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**D E C I S I O N**  
of 13 April 1994

**Case Number:** T 0032/92 - 3.2.4

**Application Number:** 83302133.0

**Publication Number:** 0122343

**IPC:** A01D 41/12

**Language of the proceedings:** EN

**Title of invention:**  
Combine harvester

**Patentee:**  
Ford New Holland N.V.

**Opponent:**  
I) Claas OHG  
II) Deere & Company  
III) Dronningborg Maskinfabrik A/S

**Headword:**  
Combine harvester/FORD NEW HOLLAND N.V.

**Relevant legal norms:**  
EPC Art. 54, 56

**Keyword:**  
"Interpretation of the claims"  
"Inventive step (yes)"

**Decisions cited:**  
-

**Catchword:**  
-



Case Number: T 0032/92 - 3.2.4

**D E C I S I O N**  
of the Technical Board of Appeal 3.2.4  
of 13 April 1994

**Appellant I:**  
(Opponent I)

Claas OHG  
Postfach 11 40  
D - 33426 Harsewinkel (DE)

**Representative:**

Hanewinkel, Lorenz, Dipl.-Phys.  
Patentanwalt  
Ferrariweg 17a  
D - 33102 Paderborn (DE)

**Other party:**  
(Opponent II)

Deere & Company  
1 John Deere Road  
Moline, Illinois 61265 (US)

**Representative:**

Feldmann, Bernhard  
Deere & Company  
European Office  
Patent Department  
D - 68140 Mannheim (DE)

**Appellant II:**  
(Opponent III)

Dronningborg Maskinfabrik A/S  
Udbyhøjvej 113  
DK - 8900 Randers (DK)

**Representative:**

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

**Respondent:**  
(Proprietor of the patent)

Ford New Holland N.v  
Leon Claeysstraat 3a  
B - 8210 Zedelgem (BE)

**Representative:**

Singleton, Jeffrey  
Eric Potter & Clarkson  
St. Mary's Court  
St. Mary's Gate  
Nottingham NG1 1LE (GB)

Decision under appeal: Decision of the Opposition Division of the European Patent Office dispatched on 11 November 1991 rejecting the oppositions filed against European patent No. 0 122 343 pursuant to Article 102(2) EPC.

Composition of the Board:

Chairman: C.A.J. Andries  
Members: P. Petti  
M. Lewenton  
H. Berger  
J.-P. Seitz

## Summary of Facts and Submissions

I. Three oppositions against the European patent No. 0 122 343, which corresponds to the European patent application 83 302 133.0 filed on 15 April 1983, were rejected by the Opposition Division in its decision dispatched on 11 November 1991. The grounds on which the oppositions were filed are related to Article 100(a) EPC.

II. The wording of Claim 1 of the patent as granted reads as follows:

"A combine harvester (1) having an engine, a traction drive transmission (31), a header (15), a threshing and separating mechanism (9) and a machine throughput control system (Figure 2) comprising a grain loss control loop (44, 45, 46, 38, 39, 41, 31) operable to produce a signal (L) representative of grain loss and including a grain loss controller (46) to which the grain loss signal (L) and a reference grain loss signal (Lref) are applied, characterised in that the machine throughput control system further comprises a machine loading control loop (37, 62, 61, 38, 39, 44, 31) operable to produce a signal (K) representative of the machine loading, the grain loss controller (46) is operable continuously to derive a reference machine loading signal (Kref) from the machine loading signal (K), the grain loss signal (L) and the reference grain loss signal (Lref), and means (38) are provided for algebraically summing the machine loading signal (K) and the reference machine loading signal (Kref) to produce a machine loading error signal ( $E_k$ ) which is used to control the machine throughput."

III. On 9 and 10 January 1992 two appeals against this decision were filed by the first (Appellant I) and the third Opponent (Appellant II), respectively. The appeal fees were paid on the respective date.

The statements setting out the grounds of appeal were received respectively on 10 and 19 March 1992.

IV. Oral proceedings were held on 13 April 1994. Neither Appellant II nor the second Opponent, although duly summoned, appeared. The oral proceedings were continued without them (Rule 71(2) EPC).

