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Veröffentlichung im Amtsblatt	Ja/Nein
Publication in the Official Journal	Yes/No
Publication au Journal Officiel	Oui/Non

Aktenzeichen / Case Number / N° du recours : T 5/84

Anmeldenummer / Filing No / N° de la demande : 80 300 609.7

Publikations-Nr. / Publication No / N° de la publication : 0 015 727

Bezeichnung der Erfindung:
Title of invention:
Titre de l'invention : Electrostatic ink jet printing apparatus and method

ENTSCHEIDUNG / DECISION
vom / of / du 12 February 1985

Anmelder/Patentinhaber:
Applicant/Proprietor of the patent:
Demandeur/Titulaire du brevet : Xerox Corporation

Stichwort / Headword / Référence : Electrostatic ink jet printing

EPÜ / EPC / CBE Art. 52(1), 56

"Inventive step"

Leitsatz / Headnote / Sommaire

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Case Number: T 5 / 84

DECISION

of the Technical Board of Appeal 3.2.1

of 12 February 1985

Appellant: Xerox Corporation, Xerox Square - 020,
Rochester New York 14644 (US)

Representative: Goode, Ian Roy et al, c/o Rank Xerox Ltd
Patent Department 338 Euston Road, Londonw NW1 3BH (GB)

Decision under appeal: Decision of Examining Division 086 of the European Patent Office dated 22 July 1983 refusing European patent application No 80 300 609.7 pursuant to Article 97(1) EPC

Composition of the Board:

Chairman: G. Andersson
Member: P. Ford
Member: K. Schügerl

Summary of Facts and Submissions

I. European patent application No. 80 300 609.7, filed on 28 February 1980 and published on 17 September 1980 under publication No. 0 015 727 was refused by a Decision of the Examining Division 086 dated 22 July 1983.

II. The decision was based on a set of claims consisting of two independent claims 1 and 4 and of the claims 2 and 3 dependent from claim 1 and of claim 5 dependent from claim 4. The wording of the independent claims is the following:

"1. An electrostatic ink jet printing apparatus for marking a record member with ink drops in a raster pattern having rows of pixel positions comprising:

a row of nozzles (2) for emitting substantially parallel streams (3) of a conductive fluid and means for promoting the formation of drops (5) from the streams at finite distances from the nozzles,

a charging electrode (6) associated with each nozzle adjacent the region of drop formation for charging drops,

electrostatic deflection electrodes (10, 11) associated with each nozzle for deflecting charged drops toward a segment of a row of pixel positions at a recording plane (14), and

stitching means (16,17,27) for aligning the drops of adjacent nozzles to appropriate pixel positions in the raster pattern characterised by an array of drop sensors (16,17) positioned near the stitch points between raster segments to sense the passage of charged drops through a corresponding array of benchmark locations

wherein all but the two endmost benchmark locations are accessible by a stream of drops from two adjacent nozzles so that said adjacent nozzles share drop sensors."

"4. An electrostatic ink jet printing method comprising:

generating a plurality of ink drop streams,

charging the drops in the streams to levels corresponding to video signals representative of pixel positions within a row of a raster scan pattern, and

deflecting the charged drops from each nozzle along a segment of a row of pixels according to the video signals, characterised by the step of sensing the passage of ink drops from each nozzle over sensing sites near the edges of each of said segments so that all but the two endmost drop streams share sensing sites with an adjacent drop stream, and

correlating the sensing and charging step to stitch together in alignment with segments covered by said ink drop streams."

III. The reason given for the refusal was that the claimed subject matter did not involve any inventive step, having regard to US-A-3 886 564 and to US-A-3 786 517.

IV. Against this decision, the applicant lodged an appeal on 24 September 1983, paid the appeal fee and submitted the statement of grounds within the prescribed time.

V. The appellant requested the grant of the patent on the basis of the present claim 1, stressing the inventiveness of this subject-matter. Further, the appellant submitted a revised set of claims as basis for an auxiliary request.

VI. On the Rapporteur's advice, the appellant submitted amendments to the description and to Claim 4 according to the main request.

Reasons for the Decision

1. The appeal complies with Articles 106-108 and Rule 64 EPC; it is therefore admissible.

2. The amendments to the description aim at removing some inconsistencies with the wording of the claims according to the main request and at deleting some unclear passages. In Claim 4 (see para. III), only "with" (last line but one) has been replaced by "the" in order to correct an obvious linguistic error. Thus, the amendments meet the requirements of Article 123(2) EPC and the procedure can be continued on the basis of these amendments.

