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D E C I S I O N
of 15 January 1996

Case Number: T 0781/94 - 3.5.1

Application Number: 85110377.0

Publication Number: 0211984

IPC: G06K 11/18

Language of the proceedings: EN

Title of invention:
Computer data entry and manipulation apparatus

Patentee:
VPL RESEARCH, INC.

Opponent:
VIRTUALITY ENTERTAINMENT LIMITED

Headword:
-

Relevant legal provisions:
EPC Art. 56, 100(a), (c), 123(2)

Keyword:
"Amendments before grant (admissible) - claim not more specific than disclosed"
"Amendments in opposition appeal (admissible) - added features disclosed"
"Inventive step (yes) - modification of known system not obvious from either one of other prior art documents"

Decisions cited:
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Catchword:
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Case Number: T 0781/94 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal 3.5.1
of 15 January 1996

Appellant: (Proprietor of the patent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 17 June 1994 revoking European patent No. 0 211 984 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: P. K. J. van den Berg
Members: W. B. Oettinger
G. Davies

Summary of Facts and Submissions

I. The appeal contests the opposition division's decision, following an admissible opposition invoking the grounds mentioned in Article 100(a) (54 and 56) and (c) EPC, to revoke the European patent No. 0 211 984 granted on patent application No. 85 110 377.0 filed on 19 August 1985.

II. The reasons given for the revocation were that:

- the subject-matter of claim 1 lacked an inventive step, and
- claim 4 extended beyond the content of the application as filed.

The lack of inventive step objection was based on the following prior art documents:

D6: P. J. Kilpatrick: Dissertation "The Use of a Kinesthetic Supplement in an Interactive Graphics System", University of North Carolina 1976 (University Microfilm International, 15 February 1977), and

D8: GB-A-2 013 617.

Referring to the notice of opposition, the opposition division concluded lack of inventive step also for the dependent claims. In that notice, inter alia, the following prior art documents were cited in addition:

D1: US-A-4 414 537,

D9: M. W. Krueger: "Artificial Reality", Addison-Wesley Publishing Company 1983, pages 105-108, 147.

In respect of a further document cited (D7), the opposition division added that the opponent had not established that this document was published before the filing date of the patent application.

III. The appeal against that decision, which was issued on 17 June 1994, was lodged by the patentee on 25 August 1994 with a request that the decision be set aside and the opposition rejected or, at least, that the patent be maintained in amended form. The appeal fee was paid on the same day.

On 24 October 1994, the appellant filed a statement of grounds of appeal.

IV. Together with that statement, the appellant filed new claims for a first and a second subsidiary request.

V. No response to the statement of grounds of appeal was received from the opponent.

VI. In an annex to the summons for oral proceedings, requested auxiliarily by the appellant, the Board communicated to the parties

- its provisional view that the subject-matter of the main request claim 1 would seem to lack novelty against D6 and that of the subsidiary requests to lack inventive step against D6 and, in particular, D9;

- its provisional view that the amendments made to the second subsidiary request claim 2 would appear to be inadmissible; and

- its provisional view that the amendments made to main request claim 4 (and corresponding subsidiary claims) would appear admissible.

VII. No response to the Board's invitation to present their comments was received either from the appellant or from the respondent.

VIII. In the oral proceedings, held on 15 January 1996, the appellant filed new

- claims 1 to 8,
- description pages 2, 3 and 5 (columns 1 to 4 and 7 to 8), and
- drawing sheet 4 (Figures 10 to 13),

requesting that the decision under appeal be set aside and the patent be maintained as amended, ie. on the basis of these new documents.

