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Bezeichnung der Erfindung: Reference channel for sensing optical contamination
Title of invention:
Titre de l'invention :

Klassifikation / Classification / Classement : G01N 21/59

ENTSCHEIDUNG / DECISION

vom / of / du 10 January 1989

Anmelder / Applicant / Demandeur : Santa Barbara Research Center

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 56 EPC

Schlagwort / Keyword / Mot clé : "Inventive step (no)"

Leitsatz / Headnote / Sommaire

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Case Number : T 428/87 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 10 January 1989

Appellant : Santa Barbara Research Center
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Decision under appeal : Decision of Examining Division 061 of the European Patent Office dated 13 August 1987 refusing European application No. 82 302 244.7 pursuant to Article 97(1) EPC

Composition of the Board :

Chairman : K. Lederer
Members : E. Turrini
L. Mancini

Summary of Facts and Submissions

I. European patent application No. 82 302 244.7 (publication number 0 066 370) was refused by decision of the Examining Division.

II. The reason for the decision was that the subject-matter of the effective single claim lacked an inventive step within the meaning of Article 56 EPC having regard to the disclosure of document DE-U-1 939 867 (D1). The claimed apparatus was in particular considered to result from an obvious incorporation of the window contamination detecting means of a smoke and dust measuring system disclosed in document D1 into a known electromagnetic energy detecting apparatus.

III. The Appellant lodged an appeal against the decision.

IV. Oral proceedings were held before the Board, during which in addition to D1 also US-A-3 931 521 (D2), US-A-4 188 533 (D3) and DE-A-2 833 635 (D4) were discussed and at the end of which the Appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of Claims 1 to 3 as filed on 16 August 1988 (main request). The set of claims in accordance with Appellant's main request reads as follows:

"1. An electromagnetic energy detector apparatus (60) for a fire sensor system comprising a radiation detector (75) for detecting electromagnetic radiation in the spectral region of long-wavelength infrared and providing an output signal indicative thereof, a reference channel including a reference source (100) of electromagnetic energy having a wavelength shorter than the wavelengths in said long-wavelength infrared spectral region, a reference

electromagnetic energy detector for detecting electromagnetic energy emitted by said reference source (100) within the field of view of the reference detector and a test circuit including means for indicating when less than a predetermined amount of electromagnetic energy is detected by the reference detector (105), the reference source (100) being calibrated to cause the test circuit to operate said indicating means when a predetermined amount of contaminants is present on the detecting surface of the reference detector corresponding to an undesired build up of contaminants on the detecting surface of the long-wavelength infrared detector.

2. Apparatus as claimed in Claim 1 in which the reference source (100) and the reference detector (105) each present an optical surface which in use is subject to contamination.

3. An electromagnetic energy detector as claimed in Claim 1 or 2 in which the radiation detector (75) is mounted in a container (65) having two protrusions (80, 85) protruding from the container wall in which the detector (75) is set, each protrusion having a window (90, 95), the reference source (100) and the reference detector (105) being situated behind respective ones of the windows (90, 95) such that the test source (100) directly irradiates the detector (105) when the test source (100) is energised."

As respective first and second auxiliary requests, the Appellant requested that a patent be granted on the basis of the claims in accordance with the main request, amended either by inclusion into Claim 1 of the language of Claim 2 with the necessary adaptation of Claim 3 (first auxiliary request), or by inclusion into Claim 1 of the language of Claim 3 and deletion of Claim 2 (second auxiliary request).

V. In support of the allowability of his requests the Appellant argued substantially as follows:

The present invention relates to an electromagnetic energy detector apparatus, more specifically included in a fire sensor system as could be indicated more clearly by adequately amending the wording of Claim 1, if need be, whereas document D1 relates to a smoke and dust measuring device and therefore lies within an area which the skilled person would not necessarily consider when seeking for guidance to solve the technical problem of monitoring window contamination in a fire sensing system. In particular, unlike fire detectors which are intended to detect sources of electromagnetic energy of which the specific characteristics are not precisely known in advance, smoke detectors of the type disclosed in document D1 exhibit internal radiation sources and measurement channels which work in closely determined conditions. Accordingly, a reference channel can certainly be expected to produce an accurate model of the conditions actually prevailing in the measurement channel of a smoke detector, but it is a priori most unlikely that a reference channel could as well modelize the conditions in a measurement channel of a fire detector.

