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D E C I S I O N
of 13 January 2000

Case Number: T 0092/94 - 3.4.1

Application Number: 87906139.8

Publication Number: 0281610

IPC: G01R 27/26

Language of the proceedings: EN

Title of invention:

Capacitor array sensors tactile and proximity sensing and methods of use thereof

Applicant:

EXTRUDE HONE CORPORATION

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 123(2), 56

Keyword:

"Inadmissible generalisation (main request)"
"Inventive step (auxiliary request: yes)"

Decisions cited:

-

Catchword:



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Boards of Appeal

Chambres de recours

Case Number: T 0092/94 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 13 January 2000

Appellant: EXTRUDE HONE CORPORATION
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 29 September 1993
refusing European patent application
No. 87 906 139.8 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: G. Davies
Members: M. G. L. Rognoni
U. G. O. Himmler

Summary of Facts and Submissions

- I. The appellant (applicant) lodged an appeal, received on 29 November 1993, against the decision of the Examining Division, dispatched on 29 September 1993, refusing the application No. 87 906 139.8 (publication No. 0 281 610). The fee for the appeal was paid on 26 November 1993 and the statement setting out the grounds of appeal was received on 2 February 1994.
- II. In the decision under appeal, the Examining Division held that the subject-matter of claim 1 did not involve an inventive step within the meaning of Article 56 EPC, having regard to the following document:
- D1: EP-A-0 004 757.
- III. In reply to a communication from the Board, the appellant filed a first set of claims 1 to 24 and new pages 5, 5a, 7, 16, 18, 26 to 28 of the description as its main request, and second set of claims 1 to 24 and pages 5 and 5a of the description as an auxiliary request, with a letter dated 24 November 1999, received on 25 November 1999.
- IV. The appellant requested that the decision under appeal be set aside and a patent be granted on the basis of the following documents:

Main Request

Claims: No. 1 to 24 as filed with the letter dated 24 November 1999;

Description: pages 5, 5a, 7, 16, 18, 26, 27 and 28
filed with the letter dated 24 November
1999,
pages 1 to 4, 6, 8 to 15, 17, 19 to 25
and 29 to 34 as originally filed;

Drawings: Sheets 1/2 to 2/2 as originally filed.

Auxiliary Request

Claims: No. 1 to 24 as filed with the letter
dated 24 November 1999;

Description: pages 5, 5a as filed with the letter
dated 24 November 1999,
pages 7, 16, 18, 26, 27 and 28 as filed
for the main request with the letter
dated 24 November 1999,
pages 1 to 4, 6, 8 to 15, 17, 19 to 25
and 29 to 34 as originally filed;

Drawings: Sheets 1/2 to 2/2 as originally filed.

V. The wording of claim 1 according to the main request
now reads as follows:

"1. A detector for selectively determining tactile or
proximity information concerning an object in contact
therewith or proximity thereto, the detector comprising
a sensor (1, 2) having capacitor plate elements (1,
100) covered with a dielectric layer (2), formed as a
plurality of such capacitor plate elements in an array
of predetermined topography extending in two surface

dimensions, and signal processing means for employing sensor signals resulting from variations in capacitance between the individual capacitor plate elements (100) and said object to determine proximity or tactile information about said object, the signal processing means being such as to combine sensor signals from capacitor plate elements of the array into a single composite measure of the capacitance between the array and said object to determine proximity information about said object or, selectively, to determine tactile information about said object based upon sensor signals from individual capacitor plate elements or from discrete groups of such elements."

The wording of claim 1 according to the auxiliary request now reads as follows:

"1. A detector for selectively determining tactile or proximity information concerning an object in contact therewith or proximity thereto, the detector comprising a sensor (1, 2) having capacitor plate elements (1, 100) covered with a dielectric layer (2), formed as a plurality of such capacitor plate elements in an array of predetermined topography extending in two surface dimensions, and signal processing means for employing sensor signals resulting from variations in capacitance between the individual capacitor plate elements (100) and said object to determine proximity or tactile information about said object, the signal processing means being such as to combine the sensor signals from the capacitor plate elements so that they effectively act as a single plate element to determine proximity information about said object or, selectively, to determine tactile information about said object based

upon sensor signals from individual capacitor plate elements or from discrete groups of such elements."

