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(54) Title: FASTENER ASSEMBLY

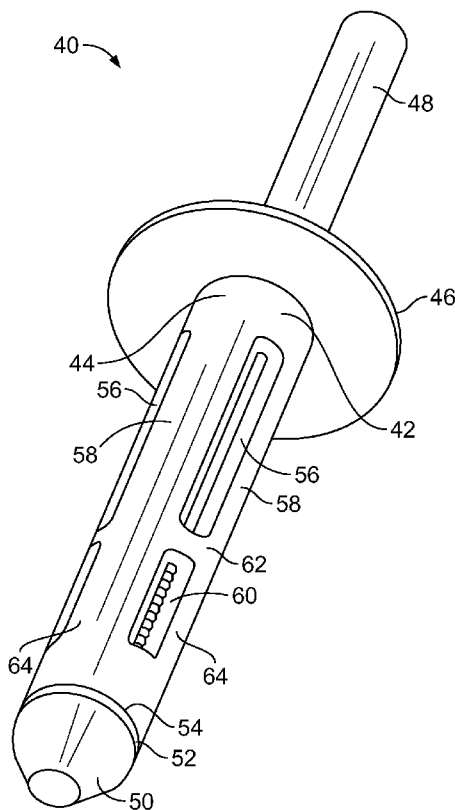


FIG. 4

(57) Abstract: A fastener assembly (40) includes a central column (44) having a central passage formed therethrough and first and second sets of foldable legs (58,64). The first set of foldable legs are at a first height, and the second set of foldable legs are at a second height that differs from the first height. The fastener assembly also includes a pin (48) secured within the central passage. The pin is fixed to a first end of the central column and configured to move relative to a second end of the central column so that the first and second sets of foldable legs move between extended and compressed positions.

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**FASTENER ASSEMBLY**  
**RELATED APPLICATIONS**

[0001] This application relates to and claims priority benefits from U.S. Provisional Patent Application No. 61/298,694 entitled "Fastener," filed January 27, 2010, which is hereby incorporated by reference in its entirety.

[0002] This application also relates to and claims priority benefits from U.S. Provisional Patent Application No. 61/301,047 entitled "Fastener," filed February 3, 2010, which is hereby incorporated by reference in its entirety.

**FIELD OF EMBODIMENTS OF THE INVENTION**

[0003] Embodiments of the present invention generally relate to a fastener assembly, and, more particularly, to a fastener assembly configured to secure two components together, such as panels within a vehicle, and/or an airbag assembly to an interior panel of a vehicle.

**BACKGROUND**

[0004] During a manufacturing process of a vehicle, various components are secured to one another. For example, an interior frame panel may be secured to an exterior door panel, or an air bag assembly may be secured to an interior door panel or glove compartment panel. Typically, components are secured together through one or more fasteners.

[0005] Figure 1 illustrates a front view of a fastener 10. The fastener 10 includes a main body 12 having a central column 14 integrally connected to a collar 16. A central channel passes through the central column 14 and is configured to retain a pin 18. The pin 18 includes a knob 20 having circumferential edges that abut into a ridge of the column 14 that surrounds an axial cross-section of the central channel. As such, the knob 20 is prevented from passing into the central channel.

[0006] A longitudinal window 22 is formed on either side of the central column 14. The opposed windows 22 allow longitudinal walls 24 of the central column 14 to flex and compress when a tool operatively engages the pin 18.

[0007] Figure 2 illustrates an isometric view of the fastener 10 being secured to a panel 26. In operation, the central column 14 is passed through a hole within the panel 26 until the collar 16 abuts a top surface 28 of the panel 26. Because the diameter of the collar 16 is greater than that of the hole within the panel 26, the collar 16 is prevented from passing into and through the hole. A tool 30 is used to engage the pin 18, thereby pulling the pin 18 in the direction of arrow A. As the pin 18 is urged upwardly, the knob 20 forces the central column 14 in the same direction. During this movement, the walls 24 collapse outwardly upon themselves. The tool 30 continues to urge the pin 18 in the direction of arrow A until the walls 24 are fully collapsed upon themselves and top folded portions of the walls 24 are flush against a lower surface of the panel 26.

[0008] The collapsed walls 24 prevent the central column 14 from being pulled through the hole within the panel 26. Thus, the panel 26 is securely sandwiched between the collar 16 and the collapsed walls 24, ensuring a secure connection. However, if a force is exerted into the fastener 10 that tends to extract the fastener from the panel 26, the folded portions of the walls 24 may snap and/or otherwise break, if the force is great enough. Accordingly, the central column 14 may then eject from the panel 26.

#### **SUMMARY OF EMBODIMENTS OF THE INVENTION**

[0009] Certain embodiments of the present invention provide a fastener assembly that includes a central column and a pin. The central column includes a central passage formed therethrough. A first set of windows are formed through the central column at a first level. First legs are defined between each of the first set of windows. A second set of windows are formed through the central column at a second level. Second legs are defined between each of the second set of windows. The first level differs from the second level. For example, the first level may be lower than the second level, or vice versa.

[0010] The assembly also includes a pin secured within the central passage. The pin is fixed to a first end of the central column. For example, the pin may include a base that abuts into a ridge of the central passage. The pin is configured to move relative

to a second end of the central column so that the first and second legs move between extended and compressed positions.

**[0011]** Each of the first set of windows may be a first length, and each of the second set of windows may be a second length that differs from the second length.

**[0012]** The central column may include a collar radially extending from the second end of the central column. At least one panel may be configured to be securely retained between the collar and the first or second legs in the compressed position.

**[0013]** The pin may include a threaded portion that threadably secures within the central column in the compressed position.

**[0014]** The central column may also include an annular ring separating the first set of windows from the second set of windows.

**[0015]** In one embodiment, the first legs are configured to shingle over the second legs during an inadvertent extraction.

**[0016]** In another embodiment, the central column may include a collar radially extending from the first end, and flanges radially extending from the second end. Ramped barbs may be proximate to the collar. A panel may be configured to be securely fastened between the collar and the ramped barbs, and a wall of a housing may be configured to be secured between the flanges.

**[0017]** Certain embodiments of the present invention provide a fastener assembly including a central column including a central passage formed therethrough and first and second sets of foldable legs. The first set of foldable legs are at a first height, and the second set of foldable legs are at a second height that differs from the first height. A pin is secured within the central passage and fixed to a first end of the central column. In this manner, the pin is configured to move relative to a second end of the central column so that the first and second sets of foldable legs move between extended and compressed positions.

**[0018]** Certain embodiments of the present invention provide a fastener assembly that includes a central column and a pin. The central column includes a central

passage formed therethrough and first and second sets of foldable legs. Each of the first set of foldable legs is separated from a neighboring one of the first set of foldable legs by a first window. Each of the second set of foldable legs is separated from a neighboring one of the second set of foldable legs by a second window. The first set of foldable legs are at a first height, and the second set of foldable legs are at a second height that differs from the first height. The central column may also include a radially-extending collar, and an annular ring separating the first windows from the second windows.

[0019] The pin is secured within the central passage. The pin may include a threaded mid-section and a beveled knob fixed to and extending from a first end of the central column. The pin is configured to move relative to the second end of the central column so that the first and second sets of foldable legs move between extended and compressed positions.

#### **BRIEF DESCRIPTION OF SEVERAL VIEWS OF THE DRAWINGS**

[0020] Figure 1 illustrates a front view of a fastener.

[0021] Figure 2 illustrates an isometric view of a fastener being secured to a panel.

[0022] Figure 3 illustrates a front view of a fastener assembly, according to an embodiment of the present invention.

