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D E C I S I O N
of 27 January 1998

Case Number: T 0848/95 - 3.2.3

Application Number: 89850043.4

Publication Number: 0328503

IPC: D21G 1/02, F16C 13/00

Language of the proceedings: EN

Title of invention:
Method for regulating the temperature of an adjustable-temperature and variable-crown roll and a temperature-regulation system intended for carrying out the method

Patentee:
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Opponent:
J. M. Voith GmbH
Eduard Küsters Maschinenfabrik GmbH & Co. KG
Sulzer-Escher Wyss GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Novelty (yes); inventive step (no) (amended claim)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0848/95 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 27 January 1998

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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 4 August 1995 revoking European patent No. 0 328 503 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: C. T. Wilson
Members: J. du Pouget de Nadaillac
M. K. S. Aúz Castro

Summary of Facts and Submissions

I. The appeal lies from the decision dated 4 August 1995 of the Opposition Division of the European Patent Office, who revoked the European patent EP-B1-0 328 503 for lack of novelty of the subject-matter of granted Claim 1 and for lack of inventive step of granted Claim 6.

The appellant (patentee) lodged the appeal on 12 October 1995, paying the corresponding fee at the same time. The statement of grounds together with a new set of four claims was received on the 14 December 1995.

II. Oral proceedings were held on 27 January 1998. Respondent I (opponent I), although duly summoned, did not appear. During these proceedings, the appellant filed a new Claim 1 as main and single request.

III. This Claim 1 reads as follows:

"Method for regulating the temperature of an adjustable-temperature and variable-crown roll, in which said roll (10) the roll mantle (12), arranged to revolve on the stationary roll axle (11), is loaded by the intermediate of a pressure medium so as to correct the deflection of the roll mantle (12) and which said roll (10) is heated by means of heating fluid passed into the roll onto the inside face of the roll mantle (12) to the areas of the roll mantle (12) from which heat is removed out of the roll (10) by means of conduction in the radial direction of the roll, i.e. to the areas in which the direction of the flow of heat is radially away from the roll, and that from the hot areas in the roll mantle (12), i.e. from the end areas of the roll from which heat is not removed by

conduction in the radial direction away from the roll mantle, heat is removed by passing cooling fluid to said areas,
characterized in
- that the heating fluid and the pressure medium are supplied separately to the roll,
- that the pressure medium is not heated,
- that the heating fluid is passed to the roll inside face substantially uniformly distributed by spraying,
- that the cooling fluid is passed onto the inside face of the roll mantle at the hot end areas by spraying,
- and that said passings of the heating and cooling fluids are such that the axial temperature profile of the roll mantle is made as uniform as possible."

IV. During these proceedings, the following prior art documents were cited:

D1: US-A-4679287 (or D1': EP-B-0179730)

D2: EP-A-0210388 (or D2': DE-A-3526283)

D3: DE-A-3128722

D4: GB-A-2041158

D7: DE-A-3014891

D8': DE-A-2503051 (cited in D8: DE-C2-3516535)

V. The appellant argued as follows:

In the variable-crown roll described in D1, the heating of the roll is not only accomplished by the heating fluid, but also by the pressure medium, which is heated. A good control of the temperature of the roll is not possible, since the heated pressurized medium permanently modifies the temperature characteristics at

different points of the roll. This document also does not suggest to control the heating temperature. No temperature adjusting means are disclosed. Moreover, the temperature profile cannot be uniform because of the axial flow direction of the heating fluid inside the roll, which makes the temperature of the roll mantle higher at the inlet end of the roll than at the opposite (outlet) end. In another variable-crown roll, which is known from the prior art citation D2, the pressure medium is heated and constitutes the heating fluid, so that there are no separate circuits for heating and pressurizing the roll and an even temperature over the roll cannot be obtained.

