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**Datasheet for the decision  
of 29 July 2014**

**Case Number:** T 0933/11 - 3.5.05

**Application Number:** 03021497.7

**Publication Number:** 1406152

**IPC:** G06F3/00

**Language of the proceedings:** EN

**Title of invention:**

Inner-force providing input device having a power-operated actuator for generating a click feel

**Applicant:**

ALPS ELECTRIC CO., LTD.

**Headword:**

Force-feedback device/ALPS

**Relevant legal provisions:**

EPC Art. 56, 84

**Keyword:**

Clarity - (yes, after amendment)  
Inventive step - (yes, after amendment)

**Decisions cited:**

**Catchword:**



**Beschwerdekammern  
Boards of Appeal  
Chambres de recours**

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Case Number: T 0933/11 - 3.5.05

**D E C I S I O N**  
**of Technical Board of Appeal 3.5.05**  
**of 29 July 2014**

**Appellant:** ALPS ELECTRIC CO., LTD.  
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**Representative:** Klunker/Schmitt-Nilson/Hirsch  
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**Decision under appeal:** **Decision of the Examining Division of the  
European Patent Office posted on 12 November  
2010 refusing European patent application  
No. 03021497.7 pursuant to Article 97(2) EPC.**

**Composition of the Board:**

**Chair** A. Ritzka  
**Members:** K. Bengi-Akyuerek  
F. Blumer

## Summary of Facts and Submissions

I. The appeal is against the decision of the examining division, posted on 12 November 2010, to refuse European patent application No. 03021497.7 on the ground of lack of inventive step (Article 56 EPC) with respect to a main request and a first auxiliary request, having regard to the disclosure of

D1: US-A-6 154 201,

combined with the skilled person's common general knowledge as evidenced by

D3: L.B. Rosenberg et al.: "Perceptual Decomposition of Virtual Haptic Surfaces", Proceedings of IEEE Symposium on Research Frontiers 1993, pp. 46-53, October 1993;

D4: P.A. Millman et al.: "Effects of Non-Uniform Environment Damping on Haptic Perception and Performance of Aimed Movements", Proceedings of ASME Dynamic Systems and Control Division, pp. 703-712, 1995;

D5: US-A-5 629 594,

and on the ground of lack of clarity (Article 84 EPC) with respect to a second auxiliary request.

Additionally, in an *obiter dictum*, the decision under appeal further stated that the independent claims of the second auxiliary request also lacked an inventive step (Article 56 EPC) in view of D1 combined with the skilled person's common general knowledge as evidenced by documents D2 (US-A-6 147 674) to D5.

- II. Notice of appeal was received on 10 January 2011. The appeal fee was paid on the same day. With the statement setting out the grounds of appeal, received on 22 March 2011, the appellant filed claims according to a main request and first to fourth auxiliary requests. In addition, it submitted an excerpt from the book "Physikalische Formeln und Tabellen" as evidence of the basic laws of mechanics. It requested that the decision of the examining division be set aside and that a patent be granted on the basis of the main request or one of the auxiliary requests.
- III. A summons to oral proceedings scheduled for 29 July 2014 was issued on 15 May 2014. In an annex to this summons, the board expressed its preliminary opinion on the appeal pursuant to Article 15(1) RPBA. In particular, objections were raised under Articles 84 and 123(2) EPC. Furthermore, the appellant was also informed that the board took the preliminary view that the cited prior-art documents D1 to D5 did "not appear to anticipate or hint at converting a damping-type force effect to impulses defined by configurable torques/forces and time units at a critical input position".
- IV. With a letter of reply dated 27 June 2014, the appellant submitted amended claims according to a main request and first to fifth auxiliary requests alongside counter-arguments with regard to the objections raised in the board's communication under Article 15(1) RPBA, and requested that a patent be granted on the basis of the main request or one of the auxiliary requests.
- V. Oral proceedings were held as scheduled on 29 July 2014, during which the appellant filed a new main request (labelled "Auxiliary Request 1\*") replacing the

former requests, in response to objections under Article 123(2) EPC raised by the board in its communication under Article 15(1) RPBA and maintained during the oral proceedings.