In contrast also with the apparatus of document D1, wherein both the smoke detection and the window contamination detection channels work with the same source of electromagnetic radiation, the claimed apparatus involves window contamination detection at a wavelength shorter than that at which the detector of the fire sensor system operates. Such move to shorter wavelengths for monitoring window contamination cannot be considered obvious in the light of the prior art. The more so since the effect of

window contamination on the transmission of radiation through the window is strongly dependent upon both the wavelength of the radiation and the nature of the contaminants deposited on the window, as evidenced by the results of comparative transmission measurements filed on 16 August 1988. There is therefore no reliable correlation to be expected between the effect of window contamination on the transmission of radiation of shorter wavelength and its actual effect on the transmission of radiation in the measurement channel.

Neither can obviousness of the claimed apparatus be without hindsight deduced from the general statement that suitability of the window contamination detection means of document D1 for monitoring also window contamination in a fire sensor system could be readily ascertained by performing simple tests. For the skilled person cannot be assumed to start testing any technical solution without a high degree of certainty that the tested measures would indeed achieve the desired result. Due to the above mentioned lack of reliable correlation, the skilled person would not have expected that a reference channel operating at a shorter wavelength than the fire detection channel could provide adequate monitoring of window contamination and meet the severe security requirements commonly imposed on this type of equipment, and there was therefore no incentive for him to proceed to such tests.

Corroborating evidence of the existence of a prejudice in the art against the use of simple equipment to monitor window contamination as defined in the claims is provided by document D3 which both shows that satisfactory determination of the transmission performance of windows used in infrared imaging systems was previously considered to require large and difficult-to-use test equipment in

laboratories (column 1, lines 11 to 30) and teaches to use an infrared radiation source for that purpose (column 2, lines 62 to 67).

The provision in a fire sensor system of a window contamination monitoring channel comprising optical surfaces subject to contamination for both the radiation source and the detector of the reference channel, and their constructional arrangement as set out respectively in Claims 2 and 3 in accordance with the main request are not obvious either from the cited prior art. In particular, the similar arrangement disclosed in document D1 is dictated only by the presence of two windows also in the measurement channel of the smoke detector described therein, which the reference channel is intended to replicate. There is, however, no suggestion in the prior art to adopt a similar arrangement also in a fire sensor system which comprises only one window in the measurement channel, whereby a noticeable improvement of the sensitivity of the contamination detection is achieved.

Finally, having in mind that the invention has already matured in a patent in the USA and has enjoyed considerable commercial success, and that there is no prior art citation available establishing that it was common knowledge both to provide a fire sensor system with a reference channel for monitoring window contamination and to use in such channel a radiation source of shorter wavelength, which distinct steps are necessary to arrive at the claimed invention, the Appellant should be given at least the benefit of the doubt.

Reasons for the Decision

1. The appeal is admissible.

2. Main request.

2.1 Novelty.

2.1.1 Document D2 discloses an electromagnetic energy detector apparatus (10) for a fire sensor system comprising a radiation detector (14) for detecting electromagnetic radiation in the spectral region of long-wavelength infrared and providing an output signal indicative thereof (Figure 1; Abstract).

This apparatus does not comprise any means for monitoring build up of contaminants on the detecting surface of the long-wavelength detector.

Thus, the subject-matter of Claim 1, be it interpreted either as defining a detector apparatus which is suitable to be included in some fire sensor system as suggested by the present wording of Claim 1 or as defining a detector apparatus actually included in such fire sensor system as submitted by the Appellant, distinguishes over the apparatus known from document D2 in that it comprises a reference channel including a reference source of electromagnetic energy having a wavelength shorter than the wavelengths in said long-wavelength infrared region, a reference detector and a test circuit, the reference channel being arranged in such a way as to operate indicating means as a consequence of undesired contamination of the detecting surface of the long-wavelength infrared detector, as further specified in the claim.

