

Internal distribution code:

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

**Datasheet for the decision
of 5 October 2011**

Case Number: T 1994/09 - 3.4.02

Application Number: 05754030.4

Publication Number: 1749201

IPC: G01N21/35, G01V8/00

Language of the proceedings: EN

Title of invention:

TERAHERTZ IMAGING IN REFLECTION AND TRANSMISSION MODE FOR
LUGGAGE AND PERSONNEL INSPECTION

Applicant:

Picometrix, LLC

Headword:

Relevant legal provisions:

EPC Art. 56

Keyword:

Inventive step

Decisions cited:

Catchword:

Independent Claims (main and auxiliary requests)- inventive
step (no)



Case Number: T1994/09 - 3.4.02

D E C I S I O N
of the Technical Board of Appeal 3.4.02
of 5 October 2011

Appellant: Picometrix, LLC
(Applicant) 2925 Boardwalk
Ann Arbor, MI 48104 (ETATS-UNIS D'AMERIQUE)

Representative: Solf, Alexander
Patentanwälte Dr. Solf & Zapf
Candidplatz 15
81543 München (ALLEMAGNE)

Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted 21 April 2009
refusing European patent application No.
05754030.4 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: A. Klein
Members: M. Rayner
B. Müller

Summary of Facts and Submissions

I. The patent proprietor has appealed against the decision of the examining division refusing European Patent Application number 05754030.4. The patent concerns a system and method to detect an article. In the examination and appeal proceedings reference has been made to, amongst others, the following document:

X4 Proceedings of the SPIE, Vol. 5411, No.1, pp. 78-83, Zimdars et al.: "Terahertz reflection imaging for package and personnel inspection".

II. In the decision under appeal, the examining division considered the subject matter of the independent claims according to the main request before it to lack novelty. The division's reasoning included the following.

Document X4 discloses detection of either explosives or weapons or flammables or biological agent or chemical weapons (see the abstract) either at persons (see section "T-Ray Reflection Imaging Beneath Clothing") or in luggage (see page 79, penultimate paragraph), by means of terahertz radiation either in reflection or transmission either in time domain or in frequency domain (see, page 78, last five lines) and using either two dimensional or three dimensional images (see page 79, middle paragraph) using either amplitude or delay or spectral power as the characteristic signature assigned to a pixel (see page 79, middle paragraph). A processor is implicitly disclosed to the skilled person.

There is thus disclosure of generating or receiving, or both generating and receiving, terahertz radiation from one or more terahertz modules, some of the terahertz radiation being reflected from the article and the remainder of the terahertz radiation being transmitted through the article (see page 79, line 18 "raster scanned transmitter-receiver reflection head and Figures 1 and 2); converting the reflected terahertz radiation (see page 80, Figures 1 and 2) information or both the transmitted and reflected terahertz radiation information to a plurality of voxels (see page 79, middle paragraph "Terahertz reflection imaging can be used to determine three dimensional structure within the sample, since multiple reflections from successive depths within the sample have differing transit times and are represented by multiple peaks within the returned THz waveform"). Moreover, characterisation is based on the three dimensional image and thus necessarily on the location and the signatures of the voxels. It is implicit for the skilled person that an article is characterized as a threat only if the number of voxels lies above a certain minimum number.

III. The appellant requested that the decision under appeal be set aside and a patent granted on the basis of a main or one of three auxiliary requests, claim 1 of the main request corresponding to that refused by the examining division. Also requested on an auxiliary basis were oral proceedings.

IV. Consequent to the auxiliary request of the appellant, the board appointed oral proceedings. In a communication attached to the summons, the board made observations including that it was not convinced of any inventive step deriving from submissions that the prior art is focussed on displaying an "article" with

operator help rather than the concept of alarming efficiently and automatically upon detection. What is submitted to be an invention amounts to no more than obvious automation of existing operator performed detections.

At the beginning of the oral proceedings, the representative of the appellant stated that he had been informed that document X4 had been published in April 2004, i.e. before the priority date of the application.

