

Publication in the Official Journal *Yes* / No

File Number: T 501/90 - 3.2.2

Application No.: 86 302 628.2

Publication No.: 0 198 661

Title of invention: Ink dot printer

Classification: B41J 3/12, G01D 15/16, B41J 3/04

D E C I S I O N
of 21 January 1992

Applicant: TOKYO ELECTRIC CO., LTD

Headword:

EPC Article 56

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

Headnote



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Boards of Appeal

Chambres de recours

Case Number : T 501/90 - 3.2.2

**DECISION
of the Technical Board of Appeal 3.2.2
of 21 January 1992**

Appellant :

TOKYO ELECTRIC CO., LTD
6-13 2-chome, Nakameguro
Meguro-ku
Tokyo (JA)

Representative :

Evans, David Charles
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Decision under appeal :

Decision of Examining Division 2.3.04.086 of the
European Patent Office dated 27 February 1990
refusing European patent application
No. 86 302 628.2 pursuant to Article 97(1) EPC.

Composition of the Board :

Chairman : G.S.A. Szabo
Members : W.D. Weiss
F. Benussi

Summary of Facts and Submissions

- I. European patent application 86 302 628.2, filed on 9 April 1986, with priority being claimed from Japanese application No. 77 867/85, dated 12 April 1985, and published under No. 0 198 661 on 22 October 1986, was refused by a decision of the Examining Division, dated 27 February 1990.

- II. The reason given for the decision was that the then valid Claim 1 could not "be allowed because of lack of novelty or at least lack of inventiveness" having regard to the documents GB-A-1 484 368 (D1) and EP-A-0 124 339 (D2). DE-A-3 417 948 (D3) was also cited in the Search Report as relevant.

In its communication dated 18 July 1988 the Examining Division has also mentioned the document EP-A-0 195 652 (D4) as a relevant prior art.

- III. A Notice of Appeal was filed against this decision on 24 April 1990, and the appeal fee was paid simultaneously. The Statement of Grounds was filed on 7 June 1990 and contained a main request and two auxiliary requests.

- IV. On 17 June 1991 the Board issued a communication pursuant to Article 110(2) EPC raising objections on the basis of Article 123(2) EPC and Article 84 EPC (clarity).

- V. On 18 September 1991, the Appellant filed three amended sets of claims standing for the main request and first and second auxiliary requests, respectively. On 9 January 1992 the Appellant again replaced the set of four claims according to main request by a redactionally amended version thereof together with adapted pages of the description.

Claim 1 of this version of the main request reads as follows:

"1. An ink dot printer comprising a recording electrode (11) and an opposed electrode (5), a recording means (16) for the supply of ink to said recording electrode (11) at a fore end thereof, means for supporting a recording medium (6) between said electrodes and means for generating an electric field between said recording electrode and opposed electrode to sputter the ink electrostatically from the fore end of said recording electrode toward said recording medium, characterised in that a square wave recording pulse signal (Vb) which is selected from a square wave corresponding to a printing signal is arranged to be applied to one of said electrodes on one side of the recording medium (6) while a continuous square wave signal (Vc) reverse-biased to the voltage of said one electrode to ground level and of the same frequency and pulse length is arranged to be applied to the electrode on the other side of the recording medium."

The dependent Claims 2 to 4 relate to particular embodiments of the printer according to Claim 1.

VI. Consequently, the Appellant requests grant of the patent according to the following main request:

Claims: Claims 1 to 4, filed on 9 January 1992, with letter of 8 January 1992;

Description: Pages 1, 1a, and 3, filed on 9 January 1992 with letter of 8 January 1992; pages 2, and 4 to 11, filed on 11 December 1988;

Drawings: Figures 1 to 9 as originally filed.

Reasons for the Decision

1. The Appeal is admissible.

2. Amendments

Claim 1 according to the main request is based on the original Claim 1 which has been specified by features which are clearly and unambiguously derivable from the drawings. The Claim 2 to 4 correspond to the original Claims 3 to 5.

Therefore, the claims according to the main request do not contravene Article 123(2) EPC.

3. Novelty

None of the documents cited in the Search Report discloses a continuous square wave which is reverse-biased to the voltage for the one electrode with respect to the ground level. This also applies to document EP-A-0 195 652 which was cited by the Examining Division. This document is a state of the art pursuant to Article 54(3) and (4) EPC.

Consequently, the subject-matter of Claim 1 according to the main request is novel.