[0023] Figure 4 illustrates an isometric bottom view of a fastener assembly, according to an embodiment of the present invention.

[0024] Figure 5 illustrates a front view of a fastener assembly inserted into two panels, according to an embodiment of the present invention.

[0025] Figure 6 illustrates a front view of a fastener assembly securely clamped to two panels, according to an embodiment of the present invention.

[0026] Figure 7 illustrates a front view of a fastener assembly securely clamped to two panels with a top portion of a pin removed, according to an embodiment of the present invention.

[0027] Figure 8 illustrates a partial cross-sectional view of folded legs of a fastener assembly in a securely clamped position, according to an embodiment of the present invention.

[0028] Figure 9 illustrates a partial cross-sectional view of folded legs of a fastener assembly during an attempted extraction, according to an embodiment of the present invention.

[0029] Figure 10 illustrates an isometric bottom view of a fastener assembly, according to an embodiment of the present invention.

[0030] Figure 11 illustrates an isometric top view of a fastener assembly, according to an embodiment of the present invention.

[0031] Figure 12 illustrates a front view of a central column, according to an embodiment of the present invention.

[0032] Figure 13 illustrates a front view of a pin, according to an embodiment of the present invention.

[0033] Figure 14 illustrates a front view of a fastener assembly, according to an embodiment of the present invention.

[0034] Figure 15 illustrates a front view of a fastener assembly being driven toward a compressed position, according to an embodiment of the present invention.

[0035] Figure 16 illustrates a front view of a fastener assembly in a compressed position, according to an embodiment of the present invention.

[0036] Figure 17 illustrates a front view of a fastener assembly in a compressed position and trimmed state, according to an embodiment of the present invention.

[0037] Figure 18 illustrates a front view of a compressed fastener assembly secured to a housing, according to an embodiment of the present invention.

[0038] Figure 19 illustrates a front view of a compressed fastener assembly securing a housing to a panel, according to an embodiment of the present invention.

[0039] Figure 20 illustrates a front view of a fastener assembly securing a housing to a panel during a deployment event, according to an embodiment of the present invention.

[0040] Figure 21 illustrates a front view of a fully extended fastener assembly securing a housing to a panel, according to an embodiment of the present invention.

[0041] Before the embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced or being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein are for the purpose of description and should not be regarded as limiting. The use of "including" and "comprising" and variations thereof is meant to encompass the items listed thereafter and equivalents thereof as well as additional items and equivalents thereof.

#### **DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION**

[0042] Figure 3 illustrates a front view of a fastener assembly 40, according to an embodiment of the present invention. Figure 4 illustrates an isometric bottom view of the fastener assembly 40.

[0043] Referring to Figures 3 and 4, the fastener assembly 40 includes a main body 42 having a central column 44 integrally connected to a collar 46. The central column 44 defines a central channel passing therethrough. A pin 48 is passed into the central channel. The pin 48 includes a beveled knob 50 at a distal end. A flat base 52 of the knob 50 abuts into a distal ridge 54 of the central column 44. The distal ridge 54 surrounds an axial cross-section of the central channel.

[0044] The diameter of the flat base 52 is greater than that of the central channel. Thus, the ridge 54 prevents the knob 50 from passing into the central channel.

[0045] A first set of windows 56 is formed through an upper portion of the central column 44. The windows 56 are the same length and at the same height or level



of the central column 44. The windows 56 may be evenly spaced about the circumference of the central column 44. For example, three or four windows 56 may be evenly spaced about the central column 44. Flexible legs 58 are defined between neighboring windows 56.

**[0046]** A second set of windows 60 is formed through a lower portion of the central column 44. The windows 60 are separated from the windows 56 by an annular ring 62 of the central column 44. As shown, the windows 60 may be shorter than the windows 56. The windows 60 are the same length and at the same height or level of the central column 44. The windows 60 may be evenly spaced about the circumference of the central column 44. For example, three or four windows 60 may be evenly spaced about the central column 44. Flexible legs 64 are defined between neighboring windows 60. The legs 64 are generally shorter than the legs 58.

**[0047]** Figure 5 illustrates a front view of the fastener assembly 40 inserted into two panels 66 and 68, according to an embodiment of the present invention. Each panel 66 and 68 includes a hole (hidden from view) formed therethrough. The holes of the panels 66 and 68 are aligned. The beveled knob 50 is aligned over the holes and the fastener assembly 40 is urged into the holes in the direction of arrow B. The central column 44 passes through the holes until the collar 46 abuts a top surface of the panel 66. Because the diameter of the collar 46 is greater than that of the holes, the collar 46 is prevented from passing into the holes. As shown in Figure 5, a portion of the pin 48 includes threads configured to threadably engage reciprocal grooves, ridges, threads, or the like 70 formed in an upper interior portion of the central column 44.

**[0048]** Figure 6 illustrates a front view of the fastener assembly 40 securely clamped to the two panels 66 and 68, according to an embodiment of the present invention. A tool is used to operatively engage pin 48 in the direction of arrow B'. The tool may pull or drive the pin 48 in the direction of arrow B'. In this manner, the threads 70 (shown in Figure 5) of the pin 48 may threadably engage the reciprocal threads formed within an upper portion of the central column 44.

**[0049]** As the pin 48 is urged in the direction of arrow B', the knob 50 forces the central column 44 in the same direction. During this movement, the legs 58 and 64 outwardly compress and fold upon themselves until there is no gap between the folded portions. As shown in Figure 6, the folded legs 58 are flush against a lower surface of the panel 68. In this position, the panels 66 and 68 are securely clamped between the collar 46 and the folded legs 58. The engagement between the grooves, ridges, threads, or the like 70 (shown in Figure 5) of the pin 48 and the reciprocal features within the central column 44 secures the fastener assembly 40 in the clamped position.

**[0050]** Figure 7 illustrates a front view of the fastener assembly 40 securely clamped to the two panels 66 and 68 with a top portion of the pin 48 (shown in Figures 5 and 6) removed, according to an embodiment of the present invention. When the fastener assembly 40 is engaged in a fully clamped position, the tool is removed from the pin 48, and the top portion of the pin 48 is removed so that the top of the remainder of the pin 48 is flush with or below the upper surface of the collar 46. For example, the pin 48 may break at a specific height as determined by a diametrical groove on the pin 48.

**[0051]** Figure 8 illustrates a partial cross-sectional view of the folded legs 58 and 64 of the fastener assembly 40 in a securely clamped position, according to an embodiment of the present invention. As noted above, in the fully-folded position, the legs 58 and 64 outwardly collapse upon themselves so that there are no gaps between folded portions. The panels 66 and 68 are securely clamped between the collar 46 and the folded legs 58.

**[0052]** Figure 9 illustrates a partial cross-sectional view of the folded legs 58 and 64 of the fastener assembly 40 during an attempted extraction, according to an embodiment of the present invention. During an attempted extraction, a force exerted in the direction of arrow B', exerts an equal but opposite force into the folded legs 58. As such, the folded legs 58 bend down toward the folded legs 64. As the folded legs 58 contact the folded legs 64, the folded legs 64 also bend down. However, the folded legs 64 block the folded legs 58 from further movement. As such, the folded legs 58 are braced, thereby preventing the folded legs 58 from snapping or breaking. Because the legs 64 are shorter than the legs 58, the legs 64 may be stronger than the legs 58, thereby

resisting breaking as they bend down. In this manner, the folded legs 58 shingle over the folded legs 64. When the force in the direction of arrow B' is removed, the legs 58 and 64 flex back to the positions shown in Figure 8.