3. US-A-3 886 564 is concerned primarily with a sensor to determine the proper position of the vertically deflected stream of droplets, emanating from a nozzle of an ink jet printer. This sensor is intended to operate either during adjustment procedures, the drops being deflected in a separate test path (col. 6, line 18) or during printer operation, sensing the passage of drops on characters with long vertical strokes (col. 3, line 51), the drops then being necessarily aimed at a certain pixel.

4. The US document refers also to "multiple sensors" (col. 1, line 52). Two examples are disclosed for such multiple sensors. The first one serves only to improve

the resolution of a single sensor (col. 6, line 59, fig. 10), a refinement without interest in the present connection; the second example deals with the control of the position of the nozzles by sensing the direction of the undeflected stream (col. 4 line 67). The resulting signal is used to align the nozzle manually or by an electromechanical technique (col. 5 line 33). Again, this device is said to be applicable to multiple nozzle printers (col. 5 line 46).

The disclosure of the US document regarding the sensing of the undeflected stream is not altogether clear. It may be gathered from column 4, line 26 that only a sensor means (70 in fig. 17a and 17b), sensing the horizontal direction of the undeflected stream is arranged in addition to the sensor controlling the deflection in the vertical direction. From column 5 line 3 however, it may be inferred that both the sensors 70 and 71 of fig. 17a and 17b are aligned to the undeflected stream, a third sensor being thus foreseen for the deflected stream.

5. The US document refers, additionally, to multi-nozzle systems (col. 4 line 63, col. 5, line 28; line 47) in connection with the aligning of nozzles (undeflected stream). The skilled person will recognise at once that the sensors in this case have to be arranged in an array and that a similar array of sensors can be provided for the sensors controlling the deviation of the deflected stream. Since the US document is exclusively concerned with vertically deflected streams, the arrangement will necessarily be a mere juxtaposition of the systems disclosed for a single nozzle.

6. The teachings of the US document, applied to the known multinozzle sytems with horizontal deflection, will result in a similar juxtaposition of the sensor means for the undeflected stream and also in a juxtaposition of the sensor means for the deflected stream, turned by 90 degrees. Accordingly, the question has to be answered whether the skilled person, starting from such an clearly obvious modification, could also take the next steps and arrive at the claimed subject matter.

7. The various sensing systems disclosed in the US document are intended to solve two problems: the mechanical aligning of the nozzles and the electrical controlling of the deflection. If both the alignment of the nozzles and the deflection of the drops are controlled in one and the same device, then a certain relationship exists between these two measures: the true pixel positions are controlled by these two references. This would also apply to systems with horizontal deflection.

8. The invention abandons this approach; first by using sensing means for two degrees of deflection, these two degrees constituting now the two references for controlling the pixel position, and, second, by using one sensor for two adjacent nozzles. No incentive to take these steps can be found in the US document. As follows from the analysis in para. 4, the "multiple sensors" are never associated with two degrees of deviation.

Only in a single passage (col. 2, line 39), referring to the state of the art, is an array of sensors mentioned, without further explanation. It remains, therefore, unclear how this device operates, and,

especially, whether more than a single degree of deflection is sensed at all. In any case, this passage, wether taken by itself or in combination with any part of the remaining disclosure cannot be considered as suggesting that the skilld person should choose two degrees of deviation as references.

9. As to the second step, no similarities or pointers can be found in the document. The fact that according to US-A-3 786 517 two adjacent nozzles share deflection plates, is incidental. This known arrangement is a simplification compared with two deflection plates per nozzle. The invention, however, can certainly not be regarded as the mere outcome of such a tendency towards simplification, but rather as a novel approach, which is not foreshadowed in the available documents. That in comparison with a notional system with two degrees of deflection as references and with two sensors per nozzle, a simplification is brought about, is then only a beneficial side effect, which speaks additionally in favour of the invention.

9. Thus the subject matter of the independent Claims 1 and 4 according to the main request - the latter circumscribes the principle of the invention, as expressed in Claim 1 in form of a method claim - are based on inventive step (Article 56 EPC); these claims and the subclaims, dependent from these claims are therefore allowable (Article 52(1) EPC).

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 European patent on the basis of the following documents:

   (a) description, pages 1 and 2, received on 23 April 1982.

   (b) description pages 3,5,6,9,11,12, received on 5 January 1985,

   (c) description, pages 4,7,8,10 as originally filed,

   (d) claims, page 1 (claims 1, 2, 3, part of claim 4), received on 23 April 1982,

   (e) claims, page 2 (part of Claim 4, Claim 5), received on 5 January 1985 and

   (f) drawings as originally filed.