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(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN, KP, KR,

(54) Title: E-FABRIC AND E-GARMENT HAVING INTERGRAL INTERCONNECTED CONDUCTORS AND EMBEDDED DEVICES

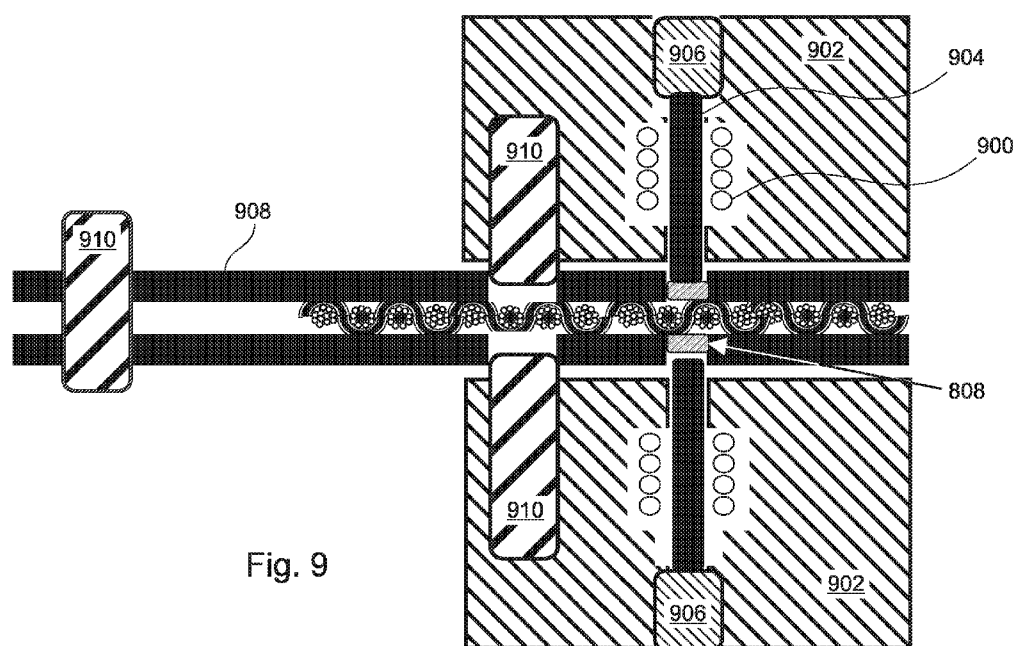


Fig. 9

(57) Abstract: Interconnections are formed between electronic devices embedded in a "smart" textile panel. A highly bendable drawn fiber in the panel includes continuous and/or discrete active elements encapsulated in a flexible matrix. E-fabrics include vias forming interconnections between conductors included on or in the fabric. A flexible connection pad of alternated conducting and insulating elastomer regions forms a plurality of interconnections between an external device and the conductors of an e-fabric. E-fabrics are formed by preassembling conductors with ribbons of adhesive to form conducting assemblies, and then bonding the conducting assemblies to fabric or to pre-manufactured garments, including across seams thereof. A garment such as a hoodie includes position, orientation, flexion, and/or acceleration sensors that enable a user to control aspects of an audiovisual concert such as volume, balance, tone, recorded feedback, and mashups, as well as light displays and pyrotechnics by physical gestures.



KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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Declarations under Rule 4.17:

- *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))*

Published:

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(88) Date of publication of the international search report:

28 December 2017 (28.12.2017)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2017/032348

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.: 5, 6, 8, 9, 11, 15, 19
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:
Claims 5, 6, 8, 9, 11, 15 and 19 are considered to be unclear in that they refer to one of the claims which do not comply with the third sentence of PCT Rule 6.4(a).

3. ☒ Claims Nos.: 4, 7, 10, 12-14, 16-18, 20, 21
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 Supplemental Box.

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 any 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.:
1-21

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.

