BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

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File No.: T 0071/93 - 3.4.2

Application No.: 88 870 155.4

Publication No.: 0 313 540

Classification: G01N 11/16

Title of invention: Method and apparatus for rheological testing

D E C I S I O N
of 1 June 1993

Applicant: MONSANTO COMPANY

Proprietor of the patent:

Opponent:

Headword:

EPC: Art. 56

Keyword: "Inventive step (yes)"

Headnote
Catchwords

A feature not explicitly mentioned in a prior art document although being generally known for alleviating a drawback usual in the same technical field, can not be considered implicitly disclosed if it is not directly derivable from said prior art document that said drawback was considered as unacceptable and/or if other solutions were proposed for alleviating said drawback.

Case Number: T 0071/93 - 3.4.2

DECISION
of the Technical Board of Appeal 3.4.2
of 1 June 1993

Appellant:
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Representative:
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Decision under appeal:
Decision of the Examining Division of the European Patent Office dated 8 September 1992 refusing European patent application No. 88 870 155.4 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: E. Turrini
Members: M. Chomentowski
M.V.E. Lewenton

Summary of Facts and Submissions

I. Current Claims 1 and 3 of European patent application No. 88 870 155.4 (publication No. 0 313 540) read as follows:

"1. A method of testing rubber or a rubber-like viscoelastic material comprising the steps of:

a) subjecting a sample of the material under pressure in sample-holding means to a sinusoidal excitation;

b) measuring the response to the excitation at displacement data points evenly spaced throughout a cycle of excitation, and

c) applying a calculation operation to the response values at each data point to convert the response values into values representing the storage modulus or loss modulus of the material. (read ";") characterised in that (a) both the sample and a standard are separately subjected to sinusoidal excitation, (b) the response of both at each of from 8 to 80 data points is measured, (c) a Fourier transform calculation operation is applied to convert the standard data points into values representing the torque and phase angle, and (d) the values of storage modulus or loss modulus of the material calculated from the material response values are corrected by reference to the standard torque and phase angle, by a Fourier transform calculation."

"3. A rheometer comprising, in combination an eccentric (8) to translate the rotary motion of a rotary drive (3) into sinusoidal oscillating motion, sample holding means (14) and (16), means (9), (10), (11), (12) and (13) cooperation (read "cooperating") with eccentric (8) and adapted to apply excitation to a sample under pressure in the sample holding means and to a standard, means (4), (5), (6), and (7) for sampling a resultant response to the excitation at displacement data points evenly spaced throughout a cycle of excitation, means (17) for measuring the said resultant response, and means for applying a calculation operation to the response values at each data point to convert the sample response values into values representing the storage modulus or loss modulus of the material, characterised in that there are from 8 to 80 displacement data points including a single reference point (7) in a cycle of excitation, and the rheometer includes means for applying a Fourier transform calculation operation to convert standard response values at each data point into values representing the torque and phase angle, and means for correcting the values representing the storage modulus or loss modulus of the material by reference to the standard torque and phase angle by a Fourier transform operation."

Claims 2, 4 and 5 are dependent claims.

II. The application has been refused on the grounds that the subject-matter of method Claim 1 did not involve an inventive step having regard to

D1 = EP-A-0 227 573,
D5 = US-A-4 584 882 and
D3 = US-A-4 154 093.

In particular, the Examining Division takes the view that D1 discloses the features of the statement of current Claim 1 and, moreover, the feature of the characterising portion that the data analysis involves a Fourier analysis because, although this is not explicitly disclosed, the reference to D5 shows that "an excitation mechanism as disclosed in D1 does not produce a pure sinusoidal excitation so that one actually must use Fourier analysis".

Concerning the other features of Claim 1, it is concluded that the choice of 8 to 80 datapoints per excitation cycle instead of 4 as disclosed in D1 is purely arbitrary, and that the technique of comparing a sample's response to that of a standard material is known from D3 and can be applied in an obvious way to the method of D1.

Objections against apparatus claims had been made during the Examination procedure.

III. The Appellant (Applicant) has lodged an appeal against this decision.

He requested that the decision under appeal be set aside and that a patent be granted on the basis of the current patent application documents as a main request, or on the basis of the current Claims 3 to 5, as an auxiliary request.

Moreover, the Appellant requested oral proceedings in case that the main request could not be allowed.