V. The following documents were cited in the appeal proceedings:

- D1: EP-A-77 667
- D2: FR-A-2 376 616
- D5: DE-A-3 023 606
- D6: GB-A-2 107 489
- D7: R. Isermann, "Digital Control systems," 1981  
Springer-Verlag Berlin, pages 294, 295, 301
- D8: J.R. Leigh, "Applied control theory", 1982,  
Peter Peregrinus Ltd, Stevenage, page 74
- D10: "Automatic control and performance evaluation of  
agricultural machines", in Biennial report - SIAE,  
April 1980 to March 1982, page 67 and following  
(seven columns).

VI. Appellant I essentially argued that the subject-matter of Claim 1 lacked novelty with respect either to document D5 or to document D10 and that it did not involve an inventive step with respect to document D1. Appellant I also argued that Claim 1 was not "workable", i.e. it did not provide a precise technical teaching permitting the invention to be carried out.

Appellant II essentially argued that the subject-matter of Claim 1 did not involve an inventive step with respect to documents D5, D10 and to the general technical knowledge of the skilled person as reflected by document D7 or D8. More particularly, Appellant II argued that Claim 1 represents a control system in which the parameters are arranged in "a well known cascade control system".

The Respondent (Patent Proprietor) contested the arguments of the Appellants and argued that the subject-matter of Claim 1 was new and involved an inventive step.

The party as of right according to Article 107 EPC (Opponent II) did not present any arguments during appeal proceedings.

VII. Both Appellants requested that the decision under appeal be set aside and the patent revoked.

The Respondent requested that the appeals be dismissed and the patent be maintained as granted (main request). The Respondent also filed subsidiary requests.

The party as of right according to Article 107 EPC (Opponent II) did not bring forward any request.

### **Reasons for the Decision**

1. The appeals are admissible.

2. *Identification of the subject-matter of Claim 1 as granted (main request)*

2.1 Claim 1 is directed to a combine harvester having a machine throughput control system. The control system comprises two control loops for two control parameters, namely a grain loss control loop in which a signal (L) representative of the grain loss is compared with a reference grain loss signal ( $L_{REF}$ ) and a machine loading control system in which a signal (K) representative of the machine loading is compared with a reference machine loading signal ( $K_{REF}$ ).

2.1.1 Each control loop implies comparing means for comparing a signal representative of the actual value of the control parameter with a reference value of this parameter in order to generate an error signal. The comparing means for the machine loading control loop are explicitly mentioned in Claim 1 (column 16, lines 3 to 7: "means (38) ... for algebraically summing ... to produce a machine loading error signal ..."). A grain loss controller to which the signals (L) and ( $L_{REF}$ ) are applied is explicitly mentioned in relation to the grain loss control loop (column 15, lines 56 to 59).

2.1.2 Claim 1 also recites the feature that the grain loss controller is operable continuously to derive a reference machine loading signal ( $K_{REF}$ ) from three signals, namely the grain loss signal (L), the reference grain loss signal ( $L_{REF}$ ) and the machine loading signal (K).

The fact that the signal ( $K_{REF}$ ) is derived from the controller of the first control loop, i.e. the output of the grain loss controller by taking account of the signals (L) and ( $L_{REF}$ ), which particularly concern the first control loop, results in the two control loops

being interactive. In other words, this circumstance defines a cascade control system in which the grain loss and machine loading control loops represent respectively main and auxiliary loops.

The technical effect obtained by the fact that the grain loss controller is operated to derive the signal ( $K_{REF}$ ) not only from the signals (L) and ( $L_{REF}$ ) but also from the signal (K) is not explicitly stated in Claim 1. However, from the description of the patent (column 9, lines 54 to 59; column 10, lines 32 to 41; column 11, lines 9 to 16, together with Figure 4; and column 15, lines 22 to 46 together with Figure 5) it can be immediately understood that the signals (L) and (K), representative of the parameters grain loss and machine loading respectively, are applied to the grain loss controller for continuously establishing a causal relationship between these parameters, whereby the grain loss signal (L), the machine loading signal (K), the current causal relationship and the signal ( $L_{REF}$ ) serve to derive the signal ( $K_{REF}$ ).