IX. The independent claim reads as follows:

"1. An apparatus for entering data into a computer according to gestures of the hand of an operator, comprising
gesture sensing means including sensors adapted to be fixed to the hand, for detecting gesture specifying flexing movements within the hand and
signal processing means coupled to said gesture sensing means for generating control signals according to said gesture specifying flexing movements,

characterized by the fact that said sensors are fixed in a glove (12), said sensors being of the type that provides a signal that is an analog representation of their degree of bend, and said sensors comprising at least one flex sensor for each finger and thumb (36, 40, 82), a flex sensor between the thumb and index finger (84), a flex sensor between the index finger and the middle finger (86) and a flex sensor across the palm (88),

and characterized by the fact that it comprises a transducer (17) fixed on the glove and a position sensing receiver assembly (18) for sensing the spatial position of said glove,

said signal processing means being also coupled to said position sensing means (17, 24) to move a cursor (26) in accordance with said position specifying movements of the hand,

said signal processing means further controlling said cursor (26) so as to implement functions or operations on virtual objects in accordance with said gesture specifying flexing movements of the hand."

Dependent claims 2 and 3 define additional sensors used.

Dependent claims 4 to 8 are identical, apart from their changed numberings and references, to granted claims 2 to 6, with claim 6 reading as follows:

"The apparatus of claim 5, including means for displaying the cursor (28) as a representation of a hand which corresponds to the position and gesture of the operator's hand."

X. In support of this request, the appellant argued essentially as follows:

Contrary to the tong tool of D6, in virtual reality it is essential that the user can move about freely and that, contrary to the limited manipulations that can be carried out with the tool of D6, a wide range of actions can be performed. Essentially, this is implemented in the claimed apparatus by using a glove with analog flex sensors fixed to it at all important places, and a non-mechanical device for continuously determining the spatial position of that glove. D6 is of no help for the aforementioned goals and for the claimed solution.

The same applies to D9, in particular as it does not give any details on sensors.

D1 relates to character entering and thus not to the virtual world.

Due to certain constraints of the graphic system of D7, the claimed subject-matter would not be rendered obvious by this document either.

Optionally, in the claimed apparatus, the flex sensors may be supplemented by hand orientation and wrist motion sensors.

XI. The respondent disagreed and requested that the appeal be dismissed, arguing in essence as follows:

The appellant is not entitled, on the basis of what was disclosed, to claim that the cursor, apart from representing symbolically a hand, would mirror the flexures of the fingers and other parts of the operator's hand. Even though the application teaches that flexing movements of the fingers are sensed, there

is no disclosure that these movements would be translated on the cursor. The significance of the term "functions or operations" is not disclosed. The term "manipulate", which is disclosed, does not require flexing fingers but only changing the thumb/finger distance as in D6. The disclosure may include a "realistic" cursor but the skilled reader would not have included it because, at the time, such kind of cursor was not usual.

In any case, if the disclosure of such a cursor were taken as being sufficient, its claimed use would not be inventive for the reasons stated in the Board's communication and, in particular, having regard to D9 and D6 and, if felt necessary, D1. There is a wealth of information in the prior art for all features claimed, if desired.

Reasons for the Decision

1. The appeal (cf. III) is admissible.

2. *Amendments*

The issue of admissibility of amendments arises both in respect of amendments made before grant of the patent and of amendments made in the opposition appeal proceedings. The various aspects of this issue will be dealt with, for all claims, in turn.

2.1 It was tacitly accepted both by the opponent (Article 100(c) EPC) and by the opposition division (Article 123(2) EPC) that granted claim 1 was not

amended, in the examination procedure, in such a way that the patent contained subject-matter which would extend beyond the content of the application as filed.

The Board agrees with this finding implicit in the decision under appeal because, apparently:

- the introductory definition in the preamble of granted claim 1 was based on that of claim 2 of the patent application as filed,
- the preamble was furthermore based, in effect, on all of the original claims 1, 2 and 3, these claims all relating to the same apparatus (claims 1 and 2) and its function (claim 3) as disclosed, stressing only different aspects of the signals or data to be generated or entered,
- the first characterising feature was based on the same original claims,
- the second characterising feature was based on the original claims 1 and 3 and on the description as filed, and
- the third characterising feature was based on the description.

