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Case Number: T 1961/10 - 3.2.07

Application Number: 04773025.4

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Title of invention:
Packaging device and packaging method for hollow cathode type spattering target

Applicant:
JX Nippon Mining & Metals Corporation

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (all requests): no"

Decisions cited:
-

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Case Number: T 1961/10 - 3.2.07

D E C I S I O N
of the Technical Board of Appeal 3.2.07
of 15 November 2012

Appellant: (Applicant)
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 5 May 2010 refusing European patent application No. 04773025.4 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: H. Meinders
Members: H. Hahn
I. Beckedorf

Summary of Facts and Submissions

I. The applicant lodged an appeal against the decision of the Examining Division to refuse the European patent application No. 04 773 025.4.

II. The following documents are cited in the present decision:

D1 = JP-A-04 231461
D2 = US-B1-6 419 806
Annex A = Application as originally filed
Annex H = English translation of D1.

III. The Examining Division held that claim 1 of the main request dated 5 December 2008 met the requirements of Articles 123(2) and 54 EPC but lacked inventive step over a combination of D1 and D2. The Examining Division further considered that the subject-matter of claim 1 of the first auxiliary request filed during the oral proceedings on 25 February 2010 contravened Article 123(2) EPC while claim 1 of the second auxiliary request complied with Articles 123(2) and 54 EPC but likewise lacked inventive step in view of D1.

IV. With a communication dated 16 August 2012 and annexed to summons for oral proceedings the Board presented its preliminary and non-binding opinion with respect to the then valid claims 1-8 of the main request, claims 1-8 of the first auxiliary request, claims 1-6 of the second auxiliary request, and claims 1-6 of the third auxiliary request, all requests as filed together with the grounds of appeal dated 3 September 2010.

First of all, none of these requests appeared to be formally allowable under Articles 123(2) and 84 EPC.

The Board further stated amongst others that either figure 2 of the present application (as suggested by the applicant) or D1 can be considered as the closest prior art or the most promising springboard towards the "invention".

However, it appeared that in both cases the person skilled in the art would directly arrive at the subject-matter of independent claims 1 and 5 of the main request by applying his common general knowledge. The same conclusion applied to the subject-matter of independent claims 1 and 4 of the first to third auxiliary requests.

The appellant was given the opportunity to file observations to the communication provided they were filed well at least one month before the date of the oral proceedings.

V. With its letter dated 12 October 2012 the appellant submitted claim sets for replacement of the main request and first to third auxiliary requests taking account of the formal objections made by the Board in its communication annexed to the summons in combination with arguments concerning inventive step.

VI. The independent claims 1 and 5 of the present main request read as follows (amendments as compared to the independent claims 1 and 5 underlying the impugned decision are in bold with deletions in strikethrough; emphasis added by the Board):

"1. A package comprising a sputtering target (1), a cover (5) covering a part of the target and a **resin** bag (3) enclosing the target (1) and cover (5), the **resin** bag (3) being sealed and the interior of the **resin** bag **(3)** being evacuated, characterised in that the target (1) is a hollow, cup-shaped, cathode sputtering target, providing a void (4) therein and said cover (5) is placed on the peripheral edge (2) of the target (1) to cover said void, **wherein said cover (5)** ~~**and**~~ is provided with one or more through-holes (6) **provided to evacuate said void (4)** and said void (4) is likewise evacuated."

"5. A method of packaging a sputtering target comprising fitting a cover over part of the target, enclosing the target **(1)** and cover **(5)** within a resin bag **(3)** housing an outlet for connection with a vacuum suction device and evacuating the **resin** bag (3) by such device and sealing the **resin** bag, characterised in that the target is hollow cup-shaped cathode sputtering target (1) providing a void (4) therein and wherein said cover (5) is placed on the peripheral edge (2) of the target (1) to cover said void and is provided with one or more through-holes (6) **provided to evacuate said void (4),** said void (4) likewise being evacuated by means of the vacuum suction device connected with an outlet (7) of the **resin** bag, the **resin** bag being thereafter sealed."

VII. Independent claims 1 and 5 of the present first auxiliary request differ from those of the main request in that the term "**inner face of the**" has been incorporated between "the peripheral edge (2) of the" and "target (1) to cover said void …".

