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**D E C I S I O N**  
**of 4 June 1997**

**Case Number:** T 0611/96 - 3.5.1

**Application Number:** 91904499.0

**Publication Number:** 0469118

**IPC:** G01S 7/52

**Language of the proceedings:** EN

**Title of invention:**

Combined reflection and transmission ultrasonic imaging method  
and apparatus

**Applicant:**

SRI INTERNATIONAL

**Opponent:**

-

**Headword:**

-

**Relevant legal provisions:**

EPC Art. 56

**Keyword:**

"Inventive step - main request, auxiliary requests 1 and 2  
(no)"

"Remittal to first instance"

**Decisions cited:**

-

**Catchword:**

-



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Boards of Appeal

Chambres de recours

Case Number: T 0611/96 - 3.5.1

**D E C I S I O N**  
of the Technical Board of Appeal 3.5.1  
of 4 June 1997

**Appellant:** SRI INTERNATIONAL  
333 Ravenswood Avenue  
Menlo Park  
California 94025-3493 (US)

**Representative:** Müller, Hans-Jürgen, Dipl.-Ing.  
Müller, Schupfner & Gauger  
Postfach 10 11 61  
80085 München (DE)

**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted 6 February 1996  
refusing European patent application  
No. 91 904 499.0 pursuant to Article 97(1) EPC.

**Composition of the Board:**

**Chairman:** P. K. J. van den Berg  
**Members:** A. S. Clelland  
G. Davies

## Summary of Facts and Submissions

I. This appeal is against the decision of the examining division to refuse European patent application No. 91 904 499.0 (from international application No. PCT/US91/00715) on the ground that the subject-matter of claims 1 and 14 lacked an inventive step, Articles 52(1) and 56 EPC. Inter alia the following documents were cited in the decision:

D1: WO-A-8 605 595

D3: EP-A-0 123 427

II. On 2 April 1996 the appellant (applicant) lodged an appeal against the decision and paid the prescribed fee. On 5 June 1996 a statement of grounds of appeal was filed, with a new set of claims. A request for oral proceedings was also filed.

In a communication from the Board, reference was additionally made to a document cited in the International Search Report:

D4: US-A-4 761 739

III. Following the communication, the appellant filed claims for a main and first and second auxiliary requests on 6 May 1997. Oral proceedings were held on 4 June 1997. At the oral proceedings the appellant requested that the decision under appeal be set aside and a patent granted on the basis of the following documents:

### Main request:

**Claims:** 1 to 25, received 6 May 1997;

**Description:** pages 1 to 20, received 6 May 1997;

**Drawings:** sheets 1 to 6, as originally filed.

**Auxiliary request 1:**

As main request, but with claims 1 to 24, received  
6 May 1997.

**Auxiliary request 2:**

As main request, but with claims 1 to 22, received  
6 May 1997.

**Auxiliary request 3:**

As main request, but with claims 1 to 20, submitted  
during the oral proceedings.

IV. Claim 17, which is the broadest claim of the main  
request, reads as follows:

"Ultrasonic imaging apparatus for imaging a section  
(20) within a subject (12, 128) of different tissue,  
including  
ultrasonic transducer means (10, 122, 130),  
transmitter means (14, 120) for energising said  
transducer means (10, 122) for transmitting an  
ultrasonic energy beam into the subject (12) for  
insonification of the subject (12, 128) at the section  
(20) to be imaged,  
scanning means (22, 136) for scanning said beam,  
focussing means for focussing the ultrasonic transducer  
means (10, 122, 130) at a focal point (F) at the  
section (20) to be imaged,  
receiver means (28, 120, 142) for detecting signals  
produced by said transducer means (10, 122, 130) in  
response to energy transmitted through and reflected  
from said focal point (F) to produce transmission image  
data substantially dependent upon transmissivity of the  
subject at the focal point (F),

c h a r a c t e r i z e d i n t h a t

said receiver means (28, 120, 142) detect signals produced by said transducer means (10, 122, 130) in response to energy reflected from a range zone (Z1) substantially centered at said focal point (F) to produce reflection image data substantially dependent upon reflectivity of the subject at the focal point (F), combining means (60) combine the reflection and transmission image data, and visual display means (64) responsive to the combined reflection and transmission image data visually display a combined image."

