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D E C I S I O N
of 10 May 2000

Case Number: T 0285/97 - 3.4.2

Application Number: 93107906.5

Publication Number: 0570010

IPC: G03G 15/02, C08G 77/34

Language of the proceedings: EN

Title of invention:
Silicone rubber roller for electrophotography and method of
producing the same

Applicant:
SUMITOMO RUBBER INDUSTRIES LIMITED

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 84, 111(1), 123(2)

Keyword:
"Claims - product-by-process"
"Decision re appeals - remittal (yes)"

Decisions cited:
-

Catchword:
-



Case Number: T 0285/97 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 10 May 2000

Appellant: SUMITOMO RUBBER INDUSTRIES LIMITED
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 16 October 1996
refusing European patent application
No. 93 107 906.5 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: E. Turrini
Members: S. V. Steinbrener
B. J. Schachenmann

Summary of Facts and Submissions

I. The appellant lodged an appeal against the decision of the Examining Division refusing European patent application 93 107 906.5 (publication No. EP-A-0 570 010) under Article 97(1) EPC.

II. In its decision, the Examining Division held that the method of original claim 6 was anticipated by the prior art known from document

D1: FR-A-2 211 346 (corresponding to D1-US: US-A-3 848 305 referred to by the appellant in the statement of grounds of appeal),

at least when taking account of the implicit disclosure of said document. Moreover, objections of more formal nature against original claims 1 and 16 were maintained by the department of first instance in that reference was made to the arguments given in a preceding communication.

III. In a communication pursuant to Article 11(2) of the Rules of Procedure of the Boards of Appeal, the Board summarised the requirements which claims of product-by-process type must meet in order to be admissible.

Moreover, the Board raised the issue of whether or not the subject matter of original claim 1 was anticipated by either the background art described in the present application (without, however, citing a document) or by the roller known from document D1-US if due account is taken of the implicit disclosure of said document. In this context, the Board expressed its doubts about the evidential value of the Test Report submitted by the appellant before the first instance.

Finally, the existence of an inventive step was questioned in view of documents D1-US or

D2: Patent Abstracts of Japan, vol. 10, No. 287,
(C-375), 30 September 1986 & JP-A-61 103 931
(cited in the search report)

and the fact that high purity starting materials were commercially available as acknowledged by the appellant in the present application.

- IV. The appellant reacted to this communication by filing a set of amended claims which it believed to be admissible and to relate to patentable subject matter.
- V. Oral proceedings took place on 10 May 2000, in the course of which further amendments to the claims were submitted. At the end of the oral proceedings the Board's decision was given.
- VI. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of claims 1 to 14, submitted as main request at the oral proceedings, or claims 1 to 13, submitted as first auxiliary request at the oral proceedings. As a second auxiliary request, it was requested to remit the case to the first instance for further prosecution.
- VII. The independent claims 1 and 6 now under consideration read as follows:

Main request

"1. A silicone rubber roller suitable for use in electrophotographic apparatus obtainable by cross-linking and molding, in the form of a roller, a molding material containing a rubber compound which comprises silicone raw rubber as a base polymer and in which the

total concentration of low grade siloxane and non-functional silicone oil is not greater than 5,000 ppm, and by heat treating the thus molded roller under vacuum on condition that the ultimate degree of vacuum is not greater than 5 mmHg and the heating temperature is from about 150°C to about 250°C for a sufficient period of time."

"6. A method of producing a silicone rubber roller suitable for use in electrophotographic apparatus comprising the steps of:

crosslinking and molding, in the form of a roller, a molding material containing a rubber compound which comprises silicone raw rubber as a base polymer and in which the total concentration of low grade siloxane and non-functional silicone oil is not greater than 5,000 ppm; and

heat treating the thus molded roller under vacuum on condition that the ultimate degree of vacuum is not greater than 5 mmHg and the heating temperature is from about 150°C to about 250°C for a sufficient period of time."

In the above wording of claim 1, an obvious correction has been carried out by the Board in that "is" before "for a sufficient period of time" has been deleted. Moreover, method claim 6 has been corrected by deleting the expression", and the treating period of time is from about 3 to 25 hours" which is obviously not in line with the appellant's intentions.

Claims 2 to 5 and 7 to 14 are appended to claims 1 and 6, respectively.

First auxiliary request

Independent claims 1 and 6 according to the first auxiliary request differ in substance from those of the main request in that "for a sufficient period of time" has been replaced by", and the treating period of time is from about 3 to 25 hours". Furthermore, in both claims a comma has been substituted for "and" before "the heating temperature".

