Europäisches Patentamt
Beschwerdekammern

European Patent Office
Boards of Appeal

Office européen des brevets
Chambres de recours

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 210/83

Anmeldenummer / Filing No / N° de la demande : 79 200 737.9

Veröffentlichungs-Nr. / Publication No / N° de la publication : 0 013 041

Bezeichnung der Erfindung: Magnetic electron lens for cathode-ray tube
Title of invention:
Titre de l'invention :

Klassifikation / Classification / Classement : H01J 29/68; H04N 9/28

ENTSCHEIDUNG / DECISION
vom / of / du 14 October 1987

Anmelder / Applicant / Demandeur : N.V. Philips' Gloeilampenfabrieken

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Articles 56, 84

Kennwort / 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 210/83

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 14 October 1987

Appellant : N.V.Philips' Gloeilampenfabrieken
Groenewoudseweg 1
NL-5621 BA Eindhoven

Representative : Koppen,Jan
Internationaal Octrooibureau B.V.
Prof. Holstlaan 6
NL-5656 AA Eindhoven

Decision under appeal : **Decision of Examining Division 047 of the European Patent Office dated 25 July 1983 refusing European patent application No. 79 200 737.9 pursuant to Article 97(1) EPC**

Composition of the Board :

Chairman : K. Lederer
Members : J. Roscoe
P. Ford

Summary of Facts and Submissions

I. European patent application No. 79 200 737.9, filed on 7 December 1979 and published on 9 July 1980: (publication number 0 013 041) claiming priority of 27 December 1978 from an application NL 7 812 540 made in the Netherlands (not as erroneously stated on the published application from DE-7 812 540 U), was refused by a decision of the Examining Division 047 dated 25 July 1983. That decision was based on Claims 1 and 7 received on 5 January 1982, Claim 7 as amended by Applicant's letter received on 14 September 1982, and Claims 2 to 6 received on 20 May 1981.

II. The reason given for the refusal was that the subject-matter of Claim 1 did not involve an inventive step having regard to the disclosures in IEEE Transactions on Consumer Electronics, Vol. CE-24, No. 3, August 1978, at pages 481 to 487 (hereafter referred to as doc. A) and in GB-A-1 535 447 (hereafter doc. B).

III. On 14 September 1983 the applicant lodged an appeal against the decision and simultaneously paid the appeal fee. A statement setting out the grounds of appeal was received on 7 November 1983.

IV. Following a communication from the Board pursuant to Article 110(2) EPC, a personal consultation with the rapporteur and a series of telephone calls, the appellant finally submitted on 15 June 1985, new pages of description, numbered 1 to 8 to replace those on file and first and second new sets of claims, each consisting of seven claims. The appellant noted the need to amend the description (evidently by deletion of "substantially" in the consistory statements corresponding to Claims 1 and 7)

if the second set of claims was allowed. The earlier request for oral proceedings was maintained only for the event of the Board not finding either set of claims allowable.

V. The appellant is, therefore, requesting cancellation of the impugned decision and the grant of a patent on the basis of either the first set of Claims 1 to 7, filed on 15 June 1985 (main request) or the second set of Claims 1 to 7, filed on the same day (auxiliary request).

The only two independent Claims, 1 and 7, of the first set read as follows:

1. A cathode-ray tube comprising in an evacuated envelope (1), an electron gun (5,6,7) to generate an electron beam (8,9,10), which is focused on a target (12), which electron gun comprises centered along an axis, a cathode (19), a grid (21) having a substantially circular aperture, a first anode (22) having an aperture and a magnetic lens of a permanent magnetic material in the vicinity of the aperture in said grid, characterised in that said magnetic lens is a magnetic quadrupole lens (32) the field lines (33) of which are perpendicular or substantially perpendicular to the electron beam, the lens exhibiting 180° rotational symmetry about said axis and having on the beam (8,9,10), in two mutually perpendicular directions, a converging and diverging effect respectively, which in combination with the stronger converging effect of the electric fields in the gun induces an astigmatic cross-over in the electron beam.

7. A cathode-ray tube comprising in an evacuated envelope (1) an electron gun (5,6,7) to generate an electron beam (8,9,10), which is focused on a target,

which electron gun comprises centered along an axis, a cathode (19), a grid (21) having a substantially circular aperture, a first anode (22) having an aperture and a magnetic lens (35) of a permanent magnetic material in the vicinity of the aperture in said grid, characterised in that the magnetic lens is disposed against the grid and constituted by a disc (35) having a central aperture (34) with two north poles located at opposite sides of the aperture on one face of the disc and two south poles on the other face of the disc opposite the north poles providing a magnetic field exhibiting 180° rotational symmetry about said axis and consisting of two oppositely located sectors the field lines (36) of which extend between the opposed poles via the aperture (34), the combined effect on the beam of this field and the beam converging electric fields in the gun being to induce an astigmatic cross-over in the beam.

