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D E C I S I O N
of 10 May 2001

Case Number: T 0610/98 - 3.2.5

Application Number: 89301388.8

Publication Number: 0329384

IPC: B41M 5/26

Language of the proceedings: EN

Title of invention:
Heat-sensitive record material

Patentee:
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Opponent:
Sihl GmbH
Stora Enso Publication Paper Aktiengesellschaft
The Wiggins Teape Group Limited
Papierfabrik August Koehler AG

Headword:
-

Relevant legal provisions:
EPC Art. 123(2), 56

Keyword:
"Addition of subject-matter (no)"
"Inventive step (no)"

Decisions cited:
-

Catchword:
-



Case Number: T 0610/98 - 3.2.5

D E C I S I O N
of the Technical Board of Appeal 3.2.5
of 10 May 2001

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Decision under appeal: Interlocutory decision of the Opposition Division
of the European Patent Office posted 5 May 1998
concerning maintenance of European patent
No. 0 329 384 in amended form.

Composition of the Board:

Chairman: W. Moser
Members: C. G. F. Biggio
P. E. Michel

Summary of Facts and Submissions

- I. Appellants I to IV (opponents 01 to 04) each lodged an appeal against the interlocutory decision of the Opposition Division maintaining the European patent No. 0 329 384 in amended form.

In the decision under appeal, it was held that the grounds of opposition submitted by appellants I to IV under Article 100(a) EPC (lack of novelty and inventive step), Article 100(b) EPC (insufficiency of disclosure) and Article 100(c) EPC (addition of subject-matter) did not prejudice the maintenance of the patent as amended.

The following documents were *inter alia* referred to in the appeal proceedings:

D1: DE-A-2 800 485

D2: GB-A-2 068 575 (equivalent of document D8)

D3: DE-A-3 419 277

D6: US-A-4 246 312

D8: DE-A-3 047 845

D12: "Pulp and Paper Chemistry and Chemical Technology", 3rd ed., Casey, vol. IV, Wiley, 1983, pages 2122, 2123, 2152-2165, 2481-2489

D13: Proceedings of the "1987 Coating Conference", published by the TAPPI Press on 1987

D16: "Billblade" brochure

D21: JP-A-62-240580 (with a German translation and a partial English translation)

D26: "Paper Pulp Technical Handbook", Paper Pulp Technical Association, Japan, page 316 with an English translation, 1982

D27: Report from the Papiertechnische Stiftung München (PTS)

D28: US-A-4 042 412

II. Oral Proceedings were held before the Board of Appeal on 10 May 2001.

III. The appellants I to IV requested that the decision under appeal be set aside and that the patent in suit be revoked.

The respondent (proprietor of the patent) requested that the decision under appeal be set aside and that the patent in suit be maintained on the basis of the following documents filed on 29 April 1999:

(a) main request:

claims 1 to 7 and description, pages 2 to 9 and page 10, lines 1 to 48, filed as main request; or

(b) auxiliary request:

claims 1 to 6 and description, pages 2 to 9 and page 10, lines 1 to 48, filed as auxiliary request.

IV. Claim 1 of the main request reads as follows:

"1. A method for producing a heat-sensitive record material, characterized in on-machine blade-coating on a base sheet a coating composition which mainly comprises at least one pigment having an oil absorption of at least 80cc/100g measured by JIS K 5101 and a binder and has a binder ratio of 5 to 16% by weight of the total solid and a solid amount of 35 to 55% by weight of the coating composition to form a middle layer, and then forming a heat-sensitive recording layer on the middle layer."

Claim 1 of the auxiliary request differs from claim 1 of the main request in that it includes the following additional feature:

"and wherein the middle layer is formed by coating an excess of the coating composition on the base sheet and then cutting off the excess amount of it with a blade within 0.015 seconds after the above coating."

V. The appellants I to IV argued essentially as follows:

The feature in claim 1, "on-machine blade-coating" is not disclosed in the application as filed and is hence not allowable in view of the requirements of Article 123(2) EPC. The introduction of claims 2 to 7 is not in response to a ground of opposition and is hence not allowable in view of Article 123(1) EPC in combination with Rule 57a EPC. The dependant claims were originally appendant to claim 1 and directed to a material *per se*, whereas in the main request they are appendant to what was originally claim 8 and are directed to a method.

The closest prior art is document D8. According to the decision of the Opposition Division, claim 1 is distinguished over the disclosure of this document by three features:

- (i) on-machine coating
- (ii) the selection of blade coating
- (iii) the composition of the middle layer.