2.1.2 Document D1 discloses an electromagnetic energy detector apparatus comprising a main radiation detector (6) for detecting electromagnetic radiation and providing an output

signal indicative thereof, a reference channel including a reference source (46, 92) of electromagnetic energy, a reference electromagnetic energy detector (42) for detecting electromagnetic energy emitted by said reference source (46, 92) within the field of view of the reference detector and a test circuit (93, 94) including means for indicating when less than a predetermined amount of electromagnetic energy is detected by the reference detector (42), the test circuit being adapted to operate said indicating means when a predetermined amount of contaminants is present on the detecting surface (73) of the reference detector corresponding to an undesired build up of contaminants on the detecting surface (25, 27, 32, 33) of the main radiation detector (Figure 1 and description page 5, last paragraph to page 11).

This known apparatus forms a smoke or dust density measuring system, and the reference source (46, 92) of the reference channel radiates light of a non-explicitly specified wavelength which necessarily lies within the spectral region in which the radiation detector (6) operates, since the smoke or dust density sensing channel and the reference channel are both supplied with electromagnetic energy radiated by a single source (46, 92). Since the radiation emitted by the source ("Lichtquelle" 46 and "Austrittsquerschnitt" 92) is used for smoke or dust detection, its radiation is clearly not in the infrared spectral range. It can reasonably be assumed to be in the visible or UV spectral region as is usual in these type of detectors and as was admitted also by the Appellant. In addition, calibration of the reference channel is obtained by properly setting the threshold value at which the reference detector signal triggers the indicating means (page 10, last paragraph).

Thus, the subject-matter of Claim 1 is distinguished from the apparatus known from document D1 in that it comprises a radiation detector for the sensing of fire, which detects electromagnetic radiation in the spectral region of long-wavelength infrared, longer than the wavelength of the radiation emitted by the reference source, and in that calibration of the reference channel is obtained through calibration of the reference source.

2.1.3 Document D3 discloses an apparatus for periodically testing infrared transmission of windows used in military and commercial infrared imaging systems and subject to wear by weather, particle erosion or electrochemical reaction with air pollutants (column 1, lines 11 to 24). Infrared transmission of the window is tested by passing through it electromagnetic radiation emitted by an infrared radiation source (heated filament 40) located on one side of the window and detecting the transmitted radiation by way of a radiation detector (58) located on the other side (Claim 7, Figure 2). This device does not form an electromagnetic energy detector apparatus for a fire sensor system, nor does it comprise a reference channel operating at a wavelength shorter than the wavelengths in the spectral region of the infrared radiation detector (58).

2.1.4 Document D4 describes a device for monitoring contamination of optical surfaces of an apparatus such as an infrared warning system (page 2 of the description, lines 15 to 21), comprising a reference channel including a reference source (2), e.g. an incandescent lamp (page 4 of the description, lines 29 and 30), which thus radiates electromagnetic radiation at a wavelength shorter than the wavelengths at which the warning system operates, a reference detector (3) and a test circuit (4 to 7) for sensing and indicating when a predetermined amount of contaminants is present on the

optical surface (description: page 6, line 26 to page 7, line 22).

In contrast with the subject-matter of Claim 1, the infrared warning system evoked in document D4 is not specified to be adapted for sensing fire, and the reference channel directly responds to the changes in reflectivity of the tested optical surface itself as caused by contaminants deposited thereon rather than to optical changes caused by contaminants present on a detecting surface of the reference detector.

2.1.5 For the above reasons, the subject-matter of Claim 1 is considered to be novel within the meaning of Article 54 EPC.

2.2 Inventive step.

2.2.1 The nearest prior art is in the Board's view constituted by the apparatus described in document D2, which is the sole document on the file relating to long-wavelength infrared detection of fire. This apparatus, which may be mounted for instance in military vehicles (D2, column 1, lines 20 to 23) does not comprise any means for monitoring build up of contaminants on the detecting surface of the long-wavelength infrared detector.