**[0053]** Thus, embodiments of the present invention shown in Figures 3-9 provide a fastener assembly 40 that provides increased extraction force to further prevent the fastener assembly 40 from being adversely or otherwise inadvertently pulled back through the holes of the panels 66 and 68.

**[0054]** It has been found that embodiments of the present invention, such as shown and described with respect to Figures 3-9, are particularly well suited for clamping panels of material softer than metal (such as plastic) together. The shingling effect of the folded legs 58 and 64 provides increased extraction force that prevents inadvertent/adverse extraction.

**[0055]** Figures 10 and 11 illustrate isometric bottom and top views, respectively, of a fastener assembly 80, according to an embodiment of the present invention. The fastener assembly 80 includes a main body 82 having a central column 84. A collar 86 radially extends from one end of the central column 84, while parallel flanges 88 radially extend from an opposite end of the central column 84.

**[0056]** A pin 90 passes through the central column 84 in the same manner as described above with respect to Figures 3-9. The pin 90 includes a beveled knob 92 that abuts into the central column 84 as described above. Two sets of windows 94 and 96 are formed through the central column 84 as described above. However, the windows 96 may be the same length as the windows 94. Flexible legs 98 and 100 are defined between neighboring windows 94 and 96, respectively.

**[0057]** Figure 12 illustrates a front view of the central column 84. Ramped barbs 102 may extend from outer surfaces of the central column 84 below the collar 86.

**[0058]** Figure 13 illustrates a front view of the pin 90. As shown, the pin 90 may include a threaded mid-section 104, as described above. The pin 90 may be the same as the pin 48, shown and described with respect to Figures 3-9. That is, the pin 90 may also be used with the embodiments shown and described with respect to Figures 3-9.

[0059] Figure 14 illustrates a front view of the fastener assembly 80, according to an embodiment of the present invention.

[0060] Figure 15 illustrates a front view of the fastener assembly 80 being driven toward a compressed position, according to an embodiment of the present invention. A tool engages the pin 90, while the top of the central column 84 is secured in a fixed position. As the pin 90 is moved in the direction of B', as noted above, the legs 98 and 100 begin to outwardly compress or collapse upon themselves.

[0061] Figure 16 illustrates a front view of the fastener assembly 80 in a compressed position, according to an embodiment of the present invention. As shown, the legs 98 and 100 are fully folded upon themselves. The threaded portion 104 of the pin 90 threadably engages internal threads of the central column 84 to maintain the compressed position. More or less legs 98 and 100 may be used than those shown.

[0062] Figure 17 illustrates a front view of the fastener assembly 80 in a compressed position and trimmed state, according to an embodiment of the present invention. The top portion of the pin 90 has been removed, as noted above with respect to Figure 7. The fully-compressed fastener assembly 80 shown in Figure 17 may be sent to an original equipment manufacturer of, for example, air bag units, in the compressed position.

[0063] Figure 18 illustrates a front view of the compressed fastener assembly 80 secured to a housing 106, according to an embodiment of the present invention. The housing 106 may be an air bag unit housing, although the air bag is not shown. The housing 106 includes a wall 108 integrally connected to a fastening chamber 110. The fastening chamber 110 includes a slot 112 into which a portion of the central column 84 between the flanges 88 passes. The flanges 88 snapably secure to the housing 106 and compressively sandwich edges 114 of the fastening chamber 110 that define the slot 112. As such, the fastener assembly 80 secures to the housing 106. A manufacturer of an air bag unit, for example, may manufacture an air bag unit with the fastener assembly 80 secured in such a manner.

**[0064]** Figure 19 illustrates a front view of the compressed fastener assembly 80 securing the housing 106 to a panel 116, according to an embodiment of the present invention. The fastener assembly 80 may securely fasten to the panel 116, such as an interior door panel of a vehicle, through the collar 86 and the barbs 102 compressively sandwiching the portions of the panel 116 around a through-hole. When passing through a hole of the panel 116, the barbs 102 flex inward to pass therethrough, as their lead ends 117 are ramped. Once the barbs 102 fully pass through the hole, the barbs 102 flex back, and straight trailing edges 119 lock into engagement with respect to a lower surface of the panel 116, thereby preventing the barbs 102 from retreating back through the hole. Thus, the fastener assembly 80 may secure the housing 106 to the panel 116.

**[0065]** Figure 20 illustrates a front view of the fastener assembly 80 securing the housing 106 to the panel 116 during a deployment event, according to an embodiment of the present invention. When a vehicle is struck by another vehicle example, the force of the collision triggers the airbag to deploy. The deployed airbag separates the panel 116 from the vehicle (behind with the airbag was secured). The panel 116 is retained from careening within the vehicle cabin by the extended fastener assembly 80. The folded legs 98 and 100 extend due to the force of the airbag deployment.

**[0066]** Figure 21 illustrates a front view of the fully extended fastener assembly 80 securing the housing 106 to the panel 116, according to an embodiment of the present invention. In the fully-extended position, the legs 98 and 100 are no longer folded.

**[0067]** Thus, embodiments of the present invention provide a fastener assembly 80 that remains in a compressed position until an air bag is deployed. The force of deployment breaks the hold between the pin 90 of the fastener assembly 80 and the central column 84, thereby allowing the legs 98 and 100 to extend. As the air bag housing 106 springs away from the panel 116, the housing 106 moves away, but remains secured to the panel 116.

**[0068]** While various spatial and directional terms, such as top, bottom, lower, mid, lateral, horizontal, vertical, front and the like may be used to describe embodiments of

the present invention, it is understood that such terms are merely used with respect to the orientations shown in the drawings. The orientations may be inverted, rotated, or otherwise changed, such that an upper portion is a lower portion, and vice versa, horizontal becomes vertical, and the like.

**[0069]** Variations and modifications of the foregoing are within the scope of the present invention. It is understood that the invention disclosed and defined herein extends to all alternative combinations of two or more of the individual features mentioned or evident from the text and/or drawings. All of these different combinations constitute various alternative aspects of the present invention. The embodiments described herein explain the best modes known for practicing the invention and will enable others skilled in the art to utilize the invention. The claims are to be construed to include alternative embodiments to the extent permitted by the prior art.

**[0070]** Various features of the invention are set forth in the following claims.

### CLAIMS

1. A fastener assembly comprising:  
a central column including a central passage formed therethrough, wherein a first set of windows are formed through said central column at a first level, wherein first legs are defined between each of said first set of windows, and wherein a second set of windows are formed through said central column at a second level, wherein second legs are defined between each of said second set of windows, wherein the first level differs from the second level; and  
a pin secured within said central passage, wherein said pin is fixed to a first end of said central column and configured to move relative to a second end of said central column so that said first and second legs move between extended and compressed positions.
2. The fastener assembly of claim 1, wherein each of said first set of windows is a first length, and wherein each of said second set of windows is a second length, wherein the first length differs from the second length.
3. The fastener assembly of claim 1, wherein said pin comprises a beveled knob fixed and extending from said first end of said central column.
4. The fastener assembly of claim 1, wherein said central column further comprises a collar radially extending from said second end of said central column.
5. The fastener assembly of claim 4, wherein at least one panel is configured to be securely retained between said collar and said first or second legs in the compressed position.
6. The fastener assembly of claim 1, wherein said pin comprises a threaded portion that threadably secures within said central column in the compressed position.
7. The fastener assembly of claim 1, wherein said central column further comprises an annular ring separating said first set of windows from said second set of windows.
8. The fastener assembly of claim 1, wherein said first legs are configured to shingle over said second legs during an inadvertent extraction.

9. The fastener assembly of claim 1, wherein said central column further comprises a collar radially extending from said first end, and flanges radially extending from said second end.

