

## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference DESK0023PWO	<b>FOR FURTHER ACTION</b>	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/US2017/049669	International filing date ( <i>day/month/year</i> ) 31 August 2017	(Earliest) Priority Date ( <i>day/month/year</i> )
Applicant DESKTOP METAL, INC.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 4 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

## 1. Basis of the report

a. With regard to the **language**, the international search was carried out 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)).

b.  This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c.  With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2.  **Certain claims were found unsearchable** (see Box No. II).

3.  **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

- the text is approved as submitted by the applicant.  
 the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- the text is approved as submitted by the applicant.  
 the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

- a. the figure of the **drawings** to be published with the abstract is Figure No. 1B  
 as suggested by the applicant.  
 as selected by this Authority, because the applicant failed to suggest a figure.  
 as selected by this Authority, because this figure better characterizes the invention.
- b.  none of the figures is to be published with the abstract.

## INTERNATIONAL SEARCH REPORT

International application No.

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**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

See Extra Sheet

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2.  As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

## INTERNATIONAL SEARCH REPORT

International application No.

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## A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - B33Y 70/00; B22F 1/00; B22F 3/00; B22F 3/10; B22F 3/12 (2017.01)

CPC - B22F 1/0096; B22F 1/00; B22F 1/0081; B22F 3/00; B33Y 70/00 (2017.08)

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

See Search History document

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2017/0008082 A1 (NINGBO GUANGBO NEW NANOMATERIALS STOCK CO LTD) 12 January 2017 (12.01.2017) entire document	41-47, 51-54
Y	CN 104387105 B (SHANGHAI INSTITUTE OF CERAMICS - CHINESE ACADEMY OF SCIENCES) 13 April 2016 (13.04.2016) see machine translation	41-47, 51-54, 76
Y	US 2015/0035209 A1 (NORTHWESTERN UNIVERSITY) 05 February 2015 (05.02.2015) entire document	53, 87, 88, 93, 94, 96
Y	US 2014/0227123 A1 (BAM BUNDESANSTALT FÜR MATERIALFORSCHUNG UND PRUFUNG) 14 August 2014 (14.08.2014) entire document	70, 76, 83, 86-88, 93, 94, 96
Y	WO 2017/070061 A1 (DOW GLOBAL TECHNOLOGIES LLC) 27 April 2017 (27.04.2017) entire document	70, 76, 83, 86-88, 93, 94, 96
A	1UBBS, Melting point and heat of fusion of poly(vinyl alcohol), Journal of Polymer Science Part A: Polymer Chemistry, Vol. 3, Iss. 12, December 1965 [retrieved on 04 December 2017]. Retrieved from the Internet: <URL: <a href="http://onlinelibrary.wiley.com/doi/10.1002/pol.1965.100031213/abstract">http://onlinelibrary.wiley.com/doi/10.1002/pol.1965.100031213/abstract</a> >. Abstract	1-96
A	US 2017/0173692 A1 (DESKTOP METAL INC) 22 June 2017 (22.06.2017) entire document	1-96
A	US 2017/0120339 A1 (METALVALUE SAS) 04 May 2017 (04.05.2017) entire document	1-96

 Further documents are listed in the continuation of Box C. See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

05 December 2017

Date of mailing of the international search report

02 JAN 2018

Name and mailing address of the ISA/US

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2017/049669

Continued from Box No. III Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees need to be paid.

Group I: Claims 1-40 are drawn to an additive manufacturing method.

Group II: Claims 41-69 are drawn to a powder for additive manufacturing of a three-dimensional object.

Group III: Claims 70-96 are drawn to a three-dimensional object comprising a plurality of different materials.

The inventions listed in Groups I through III do not relate to a single general inventive concept under PCT Rule 13.1, because under PCT Rule 13.2 they lack the same or corresponding special technical features for the following reasons:

The special technical features of Group I, an additive manufacturing method, are not present in Groups II and III; the special technical features of Group II, a powder for additive manufacturing of a three-dimensional object, are not present in Groups I and III; and the special technical features of Group III, a three-dimensional object comprising a plurality of different materials, are not present in Groups I and II.

The Groups I through III share the technical features of additive manufacturing of a three-dimensional object using a powder comprising first metallic particles and at least one component of a binder system, the first metallic particles agglomerated in the at least one component of the binder system in the form of discrete granules; and a plurality of layers, each layer defining a respective two-dimensional pattern. However, these shared technical features do not represent a contribution over the prior art.

Specifically, US 2017/0173692 A1 to Desktop Metal, Inc. teaches additive manufacturing of a three-dimensional object (Para. [0003], ... additive manufacturing, and more specifically to the three-dimensional printing of metal objects) using a powder comprising first metallic particles (Para. [0075], ... materials similarly composed of metal powder and a binder system, may be used to fabricate green parts ...) and at least one component of a binder system (Para. [0075]); and a plurality of layers, each layer defining a respective two-dimensional pattern (Para. [0071], ... a bead of material is extruded as "roads" or "paths," in a layered series of two dimensional patterns to form a three-dimensional object ...).

Further, US 2017/0120339 A1 to Metalvalue SAS teaches the first metallic particles agglomerated in the at least one component of the binder system in the form of discrete granules (Para. [0015], ... a process where metal powder is agglomerated with a binder in water; Para. [0030], ... providing a spherical metal powder, b) mixing the powder with a hydrocolloid in water to obtain an agglomerated metal powder, c) compacting the agglomerated metal powder to obtain a part of compacted agglomerated metal powder ...).

The inventions listed in Groups I through III therefore lack unity under Rule 13 because they do not share a same or corresponding special technical feature.