VIII. Independent claims 1 and 5 of the present second auxiliary request differ from those of the main request in that the features **", wherein said cover (5) has rigidity and is a flat plate that is capable of maintaining its shape after evacuation of said resin bag and said void (4)."** and **"wherein said cover (5) is rigid and is a flat plate which is capable of maintaining its shape after said evacuation of the resin bag (3) and said void (4).**", respectively, have been added at the end.

IX. Independent claims 1 and 4 of the present third auxiliary request read as follows (amendments as compared to the independent claims 1 and 4 of the second auxiliary request are in bold with deletions in strikethrough; emphasis added by the Board):

"1. A package comprising a sputtering target (1), a cover (5) covering a part of the target and a resin bag (3) enclosing the target (1) and cover (5), the resin bag (3) being sealed and the interior of the resin bag (3) being evacuated, characterised in that the target (1) is a hollow, cup-shaped, cathode sputtering target, providing a void (4) therein and said cover (5) is placed on the peripheral edge (2) of the target (1) to cover said void, **wherein said cover (5) is a flat plate and,** ~~**wherein said cover (5)**~~ is provided with one or more through-holes (6) **which extend through the flat plate** ~~**provided**~~ to evacuate said void (4) and said void (4) is likewise evacuated, **and** wherein ~~**said**~~ **the** cover (5) has rigidity and ~~**is a flat plate that**~~ is capable of maintaining its shape after evacuation of said resin bag **(3)** and said void (4)."

"4. A method of packaging a sputtering target comprising fitting a cover over part of the target, enclosing the target (1) and cover (5) within a resin bag (3) housing an outlet for connection with a vacuum suction device and evacuating the resin bag (3) by such device and sealing the resin bag, characterised in that the target is hollow cup-shaped cathode sputtering target (1) providing a void (4) therein and wherein said cover (5) is placed on the peripheral edge (2) of the target (1) to cover said void, **wherein said cover (5) is a flat plate** and is provided with one or more through-holes (6) **which extend through the flat plate** ~~**provided**~~ to evacuate said void (4), said void (4) likewise being evacuated by means of the vacuum suction device connected with an outlet (7) of the resin bag **(3)**~~**, the resin bag being thereafter sealed**~~ wherein ~~**said**~~ **the** cover (5) ~~**is**~~ **has** rigid**ity** and ~~**is a flat plate which**~~ is capable of maintaining its shape after said evacuation of the resin bag (3) and said void (4)**, the resin bag (3) being thereafter sealed**."

X. Oral proceedings before the Board were held on 15 November 2012. The issue of inventive step was discussed in view of figure 2 of the application as well as of document D1, in respect of the main request and the first to third auxiliary requests.

The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of one of the sets of claims filed as main request and as first to third auxiliary requests with letter of 12 October 2012.

At the end of the oral proceedings the Board announced its decision.

XI. The appellant argued, insofar as relevant for the present decision, essentially as follows:

Figure 2 of the present application as originally filed (= Annex A) represents the closest prior art for packaging hollow cup-shaped targets. D1 is not the closest prior art since it relates to flat targets only.

Starting from figure 2 the difference between claim 1 of the main request and the closest prior art is that the latter does not incorporate a cover placed on the peripheral edge of the hollow cup-shaped target, with the cover being provided with one or more through-holes. The technical effect of this arrangement is to protect the inner sputtering face of the hollow target. The problem solved by claim 1 of the main request is thus to prevent the inner sputtering face of a hollow cup-shaped target from being contaminated.

The person skilled in the art has no incentive or reason to modify the solution shown in figure 2 of the present application, since the package shown in this figure 2 already solves this problem and he would be satisfied by this simple but effective alternative solution. It would not be obvious for the person skilled in the art to depart from this alternative solution to go to the expense and time of modifying this arrangement by providing a cover specifically for the peripheral edge of the target. This modification may seem trivial when viewing it alongside figure 2 but

only in a hindsight analysis when viewed alongside the invention of claim 1. Without knowledge of the invention of claim 1 the skilled person would lack any motivation whatsoever to make any modification to the figure 2 arrangement. The obvious solution starting from figure 2 is to move the inlet of the resin bag for the vacuum suction unit to the top of the void and strengthen the bag material.