10. The fastener assembly of claim 9, wherein said central column further comprises ramped barbs proximate said collar.

11. The fastener assembly of claim 10, wherein a panel is configured to be securely fastened between said collar and said ramped barbs, and wherein a wall of a housing is configured to be secured between said flanges.

12. A fastener assembly comprising:

a central column including a central passage formed therethrough and first and second sets of foldable legs, wherein said first set of foldable legs are at a first height, wherein said second set of foldable legs are at a second height that differs from the first height; and

a pin secured within said central passage, wherein said pin is fixed to a first end of said central column and configured to move relative to a second end of said central column so that said first and second sets of foldable legs move between extended and compressed positions.

13. The fastener assembly of claim 12, wherein each of said first set of foldable legs has a first length, and wherein each of said second set of foldable legs has a second length that differs from the first length.

14. The fastener assembly of claim 12, wherein said pin comprises a beveled knob fixed and extending from said first end of said central column.

15. The fastener assembly of claim 12, wherein said central column further comprises a collar radially extending from said second end.

16. The fastener assembly of claim 15, wherein at least one panel is configured to be securely retained between said collar and said first or second set of foldable legs in the compressed position.

17. The fastener assembly of claim 12, wherein said pin comprises a threaded portion that threadably secures within said central column in the compressed position.



18. The fastener assembly of claim 12, wherein a first set of windows separates each of said first set of foldable legs from one another, and wherein a second set of windows separates each of said second set of foldable legs from one another.

19. The fastener assembly of claim 18, wherein said central column further comprises an annular ring separating said first set of windows from said second set of windows.

20. The fastener assembly of claim 12, wherein said first set of foldable legs are configured to shingle over said second set of foldable legs during an inadvertent extraction.

21. The fastener assembly of claim 12, wherein said main body further comprises a collar radially extending from said first end, and flanges radially extending from the said second end.

22. The fastener assembly of claim 21, wherein said central column further comprises ramped barbs proximate said collar.

23. The fastener assembly of claim 22, wherein a panel is configured to be securely fastened between said collar and said ramped barbs, and wherein a wall of a housing is configured to be secured between said flanges.

24. A fastener assembly comprising:

a central column including: (i) a central passage formed therethrough, (ii) first and second sets of foldable legs, wherein each of said first set of foldable legs is separated from a neighboring one of said first set of foldable legs by a first window, and wherein each of said second set of foldable legs is separated from a neighboring one of said second set of foldable legs by a second window, wherein said first set of foldable legs are at a first height, wherein said second set of foldable legs are at a second height that differs from the first height, (iii) a radially-extending collar, and (iv) an annular ring separating said first windows from said second windows; and

a pin secured within said central passage, wherein said pin comprises a threaded mid-section and a beveled knob fixed to and extending from a first end of said central column and configured to move relative to the second end of said central column so that

said first and second sets of foldable legs move between extended and compressed positions.

25. The fastener assembly of claim 24, wherein each of said first set of foldable legs has a first length, and wherein each of said second set of foldable legs has a second length that differs from the first length.

26. The fastener assembly of claim 24, wherein at least one panel is configured to be securely retained between said collar and said first or second set of foldable legs in the compressed position.

27. The fastener assembly of claim 24, wherein said first set of foldable legs are configured to shingle over said second set of foldable legs during an inadvertent extraction.

28. The fastener assembly of claim 24, wherein said central column further comprises flanges radially.

29. The fastener assembly of claim 28, wherein said central column further comprises ramped barbs proximate said collar.

30. The fastener assembly of claim 29, wherein a panel is configured to be securely fastened between said collar and said ramped barbs, and wherein a wall of a housing is configured to be secured between said flanges.

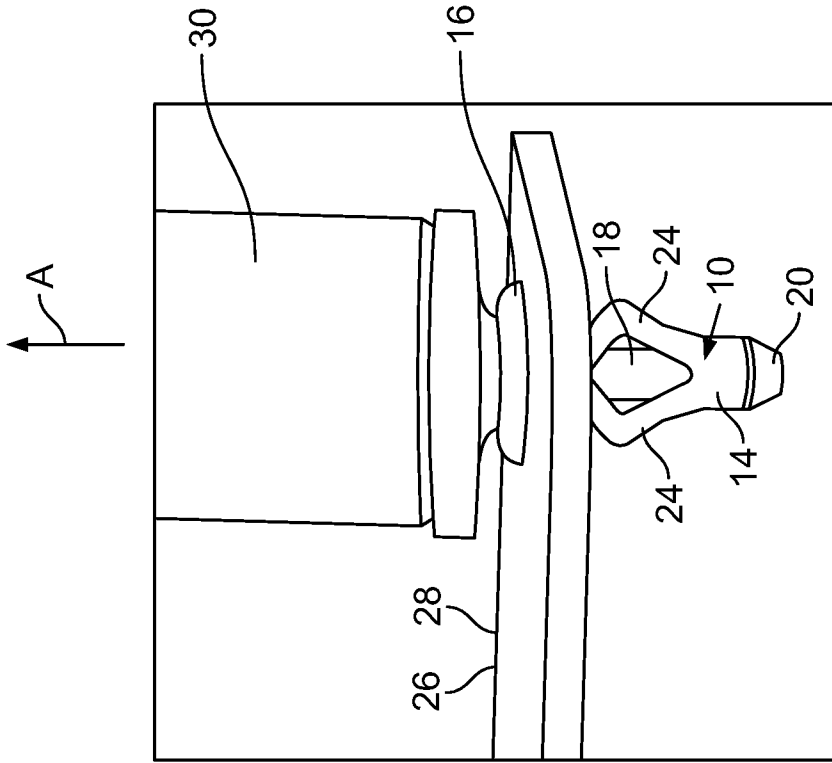


FIG. 2  
(PRIOR ART)

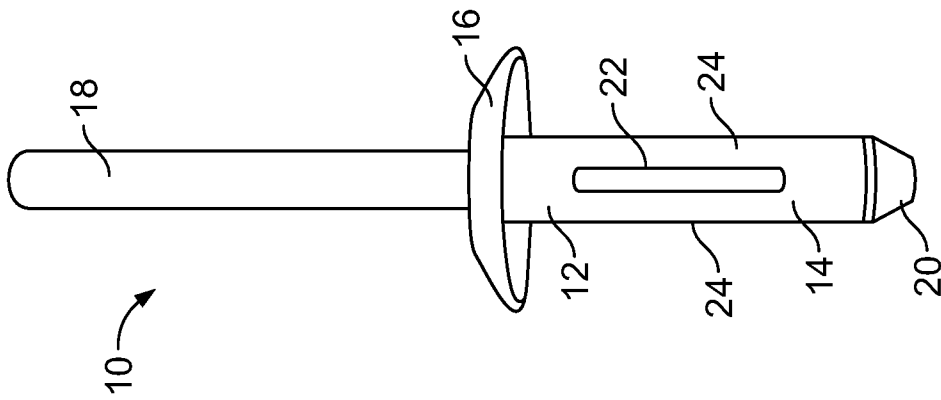


FIG. 1  
(PRIOR ART)