As regards feature (i), the choice of on-machine coating as opposed to off-machine coating does not contribute to the solution of a technical problem and is generally used in the art owing to economic considerations. On-machine coating is suggested by document D12, for example at page 2161, where an on-machine billblade coater is shown.

As regards feature (ii), as indicated in document D12, the skilled person will regard blade coating as the first choice. As set out in the table at page 2489 of document D12, air knife coating is applied for coating weights of 4 to 30 g/m², solids contents of 35 to 40% and speeds of up to 300 m/min. Blade coating is used for lower coating weights, lower solids contents and higher speeds. As shown in the Table at page 11 of the letter of appellant IV filed with the EPO on 15 September 1998, the only comparative Example in the patent in suit using an air knife coater is comparative Example 1. However, since, in this example, the solids content is also changed to a value outside the claimed range, this example cannot be used to demonstrate the advantages of the use of a blade coater. A similar criticism applies to the other comparative examples.

As regards feature (iii), following the teaching of Example 1 of document D8 results in a binder ratio of 16.5%, which is not significantly different from the claimed range, whose upper limit is 16%. The upper limit of 16% is not a critical value, particularly since the binder is unspecified and a large number of preferred binders are exemplified in the patent in suit. As demonstrated in document D27, water retention and viscosity are practically the same for a ratio of 16.5% as for 15.5%, so that spreading behaviour is also practically the same.

Insofar as the cited prior art documents do not specifically refer to heat-sensitive paper, it is noted that the middle layer consists of pigment and binder, and is thus a conventional paper coating.

Reference is also made to document D3, which discloses blade coating of a pigment layer which results in a smooth coating without stripes or scratches.

In terms of closest prior art in respect of the subject-matter claimed in the patent in suit, document D21 can be regarded as an alternative to document D8. The subject-matter of claim 1 according to the main request differs from the disclosure of document D21 only in the feature "on-machine coating". Also in this case, the selection of on-machine coating as opposed to off-machine coating does not involve an inventive step.

As regards the additional feature of claim 1 according to the auxiliary request, this relates to short dwell time coating which is known from document D3, which teaches that the excess amount of the coating should be cut off by the blade within a period of 0.0005 to 0.015 seconds after the above coating, that is, within the limit specified in the claim. In view of the known advantages of short dwell time coating, it does not

involve an inventive step to form the middle layer by coating an excess of the coating composition on the base sheet and then cutting off the excess amount of it with a blade within 0.015 seconds after the coating. The subject-matter of claim 1 according to the auxiliary request thus does not involve an inventive step in view of the combination of documents D8 and D3.

A similar result follows if document D21 is regarded as the closest prior art.

Example 4 of the patent in suit is alleged by the respondent to demonstrate the advantages of short dwell time coating. This is not accepted. Coating behaviour is also dependant on the coating composition.

VI. The respondent argued essentially as follows:

Claim 1 of the main request corresponds to claim 8 of the application as filed with addition of the feature "on-machine blade-coating", which was disclosed in the application as filed. The amendments to the appendant claims involve a change of category and do not result in a broadening of the claims. They are also in response to a ground of opposition.

It is agreed that the closest prior art is represented by document D2 or D8.

It is also accepted that the figure of 16% for the upper limit of the binder ratio does not suggest that a change from 15.9 to 16.1% involves a dramatic difference. Working in the specified range of 5 to 16% does, however, give rise to the advantages of the invention.

The closest prior art as represented by document D2 or D8 does not specify the coating method used. In particular, there is no reference to the use of a blade coater. If the teaching of document D26 is followed, it is just as likely, if not more likely, that an air knife or roll coater would be used.

Document D26 suggests that air-knife coaters are used for a coating composition containing from 30 to 50% solids, blade coaters are used for a coating composition containing from 54 to 72% solids, and roll coaters are used for a coating composition containing from 50 to 65% solids. Example 1 of document D8 uses a solids content of 50.4%. Document D26 thus suggests that such a composition would be applied using an air-knife coater.

There is no prior art which suggests the use of a blade coater in the production of a heat-sensitive paper. In ordinary printing papers, the pigments do not have a high oil absorption.

Document D21 not only does not specify the use of a blade coater, but also does not indicate the amount of pigment, the oil absorbency of the pigment or the amount of solids. It is therefore less relevant than document D2 or D8.

At page 2482 of document D12 it is suggested that off-machine coating is preferable to on-machine coating.

As regards the additional feature of claim 1 according to the auxiliary request, whilst the appellants have cited disclosures of short dwell time coating, none of these apply to the formation of layers for heat-sensitive recording material in which a pigment with

high oil absorption is present in the middle layer. The advantage in this respect is demonstrated by the improved coating applicability obtained in Example 4 of the patent in suit.

