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(71) Applicant: **SABIC GLOBAL TECHNOLOGIES B.V.**
[NL/NL]; Plasticslaan 1, NL-4612 PX Bergen op Zoom
(NL).

(72) Inventor: **NARAYANASWAMY, Venkatesha**; Plot No.
81-85 Village: Chikkadunnasandra, Anekal; Taluk, Off.
Sarjapura - Attibele Road, Karnataka, Bangalore 562125
(IN).

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kind of national protection available): AE, AG, AL, AM,
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BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
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- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

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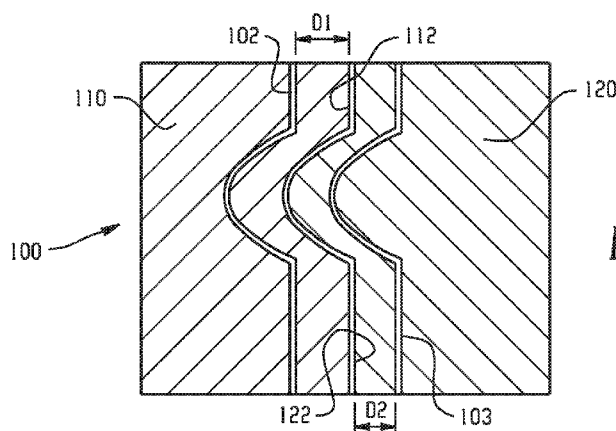


Fig. 2

(57) Abstract: A method for forming a mold apparatus comprising: forming a cavity portion through an additive manufacturing process; wherein the cavity portion comprises a cavity molding surface having a surface roughness of greater than or equal to about 0.025 μm and a plurality of cavity fluid channels; wherein the cavity fluid channels comprise a profile conforming to the profile of the cavity molding surface; treating the cavity molding surface to reduce the surface roughness to less than about 0.025 μm ; forming a core portion through additive manufacturing; wherein the core portion comprises a core molding surface and a plurality of core fluid channels; wherein the core fluid channels conform to the core molding surface.

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2015/052976

A. CLASSIFICATION OF SUBJECT MATTER

INV. B29C67/00 B29C45/73 B29C33/02 B22F5/00
ADD. B29L31/00 B29C33/42 B23P15/24

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)

B29L B29C B22F B23P B24B

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)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP H02 95821 A (TOSHIBA CERAMICS CO; SHINSHIYOU KK) 6 April 1990 (1990-04-06) abstract; figures 1,2 -----	1-4, 7-10,14
Y	US 5 849 238 A (SCHMIDT WAYDE [US] ET AL) 15 December 1998 (1998-12-15) column 1, lines 1-22,48-50,55 - column 2, lines 31,41-45 column 3, lines 11-14,29-34 column 5, lines 23-26 ----- -/--	1-5,13, 14



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

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"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

"&" document member of the same patent family

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Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Moeller Bichler, M

INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6 112 804 A (SACHS EMANUEL [US] ET AL) 5 September 2000 (2000-09-05) column 1, lines 15-46 column 2, lines 4-12 column 4, lines 40-58 column 5, lines 1-8 column 6, lines 14-26,40-42,60-65; figure 5 column 15, lines 22-26 -----	1-14
Y	DE 197 07 906 A1 (UNIV MAGDEBURG TECH [DE]; AMBOS EBERHARD PROF DR ING HAB [DE]) 25 June 1998 (1998-06-25) column 3, lines 6-37; claim 1; figure 4b -----	7-12
Y	US 5 641 448 A (YEUNG MILLAN K [CA] ET AL) 24 June 1997 (1997-06-24) column 2, line 31 - column 3, line 11,; claims 1-4; figure 3 -----	1-5,7-11
Y	BROWNLIE R: "BREAK THE MOULD", EUROPEAN PLASTICS NEWS, EMAP BUSINESS PUBLICATION, LONDON, GB, vol. 30, no. 5, 1 June 2003 (2003-06-01), page 27, XP001164797, ISSN: 0306-3534 the whole document -----	1-4, 7-10,14
Y	SACHS E ET AL: "PRODUCTION OF INJECTION MOLDING TOOLING WITH CONFORMAL COOLING CHANNELS USING THE THREE DIMENSIONAL PRINTING PROCESS", POLYMER ENGINEERING AND SCIENCE, BROOKFIELD CENTER, US, vol. 40, no. 5, 1 May 2000 (2000-05-01), pages 1232-1247, XP000969782, ISSN: 0032-3888, DOI: 10.1002/PEN.11251 page 1232, paragraph 1 page 1233, paragraph 7 page 1236, paragraph 3-7 Conclusions -----	1-12,14
Y	Georg Menges ET AL: "2.4 Machining and other Material Removing Operations" In: "How to Make Injection Molds", 1 January 2001 (2001-01-01), HANSER, Munich, XP055203495, ISBN: 3-446-21256-6 pages 54-58, Item 2.4.2.1 Grinding and Polishing; page 54 - page 58; table 2.1 -----	1-14
A	US 2002/165634 A1 (SKSZEK TIMOTHY W [US]) 7 November 2002 (2002-11-07) paragraphs [0002], [0011], [0012], [0028], [0030], [0031] -----	1-14

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2015/052976

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP H0295821	A	06-04-1990	NONE
US 5849238	A	15-12-1998	CA 2262596 A1 07-01-1999 EP 0918607 A1 02-06-1999 JP 2000516877 A 19-12-2000 US 5849238 A 15-12-1998 WO 9900234 A1 07-01-1999
US 6112804	A	05-09-2000	CA 2234365 A1 09-05-1997 EP 0862507 A1 09-09-1998 JP 4314352 B2 12-08-2009 JP H11515058 A 21-12-1999 US 5775402 A 07-07-1998 US 6112804 A 05-09-2000 US 6354361 B1 12-03-2002 WO 9716274 A1 09-05-1997
DE 19707906	A1	25-06-1998	NONE
US 5641448	A	24-06-1997	NONE
US 2002165634	A1	07-11-2002	NONE

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2015/052976

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 additional 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 an 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.:

1-14

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-14

Method for forming a mold using additive manufacturing as well as the obtained mold.

2. claims: 15-20

Method for molding a polymer, the mold therefore and the product obtained by said method.
