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D E C I S I O N
of 5 October 1994

Case Number: T 1060/92 - 3.2.5

Application Number: 86202391.8

Publication Number: 0234064

IPC: D03D 47/30

Language of the proceedings: EN

Title of invention:
Automatic picking conditions regulating method and device for carrying out the same

Patentee:
Tsudakoma Corporation

Opponent:
GEBRÜDER SULZER AKTIENGESELLSCHAFT

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-

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Case Number: T 1060/92 - 3.2.5

D E C I S I O N
of the Technical Board of Appeal 3.2.5
of 5 October 1994

Appellant: (Opponent)
GEBRÜDER SULZER AKTIENGESELLSCHAFT
Züricher Strasse 12
CH-8401 Winterthur (CH)

Representative:
Hammer, Bruno, Dr
c/o Sulzer Management AG
KS/Patente/0007
CH-8401 Winterthur (CH)

Respondent: (Proprietor of the patent)
Tsudakoma Corporation
18-18, Nomachi 5-chome
Kanazawa-shi
Ishikawa-ken 921 (JP)

Representative:
Smulders, Theodorus A.H.J., Ir
Vereenigde Octrooibureaux
Nieuwe Parklaan 97
NL-2587 BN 's-Gravenhage (NL)

Decision under appeal: **Decision of the Opposition Division of the European Patent Office orally given on 16 September 1992 and posted on 2 October 1992 rejecting the opposition filed against European patent No. 0 234 064 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: C. V. Payraudeau
Members: A. Burkhart
C. G. F. Biggio

Summary of Facts and Submissions

I. The Appellant (Opponent) lodged an appeal against the decision of the Opposition Division by which the opposition against the European patent No. 0 234 064 had been rejected pursuant to Article 102(2) EPC.

The document EP-A-0 164 773 (D3) referred to in the reasons for the decision of the Opposition Division is also relevant to the present decision.

II. Oral proceedings were held.

(i) The Appellant requested that the decision under appeal be set aside and that the patent be revoked.

(ii) The Respondent (Proprietor) requested that the appeal be dismissed.

(iii) Claims 1, 4 and 5 of the patent as granted read as follows:

"1. An automatic picking conditions regulating method for automatically regulating the picking conditions of a picking device (1) which picks a weft yarn (2) by the agency of the picking function of a picking nozzle (5) into a shed (4), which comprises steps of:
commanding the sequential variation of a picking condition for successive picking operations;
detecting the weft yarn arrival crankshaft angle where the picked weft yarn (2) arrives at a predetermined position;
storing the sequentially varied values of the picking conditions and the corresponding actual

weft yarn arrival crankshaft angles in combination, respectively;
determining a target weft yarn arrival crankshaft angle where the weft yarn (2) will arrive at the predetermined position in the normal weaving operation;
calculating an appropriate value of the picking condition corresponding to the target weft yarn arrival crankshaft angle on the basis of the correlation between the sequentially varied values of the picking condition and the measured actual weft yarn arrival crankshaft angles; and
regulating the picking condition so that the controlled value of the picking condition coincides with the calculated value of the picking condition."

"4. An automatic picking conditions regulating device for automatically regulating the picking conditions of a picking device (1) which picks a weft yarn (2) by the agency of the picking function of a picking nozzle (5) into a shed (4), which comprises:
a command unit (21) which provides different values of a picking condition sequentially;
a control unit (28) which controls the supply of the picking fluid (3) from a fluid source (13) to the picking nozzle (5) according to the different values of a picking condition provided by the command unit (21);
a weft yarn arrival detector (22) which detects the weft yarn arrival crankshaft angle where a picked weft yarn (2) arrives at a predetermined position;
a memory (25) which sequentially stores the values of a picking condition provided by the command unit (21) and the actual weft yarn

arrival crankshaft angles detected by the weft yarn arrival detector (22);
a target setting unit (26) which sets a target weft yarn arrival crankshaft angle appropriate for the normal weaving operation; and
an arithmetic unit (27) which calculates an optimum value of the picking condition corresponding to the target weft yarn arrival crankshaft angle set by the target setting unit (26), on the basis of the correlation between the actual weft yarn arrival crankshaft angles stored in the memory (25) and the values of the picking condition stored in the memory (25), and gives the optimum value of the picking condition to the control unit (28)."