IV. In support of his requests, the Appellant submitted the following arguments in his written statement of the grounds of appeal and in the accompanying declaration of Mr.D.P.King:

D1 does not disclose the feature of the Fourier analysis in the measuring method; such mathematical means, although generally known, was not considered necessary; D5 merely mentions that vibrations used in dynamic viscoelastic measuring apparatuses are not sinusoidal and proposes a different solution to the related lack of accuracy; Fourier analysis is not derivable from the other prior art documents either.

The method of D1 is based on the determination of the maximum displacement of means of the sensing apparatus, said determination being inaccurate. The present invention solves this problem in particular by doing the measurements at predetermined data points, independent from the maximum displacement, for both the sample and the standard, in a manner which is not suggested by the prior art and in particular by D3 and the calibration technique taught therein.

Therefore, the subject-method of the claims involves an inventive step.

Reasons for the Decision

1. The appeal is admissible.

2. Allowability of the amendments

2.1 No objection has been formulated concerning the amendments resulting in the present text of the patent application (Article 123(2) EPC).

3. Novelty

3.1 The novelty of the subject-matter of the claims has not been contested (Article 54 EPC).

4. The nearest prior art

4.1 A method of testing rubber or a rubber-like viscoelastic material comprising all the steps of the statement of present Claim 1 is known from D1 (see column 1, lines 5 to 8; column 1, line 44 to column 2, line 13; column 2, line 35 to column 4, line 57; Figures 1 to 3); in the known method:

(a) a sample of the material under pressure in sample-holding means is subjected to a sinusoidal excitation;

(b) the response to the excitation is measured at displacement data points evenly spaced throughout a cycle of excitation, and

(c) a calculation operation is applied to the response values at each data point to convert the response values into values representing the storage modulus or loss modulus of the material.

4.1.1 Incidentally, the following is to be noted with respect to the feature of the characterising portion of present Claim 1 concerning the application of Fourier transform calculation:

There is no explicit indication that in the method of D1 a Fourier transform calculation operation is applied to convert data points into values representing the torque and phase angle. Indeed, according to D5 (see the title and column 2, lines 32 to 36) dynamic viscoelasticity measuring apparatus of torsional vibration type wherein a periodical vibration with a predetermined period and a predetermined amplitude can be imparted to the driving means have a disadvantage in that a reciprocal vibration does not have a sinusoidal waveform; thus, by reference to this teaching, which also applies to the method of D1, no pure sinusoidal excitation is produced so that one actually could conclude that one might use Fourier analysis since there is a good and well-known reason for applying it **if one is interested in obtaining accurate measurement results.**

However, there is no indication why without Fourier analysis the method would not work. Although it can be accepted that skilled persons carrying into practice a measurement technique are always interested in obtaining accurate measurement results, however, the magnitude of said "accuracy" of the measurement is in no way specifically and universally defined. In this respect, as credibly argued in the declaration of Mr D.P. King, although skilled person were aware of the problem of non-sinusoidal excitation and of the possibilities offered by Fourier analysis, however, the results with known methods were considered as sufficient for the relevant technique and Fourier analysis was not implemented. Therefore, there can be seen no reason why Fourier analysis must be implemented.

Moreover, the reason for considering Fourier analysis as being part of the known method is based on the further document (D5) only, which mentions the problem of the non-sinusoidal character of an excitation method as disclosed in D1 but which proposes as solution a constructional modification of the apparatus and is silent about Fourier analysis. This mathematical technique is not mentioned either in the other documents of the prior art in the relevant technical field.

Thus, either the feature of implementation of Fourier analysis results from a mere combination of D1, D5 and the general knowledge of the skilled person about Fourier analysis, or it results from a desire to ameliorate the results of the measurement techniques of D1 by "bettering" its technique with reference also to D5 and the general knowledge of the skilled person and to thus "solve a non-mentioned problem" by reading into a document something which is not comprised therein. In any case, these considerations are related to the evaluation of inventive step, and not of novelty. In this respect, reference is made in particular to the decisions T 572/88 of 27 February 1991 and T 763/89 of 10 July 1991, whereby an "implicit prior description" of a feature could not be based on the grounds that a person skilled in the art would have been aware of some disadvantages and of the lack of other forms of improvements related to said feature, this being a criterion for the evaluation of inventive step.

Thus, the feature concerning the use of Fourier analysis is not derivable from D1.

