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Bezeichnung der Erfindung: A method of manufacturing a shadow mask for a colour cathode ray tube
Title of invention:
Titre de l'invention :

Klassifikation / Classification / Classement : H01J 9/14, H01J 29/07

ENTSCHEIDUNG / DECISION

vom / of / du 19 July 1989

Anmelder / Applicant / Demandeur : Kabushika Kaisha Toshiba

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 (no)

Leitsatz / Headnote / Sommaire

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Case Number : T 168/88

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 19 July 1989

Appellant : KABUSHIKI KAISHA TOSHIBA
72, Horikawa-cho, Saiwai-Ku
Kawasaki-shi Kanagawa-Ken 210 (JP)

Representative : KIRK, GEOFFREY Thomas et al.
Batchelor, Kirk & Eyles
2 Pear Tree Court
Farringdon Road
London
EC1R 0DS (GB)

Decision under appeal : Decision of Examining Division 047 of the European Patent Office dated 12 December 1987 refusing European patent application No. 84 302 821.8 pursuant to Article 97(1) EPC

Composition of the Board :

Chairman : K. Lederer
Members : C. Black
R. Schulte

Summary of Facts and Submissions

I. European patent application No. 84 302 821.8 (publication No. 0 124 354) was refused by decision of the Examining Division.

II. The decision was based on Claim 1 submitted by the Applicant at oral proceedings held on 25 March 1987 (main request). The reason for the decision was that the said claim was not clear as required by Article 84 EPC and moreover that it included subject-matter not disclosed in the application as originally filed, so that Article 123(2) EPC was also contravened. Claim 1 of a further set of claims received 8 August 1987 (considered as replacing Claim 1 of the auxiliary request made during the oral proceedings) was not allowable because it involved further amendments which the Examining Division was not prepared to admit in view of Rule 86(3) EPC. In any case the said claim did not define the matter for which protection was sought in terms of all essential features -Article 84, Rule 29(1) and (3).

III. An appeal was lodged against the said decision.

IV. In a communication from the Board, proposals were made for the formulation of a main independent claim which would overcome the objections under Articles 84 and 123(2) EPC. It was doubted however whether the subject-matter of a claim thus formulated would involve an inventive step having regard to the disclosures in

D1 = Valvo Berichte, Band XVIII April 1974, Heft 1/2, pages 77, 83, 84

D2 = Lehrbuch der Umformtechnik, Kurt Lange, Springer Verlag, Berlin-Heidelberg-New York 1975

D5 = FR-A-2 231 101

V. In response the Appellant (Applicant) accepted the said proposals and requested that the appealed decision be set aside and a patent granted on the basis of Claims 1 and 2 received 31 October 1988 of which Claim 1 reads as follows:

"A method of manufacturing a shadow mask from a metal sheet comprising the steps of annealing the metal sheet at a temperature within the range 1173 to 1473 K and under conditions such that the yield strength is reduced to a value which is above 19.6 x 10^7Pa and thereafter pressing the previously apertured metal sheet to the required shape characterised in that the metal is an alloy of iron and nickel, and the pressing step is undertaken at a temperature within the range 298 to 973 K and such that the yield strength is further reduced to 19.6 x 10^7Pa or less."

Claim 2 is dependent on Claim 1 and relates to a particular embodiment of the method according to Claim 1.

VI. In a further communication from the Board the reasons for finding that the subject-matter of Claim 1 did not involve an inventive step were amplified, citing additionally:

D3: Making, Shaping and Treating Steel, 9th Edition, United States Steel Corporation 1971, pages 606, 607

D4: Metals handbook, 8th Edition, Volume 4 (American Society for Metals) 1969, pages 437 to 440.

