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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))

[Continued on next page]

(54) Title: MOUNTING SYSTEM

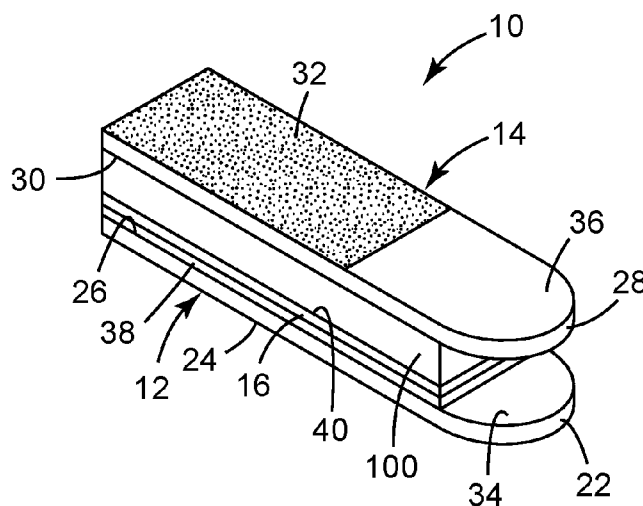


Fig. 3

(57) Abstract: The present disclosure generally relates to a mounting system capable of affixing an object to a wall or vertical surface.



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- *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))*

MOUNTING SYSTEM

Technical Field

[0001] The present disclosure generally relates to a mounting system capable of affixing an object to a wall or vertical surface.

Background

[0002] Easel back picture or photo frames include a support structure attached to the back of the picture or photo frame that holds the frame upright. When used with photo or picture frames, the easel back facilitates vertical display of the photo or picture frame, often at an angle of about 20° to the vertical.

[0003] An exemplary schematic drawing of an easel back photo frame, viewed from the back, is shown in Fig. 1. Easel back photo frame 100 includes frame portion 110 and easel back or easel stand portion 120. Easel back portion 120 is connected to frame portion 110 by a hinge 130.

Summary

[0004] The inventors of the present disclosure recognized that easel backs or stands on picture or photo frames often prevent the picture or photo frame from being securely attached or adhered relatively flush to a wall using the attachment mechanisms provided on the frame (e.g., keyhole, sawtooth, etc). This is because the easel back or easel stand portion has a thickness that can be greater than the thickness of the nail or attachment device. Additionally, the easel backs or easel stands have a thickness that can make effective use of 3M™ COMMAND™ Picture Hanging Strips challenging. This is because the thickness of the easel back or easel stand can be similar to or greater than the thickness of the 3M™ COMMAND™ Picture Hanging Strip. These issues can be resolved by removal of the easel back or easel stand, but removal of the easel stands or backs is challenging, time-consuming, and can impair or destroy the frame.

[0005] Additionally, the inventors of the present disclosure recognized that a trend in home design is to hang various wall decorations overlapping with one another such that at least some of them are hung at varying distances from the wall or vertical surface. Two examples of such wall displays are provided in Figs. 2a and 2b.

[0006] To address at least some of these problems, the inventors of the present disclosure invented improved picture hanging strip / mounting systems having an increased thickness. In some embodiments, the picture hanging strips / mounting systems mount, hang, or affix objects (including, for example, easel back picture or photo frames) flush and/or adjacent to a wall or vertical surface without requiring removal of the easel stand or easel back. In some embodiments, the picture hanging strips / mounting systems mount, hang, or affix objects (including, for example, easel back picture or photo frames) to a wall or vertical surface at a desired distance or depth from the wall or vertical surface. For example, in some

embodiments, the user can select a third connector having a desired thickness to facilitate the depth at which the user desires the object to be spaced from the wall or vertical surface when hung, attached, or mounted. Further, the mounting system embodiments described herein provide damage-free hanging.

[0007] Some embodiments relate to a mounting system, comprising: (A) a first adhesive structure comprising: a first backing layer having first and second major surfaces and first and second ends;; a first adhesive surface over at least a portion of said first major surface of said first backing layer for bonding to a surface of an object; and a second adhesive surface over at least a portion of the second major surface of said first backing layer, the second adhesive surface bonded to a first separable connector layer, said second separable connector layer having a major surface covering at least a portion of said second major surface of said backing layer; (B) a second adhesive structure comprising: a second backing layer having first and second major surfaces and first and second ends; an adhesive surface over at least a portion of said first major surface of said second backing layer for bonding to a surface of another object; and a cooperating separable connector surface covering at least a portion of said second major surface of said second backing layer; wherein said cooperating separable connector surface possesses the ability to be connected, disconnected and reconnected to said connection surface of said first backing layer without destruction of the separable connection surface, the cooperating connection surface and the adhesive tape; and (C) a third layer having opposing major surfaces that are capable of connecting to the first or second separable connector layers.

[0008] In some embodiments, at least one of the first and/or second adhesives are at least one of stretchable, peelable, or pressure sensitive. In some embodiments, at least one of the first or second backing layers are stretchable and/or stretch releasable.

[0009] Some embodiments include a non-adhesive manually engageable tab portion at one of said first and second ends to facilitate removal of said first backing layer. In some embodiments, the tab portion facilitates stretching of the first backing layer.

[0010] In some embodiments, said second backing layer and its adhesive surface are stretchable together to effect progressive debonding of the adhesive surface from the other object, after its adhesive surface is bonded to that object, by the application of a force to the first end of the second backing layer in a direction of extension of the second backing layer between its first and second ends. In some embodiments, the third separable connector layer includes a loop-engaging portion on at least one of its two major surfaces.

