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Our Ref P439.7 WO
Applicant HPS - High Performance Structures, Gestão e Engenharia Lda
Title THERMAL MULTI-LAYER INSULATION AND RADIO-FREQUENCY ABSORBER BLANKET

PCT Direct/Informal Comments - Earlier application searched by the EPO - EP17156431.3 of 16.02.2017

Dear Sirs,

We present the following informal comments for overcoming the objections raised in the search opinion established by the EPO for the EP priority application.

A marked-up copy indicating the differences in respect of the set of claims and description of the EP priority application is also enclosed.

The applicant respectfully requests that the comments below regarding the patentability of the claims of the international application be taken into account when preparing the international search report and written opinion.

1. CLARITY

The mentioned trademarks have been clarified by their respective technical features, whenever known or usable to the skilled person.

The term obtainable in claims 7-8 is allowable as the feature is indeed limiting. The product under consideration is not identical to known products. It is submitted that the thin layers involved show unavoidable leftovers consequence of the method used – laser cutting or etching – thus the products of claims 7-8 are differentiated from the claims above.

The term "complementary" in claim 15 has been clarified as being complementary but to the extent that the vertices of adjacent squares are separated by a gap. It is noted that the gap does not have to be infinitesimal. The efficiency will be improved as the gap is reduced, but the effect is due to the structural features, not the dimension of the gap.

2. NOVELTY AND BASIS OF THE AMENDMENTS

Claim 1 specifies a thermal multi-layer insulation (MLI) ... blanket.
It is submitted that a MLI is common general knowledge to the skilled person in the field of thermal and RF multilayer absorbers/filters.
None of the FSS structures of the cited documents have a thermal multi-layer insulation function.
D1-D4 do not disclose a MLI in any way.

To further clarify, the feature "having a top layer for blocking infrared and visible radiation" was added. This feature has basis in par. 2 that specifies the purpose of a MLI. The top layer is derivable from all embodiments where the infrared and visible radiation blocking layer is at the top of the product.

Thus, claim 1 is novel over the prior art disclosures (Art. 54 EPC).

3. INVENTIVE STEP REGARDING INDEPENDENT CLAIM 1

D1 can be considered the closest prior art.

Claim 1 is differentiated over the disclosures of D1-D4 by claiming a "thermal multi-layer insulation (MLI) ... blanket ... having a top layer for blocking infrared and visible radiation".

The effect conferred by these distinguishing features is that the same layered product can be both a MLI and a FSS, thus blocking IR (i.e. reflecting/radiating IR) and absorbing RF at the same time. This effect is achieved by the disclosure, see par. 1, par. 49 or par. 50, among others.

The technical objective problem is thus how to provide a better layered MLI or FSS product.

Note that it would be hindsight to formulate the technical objective problem as how to provide a layered product that is both a MLI and a FSS. None of the cited documents hint at using the same product as both MLI and FSS.

The cited documents give no hint or suggestion to this effect.

However, even if the teaching of D1 was forcibly combined with any of the other cited documents, a solution to the objective problem is not shown, as the cited documents do not mention any MLI or a layer for blocking infrared and visible radiation. See also the remarks below on D4.

In conclusion, the cited documents do not disclose, suggest or even infer the claimed MLI and RF blanket of claim 1.

For the above reasons, it is submitted that the solution of the objective problem underlying the present invention is not obvious to the skilled person.

Consequently, the thermal MLI and RF absorber blanket according to claim 1 involves an inventive step over the prior art disclosures (Art. 56 EPC).

4. INVENTIVE STEP REGARDING DEPENDENT CLAIM 2

It is noted that use of a patterned metallic coating for the FSS of claim 2 is not obvious from the cited prior art documents. D1 discloses a resistive layer which teaches away from the claimed metallic coating.

By using a metallic coating, both the FSS and IR reflective effects are thus possible and effectively so, but D1 teaches away from the claimed invention.

The cited documents do not disclose, suggest or even infer the claimed MLI and RF blanket of claim 2.

For the above reasons, it is submitted that the solution of the objective problem underlying claim 2 is not obvious to the skilled person, even if claim 1 would be obvious.

5. INVENTIVE STEP REGARDING DEPENDENT CLAIM 14

Departing from the cited prior art documents, it is noted that it would be hindsight to formulate the technical objective problem as how to provide a layered product that is both a MLI and a FSS. None of the cited documents hint at using the same product as both MLI and FSS.

Thus, it would not be obvious to the skilled person departing from D4, how to improve the disclosure to be a FSS RF absorber (D4 does not have RF absorbing characteristics). D4 is not a suitable starting point as it neither discloses a RF absorber nor an IR blocker.

Also, it is not derivable from D4 that the metal layers of D4 prevent penetration of light in the infrared spectrum.

Even if it would be obvious for the skilled person to confirm (post-facto) that the dual-layer complementary structure of D4, or in fact "any dual-layer complementary structure, provides metal coverage by metal patterns disposed in two parallel planes orthogonally oriented to an optical ray of normal incidence", still it would not be obvious, departing from D1, that D4 would provide the solution to a (post-facto) technical problem of blocking IR.