2.2 In respect of the question of admissibility in the sense of Article 123(2) EPC of the amendments made to claim 1, it remains therefore to investigate whether the amendments made in addition are admissible.

As a comparison of claim 1 (cf. point IX) with granted claim 1 (cf. published patent) reveals, these additional amendments consist in

- the omission of reference numerals in the preamble,

- the insertion of the first characterising feature and

- the replacement of the first characterising feature of granted claim 1 by the second characterising feature of claim 1 on file.

2.3 The omission of reference numerals does not change the subject-matter of the claim (Rule 29(7) last sentence).

The inserted first characterising feature is based on the description of the application as filed (page 7, lines 18 to 24, page 8, lines 10 to 12, page 9, lines 28 to 33).

To the extent that the second characterising feature is more specific than the first characterising feature replaced, this is disclosed in the description as filed (ia. page 5, lines 23 and 28 to 30).

The term "position" still includes any change of position, ie. movements, and the term "spatial" apparently implies "relative to said computer".

2.4 In summary, thus (2.1 to 2.3), claim 1 complies with Article 123(2) EPC.

2.5 As a separate requirement, it has to be established whether claim 1 was amended during the opposition and appeal proceedings in such a way as to extend the protection conferred (Article 123(3) EPC).

For this purpose, it suffices to investigate whether the aforementioned additional amendments (cf. 2.2) would broaden the scope of protection.

2.6 Apparently, this is not the case because both the inserted first characterising feature and the modified second (cf. 2.3) have the effect of restricting the subject-matter claimed.

2.7 In summary, thus (2.5 to 2.6), claim 1 complies also with Article 123(3) EPC.

2.8 Claim 2 adds, to the sensors specified in claim 1, a hand orientation sensor, and claim 3 adds a sensor at the wrist joint.

These features are based on the description (page 10, lines 6 to 10 and 21 to 24).

Although it would seem that wrist motion sensing was expressly disclosed only as an "alternative" (page 10, lines 14 to 17) to the second characterising feature of claim 1, the respondent saw, and the Board sees, no sufficient ground to exclude the possibility that, as an option and for whatever reason (eg. redundancy), sensors are secured at the wrist joint (as in Figures 7 to 9) in addition to the transducer/receiver assembly (17, 18) required by claim 1 (and as shown in Figures 1 to 3).

2.9 Claims 2 and 3, thus, comply with Article 123(2) EPC.

2.10 Neither the opponent (Article 100(c) EPC) nor the opposition division (Article 123(2) EPC) disputed the admissibility of the amendments which resulted in granted claims 2, 3, 5 and 6.

The Board agrees with this finding, implicit in the decision under appeal, and the same then applies to claims 4, 5, 7 and 8 now on file.

2.11 Claims 4, 5, 7 and 8 thus, comply with Article 123(2) EPC.

2.12 There was, and is, no dispute about the fact that means for displaying the cursor as a representation of a hand, as according to claim 6, were disclosed in the application as filed, and that this representation corresponds to the position of the operator's hand (page 3, lines 10 to 14 and Figure 1). The issue to be decided is whether it was disclosed that the said representation corresponds also to the gesture of the operator's hand.

According to the description, as originally filed the routines included in the signal processing (page 10, lines 10 to 11) respond to the output signals of the flex sensors "to identify gestures of the operator's hand" (lines 14 to 15) and manipulates virtual objects "according to commands represented by the gestures ... of the operator's hand" (lines 16 to 18), the hand-shaped cursor being "a dynamic cursor which corresponds in shape to the shape of the glove ..." (lines 25 to 26). In the Board's view, the statement in claim 4 as granted that the representation of a hand by a cursor "corresponds to the ... gesture of the operator's hand" is general enough to be in no way more specific than what can be derived from the aforementioned statements in the description as originally filed. More particularly, if, as stated,

- the gestures of the operator's hand result in sensor signals identifying these gestures,

- these signals result in commands representing said gestures,

- the operator's hand is represented by a hand-shaped cursor,

- the said commands result in manipulation of virtual objects by the said hand-shaped cursor,

it would appear to be only logical that **somehow** (in an **unspecified** way) the representation of the operator's hand by the hand-shaped cursor "corresponds" to the gestures of the operator's hand.

For the issue to be decided it would not appear appropriate to interpret the feature of present claim 6 as being more specific than that. The exact interpretation of this claim, if necessary for determining the extent of protection (Article 69 EPC and Protocol on the Interpretation), may be left to later instances, if and when the need arises.

2.13 Claim 6 is, thus, considered to comply with Article 123(2) EPC.

2.14 Dependent claims, stating only additional features of particular embodiments (Rule 29(3) and (4) EPC) cannot, logically, extend the scope of protection of the independent claim they refer to.

It follows, therefore, from the respective conclusion drawn for claim 1 (point 2.7) that claims 2 to 8 comply also with Article 123(3) EPC.

2.15 The amendments made to the description, in particular the deletion of an illustration of an application for flex sensors which has nothing to do with the quite different application of flex sensors in the claimed

invention and which, therefore, is not considered "useful for its understanding", are all in accordance with Rule 27 EPC.

2.16 All amendments made to the patent are therefore admissible.

3. *Inventive step*

Novelty not being at issue, the only issue left to be decided is whether the subject-matter claimed involves an inventive step. For this issue, it suffices to consider claim 1.

3.1 Although the preamble of claim 1 can be read on prior art other than D6, considering the ultimate purpose of the claimed "apparatus for entering data into a computer" (preamble) as specified in the last characterising feature, viz. "controlling cursor so as to implement functions or operations on virtual objects", this document appears to come nearest to the claimed invention and to represent, therefore, the most appropriate starting point.

3.2 However, the claimed apparatus differs from the "interactive graphics system" and its "kinesthetic supplement" disclosed in D6 by

- (firstly) replacing the handgrip, and any actuators thereon, of a mechanical manipulator with a glove carrying all the sensors as defined in the first characterising feature,

- (secondly) replacing the arm of the mechanical manipulator, and any sensors thereon, with a transducer/receiver assembly for sensing the

position of the operator's hand as defined in the second characterising feature, and

- (thirdly) replacing the virtual hand having the form of a pair of tongs of variable separation by one which allows functions or operations on virtual objects to be implemented in accordance with "gesture" specifying flexing movements of the operator's hand as defined in the third and fourth characterising feature.

3.3 From D6, no incentive is apparent to modify the system disclosed there in such a way.

For the first and second of the aforementioned three differences, this is readily apparent.

As to the third, the only flexing movements of the operator's hand which could be regarded as a kind of "gesture" is the movement which causes the virtual hand to close and open its tongs; in this respect, neither the text of D6 nor its figures (as far as the copies filed by the opponent allow to recognise) discloses that the actuator causing this movement would be of a kind that could be termed "sensor", and even if that were the case, there would be only one such sensor. Contrary to that very limited "gesture", the claimed apparatus allows, by virtue of the use of the output signals of all the different kinds of sensors fixed in the glove, a practically unlimited number of "gestures" to be made use of for the purpose of performing respective functions or operations, or manipulations, on the virtual objects.

3.4 Turning now to D9, because it refers to the system of D6, nothing more can be derived from this document for the three differences identified above (3.2).

For the first and second of said differences, this is apparent from Figure 7.12 and from the text referring to this figure and to Figure 7.13. Even though the pair of tongs of variable separation are replaced, in Figure 7.12, by a pair of articulated jaws giving the impression of a thumb and the rest of a hand, no other "gesture" kind of movements of the graphic manipulator is disclosed than picking up a virtual object. Where D9 refers to "hands and fingers", it does so only in the context of a skeleton allowing or resisting movements of such limbs of a person under computer control (page 106), ie. not in the reverse direction of control, namely manipulation of virtual objects (described on p. 105).

3.5 D1 is clearly not irrelevant to the subject-matter claimed, it being concerned with a man-machine interface for entering data into a computer according to gestures of the hand of an operator by means of sensors fixed in a glove.

