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Datasheet for the decision of 15 October 2014

Case Number: T 2478/10 - 3.4.01

Application Number: 06779408.1

Publication Number: 1938114

IPC: G01R27/20

Language of the proceedings: EN

Title of invention:
METHOD OF TESTING THE RESISTANCE OF AN ELECTRICAL CONNECTION

Applicant:
Seaward Electronic Limited

Headword:

Relevant legal provisions:
EPC 1973 Art. 56

Keyword:
Inventive step - (no)

Decisions cited:

Catchword:

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Case Number: T 2478/10 - 3.4.01

D E C I S I O N
of Technical Board of Appeal 3.4.01
of 15 October 2014

Appellant: (Applicant)	Seaward Electronic Limited 18 Bracken Hill, South West Industrial Estate Peterlee County Durham, SR8 2SW (GB)
Representative:	Brookes Batchellor LLP 46 Chancery Lane London WC2A 1JE (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 18 August 2010 refusing European patent application No. 06779408.1 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	G. Assi
Members:	P. Fontenay
	M. Vogel

Summary of Facts and Submissions

I. The appeal, filed on 25 August 2010, lies from the decision of the examining division, dispatched on 18 August 2010, to refuse European patent application No. 06 779 408.1. The appeal fee was paid on 25 August 2010. The statement setting out the grounds of appeal was filed on 6 December 2010.

II. The decision under appeal was taken after a communication under Rule 71(3) EPC dated 15 December 2009 was issued with which the examining division informed the applicant that the main request filed on 18 August 2009 was not allowable for lack of inventive step and that it had the intention to grant a European patent on the basis of the application documents according to the auxiliary request filed on 18 August 2009. By letter of 14 April 2010 the appellant, however, did not approve the text intended for grant and maintained the main request filed on 18 August 2009. The decision under appeal, which then ensued, therefore referred to the main request of 18 August 2009.

III. In the decision under appeal the examining division refused the application for failure to comply with the provisions of Article 56 EPC 1973.
The objection of lack of inventive step relied on the teaching of document EP-A-0 763 745 (D6), considered to represent the closest prior art, and the skilled person's general knowledge (see Reasons for the Decision, points 16 and 17). The examining division also observed that a similar conclusion would have been reached when starting from document DE-A-43 32 649 (D7) considered by the applicant to reflect the closest

prior art (see Reasons for the Decision, points 18 and 19).

IV. With the statement setting out the grounds of appeal the appellant (applicant) requested that the decision under appeal be set aside and a patent be granted with the claims according to a main request or a first auxiliary request or a second auxiliary request, all filed with the statement of grounds. The second auxiliary request corresponded to the auxiliary request which had been considered allowable by the examining division with the communication under Rule 71(3) EPC of 15 December 2009.

V. In accordance with an appellant's request, summons to attend oral proceedings were issued on 14 May 2014.

VI. In a communication of the Board pursuant to Article 15(1) RPBA dated 10 July 2014, the appellant was informed of the provisional opinion of the Board with regard to the requests then on file.

In particular, the Board drew the appellant's attention to shortcomings under Article 123(2) EPC and Article 84 EPC 1973 with regard to the claims.

Concerning Article 56 EPC 1973, the Board expressed doubts as to whether document D6 would represent the closest prior art. Documents GB-A-2 277 598 (D5) or D7 rather appeared to constitute a more realistic starting point for assessing inventive step. According to a provisional analysis, it would have been obvious for the skilled person, starting from the teaching of D5 or D7 and having to solve the problem of lack of reliability of measurements carried out with low currents, to consider the solution disclosed by

document GB-A-2 268 811 (D1). Document D1 pertained to the field of calibrators for impedance testers and was therefore considered by the Board to belong to a neighbouring technical field that would have been taken into consideration by the skilled person.