The appellant's final request was that the decision under appeal be set aside and that a patent be granted on the basis of the main request, filed as "Auxiliary Request 1\*" during the oral proceedings before the board.

At the end of the oral proceedings, the decision of the board was announced.

VI. **Claim 1** of the main request reads as follows:

"An inner-force providing input device comprising:  
an operating member (1) to be manually rotated;  
a power-operated actuator (2) for providing a torque to the operating member (1);  
rotation angle detecting means (3) for detecting a rotation angle of the operating member (1);  
operating velocity detecting means (4a) for detecting an angular velocity of the operating member (1); and  
control means for controlling the power-operated actuator (2) depending upon an[sic] rotation angle detected by the rotation angle detecting means (3) and an angular velocity detected by the operating velocity detecting means (4a);  
wherein the control means is set such that, while the operating member rotates from a predetermined first angle to a predetermined third angle beyond a predetermined second angle, when the operating member (1) is within a range of from the first angle to the second angle, a torque in a same direction as a rotating direction of the operating member is provided

from the power-operated actuator (2) to the operating member (1) and decreased with an increase in rotation angle of the operating member (1), and when the operating member is within a range of from the second angle to the third angle, a torque in a reverse direction to a rotating direction of the operating member (1) is provided from the power-operated actuator to the operating member and increased with an increase in rotation angle of the operating member, characterized in that

the control means is further set such that, when the operating member (1) reaches the second angle,

a torque product value is calculated as a product of the angular velocity of the operating member (1) detected at this time by the operating velocity detecting means (4a) and a preset proportional multiplier,

an impact torque and a provision time for the impact torque are set on the basis of the calculated torque product value, wherein:

the provision time consists of one or more unit time intervals,

an individual magnitude of the impact torque is set for each of the unit time intervals,

the individual magnitude of the impact torque is constant and equal to or smaller than a maximum torque value during each of the unit time intervals,

the individual magnitude of the impact torque is set to the maximum torque value for all but the last unit time intervals, and

the individual magnitude of the impact torque for the last unit time interval is set to such a value that the sum of the individual magnitudes of the impact torque of all unit

time intervals, multiplied by the duration of one unit time interval, equals the calculated torque product value, and the impact torque is provided over the provision time from the power-operated actuator to the operating member in a reverse direction to a rotation direction of the operating member (1)."

The further independent **claim 4** of the main request reads (with the main differences to claim 1 underlined by the board):

"An inner-force providing input device comprising:  
an operating member to be manually operated straight-line;  
a power-operated actuator for providing a force to the operating member;  
position detecting means for detecting a position of the operating member;  
operating velocity detecting means for detecting a moving velocity of the operating member; and  
control means for controlling the power-operated actuator depending upon a position detected by the position detecting means and a moving velocity detected by the operating velocity detecting means;  
wherein the control means is set such that, while the operating member moves from a predetermined first position to a predetermined third position beyond a predetermined second position, when the operating member is within a range of from the first position to the second position, a force in a same direction as a moving direction of the operating member is provided from the power-operated actuator to the operating member and decreased with an increase in moving distance of the operating member, and  
when the operating member is within a range of from the

second position to the third position, a force in a reverse direction to a moving direction of the operating member is provided from the power-operated actuator to the operating member and increased with an increase in moving distance of the operating member, characterized in that

the control means is further set such that, when the operating member reaches the second position,

an impulse value is calculated as a product of the moving velocity of the operating member detected at this time by the operating velocity detecting means and a preset proportional multiplier,

an impact force and a provision time for the impact force are set on the basis of the calculated impulse value, wherein:

the provision time consists of one or more unit time intervals,

an individual magnitude of the impact force is set for each of the unit time intervals,

the individual magnitude of the impact force is constant and equal to or smaller than a maximum force value during each of the unit time intervals,

the individual magnitude of the impact force is set to the maximum force value for all but the last unit time intervals, and

the individual magnitude of the impact force for the last unit time interval is set to such a value that the sum of the individual magnitudes of the impact force of all unit time intervals, multiplied by the duration of one unit time interval, equals the calculated impulse value, and

the impact force is provided over the provision time from the power-operated actuator to the



operating member in a reverse direction to a moving direction of the operating member."

