US 20130042432A1

(19) **United States**

(12) **Patent Application Publication**

Andrews et al.

(10) **Pub. No.: US 2013/0042432 A1**

(43) **Pub. Date: Feb. 21, 2013**

(54) **SPRING-BIASED HINGED ASSEMBLY**

(76) Inventors: **Stuart John Andrews**, Deakin (AU); **Mark Cumming**, New South Wales (AU)

(21) Appl. No.: **13/578,369**

(22) PCT Filed: **Feb. 10, 2011**

(86) PCT No.: **PCT/AU11/00132**

§ 371 (c)(1),
(2), (4) Date: **Oct. 26, 2012**

(30) **Foreign Application Priority Data**

Feb. 12, 2010 (AU) 2010900570

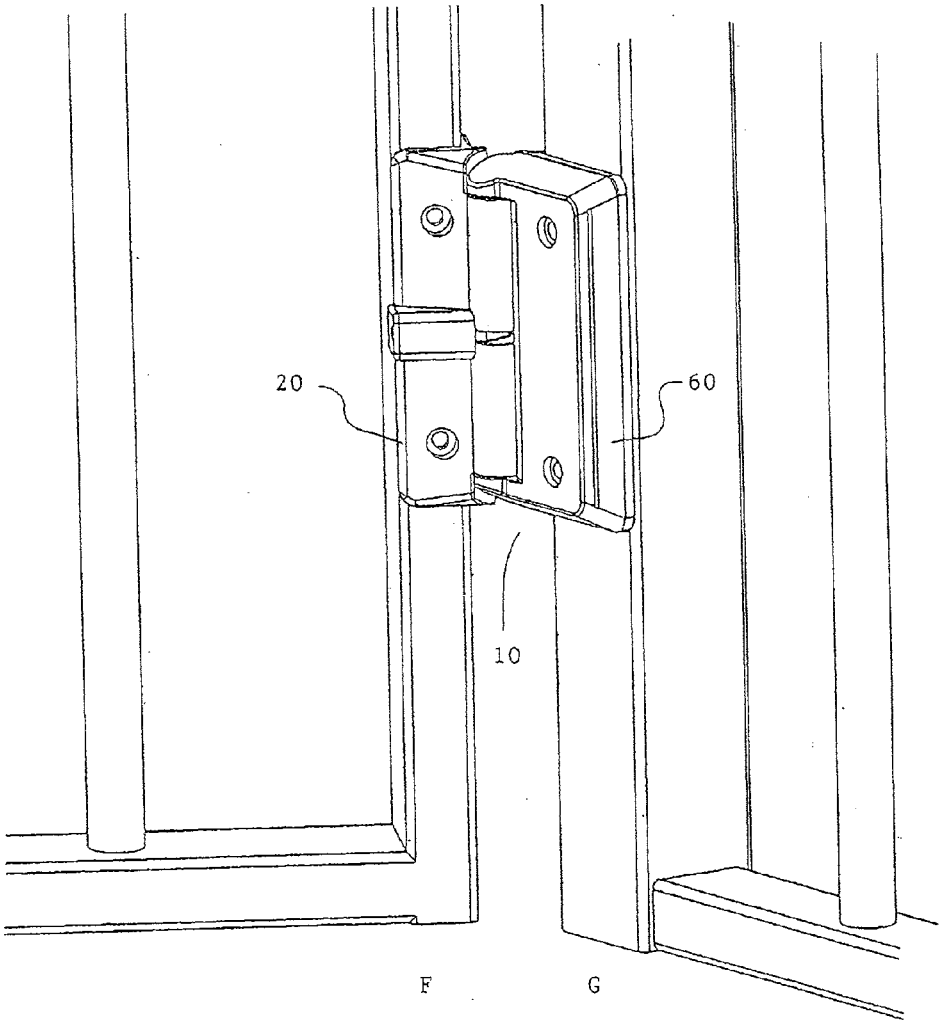
Publication Classification

(51) **Int. Cl.**
E05F 3/20 (2006.01)
E05F 1/12 (2006.01)

(52) **U.S. Cl.** **16/50**

(57) **ABSTRACT**

A spring-biased hinged assembly (**10**) including a spool (**30**) associated with a first hinged member (**20**) a spring (**70**) associated with a second hinged member (**60**) and a tensile member (**100**) extending from the spool (**30**) to the spring (**70**).