2.1.3 Therefore, Claim 1 must be interpreted as implying not only the establishing of a causal relationship between the signals (L) and (K) in the grain loss controller but also the use of the current causal relationship to derive the signal ( $K_{REF}$ ). Also the Respondent, during the oral proceedings, emphasised that Claim 1 obviously had to be interpreted accordingly.

2.2 The Board cannot accept the arguments put forward by Appellant I according to which Claim 1 does not provide a precise technical teaching permitting the invention to be carried out. According to the EPC, the independent claims of a patent must define the matter for which protection is sought (Article 84 EPC), whereas it is the content of the whole patent which is critical for the

sufficiency of the disclosure (Articles 100(b) and 83 EPC).

3. *The prior art*

- 3.1 Document D10, which was submitted for the first time during appeal proceedings, is a report of SIAE of the period April 1980 to March 1982. No evidence was produced - even after an explicit remark made by the Board in a Communication - which permits the determination of whether this report was published before 15 April 1983.

Appellant I submitted during the oral proceedings that document D10 refers to the results of tests carried out in the time from April 1980 to March 1982 and argued that the results of scientific experiments are normally made available to the public without time delay. In the absence of any further evidence, the Board cannot accept this argument.

Therefore, this late-submitted document, which gives to a skilled person information of a general nature, will be not taken into consideration as prior art according to Article 54(2) EPC.

- 3.2 Document D6 concerns a British patent application published on 27 April 1983, i.e. after the filing date of the patent in suit. This document is therefore not comprised in the prior art according to Article 54(2) or (3) EPC and will be disregarded.
- 3.3 Document D1 concerns a European patent application filed on 18 October 1982 with a claimed priority of 21 October 1981 and published on 27 April 1983. This document is comprised in the prior art according to Article 54(3) and (4) EPC for the designated states, namely DE and FR.

This document may only be considered in order to examine whether the subject-matter of Claim 1 is novel with respect to the content of this document and only for the Contracting States which are designated in both the patent in suit and this document.

According to the impugned decision, the Appellant I submitted during the proceedings before the Opposition Division that the content of document D1 was made available to the public before the filing date of the patent in suit and offered a witness to testify this submission. Since the Opposition Division considered that the subject-matter of Claim 1 did not involve an inventive step even if the content of document D1 were considered as prior art according to Article 54(2) EPC, it considered the hearing of the witness as not necessary.

Having regard to this procedural aspect, the Board - just in case it could be assumed that the content of document D1 was in fact prior art - will also investigate in sections 7.1 and 7.2 of this decision whether the subject-matter of Claim 1 involves an inventive step with respect to the content of document D1, as was maintained by Appellant I. In view of the outcome of this investigation there is no need to examine the availability to the public of the alleged prior use of a combine harvester according to document D1.

4. *Novelty (Claim 1 of the main request)*

4.1 Document D1 (see particularly Figure 3) concerns a combine harvester having a control system comprising a control loop in which a signal representative of the actual grain loss and a signal representative of the actual machine loading (crop feed rate) are combined in

order to establish a causal relationship between them. Such relationship permits a signal representing an estimated grain loss (current grain loss signal) to be derived, this signal being compared in a comparator (61) with a reference grain loss signal (set grain loss input) in order to generate an error signal to be used as a control signal for the machine throughput. This document does not describe a second control loop for the machine loading.

4.2 Document D5 (see particularly Figures 1 and 2) discloses a combine harvester having a control system comprising a controller (5) and a grain loss control loop in which a signal representative of the grain loss (produced by the sensor (7)) is compared by means of the comparator (9) with a reference grain loss signal (a preselected maximum value) which can be set by means of the rotary knob (24). The control system also comprises a machine loading (torque) control loop in which a signal representative of the machine loading (produced by the sensor (11)) is compared by means of the comparator (13) with a reference machine loading signal which is set by means of the rotary knob (26). Since the reference signals can be set independently of each other by means of knobs (24, 26) and the actuation of the system due to output of the output comparator (9) is said to be independent of the output of comparator (13) (see page 16 (handwritten numbers), lines 8 to 15), the two loop control system according to document D5 cannot be considered as a cascade control system in which the reference signal for the auxiliary loop is derived from the controller of the main loop.

4.3 Document D2 describes a combine harvester having a control system comprising a machine loading control loop in which a signal representative of the machine loading (produced by sensors (59) and (47)) is applied to a

combining circuit (94) and compared with a reference signal which can be set by a potentiometer (177). A signal representative of the grain loss (produced by the sensor (23)) can be applied to the combining circuit (94) so that a grain loss control loop can be operated if the signal representative of the grain loss is over a threshold value. Thus, in this control system, the grain loss control loop has priority over the machine loading control loop insofar as the grain loss control loop can override the machine loading control loop. This known control system cannot be considered as a cascade control system.

4.4 Documents D7 and D8 do not concern harvesters. They only reflect the general knowledge of the skilled person in the field of automatic controls.

4.5 Therefore the subject-matter of Claim 1 is novel within the meaning of Article 54 EPC.

5. *The closest prior art*

The Board is of the opinion that the pre-published document D5 can be considered as representing the closest prior art because it concerns a combine harvester having a control system comprising at least **two** control loops, namely a grain loss control loop and a machine loading control loop.

Document D2, which also describes a control system based on the parameters grain loss and machine loading, does not go beyond the content of document D5 (see the above section 4.3).

6. *Problem and solution (Claim 1 of the main request)*

In the system according to document D5 two reference signals, for the grain loss and the machine loading, must be set. The grain loss control loop has priority over the machine loading control loop (see page 10, last sentence to page 11 (handwritten numbers), first paragraph). The grain loss control loop is independent of the signal representative of the machine loading and of the output signal of the comparator (13) of the machine loading control loop (see page 16 (handwritten numbers), second paragraph). In other words, if the grain loss is under the threshold value defined by the reference grain loss signal, the control parameter for the machine throughput control system is the machine loading. If the grain loss is over the threshold value, then the grain loss signal practically overrides the machine loading signal such that the grain loss becomes the control parameter for the machine throughput control system.

The subject-matter of Claim 1 differs from the prior art according to document D5 in that

(a) the grain loss controller is continuously operable to derive a reference machine loading signal ( $K_{REF}$ ) from

(a1) the grain loss signal (L),

(a2) the reference grain loss signal ( $L_{REF}$ ) and

(a3) the machine loading signal (K),

(b) and in that means are provided for algebraic summing the reference machine loading signal to

produce a machine loading error signal which is used to control the machine throughput.

Features (a), (a1), (a2), (a3) and (b), which substantially define a cascade control system, result in a control system having two loops which continuously interact with each other. This permits the machine throughput to be continuously controlled on the basis of both the machine loading and the grain loss. Moreover, this permits only one reference value to be set, namely that for the grain loss; the second reference value, that for the machine loading, is automatically derived.

Feature (a3), in the context of features (a), (a1) and (a2), implies the establishing of a causal relationship between the signals (L) and (K) in the grain loss controller and thus the use of this causal relationship to derive the signal ( $K_{REF}$ ). Therefore, there is an inter-relationship between all distinguishing features which mutually support each other in their effect in order to obtain a new technical effect, namely the possibility of converting the error signal of the grain loss control loop into a reference machine loading signal which takes account of the current causal relationship between the parameters grain loss (L) and machine loading (K).

Therefore, the problem to be solved can be seen as to improve the performance and the stability of the machine throughput control system.

7. *Inventive step (Claim 1 of the main request)*

7.1 Starting from a combine harvester according to document D5, to arrive at the claimed invention requires at least two steps. The first one consists in the application of the cascade control technique to a control system with

two control loops in which one of the loops has priority over the other. The second step consists in the establishment of a causal relationship between the parameters (L) and (K) and in the use of the machine loading signal (K) as well as of the current relationship between the parameters (L) and (K) to derive the reference machine loading signal ( $K_{REF}$ ).