A. CLASSIFICATION OF SUBJECT MATTER**A41D 1/00(2006.01)i, A41H 43/02(2006.01)i, A41H 42/00(2006.01)i, G06F 1/16(2006.01)i, H04W 4/00(2009.01)i**

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)

A41D 1/00; D03D 15/00; D03D 1/00; A41H 42/00; A41H 43/02; G06F 1/16; H04W 4/00

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: weaving machine, non-visible fiducial, infra-red phosphor, distortion, electronic device, textile, fiber**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2011-0036448 A1 (VAN PIETERSON, L. et al.) 17 February 2011 See claims 1, 2, 6; paragraphs [0014], [0017], [0030], [0042]; and figures 1-4.	1-3
A	KR 10-2005-0008707 A (SARNOFF CORPORATION) 21 January 2005 See the entire document.	1-3
A	US 5906004 A (LEBBY, M. S. et al.) 25 May 1999 See the entire document.	1-3
A	JP 2013-079484 A (SILVERAY CO., LTD.) 02 May 2013 See the entire document.	1-3
A	US 2014-0277683 A1 (GUPTA, N. R. et al.) 18 September 2014 See the entire document.	1-3



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

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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

Date of the actual completion of the international search

01 November 2017 (01.11.2017)

Date of mailing of the international search report

03 November 2017 (03.11.2017)

Name and mailing address of the ISA/KR

International Application Division

Korean Intellectual Property Office

189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea

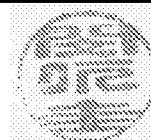


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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2017/032348

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011-0036448 A1	17/02/2011	CN 102017814 A EP 2272308 A1 JP 2011-519177 A KR 10-2011-0053923 A WO 2009-133497 A1	13/04/2011 12/01/2011 30/06/2011 24/05/2011 05/11/2009
KR 10-2005-0008707 A	21/01/2005	CN 1322837 C CN 1649539 A CN 1650057 A EP 1503665 A1 EP 1507906 A1 JP 2005-524783 A JP 2005-525481 A KR 10-2005-0046656 A US 2003-0211797 A1 US 2004-0009729 A1 US 2005-0081944 A1 US 2007-0049147 A1 US 2009-0253325 A1 US 2012-0118427 A1 US 7144830 B2 US 7592276 B2 WO 03-094719 A1 WO 03-095729 A1	27/06/2007 03/08/2005 03/08/2005 09/02/2005 23/02/2005 18/08/2005 25/08/2005 18/05/2005 13/11/2003 15/01/2004 21/04/2005 01/03/2007 08/10/2009 17/05/2012 05/12/2006 22/09/2009 20/11/2003 20/11/2003
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JP 2013-079484 A	02/05/2013	CN 102046864 A CN 102046864 B CN 102912509 A CN 102912509 B CN 102912510 A CN 102912511 A CN 102912515 A CN 102912520 A CN 102912521 A CN 102912521 B EP 2314744 A2 JP 2011-521122 A JP 2013-057161 A JP 2013-079483 A JP 2013-079485 A JP 5347022 B2 JP 5367144 B2 JP 5470444 B2 JP 5679587 B2 JP 5679588 B2 KR 10-0964092 B1 KR 10-1619515 B1	04/05/2011 12/06/2013 06/02/2013 07/01/2015 06/02/2013 06/02/2013 06/02/2013 06/02/2013 06/02/2013 01/04/2015 27/04/2011 21/07/2011 28/03/2013 02/05/2013 02/05/2013 20/11/2013 11/12/2013 16/04/2014 04/03/2015 04/03/2015 16/06/2010 10/05/2016

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2017/032348

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		KR 10-2009-0123734 A	02/12/2009
		KR 10-2010-0069530 A	24/06/2010
		KR 10-2010-0124962 A	30/11/2010
		US 2011-0074380 A1	31/03/2011
		WO 2009-145536 A2	03/12/2009
		WO 2009-145536 A3	11/03/2010
US 2014-0277683 A1	18/09/2014	US 2014-277663 A1	18/09/2014

- Invention 1: Claims 1-21 relate to a method for forming interconnections between electronic devices embedded in textile fibers, the method comprising: using a weaving machine to weave a textile panel from textile fibers; using machine vision to locate the fiducials and thereby to map distortions of the pattern of conducting fibers; transforming an interconnect pattern so that it matches the distorted pattern of conducting fibers in the textile; and applying the transformed interconnect pattern to the textile panel.
- Invention 2: Claims 22-36 relate to an active, multi-component, flexible fiber. And claims 37-51 relate to a method for forming an active, multi-component flexible fiber.
- Invention 3: Claims 52-67 relate to a conductive via an interconnection between two conductors included on or in a fabric and an interconnection between a conductor included on or in a fabric and a connecting pad on a surface of the fabric, the connecting via being formed by a volume of conductive matrix material.
- Invention 4: Claims 68-70 relate to an apparatus for forming a via that interconnects two conductors included on or in a fabric, and/or links a connection pad on a surface of the fabric with a conductor included in or on the fabric, the via being formed by a volume of conductive matrix material included in the fabric and extending between the two conductors.
- Invention 5: Claims 71-83 relate to a system for forming a plurality of electrical connections between an external device and conductors included in a fabric.
- Invention 6: Claims 84-115 relate to an e-fabric comprising a fabric layer having a conducting assembly bonded thereto, the conducting assembly including a conductor bonded to the fabric by a ribbon of adhesive.
- Invention 7: Claims 116-130 relate to a system for controlling a plurality of aspects of an audiovisual presentation.