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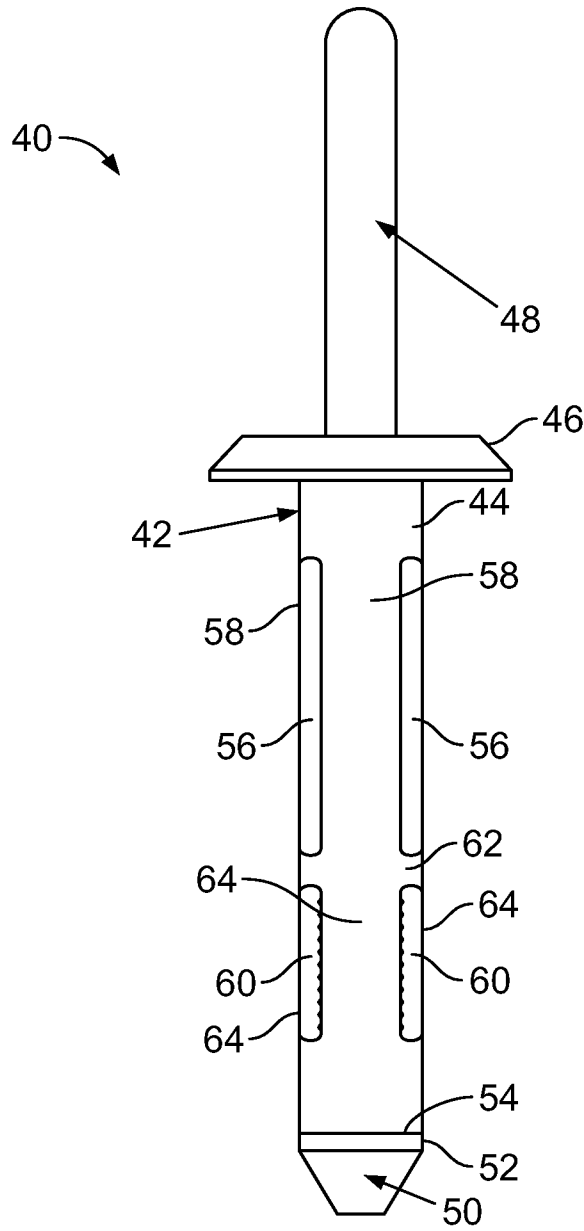


FIG. 3

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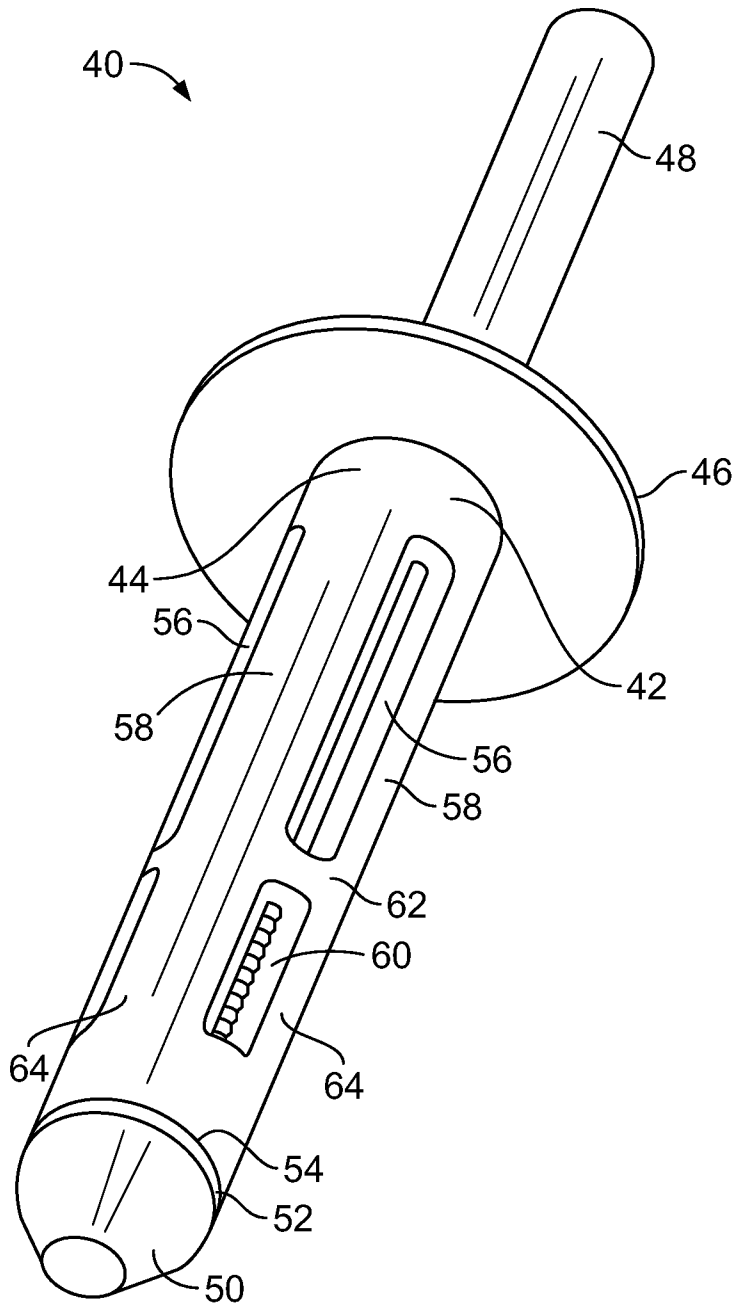


FIG. 4

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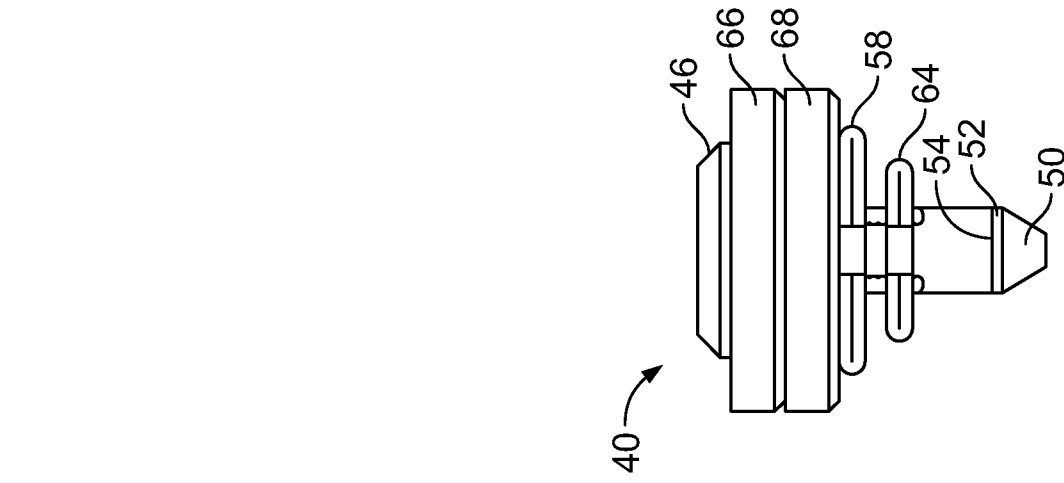