Concerning, more specifically, the first auxiliary request, the Board observed that the additional features recited in claim 1 related to the means required to generate a current of a first magnitude and addressed the problem of bulky supply sources. In particular, the claimed combination of a battery and a DC to DC converter did not appear to involve an inventive step. Reference was made, in this respect, to common general knowledge as, for example, illustrated in pages 1-7 of a book by J. P. Ferrieux "*Alimentations à découpage*", Edited by Masson, 1987 (D10).

A similar finding applied to the second auxiliary request directed more specifically at the shape of the high current pulse to be generated before the actual measurements with low currents were carried out. In the absence of any indication in the description as to the achieved advantages, no invention could be recognised in the selection of a particular current discharge curve, as claimed.

VII. With a letter of reply dated 5 September 2014, the appellant filed a new main request and three new auxiliary requests, taking due account of the comments made by the Board.

Moreover, the appellant put forward arguments against the comments made by the Board with regard to inventive step. In particular, the appellant objected to D5 as closest prior art since this document did not disclose

the measurement of the resistance of a protective earth path of an appliance. In this respect the "*CONT*" functionality disclosed in D5 concerned a simple test to determine if a connection to the earth existed in the equipment under test.

With the same letter, the appellant also filed a witness statement from Mr. Wallace dated 29 August 2014. The statement contained various comments regarding the development in the technical field of the invention and the relevance of document D1 when assessing the inventive step of the claimed invention.

VIII. On 14 October 2014, the Board sent by fax a copy of pages 135 and 136 of chapter 27 of a book by Ragnar Holm "*Electric Contacts*", Springer-Verlag, 1967 (Fourth Edition reprinted in 1981). These pages were considered to illustrate the skilled person's general knowledge in the field of electric contacts.

IX. Oral proceedings before the Board took place on 15 October 2014. The Board, which in the meantime had the whole book by Ragnar Holm at its disposal, handed over, for the sake of completeness, a copy of the whole chapter 27 (pages 135-152) entitled "*§ 27. Fritting of tarnish films*" (D11). The oral proceedings were then interrupted in order for the appellant to get familiar with the content of document D11.

In the course of the oral proceedings the appellant expressly agreed that a portable testing apparatus for testing the resistance of a protective earth path of an electrical appliance via contacts, the apparatus comprising an earth continuity measuring circuit including current supply means arranged to provide a low test current to the protective earth path, did form

part of the state of the art at the priority date (19 October 2005) of the application. In this respect, the reference in the original application to such devices, without reference to any specific document or other identifiable prior art, was correct and did not relate to internal prior art.

Moreover, during the oral proceedings the appellant withdrew the second auxiliary request filed with letter of 5 September 2014. The pending auxiliary request 3 was thus renumbered as auxiliary request 2.

X. The appellant finally requested that the decision under appeal be set aside and a patent be granted on the basis of sets of claims according to the main request or the first auxiliary request or the third auxiliary request renumbered as new second auxiliary request, all these requests filed with the letter of 5 September 2014.

XI. Claim 1 of the main request reads:

"*1. A portable testing apparatus for testing the resistance of a protective earth path of an electrical appliance (10) via contacts (6, 8) wherein the protective earth path is arranged to protect a user of the appliance against electric shock in the event of a fault occurring in the electrical appliance, the apparatus comprising:*

a high current pulse generator including first current supply means (12, 14, 16) for generating a relatively high current pulse for application to the protective earth path to reduce the resistance of the contacts (6, 8);

an earth continuity measuring circuit including second current supply means (32), and arranged to provide a relatively low test current to the protective

earth path for earth continuity measurement after the contact resistance has been reduced by the first current pulse;

switchable isolating means (18, 20) between the high current pulse generator and the earth continuity measuring circuit whereby the first current supply means (12, 14, 16) is normally isolated from the appliance; and

a control signal generator arranged to operate the switchable isolating means whereby the first current supply means is selectively connected to the contacts for a period before the earth continuity measurement is carried out."

Claims 2 to 5 of the main request are dependent claims.