"5. An automatic picking conditions regulating device for automatically regulating the picking conditions of a picking device (1) which picks a weft yarn (2) by the agency of the picking function of a picking nozzle (5) into a shed (4), which comprises:
a weft yarn arrival detector (22) which detects an actual weft yarn arrival crankshaft angle where the picked weft yarn (2) arrives at a predetermined position, at each picking cycle;
a command unit (29) which provides a command signal every predetermined number of picking cycles or every predetermined time during the weaving operation;
a picking condition command unit (21) which, upon the reception of the command signal provided by the command unit (29), provides a plurality of command signals sequentially to increase or decrease the value of the controlled picking condition of the picking nozzle (5) by a predetermined increment or a predetermined

decrement at a time within a range which will not vary the weaving condition of the loom significantly;
a memory (25) which stores the values of the controlled picking condition and the corresponding actual weft yarn arrival crankshaft angles;
an arithmetic unit (27) which determines a correlation between the controlled picking condition and the actual weft yarn arrival crankshaft angle on the basis of the data stored in the memory (25), and calculates a new appropriate value of the controlled picking condition on the basis of the correlation; and
a control unit (28) which controls the supply of the picking fluid (3) from a fluid source to the picking nozzle (5) on the basis of the new value of the controlled value."

(iv) The Appellant essentially argued as follows:

Document D3 discloses a method for automatically regulating the picking conditions of a fluid jet multiple weft loom during the weaving process, whereby during start-up of the loom for each type of weft thread the time taken to traverse the shed is measured and is used to modify and optimize the timing sequence associated with said weft thread. The only problem that remains is to find a suitable initial value (for e.g. the pressure of the picking fluid) to start the optimizing operation. It is well-known in the art to adjust manually the weft yarn arrival crankshaft angle beforehand, i.e. before the actual production of woven fabrics. This is done by measuring the weft yarn arrival times as a function of the pressure and/or loom width,

plotting the results and then establishing the optimum picking condition by interpolation. Such a trial weaving operation is equivalent to the optimizing operation according to document D3. No positive contribution to inventive step can be seen in automating the manual process of finding the optimum picking condition and then - as disclosed in document D3 - regulating the picking condition during the weaving process.

(v) The Respondent essentially argued as follows:

The invention relates to a method for automatically setting the picking conditions at the initial stage of operation of the loom and regulating these picking conditions to their target values during the weaving process. Setting the picking conditions is automatically done by a trial operation whereby a sequence of picking modes are tried: the data of the picking modes and the corresponding measured weft yarn arrival crankshaft angles are stored in a memory and the target weft yarn arrival crankshaft angles are calculated on the basis of the stored data. In contrast, document D3 discloses a method, whereby the parameters are progressively changed in order to find the optimum picking conditions. The trial-and-error method of setting the picking conditions according to document D3 is therefore the automated equivalent of manually setting the picking conditions by the operator. It is important to note that the trial operation according to the invention not only provides the appropriate picking conditions, but also provides in advance the relation between the pressures and the weft yarn arrival crankshaft angles over the range of interest, which relation can later be

used advantageously to control the picking conditions.

Reasons for the Decision

1. *Novelty*

None of the available documents discloses a method for automatically regulating the picking conditions of a picking device comprising all the features as specified in Claim 1 as granted. Since this is no longer disputed by the Appellant, there is no need for further detailed substantiation of this matter.

The subject-matter of Claim 1 is therefore new in the sense of Article 54 (1) and (2) EPC.

2. *Closest state of the art, technical problem and solution*

2.1 There is general agreement among the parties and the Board that document D3 represents the closest state of the art. This document discloses (see page 2, second paragraph) a method for automatically regulating the picking conditions of the fluid jets of a multiple weft loom, whereby the timing, or timing sequence in the case of multiple jets, for the movement of a weft thread is adapted to the type of weft thread inserted for each shot and these timing sequences are introduced into the control mechanism. Document D3 also discloses (see page 3, second paragraph) that during start-up of the loom for each type of weft thread the time taken to traverse the shed is measured and is used to modify and progressively optimize the timing sequence associated with said weft thread.

2.2 In the method according to D3 the optimum picking conditions are progressively established during the controlled weaving operation of the loom, i.e. the variation of the controlled values is large during the initial stage of the operation. Therefore, a transient unstable operation may result at the initial stage of the operation. The ranges of control of the controlled values must be chosen sufficiently large to cope with such transients, and consequently the accuracy of control of the weft yarn arrival crankshaft angle is diminished.

2.3 Therefore, the technical problem to be solved with respect to document D3 is to improve the stability and accuracy of the regulating method for automatically regulating the picking conditions of a picking device according to that document.

2.4 According to the teaching of Claim 1 of the patent as granted, this problem is solved by including the following additional automatic steps in the method according to document D3:

(a) commanding the sequential variation of a picking condition for successive picking operations;

(b) storing the sequentially varied values of the picking conditions and the corresponding actual weft yarn arrival crankshaft angles in combination, respectively;

(c) calculating an appropriate value of the picking condition corresponding to the target weft yarn arrival crankshaft angle on the basis of the correlation between the sequentially varied values of the picking condition and the measured actual weft yarn arrival crankshaft angles.