[0011] In some embodiments, the third separable connector has a thickness that is between about 0.05 and about 1.0 inches. In some embodiments, the mounting system has a thickness that is between 0.15 inches and about 5 inches. In some embodiments, the mounting system has a thickness that is greater than the thickness of an easel back or stand on a picture or photo frame.

[0012] In some embodiments, the third separable connector is attached or adhered to one of the first or second adhesive structures.

[0013] In some embodiments, the separable connector system includes at least one of a mechanical type fastener or a loop-engaging fastener material. In some embodiments, the separable connector system includes hook elements and loop elements, and at least some of the hooks elements have shape of at least one of a mushroom, a hook, a palm-tree, a nail, a T, or a J.

5 [0014] In some embodiments, the adhesive structures are separable so that the first separable connector layer remains with the first adhesive structure and the second separable connector layer remains with the second adhesive structure after separation.

[0015] In some embodiments, the third layer is a separable connector. In some embodiments, the third layer is a separate piece or unit. In some embodiments, the third layer is attached or adhered to one of the
10 first or second adhesive structures.

Brief Description of Drawings

[0016] Fig. 1 is a schematic drawing of a prior art easel-back picture frame viewed from the back.

[0017] Figs. 2a and 2b are two schematic drawings of exemplary walls including various objects hung on
15 the wall at varying depths to permit them to overlap.

[0018] Fig. 3 is perspective view of an exemplary mounting system of the type generally described herein.

[0019] Fig. 4 is a cross-sectional side view of an exemplary mounting system of the type generally described herein.

20 [0020] Fig. 5 is a schematic drawing of a front view of the mounting system of Fig. 4 shown in cross-section.

[0021] Fig. 6A is a schematic side view of an exemplary mounting system of the type described herein

[0022] Fig. 6B is a schematic side view of a prior art picture hanging strip.

[0023] Fig. 7 is a schematic drawings of the back side of a picture or photo frame to which has been
25 applied at least a portion of the mounting system generally described herein.

[0024] Fig. 8 is a schematic side view of a picture or photo frame attached and/or adhered to a wall using a mounting system of the general type described herein.

[0025] The figures are not necessarily to scale; some features may be exaggerated or minimized to show details of particular components. Therefore, specific structural and functional details disclosed herein are
30 not to be interpreted as limiting, but merely as a representative basis for teaching one skilled in the art to variously employ the present invention.

Detailed Description

[0026] The present disclosure will be described more fully hereinafter with reference to the
35 accompanying drawings, in which exemplary embodiments are shown. The scope of this disclosure,

however, may be embodied in many different forms and should not be construed as limited to the embodiments set forth or shown herein.

[0027] Some embodiments of the present disclosure constitute a mounting system comprising a picture hanging strip system having an increased thickness compared to a standard 3M™ COMMAND™ Picture Hanging Strip. In some embodiments, the thickness is greater than the thickness of an article, such as, for example, an easel back or stand on a picture or photo frame. In some embodiments, the thickness of the mounting system is at least 0.15 inches, 0.20 inches, 0.25 inches, 0.3 inches, 0.4 inches, 0.5 inches, 0.6 inches, 0.7 inches, 0.8 inches, 0.9 inches, 1.0 inch, 1.1 inch, 1.2 inch, 1.3 inch, 1.4 inch, 1.5 inch, 1.6 inch, 1.7 inch, 1.8 inch, 1.9 inch, 2.0 inches, 3 inches, 4 inches, or 5 inches. In some embodiments, the thickness is between about 0.15 inch and 5 inches. In some embodiments, the thickness of the mounting system is less than 5 inches, less than 4 inches, less than 3 inches, less than 2 inches, less than 1 inch, less than 0.5 inch, less than 0.4 inch, and/or less than 0.3 inch.

[0028] Picture hanging strips are described in, for example, U.S. Patent Nos. 6,692,807 and 6,572,945, both of which are incorporated herein in their entirety. In general, picture hanging strips, as used herein, refer to an adhesive tape construction that is removable from one or more objects to which it is adhered and which is reusably separable within its construction so that an object can be separated from another and subsequently reconnected with one another. The adhesive tape construction can be used to bond the other opposed surfaces of objects, including rigid objects such as a picture frame to a wall, where no portion of the adhesive tape construction projects from between the objects, and which subsequently affords easy separation of the objects without damage to either of them.

[0029] In some embodiments, the adhesive tape construction includes a stretch release adhesive tape structure combined with a reusable connector surface. In other embodiments, the adhesive is at least one of peelable, and/or pressure sensitive. Exemplary peelable adhesives include those described in, for example, PCT Patent Publication No. 2015/195344. As used herein, the term “pressure sensitive” refers to an adhesive that is configured to be in accordance with the Dahlquist criterion for pressure sensitive tack. The Dahlquist criterion is defined as an adhesive formulation that possesses a modulus of not more than 3×10^5 Pa at 25 °C at 1 Hz (A.V. Pocius in “Adhesives and Adhesion Technology, 3rd Ed.” 2012, Hanser Publications, Cincinnati, OH; also referenced in U.S. Patent Applications No. 2011/0179549 and in U.S. Patent Nos. 7,605,212, and 5,719,247). The Dahlquist criterion for pressure sensitive tack is also described as 1 sec compliance of a typical pressure-sensitive adhesive to be 10^{-6} cm²/dyne (D.A. Satas (ed.) in “Handbook of Pressure-Sensitive Adhesive Technology” 1982, Van Nostrand Reinhold Company Inc. New York, New York.).