The invention may also seem trivial when combining the closest prior art with D1 but also only with hindsight. At the priority date a person skilled in the art would have no motivation to look beyond said alternative solution presented by figure 2 of the present application and would not move from the hollow cup-shaped target technology of the closest prior art to the flat sputtering target technology disclosed in D1, when looking for solutions.

Even if he would do so he would not achieve the invention since D1 teaches away from placing a (flat) cover on the peripheral edge of the hollow target since its cylindrical cover should be spaced apart from the sensitive sputtering face and therefore the cover shall be kept separate from the peripheral edge of a hollow sputtering target which comprises the upper edge of the inner sputtering face of the target (see Annex H, paragraphs [0005] and [0006]). For these reasons claims 1 and 5 of the main request involve inventive step.

The inventors realised that, contrary to the teaching of D1, a cover can be placed on the peripheral edge of the target in order to effectively protect the target when packaged in a resin bag, but without affecting the

performance of the sputtering target itself. There is no recognition in the prior art of the non-critical nature of the peripheral edge of a hollow sputtering target. The inner face of the target extends to the top of the peripheral edge (see page 5, line 3 of Annex A). It is admitted that said inner face at the top of said peripheral edge interacts with the cover plate but this does not affect the sputtering. Claims 1 and 5 of the first auxiliary request therefore demonstrate inventive step.

Claims 1 and 4 of the second auxiliary request demonstrate inventive step for the same reasons as the main request but are further differentiated from the prior art in that the cover is a flat plate which has rigidity. It is also inventive over D1 which teaches away from a flat cover since the cylindrical cover of D1 has side walls and it is not obvious to go against the teaching of the closest prior art and D1 to provide a cover in the form of a flat plate without side walls. A flat plate excludes any type of cylinder as it does not have any side walls at all. It is admitted that the rigidity is inherent to the intended purpose of the cover.

Claims 1 and 4 of the third auxiliary request comprise the same differentiating features and therefore, for the same reasons as the second auxiliary request, demonstrate inventive step, particularly as the holes in the cover according to D1 are in the side wall of the cylinder.

Reasons for the Decision

1. *Allowability of amendments made in the requests (Articles 84 and 123(2) EPC)*

Since the Board considers that the independent claims 1 of the main request and the first to third auxiliary requests lack inventive step (see points 2.1 to 2.8.2 below) there is no need to discuss whether or not the amendments made in these requests comply with Articles 84 and 123(2) EPC.

2. *Inventive step (Article 56 EPC)*

Main request

2.1 First of all, the Board remarks that inventive step should exist over any feasible prior art so that in the present case either figure 2 of the present application as originally filed (corresponding to Annex A to which in the following reference is made) - as suggested by the appellant - or D1 can be considered as the closest prior art or the most promising springboard towards the "invention" (compare Case Law of the Boards of Appeal of the European Patent Office, 6th edition 2010, section I.D.3 and in particular sections I.D.3.4 and I.D.3.5).

But even when following the appellant in selecting figure 2 of the present application as the closest prior art the Board cannot acknowledge inventive step for the reasons that follow.

2.2 The Board considers that the package according to figure 2 of the present application - which depicts a

hollow cup-shaped sputtering target in an evacuated resin bag - cannot at the same time be the closest prior art and constitute an alternative solution to the technical problem underlying the subject-matter of claim 1 of the main request. The appellant's arguments in this respect cannot hold.

What the appellant does is not only define the technical effect in a too general form from the difference of the package of claim 1 over the arrangement of figure 2, but in addition defines the problem in an even more general form, completely leaving aside the problems with the arrangement of figure 2. With that generalised problem in mind the skilled person would be looking for solutions, find the arrangement of figure 2 again and stop there as it would solve that problem.

That is not the way the problem-solution approach normally works.

2.2.1 In fact, starting from a closest prior art and ending with the same means the skilled person has no problem to solve, with the result that in fact no problem-solution approach is applied.

In this approach the closest prior art from which it is started, has to be chosen as a first step. Figure 2 can serve this purpose, as also argued by the appellant. This embodiment is actually presented in the application as the starting point for the invention of the present application because the deficiencies of this embodiment are explicitly described therein.