## **Reasons for the Decision**

1. The appeal is admissible.
2. MAIN REQUEST

Although this request was submitted during the oral proceedings before the board, i.e. at a very late stage of the overall procedure, the board admitted it into the proceedings under Article 13(1) and 13(3) RPBA, since it was regarded as a successful attempt to overcome all the outstanding objections and since the board could deal with it without having to adjourn the oral proceedings.

Claim 1 of the new main request, directed towards an inner-force input device with a rotatable operating member, differs from claim 1 of the main request underlying the appealed decision essentially in that it further details the phase when the operating member reaches the second angle by specifying that (emphasis added by the board)

- A) a torque product value is calculated as a product of the angular velocity of the operating member detected at this time by the operating velocity detecting means and a preset proportional multiplier;
- B) an impact torque and a provision time for the impact torque are set on the basis of the calculated torque product value;

- C) the provision time consists of one or more unit time intervals;
- D) an individual magnitude of the impact torque is set for each of the unit time intervals being constant and equal to or smaller than a maximum torque value during each of the unit time intervals;
- E) the individual magnitude of the impact torque is set to the maximum torque value for all but the last unit time intervals;
- F) the individual magnitude of the impact torque for the last unit time interval is set to such a value that the sum of the individual magnitudes of the impact torque of all unit time intervals, multiplied by the duration of one unit time interval, equals the calculated torque product value;
- G) the impact torque is provided over the provision time from the power-operated actuator to the operating member in a reverse direction to a rotation direction of the operating member.

Present independent claim 4, directed to an alternative inner-force input device with a linearly movable operating member in accordance with Rule 43(2)(c) EPC, differs from claim 1 basically in that the angular parameters (i.e. "rotation angle", "angular velocity", "rotation direction", "torque", and "torque product") have been replaced by linear parameters (i.e. "position", "moving velocity", "moving direction", "force", and "impulse" respectively) throughout claim 4 (cf. point VI above).

The amendments according to features A) to C) and G) were made in response to the objections raised by the board under Article 84 EPC (cf. board's communication

under Article 15(1) RPBA, section 3.1), whilst the amendments in relation to features D) to F) were made in reaction to the objections under Article 123(2) EPC raised in the board's communication (cf. section 5.1) and maintained at the oral proceedings before the board.

Feature A) is supported by page 14, lines 7-16 and page 18, lines 10-19, whilst features B) and G) are based on page 14, line 25 to page 15, line 7 and page 18, line 20 to page 19, line 2 in conjunction with Fig. 3 of the application as filed. Features C) to F) are supported by Figs. 4 to 6 in conjunction with page 15, line 14 to page 16, line 9 of the original application, in particular by the teaching that the "torque product  $k\omega$  is an area of the hatched part shown in Fig. 4" (cf. page 15, lines 19-20) and the fact that the "hatched part" corresponds to the summed area of the rectangular curves built by the respective torque and time values in Figs. 4 to 8 (rather than demonstrating unequivocally that an "integral of the torque over time" is calculated, as asserted by the appellant at the oral proceedings before the board). Moreover, the corresponding features of claim 4 are supported e.g. by page 21, lines 15-24 of the application as filed.

Hence, the board is satisfied that the above amendments comply with Article 123(2) EPC.

## 2.1 Article 84 EPC

The examining division found that the phrases "a torque and a time constitute the torque product" and "a force and a time constitute the impulse" used in the former independent claims of the then pending first and second

auxiliary requests were obscure, since the torque/force and the associated time could only *be derived from* (rather than *constitute*) the corresponding torque product/impulse (cf. appealed decision, page 8, section 3.1 and page 9, section 4.1).

As a result of the above amendments, in particular of those according to features A) to C), the board is satisfied that the above objection no longer applies. Hence, the board concludes that the present claims comply with Article 84 EPC.