Dependent claim 13 of the main request has been deleted, and claim 14 has been renumbered, accordingly.

VIII. The appellant advanced the following arguments at the oral proceedings:

The original application documents are to be clarified in several respects. In particular, the passage relating to the "extraction treatment" (see page 6, lines 15 to 21) and referred to by the Board as background art in the annex to the summons to oral proceedings is in fact based on comparison tests carried out by the appellant himself who is not aware of any prior art document in this context. In consequence, this passage and Comparative Example 7 resulting from such extraction treatment cannot be considered to relate to prepublished prior art.

Furthermore, in Table 3A, the last comparative example should read "Comparative Example 2" instead of "Comparative Example 1". Similarly, in lines 3 and 8 of page 30 and also in Figure 1 "Comparative Example 4" should be replaced by "Comparative Example 7". At page 14, line 3 the expression "to effect" should be substituted for "instead of", and the meaning of "phr" at page 22 is "per hundred rubber".

The problem underlying the present application relates to image deterioration caused by bleeding of low grade cyclic siloxanes and non-functional silicone oil from the surface of the silicone rubber roller. Although rather pure rubber compounds are commercially available, use of such compounds does not sufficiently suppress the contamination effect in electrophotography. The appellant also found that the extraction treatment is not satisfactory. The above problem has however been solved by the measures of claim 1, in particular the use of a rubber compound having an impurity content of only 0.5%, and of an annealing step at a pressure below 5mmHg. In the present case, a product-by-process definition should be clearly admissible in view of the criteria given by the Board in the above-mentioned annex to the summons.

Having regard to novelty, the preferred starting material of document D1-US, i.e. RTV-60, contains about 30% of low grade siloxanes as can be seen from the appellant's Test Report. Such high impurity content cannot be removed by annealing under vacuum (see page 11, lines 11 to 14 of the present application and also the Figure of D1-US proving that siloxane formation is continuing in the prior art rubber material). Even if further "similar" rubber materials are to be taken into consideration in D1, this cannot be understood to relate to materials of completely different impurity content.

The treatment of D1-US differs from the claimed invention also in that a vacuum of as high as 20 mmHg is considered to be sufficient, and the annealing step is carried out at 260°C. The importance of the claimed lower pressure limit is explicitly stressed in the present application. Therefore, no similar effect has been achieved in the prior art.

The results of measurement-1 of the Test Report are in fact based on the original starting material of D1-US since RTV-60 is treated in the same way as in D1-US, avoiding any annealing step before the evaluation of siloxane content. Measurement-2 of the Test Report proves that the siloxane concentration of the prior art material increases on aging. Hence, document D1-US cannot be considered novelty destroying if due account is taken of what has been exactly described in that document and can be directly and unambiguously derived therefrom.

Although high purity rubber compounds are on the market, use of such compounds alone is not sufficient in order to solve the deterioration problem. Even if a skilled person would consider such materials useful, he would not apply them without the exercise of inventive skill under conditions hitherto unknown in the art, i.e. at a vacuum below 5 mmHg and an annealing temperature of between 150 and 250°C. Therefore, the claimed invention involves an inventive step with respect to the teaching of document D1-US.

An analogous finding holds with respect to the teaching of document D2 which does not relate to electrophotography nor to the present deterioration problem. Moreover, the parameter values are different, and there is no indication of an initial impurity content $\leq 0.5\%$.

Since the annealing time and temperature are normally strongly correlated, the independent claims submitted before the oral proceedings are unduly limited. These limitations have been removed in the main request, whereas they have been retained in the first auxiliary request.

Reasons for the Decision

1. *Admissibility of appeal*

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

2. *Articles 123(2) and 84 EPC*

2.1 The Board is convinced that the subject matter of claims 1 and 6 of the respective requests does not extend beyond the content of the application as filed.

The independent claims of the main request are in substance based on original claim 8 when referring back to original claim 7. The addition "for a sufficient period of time" is considered to be implicit in the claimed heat treatment step.

The independent claims of the first auxiliary request are in substance based on original claim 9 when referring back to original claim 8.

2.2 In the Board's opinion, claims 1 and 6 of the respective requests also comply with the requirements of Article 84 EPC.

Having regard to the product-by-process type definitions used in claim 1 of the respective requests, the Board accepts the appellant's argument that such definitions are appropriate in the present case, at least from a formal point of view. In order to emphasise the fact that these claims do not relate to the direct product of a specific fabrication method, but to the rubber roller as such irrespective of the method by which it was produced, "obtained" has been replaced by "obtainable".

