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Batchelder

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(54) **METHOD FOR PRINTING THREE-DIMENSIONAL PARTS WITH PART STRAIN ORIENTATION**

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CPC ***B29C 67/0088*** (2013.01); ***B33Y 50/02*** (2014.12); ***G01N 3/08*** (2013.01); ***G05B 15/02*** (2013.01); ***G05B 19/4099*** (2013.01); *G01N 2033/0078* (2013.01); *G05B 2219/49023* (2013.01); *G06F 17/50* (2013.01); *G06F 2217/12* (2013.01); *Y02P 90/265* (2015.11)

(58) **Field of Classification Search**

None

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,503,785	A	4/1996	Crump et al.
5,764,521	A	6/1998	Batchelder et al.
5,943,235	A	8/1999	Earl et al.
6,004,124	A	12/1999	Swanson et al.
6,021,358	A	2/2000	Sachs
6,070,107	A	5/2000	Lombardi et al.
6,099,573	A	8/2000	Xavier
6,118,456	A	9/2000	Cooper
6,228,923	B1	5/2001	Lombardi et al.

(Continued)

FOREIGN PATENT DOCUMENTS

EP	1448359	B1	7/2007
WO	2009047355	A1	4/2009

OTHER PUBLICATIONS

Huang et al., "Sloping wall structure support generation for fused deposition modeling", the International Journal of Advanced Manufacturing Technology, 2009, pp. 1074-1081.

(Continued)

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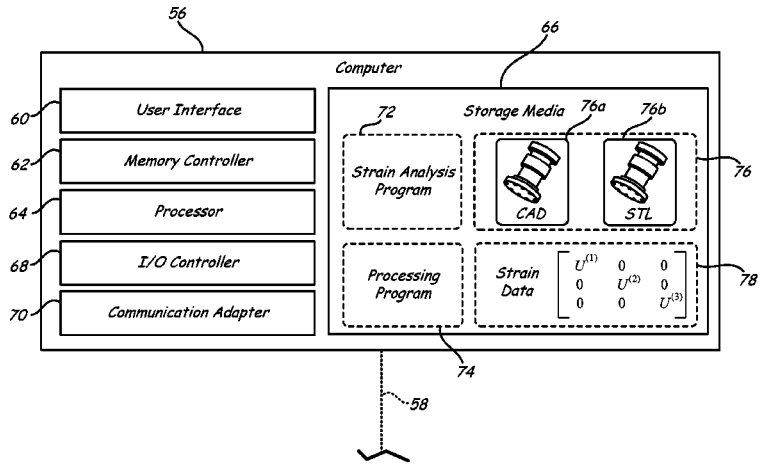
(57) **ABSTRACT**

A method and program for printing a three-dimensional part with an additive manufacturing system, the method including generating or otherwise providing strain data from a digital model of the three-dimensional part, orienting the digital model to align the directions of high tensile strain in a build plane, and printing the three-dimensional part in a layer-by-layer manner based on the oriented digital model with the additive manufacturing system.

20 Claims, 10 Drawing Sheets