4.2 Therefore, contrary to the presently claimed method, in the method of D1,

(a) there is no step of separately subjecting a standard to sinusoidal excitation,

(b) it is at each of from 8 to 80 data points, and not at only 4 data points, that the response to the sinusoidal excitation is measured,

(c) a Fourier transform calculation operation is applied to convert the standard data points into values representing the torque and phase angle, and

(d) the values of storage modulus or loss modulus of the material calculated from the material response values are corrected by reference to the standard torque and phase angle by a Fourier transform calculation.

5. Problems of the prior art and inventive step

5.1 According to the Appellant's arguments and to the declaration of Mr D.P. King, the method known from D1 is not accurate: the limited number of data points, i.e. four, for measuring sample torque at each maximum and at each related delayed intermediate positions of the angular movement of the rotor results in a limited resolution of the harmonics; moreover, the known method does not comprise any calibration measurements with a standard.

5.2 Since it uses in particular a calibration technique and more data points, the method of the present invention (see the characterising portion of Claim 1) credibly solves these accuracy problems.

5.3 The method known from D1 (see column 1, line 49 to column 2, line 13; column 3, line 32 to column 4, line 57; Figure 2) requires **an accurate determination of the occurrence of the maximum displacement** amongst the variable displacements of the disc (38). Indeed, by separately measuring in the method known from D1 the response to excitation for different materials, for instance a standard and a sample, **the maximum displacement** of the disc (38) will occur **at different locations** because of the different viscoelastic properties, if the other parameters of the method remain the same; thus, the intermediate data points determined by the timer (60) for different materials will also be different.

5.4 Calibration techniques using standards in measurement methods of viscoelastic properties of materials are taught in D3 (see column 1, line 44 to column 2, line 18; column 2, line 56 to column 3, line 36; column 5, lines 7 to 14; column 6, lines 54 to 59; Figures 1 to 4); the source of oscillation can be operated at a fixed, predetermined frequency and measurements are made of the amplitude of the resulting oscillations of the vessel and sample and also the angular difference between those oscillations and those of the source, or, alternatively, by adjusting the frequency of the source of oscillation to coincide with the resonant frequency of in particular the vessel and the sample and measuring the amplitude and the frequency of the resulting oscillations; the characteristics measured may be used directly as basis for the empirical comparison of samples or, alternatively, the viscoelastic moduli of the materials under test, or parameters related to those moduli, can be obtained either by calculation according to certain theoretical formulae or by reference to calibration graphs or tables previously prepared by calculation using such formulae. The measurement techniques and resulting graphs or formulae of D3 do not correspond either to predetermined measurement data points.

5.5 In contrast therewith, in the method of present Claim 1 both the sample and a standard are separately subjected to sinusoidal excitation, **the response of both at each of a plurality of data points being measured**. Thus, if the person skilled in the art were to consider that by taking into account the calibration technique of D3 the accuracy of the measuring method known from D1 could be increased, this would lead to a method wherein the respective maximum displacement and the respective delayed intermediate displacement data points for the sample and for the standard would still be different and the calibration would be done using empirical comparison of results or use of formulae or graphs. Therefore, even if the combination of D1 and D3 were obvious, it would not lead to a method wherein the data points where measurements are effected separately for both the sample and the standard are fixed independently of the maximum detected displacement point.

5.6 The further prior art is more remote. Incidentally, it is to be noted that the relevant prior art does not incite the skilled person to additionally use Fourier transform calculation.

5.7 Therefore, the subject-matter of present Claim 1 involves an inventive step in the sense of Article 56 EPC and Claim 1 is allowable under Article 52(1) EPC.

6. Moreover, the same reasoning applies mutatis mutandis to the subject-matter of the apparatus Claim 3.

7. Claims 2, 4 and 5 are also allowable due to their dependence on the corresponding independent claims.

8. Thus, a patent may be granted (Article 97(2) EPC).

9. Since the Appellant's main request is allowable, his auxiliary request needs not be considered and oral proceedings requested auxiliarily are not necessary.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.

2. The file is remitted to the first instance with the order to grant a patent on the basis of the following patent application documents:

Description: Pages 1, 2, 2b, 2c and 5 filed with letter of 10 June 1992;
Pages 2a, 3 and 4 filed with letter of 10 April 1991, and
Pages 6 to 8 as originally filed,

Claims: Nos. 1 to 5 filed with letter of 10 June 1992;

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

The Registrar:

E. Görgmaier

The Chairman:

E. Turrini