FIG. 5

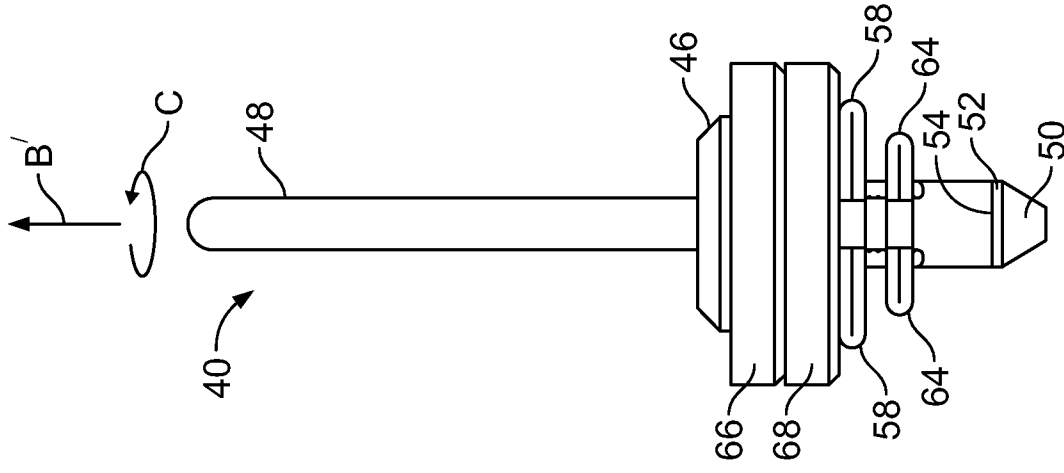


FIG. 6

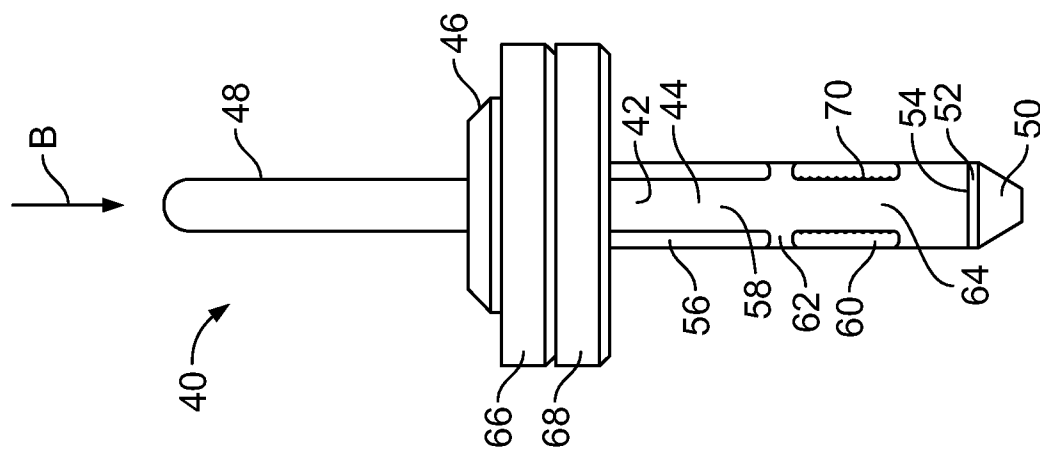


FIG. 7

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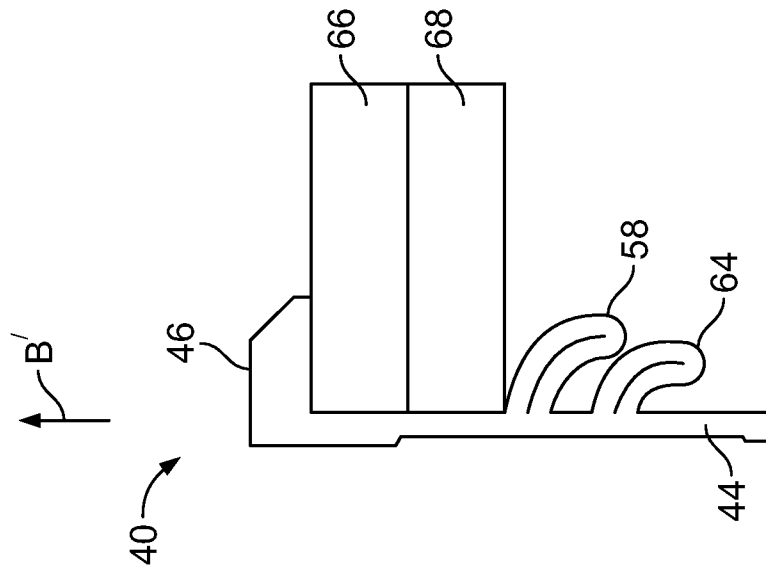