In the context of the cited prior art, which includes D1 (corresponding to "Patent Document 4" of the quoted five prior art documents), it is stated that in order to ship and store flat-plate sputtering targets, they are placed in a resin bag and the inside of the bag is subjected to vacuum suction or inert gas is introduced into the bag in order to prevent the adhesion of dirt and oxidization of the sputtering surface (see Annex A, page 2, lines 2 to 16).

It is further stated that the method of performing vacuum suction with this kind of bag is effective in preventing the adhesion of dirt and oxidization but when applied to a hollow cathode sputtering target there exists a problem in terms of structure (see Annex A, page 2, lines 18 to 20).

Thereafter the package according to figure 2 is described. Figure 2 shows that the resin bag 3 adheres to the peripheral edge 2 of the hollow cathode sputtering target 1 so that the void 4 cannot be sufficiently evacuated (the resin bag 3 is connected with a vacuum suction unit 7 via a gas inlet which is arranged on the left side of the package above the rim of the sputtering target 1) so that oxidation of the sputtering surface cannot be sufficiently prevented (see Annex A page 2, lines 21 to 24). Further, "since the void 4 will be decompressed, there exists another problem that the resin bag will be pulled inward, and a tension thereof could cause the bag 3 to burst" (see Annex A, page 2, lines 25 to 27).

2.2.2 Second comes the determination of the difference of the claimed invention over this prior art and the effect(s)

obtained thereby. The package of claim 1 of the main request is distinguished from the embodiment of figure 2 in that a cover having one or more through-holes is provided on the peripheral edge to cover the void.

The technical effect of this cover is that the void can be effectively evacuated so that oxidation of the sputtering surface and pulling of the resin bag inward in the area of the void with a possible rupture thereof is prevented (compare Annex A, page 2, line 19 to page 3, line 3; and page 4, lines 3 to 10).

2.2.3 Thirdly, the objective technical problem to be solved has to be determined. This is providing the package of figure 2 with means that allow for an effective evacuation of the void and that prevent that the resin bag is pulled inward in the area of its void, thus continuing to prevent oxidation of the sputtering surface of the hollow cup-shaped target.
This problem is solved by the subject-matter of claim 1 of the main request.

2.2.4 As a fourth step it then has to be determined whether the solution of the invention is obvious to the skilled person, in view of his normal technical skills as well as the available prior art.

2.3 First comes the question in which technical fields the skilled person will look for solutions. From the above mentioned content of page 2 of Annex A it has to be concluded that the technical problem underlying the present application arises from applying the known method of packaging a flat-plate sputtering target in a

resin bag - such as that according to document D1 - to the packaging of a hollow cup-shaped target.

As explained at the oral proceedings, for the Board, the application of packaging methods known for flat targets to hollow targets is clearly contemplated by the skilled person as both types of sputtering targets belong to the same technology and are produced by the same industries. The skilled person will therefore take account of the teaching of D1.

2.4 It is clear to the person skilled in the art from D1 that during the evacuation step of the resin bag the bag material is kept away from the target material by a rigid cylindrical cover. This prevents the bag material to come into contact with the target material, see paragraph [0003] of Annex H. The void created by this solution is very effectively evacuated by a hole being provided in this cover, in an arbitrary position, see paragraph [0007] of Annex H.

This solution perfectly fits the two problems defined in point 2.2.1 above: the resin bag closing off the void with resultant insufficient evacuation; the resin bag being pulled into the void (with resulting contact) and possibly bursting.

2.4.1 The skilled person will therefore consider this solution proposed by D1. As far as the application of D1's teaching to hollow, cup-shaped targets is concerned, he is considered to be capable of the necessary technical adaptations.

2.5 In this respect the person skilled in the art will consider that the shape of this cover has to be as simple as possible for the intended purpose of closing the void. This simple shape of the cover has to be seen in the context that the cover and its manufacturing process should be as cheap as possible while serving the intended purpose of supporting the packaging of the cup-shaped hollow target.

For a hollow cup-shaped target the simplest form of such a cover is a circular plate. It can be easily and cheaply manufactured by e.g. punching it out of plastic or metallic plate or sheet material, depending on the required rigidity. The Board therefore does not follow appellant's argument that the cover **must** be according to D1, i.e. with a cylindrical wall.