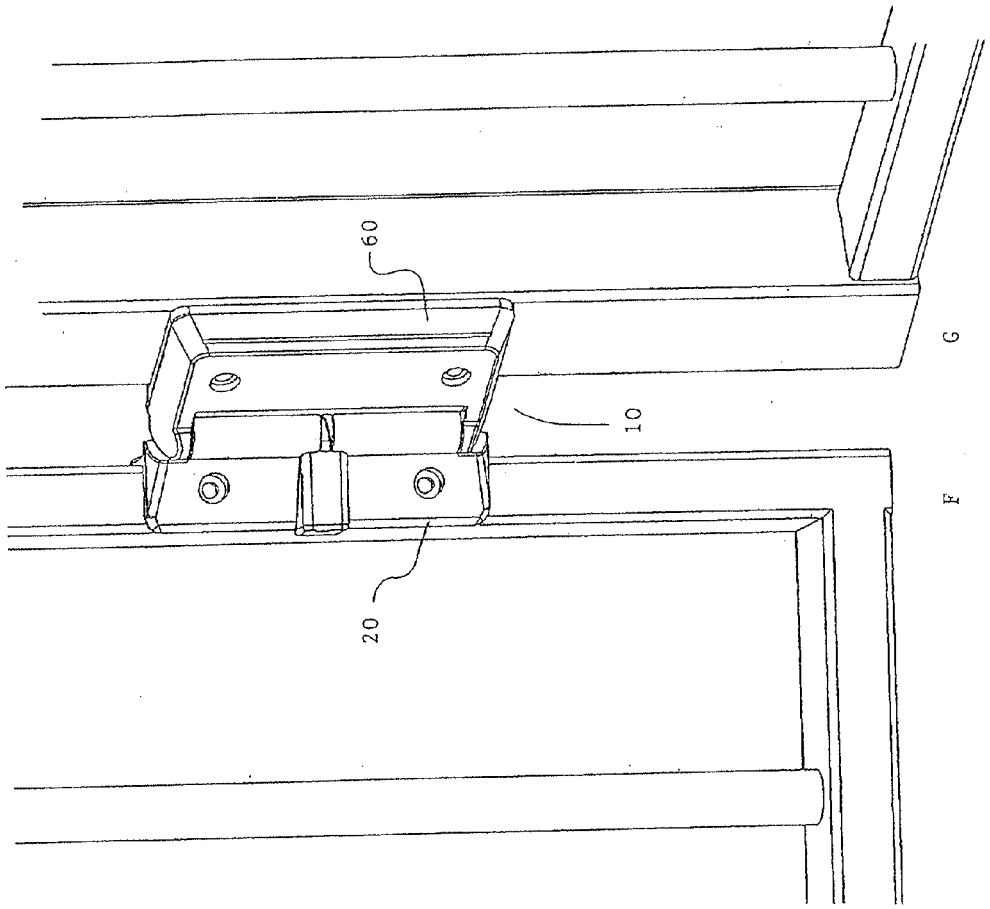


FIG 1

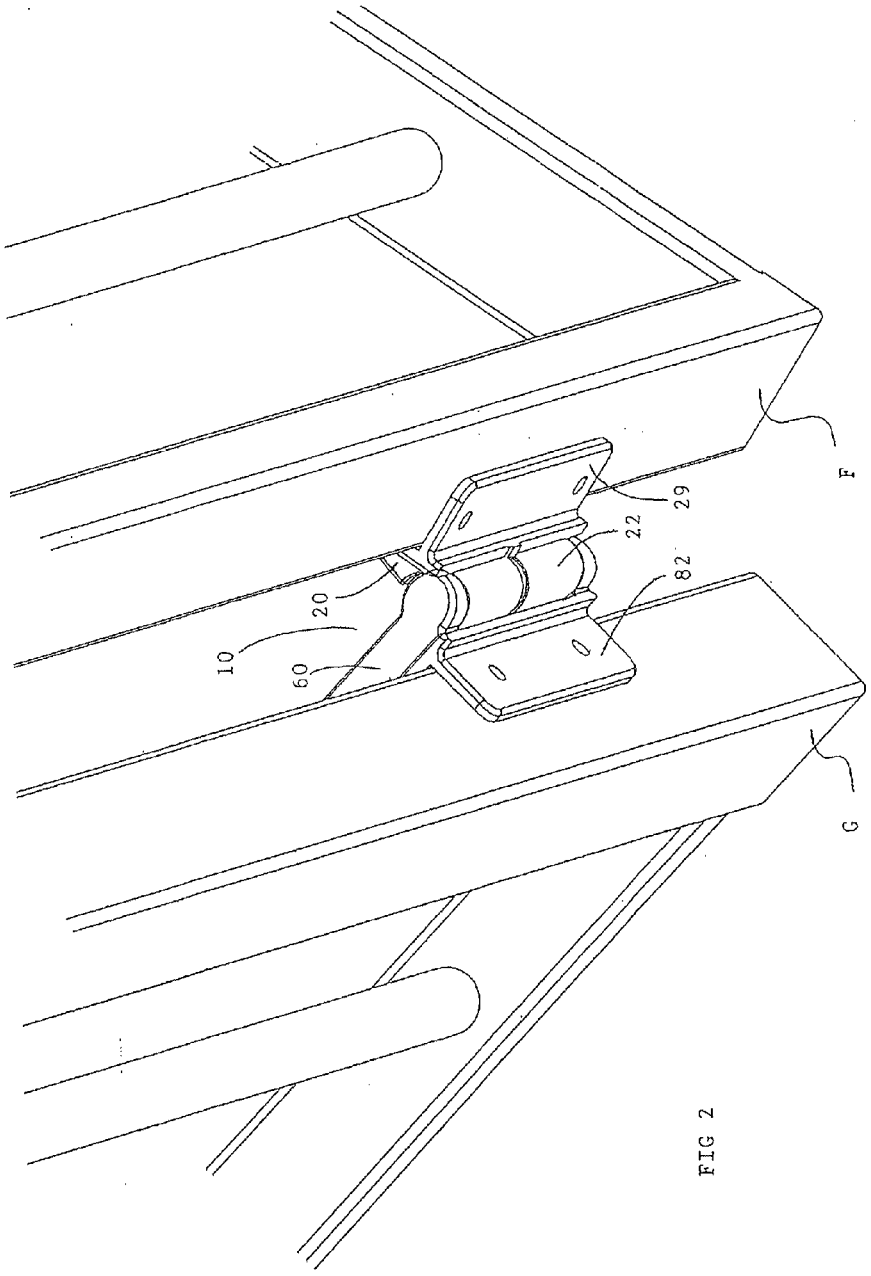