The wordings of claims 11, 12 and 19 according to the main and auxiliary requests read as follows:

"11. A combination of an object with a predetermined topography and a capacitance sensor device for tactile sensing of quality control properties of the object, comprising a detector as claimed in claim 1 with the predetermined topography of said array conforming to the predetermined topography of said object, and means (4, 7) for connecting each of said plate elements and said object to one of a plurality of corresponding oscillator circuits (6) so that the oscillation frequency of each said circuit is a function of the capacitance between each said plate element (100) and said object, and wherein the signal processing means comprises means for generating an output from said sensor device which is a function of the conformity of the actual shape of said object, as determined by responses of the oscillator circuits, of said plurality, compared to the predetermined shape of the object."

"12. A capacitance sensor device for proximity and tactile sensing of properties of an object comprising a detector as claimed in claim 1, and means (4, 7) for connecting each of said plate elements and said object to one of a plurality of corresponding oscillator circuits (6) so that the oscillation frequency of each said circuit (6) is a function of the capacitance between each said plate element and said object, when said sensor array and said object are in contact, and

wherein the signal processing means comprises means for generating an output from said sensor device which is a function of the tactile properties of said object."

"19. A capacitance sensor device for detecting relative movement between its sensors and an object, comprising a detector as claimed in claim 14 where the signal processing means is capable of sensing a relative movement of greater than 2.5 micrometres in less than 10 milliseconds and can thereby be used to generate an output signal which is a measure of slip."

Claims 9 to 10, 13 to 18 and 20 to 23 are directly or indirectly dependent on claims 1, 12 and 19, respectively. Claim 24 is dependent on claims 1 to 10 or 11 to 23.

VI. The applicant's arguments can be summarised as follows:

Claim 1 of the main request included the feature that the signals from a plurality of capacitor plate elements had to be combined in the proximity mode. However, the wording permitted that not all of the signals from all the plate elements needed to be included in the composite measure of the capacitance between the array and an object. According to page 11, lines 3 to 5, of the published application, it was considered that the best arrangement was to have the whole array treated as a single capacitor plate in the proximity mode. However, the fact that the best arrangement was explicitly identified in the description clearly implied that there were other, less preferred, arrangements which were also within the scope of the invention, and in which a plurality of the

capacitor elements, though not the whole array, were treated as a single capacitor plate. Hence, claim 1 according to the main request was admissible under Article 123(2) EPC.

The present invention as specified in claim 1 of the main and auxiliary requests consisted essentially in providing a detector comprising an array of capacitor elements which could provide both proximity and tactile information concerning an object. The closest prior art document D1 was only concerned with the determination of proximity information and relied on sensor signals resulting from variations in capacitance between individual capacitor plate elements and an object to determine proximity information about said object. There was no mention of combining the responses of the individual capacitor plate elements in D1 to allow the apparatus to act as a sensor for both proximity and tactile information, as specified in claim 1 of the main and auxiliary requests. Hence, the subject-matter of these claims involved an inventive step within the meaning of Article 56 EPC.

Reasons for the Decision

1. The appeal is admissible.

Main request

- 2.1 According to claim 1 of the main request the signal processing means are "such as to combine sensor signals from capacitor plate elements of the array into a single composite measure of the capacitance between the

array and said object to determine proximity information about said object" (emphasis added). The above wording implies that in the proximity sensing mode only the sensor signals from some of the capacitor plate elements are combined into a signal indicative of the capacitance between such elements and the object.

2.2 In the passage of the description cited by the appellant in support of the above wording, it is specified that "it is relatively simple to combine the values of the discrete elements of the array of the present invention into a single composite measure of the capacitance between the array and the sensed object" (page 10, lines 21 to 24 of the application as published), and that "the coupling value is best treated as a single value, with the array treated as a single capacitor plate" (ibid. page 11, lines 3 to 5). This clearly implies that the signals from all the capacitor plate elements are combined into a single composite measure of capacitance when the array of the invention is used in the proximity mode. In fact, the application as originally filed does not explicitly mention the possibility of treating only some of the capacitor plate elements as a single capacitor in the proximity mode.

The mere fact that the present application explicitly teaches to treat the whole array as a single capacitor does not imply, in the opinion of the Board, that other, less preferred, arrangements, in which, for instance, only some elements of the array are treated as a capacitor, should be regarded as disclosed.

