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BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

Publication in the Official Journal Yes / No

File Number: T 569/89 - 3.2.2

Application No.: 85 900 812.0

Publication No.: 203 070

Title of invention: Printer device

Classification: B41J 7/84, B41J 9/38

D E C I S I O N
of 18 March 1991

Applicant: Swedot System AB

Headword:

EPC Article 56

Keyword: "Inventive step (yes, after amendment)"

Headnote

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammem | Boards of Appeal | Chambres de recours

Case Number : T 569/89 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal
of 18 March 1991

Appellant : Swedot System AB
Gamlestadsvägen 8
S-415 02 Göteborg (SE)

Representative : Ström, Tore
Ström & Gulliksson AB
Studentgatan 1
P.O. Box 4188
S-203 13 Malmö (SE)

Decision under appeal : **Decision of Examining Division 086 of the European Patent Office dated 6 March 1989 refusing European patent application No. 85 900 812.0 pursuant to Article 97(1) EPC.**

Composition of the Board :

Chairman : G. Szabo
Members : W.D. Weiß
F. Benussi

Summary of Facts and Submissions

I. European patent application No. 85 900 812.0, filed under PCT on 29 January 1985, with priority being claimed from Swedish application No. 8400439-9, dated 30 January 1984, was refused by a decision of the Examining Division, dated 6 March 1989.

II. The reason given for the decision was that the subject-matter of the claims submitted with letter of 4 October 1988 lacked an inventive step with respect to a combination of the documents DE-A-3 137 690 and US-A-4 374 665. With respect to the dependent Claim 4 additional reference was made to Derwent-Abstract No. G6905 D29 (1981), SU 765913.

III. A Notice of Appeal was filed against this decision by telecopy on 28 April 1989 and the appeal fee paid simultaneously. A written confirmation arrived at the EPO on 2 May 1989. The statement setting out the Grounds of Appeal was filed on 24 June 1989.

IV. On 28 February 1991 the Board issued a communication pursuant to Article 110(2) EPC summarising objections on the basis of Articles 123(2) and 84 EPC which had been raised during a consultation by telephone held on 25 February 1991.

V. On 5 March 1991 the Appellant filed an amended set of five claims with the intention to overcome thereby the objections raised.

Claim 1 which was filed reads as follows:

"1. Printer device in which a striking movement is imparted to a striking member (6) for transmitting a print

(5) via an ink ribbon (3) to a paper (2) or the like bearing against an abutment (1), the striking movement of the striking member (6) being effected by means of a motion generator unit (8, 8A, 8B) of a magnetostrictive material, one end of said motion generator unit (8, 8A, 8B) being fixed to a supporting structure (9) and the opposite end thereof being fixed to said striking member, characterised in that said motion generator unit (8, 8A, 8B) comprises a rod of a giant magnetostrictive alloy of rare earth metals with iron, cobalt or nickel, particularly an alloy of one or several of the substances terbium, dysprosium and samarium with iron, said rod being surrounded essentially along its entire length by a magnet coil (10, 10A, 10B) which is connected to a source of electric current for generating a magnetic field over the motion generator unit (8, 8A, 8B), the magnetic field being variable in correspondence to the supply of current to said magnet coil, and control means for controlling the supply of current to the magnet coil (10, 10A, 10B) in accordance with a predetermined pattern in order to continuously control the change in length of said rod caused by said variations in the magnetic field and thus continuously during the striking movement of the striking member (6) controlling the striking force as well as the timewise dependent velocity in accordance with said predetermined pattern."

The dependent Claims 2 to 5 relate to particular embodiments of the printer device according to Claim 1.

VI. The Appellant, by implication, requests grant of the of the patent on the basis of the following documents:

Claims: Claim 1, filed on 5 March 1991, in line 14 of which the word "between" has been replaced by "of" by the Board.
Claims 2 to 5, filed on 5 March 1991

Description: A description which has to be adapted having regard to the provisions of Rule 27(1)(c) and (d);
Drawings: Figures 1 to 3 as originally filed.

Reasons for the Decision

1. The Appeal is admissible.

2. Amendments

The examination of formal admissibility of the amended Claims under Article 123(2) EPC by the Board results in the following observations:

New Claim 1 differs from its original predecessor, besides by purely redactional amendments, by the features:

(a) the motion generator unit comprises a **rod of a giant magnetostrictive alloy;**
(b) the magnet coil surrounds the rod **essentially along its entire length;**
(c) the supply of current to the magnet coil has to be such as **to continuously control the change of length of said rod caused by said variations in the magnetic field.**

Feature (a) is mentioned in particular on page 8, line 33, of the original description.