Accordingly, the objectively assessed technical problem to which the present invention achieves a solution is to provide the apparatus of document D2 with means for indicating when an undesired amount of contaminants is present on the detecting surface of the long-wavelength infrared detector.

2.2.2 No contribution to inventive step can be seen in formulation of the technical problem per se since the

adverse effect of contaminants such as dirt, grease or oil on the proper operation of the known fire sensing apparatus may be readily recognised in use and, furthermore, attempts have already been made in the prior art to devise adequate test sources for testing window contamination of infrared detectors, as acknowledged in the present description (page 3, lines 9 to 21).

2.2.3 When faced with the above technical problem, the skilled person would not, in the Board's opinion, limit the scope of his investigation to the narrow field of infrared fire detection and thus disregard any documents relating, for instance, to smoke detection, as was submitted by the Appellant. Contamination of optical surfaces is a phenomenon which a priori is totally independent from the specific nature of the detector mounted behind these optical surfaces. Therefore, devices capable of monitoring build up of certain contaminants in one detector apparatus including optical surfaces for the transmission of electromagnetic radiation would normally be expected to be adaptable also for performing the same function in a different detector apparatus. Documents D1 and D4, which in accordance with their respective titles are clearly directed to devices for measuring the contamination of optical surfaces, must therefore be assumed to be part of the prior art which the skilled person would contemplate when seeking for a solution to the posed problem.

Document D1 discloses a means for indicating undesired build up of contaminants on optical surfaces comprised in the measurement channel of a smoke or dust density sensing apparatus, which comprises a reference channel including a reference source of visible or UV radiation, a reference detector having a detecting surface subject to contamination, and a test circuit for indicating when radiation transmission from the reference source through

the detecting surface produces a detector signal which is below a settable threshold value (see point 2.1.2 above).

The Board cannot follow Appellant's argumentation that the skilled person can only be expected to test the prior art arrangements for which there is a high degree of certainty that they would adequately solve the problem under investigation. On the contrary, the skilled person is expected to envisage testing any solution taught or suggested by his general knowledge or the prior art, unless there is any strong reason for him to suppose that these measures could not work.

The existence of a general prejudice against the capacity of the window contamination sensing means disclosed in document D1 to operate in a proper manner when included in a fire detection system of the type known from document D2 has, however, not been convincingly demonstrated by the Appellant. The rather vague statement in one particular patent specification (document D3) that, before the invention described therein was made, test equipment for infrared windows were large and difficult to use, is no more than the opinion of the authors of that document and cannot therefore by itself establish the existence of a generally recognised prejudice against the use of simple window contamination detecting means in infrared fire detection systems as was alleged by the Appellant.

Moreover, this opinion is disproved by the disclosure in document D4 of a device for monitoring contamination of detecting surfaces such as protective windows in infrared detection systems, which is simple in construction and wherein, furthermore, contamination is sensed either by using short-wavelength or visible light in accordance with a first embodiment as described with reference to Figure 1, or, in the embodiment of Figure 2, without even detecting

its influence on electromagnetic radiation but by monitoring instead the change induced by surface contamination in the electrical characteristics of a capacitor formed on that surface. This document thus further establishes that, although it is admitted that transmission of radiation is indeed affected by surface contaminants in a manner which is strongly dependent on the nature of the contaminants and the wavelength of the radiation, as was submitted by the Appellant, detection of such contamination in infrared sensing systems does not necessarily call for infrared radiation being used for that purpose.

For these reasons, testing the suitability of window contamination indicating means as disclosed in document D1 to adequately indicate surface contamination in a radiation detector apparatus for a fire sensor system as known e.g. from document D2 must be considered a step which the skilled person faced with the above defined problem would indeed undertake without the exercise of any inventive ingenuity. He would then readily recognise that an acceptable compromise between the desired reliability of contamination indication and the resulting complexity of the device could be achieved by properly calibrating the surface contamination indicating means. Although contamination affects transmission of electromagnetic radiation through a window in a manner which is dependent on both the wavelength of the radiation and the type of the contaminants involved, as envidenced by the transmission data submitted by the Appellant on 16 August 1988, the Board is not convinced that anything more than the performance of mere routine tests would be necessary for achieving adequate calibration of the indicating means. The more so since the present claims or description do not call for any non conventional measure being required to achieve adequate calibration of the indicating means.