2.3 As claim 1 according to the main request contains

subject-matter which extends beyond the content of the application as originally filed, the main request is not admissible under Article 123(2) EPC.

Auxiliary request

3.1 Claim 1 according to the auxiliary request differs from claim 1 of the main request in that in the former it is recited that the signal processing means are "such as to combine the sensor signals from the capacitor plate elements so that they effectively act as a single plate" (emphasis added). In other words, claim 1 clearly implies that "all the array is treated as a single capacitor plate" (cf. application as published, page 1, lines 4 and 5).

3.2 Hence, the subject-matter of claim 1 finds support in the application as originally filed and, for this reason, is admissible under Article 123(2) EPC.

Furthermore, the Board is satisfied that all application documents of the auxiliary request are in conformity with Article 123(2) EPC.

4. The present invention as specified in claim 1 relates to a detector for determining tactile or proximity information of an object and consists essentially in combining the sensor signals from an array of capacitor plate elements so that all the array is treated as a single capacitor plate in the proximity mode, or in processing signals from individual elements or from groups of elements in order to determine tactile information when the detector is in contact with the object.

5. Since none of the prior art documents on file shows a detector comprising all the features recited in claim, the subject-matter of this claim is new within the meaning of Article 54 EPC.

6.1 D1 shows a detector comprising the following features recited in claim 1 of the present application:

- a sensor 16 (fig. 2) having a plurality of capacitor plate elements 60 formed as an array of predetermined topography extending in two surface dimensions; and
- signal processing means (34) for employing sensor signals resulting from variations in capacitance between the individual capacitor plate elements and said object to determine proximity information about said object.

6.2 D1 relates to a non-contact gauging system and is essentially concerned with the problem of processing the sensor signals to provide an evaluation of the probe-to-workpiece distance.

6.3 The subject-matter of claim 1 differs from the detector known from D1 in that:

- the capacitor plate elements are covered with a dielectric layer, and
- the signal processing means is such as to combine the sensor signals from the capacitor plate elements so that they effectively act as a single

plate element to determine proximity information about an object or, selectively, to determine tactile information about said object based upon sensor signals from individual capacitor plate elements or from discrete groups of such elements.

7.1 None of the documents on file relates to a detector for selectively determining tactile or proximity information concerning an object. Furthermore, the available prior art does not suggest processing the signals from the capacitor plate elements of a detector so as to treat them as a single capacitor plate or as an array of capacitor plates of variable dimensions, according to the information which is to be obtained capacitively from the examined object.

7.2 In the light of the available documents and of the general knowledge in the art, it would not be obvious to the skilled person starting from D1 to arrive at a detector falling within the terms of claim 1 of the present application. Hence, the subject-matter of this claim involves an inventive step within the meaning of Article 56 EPC.

8. Claim 11 relates to a combination of an object with a predetermined topography and a capacitance sensor device comprising a detector as claimed in claim 1. Claim 12 is directed to a capacitance sensor device for proximity and tactile sensing, and claim 19 to a capacitance sensor device for detecting relative movement between the sensors and an object. The sensors according to these claims comprise a detector as claimed in claim 1. Hence, for the same reasons given above, the subject-matters of claims 11, 12 and 19

involved an inventive step within the meaning of Article 56 EPC.

9. Claims 2 to 10, 13 to 18 and 20 to 24 are dependent, and, therefore, their subject-matters also involve an inventive step.
10. In summary, the Board concludes that the appellant's main request is refused and that a patent can be granted on the basis of the appellant's auxiliary request.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The main request is refused.
3. The case is remitted to the department of first instance with the order to grant a patent on the basis of the following documents according to the auxiliary request:

Claims: No. 1 to 24 as filed with the letter dated 24 November 1999;

Description: pages 5, 5a as filed with the letter dated 24 November 1999,
pages 7, 16, 18, 26, 27 and 28 as filed for the main request with the letter dated 24 November 1999,
pages 1 to 4, 6, 8 to 15, 17, 19 to 25 and 29 to 34 as originally filed;

Drawings: Sheets 1/2 to 2/2 as originally filed.

The Registrar:

The Chairman:

M. Beer

G. Davies