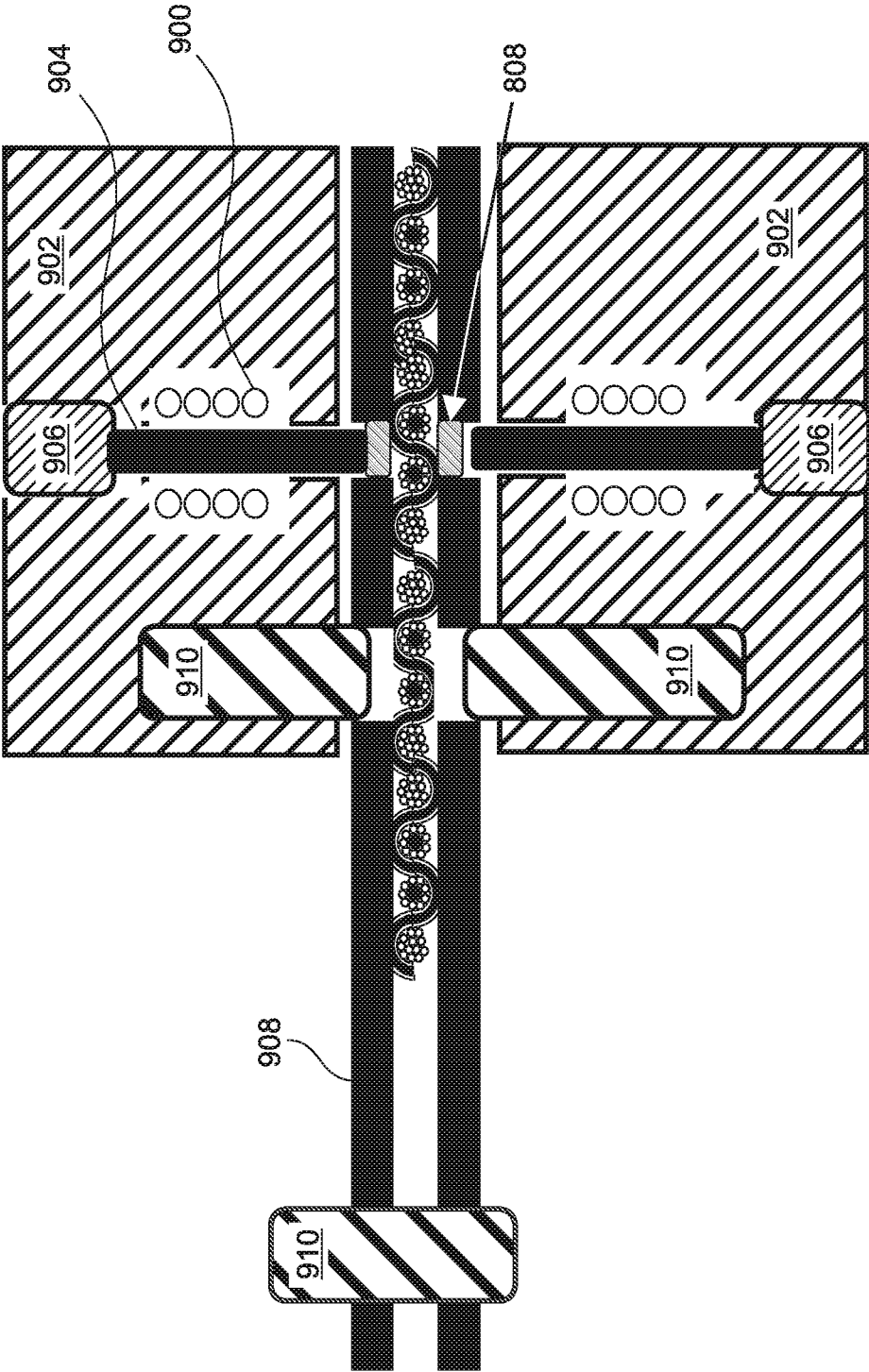


Fig. 9