Feature (c) is based on page 8, line 18, to page 10, line 5, of the original description.

Feature (b) is an indispensable consequence of the functional feature (c), because this continuous control is

based on the precondition that every single volume element is subjected to the variation of the magnetic field simultaneously. Moreover, this feature is clearly and unambiguously derivable from all the Figures of the application under appeal.

Claims 2 to 5 are identical to their respective original predecessors.

Therefore, the current version of the claims does not contravene Article 123(2) EPC.

3. State of the Art

3.1 The preamble of current Claim 1 is based on the device according to DE-A-3 137 690, (cf. in particular Figures 5C and 2A together with the respective description). The document discloses:

A printer device in which a striking movement is imparted to a striking member (tip of 1) for transmitting a print via an ink ribbon (9) to a paper (14) or the like bearing against an abutment (8), the striking movement of the striking member (tip of 1) being effected by means of a motion generator unit (1) of a magnetostrictive material, one end of said motion generator unit (1) being fixed to a supporting structure (25) and the opposite end thereof being fixed to said striking member (tip of 1).

3.2 The prior art booster (1) is a conically shaped tubular member. It is rather doubtful, if a person skilled in the art would think of such a particular shape in connection with the word "rod", which is normally defined as being a slim cylinder of metal, wood etc. Although the booster in the prior art is surrounded by a magnet coil (28) which is

aimed to be connected to a source of electric current for generating a magnetic field over the motion generator unit, the magnetic field, being variable in correspondence to the supply of current to said magnet coil, is not surrounded along its entire length. Moreover in the prior art, there are control means for controlling the supply of current to the magnet coil, see pages 25 and 26, but these control means are not designed to continuously control the change in length of said rod caused by said variations in the magnetic field. Therefore, the Board is of the opinion that the transfer to the preamble of parts of the features mentioned above, although it could be considered as justified from a formal point of view, would lead to distorted formulations and therefore affect the clarity of the Claim.

3.3 Thus, Claim 1 also meets the requirements of Rule 29(1)(a) and (b) EPC, since it is correctly delimited over the nearest prior art.

4. Novelty

The closest prior art document does not provide for a continuous control of the change in length of the booster (1), and thus of the striking movement of the striking member controlling the striking force as well as the timewise dependent velocity, caused by the variations in the magnetic field. The reason for this is that the known booster is not following the form of the signal by which it is driven, but this signal serves only to excite its self-oscillation which then propagates in the booster with the sound velocity of its material from the excited wide end to the narrow free end (see page 23, third paragraph, page 29, last paragraph, to page 33). Consequently, once such a wave has been excited it is like a bullet which has left the gun: during its propagation along the booster,

the form of the wave can no longer be influenced by the excitation element. The amplitude of this wave is increased during its propagation from the wide end to the narrow end. This increase has a constant value which depends on the elasticity of the material and the geometry of the booster. Since according to DE-A-3 137 690 it is important that the narrow free end of the motion generator can swing freely in its self frequency in this form of a booster, the exciting element, be it piezoelectric or magnetostrictive of nature, is located remote from this free end. In contrast thereto, the desired continuous control of the magnetostrictively created signal in the rod according to Claim 1 of the application under appeal can only be achieved, when the signal is created simultaneously in every volume element of the rod. Therefore the constructional prerequisite to achieve this continuous control is that the rod is surrounded by the magnet coil essentially along its entire length.

A further difference with respect to the closest prior art consists in the feature that according to Claim 1 the rod consists of a so called "giant" magnetostrictive material. This is a material with a magnetostrictive response of 1700 μm/m. According to DE-A-3 137 690, a material with a response on the level of 1 μm is used, (see in particular page 25, first paragraph). This small response is boosted in the state of the art by a factor of 219, which results in a stroke length of the booster of more than 200 μm needed for the printer function (see page 30, last paragraph, to page 32, first paragraph). According to the application under appeal a similar stroke length is achieved without any boosting. On the contrary, the boosting of a giant magnetostrictive material by a factor on the level of 200 would result in the immediate disintegration of the material.

US-A-3 473 466, concerns a printer device in which a striking movement is imparted to a striking member by a motion generator which may comprise a piezoelectric or a ferroelectric material. The striking member of this known device is, however, not fixed to the motion generator but is free-flying like a projectile. Consequently, a continuous control of the movement of the striking member is not aimed at. US-A-4 374 665, on the other hand, suggests the use of amorphous alloys of iron, boron, lanthanum and lanthanide, which undoubtedly display a giant magnetostrictive behaviour, as materials for magnetostrictive elements in a transducer for the production of signals. This document does not contain any reference to printer devices and not even to a similar field of technology. The same applies to Derwent's abstract No.G6905, D/29, referring to SU 765913.