[0030] An exemplary mounting system / picture hanging strip of the type generally described herein is shown schematically in Figs. 3-4. Picture hanging strip / adhesive tape construction 10 includes a first stretch release adhesive tape structure 12 and a second stretch release adhesive tape structure 14 connected together by two separable connector systems 16 and 100. The first stretch release adhesive structure 12 is connected with the second stretch release adhesive tape structure 14 by separable

connector system 16 and with a first liner 18 covering one side of the adhesive tape 10 and a second liner 20 covering the other side of the adhesive tape 10.

[0031] In some embodiments, the first stretch release adhesive structure 12 comprises a backing layer 22 and adhesive layers 24 and 26 of the same or different pressure-sensitive adhesive compositions on opposite major surfaces of the backing layer 22. The thicknesses of the layers of the Figures are not to scale with respect to one another. In some embodiments, second stretch release adhesive structure 14 likewise comprises a backing layer 28 and adhesive layers 30 and 32 of the same or different pressure-sensitive adhesive compositions on opposite major surfaces of the backing layer 28. In some embodiments, the external surfaces of the adhesive layers 24 and 32 of the first and second stretch release adhesive tape structures 12 and 14, respectively, are covered by the liners 18 and 20, respectively. In some embodiments, the thicknesses of one or more of the layers can be tailored for the end application. For example, the thickness of one or more of the layers can be increased to ensure that the total thickness of the mounting system is greater than the thickness of the easel back or stand.

[0032] In some embodiments, the backing layers 22 and 28, as illustrated, comprise a stretchable polymeric foam layer. In some embodiments, the backing layers 22 and 28 can alternatively comprise a stretchable polymeric film layer. The choice of polymeric foam or polymeric film depends on the specific application for the adhesive tape 10.

[0033] In some embodiments, each of the first and second stretch release adhesive tape structures 12 and 14 preferably include a tab 34 and 36, respectively. In some embodiments, tabs 34 and 36 facilitate the stretch release of each adhesive tape structure 12 and 14, respectively. Tab 34 is preferably provided as an extension of the backing layer 12. That is, the backing layer 22 extends farther longitudinally than the adhesive layers 24 or 26. Tab 36 comprises an extension of the backing layer 28 that extends farther longitudinally than the adhesive layers 30 and 32. Preferably, the adhesive layers 24, 26, 30 and 32 each cover a similar area of the backing layers 22 and 28, respectively. In some embodiments, tabs 34 and 36 can also be specifically shaped to facilitate the easy gripping thereof for the stretch release, described below. Where a solid adhesive is used, it may further be desirable to make the tab(s) non-adhesive. This can be done by any way of masking the adhesive surface or by rendering the adhesive surface non-adhesive, *i.e.* detackifying the adhesive surface.

[0034] In some embodiments, separable connector system 16 preferably comprises a first connector component 38 and a second connector component 40. In some embodiments, the first connector component 38 is bonded to the first stretch release adhesive tape structure 12 by the surface of adhesive layer 26. In some embodiments, the second connector component 40 is bonded to the second stretch release adhesive tape structure 14 by the surface of adhesive layer 30. In some embodiments, the first and second connector components 38 and 40 are preferably co-extensive with and cover the similar areas as the adhesive layers 24, 26, 30 and 32.

[0035] In some embodiments, the separable connector system 16 or 100 can comprise any known or developed reusable connector system for connecting the first and second stretch release adhesive tape

structures 12 and 14 together. Preferably, the separable connector system 16 permits the reusable separation and connection of the stretch release adhesive tape structures 12 and 14 along a general plane. The connector system 16 may comprise, for example, mechanical type fasteners, including interlocking systems, intermeshing systems (having connection without macroscopic mechanical deformation or interference), releasable contact responsive fasteners, and the like. In some embodiments, the stretch release adhesive tape structures 12 and 14 are separable so that the first connector component 38 remains with the first stretch release adhesive tape structure 12 and the second connector component 40 remains with the second stretch release adhesive tape structure 14 after separation of the connector system 16.