Claims 1 and 7 of the second set are the same with the single exception that at lines 4-5 of each claim the aperture is described as circular rather than substantially circular.

Reasons for the Decision

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

2. In the specification as originally filed, the expression "substantially circular aperture", now used in connection with the grid in independent Claims 1 and 7 of the main

request, did not appear and there was no disclosure of grids having apertures which could aptly be described as substantially circular but not circular in the strict sense when due allowance was made for manufacturing tolerances.

In the discussion of a prior art cathode-ray tube on page 2, line 19 of the specification, attention was drawn to the fact that because of its grid configuration electron emission occurs from a non-circular region of the emissive layer of the cathode. At page 3, lines 1 to 7, it was said to be the object of the invention "to provide a cathode-ray tube ... emission takes place from a circular region of the emissive layer of the cathode" and at page 3, lines 28-32, to which the appellant draws attention in support of the expression "substantially circular aperture", that the aperture in the first grid may be rotationally symmetrical so that the electrons are emitted from a rotationally symmetrical region of the emissive surface of the cathode. This latter statement is construed to mean that the object is to be fulfilled by the use of apertures of this shape. It cannot be seen to suggest deliberate deviations from the circular e.g. to the four-sided apertures formed by rounded sides as now contemplated by the appellant (see letter filed 2 November 1984) whether to provide an effect different from or the same as that provided by a circular aperture.

The Board takes the view that in the circumstances the scope of the expression "substantially circular aperture" is indeterminate and that the claims of the main request do not therefore satisfy the requirement of Article 84 EPC that they should be clear. Moreover, insofar as they could be construed to cover intentional deviations from circular they would represent an addition to the subject-matter of the original disclosure contrary to the provisions of Article 123(2) EPC.

The main request has therefore to be refused.

3. The claims of the auxiliary request are supported by the original disclosure and the amendments made to the description, required mainly to bring it into conformity with the new formulation of the claims introduce no new subject-matter. In view of the disclosure on page 7, lines 29 and 30 of the original description, it is not necessary to restrict Claim 1 to a magnetic lens "disposed against the grid" as in Claim 7. Therefore, no objection arises under the terms of Article 123(2) EPC in relation to the auxiliary request.

The two-part formulation of independent Claims 1 and 7 is based on the cathode-ray tube disclosed in US-A-3 217 200 (hereafter doc. C) which, from a constructional point of view, is the closest prior art in the Board's opinion. Since the combination of features which is common to that tube and the claimed tube forms the preamble of both claims the requirements of Rule 29(1)(a) EPC are met.

The description contains a resumé not only of the pertinent features of the tube disclosed in doc. C but also those of the cathode-ray tube, described in doc. A, which comes closer to the tubes claimed in respect of the beam configuration. It thus meets the requirements of Rule 27(1)(c) EPC.

4. A thorough examination of all the documents cited on the search report and of those referred to in the application itself or in the appealed decision reveals that none of them discloses a cathode-ray tube having all the features of either of the two independent Claims 1 and 7. The subject-matter of these claims is therefore novel in relation to the state of the art known to the Board.

5. The question which remains to be decided is therefore whether, having regard to this state of the art, the subject-matter of the main Claims 1 and 7 involves an inventive step.

6. As already indicated, a cathode-ray tube according to the preamble of both of these claims was known at the priority date claimed from doc. C in Figure 1 of which the cathode, grid, first anode and magnetic lens are identified as 2, 3, 4 and 5 respectively. The field of the magnetic lens, consisting of an apertured disc, is said to draw the electrons together into a constricted cross-over region thereby providing an improved cross-over configuration of reduced cross-section and longitudinal dimensions exhibiting substantially less spherical aberration (column 3, lines 44-49) than appears in an otherwise similar structure lacking the lens.

7. According to the description in the present application in such a tube increases and decreases in the beam current cause the cross-over to move along the beam axis away from and towards the cathode respectively, this varying the focusing influence of the lens and hence the dimensions of the spot on the display screen.

This spot must, however, have predetermined generally small dimensions and the haze surrounding the spot should be a minimum (page 1, lines 18-21).

8. Therefore, the problem in relation to this known type of tube is to be seen as how to minimise this undesired variation of the spot dimension with variations in beam current.

9. According to the invention, this problem is solved either by using as magnetic lens a magnetic quadrupole lens, the field lines of which are perpendicular or substantially perpendicular to the electron beam, which lens exhibits 180° rotational symmetry about the electron gun axis and has a converging and diverging effect respectively in two mutually perpendicular directions on the beam which in combination with the stronger converging effect of the electric fields in the gun induces an astigmatic cross-over in the electron beam (tube according to Claim 1) or by using as magnetic lens, disposed against the grid, a disc having a central aperture with two north poles located at opposite sides of the aperture on one face of the disc and two south poles on the other face of the disc opposite the north poles, providing a magnetic field exhibiting 180° rotational symmetry about the gun axis and consisting of two oppositely located sectors, the field lines of which extend between the opposed poles via the aperture, the combined effect on the beam of this field and the beam converging electric fields in the gun being to induce an astigmatic cross-over in the beam (tube according to Claim 7).

