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Bezeichnung der Erfindung: TRANSDUCER SUSPENSION

Title of invention:

Titre de l'invention :

Klassifikation / Classification / Classement : G11B 5/54

**ENTSCHEIDUNG / DECISION**

vom / of / du 14 March 1989

Anmelder / Applicant / Demandeur : IBM Corporation

Patentinhaber / Proprietor of the patent /  
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 56 EPC

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

**Leitsatz / Headnote / Sommaire**

Europäisches  
Patentamt

European Patent  
Office

Office européen  
des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours



Case Number : T 252/87 - 3.5.1

D E C I S I O N  
of the Technical Board of Appeal  
of 14 March 1989

Appellant : INTERNATIONAL BUSINESS MACHINES CORPORATION  
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USA

Representative : Blake, John  
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Decision under appeal : Decision of Examining Division 067  
of the European Patent Office  
dated 10 March 1987 refusing European  
patent application No. 84 101 276.8  
pursuant to Article 97(1) EPC

Composition of the Board :

Chairman : P.K.J. van den Berg

Members : J. Borloz  
F. Benussi

## Summary of Facts and Submissions

- I. European patent application No. 84 101 276.8 filed on 8 February 1984 and published on 10 October 1984 under No. 0 121 057, claiming priority from an earlier application filed on 30 March 1983 in the United States, was refused by Decision of the Examining Division of the European Patent Office on 10 March 1987. This decision was taken on the basis of the seven claims filed with the letter of 2 May 1986.

Claim 1 (after correction of a typing error - "boutboard") reads as follows:

"A transducer support assembly including a rigid arm, a resilient elongate load beam (24) for supporting a transducer head (20) at the outboard end thereof, the inboard end of the load being secured to the rigid arm, a substantial portion of the load beam (24) spaced from its outboard end having a flat surface area, the assembly being characterised by a layer (34) of viscoelastic material confined to the flat surface area of said portion of the load beam (24) and sandwiched between the load beam and a constraining member (36) so that the amplitude of vibrations is reduced to absorption of shear energy in the layer of viscoelastic material."

- II. The application was refused for lack of inventive step.

According to the Examining Division, document D1 (IBM Technical disclosure bulletin, Vol. 21, No. 8, January 1979) discloses a transducer support assembly, an arm and a transducer head at the outboard end thereof.

According to this document it is a problem that head vibrations cause instability, reduction in performance of the head track following system or even degradation of the data signal. Document D1 teaches how to solve this problem by damping these head vibrations by means of a sandwich structure comprising a head carrying layer, a layer of viscous damping material and a further layer constraining the damping layer. The orientation of the damping layer is substantially parallel to the record surface.

Furthermore, document D3 (EP-A-0 074 467) shows a transducer support assembly including a rigid arm (10), a resilient elongate load beam (38, 42) for supporting a transducer head (44) at the outboard end thereof, the inboard end of the load beam being secured to the rigid arm, a substantial portion of the load beam spaced from its outboard end having a flat surface area. Thus, D3 discloses an assembly according to the preamble of Claim 1 and furthermore quite similar to the assembly disclosed in Figure 1 of the present application.

Finally, document D2 (EP-A-0 060 358) teaches how to damp the vibrations caused by each head individually.

Thus, it is considered to be obvious to the person skilled in the art to apply damping material to each of the load beams in an assembly as disclosed in D3 and to use a sandwich construction comprising a layer of viscous damping material oriented in the plane of the beam structure according to D1.

III. The applicant filed an appeal against this decision on 24 April 1987 and paid the fee for appeal on the same day. In his statement of grounds, filed on 15 May 1987, the appellant essentially developed the following arguments:

The nub of the invention resides in the provision of a layer of viscoelastic material which is confined to the flat surface area of a portion of the resilient load beam of a transducer support of the type set out in the pre-characterising portion of Claim 1, the viscoelastic material being sandwiched between the resilient load beam and a constraining member so that the amplitude of vibrations is reduced due to the absorption of shear energy in the layer of viscoelastic material.