Reasons for the Decision

Main request

1. *Allowability of the amendments*

The feature of on-machine blade coating is disclosed in the application as filed at page 3, lines 48 to 51 of the application as published, where it is stated that:

"The blade-coating of the coating composition may be applied with either off machine coater or on machine coater set on a paper making machine. Particularly, when wood free paper is used as a base sheet, on machine coaters are preferably used, because a sufficient coated amount is easily obtained due to the effects of the paper temperature immediately before coating and the drying property is good."

The introduction of the feature "on-machine" blade coating also results in a restriction of the protection conferred as compared with claim 1 as granted.

The amendment thus complies with the requirements of Articles 123(2) and (3) EPC.

Dependant claims 2 to 7 as granted were directed to a material *per se*. The change in category of these claims, which are directed to a method, is occasioned by grounds of opposition, namely the grounds of lack of

novelty and inventive step of the claims directed to a material per se. The amendments are thus allowable in view of Rule 57a EPC.

2. *Novelty*

The Board concurs with the finding of the Opposition Division that the subject-matter of claim 1 is novel, in particular having regard to the disclosure of document D8. It is also noted that the appellants did not raise any objections of a lack of novelty.

3. *Inventive step*

3.1 *Closest prior art*

Document D8 represents the closest prior art and discloses a method for producing a heat-sensitive record material, in which a base sheet is coated with a coating composition which mainly comprises at least one oil absorbent pigment. The coating composition forms a middle layer on which a heat-sensitive recording layer is subsequently formed. A binder for the pigment may be included in the middle layer. In Example 1, the coating composition includes a 50% styrene-butadiene rubber latex as the binder at a binder ratio of 16.5% by weight of the total solid and the coating composition has a solid amount of 50.4% by weight. In Example 1, the binder is calcined kaolin having an oil absorption of 150 mg/100 g measured by JIS K 5101. The pigment thus possesses an oil absorption above 80 cc/100 mg as required by claim 1.

Document D8 does not disclose the method by which the coating composition is applied to the base sheet, it merely being stated at page 13, lines 28 to 33 that,

after application and drying, the paper was subject to calendering. There is thus no disclosure in document D8 of:

- (i) on-machine coating;
- (ii) blade coating; and
- (iii) a binder ratio of 5 to 16% by weight of the total solid.

3.2 Object of the invention

The problem facing the person skilled in the art starting from the disclosure of document D8 is to choose suitable conditions for carrying out the coating procedure as disclosed in this document.

It was submitted on behalf of the respondent that the object of the invention is to provide a middle layer "which can develop color images superior in color density and having a good quality" (patent in suit, page 2, lines 21 and 22). This cannot be accepted as being the objective problem to be solved, starting from document D8 as the closest prior art, since this document makes available a heat sensitive recording paper capable of producing sufficient colour density in response to short heat pulses providing a low amount of thermal energy.

The examples and comparative examples of the patent in suit are not sufficient to demonstrate that improved image quality as compared with the material of document D8 arises from the utilisation of features (i) to (iii) mentioned under point 3.1 above.

Comparative Example 1 uses an air knife coater and is thus the sole example of a coating method using a coater other than a blade coater. However, the fact that the solids amount is 23% means that a direct comparison of the results is not possible and that the poor image quality may well arise from the dilution of the composition.

Comparative Example 2 uses a binder ratio of 3.7% (below the claimed range) and gives rise to a high quality image and a good coating applicability, however showing poor cutting operability.

Comparative Example 3 uses a binder ratio of 19.4% (above the claimed range) and has poor image quality.

Comparative Example 4 uses a pigment with low oil absorption, resulting in a poor quality image.

Comparative Example 5 uses a high solids amount and failed to obtain a middle layer.

The examples thus cannot be used to draw any conclusions about the effect of using a blade coater or on-machine coating. As regards the binder ratio, Examples 1, 2, 4 and 5 according to the invention use a ratio of 11.6 %, whilst Example 3 uses a ratio of 8.4%. The examples appear to indicate generally that decreasing the amount of binder from well above the claimed range (19.3%) to a value well within the claimed range (11.6%) can improve image quality. Further, an excessively low binder content (3.7%), as may be expected, reduces cutting operability. No effects can, however, be seen which are dependent upon the selection of a range having a lower limit of 5% and an upper limit of 16%, as compared with the prior art disclosure of 16.5% (Examples 1 and 2 of document D8).

4. *Solution*

4.1 On-machine coating

The term "on-machine" coating refers to the application of coating in line on the machine on which the paper is made. Off-machine coating refers to the application of coating on a line or machine different from the web-making machine (document D12, page 2482).