Method claims 1 and 2 of the main request generally correspond to apparatus claim 17, but specify the combining of the reflection and the transmission data is achieved using a "nonlinear" and a "linear" combining function, respectively.

In auxiliary request 1, claim 16 adds to claim 17 of the main request the features of "weighting means for weighting the reflection and transmission image data" and "varying means vary at least one of said weighting means". Method claim 2 corresponds to this apparatus claim and method claim 1 is the same as that of the main request.

In auxiliary request 2, claim 15 adds to claim 16 of auxiliary request 1 the feature of "adding means for adding the weighted reflection and transmission image data". Method claim 2 corresponds to this apparatus claim, but defines the weighting step with "multiplying said values of weights with said reflection and transmission image data". Method claim 1 is the same as that of the main request.

In auxiliary request 3, claim 12 adds to claim 17 of the main request the feature "determining means for determining variable values of weights by using reflection and transmission image data from a plurality of subjects, separating pixel signal values from first and second areas of the reflection and transmission images of said subjects and maximizing the difference between the means of the pixel signal values from the first and second areas relative to a measure of their scatters, combining means multiply said values of weights with said reflection and transmission image data". The single method claim 1 corresponds to this apparatus claim.

V. The appellant argued as follows:

The invention improved the quality of C-scan ultrasonic images by combining the reflection and the transmission data in a single image. Although D1 disclosed producing the two images at the same time, there was no hint that they could be combined. The skilled person would not have considered D3 or D4 as they were in different fields. In any case, D3 and D4 concerned combining different types of image and/or a different way of combining and were not relevant to the present invention.

Moreover, the invention was not merely a combination of the two images on a single display. First, the reflection image was derived from a range zone and not simply from the focal point as in the prior art. Secondly, the two images were processed in parallel in a single method, whereas D1 did not even describe processing the reflection image data. Finally, the data

from both images was combined at the data level, namely on a pixel-by-pixel basis, which gave greater flexibility than if the data were simply combined at the display.

- VI. In the course of the oral proceedings on amendment to claim 17 of the main request, to specify that the combining means are for generating combined image data, was put to the Board but was not made the subject of a request.

### Reasons for the Decision

1. The appeal complies with Article 106 to 108 and Rule 64 EPC and is, therefore, admissible.
2. *Inventive step (main request)*
  - 2.1 In C-scan ultrasonic imaging a focussed beam of ultrasonic waves scans an image plane which is normal to the sensor axis and located within the object under investigation. The conventional method produces a reflection image by detecting the ultrasonic waves reflected back to the transmitter by the tissue at the focal point under investigation. This method is so well known as to constitute part of the common general knowledge in the art. In addition to this method, the present application provides a transmission image by analysing the waves transmitted through the focal point. This can be done by placing a detector behind the target (cf Figure 8 of the application); alternatively, a reflex transmission image can be produced by detecting waves that have passed through the focal point and are reflected back to the transmitter by tissue in a back-scatter zone behind the focal point (cf Figure 1). The application is concerned

with the problem of improving the image quality of ultrasonic imaging using both C-scan reflection and transmission image data.

2.2 It is common ground that D1, which is acknowledged in the introductory part of the application, discloses an ultrasonic imaging method and apparatus for producing transmission C-scan images. It also discloses, at page 7, lines 14 to 16, receiving energy reflected from the focal point. These features form the pre-characterising parts of independent method claims 1 and 2 and apparatus claim 17.

