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Bezeichnung der Erfindung: Apparatus for tracking an information track on a recording medium
Title of invention:
Titre de l'invention :

Klassifikation / Classification / Classement : G11B 7/08, G11B 21/10

ENTSCHEIDUNG / DECISION

vom / of / du 25 April 1988

Anmelder / Applicant / Demandeur :

Patentinhaber / Proprietor of the patent /
Titulaire du brevet : Discovision Associates

Einsprechender / Opponent / Opposant : N.V. Philips' Gloeilampenfabrieken

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Art. 56

Kennwort / Keyword / Mot clé : "Inventive step (yes)"

Leitsatz / Headnote / Sommaire

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Case Number : T 318/86 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal 3.5.1
of 25 April 1988

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Decision under appeal :
Decision of the Opposition Division of the European Patent Office dated 4 June 1986 dispatched on 14 August 1986 rejecting the opposition filed against European patent No. 17 433 pursuant to Article 102(2) EPC

Composition of the Board :

Chairman : P. Ford
Members : W.B. Oettinger
Y. van Henden

Summary of Facts and Submissions

I. European patent No. 17 433 was granted on European patent application No. 80 300 959.6, filed on 27 March 1980 claiming a priority of 6 April 1979. The grant was published on 23 May 1984.

The independent Claim 1 as granted reads as follows:

"Apparatus for maintaining a scanner (25, 27) in a prescribed transverse position relative to a selected substantially circular information track on a record medium (11) in the form of a rotatable thin disk having a plurality of parallel and substantially evenly spaced information tracks and for selectively advancing the scanner to an adjacent track; said apparatus comprising a carriage (33) for controllably positioning the scanner in a direction transverse to the axis of the information track; said scanner being arranged to receive a beam (15) of radiation read from the record medium; a detector (43) for detecting the transverse position of the scanner relative to the information track and for producing a control pulse signal (at 91, 93) in accordance with the detected position; and a motor (45) responsive to the control pulse signal for moving the carriage transversely to the information track to tend to maintain the scanner in the prescribed position relative to the track; characterised in that said motor (45) is a stepper motor and the spacing between adjacent tracks corresponds to a prescribed plurality of steps of said stepper motor; and further characterised by first means (49) for receiving said control pulse signal and controlling accordingly the stepper motor (45) to position the carriage by one or more forward or reverse steps and by a second means for selectively causing said stepper motor to advance said

prescribed plurality of steps to thereby advance said scanner to the next track."

According to the description, the claimed invention fulfils the need for an effective apparatus for maintaining a radially movable carriage in a prescribed relationship relative to information tracks on a storage disk, regardless of temperature variations, that cause the disk to expand or contract.

It also follows from the description that the apparatus is "effective" also insofar as the stepper motor performs two functions, and is thus economic, and that it is particularly, although not exclusively, applicable in direct-read-after-write disk recording systems.

Dependent Claims 2 to 8 concern various features of a particular embodiment of that apparatus. In particular, the features in Claim 4 limit the responsiveness of the detector to relatively slowly-varying radial changes of the scanner position; the features in Claims 6 and 7 define the use of a dither signal for detecting the transverse position of the scanner and Claim 8 relates to the use of the claimed apparatus in a direct-read-after-write recording system.

II. On 25 February 1985 an admissible opposition was filed by the Appellant on the ground that the claimed invention was not patentable owing to lack of inventive step.

In particular, the subject-matter of Claim 1 was obvious against

(D1) NL-A-7 204 205
(D2) Philips Press Release No. 7 943 e/March 1979
(D3) DE-A-2 337 015

In addition, the following references were cited against Claim 4 (D4), Claims 5 and 7 (D5) and Claim 6 (D4 and D5):

(D4) US-A-4 074 085
(D5) US-A-4 142 209

Reference was further made to the following documents acknowledged as prior art in the description of the patent in suit:

(D6) FR-A-2 366 636
(D7) US-A-3 956 766
(D8) US-A-3 977 024

Later, the Respondent contributed the following correspondences to D1, D3 and D6 respectively:

(D1') GB-A-1 429 882
(D3') GB-A-1 482 153
(D6') GB-A-1 582 603 (published late).

