination of the objective problem to be solved by the claimed subject-matter was indicated.

IV. Oral proceedings were held on 25 October 2005.

The appellant requested that the decision under appeal be set aside and that the European patent be maintained with claims 1 to 3 as filed during oral proceedings.

The respondent requested that the appeal be dismissed.

V. Claim 3 of this request reads:

"A resonator (7) for use in an ultrasonic bonding machine (1) for bonding an overlapped interface (Wa) between a plurality of members (W_1, W_2) to be bonded together with vibration of a vertical ultrasonic wave, wherein
the resonator (7) resonates with ultrasonic vibration from a transducer (10) at a predetermined frequency and has five maximum ultrasonic vibrational amplitude

points (f1; f3; f5; f7; f9) between both end sides, wherein the total length of the resonator (7) is set to be equal to two times the wavelength of a resonance frequency;
the resonator (7) consists of three parts, by two faces (21; 22), said resonator comprises a single ultrasonic horn (18), having the bonding working portions (11), and two ultrasonic boosters (19; 20), each having each of support portions (16; 17), respectively,
the ultrasonic horn (18) and the two ultrasonic boosters (19; 20) are connected coaxially and formed to a single body with one of two end faces of ultrasonic boosters (19; 20) being contacted with each of both end faces of ultrasonic horn (18), respectively, using two headless bolts (40, 41),
the bonding working portions (11) projecting outwardly from peripheral surface of the resonator forming a single body with the resonator at a position corresponding to the maximum ultrasonic vibration amplitude point (f5) at the center,
the support portions (16, 17) projecting from peripheral surface of the resonator (7), forming a single body with the resonator at positions corresponding to the two minimum vibration amplitude points (f2; f8), located between the maximum vibration amplitude point (f5) at the center and the maximum vibration amplitude points (f1; f9) at both end sides,
the two faces (21; 22) are located at positions of the maximum vibration amplitude points (f3; f7) located between the maximum vibration amplitude point (f5) located correspondingly to the bonding working portion (11) and the two minimum vibration amplitude points (f2; f8) located

correspondingly to the two support portions (16; 17), the minimum vibration amplitude points (f2, f8) are located at positions equally apart from and on both sides of the maximum vibration point (f5),
the ultrasonic horn (18) has threaded apertures (25; 26) on the center axis of the ultrasonic horn at centers of both end surface of the horn /18) toward inner side of the horn,
one of the ultrasonic boosters (20) has a threaded aperture (31) on the center axis of the booster at least at a center of one end surface of the booster (20) toward inner side of the booster,
another ultrasonic booster (19) has threaded apertures (31; 34) on the center axis of the booster at centers of both end surfaces of the booster (19) toward the inner side of the booster,
wherein the ultrasonic horn (18) and one of two ultrasonic boosters(20) are connected by means of a single headless bolt (41) with one of end faces (22) of the ultrasonic horn (18) being faced to the end face (22) having an opening of the threaded aperture (31) of the ultrasonic booster (20), and
the ultrasonic horn (18) and another ultrasonic booster (19) are connected by means of another headless bolt (40) with another end face (21) of the ultrasonic horn (18) being faced to the end face (21) having an opening of the threaded aperture (31) of another ultrasonic booster (19)."

VI. In support of his request the appellant essentially relied upon the following submissions:

The first embodiment disclosed in the patent in suit formed the basis for the subject-matter of claim 3.

With respect to the feature of the boosters having a length equal to half the wavelength disclosed for this first embodiment and its support in the original disclosure (Article 123(2) EPC), it was already clear from the combination of features now claimed in claim 3, that other possibilities were excluded. Therefore, it was superfluous to insert this feature into claim 3.

With respect to inventive step, the starting point for the evaluation of inventive step should be formed by E1 which disclosed a vibratory welding apparatus comprising a resonator with a length equal to one wavelength. The bonding working portion of the vibratory welding apparatus was provided at the center of the resonator at the maximum vibration amplitude point. However, E1 did not disclose any booster as required according to claim 3 of the patent in suit.

The general objective of the patent in suit was to enhance the vibratory bonding energy at the bonding working portions. This specific problem was not addressed in E1.