[0036] Separable connector system 100 can be any separable connector system, including, for example a loop-engaging fastener material. Generally, hook elements with loop-engaging heads have a head shape that is different from the shape of the stem. As used herein, the term "loop-engaging" relates to the ability of a hook element to be mechanically attached to a loop material. For example, the hook element may be in the shape of a mushroom (*e.g.*, with a circular or oval head enlarged with respect to the stem), a hook, a palm-tree, a nail, a T, or a J. The loop-engageability of hook elements may be determined and defined by using standard woven, nonwoven, or knit materials. One exemplary commercially available loop-engaging material is 3M™ Dual-Lock™ fastener. Any loop-engaging material, apparatus, device, method of making, or method of use described in any of the following references (all of which are incorporated herein in their entirety) can be used in any of the embodiments described herein: US Patent Nos. 8,777,919; 4,699,622; 4,894,060; 5,077,870; 5,312,387; 5,344,691; 5,399,219; 5,487,809; 5,537,722; 5,554,146; 5,705,013; 5,759,317; 5,851,205; 5,957,908; 5,985,081; 6,030,373; 6,051,094; 6,075,179; 6,190,758; 6,406,468; 6,544,245; 6,575,953; 7,032,278; 7,125,400; 7,361,246; 7,371,302; 7,517,572; 7,578,812; 7,658,813; 3,471,903; 4,120,718; 4,223,067; 4,216,257; 4,391,687; 4,322,875; 4,415,615; 4,454,183; 4,563,388; 3,353,663; 3,408,705; 4,977,003; 4,679,851; 4,819,309; 4,776,636; 5,308,428; 5,135,598; 4,910,062; 4,887,339; 4,985,488; 5,679,302; 4,894,060; 5,145,929; 5,908,695; 5,024,880; 5,852,855; 5,040,275; 5,149,573; 4,290,832; 5,453,319; 5,614,232; 5,691,027; 5,713,111; 5,671,512; 5,625,929; 5,671,511; 5,851,663; 5,654,487; 5,602,221; 5,598,610; 5,691,021; 7,879,441; 8,277,922; 6,470,540; 6,076,238; 6,592,800; 6,630,239; 6,588,074; 7,217,455; 7,703,179; 6,874,777; 7,140,774; and US Patent Publication No. 2004/0010217.

[0037] In some embodiments, the area of connection and the type of the separable connector system 16 or 100 is preferably selected so that the force required to separate the adhesive tape 10 into the first and second stretch release adhesive tape structures 12 and 14 can be readily applied by a user. Such a force may be applied in a direction substantially perpendicular to the general plane of the connector system, or as a peeling force, a cleavage force, combinations thereof or other release mechanisms. The type of force applied depends largely on the objects that are bonded together. With very flexible materials, a peeling force would likely be a primary force utilized for releasing the separable connector system 16. With rigid materials, a cleavage force may be mostly applied; that is where a person would pull from the bottom edge of the frame (causing angular displacement) to release the separable connector system 16 and/or 100

of the adhesive tape 10 located at the top. If the frame were pulled to release in a perpendicular direction, a perpendicular force is applied. Moreover, the connector system 16 or 100 should provide sufficient strength along the general plane of its separation so that, depending on the specific application, the separable connector system 16 or 100 will not separate based on the use of the adhesive tape 10 between plural objects. In the case of an object such as a picture frame mounted to a vertical wall surface, the connector system 16 or 100 should be of sufficient strength in the direction of its general plane of separation so that the picture frame will not shift downward during application or over time. The separable connector system 16 or 100 provides an internal static shear strength in a direction parallel to the surfaces of the adhesive layers 24 and 32 for supporting the objects between which the adhesive tape 10 is attached in that direction. That is, the shear strength of the connector system 16 or 100 preferably equals or exceeds the highest shear force that the pressure sensitive adhesive can develop with surfaces to which it is applied (e.g., about six pounds per square inch (0.041 MPa)).

[0038] Fig. 5 shows a photographic front view of the mounting system shown in cross-section in Fig. 4. Fig. 6A schematically shows mounting system 10. Fig. 6B schematically shows a prior art picture hanging strip in cross-section.

[0039] As shown schematically in Figs. 7 and 8, adhesive tape 10 can be positioned between a first object 50 (a wall) and a second object 52 (a picture frame) without any portion of the adhesive tape 10 extending out from in between the first and second objects 50 and 52. The picture frame can be connected by a single adhesive tape 10 positioned to provide a balanced support to the wall; however, any number of adhesive tapes 10 can be used (for example, two mounting systems of the type described herein are used in Figs. 7 and 8). Moreover, the ability to reposition the objects together is facilitated to allow for accurate alignment and balanced positioning.

[0040] The recitation of all numerical ranges by endpoint is meant to include all numbers subsumed within the range (*i.e.*, the range 1 to 10 includes, for example, 1, 1.5, 3.33, and 10).

[0041] The terms first, second, third and the like in the description and in the claims, are used for distinguishing between similar elements and not necessarily for describing a sequential or chronological order. It is to be understood that the terms so used are interchangeable under appropriate circumstances and that the embodiments of the invention described herein are capable of operation in other sequences than described or illustrated herein.

[0042] Moreover, the terms top, bottom, over, under and the like in the description and the claims are used for descriptive purposes and not necessarily for describing relative positions. It is to be understood that the terms so used are interchangeable under appropriate circumstances and that the embodiments of the invention described herein are capable of operation in other orientations than described or illustrated herein.

[0043] All references mentioned herein are hereby incorporated by reference in their entirety.

[0044] It is understood that connector systems may have many different properties that make them particularly suitable for certain applications or for connecting certain types of objects together. Thus, in

accordance with the present invention, any such connector system can be used, but the chosen connector system can be advantageously picked based upon its properties that make it particularly suitable for a specific application or for connecting certain types of objects together.

[0045] Those having skill in the art will appreciate that many changes may be made to the details of the above-described embodiments and implementations without departing from the underlying principles thereof. Further, various modifications and alterations of the present disclosure will become apparent to those skilled in the art without departing from the spirit and scope of the disclosure. The scope of the present disclosure should, therefore, be determined only by the following claims.