Document D2 leads away from the present invention by suggesting the damping material should be applied to the rigid part of the assembly rather than to the flexible load beams. Although D2 states that the damping material should be located as close as possible to the heads, it does not teach that the damping material should be applied to the closest point to the heads (i.e. to the flexible load beams), but instead teaches that the damping material is applied to the closest position on the rigid part of the assembly. It must be remembered that the physics of a rigid structure are quite different from those of a resilient one. The skilled person will realise that it cannot be simply assumed that a technique which works for a rigid structure would work for a resilient one. If the present invention was so obvious, one would surely have expected the damping layer to be applied to the resilient load beams in the assembly shown in D2.

Before the priority date of the present application there is no suggestion that the provision of a damping layer and a constraining layer on a resilient load beam could be used effectively to damp vibrations without so affecting the resilience of the load beam that the head could no longer follow the contour of a disk with sufficient precision. The surprising effect of the present invention is that if a layer of viscoelastic material is confined to the flat

surface area of a portion of the resilient load beam spaced from its outboard end, the viscoelastic material being sandwiched between the resilient load beam and a constraining member, effective damping can be achieved without adversely affecting the desired resilience characteristics of the load beam.

The appellant requested that a patent be granted on the basis of the application documents as originally filed. Moreover, he informed the Board of Appeal that he would seek oral proceedings should the Examining Division's decision be confirmed.

- IV. In a communication pursuant to Article 11(2) of the Rules of Procedure of the Boards of Appeal the Board endorsed the Examining Division's conclusions.

In his reply to that communication submitted on 27 January 1989 the appellant further developed the arguments set out in his statement of grounds of appeal and filed an amended Claim 1 that, in his view, took account of the objections made by the rapporteur.

- V. On 14 March 1989, in the course of oral proceedings before the Board of Appeal, the appellant's representative explained his client's position by showing a mechanical part incorporating the suspension assembly to which the invention relates.

Furthermore, at the beginning of the oral proceedings, the appellant's representative filed a statutory declaration by the inventor of the assembly forming the subject-matter of the application to which D2 related. The inventor, an employee of the applicant in question, stated under point 5 of his declaration:

"My invention as described in Document D2 was directed at the problem of damping resonances in the rigid arm structure by placing damping material on the rigid arm structure. I did not envisage that damping material should be provided on the springy load beam itself. At the time, I would have thought, and I imagine in common with others working in the art, that it would be undesirable to coat the load beam with damping material since this might adversely affect the load beam's spring rate which needs to be accurately controlled."

VI. In the oral proceedings the appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of Claims 1 to 7 filed on 27 January 1989, description pages 1, 2 and 4 to 7 filed on 7 May 1986, page 2A, filed on 27 January 1989 as amended in the oral proceedings and pages 3 and 8 as originally filed, as well as drawings as originally filed.

VII. Claim 1 reads as follows:

1. A transducer suspension assembly for a disk file of the type in which a transducer head (20) is loaded against an air bearing between the transducer head and a disk surface, the assembly including an elongate load beam (24) for supporting the transducer head (20) at an outboard end thereof, and means (26) at the inboard end of the load beam for securing the load beam to a transducer support arm (10), the load beam (24) being formed from a spring member having a flat surface area (30) spaced from said outboard end and being adapted over a part of its length to provide sufficient stiffness to load the transducer head (20) towards the disk surface, the assembly being characterised by a layer (34) of viscoelastic material located on at least a portion of said flat surface area and sandwiched between the load beam and a constraining member (36) so

that the amplitude of vibration is reduced due to absorption of shear energy in the layer of viscoelastic material.

Claims 2 to 7 are dependent claims relying on Claim 1.

#### Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is, therefore, admissible.
2. In the introductory part of the description of the present application (pages 1 and 2) mention is made of the fact that the need for effective damping of magnetic head support apparatus has been recognised in the prior art but that the proposed solutions have been unable to reduce effectively all forms of head support vibration. The invention according to Claim 1 proposes an arrangement that reduces appreciably the level of all forms of vibration without major changes to the structure of the magnetic head support.
3. The present Claim 1 is adapted more precisely to the embodiments described in the application than the Claim 1 refused by the Examining Division.
  - 3.1 According to Claim 1 the transducer suspension assembly consists of two main components: an elongate load beam (24) for supporting the transducer head (20) and a transducer support arm (10) to which the elongate load beam is secured. The latter has to satisfy two conditions: it must pull the transducer head towards the disk and at the same time be sufficiently elastic so as to be able to adapt to the slight irregularities in the rotating disk. The load beam of the suspension assembly, which is the subject of

the invention, consists of a spring member having a flat surface and the suspension is provided with a damping layer of viscoelastic material applied and confined to part of the flat surface area of the spring member.

Present Claim 1 thus makes it explicitly clear and emphasises that the load beam consists of a spring member.

Old Claim 1, as refused by the Examining Division, only mentioned a "resilient" elongate load beam.

- 3.2 Three documents D1, D2 and D3, identified under point II above, have been found to show independently features of the subject-matter of the application.

In D1 a viscous damping layer is used to damp the vibrations of an arm supporting a magnetic head.

However, in the device of document D1 there is no elastic suspension for the arm, and this arm itself has to be kept stiff as mentioned in the last sentence of D1: "If the arm vibrates due to actuator motion or its own resonance, the motion is quickly damped out without sacrificing the radial stiffness necessary for good servo control".

The teaching of D1, that is to say the damping of the vibrations of a rigid arm by means of a viscous layer without weakening the stiffness of this arm, appears as inadequate for a resilient arm taking into account the functional characteristics which have to be obtained.

In D2, which concerns a head support arm, the problem to be solved consists, as with the application in suit, in damping vibrations in the support arms.

To this end, a layer of damping material is applied to a flat rigid part of the support arm (the arm comprising a relatively rigid beam structure of flattened cross-section - page 3). The site chosen for this damping layer constrained by a side bar is not without importance and the following passage is to be found on page 4 of D2:

"It is preferable also that the side bar and damping material should extend along a portion only of the length of the arm nearest to the head support end. This reduces the mass of the arm while preserving effective damping nearest to the point at which it is needed, i.e. the heads. Extension of the side bar and damping material along the whole length of the arm is relatively ineffective."

Despite this passage it will be found that although the ideal position for the damping layer is the point nearest to the source of the vibrations, i.e. towards the transducer head, in the embodiment illustrated by Figure 4 in D2, the damping layer (16) is placed on the rigid structure (44) and not on the leaf spring (43).

Moreover, the last sentence in this passage indicating that extension of the damping material along the whole length of the arm is relatively ineffective, shows that the solution adopted by the inventor is the one that has proved effective and that other sites for the damping material are not necessarily favourable.

- 3.3 Documents D3 and D4 (EP 0 007 401, submitted by the Appellant with his communication of 20 January 1989) both reveal magnetic transducer head support assemblies very

close to the assembly according to the invention, in particular because of the presence of an elongate load beam formed from a spring member having a flat surface.

- 3.4 The question of damping the vibrations does not arise in D3 and D4. It might be considered, as the Examining Division did, that transposing the damping means provided for in D2 to the springy load beam according to D3 and D4 amounts to an obvious and logical step for the skilled person. Bearing in mind that, on the one hand, the teaching of D2 did not suggest placing the damping beam at a site other than that indicated in this document and, on the other hand, that the function of the springy load beam did not call for the application to the same of any element able to alter its elasticity and inertia, the Board concludes that the solution proposed involves an inventive step within the meaning of Article 56 EPC.

#### Order

For these reasons, it is decided that:

1. The decision of the Examining Division of the European Patent Office is set aside.
2. The application is remitted to the first instance with the order to grant a European patent on the basis of the documents mentioned under point VI above.

The Registrar:

The Chairman:

S. Fabiani

P.K.J. van den Berg