Candidate's answer

New Claims:

1. *A smoke detector (100, 200, 300) comprising:*
an infrared light source (42),
a light sensor (44) arranged to receive infrared light from the infrared light source (42) which has been scattered by smoke and to sense the intensity of the received infrared light,
a light shield (40) arranged to prevent infrared light from the infrared light source (42) from being directly received by the light sensor (44), a control unit (125, 225, 325) electrically connected to the light sensor (44), the control unit (125, 225, 325) being arranged to generate a smoke alarm signal when the intensity of infrared light sensed by the light sensor (44) exceeds a light intensity threshold value,
characterised by further *comprising a* further *light sensor (150, 250, 350) arranged to receive light directly from the infrared light source* (42)*, and to sense the intensity of the received infrared light, wherein the control unit (125, 225, 325) is electrically connected to the further light sensor (150, 250, 350),* and the control unit (125, 225, 325) is arranged to set the light intensity threshold value as a function of the intensity of infrared light sensed by the further light sensor (150, 250, 350).

2. A smoke detector (100, 200, 300) according to claim 1, wherein
the infrared light source (42) is arranged to emit infrared light having a wavelength in the range of 850-900nm, and
the light sensor (44) and the further light sensor (150, 250, 350) are arranged to sense the intensity of infrared light having a wavelength in the range of 850nm – 900nm.

3. A smoke detector (100, 200, 300) according to claim 1 or 2, wherein the smoke detector is operable to be powered by a battery or by mains electricity when available.

4. *A smoke detector (100) according to* any of the previous claims, *wherein the further light sensor (150) is physically in contact with the infrared light source (42).*

5. *A smoke detector (200, 300) according to* any of claims 1 to 3, *wherein the further light sensor (250, 350) and the infrared light source (42) are spaced apart by a gap (X, Y).*

6. A smoke detector (200) according to claim 5, wherein the gap (X) is less than 5mm.

7. A smoke detector (200) according to claim 6, wherein the gap (X) is 4mm.

8. A smoke detector (300) according to claim 5, wherein the gap (Y) is greater than or equal to 5mm, and further comprising:
a signal-averaging filter 326 that is arranged to receive an electrical signal representing the intensity of the infrared light sensed by the further light sensor (350), to average the signal over a period of time, and to send an average light intensity signal to the control unit (325).

9. A smoke detector (300) according to claim 8, wherein the period of time is 24 hours.

To: EPO Munich 2 March 201

Patent Application No. XXY

In response to the outstanding examination report in respect of the above mentioned patent application, we file herewith new claims 1 to 9 to replace previously filed claims 1 to 7 currently held on file. Please also find a receipt for documents form 1037. All amendments are without abandonment of subject matter.

Amendments and Basis

New Claim 1:
New claim 1 is based on claim 1 as originally filed. The 'method step' has been removed from the characterising portion. Being a method step, it did not have any limiting effect on the scope of claim 1, and therefore the scope of claim is not affected by its removal. However, for completeness we note that new claim 1 now includes wording defining a feature analogous to the removed method step but positively recited as an apparatus feature:

'the control unit is arranged to set the light intensity threshold value'.
The characterising portion of claim 1 now incorporates the subject matter of claim 2 as originally filed. Basis for this incorporation is provided by the dependency of original claim 2 on original claim 1.

Finally, the following wording has now been added to the end of claim 1, after the subject matter of original claim 2:

'and the control unit is arranged to set the light intensity threshold value as a function of the intensity of infrared light sensed by the further light sensor'.

Basis for the new wording is provided by the description at page 5, lines 3 to 6, which relates to a first of three embodiments. In terms of the second embodiment, the description at page 6, lines 9 to 10, states that 'the control unit is arranged to set the light intensity threshold value as described above in conjunction with the first embodiment'. Finally, in relation to the third embodiment, which features a signal-averaging filter, we note from the description at page 7, lines 9 to 13, that the control unit is arranged to set the light intensity threshold value in the same way as in the first two embodiments, regardless of the presence of the signal-averaging filter.

New Claim 2:
Claim 2 is a new claim based on the description at page 7, lines 19 to 22. In accordance with the Examiner's comments in section 5.2 of the examination report, the claim specifics the wavelength range of the sensors and the light source.

New Claim 3:
Claim 3 is a new claim based on the final two lines of the description at page 7, lines 22 to 23.

For both new claims 2 and 3 we note that, as stated at page 7, line 19, the relevant section of the description on which the claims are based relates to all three embodiments.

Claim 4:
New claim 4 has the same subject matter as original claim 3, with the claim dependency amended in accordance with the above-detailed amendments.

Claim 5:
New claim 5 has the same subject matter as original claim 4, with the claim dependency amended in accordance with the above detailed amendments.

New Claim 6:
New claim 6 is a new claim based on the second embodiment, with particular basis for the claimed range of gap size being provided by the description at page 5, lines 25 to 27.

New Claim 7:
Claim 7 is a new claim to a specific gap size and is based on the description at page 6, lines 1 to 4.

New Claim 8:
Claim 8 provides an alternative range of gap sizes to claims 6 and 7. Claim 8 is a new claim based on the third embodiment, with basis for the particular range claimed being provided by the description at page 6, line 17. Furthermore, it is stated in the description at page 6, lines 15 to 19, that such embodiments also comprise a signal-averaging filter, and this is claimed accordingly. Basis for the particular wording used to define the signal-averaging filter is provided by the description at page 7, lines 6 to 9.

New Claim 9:
Claim 9 is new claim based on the description at page 7, lines 15 to 17.

Thus basis for the above amendments can be found in the application as originally filed, and A123(2)EPC is not contravened.

Clarity

In response to the objection in section 3 of the examination report, claim 1 has been amended so that its subject matter is defined purely in terms of apparatus feature. We therefore submit that said objection is overcome. In response to the objection in section 7.2, the term ‘very small’ is no longer used in the claims and specific numeric ranges are recited instead.

Added Subject Matter in the previously-filed Claims

In response to the Examiner’s objection in sections 5.1 to 5.3 of the examination report, the claims have been amended so that the definition of the further light sensor does not extend beyond the subject matter of the application as originally filed, and the wavelength ranges are defined for both the light source

and the light sensors. We submit the objections under A123(2)EPC are now overcome.

Novelty

Claim 1 now defines a smoke detector having a light sensor and a further light sensor. The smoke detector disclosed by cited document D1 only has one light sensor. There is no disclosure of a further light sensor in D1.

Claim 1 defines that the control unit is arranged to set the light intensity threshold value as a function of the intensity of infrared light sensed by the further light sensor. This feature is not disclosed by D2. D2, at page 21, lines 2 to 6, discloses a control unit setting a light intensity threshold value based on a power source. Furthermore, D2 discloses at page 22, lines 11 to 16, setting a power-threshold value as a function of light intensity sensed by a second light sensor. However, the second light sensor is not arranged to receive light directly from the infrared light source, and there is no disclosure of setting the light intensity threshold value as a function of light intensity sensed by the second light sensor.

Claim 1 defines the control unit being arranged to set the light intensity threshold value as a function of the intensity of infrared light sensed by a further light sensor. D3 does not disclose any such feature. In D3 there is no disclosure relating to the control unit setting the light intensity threshold value.

Hence the requirements of Article 54 EPC are met.

Inventive Step

We take document D1 to be the closest prior art document for the assessment of inventive step. D1 is in the same technical field as the present invention, namely smoke detectors, and concerns the same general problem, namely how to modify the light intensity threshold value of a smoke detector to compensate for factors such as the battery power or dirt in the detector causing the sensitivity of the smoke detector changing over time. D3 is aimed at a different problem-how to warn a user when the light source has failed. D2 is aimed at two problems, both different to the present invention-how to compensate when the power source changes, and how to ensure that a low-battery indicator alarm does not sound at night.

The closest prior art does not disclose at least the features of: a further light sensor arranged to receive light directly from the infrared light source and to sense the intensity of the received infrared light; the control unit being electrically connected to the further light sensor; or the control unit being arranged to set the light intensity threshold value as a function of the intensity of infrared light sensed by the further light sensor.

The technical effect of the above-identified distinguishing feature is that the smoke detector consistently generates a smoke alarm signal as soon as the smoke concentration in the smoke detecting chamber reaches a dangerous level, irrespective of the condition of the battery, and without any need for manual calibration.

Thus, an objective technical problem with the closest prior art is a need to calibrate the light intensity threshold value to reflect changes in the light intensity produced by the light source over time without requiring manual calibration by the user, which is inconvenient, inaccurate, and potentially dangerous if not performed frequently enough.

The skilled person looking to modify the closest prior art to solve this problem would not find it obvious to do so in the manner recited in claim 1 because the optimisation process in D1 is based on adapting a controller (control know 410) to compensate changes in the smoke detector. That is to say, in D1, the light intensity threshold value changed by a light intensity control part (control knob 410) being set to compensate for changes in the smoke detector over time. Therefore, even if the skilled person were to seek to automate the calibration procedure of D1, as is suggested at page 19, lines 15 to 16, they would not arrive at a solution using a light sensor as defined by claim 1 – sensing the light intensity and modifying the light intensity threshold value.

The skilled person would not seek to combine documents D1 and D2. Document D2 does not deal with the problem of calibrating a smoke detector to compensate for changes over time. Furthermore, even if the skilled person were to attempt to combine the teaching of D2 with the disclosure of D1, the light intensity threshold in D2 is only changed when the power source changes from battery to mains electricity and vice-versa. The second light sensor in D2 is used to set a power-threshold value, which is for determining when to generate a low-battery alarm signal, and is completely different from the light intensity threshold value of the present invention. Therefore, the invention of claim 1 would not be obvious even if the skilled person was to seek to combine D1 with D2.

The skilled person would not seek to combine documents D1 and D3. Document D3 does not deal with the problem of calibrating a smoke detector to compensate for changes over time. D3 deals with sounding an alert when the light source fails, see page 25, lines 10 to 12. Even if the skilled person were to seek to combine documents D1 and D3, D3 does not suggest using the further light sensor to set a light intensity threshold value based on intensity of infrared light sensed by the further light sensor. Therefore it would not be obvious to arrive at a smoke detector falling within the scope of claim 1.

EXAMINATION COMMITTEE I

Candidate No.

Paper B (Electricity/Mechanics) 2011 - Marking Sheet

Category		Maximum possible	Marks awarded	
			Marker	Marker
Claims	Independent	20	20	20
	Dependent	20	20	20
Arguments	Basis for Amendments	16	14	15
	Clarity	6	6	6
	Novelty	5	5	5
	Inventive Step	33	28	28
Total		**100**	**93**	**94**

Examination Committee I agrees on 94 marks and recommends the following grade to the Examination Board:

☒ PASS (50-100) ☐ COMPENSABLE FAIL (45-49) ☐ FAIL (0-44)

30 June 2011

Chairman of Examination Committee I