Claim 1 of the first auxiliary request reads:
"*1. A portable testing apparatus for testing the resistance of a protective earth path of an electrical appliance (10) via contacts (6, 8) wherein the protective earth path is arranged to protect a user of the appliance against electric shock in the event of a fault occurring in the electrical appliance, the apparatus comprising:*

a high current pulse generator including first current supply means (12,14, 16) for generating a relatively high current pulse for application to the protective earth path to reduce the resistance of the contacts (6, 8), the first current supply means including a battery (12) for providing a supply voltage, a DC to DC converter (14) adapted to step up the supply voltage provided by the battery to a second voltage having a magnitude greater than the supply voltage, and at least one capacitor (16) adapted to be charged by said second voltage whereby discharge of the capacitor produces the high current pulse;

an earth continuity measuring circuit including second current supply means (32), and arranged to provide a relatively low test current to the protective earth path for earth continuity measurement after the contact resistance has been reduced by the first current pulse;

switchable isolating means (18, 20) between the high current pulse generator and the earth continuity measuring circuit whereby the first current supply means (12, 14, 16) is normally isolated from the appliance; and

a control signal generator arranged to operate the switchable isolating means whereby the first current supply means is selectively connected to the contacts for a period before the earth continuity measurement is carried out."

Claims 2 to 4 of the first auxiliary request are dependent claims.

Claim 1 of the second auxiliary request reads as follows:

"*1. A portable testing apparatus for testing the resistance of a protective earth path of an electrical appliance (10), wherein the protective earth path is arranged to protect a user of the appliance against electric shock in the event of a fault occurring in the electrical appliance, the apparatus comprising:*

current supply means (2, 32) for providing a current of a first magnitude to the protective earth path to be tested, wherein the magnitude of the current is decreasable from said first magnitude in use, the current supply means comprising:

a battery (12) for providing a supply voltage;

a DC to DC converter (14) adapted to step up the supply voltage provided by the battery to a second

voltage having a magnitude greater than the supply voltage; and

at least one capacitor (16) adapted to be charged by said second voltage, wherein discharge of the capacitor provides current of said first magnitude to reduce the contact resistance of the protective earth path,

wherein said current of said first magnitude has an initial value of approximately 60A, which decays in the space of just over 0.2ms to a negligible current value, when said capacitor is discharged through a resistance of 1 ohm."

Claims 2 to 6 of the second auxiliary request are dependent claims.
Independent claim 7 of the second auxiliary request concerns a "*method of testing the resistance of a protective earth path of an electrical appliance*" making use of a portable testing apparatus according to anyone of the previous claims.

Reasons for the Decision

1. Applicable law

It is noted that the revised version of the Convention (EPC 2000) does not apply to European patent applications pending at the time of its entry into force (13 December 2007), unless otherwise provided. In the present decision, where Articles or Rules of the former version of the EPC apply, their citation is followed by the indication "*1973*".

2. Admissibility of the appeal

The appeal meets the requirements of Articles 106 to 108 EPC and Rule 99 EPC. It is thus admissible.

3. Prior art

The appellant expressly agreed that a portable testing apparatus for testing the resistance of a protective earth path of an electrical appliance via contacts, the apparatus comprising an earth continuity measuring circuit including current supply means arranged to provide a low test current to the protective earth path, did form part of the state of the art at the priority date (19 October 2005) of the application. Such an apparatus is referred to, although in general terms, in the introductory portion of the patent application (cf. page 1). Moreover, the existence of such state of the art can be derived from the witness statement from Mr. Wallace dated 29 August 2014.

In the Board's view, this undisputed prior art represents a realistic starting point when assessing inventive step, which can thus be considered as the closest prior art.

4. Main request

4.1 The subject-matter of claim 1 according to the main request differs from the closest prior art as defined above by the following features (in italics):

(a) "*a high current pulse generator including first current supply means for generating a relatively high current pulse for application to the protective earth path to reduce the resistance of the contacts*";

(b) "*switchable isolating means between the high current pulse generator and the earth continuity*

measuring circuit whereby the first current supply means is normally isolated from the appliance";

(c) "*a control signal generator arranged to operate the switchable isolating means whereby the first current supply means is selectively connected to the contacts for a period before the earth continuity measurement is carried out*";

(d) the earth continuity measuring circuit is arranged to provide the relatively low test current to the protective earth path for earth continuity measurement "*after the contact resistance has been reduced by the first current pulse*".