V. In support of its case the appellant argued as follows.

The Examination Division seemed to have believed that because document X4 mentions the creation of a three dimensional image using terahertz radiation, it would be obvious to determine that the article is an explosive device based on the location of the plurality of voxels within the 3-dimensional image and the characteristic signatures of each voxel of the plurality of voxels. However, while an image of the article is shown, there is no mention as to how a determination is made that the article is explosive. It must be assumed that this image must then be processed by a human operator so as to determine if there are any dangerous objects within the storage device. The method that the human operator uses to make this determination is not disclosed. Therefore, the entire claimed invention is not disclosed. An object of the invention is further development with automatic voxel characteristic determination using a detection algorithm.

The prior art documents do not disclose that explosives are detected by using both their characteristic signatures and the location of voxels containing

characteristic signatures. Thus, pixels indicating a ball of explosive material might be very few in number compared with the overall contents of a suitcase, so a detector using one or two dimensional data may not detect the danger. In the case of a suitcase filled with clothes contaminated with a thin layer of chemicals similar to chemicals found in plastic explosives, this is not a real threat because these chemicals are not concentrated in one area, yet a detector using one or two dimensional data may determine an amount of chemicals so great, that the suitcase must contain an explosive device. Three dimensional data used according to the invention solves this problem because an additional determination is made as to the location of each voxel within a volume. The detector can determine the number of voxels that indicate an explosive material if they are located near other voxels of the same type to determine that the suitcase is a danger because the explosive material is concentrated in one area. Similarly, the inventive system will determine when many voxels indicating an explosive material are scattered and pose no real threat. The system therefore determines if something is a threat or not automatically, by using an algorithm without needing a person to compare the signatures obtained by the THz measurements with a 3-D picture as done according to the prior art.

Since none of the cited references discloses how a determination is made that the article is explosive, the references do not disclose or suggest the two specific methods claimed in the independent claims.

VI. Independent claim 1 according to the respective requests of the appellant is worded as follows.

Main Request

"1. A system to detect an article comprising:
one or more terahertz modules, each module either
generating or receiving, or both generating and
receiving, terahertz radiation, some of the terahertz
radiation being reflected from the article and the
remainder of the terahertz radiation being transmitted
through the article; and
a processor configured to convert the reflected
terahertz radiation information to a plurality of
voxels, and assign each voxel of the plurality of
voxels a location within a 3-dimensional map and a
characteristic signature, wherein the characteristic
signature indicates a material characteristic,
characterize the article based on the location of the
plurality of voxels within the 3-dimensional map and
the characteristic signatures of each voxel of the
plurality of voxels, and determine if the article is an
explosive device based on the location of the plurality
of voxels within the 3-dimensional map and the
characteristic signatures of each voxel of the
plurality of voxels."

Auxiliary Request

"1. A system (10) to detect an article comprising:
one or more terahertz modules (13), each module (13)
either generating or receiving, or both generating and
receiving, terahertz radiation, some of the terahertz
radiation being reflected from the article and the
remainder of the terahertz radiation being transmitted
through the article; and
a processor (21) configured to
convert the reflected terahertz radiation information
to a plurality of voxels, and assign each voxel of the

plurality of voxels a location within a 3-dimensional map and a characteristic signature, wherein the characteristic signature indicates a material characteristic,
characterize the article based on the location of the plurality of voxels within the 3-dimensional map and the characteristic signatures of each voxel of the plurality of voxels,
determine if the article is an explosive device based on the location of the plurality of voxels within the 3-dimensional map and the characteristic signatures of each voxel of the plurality of voxels and
characterize the article by determining if the plurality of voxels having an explosive signature are sufficiently contiguous within the 3-dimensional map or by determining if the number of voxels having an explosive signature located within the 3-dimensional map is above a threshold value."

Auxiliary Request 2

Claim 1 of this requests differs from that of the main request by insertion of "broad band pulsed" between "...receiving, "and" terahertz radiation..." at the first mention of terahertz radiation in the fourth line of the claim.