10. The Board has no reason to doubt that these measures overcome or at least mitigate the addressed problem.

11. Neither doc. C nor any of the other documents cited in the search report suggests how a reduction in the axial movement of the cross-over point with changes in the beam current could be achieved, still less hints at the association of an electric field with either a quadruple magnetic lens or a lens of the construction required by Claim 7 to generate an astigmatic cross-over in the beam either to effect such a reduction or for any other purpose. Furthermore, none of these documents even discloses a lens of the construction called for by Claim 7.

12. On the other hand, US-A-3 725 831 and the corresponding DE-A-2 226 355 do disclose use of a quadrupole magnetic lens in association with a cathode-ray tube. It is, however, located outside the neck of the tube and acts in conjunction with other magnetic lenses to introduce opposing shifts of the outer beams of an in-line tri-beam shadow mask colour kinescope without substantially affecting the central axial beam. There is absolutely no hint in these documents that such a lens might be used either alone or in conjunction with electric fields in order to stabilise the position of the cross-over against grid voltage variations or to produce an astigmatic cross-over in the beams.

13. Doc. B relates to a plural beam cathode-ray tube for displacing coloured pictures in which the display screen, comprising a plurality of strips luminescing in different colours is located behind a shadow mask which has apertures which assign each beam to luminescent strips of one colour. In each aperture there is provided a magnetic quadrupole lens, the axis of which coincides with that of the electron beam passing through it, which lens focuses the beam in a first plane while defocusing it in a second plane normal to the first plane. The strong focusing results in more electrons impinging on the screen which is located at or close to the focus to give a brighter picture. By the substitution of quadrupole lenses for the axial-symmetric lenses hitherto used in this application focusing is said to be achieved with a comparatively small magnetisation.

In this tube, the quadrupole lenses, although used to focus an electron beam, do not act to modify the focusing effect of a strong electric field to provide two spatially separated focal lines as in the arrangement claimed in Claim 1. The teaching of this document would not therefore

lead the skilled man to replace the axial-symmetric magnetic lens of doc. C by the combination of a magnetic quadrupole lens in order to reduce variations of the spot size with beam current or indeed in the expectation of any other useful result. Still less would it suggest to him the use of the type of magnet claimed in Claim 7.

14. Doc. A describes an electron gun for use in a TV display system designed to give improved spot sharpness and focus uniformity. It is explained that the size of the spot on the screen depends not only on the spherical aberration of the main lens but also on that occurring during formation of the cross-over. Because of the high current density of the electrons in the cross-over and their low velocity, space charge repulsion in this part of the gun accounts for an extra contribution to spot size. Both of these latter effects are said to be reduced by introduction of a quadrupole disturbance of the rotationally symmetric lens field in front of the cathode. This field is formed by replacing the normally circular apertured first grid by an assembly of two plates, one having a horizontal and the other a vertical slit, welded together to provide a square aperture where the slits overlap, which aperture focuses the electron beam into two focal lines. Spherical aberration in these lines is less than in the conventional cross-over due to the fundamentally better focusing action of a quadrupole lens and the lower current density in the line cross-overs compared to a point cross-over reduces the influence of space charge repulsion.

15. The Board cannot, however, see why the skilled man should be brought by this disclosure, in which no reference is made to quadrupole magnets or magnetic fields to the idea of replacing the focusing magnet in the tube of doc. C, which also contains no reference to a quadrupole magnet, by such a magnet and an associated electric field with a

focusing effect stronger than the defocusing effect of the magnet in one plane, in order to produce an astigmatic cross-over in order to avoid the variation of spot size with beam current. Rather would it suggest the use of the electrostatic lens in conjunction with the existing magnetic focusing.

16. In view of what has been said above, the Board finds that the subject-matter of Claim 1 does involve an inventive step (Article 56 EPC). This claim and Claims 2-6, which relate to particular embodiments of it are thus allowable. The Board also finds the subject-matter of the independent Claim 7 to involve an inventive step in the absence of any prior art disclosing a magnet of the type claimed, let alone its use to produce an astigmatic cross-over in an electron beam.

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:

Claims 1 to 7 filed on 15 June 1985 and headed "second set of new claims ...";

description, pages 1 to 8 filed on 15 June 1985 with the word "substantially" deleted on page 2, line 24 and page 4, line 7, and the spelling of the word "permanent" corrected at line 5 of page 1;

drawings: sheets 1 to 4 as originally filed.

The Registrar The Chairman

F.Klein K.Lederer