Furthermore it must be taken into account that the grain loss control loop according to document D5 is only present to avoid that the value of the grain loss **exceeds** a preselected maximum value. The grain loss control loop according to document D5 therefore is only acting to keep the grain loss **below** a certain value. With the grain loss control loop according to Claim 1 however, the grain loss is continuously controlled with regard to a certain value.

The cascade control technique belongs to the general technical knowledge of a skilled person in the field of automatic controls, see for instance document D7 which shows in Figure 16.1 (page 294) a typical block diagram of a cascade control system in which the reference signal of the second auxiliary loop is derived from the controller of the first main control loop as a function of the actual and reference signals of the first main loop.

Document D1 describes a control system with a grain loss control loop in which a causal relationship between grain loss and machine loading is established and used to derive an estimated grain loss signal but it does not suggest at all the use of the relationship in a cascade control system.

Neither document D1 nor the documents reflecting the general technical knowledge of the skilled person

suggest the possibility of converting the error signal of the grain loss control loop into a reference machine loading signal which takes account of the current causal relationship between the parameters grain loss and machine loading and of the reference grain loss signal.

Having regard to the mutual interaction between the features which distinguish the subject-matter of Claim 1 from the closest prior art, it is irrelevant that the individual features which distinguish the claimed invention from the prior art are known by themselves. Since the available prior art does not give any hint towards a combination of the distinguishing features, the subject-matter of Claim 1, as interpreted by taking account of the description of the patent (see section 2.1.3), is considered as involving an inventive step over the cited prior art.

7.2 Appellant I considered document D1 to reflect the closest prior art and essentially argued that the subject-matter of Claim 1 represents a technically equivalent system of the control system described in document D1 which could be arrived at by inverting the functions of the signals representing the grain loss and the machine loading.

The Board cannot accept this argument because the control system according to document D1 has only one control loop, namely the grain loss control loop which controls the machine throughput on the basis of the grain loss taking account of the machine loading. By inverting the functions of the parameters grain loss and machine loading at best a control system could be arrived at having a machine loading control loop which controls the machine throughout on the basis of the machine loading taking account of the grain loss. Since

only one control loop is present, only one control loop will exist after inverting the functions of the signals.

The control system according to document D1 is based on establishing a causal relationship between grain loss and machine loading and the use of this relationship to derive an estimated grain loss signal which takes account of the machine loading signal. The Board however does not consider document D1 as the closest prior art because the subject-matter of Claim 1 differs from the prior art according to this document not only by the features (a), (a1), (a2), (a3) and (b) but also by a second control loop, namely the machine loading control loop.

Starting from a control system according to document D1, three steps are required in order to arrive at the claimed invention. A first step consists in providing the control system with a second control loop whereby the machine loading is selected as the control parameter for the second control loop. A second step consists in the application of the cascade control technique to a control system with two control loops, whereby the machine loading is selected as the auxiliary parameter. A third step consists in the use of the current relationship to derive the reference machine loading signal for the second control loop. These three steps are not independent of each other but are closely interconnected. Therefore it is irrelevant that the individual features which distinguish the claimed invention from the prior art are known or partially known by themselves.

Since the available prior art does not provide a suggestion towards the totality of the features which distinguish the combine harvester according to Claim 1 from the content of document D1, the subject-matter of

Claim 1 is considered as being inventive over the cited prior art.

7.3 Furthermore, having regard to the considerations made in above sections 2.1.2, 7.1 and 7.2, the Board cannot accept the argument of Appellant II according to which Claim 1 only defines a simple cascade control system.

8. The patent can therefore be maintained as granted.

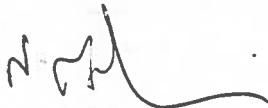
9. The main request of the Respondent being allowable, there is no need to examine the subsidiary requests.

**Order**

**For these reasons, it is decided that:**

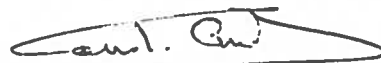
The appeals are dismissed

The Registrar:



N. Maslin

The Chairman



C. Andries

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