The skilled person has no hint or suggestion that D4 would provide a beneficial IR performance over the disclosure of D1.

For the above reasons, it is submitted that the solution of the objective problem underlying claim 14 is not obvious to the skilled person, even if claim 1 would be obvious.

6. INVENTIVE STEP REGARDING REMAINING DEPENDENT CLAIMS

The remaining set of claims is also new and inventive, depending on said independent claim 1.

7. CONCLUSION

The applicant respectfully requests that the above comments regarding the patentability of the claims of the international application be taken into account when preparing the international search report and written opinion.

Yours sincerely,
Luís Humberto Ferreira

European Patent Attorney

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Association before EPO n. 669
Signed and submitted electronically

C L A I M S

1. Thermal multi-layer insulation (MLI) and radio-frequency (RF) absorber blanket having a top layer for blocking infrared and visible radiation, comprising:
   an upper layer comprising a patterned frequency-selective structure (FSS) coating whose capacitance is tuned in function of the RF frequency band to be absorbed;
   one or more intermediate resistive layers for RF absorption;
   a lower RF ground layer.

2. Thermal MLI and RF absorber blanket according to claim 1, wherein the upper layer comprises a polymeric film and a patterned metallic coating, said patterned metallic coating being the frequency-selective structure and being the top layer for blocking infrared and visible radiation.

3. Thermal MLI and RF absorber blanket according to claim 2, wherein the polymeric film is polyimide film or polyester film, in particular a poly (4,4'-oxydiphenylene-pyromellitimide) or a poly (5,5'-Bi-2-benzofuran-1,1',3,3'-tetrone), or in particular a Kapton(tm) and Upilex(tm), or Mylar (tm) commercial film, respectively.

4. Thermal MLI and RF absorber blanket according to any of the claims 2-3, wherein the metallic coating is vacuum deposited aluminium (VDA), in particular the upper layer is polyimide~~Kapton(tm)~~ with VDA.

5. Thermal MLI and RF absorber blanket according to claim 1, wherein the upper layer comprises a patterned polyimide film loaded with inorganic carbon, which is said patterned frequency-selective structure.

6. Thermal MLI and RF absorber blanket according to the previous claim, wherein the upper layer comprises a polymeric film and a patterned Black Kapton(tm) film, said patterned Black Kapton(tm) film being the frequency-selective structure.

7. Thermal MLI and RF absorber blanket according to any of the previous claims, wherein said patterned frequency-selective structure is obtainable by etching said pattern, in particular by laser etching.

8. Thermal MLI and RF absorber blanket according any of the claims 1-76, wherein said patterned frequency-selective structure is obtainable by cutting said pattern, in particular by laser cutting.

9. Thermal MLI and RF absorber blanket according to any of the previous claims, wherein the patterned FSS sheet has a pattern of square, rectangular, hexagonal, or circular patches arranged in a grid, in particular in a pattern of groups of unconnected patches arranged in a grid.

10. Thermal MLI and RF absorber blanket according to any of the previous claims, wherein the one or more intermediate resistive layers for RF attenuation are 1 to 5.

11. Thermal MLI and RF absorber blanket according to any of the previous claims, wherein an intermediate resistive layer comprises a polyimide film loaded with inorganic carbon, in particular Black Kapton(tm), in particular wherein an intermediate resistive layer further comprises a spacer layer, in particular a spacer layer being a polymeric layer, in particular a Upilex(tm) foam layer, a Dacron(tm polyester) mesh layer, Beta Cloth scrim layer, glass fabric scrim layer, ceramic fabric scrim layer or a Nomex(tm) scrim layer.

12. Thermal MLI and RF absorber blanket according to any of the previous claims comprising one or more adhesive layers between any said contiguous layers and/or sheets, in particular an adhesive layer comprises transfer tape, in particular transfer tape 3M(tm) 9460 or 3M(tm) 966.

13. Thermal MLI and RF absorber blanket according to any of the previous claims wherein said ground layer is a MLI or the first layer of a MLI comprising a deposited metallic coating, in particular a vacuum deposited aluminium (VDA) coating.

14. Thermal MLI and RF absorber blanket according to any of the previous claims, further comprising a topmost RF-transparent IR-filter comprising:
a first patterned FSS sheet;
an intermediate polymeric film which is substantially transparent to IR;
a second patterned FSS sheet;
wherein the first and second patterned FSS sheets have complementary patterns.

15. Thermal MLI and RF absorber blanket according to the previous claim, wherein the first and second patterned FSS sheets have ~~complementary checkerboard patterns, in particular~~ complementary checkerboard patterns of unconnected square patches, complementary to the extent that the vertices of adjacent squares are separated by a gap.
further in particular wherein said intermediate polymeric film is a polyimide film or polyester film, or in particular a polyimide~~Kapton (tm)~~, Mylar (tm) or Upilex (tm) film; and said first and second patterned FSS sheets are patterned deposited metallic coatings, further in particular being patterned vacuum deposited aluminium (VDA) coatings, further in particular obtainable by laser etching.