2.3 Of course, the claimed rubber rollers themselves must then meet the requirements for patentability, which still has to be assessed (see points 3.2 and 3.3 below).

3. *Article 111(1) EPC*

3.1 The specific combination of features now claimed in accordance with the respective requests has not yet been examined by the first instance in the light of the available prior art.

Therefore, in order to allow an examination of the claimed subject matter before two instances and in accordance with the appellant's second auxiliary request, the Board exercises its discretion under Article 111(1) EPC to remit the case to the department of first instance for further prosecution.

3.2 In this context, it will be necessary to consider the issue of whether or not the rubber roller of the main request is anticipated by the roller disclosed in document D1-US.

Although document D1-US does not specify the siloxane content of the rubber compound RTV-60 and preferably provides somewhat higher values for the heat treatment and the associated pressure (see D1-US, column 4, lines 44 to 49: 260°C/20 mmHg), a similar effect seems to have been achieved in the prior art (see the Figure), and the concrete parameter values apparently depend on the specific type of silicone elastomer used (see D1-US, column 7, lines 34 to 40).

The appellant is right in pointing out that the aging or degradation process continues in the prior art roller, otherwise the weight loss curve of the Figure should be parallel to the abscissa in the steady state

region. However, this may be due to the fact that the prior art roller must be kept at an elevated temperature for fusing toner particles to a porous substrate and thus necessarily suffers from thermal degradation (see D1-US, column 6, lines 14 to 18), whereas the weight loss might be zero in region 14 of the Figure for subsequent applications at room temperature.

Apparently, in the present case the existence of novelty can only be assessed by subjecting the known roller (which may have been fabricated in a different way) to similar contamination tests as have been carried out in the examples and comparative examples of the present application.

In this context, the appellant's Test Report mixing up test conditions of the prior art and the present application in a somewhat arbitrary manner should be reconsidered regarding its persuasiveness. In particular, measurement-1 does not refer to the impurity content of the starting material as set out in claim 1 but to that of a moulded roller obtained by mixing the rubber compound and the cross-linking agent and curing at room temperature for 24 hours in accordance with column 5, lines 30 to 32 of D1-US. However, in the moulding process quantities of low grade cyclic siloxanes are formed due to incomplete cross-linking (see D1-US, column 3, lines 48 to 50) so that the results displayed in Figure 1 may not have any significance for the starting material, even if no specific annealing step was performed at this stage as the appellant pointed out at the oral proceedings.

In measurement-2, the prior art roller is subjected to the annealing conditions of the present application, which may not be adequate for RTV-60, without however performing the secondary cross-linking step provided in

column 5, lines 32 to 36 of D1-US. Finally, a 60-day aging test as shown in Figure 2 of the Test Report for the roller of measurement-2 and used as a basis for the contamination test of Table 1 of the Test Report is not available for any one of the Examples or Comparative Examples of the present application so that no comparison is possible. Nevertheless, despite these rather severe aging conditions the contamination results of the roller of measurement-2 seem to be surprisingly good.

3.3 If novelty of the claimed roller can be established, the Examining Division will have to consider the existence of an inventive step, in particular whether or not it would be obvious, starting from D1, to select conventional high purity rubber compounds (see the present application, in particular page 5, second paragraph and Example 1) as a starting material and to adjust the known parameter values of the fabrication process to such compounds, given the facts that document D1-US

- refers to the possibility of using similar materials from other vendors, the exact conditions of curing for each particular material depending on the amount of time available for curing, the operating temperature of the roller and the type of silicone elastomer used (see D1-US, column 7, lines 20 to 40); and
- gives indications of the origin of the contamination observed, i.e. the bleeding of cyclic siloxanes (see column 4, lines 51 to 55), the origin of these siloxanes (present in the starting material or due to the cross-linking

process or the breaking of weak bonds on heating; see D1-US, column 5, lines 45 to 58) and the removal of such siloxanes by heating in vacuum (see D1-US, column 5, lines 58 to 65).

Document D2 discloses similar numerical parameter values for an annealing step by which low-molecular siloxane is removed from a silicone rubber moulded article.

- 3.4 As regards the first auxiliary request, it will have to be assessed whether or not the additional specification of the annealing time can make a major contribution to patentability in view of the fact that annealing times falling in the claimed range are disclosed in document D1-US (see column 5, lines 40 to 44).

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 for further prosecution.

The Registrar:

The Chairman:

P. Martorana

E. Turrini