The present invention as claimed solves this problem by providing a complete separation system, that is to say the heating and the pressurized fluids are not only separated, but also the pressure fluid is further not heated. Moreover, the heating fluid and the cooling fluid are sprayed and it is the uniform distribution of the heating fluid made by spraying, which allows to obtain a uniform temperature profile in the middle portion of the roll.

In document D8', it is not clear whether the pressure medium is heated or not, so that, even if a separation of the heating and pressurizing circuits is suggested therein, it is not a complete separation as claimed by the present invention. Thus, a combination of D1 or D2 with this prior art does not lead to the method as claimed.

D7 concerns a roll without loading elements, hence without pressure medium, so that the heating problem is not identical to that of the present invention. Moreover, the heating fluid in this prior art flows axially inside the roll, so that the temperature profile in the middle portion of the roll is not

uniform. This citation, indeed, teaches to cool the ends of the roll, however for this precise reason it cannot be combined with citation D4, which teaches the contrary, namely to heat the roll ends. In this last prior art D4, a uniform temperature profile is not obtained, since there is no cooling of the roll ends.

The method according to Claim 1 is therefore not suggested.

VI. Respondent III (opponent III)

In the roll disclosed in document D1, the ends of the roll are isolated from the heated middle region of said roll and moreover are cooled. Figure 1 of this prior art shows that these end regions correspond to the areas which are not covered by the paper web. An identical teaching can be found in D7, which essentially deals with the problem of a temperature drop between the roll ends and the middle region covered by the paper web. As in the present invention, this problem is solved by a cooling of the end regions. Should therefore the disclosure of the "end areas" according to D1 be put in question, document D7 shows that the claimed solution of a temperature drop at the ends of a roll was known.

Thus, all the features of the preamble of the contested Claim 1 can be found in the prior art document D1. Moreover, the heating and pressurized circuits are separated. It is true that, in this prior art, the pressure medium is heated, but for the skilled person, it is obvious to decide not to heat this medium, as soon as it appears that this particular heating brings problems. Moreover, such a feature is suggested by D8',

which clearly indicates that, in the crown roll disclosed therein, the support function is separated from the heating function. Such a wording can only mean that the pressure fluid is not heated.

The problem to be solved by the subject-matter of the contested Claim 1 remains the same as in D1, namely to reach a uniform temperature profile. The solution according to Claim 1 is to be seen in the spraying of the heating and cooling fluids. However, this feature is suggested by document D4, and that for the same object. Furthermore, this feature is disclosed in the introductory part of the patent in suit as being known. Thus, the method of Claim 1 lacks the necessary inventive step having regard to documents D1 and D4, adding D7 if necessary.

Starting from the roll described in D2, the same conclusion can be drawn. In this prior art, different heating zones are distributed along the roll by means of the loading elements, which are heated. Thus, no inventive step can be seen in the replacement of these heating elements by nozzles spraying the heating fluid, as shown in the single figure of the patent in suit. Moreover, it is to be noticed that the contested Claim 1 only mentions a "spraying" without indicating how this is to be realized. The fine tubes or holes of the loading elements according to D2 are means for spraying. In any case, D4 discloses the use of holes (Fig.1) or of jet pipes (Fig.5) for spraying a heated fluid onto the inside face of a roll mantle and D8' teaches to separate the heating from the pressurizing, so that the two distinguishing features of Claim 1 over the roll according to D2 are known.

VII. Respondent II (opponent II) based his arguments on a further combination of documents, since in his opinion the controlled deflection roll described in D4 can also represent the closest prior art. This roll comprises a stationary axle and a rotatable mantle. This mantle is heated and is internally supported by loading elements. In this citation, it is indeed stated that the pressure medium can be used as the heating fluid, but also that different fluids with different circuits can be used for these two purposes, as shown by the drawings. The heating of the inside face of the roll mantle is achieved by spraying in order to obtain an adequate uniformity of the roll heating. According to Figure 5, which corresponds to the embodiment of Figure 1 (cf. column 3, lines 114 to 120), spray jets are distributed along the roll length and are connected to conduits, each having means for adjusting the temperature of the heating fluid. This prior art furthermore emphasizes the possible temperature drop at the end zones of the roll. Therefore, a direct link is given between this closest prior art and document D7, which teaches to cool the ends portions of a roll, which are not in contact with the paper web, in order to obtain a uniform temperature profile of the roll. The solution of Claim 1 is therefore obvious.