However, the only characterising feature of claim 1 for which D1 is relevant, is the first, defining the sensors fixed in a glove.

From D1, such a glove having sensors fixed in it is known. However, the data entered are of a kind very different from the patent in suit. In D1, the hand positions sensed are of a **discrete** kind and represent alpha-numerical characters (cf. Figure 17) as in the case of a glove (Figures 1 to 3) for use by the deaf or hearing impaired, skilled in the use of a single hand manual alphabet sign language (column 2, lines 23 to 28), the alpha-numerical characters so entered being used in a typewriter or (other character processing) computer (lines 32 to 49). In contrast, in the patent in suit, the hand positions sensed include any **analog**

degree of bend and represent all kinds of gestures allowing functions or operations on virtual objects to be implemented similar to the case of manipulation of real objects by means of a mechanical manipulator.

In accordance with this difference, the sensors are not of the same kind in D1 and in the patent. In D1, first, second, third and fourth types of sensors are used. The first, termed "touch/proximity" sensor, is not relevant at all for the present case. The second, termed "knuckle-bend" sensor, would appear relevant but is of a **binary** kind supplying only a "bend" or "no bend" output signal (as shown, for instance, in Figure 7). The third, termed "tilt sensor", is not relevant for claim 1 (although it might be relevant for claim 2). The fourth, termed "inertial" sensor, is also not relevant for claim 1. In contrast, in the claimed apparatus, all sensors are of the **analog** type distinguishing varying degrees of bend. This is true even though the construction of the sensor (40) shown in Figures 5 and 6 is very much alike that of the sensor (102) shown in Figures 4 and 5 of D1; the reason why the sensors of the claimed apparatus are nevertheless different from those of D1 is that the output signal of this latter sensor is electronically made binary (by two-state detector 407), whereas that of the sensor (40) of the patent is left as it is.

3.6 The conclusion the Board draws from these differences between the sensor glove used in the claimed apparatus and the sensor glove known from D1 is that, while it might at first sight appear obvious from D1 to use a glove also in a system of the kind known from D6 or D9, the sensors of D1 would appear to be wholly unsuitable for the purposes of this latter system so that the skilled person would refrain from pursuing the idea of using a glove like that of D1 in the system of D6 (or

D9). In the Board's view, the purposes the output signals of the sensors serve in both cases are so different that the skilled person would not try to modify the sensors of D1 so as to render them suitable for the system of D6.

In other words, it would not appear obvious from the disclosure in D1 of a glove having discrete **character** specifying sensors allowing text characters to be entered for typing or similar purposes, for the skilled person, to replace the manipulator of D6 (or D9) by a glove having analog **gesture** specifying sensors providing a signal representing variable degrees of bend allowing virtual objects to be manipulated accordingly with a virtual hand.

3.7 D8 was considered, in the decision under appeal, to be particularly pertinent for claim 1 then on file.

In the Board's view, this document is still relevant, but less pertinent, for claim 1 now on file.

It discloses a remote manipulator having a master hand and an artificial, or slave, hand and proposes to use, as master hand, a glove having sensors fixed to it.

However, the glove (Figure 3), having a rigid external shell (22), optionally connected to the operator's hand by a flexible shell (23), resembles a box (42, Figure 4) more than a real glove. The sensors are either displacement sensors providing signals representative of the instantaneous spatial position of each of the articulated elements of the hand, or angle sensors (33 to 36) providing signals representative of the bend of finger joints; but flex sensors between the thumb and index finger and between the index and middle finger as

well as a flex sensor across the palm, as required in the apparatus of the patent according to claim 1, are absent from the device known from D8.

In this situation, the first characterising feature of claim 1 is considered to differ substantially from what can be derived for a sensor "glove" from D8 and what might therefore be rendered obvious to apply to a virtual manipulator like that of D6.

3.8 The second and further characterising features in claim 1 cannot be derived from D8 either.

For the second, this is readily apparent.