VII. The Appellant in response maintained the requests set out in paragraph V.

VIII. The Appellant argues essentially as follows.
D5 and the Japanese patent publications referred to on page 2 of the application in suit indeed propose the use of Fe-Ni alloys for shadow masks because of their low coefficient of thermal expansion in order to avoid the dome phenomenon resulting from expansion of the material of the shadow mask when it is heated by the electron beam. However this had not been put into practice because it had not been possible using existing pressing techniques and equipment to manufacture satisfactory shadow masks from such alloys. In this respect the person of average skill in the art, which is that of making cathode ray tubes and shadow masks therefor, would use for Fe-Ni alloy the same manufacturing techniques as he uses for low carbon steels i.e. annealing followed by cold pressing as disclosed e.g. in D1. If he does so however, a satisfactory mask cannot be obtained because the yield strength of the material has not been overcome by the annealing step. The problem of "spring-back", that is the tendency of a pressed sheet to return to its shape prior to pressing has been solved in the case of titanium alloys by hot-pressing, but the above-mentioned average skilled person is not a metallurgist, therefore would not investigate titanium alloys in seeking the solution to this problem. Even if it could be conceded that he was a metallurgist, he would not be led to try hot-pressing, known for titanium alloys, also for Fe-Ni alloys because of his knowledge of the difference in crystal structure between these. In particular, titanium alloys have the hexagonal close packed structure whereas Fe-Ni alloys have the face-centred cubic structure. The Board's provisional negative opinion as regards inventive step is based on hindsight and this

contention is supported by the fact that the Board has referred to five documents in coming to this opinion.

Reasons for the Decision

1. The appeal is admissible.

2. The Board agrees with the decision of the Examining Division refusing the application on the basis of the main and auxiliary requests then before it, on the ground that the requirements of Article 84 and 123(2) were not met.

3. Claim 1 now under consideration takes into account proposals referred to in paragraphs IV and V above and is considered to meet the requirements of Article 84 and 123(2).

4. This claim however contains no features which were not present in a Claim 1 received 22 December 1986 and which the Examining Division, in its annex to a summons to oral proceedings, found to be lacking in inventive step. The claim under consideration differs only in containing clauses which explain the required effect of the annealing and hot-pressing steps. The Board can accept that the subject-matter of the claim is novel because no document discloses hot-pressing an annealed Fe-Ni sheet to form a shadow mask, but agrees with the Examining Division that it does not involve an inventive step, for the following reasons.

5. The known method of manufacturing a shadow mask is exemplified by the disclosure in D1, page 83, paragraph 2.1.1, and involves annealing an apertured sheet

of low carbon steel at e.g. 1203 K followed by deep-drawing (pressing) at ambient temperature ("kalte Verformung").

6. The subject-matter of Claim 1 therefore differs from this disclosure in the following respects:

(a) the material for the shadow mask is a Fe-Ni alloy

(b) the alloy sheet is annealed at a temperature within the range 1173 to 1473 K under conditions such that its yield strength is reduced to a value which is above 19.6×10^7Pa

(c) the apertured sheet is hot-pressed at between 298 and 973 K such that the yield strength is further reduced to 19.6×10^7Pa or less.

7. A problem with a shadow mask manufactured from low carbon steel is that in use it is struck by the electrons of the electron beam, is thereby heated and expands (the dome phenomenon), resulting in degradation in the colour purity of the cathode ray tube. This problem is discussed in the description of the application in suit and is known from D5. D5, and also the three Japanese patent publications referred to in the description of the patent in suit, propose, in order to overcome the dome phenomenon, to use a Fe-Ni alloy having low or zero co-efficient of thermal expansion as the material for a shadow mask. The use of a Fe-Ni alloy creates however a new problem in that when the annealed and perforated sheet is pressed at ambient temperature it tends to return to its original shape after removal from the mould ("spring-back"), therefore does not have the proper curvature and again colour purity is impaired.

8. Accordingly, starting from the most appropriate prior art, which is the conventional process exemplified by the disclosure in D1 and considering those features of Claim 1 which distinguish it from the said disclosure, the technical problem which the invention defined in Claim 1 seeks to solve is the manufacture of a shadow mask which does not exhibit the dome phenomenon and whose curvature corresponds closely to that of the mould in which it has been pressed.

9. As indicated in paragraph 7 above, the dome phenomenon problem is known. Further the unsatisfactory nature of the Fe-Ni sheets pressed at ambient temperature would be apparent on inspection. Accordingly recognition of the problem does not contribute to the inventivity of the subject-matter of Claim 1.