VIII. The appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of Claim 1 filed during the oral proceedings.

The respondents requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admisible.

2. During the oral proceedings the admissibility of the new Claim 1 having regard to the requirements of Article 123 EPC was examined. The Board is in agreement with the parties that said claim is admissible.

During this examination, the appellant agreed that the last feature of Claim 1 is to be interpreted as merely intending to indicate that the temperature at the end regions is brought as near as possible to the same level as the temperature in the "web region", i.e. the large middle region of the roll covered by the paper web.

3. The variable-crown roll concerned by the present invention is used in particular in the paper making industry as a calender roll, which aims at giving particular characteristics to the paper web by means of pressure and heat. The variable-crown roll here in question comprises a stationary roll axle and a rotatable roll mantle, which is supported by loading elements acting onto its inside face. Said roll is also heated by means of a heating fluid also passed onto its inside face. To obtain a uniform quality of the paper web, it is of course important to have the heating and the pressurizing of the roll as uniform as possible along the whole length of the roll, in order to avoid any deflection of the roll mantle. The present invention deals essentially with the heating aspect and distinguishes two portions of the roll mantle, which are defined in a particular way by Claim 1. In this claim, the "areas of the roll mantle, from which heat is removed out of the roll by means of conduction in

the radial direction of the roll", are in fact the region of the roll covered by the paper web passing over the roll. This region will be refered to hereinafter as the "middle area" of the roll. The "end areas of the roll, from which heat is not removed by conduction in the radial direction away from the roll mantle" are the remaining parts of the roll mantle, namely the end areas which are not covered by the paper web.

4. The only issue to be decided is whether the subject-matter of Claim 1 involves an inventive step.

In the Board's opinion, document D1 (or D1') represents the prior art closest to the present invention preferably to D2 or D4, since it simultaneously discloses a separation of the heating and pressurizing circuits inside the variable-crown roll and a cooling of the end areas of the roll. According to this prior art, the object of said cooling is to protect the roll bearings against the heat transfer from the remainder of the roll and, for this purpose, at each end of the roll a cooled insulating chamber is provided between the bearing and the middle area of the roll. Figure 1 of this prior art, however, shows that this chamber is arranged at the limit of said middle area. In the description of this document (column 4, lines 30 to 33), it is also stated that this insulating chamber provides a heat barrier from the space corresponding to the middle region of the roll towards the bearings. Such a disclosure corresponds to the end areas, as defined in Claim 1. The roll described in this prior art is moreover a variable-crown roll, so that all the fea- tures of the preamble of the contested Claim 1 are found in this prior art. Even if no adjusting temperature means are shown, they are implicitly disclosed, since a control of the roll temperature is an important issue of this document.

The first feature of the characterizing portion of the claim is also present in this prior art, since the pressurized support oil and the heating oil are supplied separately to the roll and, inside the roll, follow separate circuits. Moreover, as the end areas of the roll are cooled, the last feature of Claim 1 is also fulfilled having regard to its interpretation as set out in point 2 above. In this prior art roll, however, the pressure medium is heated and furthermore, the heating fluid, once introduced at one end of the roll, flows axially through the roll along its mantle and leaves through the opposite end of the roll.

5. Therefore, the method according to Claim 1 differs from the method known from D1 in that:

(a) the pressure medium is not heated,

(b) the heating fluid is passed to the roll inside face substantially uniformly distributed by spraying, and

(c) the cooling fluid is passed onto the end areas by spraying.