US-A-4 193 703, US-A-3 614 486 and US-A-4 272 200 exclusively relate to piezoelectrically driven printing elements.

Thus the subject-matter of Claim 1 is novel in view of all the documents cited.

5. Inventive step

5.1 The description of the application under appeal starts from known printers, the striking members of which are actuated by means of electromagnets and springs. It is claimed that the printing velocity of these known printers is limited. Moreover, a high noise level obtained during the operation of these known printers is suggested to constitute a major problem. This noise partly consists of mechanical clatter from the interconnected, moveable parts of the striking mechanism, and partly of noise generated when the striking members hit the paper through the ink

ribbon. Although it may be true that known printers of the piezoelectrically or magnetostrictively operated type (DE-A-3 137 690, US-A-4 272 200), which do not comprise any free flying mechanical components, have already reduced the above mentioned problems of reduced velocity and mechanical clatter, the problem of the noise originating from the striking member that hits the paper through the ink ribbon still prevails.

5.2 The characterising features of Claim 1 solve this remaining problem by providing a continuous control of the motion of the striking element on its way to and from the paper. The velocity of the striking element may thus be controlled in a way that its energy, when hitting its target, is sufficient to produce a clean print on the paper but not as high as to result in bouncing oscillations.

5.3 The striking elements according to the documents cited in the Search Report are, without any exception, actuated by an impact excitation. A pulse wave either excites a self oscillation which propagates through a booster shaped striking element (e.g. DE-A-3 137 690, US-A-4 272 200), or excites a mechanical mass-spring system via a piezoelectric element (e.g. US-A-3614486), or via a piezoelectric or magnetostrictive element, which is used to accelerate a free-flying striking element (e.g. US-A-3 473 466, US-A-4 193 703). In all of these known devices the pulse wave is principally a source of energy whereas the characteristics of the motion of the striking element are substantially defined by its material and constructional parameters.

DE-A-3 137 690, (cf. in particular page 21, penultimate paragraph), has in principle recognised that a problem resides in that uncontrolled oscillations and bouncing

motions result in a prolongation of the single striking action and thus in a reduction of the overall printing velocity. But the solution is solely seen in a smooth and non-vibratory return to the retracted position of the striking element thus reducing the time between two subsequent actuations of the same striking element. DE-A-3 137 690 (see pages 34 to 38 as well as Figures 3A to 3B), therefore, foresees the correctly timed excitation of a counterpulse to partly compensate for the backward oscillation of the striking element.

A forced and continuously controlled motion of the striking element over the whole striking phase, however, would not have been possible with these prior art devices and has not even been suggested as something desirable for any reason.

5.4 Giant magnetostrictive alloys have been known before the priority date of the application under appeal, see US-A-4 374 665 and SU-765 913. These materials, the preparation of which involves a rather complicated and therefore costly process, are suggested to be used as magnetostrictive components of transducers for control devices which provide for a precise conversion of an electrical into a mechanical elongation signal. These are, however, not applications which can be associated with the actuation of the striking elements of a printing device which, according to the understanding of the person skilled in the art before the priority date of the application under appeal needed to be "fired" into the direction to provide for a sufficiently strong impact on the paper.

5.5 Even if, hypothetically, the person skilled in the art of printing would have considered the use of a "giant magnetostrictive" material in a known printing device,

for instance the one of DE-A-3 137 690, he would have simply exchanged the normal magnetostrictive material against the "giant" one and would have been content to have less power for the actuation of the striking elements. He would not have had any reason to modify the construction principle of the device in particular of its control section.

Therefore, the exchange of the normal magnetostrictive material in a hitherto known printing device against a per se known "giant" magnetostrictive material would have not resulted in a device as defined in Claim 1.

5.6 The Board's view, therefore, is that the claimed invention is not rendered obvious by the available known art and hence the required inventive step is also involved (Article 56 EPC).

Claims 1 is thus allowable in accordance with Article 52(1) EPC.

6. Dependent Claims 2 to 5 are not open to objection on formal grounds and their subject-matter includes particular embodiments of the invention defined in Claims 1 and 3, respectively. They are, therefore, likewise allowable.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the Examining Division with the order to continue and finalise the examination on the basis of the allowable claims specified in paragraph VI above.

The Registrar

N. Maslin

The Chairman

G. Szabo

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