Auxiliary Request 3

Claim 1 of this requests differs from that of the auxiliary request by insertion of "broad band pulsed" between "...receiving," and "terahertz radiation..." at the first mention of terahertz radiation in the fourth line of the claim.

The respective requests also contain respective corresponding independent claims 15, 16, 14 and 15 directed to a method to detect an article. In the case of the auxiliary request, the final feature reads

"characterizing the article by determining if the plurality of voxels having an explosive signature are sufficiently contiguous within the 3-dimensional map **and/or** by determining if the number of voxels having an explosive signature located within the 3-dimensional map is above a threshold value {N.B. Bold typeface added by the board}." A corresponding amendment from "or" to "and/or" was also made in auxiliary request 3).

VII. At the end of the oral proceedings, the board gave its decision.

Reasons for the Decision

1. The appeal is admissible.
2. Prior art
 - 2.1 The closest prior art can be taken to be represented by document X4. Pertinent disclosures in document X4 include the following.
 - 2.1.1 Abstract, first five lines

Terahertz imaging has the potential to reveal concealed explosives; metallic and non-metallic weapons (such as ceramic, plastic or composite guns and knives); flammables; biological agents; chemical weapons and other threats hidden in packages or on personnel. Because terahertz imaging employs safe non-ionizing radiation that penetrates clothing, people may be

routinely scanned as well as packages. Time domain terahertz imaging can be employed in reflection mode to image beneath clothing with sub millimetre resolution.

2.1.2 Page 79, middle paragraph.

Some property of the terahertz pulse (peak to peak amplitude, delay, spectral power within a range) is calculated and used to assign a pixel value at that point. In a reflection image, the reflection of the terahertz pulse from the surface(s) within the sample is collected and some property of the terahertz pulse is calculated and used to assign a pixel intensity. Terahertz reflection imaging can be used to determine three dimensional structure within the sample, since multiple reflections from successive depths within the sample have differing transit times and are represented by multiple peaks within the returned THz waveforms.

2.1.3 Page 80, last paragraph

...the THz spectrum was substantially similar to the transmission geometry spectrum, peaked at 0.25 THz and rolling off at 2 THz.

2.1.4 Page 81, Figure 3 and description

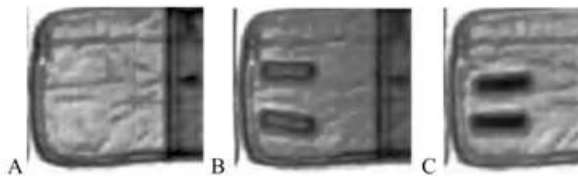


Figure 3A is the image of the empty pocket. The seams and buttonhole are visible. Figure 3B is the image of the pocket with 2 rectangular 1 cm thick polystyrene cuvettes inside the pocket, underneath the opaque

cloth. Note that the empty cuvette appears transparent. Cuvettes were chosen to simulate placing vials of dangerous (or harmless) liquids in a pocket. Figure 3C is the image of cuvettes filled with water and oil. While not easily discerned in the Figure 3 data alone, the water cuvette is wholly opaque but the oil cuvette is transparent. In Figure 3 both the water and oil cuvette appear dark because the reflected pulse of interest occurs outside the optical delay window scanned during the image. In the case of the oil, the THz pulse was delayed by the greater index out of the window. In the case of the water, only the reflection from the first surface of the water is detectable. The presence of a time-delayed pulse indicates a full cuvette, filled with a non-polar (and non-water) potentially harmful or flammable liquid.

3. Patentability - Main Request

3.1 The appellant has not disputed the novelty analysis of the examining division except to argue that an image must be processed by a human operator so as to determine if there are any dangerous objects within the storage device. The method that the human operator uses to make this determination is not disclosed.

