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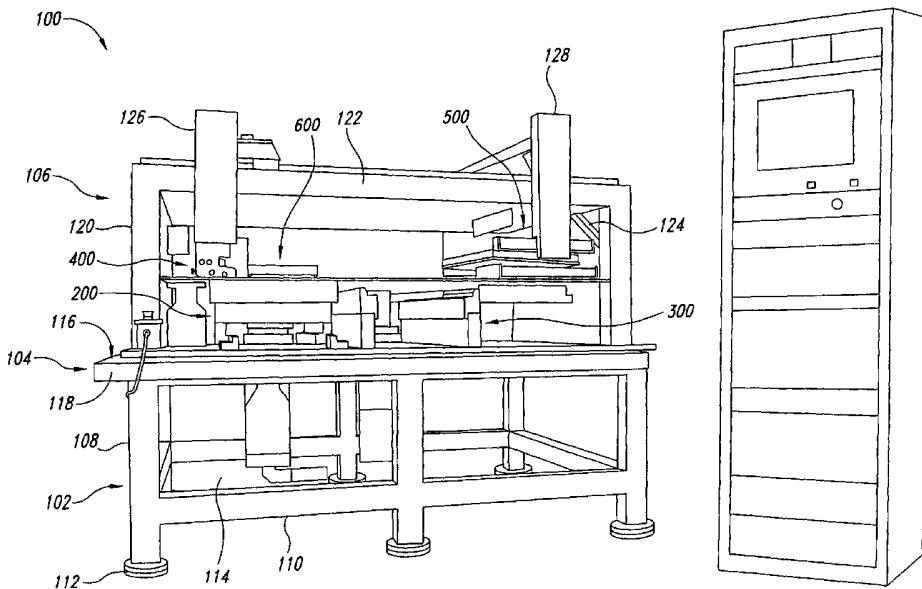
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AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,  
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GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,  
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[Continued on next page]

(54) Title: THREE-DIMENSIONAL PRINTING METHOD AND APPARATUS



(57) Abstract: Apparatus, systems and methods for use in three-dimensional printing are shown and described. Various embodiments of the invention allow for more precise and controlled delivery of heat to achieve interlayer drying; isolation of the working region from the outside for reasons of cleanliness and in connection with the vapors of organic solvents; better control of the temperature of the working region; better accuracy in the flowrates of binder fluid dispensed; matching of delivered flowrates for multiple dispensers; verification of delivered flowrate or drops; provision for easier changeover of the machine from one powder to another; cleanability; and other needs.

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SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US,  
UZ, VC, VN, YU, ZA, ZM, ZW.

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PCT/US 03/20447

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B29C67/00 B41J2/045 B41J29/377 G01F1/34 F16C29/02  
 F16C27/02 //B29C35/02, B29C31/04

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)

IPC 7 B29C B41J G01F F16C

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 practical, search terms used)

EPO-Internal, WPI Data, PAJ

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Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 1 099 534 A (MASSACHUSETTS INST TECHNOLOGY) 16 May 2001 (2001-05-16)  paragraph '0013! – paragraph '0014!; figure 1 paragraph '0021!; figure 7 paragraph '0035! paragraph '0043! paragraph '0026! – paragraph '0027!; figure 10 ---- -/-	1-5, 9, 11, 15-24, 26-33
X		127, 128, 134, 137, 138

 Further documents are listed in the continuation of box C. Patent family members are listed in annex.

## ° Special categories of cited documents :

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- \*E\* earlier document 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
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- \*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
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- \*&\* document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

15 April 2004

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X	column 11, line 44 - line 58 ---	92-94
A	US 5 908 569 A (WILKENING CHRISTIAN ET AL) 1 June 1999 (1999-06-01) column 2, line 41 - line 54 column 2, line 60 -column 3, line 37; figures 1-3 ---	1-33
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**INTERNATIONAL SEARCH REPORT**International application No.  
PCT/US 03/20447**Box I Observations where certain claims were found unsearchable (Continuation of item 1 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 II Observations where unity of invention is lacking (Continuation of item 2 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 fee, this Authority did not invite payment of any additional fee.
  
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.
- 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: 1-33

three-dimensional printing method and apparatus therefore using a movable heat source for accurate heating of the powder layer

2. Claims: 34-45

three-dimensional printing method and apparatus therefore using a heated spreading roller for facilitating evaporation of volatile liquids

3. Claims: 46-55

roller assembly for a three-dimensional printing machine comprising sliders to prevent powder from escaping

4. Claims: 56-67

roller assembly for a three-dimensional printing machine comprising a vertically adjustable roller to control the layer thickness of the spread powder layer

5. Claims: 68-91

three-dimensional printing method, apparatus and control method therefore to control the amount of binder liquid dispensed

6. Claims: 92-109

isolated apparatus for three-dimensional printing

7. Claims: 110-116

three-dimensional printing machine machine using an encoder strip to control the ink-jet printhead

8. Claim : 117

three-dimensional printing machine comprising deformable bearing assemblies to compensate for deformation of the rails

9. Claims: 118-126

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

printhead for a three-dimensional printing apparatus comprising independently removable dispensers

10. Claims: 127-152

movable powder bed assembly for a three-dimensional printing machine

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