These distinguishing features have the advantage that, since the optimum picking conditions are established beforehand, i.e. before the actual controlled weaving operation of the loom, the variation of the controlled values is small when the picking conditions are regulated. Therefore, transient unstable operation at the initial stage of the operation is avoided, the ranges of control of the controlled values are narrowed and a more accurate automatic control of the weft yarn arrival crankshaft angle is achieved, cf. the description, column 2, lines 51 to 61.

2.5 The Appellant has contended that the problem to be solved with respect to document D3 lies in choosing a suitable initial value for the picking conditions to start the optimizing operation, as is normal practice in any weaving operation. Usually the operator would determine beforehand the appropriate picking conditions in a trial weaving operation by repeatedly changing the picking conditions manually until an appropriate target weft yarn arrival crankshaft angle is obtained, as is explained in column 1, lines 17 to 24 of the patent-in-suit. This conventional trial weaving operation would include the method steps (a), (b) and (c) recited above. The method of Claim 1 would lack an inventive step, because automating this well-known manual process of finding the optimum start-value for the picking conditions, and using this value in the method according to document D3, had to be regarded as a normal design option for the person skilled in the art.

The Board cannot agree with this contention for the following reasons:

Document D3 is silent about a trial weaving process and by no means teaches that by choosing an optimum initial

value for the picking conditions the accuracy and stability of the loom regulating method can be improved.

On the contrary, document D3 teaches expressly that the optimum picking conditions are obtained during the normal automatic picking regulating method (see Claim 1, last line). In the light of this teaching of document D3, establishing an optimum picking condition before the normal picking regulating method would appear to be redundant, and therefore document D3 points away from providing an additional automatic trial weaving operation comprising the method steps (a), (b) and (c) recited above.

Even if the person skilled in the art would add an automatic trial weaving operation similar to the manual trial weaving operation as explained in the patent-in-suit in column 1, lines 17 to 24 to the method according to document D3, he would not arrive at the method according to Claim 1.

The above-mentioned steps (b) and (c), which are essential features of the method of Claim 1, are not contained in the trial weaving operation described in column 1, lines 17 to 24, of the patent-in-suit. Contrary to the conventional trial-and-error method, wherein the picking conditions are progressively changed until the optimum picking conditions are found, in the trial weaving operation according to Claim 1 the picking conditions are changed over a predetermined range, then, on the basis of the data obtained during this trial weaving operation, a correspondence table between the sequentially varied values of the picking conditions and the corresponding actual weft yarn arrival crankshaft angles is stored in the computer memory, on the basis of which correspondence table an optimum value of the picking condition is calculated (see Figures 2 and 3 of

the patent-in-suit). This stored correspondence is advantageously also available to the controller unit later during the normal weaving operation.

2.6 The textbook "Kleines Handbuch technischer Regelvorgänge", W. Oppelt, Verlag Chemie Weinheim, 1972, pages 730 to 732, which was referred to in a communication pursuant to Article 11(2) of the Rules of Procedure of the Boards of Appeal, merely shows that it is known to determine automatically the optimum values for the control system in auto-adaptive controllers. This textbook is silent, however, about carrying out a trial operation in the sense of Claim 1. The Appellant referred during the oral proceedings to the textbook "Regelungstechnik: Einführung in die Methoden und ihre Anwendung", O. Föllinger, AEG-Telefunken Aktiengesellschaft, 3. Auflage, 1980, in particular to Figure 1/63, page 35, which shows that the number of revolutions of an engine can be adjusted for a given load by choosing the number of revolutions of the idle engine. This textbook also gives no hint or indication to the subject-matter of Claim 1 as granted. It can be concluded that the teachings of these textbooks could not, either alone or in combination with the teaching of document D3, lead the person skilled in the art to a method for automatically regulating the picking conditions of a picking device according to Claim 1.

2.7 The person skilled in the art, starting from the method for automatically regulating the picking conditions of fluid jets of a multiple weft loom according to document D3, will therefore not arrive at the subject-matter according to Claim 1, either by his expert knowledge alone, or in combination with any other teaching of the cited prior art.

Hence the subject-matter according to Claim 1 involves an inventive step within the meaning of Article 56 EPC.

3. Independent Claims 4 and 5 define two embodiments of devices, which are suitable for carrying out the method according to Claim 1 and likewise involve an inventive step within the meaning of Article 56 EPC.

4. In view of the above, the patent as granted can be maintained with Claims 1, 4 and 5 together with the dependent Claims 2, 3 and 6 to 8 concerning particular embodiments of the subject-matter of the independent claims.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

A. Townend C. Payraudeau