III. In Oral Proceedings before the Opposition Division, held on 4 June 1986, the opposition was rejected.

The reasons for this decision were given in a written decision dated 14 August 1986.

In this decision the Opposition Division considered, in particular, the Opponent's "Route 1" or "Route 2" argumentation.

Route 1 was defined by starting from D7 and combining it with D6, Route 2 by starting from one or more of D1, D2 and D3 and combining it or them with D7.

However, it was held that the subject-matter of Claim 1, and consequently also of the dependent claims, was unobvious even against the most relevant of the above prior art documents, including (7) which discloses a stepper motor in a (according to the Respondent) similar apparatus as claimed.

Other "Routes" through the prior art, in particular starting from D6 or replacing D7 by D8, would also not lead to the invention claimed.

IV. The Appellant lodged an appeal against that decision on 13 September 1986 and paid the appeal fee on the same date.

On 13 December 1986, the Appellant filed a Statement of Grounds of Appeal contesting the correctness of the decision's approach to his "Routes" 1 and 2.

V. In a response, filed on 3 June 1987, the Respondent submitted that the approach in the decision under appeal was correct.

VI. From the notice of appeal and the Statement of Grounds it follows that the Appellant requests that the decision under appeal be set aside and that the patent be revoked in its entirety.

In a letter filed on 17 February 1988 the Appellant requests that a decision be taken in written proceedings, withdrawing an earlier request for Oral Proceedings.

VII. The Respondent requests that the appeal be dismissed.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is, therefore, admissible.

2. While it has never been disputed that the claimed invention is new, the question at issue is whether it involves an inventive step.

To decide on this question, the prior art coming nearest to the claimed invention, as the most appropriate basis to start from, must be determined.

2.1 In this context it is important that, according to the preamble of Claim 1, a motor moves, in response to a control signal produced in accordance with the transverse position of a scanner relative to a circular information track on the rotatable recording disk, the carriage positioning the scanner transversely to the track so as to "tend to maintain the scanner in the prescribed position relative to the track".

There has been discussion about the proper interpretation of this feature. The Board considers that, having regard to the description of the patent-in-suit, it may be construed only in the following way:

The motor is part of a feedback loop tending to make the scanner follow the track. This feedback loop may or may not contain a low pass filter according to Claim 4. So it may or may not be fast-reacting enough to follow, apart from slow (e.g. temperature induced) radial changes of the track position, also much faster ones. The speed of response of the feedback loop where there is no low pass filter, must be regarded as restricted only by the properties of the stepper motor used.

It is therefore considered that the claimed invention is not directed to mere scanner positioning, as the Appellant seems to submit, but to track following, be it relatively slow or faster.

2.2 In this situation, D7 would clearly be an improper starting point since it does not disclose the use of a track following feedback loop.

2.3 Comparing the other citations mentioning feedback loops, D6 is considered to be the one coming nearest to the invention.

3. D6 discloses principally two alternative embodiments. One is described with reference to figures 1 to 6 and - slightly modified - to figure 7. The other is only briefly described (page 7, lines 27 to 30).

3.1 The first-mentioned embodiment can be summarised as follows:

Information is recorded on a spiral track (at I) on a rotatable disk (1) by a light beam (4). The information recorded on the previous track (at K) is read, using a read beam (8), by a detector (24). Another detector (15) senses any radial deviation of the scanner (2, 5, 3) from the track centreline. Its error signal is, first, used to radially move the scanner, by means of a motor (20), continuously so that the read beam follows said previously recorded spiral track. By an appropriate offset angle ( ) between the recording beam and the read beam, the recording track is thus, at any time, held equidistant from the track being read at that time. However, in order not to transfer any instantaneous position errors in the read track to the recording track (thus accumulating these errors), the responsiveness of this feedback loop must, by means of a low pass filter (19), be kept so slow that only the mean value of the error signal controls the motor, which means that the scanner follows only relatively slow variations in

track position, such as deviations which may have occurred during interruptions (page 8, line 12), obviously including deviations caused by thermal effects. Fast variations, such as are caused by vibrations (page 1, line 34 and page 8, line 12) are not corrected in this way, but by feeding the error signal, secondly, via a much "faster" low pass filter (figure 5), to another motor (23) rotating the mirror. A real time direct-read-after-write facility is available by using another read beam (page 7, lines 32 to 35) in the recording track (at J).

