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D E C I S I O N
of 2 February 2000

Case Number: T 0439/99 - 3.4.2

Application Number: 93202999.4

Publication Number: 0599364

IPC: G01J 5/10, G01J 5/20, H01C 7/02, H01C 7/04, G01K 7/22

Language of the proceedings: EN

Title of invention:
Infrared detecting device and infrared detecting element for use in the device

Applicant:
MATSUSHITA ELECTRIC WORKS, LTD.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
"Novelty - yes (after amendment)"
"Inventive step - yes (after amendment)"

Decisions cited:
-

Catchword:

-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0439/99 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 2 February 2000

Appellant: MATSUSHITA ELECTRIC WORKS, LTD.
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 23 October 1998 refusing European patent application No. 93 202 999.4 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: E. Turrini
Members: M. A. Rayner
M. Lewenton

Summary of Facts and Submissions

I. The present appeal is against the decision of the examining division to refuse European patent application No. 93 202 999.4 (EP-A-0 599 364). The division reasoned that the independent claim then under consideration comprised two alternatives, one of which lacked novelty and the other inventive step. Reference was made in the decision to documents including the following:

D1: DE-A-38 39 482

D2: US-A-4 276 535

D3: EP-A-0 354 369

D4: JP-A-63 150976 (English Abstract)

D5: Meyers Großes Taschenlexikon; Mannheim 1990, headword "Schutzgas"

D6: CRC Handbook of Chemistry and Physics, 59th edition, Palm Beach 1979; page E-2 "Thermal conductivity of Gases".

II. In its notice of appeal, the appellant (patent applicant) requested that the decision be set aside and a patent granted. In support of inventive step, the appellant drew attention to features relating to the choice of materials and embodiment of electrodes and connecting pads and submitted that these lead to markedly reduced internal stresses.

III. The appeal board issued a communication, subsequent to which the appellant filed an amended set of application documents and requested grant of a patent based thereupon. Oral proceedings were requested should a negative decision be contemplated by the board. The wording of the claim 1 of this request is as follows:

"1. Method of making an infrared detecting device comprising the steps of:

- providing an infrared detecting element (10) comprising a substrate (12Ga) having a cavity (11G) defined therein;

- the cavity (11G) being substantially of a square shape and formed in the central part of the substrate (12Ga);

- providing an insulating film (13G) on the substrate (12Ga) to cover the cavity (11G), the insulating film (13G) being formed of a silicon oxide film or of a multi layered film of silicon oxide film and silicon nitride film;

- disposing an infrared detector (14G) made of amorphous silicon on the insulating film (13G);

- disposing the substrate (12Ga) on a base plate (15), formed to have a peripheral stepped part;

- forming a ventilator (19) in the form of a hole or groove made in the substrate, the insulating film, the base plate (15) or a spacer between the substrate (12Ga) and the base plate (15) or by an

interposition member therebetween so that the cavity (11G) in the substrate (12Ga) can communicate with the surrounding space (17) through the ventilator (19);

- providing electrodes of chromium (Cr) to both upper and lower surfaces of the infrared detector (14G), which electrodes (14Ga) are extended diagonally with respect to said square shape outward;

- providing connecting pads (14Gb) at the extended ends of the electrodes (14Ga);

- covering the upper side electrode (14Ga) on the detector (14G) with an infrared absorbing film (14Gc) of silicon oxynitride;

- accommodating the assembly created in the foregoing steps, together with a separate cap (16), within a hermetically sealed chamber (18) defining therein an interior space (17), the infrared detector (14G) on the insulating film (13G) being positioned to be between the cavity (11G) formed in the substrate (12Ga) and the interior space (17) defined in the chamber (18);

- exhausting the gas inside the chamber (18) at a flow rate (Q0) and an exhaust speed (S0) such that a tolerance limit of the pressure difference between the pressure (P1) within the cavity (11) and the pressure (P2) in the chamber (18) is determined by the pressure resisting break strength of the insulating film (13G),

- if the infrared detecting element is to be charged with a gas of a lower thermal conductivity than air, charging this gas into the chamber; and

- joining the cap (16) to the base plate (15) to form a casing within the hermetically sealed chamber (18), so that the infrared detecting element is hermetically sealed in the casing having the same atmosphere as the interior space of the chamber (18).

Reasons for the Decision

1. The appeal complies with the provisions mentioned in Rule 65(1) EPC and is therefore admissible.

2. The present description derives from subject-matter present in pages 1 to 18, Figures 1 to 18 and the claims as originally filed and thus satisfies the requirement of Article 123(2) EPC.