5

What is claimed is:

1. A mounting system, comprising:

a first adhesive structure comprising:

a first backing layer having first and second major surfaces and first and second ends;

a first adhesive surface over at least a portion of said first major surface of said first backing layer for bonding to a surface of an object;

wherein the second major surface of said first backing layer can be attached or bonded to a first separable connector layer, said first separable connector layer having a major surface covering at least a portion of said second major surface of said backing layer;

a second adhesive structure comprising:

a second backing layer having first and second major surfaces and first and second ends;

an adhesive surface over at least a portion of said first major surface of said second backing layer for bonding to a surface of another object; and

a cooperating second separable connector layer having a second separable connector surface covering at least a portion of said second major surface of said second backing layer;

and

wherein said cooperating second separable connector layer possesses the ability to be connected, disconnected and reconnected to said connection surface of said first backing layer without destruction of the first or second separable connection layer connection surfaces and/or the first and second adhesive surfaces;

a third layer having opposing major surfaces that are capable of connecting to at least one of the first or second separable connector layers.

2. The mounting system of claim 1, wherein the third separable connector layer includes a loop-engaging portion on at least one of its two major surfaces.

3. The mounting system of any of the preceding claims, wherein the third separable connector has a thickness that is between about 0.05 and about 1.0 inches.

4. The mounting system of any of the preceding claims, wherein the mounting system has a thickness that is between 0.15 inches and about 5 inches.

5. The mounting system of any of the preceding claims, wherein the mounting system has a thickness that is greater than the thickness of an easel back or stand on a picture or photo frame.

6. The mounting system of any of the preceding claims, where the third separable connector is attached or adhered to one of the first or second adhesive structures.

5 7. The mounting system of any of the preceding claims, wherein at least one of the first and second adhesive structures are stretch releasable.

8. The mounting system of claim 7, wherein at least one of the first and second backing layers are stretchable.

10 9. The mounting system of any of claims 7 or 8, wherein said second backing layer and its adhesive surface are stretchable together to effect progressive debonding of the adhesive surface from the other object, after its adhesive surface is bonded to that object, by the application of a force to the first end of the second backing layer in a direction of extension of the second backing layer between its first and
15 second ends.

10. The mounting system of any of the preceding claims, further including:
a non-adhesive manually engageable tab portion at one of said first and second ends to facilitate removal of said first backing layer.

20 11. The mounting system of any of claims 7-10, wherein the tab portion facilitates stretching of the first backing layer.

25 12. The mounting system of any of the preceding claims, wherein at least one of the first and second adhesive structures are peelable.

13. The mounting system of any of the preceding claims, wherein at least one of the first and second adhesive structures are pressure sensitive adhesives.

30 14. The mounting system of any of the preceding claims, wherein the separable connector system includes at least one of a mechanical type fastener or a loop-engaging fastener material.

35 15. The mounting system of claim 14, wherein the separable connector system includes hook elements and loop elements, and at least some of the hook elements have shape of at least one of a mushroom, a hook, a palm-tree, a nail, a T, or a J.

16. The mounting system of any of the preceding claims, wherein the adhesive structures are separable so that the first separable connector layer remains with the first adhesive structure and the second separable connector layer remains with the second adhesive structure after separation.

5 17. The mounting system of any of the preceding claims, wherein the third layer is a separable connector.

10 18. The mounting system of any of the preceding claims, wherein at least a portion of the second major surface of the first backing layer includes an adhesive that can be attached or bonded to the first separable connector layer.

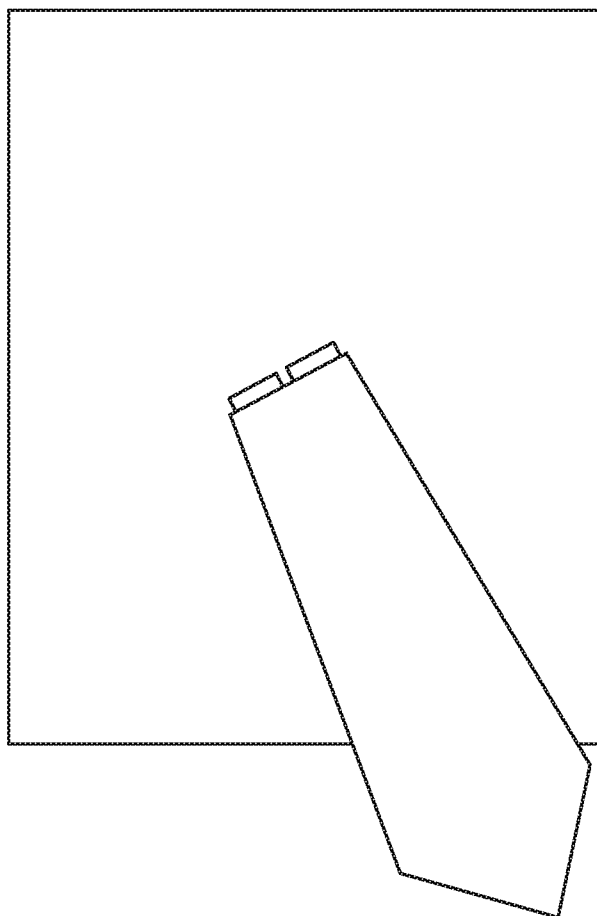


Fig. 1
PRIOR ART

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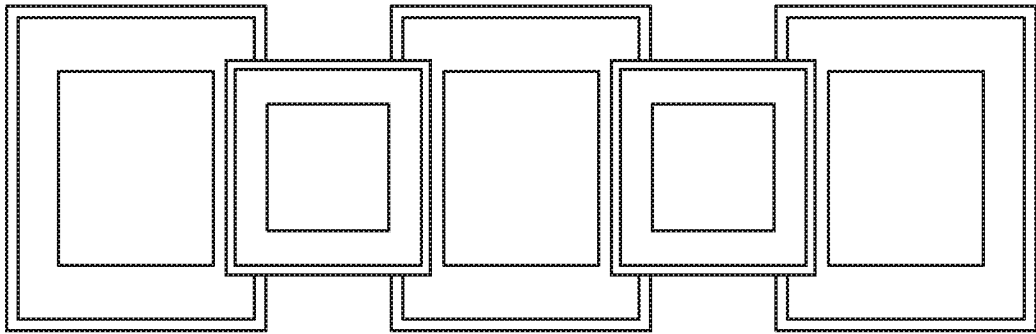