3.2 The second embodiment in D6 relates to disks having concentric circular tracks, rather than a spiral track (page 7, line 27). In this embodiment, not only the motor (21) for rotating the disk is controlled by a synchronisation signal in the read signal (page 5, lines 11 to 13), but also the translation motor (20) (page 7, line 29). The effect of this latter control is to cause the scanner to perform a jump, at each revolution, by one track (page 7, line 30). No further information being provided, it must be assumed that even in this embodiment the equidistance of the recording and read tracks is maintained by way of said offset angle between the recording and reading beams and of the two feedback loops controlling the translation and mirror motors (20, 23). However, since it is necessary, in this embodiment, to jump from one track to another, the motor must be fast-reacting and the low pass filter (19) in the translation control signal path must be ineffective during the jumping function. A direct-read-after-write facility in accordance with that of the first embodiment is not expressly mentioned, but appears, in principle, possible.

4. For the claimed apparatus specifically this second embodiment in D6 is relevant.

4.1 In particular, the track following means in Claim 1 are in no respect, save for the "pulse" control and the "stepper" kind of motor, different from the track following control loop (15, 20) of D6.

4.2 Even including the low pass filter of Claim 4, the apparatus as claimed differs in no respect from D6 (low pass filter 19).

In both the claimed invention and the prior art embodiment, thermal disk expansion/contraction problems are solved by this tracking loop, but any eccentricity problem is not.

4.3 For dealing with the latter problem, D6 requires an additional tracking loop (15, 23) having only the very much "faster" low pass filter (figure 5) if any; the claimed invention is not concerned with this further problem.

4.4 Nevertheless, Claim 1 not being restricted to the use of a low pass filter (cf. Claim 4), it must be regarded as covering a case in which relatively fast track following is accomplished, as by the second tracking loop (15, 23) of D6, the only restriction being that the stepper motor must be suitable for such fast control depending on the required speed of response.

4.5 Further, the track jumping as such in Claim 1 is in no respect, save for the number of "pulses" and the "stepper" kind of motor, different from the "jump at each turn" disclosed in D6 (page 7).

4.6 Claim 1 defines that it is the same motor which performs the track following and, selectively, the jumping function.

The same applies to D6, as long as the "slow" tracking motor (20) is regarded (cf. paragraph 4.2).

If, in the claimed invention, the track following is "slow" (Claim 4), it is clear that the low pass filter must be disabled during the jumping function. This is also the case with D6, as explained above (paragraph 3.2).

4.7 This is no longer the case, when Claim 1 is construed as covering fast track following (cf. paragraph 4.4). In this case, D6 must be regarded as not suggesting to use the same motor for both purposes (20, 23).

5. Therefore, when considering the difference between the subject-matter of Claim 1 and the prior art starting point, the following facts should be noted:

5.1 Taking the low pass filter into account, the subject-matter of Claim 1 differs from the second embodiment of D6 only in that the motor is a "stepper motor", the track spacing corresponding to such a multiplicity (e.g. ten) of steps that one or at most a few positive or negative steps have the required effect of compensating any deviation of the scanner from the track.

5.2 Taking the possibility of the absence of the low pass filter into account, the subject-matter of Claim 1 would furthermore differ from the second embodiment of D6 by the feature that the same motor is used for performing the track following and the jumping function.

6. In D6, nothing points to either of these modifications of the apparatus described there.

Even if the translation motor (20) is said to be controlled by a synchronisation signal in order to perform track jumping, this does not point to stepper motors but only to the requirement that the motor must be fast-reacting enough to perform this function within the duration of a reasonably short signal derived from the synchronisation signal.

7. It still remains to be examined whether any of the other prior art documents gives an incentive to replace the (unspecified) motor (20) of D6 (cf. paragraph 5.1), or the motors 20 and 23 (cf. paragraph 5.2), by a stepper motor and to control the latter by a small number (e.g. one) or, selectively, by an appropriate plurality of pulses as defined in Claim 1.