FIG. 9

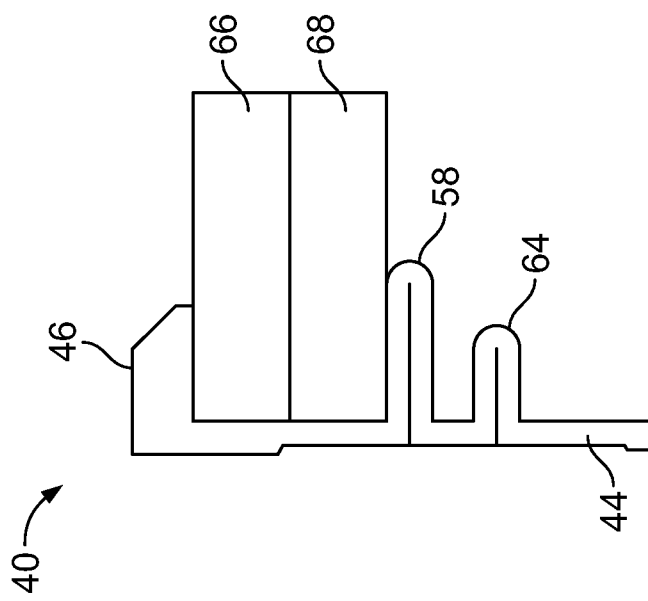


FIG. 8

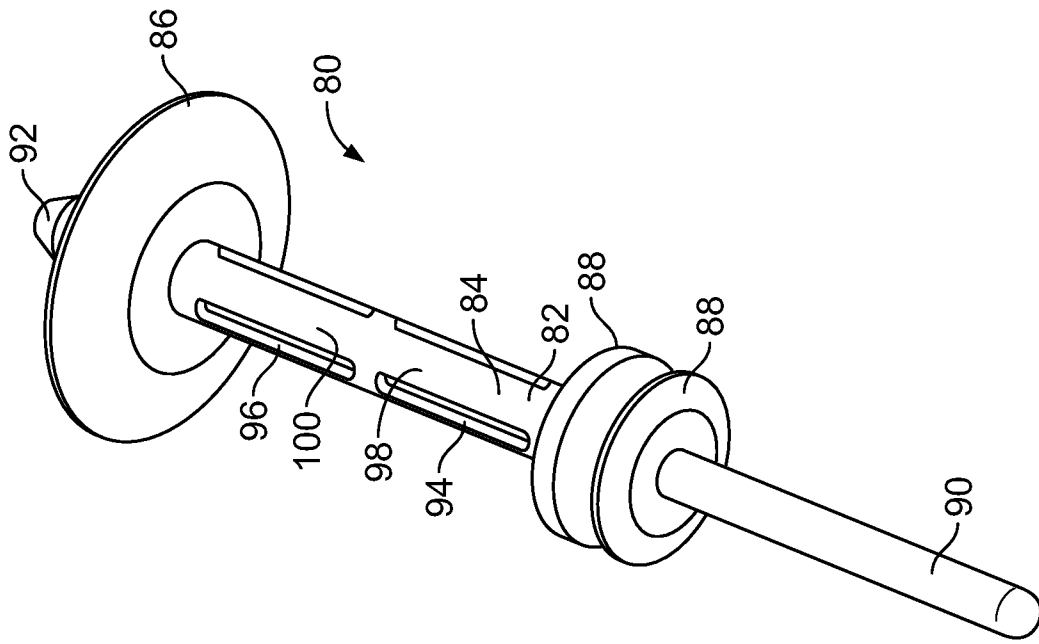


FIG. 11

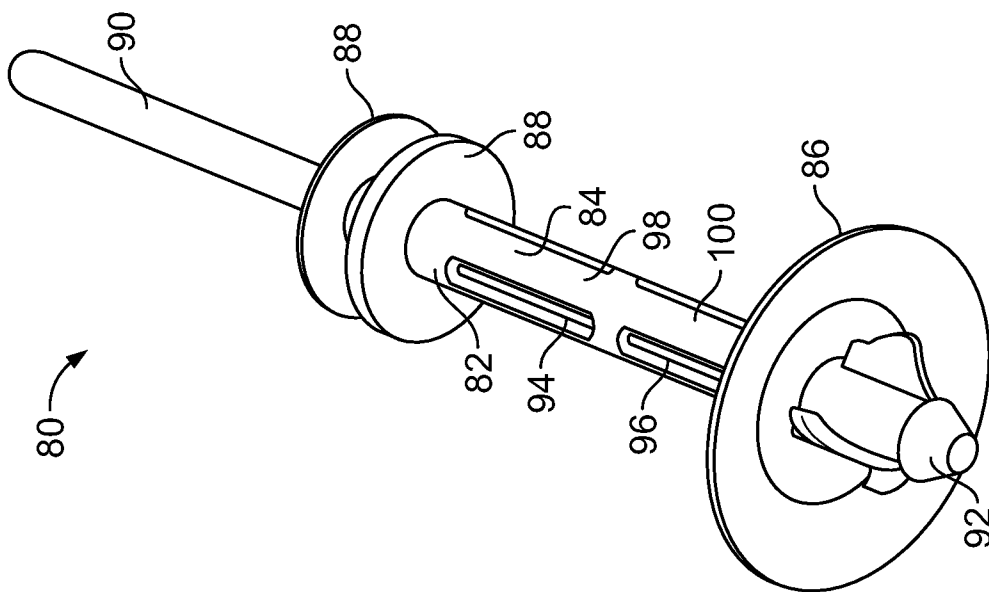


FIG. 10



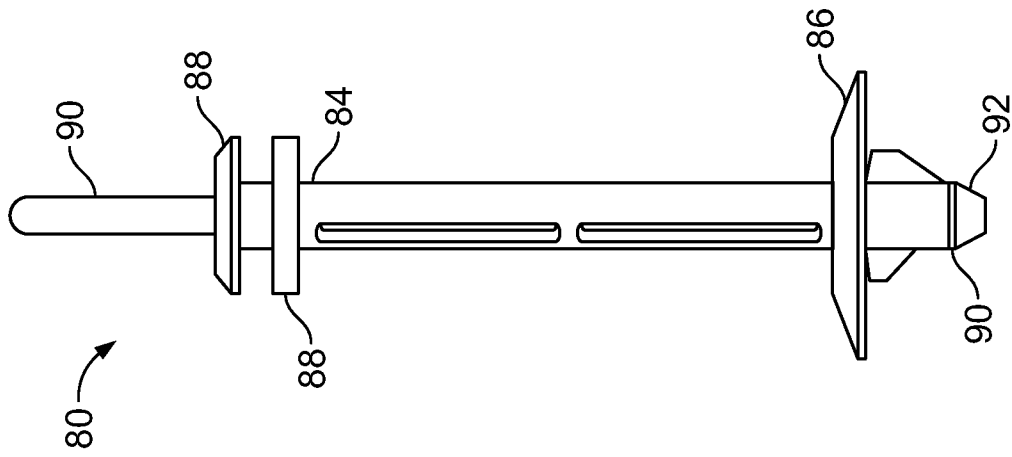


FIG. 14

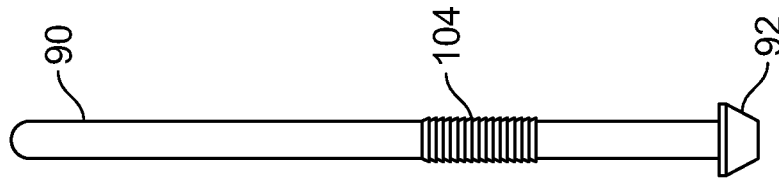


FIG. 13

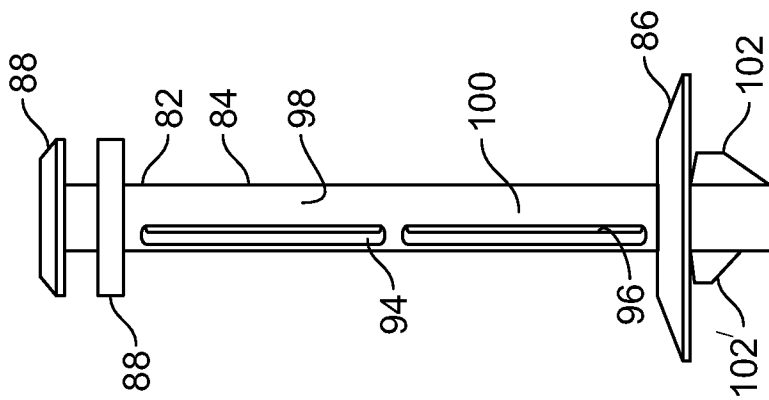


FIG. 12

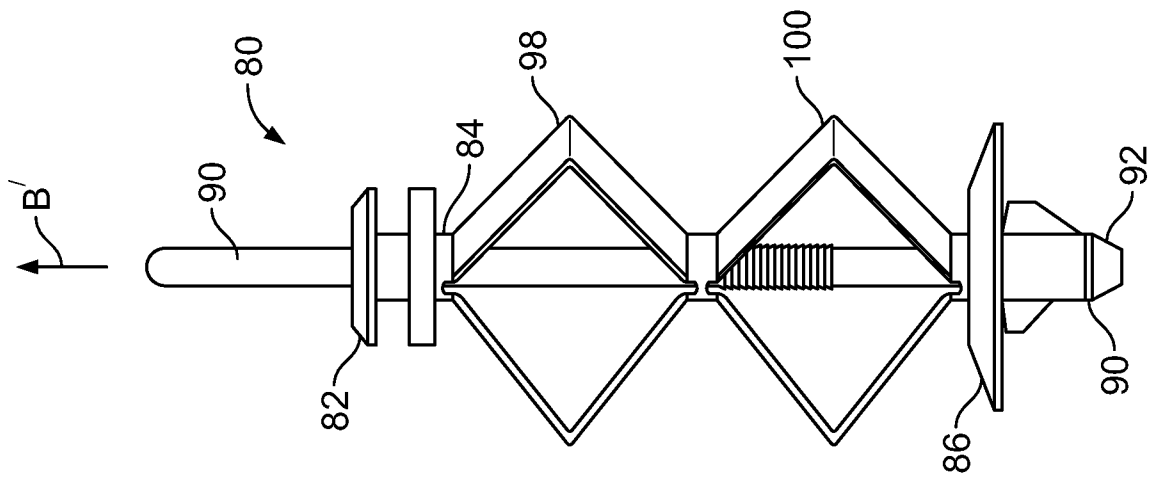


FIG. 15

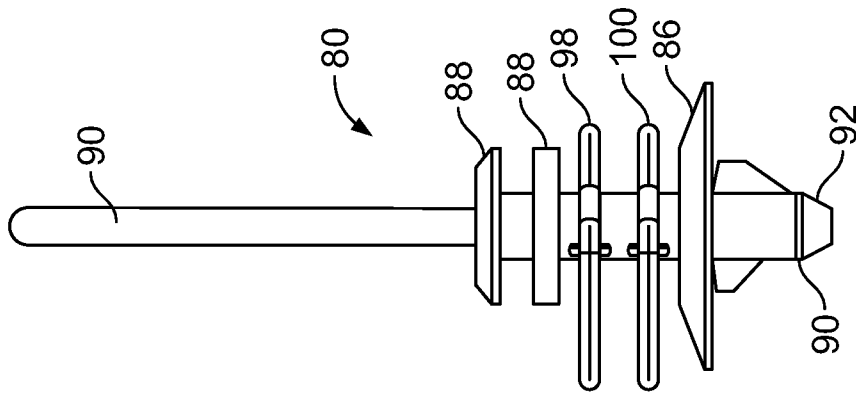


FIG. 16

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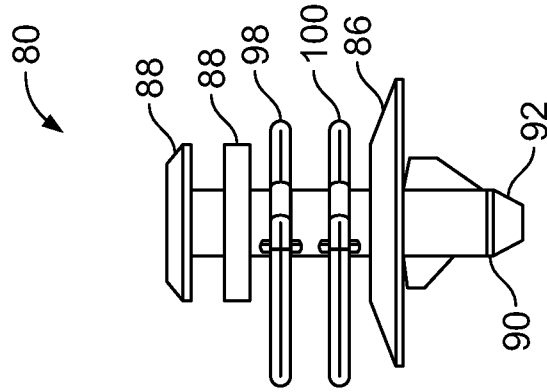