Fig. 2a

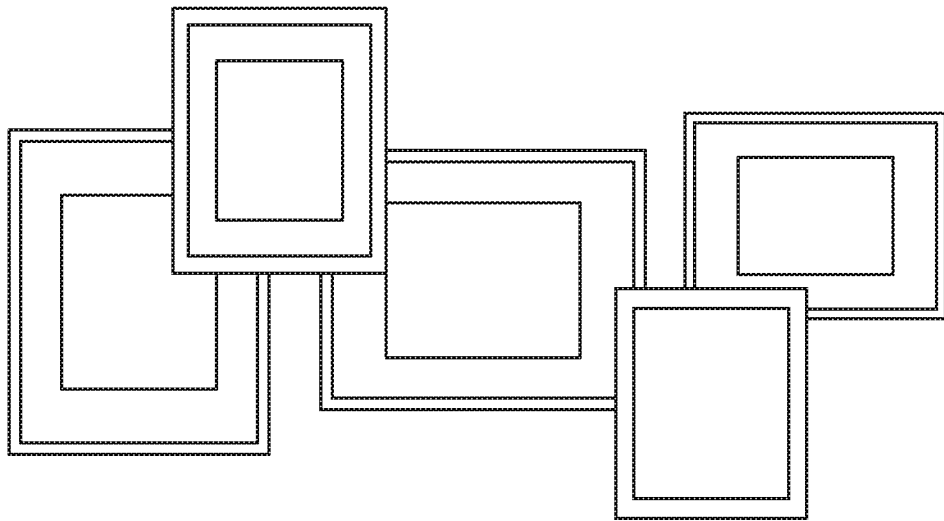


Fig. 2b

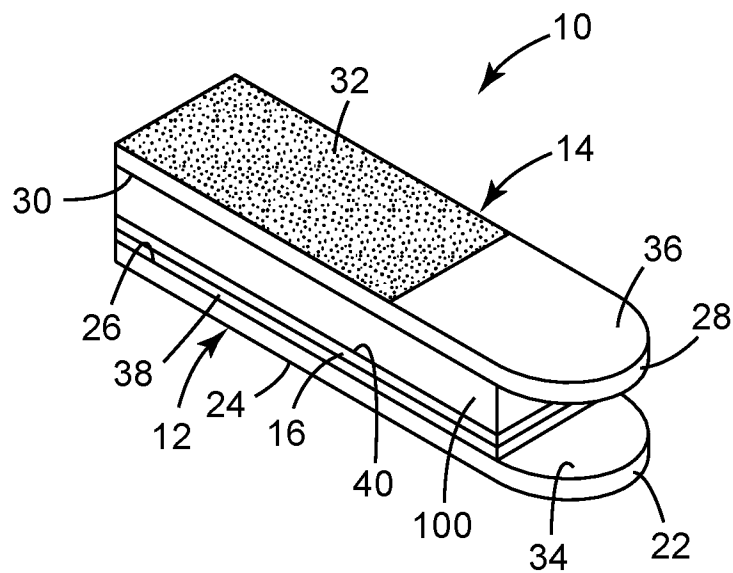
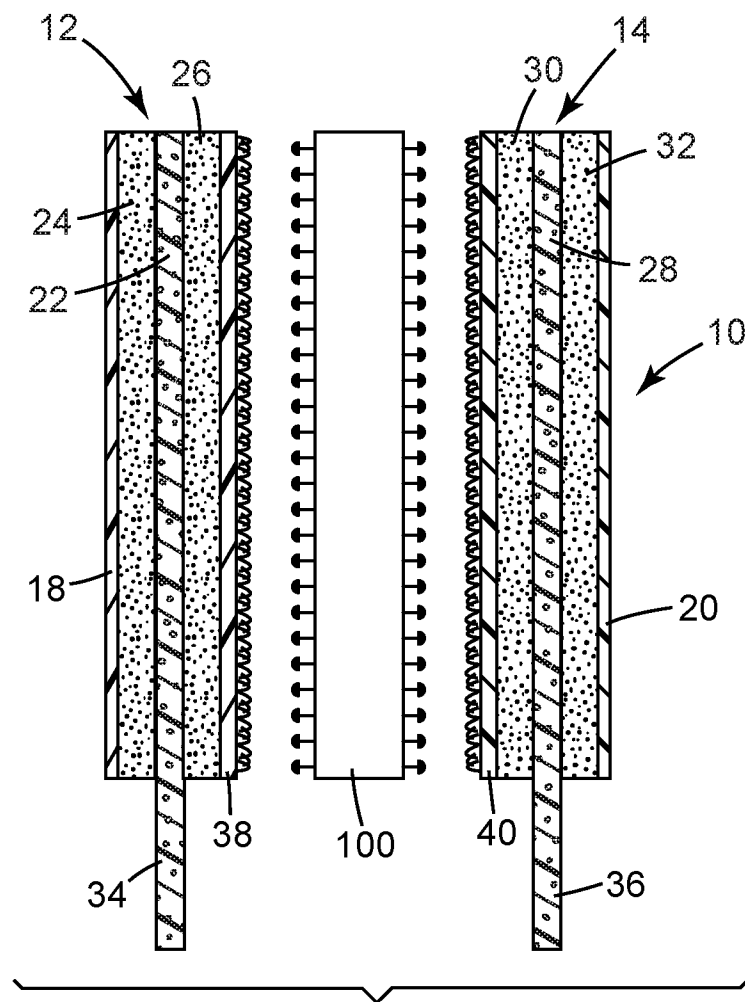
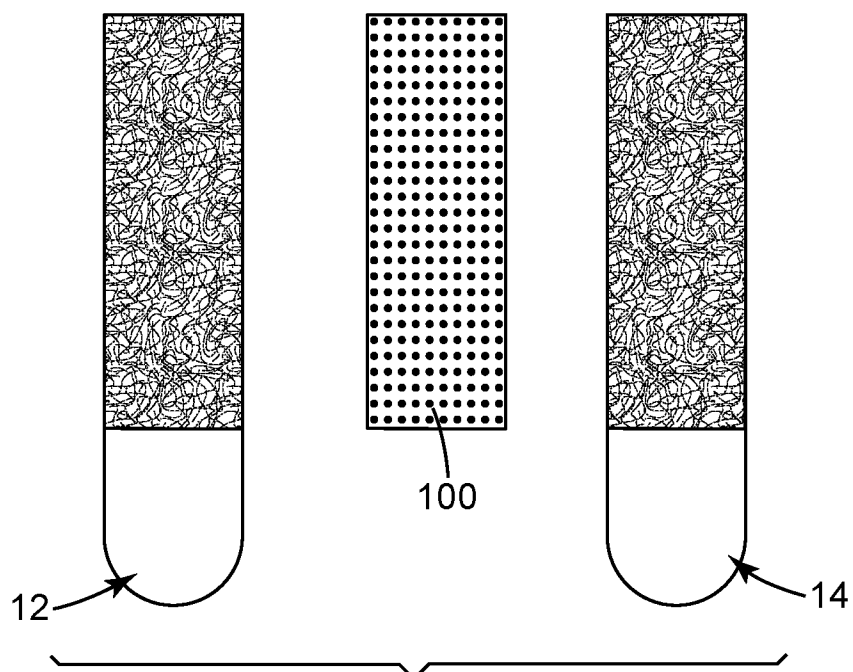