## 2.2 Article 52(1) EPC: Novelty and inventive step

The board judges that the independent claims of this request meet the requirements of Article 52(1) EPC in conjunction with Articles 54 and 56 EPC, for the following reasons:

- 2.2.1 The present invention concerns a force-feedback input device for both angular and linear movements of its operating unit. According to the present application, the problem to be solved by independent claims 1 and 4 is to provide an electrical input device capable of generating a "clear click feel" at a certain input position similar to that of a click mechanism of a mechanical input device (see e.g. page 4, lines 1-13 and page 19, lines 17-21 of the application as filed). This problem is essentially solved by providing an impact in the form of a torque or a force to the user at the critical input position (cf. page 6, lines 10-12 and page 19, lines 21-26 of the application as filed).
- 2.2.2 The board concurs with the finding of the decision under appeal and the appellant (cf. statement setting out the grounds of appeal, page 16, section 5.1) that

document D1 constitutes the closest prior art for the subject-matter of the present independent claims, since it is, like the present invention, also related to a haptic force-feedback input device based on using various detents to mark three input positions by means of spring-type (i.e. displacement-dependent) force effects.

2.2.3 According to the teaching of D1, a rotatable or linearly movable "control knob 18" of the input device ("device 10") experiences an "assistive force F" when moved clockwise from a first position "P1" to a second position "O1" whilst that assisting force is decreased in magnitude until no force is output when the knob is positioned at the second position (see e.g. column 14, lines 44-52 in conjunction with Fig. 6A). Furthermore, when moving the knob clockwise away from the second position, the knob experiences a "resistive force F" with an increasing magnitude until it reaches a third position "P2" (see e.g. column 14, lines 57-62 in conjunction with Fig. 6A).

Therefore, the board agrees with the finding of the decision under appeal (cf. Grounds for the Decision, section 2.1) that D1 anticipates all features of the preamble of independent claims 1 and 4.

2.2.4 However, the board finds that D1 fails to disclose the characterising portion of present claims 1 and 4, i.e. features A) to G), since D1 is silent as to a two-stage process applied at a critical input position (i.e. at the second position "O1") which consists in first applying a velocity-dependent calculation of a torque or impulse value (according to a damping-type force effect) and then converting that value into a corresponding impact torque or force provided over a

certain "provision time". Thus, the subject-matter of claims 1 and 4 of the main request is novel over D1 (Article 54 EPC).

- 2.2.5 The board accepts that the above distinguishing features A) to G) contribute to an overall synergistic effect of generating a feel similar to that of a mechanical click mechanism ("clear click feel") when the respective operating member reaches the second angle or position according to the wording of present claims 1 and 4. The board is also satisfied that the above effect can be derived from the application as filed (see e.g. page 19, lines 17-26).

Hence, the objective technical problem to be solved by claim 1 may be formulated as "how to provide a click feel resembling that of a mechanical device to a user of an electrical force-feedback input device as described in D1 when reaching a critical input position".

- 2.2.6 Starting out from the teaching of D1, the skilled person would first notice that it also teaches a combination of spring-type (displacement-dependent) and damping-type (velocity-dependent) force effects (see in particular column 10, lines 62-67). In this context, the board agrees with the finding in the decision under appeal (cf. section 2.4) that feature A) *per se*, i.e. the calculation of a velocity-dependent torque or force value upon reaching a critical input position, is rendered obvious by that teaching of D1. Nonetheless, as to the conclusion reached in the impugned decision with regard to feature A), it no longer matters - in view of the amendments made according to features B) to G) - whether the skilled person would indeed consider and apply damping-type force sensations in combination

with spring-type force effects, as apparently evidenced by documents D3 to D5 (cf. appealed decision, Grounds for the Decision, section 2.4). What matters for the assessment of inventive step in the present case is whether the skilled person would envisage the conversion of any such damping-type force sensation from a one-dimensional physical quantity (i.e. a torque/force product) to a two-dimensional quantity (i.e. the product of torque/force magnitude and provision time) as claimed.