Document D8 does not contain any indication as to whether the coating step is to be carried out on-machine or off-machine. In order to carry out the method of document D8, the person skilled in the art thus has to exercise a choice between on-machine and off-machine coating. Both methods are widely used in the art. As stated in the patent in suit at page 3, lines 48 to 51, on-machine coating has the advantage of facilitating drying of the coating in view of the paper temperature. Off-machine coating has the advantage of flexibility in the choice of the coating method.

The person skilled in the art will take economic considerations into account. On-machine coating has economic advantages owing to the fact that it is not necessary to transport the paper from the paper making machine to a second line in order to carry out the coating. From this point of view, the first choice is on-machine coating, off-machine coating only being chosen if the conditions in the paper making line, such as paper speed and temperature, cannot be adapted to the conditions necessary to achieve a satisfactory on-machine coating.

The view of the respondent that document D12 expresses a preference for off-machine coating is not accepted. It is merely stated at page 2482 that "Off-machine coating is generally used for functional coatings...",

whilst "On-machine coating is common for pigment-coated printing papers". Subsequently, in document D12, at page 2488, line 13 from the bottom, it is noted that the "Cost of drying represents a major part of the process cost,...". Since on-machine coating saves drying costs owing to the heat available in the paper, this confirms the view that on-machine coating is, if practicable, the preferred approach.

The choice of on-machine coating thus does not involve an inventive step.

4.2 Blade coating

When carrying out the method of document D8, the person skilled in the art has a choice between air knife coating, roll coating and blade coating.

According to document D12, page 2152, "Blade coating is now the dominant form of coating" (line 16) and there exists a "preference for blade-coated paper because of its higher quality, which is due to the absence of the film-split pattern that is characteristic of roll-coated papers" (lines 22 to 24). Blade coating is also suitable for coating at high speed with compositions having high solids contents and would therefore be considered to be a prime candidate for coating with the composition of Example 1 of document D8 (see document D27, page 5, lines 10 to 14).

Document D16 indicates that a Billblade coater could be a suitable choice in view of the possibility of obtaining a regular, smooth coating at high speeds, which can be installed on-machine, and which has been successfully used in the manufacture of various special papers. According to document D12, page 2161, lines 18 to 24, Billblade coaters were introduced "in the early 1970s" and are capable of uniformly applying high

solids coatings. These coaters were thus available well before the priority date of the patent in suit. Consequently, while it has to be admitted that the exact publication date of document D16 cannot be established, there is no reason to doubt that the content of this document represents prior art within the meaning of Article 54(2) EPC.

As stated in document D27, at page 5, lines 27 to 32, air knife coaters can only achieve the required coating weight with coating compositions having lower solids amounts or with coating compositions not containing pigments. This appears to be confirmed by the fact that, in comparative Example 1 of the patent in suit, the coating composition was diluted to a solids content of 23% for use with an air knife coater.

In addition, it follows from document D27, page 5, lines 16 to 25, that a satisfactory result can only be obtained with an air knife coater when the coating composition has a good water retention. However, the latex binder used in Example 1 of document D8 possesses a relatively low water retention.

It is correct to say, as does the respondent, that documents D12 and D16 do not relate to heat sensitive recording papers. Nevertheless, in the absence of any teaching which relates specifically to the narrower field of heat sensitive paper, the person skilled in the art of paper making will apply knowledge from paper making in general when making a decision as to how to carry out the teaching of document D8.

In this respect, the possibility of obtaining regular, smooth coating at high coating speeds would lead to the selection of a blade coater.

It was suggested on behalf of the respondent that Table 2 of document D26 would deter the person skilled in the art from using a blade coater for the coating composition of Example 1 of document D8, which has a solids content of 50.4%. This table reads (in part) as follows:

<u>Coater</u>	<u>Solids content of coating composition</u>
air knife coater	30-50%
blade coater	54-72%
roll coater	50-65%

However, reference may also be made to Table 29-5 on page 2489 of document D12, which shows the following figures:

<u>Coater</u>	<u>Solids content of coating composition</u>
air knife coater	35-40%
blade, puddle	50-60%
blade, inverted	50-62%
bent blade	50-60%
Billblade	40-60%
reverse roll	25-50%

It thus appears that the person skilled in the art who is aware of the disclosures of both these documents would not be deterred from using a blade coater merely because of the presence of a solids content of 50.4%. The cited tables indicate generally that blade coaters are useful for higher solids contents and that the selection of a suitable coater does not depend solely upon the solids content of the coating composition.