FIG. 17

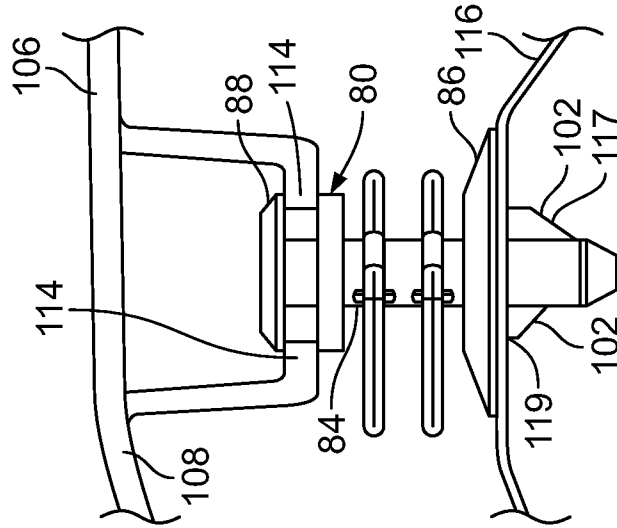


FIG. 19

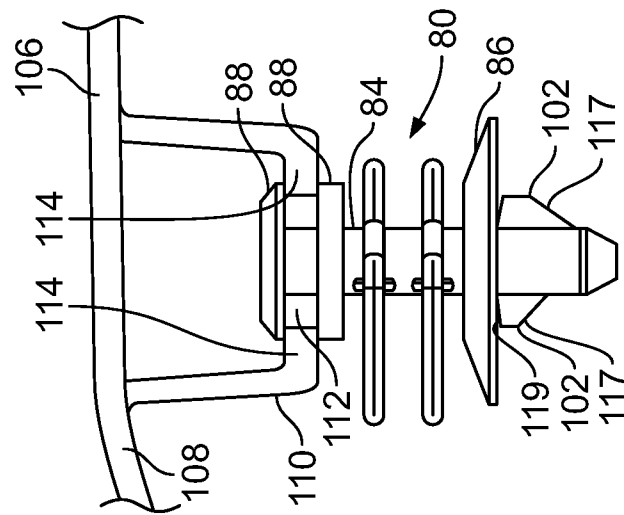


FIG. 18

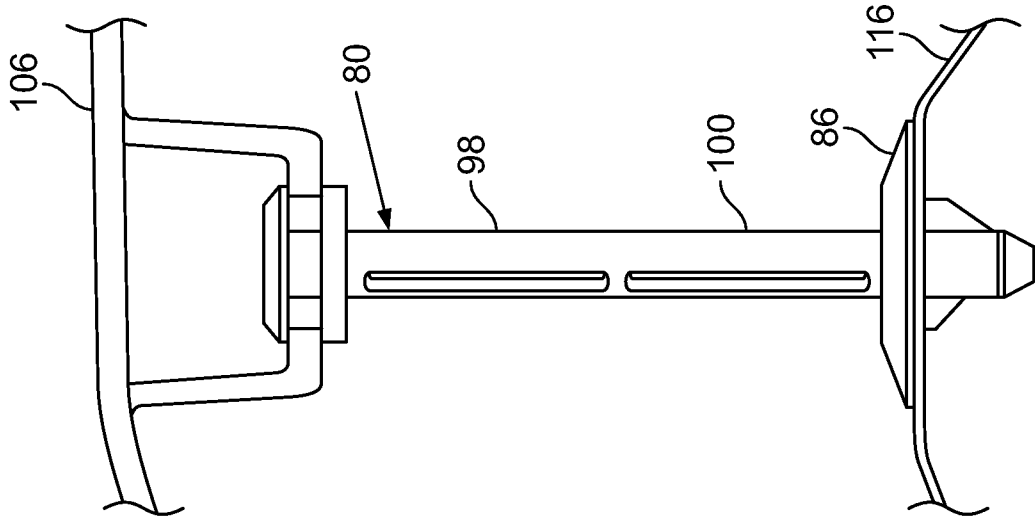


FIG. 21

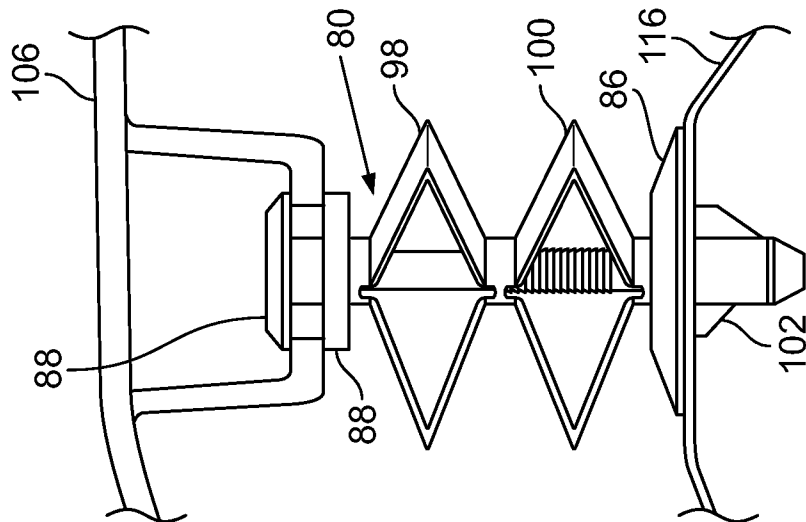


FIG. 20

INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2011/020831

A. CLASSIFICATION OF SUBJECT MATTER  
INV. F16B19/10  
ADD.  
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)  
F16B

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 practical, search terms used)  
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 846 039 A (KIRCHEN JAMES T [US] ET AL) 8 December 1998 (1998-12-08) the whole document	1-30
A	US 4 556 351 A (WOLLAR BURNELL J [US] ET AL) 3 December 1985 (1985-12-03) the whole document	1-30
A	EP 0 691 479 A1 (EMHART INC [US]) 10 January 1996 (1996-01-10) abstract figures 1-3	1-30
A	US 2007/059120 A1 (VIGLIOTTI DANIEL P [US] ET AL) 15 March 2007 (2007-03-15) the whole document	1-30
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See patent family annex.

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Date of the actual completion of the international search  4 April 2011	Date of mailing of the international search report  14/04/2011
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  Huusom, Carsten
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# INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2011/020831

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 708 553 A (BRAYCHAK JOSEPH J [US] ET AL) 24 November 1987 (1987-11-24) the whole document -----	1-30

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Information on patent family members

International application No

PCT/US2011/020831

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US 4708553	A	24-11-1987	NONE	
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