However, D1 fails to provide any hint towards providing a "click feel" and is silent as to actually converting a damping-type (velocity-dependent) force effect to impact torques or impulses defined by configurable torques/forces and time units at a critical input position in a two-stage process, as implied by distinguishing features A) to G). In other words, electronically simulating a mechanical click mechanism is not of concern at all in D1. The only more specific problem to which D1 refers is that, in the event of closely spaced detents, the user might unintentionally move the knob past the second detent due to the assistive detent forces of the second detent (see D1, column 15, lines 7-23). Rather, the board considers that the skilled person in the field of haptic devices, regardless of the usability of the allegedly well-known pulse width modulation technique (cf. appealed decision, Grounds for the Decision, sections 3.4 and 5.2) and the adjustability of a maximum force value and its provision time (cf. appealed decision, *Obiter Dictum*, section 7.3), would be deterred from applying an overly intricate process according to features A) to G) of claim 1 to the system of D1, i.e. translating a single, already calculated velocity-based force value into a tuple made up of a duly set torque/force

magnitude and its provision time. Even if the person skilled in the art were to take up the pulse width modulation technique to deliver energy to an electrical actuator as a function of the signal amplitude and a time signal, as assumed by the examining division, the board finds that the skilled person would still not arrive at the solution that a physical quantity based on a rotating/moving velocity is translated to specific impact torque/force over time scenarios according to features D) to F). Hence, the board sees no reason why the skilled person, starting from D1, would come up with such a solution which credibly provides a synergistic effect going beyond the sum of the individual effects of the above distinguishing features.

2.2.7 Moreover, the board considers that none of the other documents on file, i.e. D2 to D5, whether taken alone or in combination with the disclosure of D1, renders the subject-matter of claims 1 and 4 obvious, for the following reasons:

Document D2 relates to a haptic mouse or joystick based on modeling force feedback sensations with different force profiles such as spring-type, damping-type or texture-type force effects. Even though it contains pointers towards the combined use of damping-type and spring-type force effects (see column 17, line 64 to column 18, line 13 in conjunction with Fig. 6) and the use of force profiles based on "impulse level" over "settle time", (see column 24, lines 16-39 in conjunction with Fig. 9), there is no disclosure or hint discernible as to converting a damping-type, i.e. velocity-dependent, force effect to outputs defined by configurable torques/forces and time units at a critical input position.



Documents D3 to D5 were introduced into the examination proceedings by the examining division merely as evidence of the common general knowledge regarding the usefulness of combining spring-type and damping-type haptic feedback profiles (see e.g. D3, Table 1; D4, Fig. 2; D5, column 10, line 18 to column 11, line 27 in conjunction with Figs. 15a and 15b). However, they neither touch on the issue of providing a click feel to a user of a force-feedback input device when reaching a critical input position nor provide any pointer, incentive or motivation to convert a one-dimensional physical quantity to a two-dimensional quantity via a two-stage process.

Therefore, even if the teachings of D2 to D5 were to be combined with D1, the skilled person would not arrive at the claimed solution.

2.2.8 In conclusion, having regard to the cited prior art, the subject-matter of independent claims 1 and 4 is held to be new and to involve an inventive step within the meaning of Article 52(1) EPC in conjunction with Articles 54 and 56 EPC.

2.3 Since all the other requirements of the EPC are also found to be fulfilled, the board decides to grant a patent on the basis of claims 1 to 4 according to the main and sole request.

## Order

### For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance with the order to grant a patent on the basis of the following documents:

Description (pages):

- 2, 3, 6, 7, 10 to 21 as originally filed;
- 1, 4, 4a, 5, 8, 9 as submitted with letter of 13 October 2006;

Claims (Nos.):

- 1 to 4 of the main request, filed as "Auxiliary Request 1\*" during the oral proceedings before the board;

Drawings (sheets):

- 1/4 to 4/4 as originally filed.

The Registrar:

The Chair:



K. Götz-Wein

A. Ritzka

Decision electronically authenticated