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- (54) Title: METHODS AND SYSTEMS FOR FORMING INTEGRAL COMPOSITE PARTS WITH A SMP APPARATUS

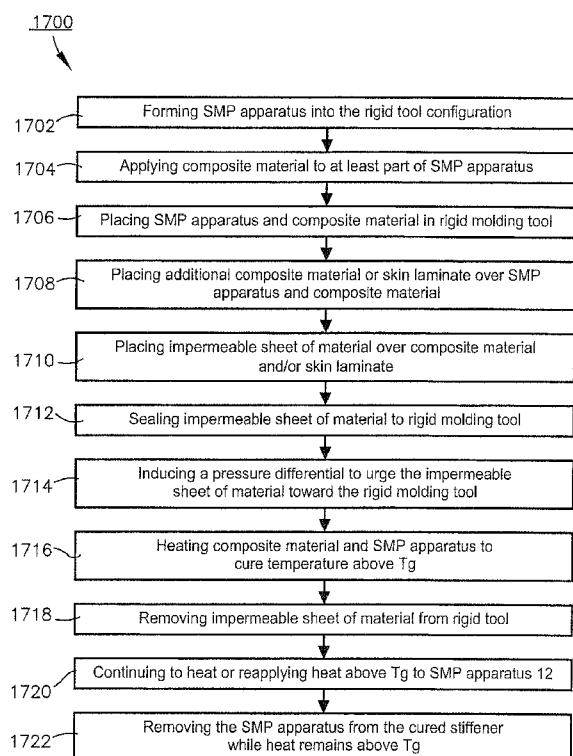


Fig. 17

(57) Abstract: A method and apparatus for fabricating a composite part, such as a fuselage or internal stiffener, with a shape memory polymer (SMP) apparatus usable as a rigid lay-up tool. The SMP apparatus may be heated until malleable, shaped, and then cooled in a desired rigid tool configuration. For example, cavities may be formed into the SMP apparatus for nesting components therein to co-bond or co-cure with the composite part. The composite material and/or nested components may be heated and compressed against the SMP apparatus. The SMP apparatus may be configured to remain rigid during the composite cure cycle. Once the composite material is cured, the SMP apparatus may be triggered to a malleable state and urged away from the cured composite material.



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INTERNATIONAL SEARCH REPORT

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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)

B29C 61/06; B28B 1/30; B29C 71/00; B28B 7/32; B29C 33/40; B28B 7/10

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: composite part, integrated stiffener, shape memory polymer apparatus, cavity, composite material, co-curing

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 7622069 B1 (KIA, HAMID G. et al.) 24 November 2009 See abstract and claims 1,2	1-22
A	US 2010-0230859 A1 (SANDERSON, TERRY M.) 16 September 2010 See abstract and claim 1	1-22
A	US 7422714 B1 (HOOD, PATRICK J. et al.) 09 September 2008 See abstract; claim 1; and figure 6	1-22
A	US 2010-0123270 A1 (OWENS, JOHN N. et al.) 20 May 2010 See claims 1,4; paragraph [0012]; and figures 1B-1D	1-22

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

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"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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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7622069 B1	24.11.2009	None	
US 2010-0230859 A1	16.09.2010	US 7887734 B2 US 8007705 B2 WO 2010-107527 A2 WO 2010-107527 A3	15.02.2011 30.08.2011 23.09.2010 23.09.2010
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US 2010-0123270 A1	20.05.2010	None	