A further factor to be considered is the viscosity of the coating composition. The composition of Example 1 of document D8 uses a latex binder, which will result in a high viscosity. Table 2 of document D26 indicates that an air knife coater is suitable for viscosities of 50~400 cps, whereas a blade coater is suitable for viscosities of 500~10,000 cps. A blade coater is thus more suitable for use with high viscosity compositions.

The choice of a blade coater thus does not involve an inventive step.

4.3 Binder ratio

A reduction of the binder ratio from 16.5% to 16% or below does not lead to a significant change in the properties of the middle layer. In document D27, it is demonstrated that a reduction of the binder ratio from 16.5 % to 15.5% does not lead to a significant change in the properties, such as smoothness and resultant image quality, of the middle layer.

It is also noted that, according to the patent in suit, a large number of different materials may be used as binder, as set out in the patent in suit at page 4, line 55 to page 5, line 4. In view of the differing behaviour of such materials, it may be expected that a greater or lesser amount of binder may be appropriate as compared with the exemplified styrene-butadiene copolymer latex. Thus, the person skilled in the art wishing to use a different binder would expect to have to carry out routine experiments to determine a suitable amount.

In the list at page 2122 of document D12, there are set out ranges for the amount of binder which are suitable for various printing papers. These vary from 7 to 20 parts binder solids per 100 parts pigment. This is the

equivalent of 6.5 to 16.7% in terms of the weight of binder when expressed as a percentage of the total amount of solids. Thus, the claimed range of 5 to 16% corresponds roughly to the amounts generally used in pigment coating mixtures.

According to the closest prior art document, D2 or D8, the middle layer should have high oil absorbency and heat insulation (document D8, paragraph common to pages 9 and 10). In view of the fact that a high amount of binder will tend to endanger these properties, the person skilled in the art will tend to reduce the amount of binder present as long as the desired binding effect, preventing pigment particles from becoming detached from the layer, is achieved.

The result of routine trials and experiments would thus lead to a reduction of the amount of binder below the amount of 16.5% used in Example 1 of document D8.

The choice of an amount of binder falling within the range of 5 to 16% by weight of the total solid thus does not involve an inventive step.

5. Thus, the person skilled in the art of paper coating will arrive at a coating method according to claim 1 by carrying out routine trials to find suitable and cost effective procedures for carrying out the teaching of document D8.

The subject-matter of claim 1 of the main request thus does not involve an inventive step.

Auxiliary request

6. *Inventive step*

According to the auxiliary request of the respondent, the following feature is added to claim 1:

"and wherein the middle layer is formed by coating an excess of the coating composition on the base sheet and then cutting off the excess amount of it with a blade within 0.015 seconds after the above coating."

The words "the middle layer is formed by coating an excess of the coating composition on the base sheet and then cutting off the excess amount of it with a blade" merely express a conventional blade coating procedure. The sole additional feature added to the claim is thus that the blade is applied to the coating within 0.015 seconds after the coating.

Coaters in which the excess coating composition is removed rapidly after application of the coating are referred to as short dwell time coaters.

According to page 145 of document D13, short dwell time coaters reduce base sheet penetration and thereby give rise to a number of advantages, in particular that, by virtue of the fact that a larger amount of the coating remains on the surface of the sheet and a smaller amount of the coating composition is absorbed by the paper, the coated layer is able to fully contribute to the printing properties of the coated sheet. More particularly, it is stated that dwell times below 0.03 second, or even better below 0.003 second, are most effective (cf. left hand column, paragraph of the text referring to Figure 11).

In addition, document D3 discloses that, with high solids concentrations and at dwell times above 0.015 second, control of the coating weight becomes difficult (page 11, lines 23 to 31). A lower limit of 0.0005 second is given, owing to operational difficulties with the coater at such speeds.

Whilst the respondent points out in this connection that documents D3 and D13 are not concerned with heat sensitive recording materials, the Board is of the opinion that the advantages of reducing base sheet penetration as taught by these documents are also valid for the middle layer of the material disclosed in document D8. Furthermore, whilst document D3 sets out problems which arise with excessively short dwell time, these are associated with dwell times as short as 0.0005 second, well below the upper limit of claim 1.

The person skilled in the art would thus as a matter of routine use a dwell time having a value well below the maximum value of 0.015 second as specified in claim 1.

The subject-matter of claim 1 according to the auxiliary request thus also does not involve an inventive step. In view of this conclusion, it is not necessary to consider the alternative approach to the question of inventive step suggested by the appellants I to IV, in which document D21 is considered to represent the closest prior art.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

M. Dainese

M. Dainese

The Chairman:

W. Moser

W. Moser