3.2 In view of the disclosure mentioned in point 2, the board does not agree with the appellant that there is no mention of how a determination is made that an article is explosive. For example, establishing that a harmful liquid (as opposed to water) is in a pocket as shown with respect to Figure 3 requires the voxels and their position to be so characterised, in other words, detection of an explosive is disclosed to the skilled person mindful, for example of the Abstract (see section 2.1.1 above). Moreover, since the harmful

liquid is shown in the display, a processor must be involved in doing this. Nevertheless, while the claim is not very precise, the board can concur with the appellant that there is no disclosure of a processor configured to make the determination, if this feature is read as involving no operator participation, i.e. no one to recognise and act upon the display of the harmful liquid determined as located in the pocket. For this reason, the board will take a favourable line towards the appellant and acknowledge novelty of the subject matter of claim 1.

3.3 The board can accept the appellant's position that the problem addressed by the novel subject matter is then further development with automatic voxel characteristic determination. However, what is claimed as an invention amounts to no more than obvious automation of existing operator performed detections. The reason is that lower cost operation is an obvious desideratum and is well known to be achievable by avoiding the cost of involvement of a human operator. There is no feature in the claim going beyond this obvious desideratum. The subject matter of the claim cannot therefore be considered to involve an inventive step.

3.4 The arguments of the appellant pertaining to 3-D as opposed to 1 or 2-D detection, i.e. the ball of explosives or contaminated clothing, imply 3-D detection is not known which is not correct because document X4 discloses this (see above point 2.1.2, last sentence and point 2.1.4 last sentence). These arguments are not therefore to the point and thus did not persuade the board.

4. Patentability - Auxiliary Request

- 4.1 This request adds to the main request that the processor is configured to characterize the article by determining if the plurality of voxels having an explosive signature is sufficiently contiguous within the 3-dimensional map or by determining if the number of voxels having an explosive signature located within the 3-dimensional map is above a threshold value.
- 4.2 The board was not persuaded as to patentability by the appellant's argument that since none of the cited references discloses how a determination is made that the article is explosive, the references do not disclose or suggest the two specific methods claimed in the independent claims. The reason for this is that firstly a determination is made according to document X4 as set out in paragraph 3.2 above and that secondly both of the "specific methods" are obvious for the skilled person seeking to meet the obvious desideratum of further development with automatic voxel characteristic determination. This is because a threshold detection is an obvious requirement for determining a threat and the harmful liquid disclosed in document X4 is above its detection threshold, otherwise it would not be shown. Moreover, as the harmful liquid according to document X4 is shown as contiguous, it is by definition so detected.
- 4.3 Accordingly, the board reached the conclusion that the subject matter of claim 1 cannot be considered to involve an inventive step.

5. Patentability - Auxiliary Request 2

Claim 1 of this request adds to claim 1 of the main request that "broad band pulsed" terahertz radiation is generated or received. The board considers the

reference to 0.25 to 2 THz in document X4 (see point 2.1.3 above) to meet the term broadband, which is not precisely defined in the claim, document X4 also containing numerous references to pulses. Since the additional feature cannot be considered novel, claim 1 of this request is considered to lack an inventive step for the same reasons as claim 1 of the main request.

6. Patentability - Auxiliary Request 3

6.1 Claim 1 of this request adds to claim 1 of the auxiliary request that "broad band pulsed" terahertz radiation is generated or received. Corresponding considerations to those set out in section 5 above for the main request/second auxiliary request therefore apply to this claim in relation to the auxiliary request. Claim 1 of this request is therefore considered to lack an inventive step for the same reasons as claim 1 of the auxiliary request.

7. Method Claims

The method claims do not contain any features, the substance of which has not been dealt with in respect of the system claims and therefore cannot be considered directed to patentable subject matter for reasons corresponding to those applied to the features there concerned. In particular, the reference to "and/or" does not alter the obvious character of the "specific methods" concerned.

8. In view of the foregoing, all the requests of the appellant failed to convince the board as to patentability of the subject matter claimed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

M. Kiehl

A. Klein

Decision electronically authenticated