E6 disclosed in its Figure 1 an assembly comprising just one booster, the booster being removably attached to the ultrasonic converter on one side and to the ultrasonic horn at the other side. In view of the different configurations of the ultrasonic equipment known from E6 when compared to E1 it was not clear how the skilled person should combine the respective teachings. Moreover, the solution provided in claim 3 required two boosters at specified locations. Providing a second booster at the position as claimed in claim 3

would be impossible in E6. Similar arguments applied to the combination of E1 and E5.

Since there was no teaching at all in the prior art how and where to put a second booster the respondent's argumentation was based on hindsight.

According to the resonator claimed in claim 3 it was essential to place the boosters at exactly the points as claimed, because only then the horn, in fact the only part that could wear out, was easy to replace and this was the advantage of the claimed resonator. No such concept could be derived from the available prior art. Therefore, an inventive activity had to be conceded.

VII. In support of his request the respondent essentially relied upon the following submissions:

Claim 3 was not formally correct in view of Article 123(2) EPC. The particular reference to the booster having a length which was equal to half the wavelength was lacking. According to the case law, in particular decision T 284/94, introduction of a technical feature taken in isolation from the description of a specific embodiment usually causes an objection of added subject-matter. In the present case this means that all features of the embodiment now referred to in amended claim 3 should be inserted into the claim.

The starting point for the evaluation of inventive step should be formed by E1. It did not disclose a booster. However, a booster could only be mounted to the

ultrasonic horn at the point of maximum amplitude and support should be at points of minimum amplitude. Therefore, the features defined in claim 3 referred to general and well-known subject-matter. There are two maxima available according to Figure 2 in E1 which directly point to the possibility to connect two boosters. E5 and E6 referred to the possibility to connect a booster to the ultrasonic horn in order to increase the effect. In order to further increase / amplify the effect of one booster it was immediately apparent to the skilled person to add a further booster. No other possibility to connect a second booster to the horn was available than to place it at the claimed position. The use of a second booster just depends on the fact whether further amplification is needed. Therefore, the claimed resonator was based only on the application of measures well-known to the skilled person and therefore lacks an inventive activity.

Reasons for the Decision

1. The appeal is admissible.

2. *Article 123(2) EPC*

The respondent argued that claim 3 relating to the first embodiment shown in Figures 1 to 9 comprised added subject-matter because it did not specify all the features in their disclosed combination. In particular the feature according to which the boosters had a length of half a wavelength of amplitude was missing (reference was made to T 284/94).

However, considering claim 3 in more detail it specifies

- a resonator which has five maximum ultrasonic vibrational amplitude points (f1; f3; f5; f7; f9) between both end sides,
- the total length of the resonator is set to be equal to two times the wavelength of a resonance frequency;
- the resonator consists of three parts, a single ultrasonic horn having the bonding working portions, and two ultrasonic boosters;
- the ultrasonic horn and the two ultrasonic boosters are connected coaxially and formed to a single body with one of two end faces of ultrasonic boosters being contacted with each of both end faces of ultrasonic horn, respectively,
- the two end faces of the ultrasonic horn are located at positions of the maximum vibration amplitude points (f3; f7) located between the maximum vibration amplitude point (f5) located correspondingly to the bonding working portion.

Clearly such configuration only allows for a booster length of half a wave length. Therefore, it is not necessary to add the information concerning the length of the boosters to claim 3 because it is already implicitly present. Consequently, the subject-matter of claim 3 does not give rise to objections under Article 123 (2) EPC.

3. *Novelty*

E1 represents the closest prior art, which view was shared by the opposition division, the patent proprietor and the opponent. In its Figure 1, a

resonator is depicted with a transducer 10 and an elongate bar 16 which acts as a full wavelength resonator. Support members 30 and 32 are coupled to the resonator 16 at the two end regions corresponding to the maxima vibration amplitude points 20 and 24 and are secured with their respective other ends to a stationary base 34. The bonding working portion 40 is screw fastened to the resonator at the maximum vibration amplitude point 22 which is disposed medially between the maximum vibration amplitude points 20 and 24 at the ends of the full wavelength where the attachment is applied. The general layout is thus comparable to the one of the resonator of the patent in suit.

The subject-matter of claim 3 differs from the resonator disclosed in E1 by the boosters and their position in the resonator. The subject-matter of claim 3 hence meets the requirement of novelty (Article 54 EPC).