2.3 D1 also contains the following passage at page 22, lines 20 to 26:

"Obviously, a conventional C-scan image may be obtained at the same time a reflex transmission C-scan image is obtained by simply processing those signals reflected from scatterers at the focal point, in a conventional manner, then processing those signals obtained from a range zone opposite the focal point, in the manner of the present invention."

This shows that the inventor also envisaged incorporating the steps necessary to produce reflection C-scan images at the same time as reflex transmission images. Thus, although they are not explicitly disclosed in D1, the receiving, processing, detecting and repeating features of the characterising parts of claims 1, 2 and 17 are nevertheless implicit in the disclosure.

2.4 The essential difference between the subject-matter of on the one hand claims 1, 2 and 17 and on the other that of D1 is that the reflection and transmission image data is combined and the combined image data displayed visually, claim 1 additionally specifying a

non-linear combining function and claim 2 a linear combining function. An image of improved quality is thus obtained.

- 2.5 At the oral proceedings the discussion primarily revolved around the question of how the skilled person would interpret the above-cited passage in D1. In particular, would the skilled person be more likely to combine the conventional and reflex transmission signals, or simply to display them on different displays as argued by the appellant?
- 2.6 In favour of the former interpretation is the fact that the two signals will show the same features but with differing emphases, since one signal is based on reflectance and the other on transmittance. Since both signals relate to the same scene, their combination would readily suggest itself to the skilled person. On the other hand, D1 itself only ever provides one display at a time; in the Figure 8 embodiment of D1 a B-scan and a C-scan signal are provided simultaneously but only one signal is displayed, the selection being made by means of a switch 218. It could be argued that the skilled person would therefore be led by D1 to provide switching between the two images.
- 2.7 The Board however considers that the combination of two differing images of the same scene would be obvious to the skilled person. D1 gives no details of how the two C-scan images should be displayed and the skilled person accordingly has to call upon his knowledge of the art. The Board takes the view that the skilled person, faced with the applicant's problem, could be expected to look in the related diagnostic imaging fields, and D3 in particular. The Board disagrees with the appellant's argument in the written proceedings that D3 was "far away from the claimed method and do[es] not concern the object of the invention". First,

D3 refers to providing "enhanced" and "more precise and reliable" diagnostic information at page 3, lines 30 to 33, page 4, lines 21 to 24 and page 16, lines 22 to 25, which is the problem underlying the alleged invention. Second, D3 also discloses combining an ultrasonic transmission and reflection image. Although it is true that D3 describes tomographic images in which, in the case of the transmission image at least, the ultrasonic beam is unfocussed, the Board considers that it nevertheless establishes the idea that a combination of transmission and reflection images of the same object can be used to improve the image quality.

2.8 This general teaching is confirmed by D4, in which enhanced diagnostic information is achieved by taking two x-rays of the same scene but with different energy levels and subtracting one from the other. It is stated at column 1 lines 20 to 57 that subtractive signal processing as such is conventional, one example of a prior art technique given being that of x-raying a patient, injecting a contrast medium, repeating the x-ray and subtracting the first x-ray image from the second. It is stated that the two image signals must be appropriately weighted. Since both x-ray and acoustic imaging can loosely be lumped together under the heading of medical diagnostic imaging, an advance in the display of x-ray diagnostic images could be expected to be of interest in the field of acoustic imaging.

2.9 The independent method claims 1 and 2 of the main request add to the mere combination of image data that this is done with a nonlinear and a linear combining function respectively. The Board takes the view that once the skilled person has decided to combine the two images, the actual combining function used is a matter of non-inventive choice; a linear combining function is implied by the combination of two sets of data, whilst

in view of the well-known nonlinear properties of acoustic systems which cause the transduction of acoustic data to image data to be inherently nonlinear, the skilled person could be expected to compensate for this as and when necessary. The independent apparatus claim 17 merely states that the two kinds of image data are combined. Accordingly, the subject-matter of each of claims 1, 2 and 17 lacks an inventive step.