Such introduction of a window contamination detection device as disclosed in document D1 in a detector for a fire sensor system as known in principle from document D2 leads to an apparatus from which the subject-matter of Claim 1 is distinguished only in that the contamination indicating means is calibrated by calibrating the reference source instead of the reference detector as specifically disclosed in document D1 (page 10, last paragraph). Calibration of the reference channel can, however, obviously be achieved by controlling the reference signal in any point of the channel and, accordingly, regulating the output signal of the reference source as set out in Claim 1 does not involve more than the selection of an equivalent alternative to the known detector signal calibration, which does not go beyond the normal competence of the skilled person.

2.2.4 The remaining submissions made by the Appellant could not convince the Board of the non-obviousness of the subject-matter of Claim 1 either. In particular, the fact that a US patent has already been granted for the present invention cannot be construed as necessarily implying that the latter also involves an inventive step within the meaning of Article 56 EPC. Not only are the examining proceedures before the US and European Patent Offices independent from each other and often based on different prior art, but the respective patent laws and the standards for assessing inventive step are not harmonized either.

The Appellant also failed to establish that the alleged commercial success of his invention results from the technical features of the claimed apparatus rather than from other influences, e.g. his marketing techniques.

Finally, since Appellant's arguments as a whole could not, in the Board's view, seriously question the correctness of

its reasoning, there is no room for any doubt of which the benefit could be given to the Appellant.

2.2.5 For the above reasons, the subject-matter of Claim 1 is not considered to involve an inventive step within the meaning of Article 56 EPC.

2.3 Accordingly, Claim 1 is not allowable under Article 52(1) EPC. Claims 2 and 3 are not allowable either, since they are dependent on unallowable Claim 1.

Therefore, Appellant's main request is rejected.

3. Auxiliary requests.

3.1 Claim 1 in accordance with Appellant's first auxiliary request differs from Claim 1 of the main request by the addition of the feature of Claim 2 of the main request reciting that the reference source and the reference detector each present an optical surface which in use is subject to contamination.

This feature is already known from document D1 (Figure 1, optical surfaces 72 and 73) and has the same effect in both cases, i.e. increasing the sensitivity of the reference channel. It cannot, therefore, in any way contribute to inventive step.

Consequently, Appellant's first auxiliary request is to be rejected too.

3.2 The single claim in accordance with Appellant's second auxiliary request differs from Claim 1 of his main request by the addition of the features of Claim 3 of the main request, which essentially define the constructional arrangement of the apparatus in a container comprising two

protrusions, each having a window, the reference source and the reference detector being situated behind respective ones of the windows.

This specific arrangement is known also from document D1, which discloses the provision of a container (10) comprising a recess (29) in its outer wall. This recess (29) is defined by opposite parallel walls (30, 31) with respective windows (72, 73) behind which the reference source (46, 92) and the reference detector (42) are respectively situated. The portions of the container (10) located on either side of the recess (29) defined by the side walls (30, 31) necessarily form "protrusions protruding from the container wall" (Figure 1; page 6, lines 2 to 4; page 8, lines 11 to 26).

The only difference from the claimed arrangement is that the main radiation detector (6) is not set behind its associated window in the container wall but receives radiation via two mirrors (36, 37). This, however, is considered as a trivial constructional modification dictated by the fact that the known main radiation detector is sequentially irradiated via two comparative channels whereas the main radiation detector (75) of the claimed apparatus is constantly exposed to possible radiation coming in one and the same way.

For the above reasons, the subject-matter of the single claim in accordance with the Appellant's second auxiliary request is considered to lack an inventive step within the meaning of Article 56 EPC, and the claim therefore cannot be allowed (Article 52(1) EPC).

3.3 Accordingly, Appellant's secondary request is to be rejected too.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar: **The Chairman:**

F. Klein K. Lederer