2.5.1 When placed on the peripheral flat edge of a hollow cup-shaped sputtering target such a cylindrical cover could, however, interact with the thin top layer of the periphery of the sputtering material.

Such an interaction at the peripheral edge of the hollow cup-shaped target between the cover and the sputtering material is apparently not critical in terms of contamination.

This conclusion of the Board is based on the fact that the claim does not exclude a cover of which the cross-section has a re-entrant form at the area where the cover cooperates with the peripheral edge of the hollow target, such that it cannot easily slide off its open end.

Further, the present application is silent with respect to any contaminating effect of this interaction of the resin bag and the sputtering surface (which is inherent to the package according to figure 2 as it is pulled into the void of the cup-shaped target) but only mentions a risk of damaging the inner face of the target (see Annex A, page 6, lines 6 to 10).

In this context it is remarked that it appears not to be surprising that the peripheral edge of the hollow cup-shaped target - even if made from the high-purity sputtering material - need not be protected against the cover (which can be made from an unspecified material) since it is only the inner surface of the hollow portion of the cup-shaped sputtering target which is stringently smoothened and which will be eroded during the sputtering process (see Annex A, page 5, lines 3 to 6).

2.5.2 The appellant also argues that changing the position of the inlet of the resin bag for the vacuum suction unit to the top of the void and strengthening the bag material would be an easier solution to the problem. This presupposes that the skilled person will not look for solutions in the equally valid field of packaging flat targets, as well as that only one solution can be obvious. To both the Board does not agree, as discussed above.

2.5.3 In view of the above, the Board considers that the person skilled in the art, starting from the packaging of a hollow cup-shaped target of figure 2, will directly arrive at the subject-matter of claim 1 of the main request without inventive skills by simply

applying the teaching of D1 as well as his common general knowledge.

Consequently, claim 1 of the main request lacks inventive step. The main request is therefore not allowable.

First auxiliary request

2.6 Claim 1 of the first auxiliary request differs from that of the main request in that it makes an implicit feature explicit by specifying that the cover is placed on the peripheral edge of the **inner surface** of the sputtering target (see point VII above).

As already discussed in point 2.5.1 above, the inner surface of the hollow cup-shaped sputtering target extends to its peripheral edge on which the flat cover will be placed so that the latter is in contact with the sputtering material.

Consequently, the conclusion of point 2.5.3 above fully applies to claim 1 of the first auxiliary request which therefore lacks inventive step. The first auxiliary request is therefore not allowable.

Second auxiliary request

2.7 Claim 1 of the second auxiliary request differs from that of the main request in that it defines some properties of the cover, namely that it has rigidity and is a flat plate which is capable of maintaining its shape after evacuation of the package (see point VIII above).

2.7.1 As discussed in point 2.5.1 above, in order to be suitable for the intended purpose of preventing the inward pulling of the resin bag the cover must have a sufficient rigidity to maintain its shape during and after the evacuation step and it will have a simple shape, e.g. a circular plate, so that it is cheap and can be easily manufactured.

2.7.2 Consequently, the conclusion of point 2.5.3 above fully applies to claim 1 of the second auxiliary request which therefore lacks inventive step. The second auxiliary request is therefore not allowable.

Third auxiliary request

2.8 The subject-matter of claim 1 of the third auxiliary request differs from that of the second auxiliary request in that it makes another implicit feature explicit by specifying that the one or more through-holes for evacuating the void extend through the flat plate (see point IX above).

2.8.1 As discussed in points 2.4 and 2.5 above, it is self-evident to the person skilled in the art applying the teaching of D1 that the flat plate must continue to comprise at least one hole which extends through the plate in order that this cover is suitable for

i) closing the void of the hollow cup-shaped sputtering target, and

ii) still allowing evacuating the closed void.

The location of this hole is arbitrary according to D1 (see paragraph [0007] of Annex H), therefore will be

chosen according to requirements: if it is to guarantee proper evacuation of the void, it will be over the top of the void.

2.8.2 Consequently, the conclusion of point 2.5.3 above also fully applies to claim 1 of the third auxiliary request which therefore lacks inventive step. The third auxiliary request is therefore not allowable, either.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

G. Nachtigall H. Meinders