4.2 The claimed apparatus permits to reduce the effects resulting from surface oxidisation at junctions or interconnections within the protective earth path or constrictions due to surface irregularities at the molecular level (cf. published application, paragraph bridging pages 1 and 2).

4.3 The problem solved by the invention is thus to obtain more realistic measurements of the resistance of the protective earth path, i.e. measurements that are not affected by the higher resistance resulting from the effects evoked above (cf. published application, paragraph bridging pages 2 and 3).

4.4 D11 is a chapter of a standard book in the technical field of electric contacts. The book was originally published in 1967 and reprinted in 1981. Its relevance as evidence for what constituted the skilled person's general knowledge in the field of electric contacts at the priority date of the application was not challenged by the appellant.

According to D11 (cf. page 135, first paragraph), "*wiring connections are often made without previously liberating the contacting wires from their tarnish films, although these may be visible as a color that is slightly different from the color of a clean metal. According to the conventional experience it is taken for granted that these films, which actually are insulators when coherent, do not essentially disturb the conduction through the contact. However, the experienced conduction is not due to a proper quality of the films but to the fact that they either become mechanically ruptured in some spots at contact make or are electrically broken down when enough voltage is applied. The breakdown considered is called fritting*".

The example is then mentioned concerning "*a symmetric contact containing a high-resistivity film, a few 100 Å thick say 500 Å. A low beginning voltage is applied and gradually increased. Initially, because of the high resistivity of the film, a very feeble current flows. But, when a potential gradient of the order of* 10^8 *V/m, i. e. a fritting voltage* U_F *of about 5 V is reached, the usually sudden increase of the current and decrease of the contact voltage indicate that fritting has generated an a-spot. This spot is able to carry the current at a contact voltage below the melting voltage but above the softening voltage of the metal. We call this voltage the cessation voltage of the fritting and label it* U_h*, where h refers to halt*" (cf. paragraph bridging pages 135 and 136).

In other words, D11 discloses that the application of a sufficiently high potential difference, a fritting voltage, across an oxidised contact has an advantageous effect on the current flowing through the contact.

In view of the foregoing, the skilled person would know, from his general knowledge, as evidenced by D11, not only about the origins of the problem encountered when measuring the (low) resistances of a protective earth path, but also of a method to solve it. This knowledge would then lead the skilled person to implement fritting means in a prior art testing apparatus as defined above. In particular, this would imply providing a high current pulse generator for generating a relatively high current pulse to be applied to the protective earth path in order to reduce the resistance of the contacts (cf. feature (a) mentioned above). In this respect, the claimed combination of switchable isolating means (cf. feature (b) mentioned above) with a control signal generator (cf. feature (c) mentioned above) does not go beyond the usual technical expertise of the skilled person who knows, as evidenced by D11, that the earth continuity measurement should be carried out after the contact resistance has been reduced by the fritting means (cf. feature (d) mentioned above).

4.5 The appellant contested this assessment. In its view, D11 disclosed a fritting voltage of 5 V (cf. sentence bridging pages 135 and 136). The provision of a high current pulse generator would then be superfluous in the context of an apparatus according to the closest prior art, since such an apparatus usually relied on 6 V or 9 V batteries, i.e. power supply sources generating voltages which would have been sufficient, as such, to achieve the required effect.

This argument could not convince the Board. The 5 V threshold evoked in D11 is disclosed in the context of a specific example concerning a contact with a high resistivity film having a thickness of 500 *Å (1 Å =*

10^{-10} m). As underlined in D11, the actual relevant parameter indicative of whether or not fritting would take place is constituted by the potential gradient in the film which must be of the order of 10^8 V/m. Applied to a thickness of 500 *Å*, this condition would indeed lead to a minimum potential of 5 V (10^8 V/m * 5 10^{-8} m). However, in case of a film with a thickness two or three times as much, a minimum potential difference of 10 V or 15 V, respectively, would be required.

Since the claimed portable testing apparatus is to be used for testing the resistance of the protective earth path of any undefined electrical appliance with *a priori* unknown characteristics, the claimed "*relatively high current pulse*" to be generated should be able to cope with all kinds of situations, in particular oxidisation layers with various chemical compositions and/or thicknesses which might noticeably exceed 500 *Å*.

4.6 The appellant also argued that an essential feature of the invention was to generate a "*relatively high current pulse*", this current pulse constituting the key parameter in order to solve the problem identified above. In this respect, the teaching of the invention differed from D11 which only disclosed the voltage as relevant parameter.

In the Board's view, however, the application of a minimum voltage across a contact according to the teaching of D11, implies *de facto* that a corresponding relatively high current would flow across said contact. This finding is the direct consequence of the Ohm law according to which the current flowing across a resistance is directly proportional to the voltage applied between its extremities.

Moreover, contrary to what is suggested by the appellant's argument, the wording of claim 1 according to the main request should not be construed as implying that a constant current, i.e. independent of the resistance of the insulating film, is delivered by the high current pulse generator. According to the embodiment of the invention, the current generated by the high current pulse generator which flows across the contact corresponds to the discharge of a capacitor which has previously been charged under a voltage of 30 Volts. That is, the current actually flowing across the contact is directly influenced by the resistance of the insulating layer, as is also the case in D11 when a specific voltage, e.g. 5 V., is applied.

4.7 For these reasons, the arguments put forward by the appellant are not convincing.

4.8 Therefore, the subject-matter of claim 1 according to the main request does not involve an inventive step in the sense of Article 56 EPC 1973.

The main request is not allowable.

5. First auxiliary request

5.1 Claim 1 of the first auxiliary request differs from claim 1 of the main request in that the "*first current supply means*" has been further defined by addition of the following features:

(a) "*a battery for providing a supply voltage*";

(b) "*a DC to DC converter adapted to step up the supply voltage provided by the battery to a second voltage having a magnitude greater than the supply voltage*";

(c) "*at least one capacitor adapted to be charged by said second voltage whereby discharge of the capacitor produces the high current pulse*".

These added features define additional distinguishing features between the subject-matter of claim 1 and the closest prior art as defined above. It is noted, in this respect, that the battery provided in a portable testing apparatus according to the closest prior art does not form part of the claimed "*first current supply means*".

5.2 The additional distinguishing features permit, together with the other distinguishing features identified above with regard to claim 1 of the main request, to generate a current pulse that is high enough to reduce the resistance of the contacts before carrying out an earth continuity measurement with a "*relatively low test current*" in a manner that is advantageous in terms of physical dimensions and costs (cf. published application, page 4, penultimate paragraph).

5.3 As stressed by the appellant, document D11 was silent as to possible embodiments for carrying out fritting. The content of D11 was solely concerned with the theory underlying fritting and, in particular, the conditions required for it to take place. The claimed means were also not disclosed in any other document of the cited prior art relating to testing apparatuses.

However, the Board does not share the conclusion reached by the appellant according to which the fact that the claimed high current pulse generator was not known from any of the cited documents concerning portable testing apparatuses would be an indication of the presence of an inventive step. This would only be

the case if the claimed configuration, taking due account of the effects it produces, did extend beyond normal practise and what might be expected from a skilled person under the circumstances. In this respect, only technical effects which appear both realistic and relevant in the context of the invention are to be taken into account. *A contrario*, effects which may be considered irrelevant in the context of the invention cannot confer any merits to the structure from which they originate.

In the present case, it is worth observing with regard to document D11 that any means which creates the required fritting voltage would be suitable to carry out fritting. As already mentioned with regard to the main request, this implies *de facto* that a relatively high current is generated.