2.10 The appellant argued that the alleged invention did not follow from D1 even if the skilled person were to consider combining the two images. First, the reflection image was obtained from energy received from a range zone (Z1). This gave a better image than the prior art technique in which the energy was received from just the focal point (F). The Board however considers that this is also implicit in the prior art technique; the reflected signal must be gated for some finite time to receive enough energy to produce an image and is not therefore merely from a point but from a range. Secondly, it was argued that the invention processed both the images in parallel in a single method or apparatus. D1 merely showed in Figure 2 a time T3 when the reflected signals arrived, but these were not processed. The Board considers that D1 implies parallel processing in the passage quoted at point 2.3 above, which refers to two images being obtained "at the same time". Finally, it was argued that the data from both images was combined at the data level, namely on a pixel-by-pixel basis, which gave greater flexibility than if the data was simply combined on a display. Leaving aside the question of whether this feature is reflected in the claims, the distinction appears artificial. In combining two images using conventional modern electronic display technology the data signals representing the images must be electronically combined. Since acoustic imaging usually implies scan conversion it follows that any combination

will be done on a pixel-by-pixel basis by processing and adding the respective pixel outputs from two memories, for example. Even the combination of two analog signals which are in synchronism can be viewed as being on a pixel-by-pixel basis. It is observed that the proposed amendment referred to at point VI above would not have had any effect on the above analysis.

3. *Inventive step (auxiliary request 1)*

3.1 Claim 1 of this request is identical in scope to claim 1 of the main request and accordingly open to the same objection of lack of inventive step. Claim 2 adds to claim 2 of the main request that the weighting of the image data is variable, whilst independent apparatus claim 16 adds to claim 17 of the main request that weighting means, at least one of which can be varied, are provided. It is however self-evident that as the aim is to gain enhanced diagnostic information some method of determining the weighting must be provided in order to ensure maximum enhancement. D4 refers at column 2 lines 34 to 44 to the weighting factors being determined experimentally, which is what might be expected. A controllable, i.e. a variable, weighting would thus appear to be a necessity. Accordingly, the subject-matter of each of claims 1, 2 and 16 of this request lacks an inventive step.

4. *Inventive step (auxiliary request 2)*

4.1 Claim 1 of this request is identical in scope to claim 1 of the main request and accordingly open to the same objection of lack of inventive step. Claim 2 adds to claim 2 of the main request that the weighting of the image data is variable and determined by multiplying and adding, whilst independent apparatus claim 15 adds to claim 17 of the main request that

variable weighting means, and adding means for adding the weighted data, are provided. Reference is directed to the comments above on auxiliary request 1. The use of multipliers and adders is the obvious manner in which to effect a weighting and indeed is known from D4, see the equation at column 2, line 32. Accordingly, the subject-matter of each of claims 1, 2 and 15 of this request lacks an inventive step.

5. *Inventive step (auxiliary request 3)*

5.1 This includes a single independent method and independent apparatus claim directed to the same features. The apparatus claim adds to claim 17 of the main request means for determining variable values of weights using the reflection and transmission image data from a plurality of subjects, separating pixel values from first and second areas of the images of these subjects, and maximising the difference between the means of the pixel signal values from these areas relative to a measure of their scatterers, the combining means multiplying the values of weights with the reflection and transmission image data. In other words, the weighting is adjusted to maximise the difference between the area of interest and the background.

5.2 It was pointed out by the appellant that the examining division had in the course of the examination proceedings indicated that claims of this scope would be allowable. It is not however clear from the examination file whether these claims were ever fully examined by the examining division. Therefore, in order to preserve two instances, the Board considers it appropriate to remit the case to the examining division for examination to be completed.

**Order**

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

1. The decision under appeal is set aside.
2. The main request and auxiliary requests 1 and 2 are refused.
3. The case is remitted to the first instance for further prosecution on the basis of auxiliary request 3.

The Registrar:

The Chairman:

N. Maslin

P. K. J. van den Berg