

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

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PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/EP2024/051535

International filing date (day/month/year)
23.01.2024

Priority date (day/month/year)
15.09.2023

International Patent Classification (IPC) or both national classification and IPC
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Applicant
CEMEX INNOVATION HOLDING AG

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA:



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Date of completion of
this opinion

see form
PCT/ISA/210

Authorized Officer

Voltz, Eric

Telephone No. -0



Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:
- ☒ the international application in the language in which it was filed.
 - ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))
3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:
- a. ☐ forming part of the international application as filed.
 - b. ☐ furnished subsequent to the international filing date for the purposes of international search (Rule 13ter.1(a)),
 - ☐ accompanied by a statement to the effect that the sequence listing does not go beyond the disclosure in the international application as filed.
4. ☐ With regard to any nucleotide and/or amino acid sequence disclosed in the international application, this opinion has been established to the extent that a meaningful opinion could be formed without a WIPO Standard ST.26 compliant sequence listing.
5. Additional comments:

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement
- | | | |
|-------------------------------|-------------|------------|
| Novelty (N) | Yes: Claims | <u>1-9</u> |
| | No: Claims | |
| Inventive step (IS) | Yes: Claims | <u>1-9</u> |
| | No: Claims | |
| Industrial applicability (IA) | Yes: Claims | <u>1-9</u> |
| | No: Claims | |

2. Citations and explanations
- see separate sheet**

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V

1 Cited documents

Reference is made to the following documents:

- D1 US 2022/250986 A1 (FEICHTENSCHLAGER BERNHARD [DE] ET AL) 11 August 2022 (2022-08-11)
- D2 US 2019/194072 A1 (ESNAULT VIVIEN [FR] ET AL) 27 June 2019 (2019-06-27)
- D3 US 2021/355031 A1 (CHUNG BYONG-WA [US] ET AL) 18 November 2021 (2021-11-18)
- D4 US 2021/284575 A1 (MARTINAGE OLIVIER [FR] ET AL) 16 September 2021 (2021-09-16)

1 Independent claims 1 and 9

- 1.1 D1 (the references in parentheses applying to this document) is considered to be the prior art closest to the subject-matter of independent claim 1 and discloses

3D printing industrial production method for fresh construction material containing a hydraulic binder ([0007]), said method comprising the following steps:

h) Preparing a ready-mix construction material *in a concrete-type mixer or concrete batching plant or local static concrete mixer or concrete truck (considered to be implicitly disclosed)*, from the following mix design:

- Binder ([0216]) (250 to 700 kg/m³) (*features between brackets are regarded as facultative in the meaning of the PCT Guidelines 5.23*);

- Water ([0236]) (100 to 455 kg/m³);

- Sand ([0238]) (400 to 1100 kg/m³);

- Aggregates having a size from 4-16 mm ([0237]), preferably from 4-12 mm, (400 to 1200 kg/m³);

i) Transporting CM1 obtained in a) from the concrete-type mixer or concrete batching plant or local static concrete mixer or concrete truck, to a jobsite equipped with a 3D printing equipment;

j) *Optionally transferring CM1 into a buffer container at the jobsite (facultative feature in the meaning of the PCT Guidelines 5.40)*;

k) Moving the CM1 towards a printer head of the 3D printing equipment ([0246]);
l) Adding a first (ADMS1) ("component A of the additive kit" according to [0243]) and/or second (ADMS2) ("component B of the additive kit" according to [0243]) admixture system to CM1, uphill from a nozzle of the printer head of the printing equipment yet at a distance located from 0.2 m to 4 m from the nozzle ([0246]), to obtain a second construction material, provided that:
~~ADSM1 is added in step e) when ADMS2 is added in step a), b), c) and/or d)~~
(alternative not disclosed);
ADSM2 is added in step e) when ADMS1 is added in step a), b), c) and/or d) ([0246]); or
~~ADMS1 and ADMS2 are both added in step e)~~ (alternative not disclosed); and
~~wherein ADSM1 comprises at least a high molecular weight, non-ionic water-soluble component, and is dosed at a range from 0.0001 to 0.5 weight% of the binder content;~~
~~wherein ADSM2 comprises at least a polymerized system containing a conjugated or aromatic/non-aromatic, homocyclic/heterocyclic, mono-ring, bi-ring or poly-ring system that contains solubilizing functional groups, and is dosed at a range from 0.05 to 5 weight% of the binder content;~~
m) Extruding CM2 obtained in e) through the nozzle of the printed head of the printing equipment ([0246]);
n) Recovering the stiffened construction material after the nozzle of the printed head of the printing equipment.