Considering that the Board, with regard to claim 1 of the main request, has already come to the conclusion that a testing apparatus comprising a high current pulse generator would not involve an inventive step in view of the closest prior art as mentioned above and the disclosure of D11, the technical problem faced by the skilled person with regard to claim 1 of the auxiliary request can be seen in how to implement said high current pulse generator in a manner that is advantageous in terms of physical dimensions and costs.

The problem thus defined is not limited to the field of the present invention. Rather, it is common in the field of supply sources, in which DC to DC converters are well known, such converters permitting to save space (cf. D10). In this respect, the Board fails to identify any additional effect which would result from the association of a DC to DC converter with a

capacitor and their incorporation in a testing apparatus according to the closest prior art. In the absence of any such additional effect, all configurations able to produce the required voltage or current and advantageous in terms of physical dimensions would have to be considered as being equivalent.

5.4 The appellant further argued that the skilled person faced with the necessity to generate a sufficiently high current pulse would have reversed to the known solution of mains powering the testing apparatus.

As underlined in paragraph 6 of the witness statement made Mr. Wallace, known mains powered high current testers had significant shortcomings. They were bulky and heavy and, moreover, could damage the equipment under test if applied incorrectly. In view of these shortcomings, it would be unlikely that the skilled person would consider the mains powering to represent a suitable solution. Rather, the skilled person would opt for keeping the benefits of portable testers with independent supply means, insofar as it would be practicable.

5.5 Moreover, the implementation of a high current pulse generator as claimed does not appear to require any skills going beyond what might be expected from the skilled person.

5.6 Therefore, the subject-matter of claim 1 according to the first auxiliary request does not involve an inventive step in the sense of Article 56 EPC 1973.

The first auxiliary request is not allowable.

6. *Second auxiliary request*

6.1 Claim 1 of the second auxiliary request differs from claim 1 of the first auxiliary request in that the features regarding the "*earth continuity measuring circuit*", the "*switchable isolating means*" and the "*control signal generator*" have been deleted and, moreover, in that the high current pulse generator mentioned as "*current supply means*" is specified by addition of the following features:

(a) "*said current of said first magnitude has an initial value of approximately 60A, which decays in the space of just over 0.2ms to a negligible current value, when said capacitor is discharged through a resistance of 1 ohm*".

6.2 According to the appellant the claimed particular discharge curve of the capacitor was optimal under real conditions in that it guaranteed a high current peak and a sufficient amount of energy flowing through the contacts. These two parameters were indeed crucial in the context of the invention.

The Board agrees with the appellant that D11 did not suggest a high current pulse of the kind resulting from the claimed wording. However, this finding is not sufficient to acknowledge the existence of an inventive step.

It has been established with regard to the main request that the provision of means to carry out fritting in a testing apparatus according to the closest prior as defined above does not involve an inventive step in view of D11. As a matter of fact, all current pulses leading to a fritting voltage would be equivalent in the light of the disclosure of document D11 unless the

appellant could convincingly rely on the existence of additional effects which could serve as a basis for the definition of a problem whose solution would not be obvious.

In this respect, the appellant submitted that, due to the rapid decrease of the capacitor discharge, risks of deterioration of the electrical appliance under test were minimised as compared with high current pulses of longer duration.

Although this argument is technically meaningful, it is nevertheless insufficient to justify the existence of an inventive step. In the Board's view, it has to be expected from the skilled person that any measure is taken when designing the testing apparatus to avoid any deterioration of the electrical appliance under test. In other words, the skilled person, when designing the high current pulse generator to carry out fritting, would have indeed taken all the necessary precautions to guarantee the integrity of the electrical appliance.

In the absence of any other particular effect, all discharge curves fulfilling the two conditions mentioned above, i.e. fritting and integrity of the electrical appliance, have to be considered as equivalents.

Moreover, the practical implementation a current pulse as claimed does not require any skills going beyond what might be expected from the skilled person.

6.3 Therefore, the subject-matter of claim 1 according to the second auxiliary request does not involve an inventive step in the sense of Article 56 EPC 1973.

The second auxiliary request is not allowable.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

R. Schumacher G. Assi

Decision electronically authenticated