As to the third and fourth, since D8 relates to a real manipulator, ie. not to manipulation of virtual objects with a virtual hand, and although it proposes the optional utilisation of a visual means (direct or by television) for supervising purposes, there is no display of virtual objects and of a virtual hand.

3.9 In these circumstances, although D8 proposes formally to use a "glove" as the master hand of a real manipulator, and because it might therefore be considered to be obvious to use a glove as the master hand of a manipulator for virtual objects, no incentive can be derived from D8 to modify the kind of sensors in the way as claimed in the first characterising feature. Nor is it obvious from D8 to apply the second and further ones.

3.10 Effectively for the reasons explained individually above (3.4 to 3.9), not even a tentative combination of prior art documents D6, D9, D1 and D8 would result in the subject-matter claimed, in particular because non-evident modifications of the features which might be

derivable from one or the other of these documents would be required.

3.11 Neither D11 nor any other document was found to require specific consideration.

As to D7, the situation remains as stated in point II above (last paragraph).

3.12 Summarising these findings, the subject-matter of claim 1 is considered to involve an inventive step.

4. *Other matters*

Apart from Articles 123 (cf. point 2) and 56 (point 3), in the Board's view also the other requirements of the Convention for maintaining the patent as amended (Article 102(3) EPC) are met.

4.1 It might be questioned whether this is true for claim 4 filed in the oral proceedings. It would appear that this claim is unnecessary under the circumstances (Rule 34(1)(c) EPC) because it does not seem to add any additional feature to the subject-matter of claim 1.

When the first characterising feature was admissibly introduced in claim 1 on the basis of the disclosure in the description (cf. point 2.3), it was apparently overlooked that one sub-feature thereof was the only feature of claim 2 as granted and that therefore, by the amendment of claim 1, claim 2 became superfluous and should have been deleted rather than amended to become claim 4.

4.2 The Board saw nevertheless no sufficient reason to delay, for the sole purpose of having this formal deficiency remedied, a final decision on the case.

Firstly, the redundancy of a dependent claim in the sense of Rule 34(1)(c) EPC may be considered as being matter which, having no impact on any question of substance, is too unimportant to justify, if a decision on the substantive issues of a case is possible, any delay by a further action before a decision is taken. It should be mentioned that such a formal deficiency would not be a ground for opposition (Article 100 EPC) and that it would be contrary to the Convention to raise a respective objection if the case were such that the grounds for opposition did not prejudice the maintenance of the patent unamended (Article 102(2) EPC). The same would even apply if the case were such that the grounds for opposition would allow the patent to be maintained only as amended (Article 102(3) EPC) but where it would not be appropriate, on the basis of the grounds invoked for opposition, to decide on formal deficiencies which are not related to the invoked grounds for opposition.

Secondly, even though the first instance will be bound by the order of this decision to maintain the patent "according" to, or "on the basis" of, claims 1 to 8, this would neither preclude a request from the proprietor of the patent to correct the obvious mistake made in the filing, in the oral proceedings, of claim 4 and to delete, to this effect, that claim, with claims 5 to 8 and their references being renumbered accordingly; nor would it prevent the opposition division, if such a request is made, from allowing it under Rule 88 EPC.

4.3 Otherwise, no observation appears necessary on the patent documents now on file.

As to the description, it complies, now that it has been amended (cf. point 2.15), with Rule 27(1) EPC. It indicates the prior art known from D1 (Rule 27(1)(b) EPC), and it was felt unnecessary to supplement this by an indication of other prior art documents, such as D6.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent as amended on the basis of the following documents:

Description: pages 2, 3 and 5 filed on 15 January 1996,
page 4 as published;

claims: 1 to 8 filed on 15 January 1996;

drawings: sheet 1 to 3 (Figures 1 to 9) as published,
sheet 4 (Figures 10 to 13) filed on 15 January 1996.

The Registrar: The Chairman:

M. Kiehl P. K. J. van den Berg