6. According to the appellant, it is very difficult within the variable-crown roll known from D1 to control the heating, since the pressurizing oil is heated and, thus, brings various fluctuations in the axial temperature profile of the roll mantle. Moreover, the axial flow of the heating fluid itself inside the roll provides higher temperatures at one end of the roll than at the opposite end, so that the axial temperature profile decreases from one end of the roll to the other. The above distinguishing features (a) to (c) of the present invention avoid these disadvantages and as a consequence, the temperature of the roll mantle can be made more uniform.

Therefore, the problem underlying the present invention is to be seen in the provision of a method which achieves a more uniform axial temperature profile of the mantle roll.

7. As soon as the person skilled in the art sees that the heating of the pressure medium brings problems on the roll heating, his first reaction will be to suppress the reason of the created disturbances, that is to say the heat of the pressure medium. D1 (cf. column 1, line 66 to column 2, line 39, more particularly column 2, lines 20 to 25) has already advised him that a better control of the temperature roll can be obtained by separating the supplies of the three fluids, namely the heating, pressurizing and cooling fluids, and that moreover the pressure value is important for the pressure medium, while the temperature and volume characteristics predominate for the heating fluid. Additionally, the heating influence of the pressure medium is shown to him as being of no great importance (cf. column 3, lines 54 to 58). Thus, the above mentioned distinguishing feature (a) is only an obvious improvement of the already disclosed separation step, being a consequence of the problems that the pressure medium brings with its heating.

8. The possibility of an inclined axially increasing temperature profile from one end to the other due to the axial flow of the heating fluid inside the roll was already considered in said closest prior art D1, see column 5, lines 14 to 21. The solution proposed in this citation resides in the supply of a high volume of heating fluid flowing from the entry to the delivery end of the roll, so that in fact no temperature differential appears between these two ends. Thus, the skilled person was already aware of this problem. However, in this technical field of paper machines, another document, namely document D4, shows that it was

known to heat the inside of the mantle of a similar roll by spraying. On page 1, lines 38 to 52, of this citation, it is disclosed that a spray system gives optimum heat transfer between the jets and the wall of the roll and that an adequate uniformity of heat control is thereby obtained. In view of this teaching, which corresponds to the problem underlying the present invention, the above features (b) and (c) are obvious, being restricted to the repacement of one known solution by another known solution of the same problem.

9. It follows that the subject-matter of Claim 1 cannot be regarded as involving an inventive step. Claims 2 to 4 dependent on Claim 1 share the fate of the independent claim.

10. Taking D2 as the starting point, the same conclusion is drawn. The two-part form of the contested Claim 1 was drafted upon this prior art. In the variable-crown roll according to this citation D2, the problem of the temperature drop at the roll ends was also solved, and that in the same way as in D1, that is to say by providing a cooling fluid at the end areas inside the roll, as shown by Figure 1 or more clearly by Figure 4. In contrast to the disclosure of D1, the heating of the roll is accomplished by heating the same oil which is used for pressurizing the roll. This oil is distributed into different loading elements or chambers, which are divided into zones along the inside face of the mantle roll in the axial direction of the roll. The Board cannot agree with Respondent II, who considers these loading elements as being spraying means, since the pressurized fluid is supplied by fine conduits. As soon as the loading elements or chambers are filled, no spraying effect takes place.

The method according to the contested Claim 1 differs from that of this prior art D2 essentially by the provision of spraying means and by a clear separation of the heating and pressurizing fluids. These two differences however are suggested by document D4. This citation indeed not only discloses the use of spraying means - as seen above -, but also indicates that it is possible to separate the heating fluid from the pressure medium, so that these two functions are achieved separately. Feature (a) per se is not disclosed, but as seen above, this feature is obvious, being derivable from the problem underlying the present invention. Therefore, a combination of documents D2 and D4 would also lead to the subject-matter of Claim 1 in an obvious manner.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

N. Maslin C. T. Wilson