4. Closest State of the Art

4.1 The preamble of current Claim 1 is based on GB-A-1 484 368, hitherto called (D1). This document in particular in its embodiments represented by the Figures 3 and 6 discloses:

An ink dot printer comprising a recording electrode (3) and an opposed electrode (4), recording means (8) for the supply of ink to said recording electrode (3) at a fore end thereof, means (1, 1a) for supporting a recording medium (6) between said electrodes and means (battery symbol, 9) for generating an electric field between said recording electrode (3) and opposed electrode (4) to sputter ink electrostatically from the fore end of said recording electrode (3) toward said recording medium. Consequently, all the features in the first part or Claim 1 are disclosed in (D1).

It represents the closest state of the art.

- 4.2 Document (D1) deals with the problem to avoid air breakdown of the tension between the electrodes (cf. page 1, lines 43 to 49). Its solution, therefore, tends to keep the surface level of the ink liquid permanently in a state that only a low additional electrical field is needed to pull a droplet reliably from the liquid on request. The DC biasing field taught in this document is also used by the present application, however, only as an additional measure in the frame of the dependent Claim 3, which has no influence on the judgement of Claim 1.
- 4.3 There is no mentioning at all in (D1) that square wave signals are used in connection with the devices disclosed therein. In connection with the embodiment displayed in Figure 3 the document mentions on page 4, lines 16 to 23, that "any suitable potential of either alternating or direct current may be established between the shaft electrode (3) and the external electrode". The embodiment of Figure 3 does not disclose any second signal or wave at all, even if this very general disclosure would lead a person skilled in the art to use a square wave. The

embodiment according to Figure 6 comprises two sources of high voltage which are represented by the electrical input means (9) and by the battery symbol. According to page 5, lines 6 to 23, the electrical input generator (9) delivers a potential sufficient to cause a stream of droplets to move in a desirably straight path from each of the shaft electrodes in the droplet source (8) toward the external electrode (4). The following sentence suggests that the source (9) delivers a high voltage video printing signal. At this passage the battery symbol is not referred to at all. It may be that the battery provides for a potential which may be held on the shaft electrode sufficient to maintain a covering of marking liquid over the protruding end of the recording electrode (3) (cf. page 4, lines 80 to 87). Therefore, a skilled person would interpret this battery symbol as representing a biasing DC voltage. The document, however, does not contain any information about where the ground level is connected to the circuit. It has, therefore, to be assumed that here, as usual in the state of the art, the whole voltage is summed up on one electrode and the other is connected to ground level (see e.g. (D3) page 7, last sentence).

5. Problem

The application starts from the obvious drawback of the prior art as represented by the document (D1) that the large high tension which is necessary to sputter the ink droplets from the recording electrode is built up with respect to ground level and, thus it is rendered difficult to maintain proper insulation among individual components. Thus complete safety is not easy to achieve.

6. Solution

The principle of the solution as presented by Claim 1

according to the main request consists in that the ground level is connected to the circuit at a position between the electrodes, that the printing signal, in form of square pulses selected from a square wave, is applied to one electrode while a continuous square wave of the same frequency and pulse length but with opposite polarity is applied to the other electrode.

7. Inventive step

The technical problem specified above on which the application under appeal is based, does not even arise in documents (D2) and (D3).

The basic problem of document (D2) is to increase the sharpness of images deposited on paper. Consequently, the pulse length of the pulses with reverse polarity which are applied to the opposed electrode is much smaller there than that of the printing pulse signal and is placed at the very start of the latter and exclusively there (cf. Fig. 8). A continuous square wave there is not mentioned at all. Moreover, the recording medium is not positioned between the recording and the opposed electrodes but behind the opposed electrode.

Document (D3) is also concerned with the reliable release of ink droplets from the liquid surface level. Although this document discloses printing pulse signals which have a square shape, it is silent about the fact, whether these pulses are selected from a squarewave, and therefore all have the same pulse length, or are created on demand and with varying pulse length. Anyway, the opposed electrode (3) here is grounded only and the entire printing voltage is present between ground and the printing electrode (N).

Since none of these other documents disclose the means which would have enabled the skilled person to modify the device according to (D1) in the manner specified in the characterising part of Claim 1, the subject-matter thereof cannot be obvious.

Hence the required inventive step is also involved.

Claim 1 according to the main request is thus allowable in accordance with Article 52(1) EPC.

8. Dependent Claims 2 to 4 according to the main request are not open to objection on formal grounds and their subject-matter covers particular embodiments of the invention defined in Claim 1. They are, therefore, likewise allowable.
9. Since the main request is allowable, the auxiliary requests need not be considered.

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 grant a patent on the basis of the following documents:

Claims: Claims 1 to 4, filed on 9 January 1992, with letter of 8 January 1992;

Description: Pages 1, 1a, and 3, filed on 9 January 1992,
with letter of 8 January 1992; pages 2, and 4
to 11, filed on 11 December 1988;

Drawings: Figures 1 to 9 as originally filed.

The Registrar

The Chairman



S. Fabiani



G. Szabo