4. *Inventive step*

4.1 The design of the resonator of E1 is comparable to the one claimed, particularly as regards the bonding working portion which is arranged at a position representing a maximum of the amplitude of the ultrasonic horn and being arranged parallel to the length of the resonator.

4.2 With respect to claim 3, the problem to be solved as indicated in the patent in suit is to facilitate the exchange of the ultrasonic horn (paragraph 0015). However, this general problem was already solved in E1,

in which the configuration of the resonator also allows exchange in the same manner as in the resonator according to the patent in suit,. Therefore, a reformulated problem to be solved is concerned with the use of two boosters, their position in the resonator and their connection with respect to the ultrasonic horn (and the bonding working portion). Insofar, the problem underlying the subject-matter of claim 3 of the patent in suit is to enhance the vibratory bonding energy at the bonding working portion while maintaining easy exchange of the horn.

4.3 Facing the problem of providing an enhanced bonding energy at the bonding working portion, the skilled person was aware that a booster could be used to increase the bonding energy. Such boosters are known from E5 and E6.

4.4 E6 discloses an assembly with one ultrasonic booster 12 which is removably attached at its top to an ultrasonic converter 16 and at its bottom to an ultrasonic horn 18 (Figure 1). The booster 12 increases the amplitude of the vibration and transfers the energy to the horn 18. The opposite tip of the horn 18 represents the bonding working portion. The problem to be solved by E6 is concerned with shock-absorbency in order to avoid broken pegs.

E5 discloses in Figures 4 and 8 an assembly with a pistol grip type handle with a housing wherein is mounted a sonotrode 10 connected to a booster 44 which itself is connected to converter 45. The screws 64 support the sonotrode 10 in the last ultrasonic node point before the working end (bonding working portion)

31 of the sonotrode 10 (Figure 11). A two-part anvil 7 comprises three working surfaces 31 pivotally arranged in an end position of the of the sonotrode. E5 is particularly concerned with the comfort of handling of the apparatus, which is realized *inter alia* by the fact that the anvil parts are moveable in different directions relative to each other.

4.5 Thus, although E5 as well as E6 solve problems remote from the one to be solved by the subject-matter of claim 3 they at least also disclose the basic idea to use a booster. However, with respect to the bonding working portions and working positions and the overall arrangement in view of the transmitted vibration energy, the assembly of E5 as well as that of E6 is based on a different arrangement of the main parts of the resonator and due to this the skilled person cannot, without substantial redesigning, apply the teaching from E5 or E6 to E1.

Furthermore, E5 and E6 only use one booster which is shown in direct contact with the ultrasonic horn on the one side and a transducer on the other side. Thus, neither the number of boosters to be applied nor their position in the resonator arrangement can be derived from E5 or from E6.

4.6 The respondent argued that due to the function of the booster in combination with the ultrasonic horn the skilled person knew that the connection of the booster to the horn inevitably had to be effected at a maximum of the amplitude of the vibration curve and, therefore, the skilled person was aware from Figure 2 of E1 that

when using two boosters they could only be positioned in the two maxima shown.

In this context the Board notes that the respondent failed to provide evidence of the alleged common knowledge of the use of multiple boosters and furthermore, that the patent in suit discloses another embodiment (Figures 8 and 9), with an intermediate booster 70 which is connected on one side to the output end of the transducer 10 and on the other side to the booster 19. Thus, also the respondent's further allegation according to which the skilled person had no other choice for connecting the booster than at the positions claimed, is based on hindsight.

4.7 It follows that E1 when considered in combination with E5 or E6 and with the common knowledge of the skilled person, cannot provide any guidance for the solution of the technical problem in the manner as claimed in claim 3 in the patent in suit.

4.8 For the above reasons, the subject-matter of claim 3 is novel and involves an inventive step. Together with claims 1 and 2 which had not been the subject of the present appeal and the amended description as well as the figures as granted, it can form a basis for the maintenance of the patent in amended form.

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 with claims 1 to 3 and the description, columns 1 to 20 both as filed during the oral proceedings on 25 October 2005, Figures 1 to 14 as granted.

The Registrar: The Chairman:

M. Patin P. Alting van Geusau