10. The question to be answered therefore is whether the person of average skill in the art, having elected to further investigate Fe-Ni alloys which are well known for their low thermal expansion coefficient and, therefore, have already been proposed as a material for shadow masks to solve the dome phenomenon problem, would be led to use hot-pressing to overcome the spring-back problem, and to carry this out after an annealing operation.

11. According to D1 the effect of annealing is to homogenise the starting material, otherwise the pressing operation introduces defects; the necessity for a homogeneous starting material must apply also in the case of Fe-Ni alloys. Moreover the Appellant agrees that annealing before pressing is a standard step in the manufacture of shadow masks and in the Statement of Grounds for the appeal referred to US-A-3 909 311 as demonstrating that annealing reduced the yield strength of the starting material, this being associated with a reduction in grain

number (increase in grain diameter). The annealing temperature range required by Claim 1 (1173-1473 K) is not abnormally high, and it embraces the values quoted for low carbon steel in D1 (1203 K) and US-A-3 909 311 (1213 K). It is reasonable to assume that the average skilled person, in carrying out a conventional annealing step on Fe-Ni alloy sheet, will be investigating temperatures within the above-mentioned range. The Board therefore concludes that the features of Claim 1 relating to the use of Fe-Ni alloy and the annealing step do not contribute to the inventivity of its subject-matter. The Appellant, in the Statement of Grounds (final page), acknowledges that the invention is not characterised by the provision of an annealing step or the particular annealing conditions.

12. From D4 it is known that hot forming, which embraces hot-pressing, is a remedy for the problem of spring-back in the case of titanium alloys. In column 3 it is stated that spring-back in titanium alloys is more difficult to predict than spring-back in steel, although it depends on the same principles. This is seen as providing sufficient incentive for the average skilled person to investigate whether hot-pressing might solve the spring-back problem also in the case of Fe-Ni alloys, whose formation requirements would be expected to be just as comparable with those of titanium. The Appellant has argued that the Board has selected phrases from the disclosure in D4 to support its argument; however there is nothing in D4 to contradict the said phrases or which would cause the skilled person to foresee no prospect of success, even though he knows that titanium and Fe-Ni alloys have different crystal structures. Accordingly when he selects a Fe-Ni alloy as the material for a shadow mask as taught e.g. by D5, carries out a conventional annealing treatment (see paragraph 13) and combines with this the teaching of D4, he will establish by routine experimentation what hot-

pressing temperatures, if any, overcome the spring-back problem and thus automatically arrive at the subject-matter of Claim 1, which therefore does not involve an inventive step.

13. The Appellant's argument that the art in question here is that of making cathode ray tubes and shadow masks therefor, and that the appropriate skilled person would not know about or consider investigating the properties of titanium alloys cannot be followed. The average skilled person is a notional person who may be a composite entity to whom several skills may be attributed where the problem he is faced with covers more than one art. Moreover, even if the skilled person's competence were limited to that envisaged by the Appellant, once he had started off on the right track by investigating the possibilities of using Fe-Ni alloys and having encountered the problem of spring-back, it is reasonable to expect him to seek advice from someone skilled in the field of metal working.

14. The Appellant has also argued that if the Fe-Ni alloy sheet is annealed at too high a temperature in an attempt to reduce its yield strength sufficiently so that pressing at ambient temperature might be successful, the crystal grain size becomes excessively large at certain parts causing failure of these parts when pressing is carried out at ambient temperature. This is seen only as another explanation of why the process according to Claim 1, found to be obvious, is necessary.

15. To the Appellant's contention that the Board required four or five documents to conclude that the subject-matter of Claim 1 was obvious, it is pointed out that it has relied on D5 to demonstrate the possible use of Fe-Ni alloys for shadow masks, common general knowledge as exemplified by D2 for the annealing step and D4 for the hot-pressing

step. Other documents referred to in the course of the proceedings contain nothing inconsistent with what has been derived from D2, D4 and D5 and can be seen as at least corroborating the disclosure of these documents.

16. The feature of Claim 2 is the known percentage range for the content of nickel in low expansion Fe-Ni alloys and therefore adds nothing inventive to the subject-matter of Claim 1.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar: The Chairman: