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Datasheet for the decision of 15 November 2007

Case Number: T 1534/05 - 3.5.03

Application Number: 01970413.9

Publication Number: 1320789

IPC: G05D 7/06

Language of the proceedings: EN

Title of invention:
Process and device for flow control of an electrical motor fan

Applicant:
3M Innovative Properties Company

Headword:
Flow control/3M

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - no (main and first to third auxiliary requests)"

Decisions cited:
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Catchword:
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Case Number: T 1534/05 - 3.5.03

D E C I S I O N
of the Technical Board of Appeal 3.5.03
of 15 November 2007

Appellant: 3M Innovative Properties Company
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 14 July 2005 refusing European application No. 01970413.9 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: F. van der Voort
Members: A. Madenach
M.-B. Tardo-Dino

Summary of Facts and Submissions

I. The present appeal is against the decision of the examining division to refuse European patent application 01970413.9 on the ground that the subject-matter of claims 1 and 6 did not involve an inventive step (Article 56 EPC) having regard to the disclosure of the following document:

D1: EP 0 518 538 A

II. A notice of appeal was filed on 13 September 2005. In a statement setting out the grounds of appeal, submitted by letter of 15 November 2005, the appellant requested that the examining division's decision be set aside and a patent be granted on the basis of a set of claims of a main request. Oral proceedings were conditionally requested.

III. In a communication accompanying a summons to oral proceedings the board gave its preliminary opinion on the case under appeal, pointing out that the subject-matter of claim 1 of the main request did not appear to involve an inventive step (Article 56 EPC) having regard to the disclosure of D1 and taking into account the common general knowledge of a person skilled in the art.

IV. In a letter dated 12 October 2007 the appellant filed four sets of claims (main request, first to third auxiliary requests) and requested that a patent be granted on the basis of the claims of the main request.

V. In a further letter dated 9 November 2007 the appellant informed the board that it did not intend to take part in the oral proceedings.

VI. Oral proceedings took place on 15 November 2007 in the absence of the appellant.

After deliberation the chairman announced the board's decision.

VII. Independent claim 1 of the main request reads as follows:

"Method for flow regulation of a fan (3) powered by an electrical motor (2), for maintaining the flow from the fan at a chosen predetermined value, said fan having a filter (5) positioned at the suction side of the fan, wherein values representing the actual current consumption and the actual speed of the motor (2) are determined, and wherein the actual current consumption of the motor is determined by means of a series resistor characterised by the following steps:
- determining the actual speed of the motor by creating a pulse signal (p) in the motor (2) said pulse signal being converted into a motor speed indicating signal;
- comparing the actual current and the actual speed values to a predetermined curve or table of a plurality of curves or tables stored in a memory (14) in a control unit (12), which curves or tables indicate the correlation between current consumption and speed for predetermined flows of the fan;
- determining a deviation in the actual current value as compared with the predetermined value in the chosen curve or table;

- controlling by means of the control unit (12) a change of the electrical current supplied to the motor in a direction such as to reduce the deviation; and
- repeatedly determining and comparing and controlling, in the control unit (12), the actual current and actual speed values with the chosen predetermined curve and table and when no deviation is found from the predetermined curve or table the chosen flow is maintained."

In independent claim 1 of the first auxiliary request the controlling feature of claim 1 of the main request is amended to:

"controlling by means of the control unit (12) and pulse technology a change of the electrical voltage supplied to the motor in a direction such as to reduce the deviation".

Independent claim 1 of the second auxiliary request comprises compared to claim 1 of the main request the additional feature:

"selecting a desired flow and sending a signal (q) to a control unit (12) which in turn selects a corresponding curve or table in a memory (14)".

In independent claim 1 of the third auxiliary request the controlling feature of claim 1 of the second auxiliary request is amended to:

"controlling by means of the control unit (12) and pulse technology a change of the electrical voltage

supplied to the motor in a direction such as to reduce the deviation".

Reasons for the Decision

1. *Procedural matters*

1.1 The board considered it to be expedient to hold oral proceedings for reasons of procedural economy (Article 116(1) EPC). The appellant, which was duly summoned, had informed the board that it did not intend to take part in the oral proceedings and, indeed, was absent. The oral proceedings were therefore held in the absence of the appellant (Rule 71(2) EPC, Article 11(3) RPBA).

1.2 In the communication accompanying the summons, objections under Article 56 EPC were raised in respect of claim 1 of the main request pending at the time. The appellant was thereby informed that at the oral proceedings it would be necessary to discuss these objections and, consequently, could reasonably have expected the board to consider at the oral proceedings these objections not only in respect of the amended main request but also, if this request failed, in respect of the auxiliary requests, all as filed in reply to the summons. In deciding not to attend the oral proceedings the appellant chose not to make use of the opportunity to comment at the oral proceedings on these objections but, instead, chose to rely on the arguments as set out in the written submissions, which the board duly considered below.

In view of the above and for the reasons set out below, the board was in a position to give at the oral proceedings a decision which complied with the requirements of Article 113(1) EPC.

1.3 For procedural economy the board will in the following first analyse the question of inventive step in relation to the subject-matter of claim 1 of the third auxiliary request. Its scope is in essence more restricted than that of claim 1 of each of the higher ranking requests (see point 3 below).

2. *Third auxiliary request: Inventive step (Article 56 EPC)*

2.1 Notwithstanding possible objections under Articles 84 and 123(2) EPC the board is in a position to examine whether or not the subject-matter of claim 1 of the third auxiliary request involves an inventive step.

2.2 The board preliminarily notes that claim 1 contains a number of terms and passages which require interpretation:

2.2.1 In various parts of claim 1 the term "current consumption" is used. This term is not appropriate since current is not "consumed". According to the description, a voltage drop across a resistor connected in series with the motor is proportional to the "current consumption" of the motor (page 3, lines 20-23). From this it follows that "current consumption" simply means "current" here. This interpretation, which also makes technical sense within the context of the claim, will be used by the board in the following.

2.2.2 The feature "controlling by means of ... pulse technology" is not well defined in the relevant technical field. It is understood to comprise a controlling by means of pulse width modulation. This interpretation is in accordance with the passage at page 5, lines 16-17 of the description in that pulse width modulation minimises the power dissipation in the motor.

2.2.3 The "predetermined curve or table" referred to in various parts of claim 1 is understood to be the same curve or table as the "corresponding curve or table" and the "chosen curve or table" both also referred to in the claim. It is also understood that "the chosen predetermined curve and table" should read "the chosen predetermined curve or table".

2.2.4 Since currents, speeds, curves and tables are different entities, the last feature of claim 1, i.e. "repeatedly ... comparing ... the actual current and actual speed values with the chosen predetermined curve and table" is understood such that the actual current and actual speed values are compared to current and speed values as represented by the predetermined curve or table.

2.3 The board considers D1 as representing the closest prior art and so did the appellant.

2.3.1 D1 discloses, using the language of claim 1 of the third auxiliary request, a method for flow regulation of a fan powered by an electrical motor, for maintaining the flow from the fan at a chosen predetermined value (see D1, the abstract), the fan

having a filter positioned at the suction side (abstract and col. 3, lines 26-33), wherein values representing the actual current and the actual speed of the motor are determined and wherein the actual current of the motor is determined by means of a series resistor (col. 4, lines 46-52). The preferred method includes the following steps:

- selecting a desired flow and sending a signal to a control unit 12 (col. 4, lines 41-46, and Fig. 4);
- determining the actual speed of the motor (col. 4, lines 48-50);
- comparing an actual flow value which is calculated using the actual current and the actual speed value to a predetermined flow value (col. 5, lines 7-11);
- determining a deviation in the actual flow value as compared with the predetermined or desired flow value (col. 5, lines 11-15);
- controlling by means of the control unit 12 and pulse technology a change in the pulse width of voltage pulses supplied to the motor in a direction such as to reduce the deviation (col. 4, line 52 - col. 5, line 22); and
- repeatedly determining the actual current and actual speed values and, in the control unit, comparing the prevailing flow calculated using the actual current and actual speed values with the chosen predetermined flow value, and controlling the pulse width. When no deviation is found from the predetermined flow the prevailing flow is maintained (ibidem).

In D1, the motor speed is preferably derived from the measured back EMF of the motor (col. 2, lines 27-34, and col. 4, lines 48-50). Further, the actual current and actual speed values are used to calculate the

airflow using an algorithm (col. 4, lines 17-26, and col. 5, lines 1-11).

2.3.2 The board notes that pulse width modulation changes the electrical power supplied to a motor by switching on and off the voltage and current supplied to it at intervals of variable lengths. In this sense, a control of a change in the electrical power by pulse width modulation implies a control of a change in the electrical voltage as claimed, and in the electrical current.

2.4 The claimed subject-matter differs from the method of D1 in that (a) the actual speed of the motor is determined by creating a pulse signal in the motor, the pulse signal being converted into a motor speed indicating signal, in that (b) the control unit selects a curve or table in a memory corresponding to the selected flow, in that (c) the actual current and actual speed values are compared with current and speed values of the selected curve or table of a plurality of curves or tables stored in the memory in the control unit, which curves or tables indicate the correlation between the current and speed for predetermined flows of the fan, and in that (d) a deviation in the actual current as compared with the predetermined value in the selected curve or table is determined.

2.5 The problem underlying the above distinguishing feature (a) may be seen in improving the accuracy of the measurement of the speed of the motor as compared with a measurement based on back EMF. The problem underlying features (b) to (d) may be seen in providing an alternative way of maintaining the actual airflow equal

to the predetermined airflow, using the same input parameters, i.e. actual speed and current.

2.6 With respect to feature (a) the question to be answered is whether, at the priority date, it was obvious for a person skilled in the art to modify the method of D1 in such a way that the motor speed is measured by means of a pulse signal.

The board notes that the use of a magnetic actuator mounted to a motor's rotor for generating pulse signals to be sensed by an associated sensor for measuring the rotor speed is a well known method in order to accurately determine the motor speed. This finding was not contested by the appellant. Further, in the board's view, the skilled person would have evaluated the trade-off between a more accurate speed measurement provided by such a method on the one hand and the necessity of providing an additional actuator and an associated sensor on the other hand (see also D1, col. 2, lines 27-39). The skilled person would therefore have selected without the exercise of inventive skill a measurement using a magnetic actuator and sensor if the circumstances required this.

2.7 With respect to features (b) to (d) the board notes that D1 essentially teaches that only maintaining the motor current constant is insufficient for maintaining a constant flow rate and that for a given flow rate a unique relationship exists between the motor speed and the current. By monitoring these two parameters it is possible to control the power supply to the motor to provide a constant rate of flow notwithstanding changes

in the load conditions (col. 1, line 56 - col. 2, line 8).

More specifically, Figure 2 shows a set of curves relating the motor current I to the fan speed N for different constant flows Q_1, Q_2, Q_3. The points X→Y→Z illustrate an example of the response of the control system (col. 5, lines 23-41). This example starts at an initial pair of current and speed values X producing a selected flow Q_1 and ends at a value Z producing again the selected flow Q_1 and goes via a value Y producing a flow deviating from Q_1.

Hence, Figure 2 suggests to the skilled person to base the regulation of the flow on a direct adjustment of the current and/or speed in case of a deviation from the desired flow curve, e.g. Q_1. Implementing such a method of flow regulation using the electronic control system of D1 including a microprocessor 12 as shown in Figure 4 would require the storage of the pairs of current and speed values corresponding to the different flows Q_1, Q_2, Q_3, e.g. in the form of tables, in a memory. Actual speed and current values would then be compared with the speed and current values corresponding to the selected flow, e.g. Q_1, and be corrected repeatedly until no deviation is found.

The skilled person faced with the problem of finding an alternative method to the preferred embodiment of D1 would therefore have recognized from Figure 2 of D1 that the motor power control may alternatively be based on a determination of a deviation in the actual current value from any of the points of the curve representing the desired constant flow and on a direct control of

the current, and, hence, voltage (see point 2.3.2 above) supplied to the motor and would therefore have implemented it in an electronic control system resulting in the inclusion of the features (b) to (d) in the above-mentioned method known from D1 (see point 2.3.1).

The appellant argued that the curves in Figure 2 were only for illustrative purposes and that the method of D1 required the intermediate step of calculating the actual flow value on the basis of the actual speed and the actual current. The board notes, however, that this intermediate step is only part of a preferred embodiment, see the description at column 4, lines 17-32 and column 5, lines 7-22, according to which the actual flow is calculated and compared with the desired flow (see also D1, claim 5). The teaching of Figure 2 is however more general.

2.8 As the inclusion of features (a) to (d) is held to be obvious to the skilled person and the board is not aware of any synergistic effect between feature (a) on the one hand and features (b) to (d) on the other hand, the subject-matter of claim 1 lacks an inventive step (Articles 52(1) and 56 EPC). Consequently, the third auxiliary request is not allowable.

3. As already pointed out at point 1.3 above, the scope of claim 1 of each of the higher ranking requests is in essence broader. The board notes that according to claim 1 of the main and second auxiliary requests a change in the electrical voltage is controlled, whereas according to claim 1 of the first and third auxiliary requests the electrical current is controlled. For the

reasons set out at point 2.3.2, this distinction does not contribute to an inventive step.

Consequently, the subject-matter of claim 1 of each of these requests does not involve an inventive step (Articles 52(1) and 56 EPC) having regard to the teaching of D1 and taking into account the common general knowledge of the person skilled in the art for the reasons set out above. Hence, none of the requests is allowable.

The appeal must therefore be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar The Chairman

D. Magliano F. van der Voort