Fig. 3

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*Fig. 4**Fig. 5*

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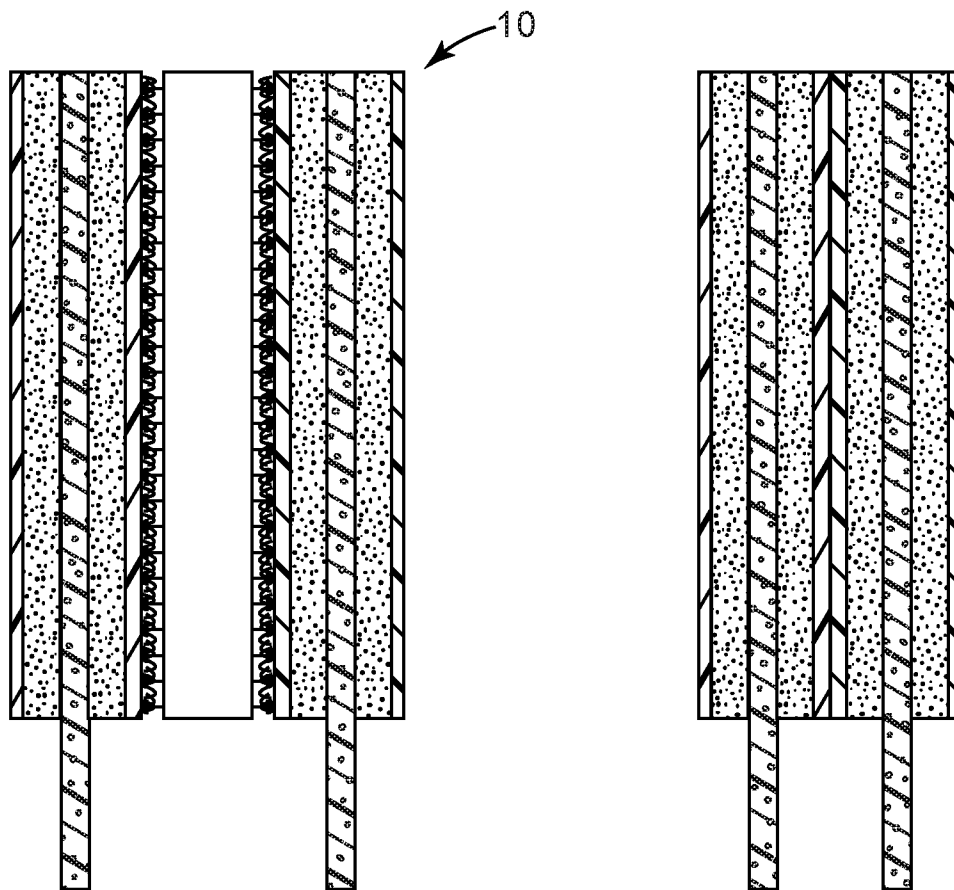


