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[Continued on next page]

(54) Title: METHODS AND SYSTEMS FOR FABRICATING COMPOSITE STIFFENERS WITH A RIGID/MALLEABLE SMP APPARATUS

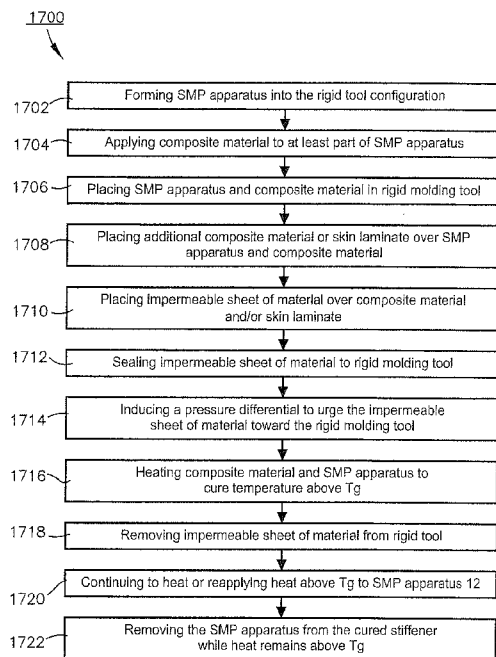


Fig. 17

(57) Abstract: A method and apparatus for fabricating a composite part, such as an internal stiffener, with a shape memory polymer (SMP) apparatus usable as both a rigid tool and as a bladder. The SMP apparatus may be heated until malleable, shaped, and then cooled in a desired rigid tool configuration. The composite material may be applied onto the SMP apparatus and then placed into a rigid external mold and heated to composite cure temperatures at which the SMP apparatus is malleable. In some embodiments, an impermeable sheet of material may also be placed over portions of the composite material to compress it against the SMP apparatus. A pressure differential may be induced which urges the SMP apparatus to compress the composite material against the rigid external mold. When the composite material is cured, the pressure differential may be equalized and/or reversed and the malleable SMP apparatus may be removed from within the composite part.

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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; B28B 21/50; H05B 6/02; 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: shape memory polymer(SMP), composite material, impermeable sheet, sealing, vacuum bag, heating, cure, pressure differential, compress, molding tool

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2010-0127427 A1 (KIA, HAMID G. et al.) 27 May 2010 See abstract; paragraphs [0018]-[0024]; and figures 1A-1D	1-25
A	US 2008-0315466 A1 (HOOD, PATRICK J. et al.) 25 December 2008 See abstract; claims 1,9-16; and paragraphs [0022],[0033],[0038]	1-25
A	US 7422714 B1 (HOOD, PATRICK J. et al.) 09 September 2008 See abstract; claims 1,2; columns 6-7; and figures 1-6	1-25
A	US 2010-0123270 A1 (OWENS, JOHN N. et al.) 20 May 2010 See abstract; claims 1-5,13,15; paragraphs [0012],[0018]; and figures 1A-1E	1-25

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

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Information on patent family members

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