3.1 Document D1 discloses an infrared detection arrangement with a protective gas filling, in which a cavity is provided beneath the film carrying the infrared detector chip. Overflow channels (Überströmkanäle) connect the cavity with the space above the detector chip, the cavity also being filled with protective gas (see the figure). However, no method of making the infrared detection arrangement is disclosed. The method according to present claim 1 also differs from the disclosure of document D1 by providing a novel choice of materials of insulating film and an infrared

absorbing film of silicon oxynitride as well as in electrode configuration (electrodes extending diagonally outward).

3.2 Document D2 discloses a thermistor (see Figures 2 and 3) with a temperature sensitive resistor of silicon carbide with a base support for example of silicon, an insulating layer for example of silicon oxide or nitride and electrodes of for example multilayer chromium/platinum. The subject matter of claim 1 differs from this disclosure because, for example, no cavity of substantially square shape is present in the substrate and nor is a covering film of silicon oxynitride provided. Moreover, the electrodes are not extended diagonally with respect said square shape outward.

3.3 Document D3 discloses making of an infrared detector using amorphous silicon in a stack with titanium nitride electrodes and silicon dioxide with a vacuum therunder subsequent to plasma ashing of a polyimide layer through plasma etch access holes. The stack is supported by titanium-tungsten interconnects (see especially Figure 4a and lines 29 to 33 on page 8). The subject-matter of claim 1 thus differs from this disclosure because, for example, no cavity of substantially square shape is present in a substrate and nor is a covering film of silicon oxynitride provided. Moreover, the electrodes are not extended diagonally with respect said square shape outward.

3.4 Document D4 discloses an infrared detector with a reflection prevention film of silicon oxynitride on a compound semiconductor substrate made of CdTe, the film

thickness being such that reflectivity of incident infrared ray is minimised. Documents D5 and D6 relate to properties of protective gases and do not concern infrared detectors as such.

4.1 While no specific method of making an infrared detecting device is disclosed therein, the closest prior art is nevertheless represented by document D1 because of the disclosure of an infrared device having a detector chip etched away to the carrying film (see column 2, lines 42 to 46). The novel choice of materials and electrode configuration together with the tolerance limit of pressure difference in relation to exhausting gas as defined in the method according to claim 1 mitigate distortion or damage to the insulating film upon which the detector is carried. Accordingly, these novel features can be considered to solve reliability problems both in the method of production and the device produced.

4.2 These reliability problems are not addressed in any of the remaining prior art documents. In the case of document D3, a different type of device (resistor suspended from metal interconnects) is produced and infrared absorption is provided by the TiN resistor electrodes (see for example the last line on page 6) within which leads (170, 174, 270, 274) are disposed. There is no reason to pick features from this document to associate with the teaching of document D1 and even if this were done, the subject matter of claim 1 would not be reached. A similar situation exists with respect to document D2, since a type of device without any cavity under the insulation film 14 is provided. While document D4 discloses an SiOxNy film, the infrared

detector is of a type using HgCdTe and there is no reason to transfer this disclosure to the teaching of any of documents D1 to D3. Since documents D5 and D6 concern protective gas, they are further from giving any suggestion towards the problem solved by the present invention. The electrode configuration provided according to the claimed method cannot be reached even by picking features from the differing types of infrared detector according to any of the prior art documents. Therefore, since the problem addressed by the invention is not realised in any of documents D1 to D6 and any combination thereof is not obvious and, even if nevertheless effected, would not lead to the subject matter of claim 1, this subject matter is considered to involve an inventive step within the meaning of Article 56 EPC.

5.1 Since the request for oral proceedings was conditional on a negative decision, which condition is not met, no oral proceedings are necessary.

5.2 Having regard to Article 111(1) EPC, the board considers it appropriate to exercise favourably the power of the examining division in the present case because it has convinced itself that the documents according to the request of the appellant meet the requirements of the Convention.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to grant a patent in accordance with the main request of the Appellant as follows:

Claims: Claim 1 filed with the letter of 31 January 2000
Claims 2 to 5 filed with the letter of 2 November 1999

Description: pages 1 to 6, 8 filed with the letter of 2 November 1999
page 7 filed with the letter of 31 January 2000

Drawings: Sheets 1/8 to 8/8 filed with the letter of 31 January 2000

The Registrar: The Chairman:

P. Martorana E. Turrini