Fig. 6A

Fig. 6B

PRIOR ART

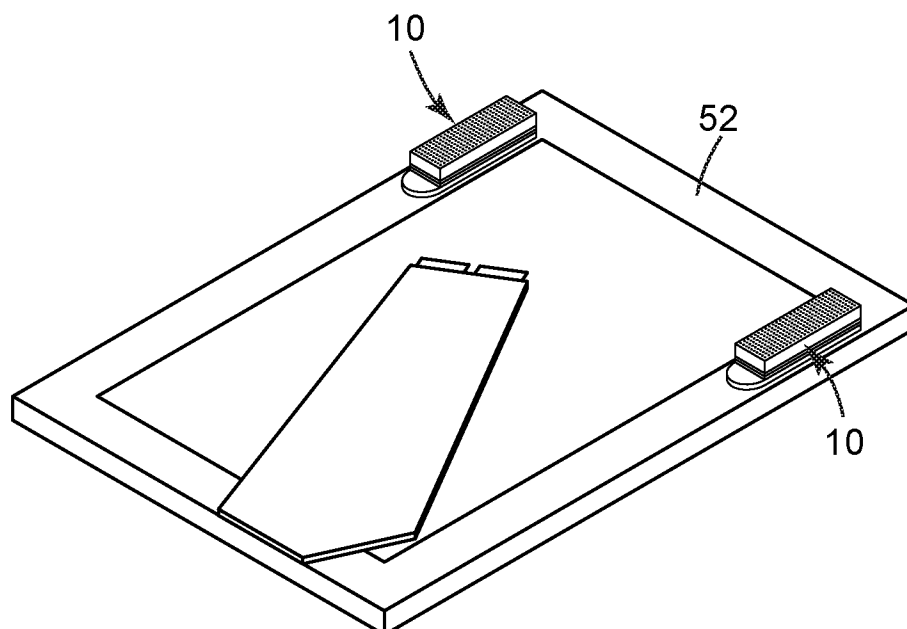


Fig. 7

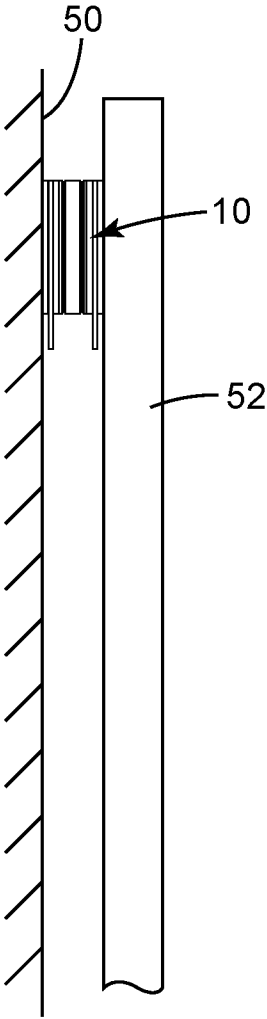


Fig. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US16/21469

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - B32B 7/06 (2016.01)

CPC - B32B 7/06

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(8): B29C 65/44, 65/64; B32B 7/06; C09J 7/02 (2016.01); CPC Classifications: A44B 18/0073; A47G 1/175; B29C 65/44, 65/64; B32B 7/06; C09J 7/02, 2201/128; Y10T 24/27, 24/275, 24/2708, 428/24017; USPC: 428/39, 40.1

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 practicable, search terms used)

PatSeer (US, EP, WO, JP, DE, GB, CN, FR, KR, ES, AU, IN, CA, INPADOC Data); Google; Google Scholar; EBSCO; IP.com; keywords: hook, loop, Velcro, cover, protect, sheet, adhesive, sheet, layer, mount, attach, fastener, thickness, dimension, inch, mills, centimeters, meter, millimeter

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2003/0161984 A1 (BRIES JL et al.) August 28, 2003; figure 5; paragraphs [0041], [0078]	1, 3/1
X	US 2013/0056597 A1 (BOELSTLER SG) March 7, 2013; figures 4, 9; paragraphs [0020]-[0023]	1, 2, 3/1, 3/2
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Y		3/1, 3/2
X	US 5,605,729 A (MODY KC et al.) February 25, 1997; figure 1; column 3, lines 60-65; column 5, lines 45-50; column 6, lines 60-65	1, 2, 3/1, 3/2
Y	US 2006/0249870 A1 (TACHAUER) November 9, 2006; paragraphs [0013], [0018], [0036]	3/1, 3/2
A	US 4,310,137 A (FRYE BJ) January 12, 1982; entire document	1, 2, 3/1, 3/2
A	US 2010/0206377 A1 (SAHLIN KM et al.) August 19, 2010; entire document	1, 2, 3/1, 3/2
A	US 2011/0250375 A1 (BRIES JL et al.) October 13, 2011; entire document	1, 2, 3/1, 3/2

☐ 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

27 April 2016 (27.04.2016)

Date of mailing of the international search report

20 MAY 2016

Name and mailing address of the ISA/

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-8300

Authorized officer

Shane Thomas

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PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US16/21469

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.:
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.: 4-18
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:

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 additional fees, this Authority did not invite payment of 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.:

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.