7.1 Beforehand, it appears necessary to determine what the objective problem solved by the new features of the claimed invention is.

In both the slow track following case (cf. paragraph 4.2) and the possible faster track following case (paragraph 4.4) this problem can be understood to lie in the selection of a motor and control circuit therefor that are suitable for this purpose in the following sense: for track following, be it slow or fast, the motor should be controllable by simple electronic means to perform an exactly defined amount of translation compensating any scanner deviation liable to become too large, without however wasting energy for compensating insignificant deviations; for track jumping it should be controllable by the same kind of means to perform very much faster but with the same degree of exactitude, a defined amount of translation corresponding to the distance between adjacent tracks.

7.2 Of all citations disclosing stepper motors, D7 is relevant for the claimed invention insofar as it proposes to use such a motor for radially moving a scanner over circular tracks on a recording disk. The disk is of magnetically recording material but this is not an obstacle for the skilled person to consider the possibility of transferring the teaching of this document to an optically recording medium such as that of D6.

However, this teaching consists solely

(a) in using the stepper motor for positioning the scanner on a particular track, by moving the scanner across a certain number of tracks to the one having a particular number, and

(b) in compensating for any long term errors, e.g. caused thermally, in the position of the searched track by resetting a track counter to zero at the instant when the scanner passes the centre of a reference track (without following it) when being moved (by positive steps only) over that reference track, so that the counter gives a correct number when the search track is reached. A feedback tracking loop is, contrary to the Appellant's submission, absent from D7. Consequently, temperature induced expansions or contractions of the disk are compensated only insofar as they do not occur temporarily or appear locally between the reference track and the searched track.

From this teaching it might at most be deduced that a stepper motor is particularly suitable for advancing the scanner, in one direction, by a particular number of tracks, or even for jumping by one track, but no information is given which would point to an equally suitable applicability in a feedback loop for following a track, however slowly, by compensating deviations of either sign.

The essentially "analogue" function of such a feedback loop, normally having a substantially proportional characteristic, antisymmetric with respect to zero, would even appear as an obstacle for the skilled person to envisage using a kind of motor, and a corresponding control circuit, which function essentially "digitally" and only in positive increments.

Thus, from D7 it cannot be derived that part of the problem (paragraph 7.1) relating to track following can be solved by using, in the apparatus of D6, the stepper motor of D7, and a suitable control circuit.

7.3 In this situation, it is of secondary importance that in an embodiment of D7 the number (ten) of steps used to perform one jump equals exactly that used in an embodiment of the invention. Only after a prior art disclosure has given an incentive to use the stepper in track following, would it be obvious to use the same number of steps per track distance as in D7. There being no such incentive, such a consideration must be discarded as being based on hindsight.

7.4 No other citation, including the correspondences, comes nearer to the claimed invention than D6 or D7.

The only contribution of D3 to the teaching of D6, that track jumping and slow track following can combinedly be carried out by one and the same motor, is that track jumping can also be combined with fast track following in the same motor, in this case of the moving coil type.

D1, D2, D4 and D5 do also not relate to stepper motors.

D8, relating to a stepper motor scanner drive, is not concerned with, but rather suggests to avoid, a closed loop feedback control for track following and does not therefore contribute more than D7.

The above "Route" of argumentation differs from the Appellant's "Route 1" and "Route 2" in that it starts from D6.

Nevertheless, it is a route considered in the Decision under Appeal (paragraph 23) and discussed by both parties to the procedure insofar as it relates to the same combination of D6 and D7 as does "Route 1".

No other result is envisageable if "Route 2" had been tried to follow.

The Appellant's submissions to support the opposite view are found unconvincing, in particular in view of the fact that D7 does not disclose track following and of the further fact that the claimed invention does concern track following, albeit not in the restricted sense that even high frequency deviations would be compensated.

8. Summarising the above finding, no possible combination of the cited prior art documents is sufficient to establish the alleged lack of inventive step of the subject-matter of Claim 1.

This claim, and consequently also all other claims as granted, are therefore valid.

The decision under appeal must therefore be confirmed.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar The Chairman

S. Fabiani P. Ford