- 1.2 The subject-matter of independent claim 1 differs therefore from this known method of D1 in that ADMS1 comprises at least a high molecular weight, non-ionic water-soluble component, and is dosed at a range from 0.0001 to 0.5 weight% of the binder content and ADMS2 comprises at least a polymerized system containing a conjugated or aromatic/non-aromatic, homocyclic/heterocyclic, mono-ring, bi-ring or poly-ring system that contains solubilizing functional groups, and is dosed at a range from 0.05 to 5 weight% of the binder content.
- 1.3 Under consideration of §6 of Item VIII, the selection of ADMS1 (the first admixture system) and ADMS2 (the second admixture system) ensures that a chemical strong interaction occurs between ADMS1 and ADMS2 thereby providing the highest possible material stiffness to the extruded material. The reaction in the form of a polymerization produces a 3D connected net that immediately reduces the fluidity of the construction material by a matrix effect and provides stiffness property that allow the extruded/printed material to

support its own weight without deformation, keeping stable dimensions and geometries of parts/layers from the nozzle (see page 8, 4th paragraph of the description of the present application).

- 1.4 The problem to be solved by the present invention may therefore be regarded as providing a 3D printing industrial production method ensuring a high production rate while providing for a radical change of the rheological properties of the fluid/plastic construction material between the state prior to the extrusion die or nozzle and the material exiting the die/nozzle.
- 1.5 None of the cited documents at hand discloses or suggests the solution as defined in claim 1:
- 1.6 D1 ([0114] and [0181]) discloses that ADMS1 consists of a polycarboxylic ether (PCE) and ADMS2 consists of a hardening accelerator.
- 1.7 D2 ([0025] and [0030]) discloses that ADMS1 consists of a plasticiser and ADMS2 consists of a hardening accelerator.
- 1.8 D3 ([0018]-[0024]) discloses the use of a redox pair in an additive manufacturing process, wherein the second component of the redox system (e.g., sodium bisulfite) is injected into the hose to become mixed with the settable composition and first component of the redox system (e.g., potassium persulfate) to activate polymerization of the monomer components in order to confer early age strength with desirable yield stress properties that need not depend upon the hydration reaction dynamics within the cementitious material. D3 achieves therefore the same technical effect but in an alternative way.
- 1.9 D4 (figure 1; [0073]) discloses that ADMS1 consists of a superplasticiser (such as modified polycarboxylic ethers (PCE), polynaphthalene sulfonates (PNS), polymelamine sulfonates (PMS), calcium, sodium or ammonium lignosulfonates (LS) and polyacrylates) and ADMS2 consists of a setting trigger (such as «alkaline» accelerators based on sodium or potassium silicate and «non-alkaline» accelerators based on aluminum sulphates or aluminum hydroxides).
- 1.10 Hence, the subject matter of claim 1 seems to involve an inventive step in the meaning of Art. 33(3) PCT.
- 1.11 The subject matter of claim 9 relates to the use of the construction material obtained by the process of claim 1, wherein said construction material is distinguishable from that of the prior art documents in said mechanical and chemical properties. Hence, the subject matter of claim 9 seems also to involve an inventive step in the meaning of Art. 33(3) PCT.

2 Dependent claims

- 2.1 The claims 2-8 depend on inventive claim 1 and seem therefore also to meet the requirements of the PCT in respect of novelty and/or inventive step.

3 Industrial applicability

- 3.1 The subject matter of claims 1-9 is considered as being industrially applicable (Article 33(4) PCT).

Re Item VII

- 4 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in D1 is not mentioned in the description, nor is this document identified therein.
- 5 The subject matter of claim 7 appears to be redundant with that of claim 1.

Re Item VIII

- 6 The subject matter of claim 1 is broader than what is justified by the description of the present application. Indeed, the admixture systems defined in claim 1 are too broadly defined and encompass therefore many compounds that are not adequately supported by the description and for which the present application has failed to demonstrate that the same technical effect can be achieved. In addition, it appears evident from the passage on page 8, 4th and 5th paragraphs, of the description of the present application and from the examples given starting on page 16, that a first admixture system ADMS1 selected from PEO/PEG as defined in claim 5 and a second admixture system ADMS2 from the group consisting of benzene, triazine, naphthalene, anthracene, pyrene, phenanthrene, isoquinoline, and chrysene, containing solubilizing functional groups such as sulfate, carboxylic acid, nitrate as defined in claim 6 are essential for achieving the technical effect the present invention intends to achieve. The requirements stipulated under Art. 6 PCT are therefore not met.