FIG 2

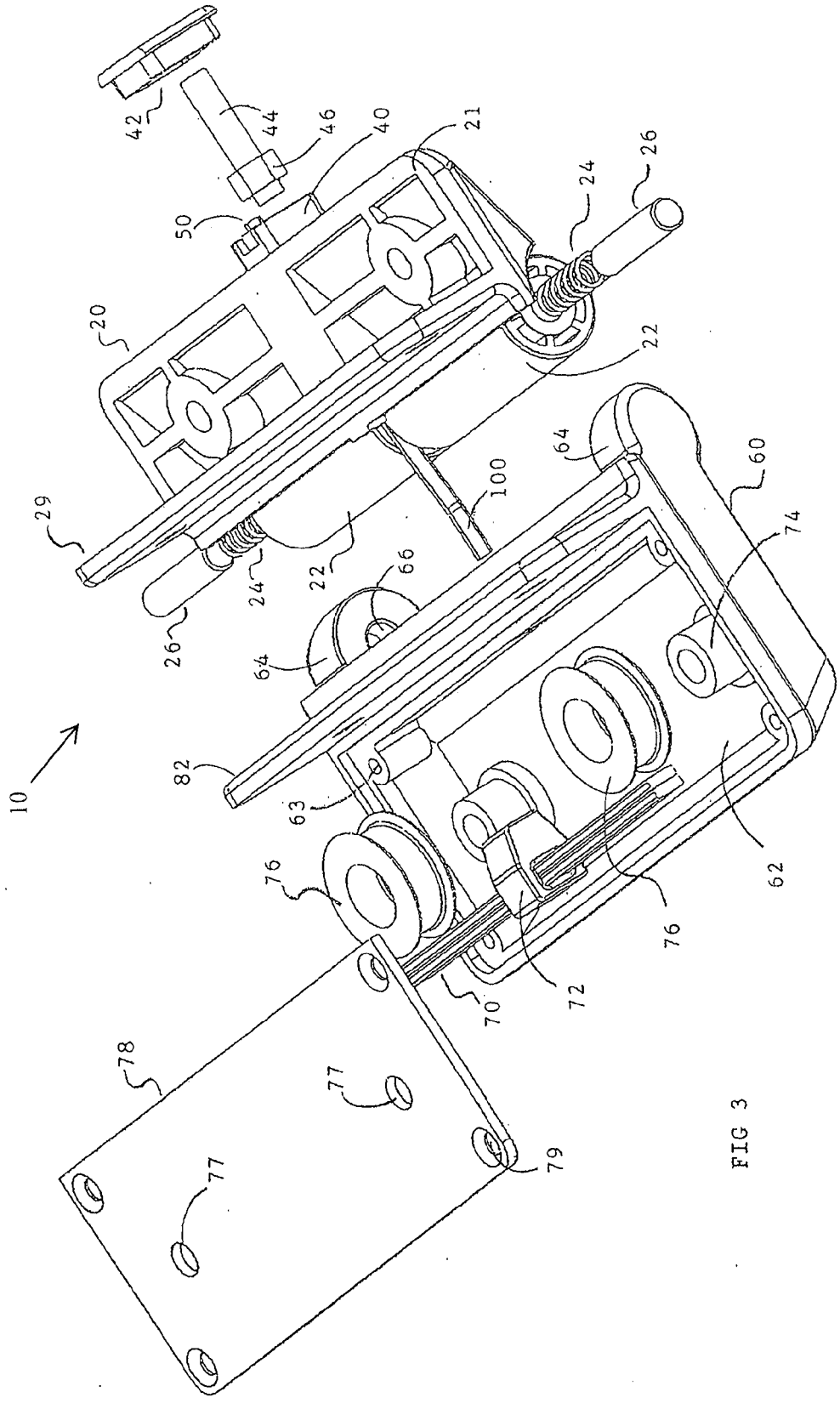

42
44
46
40
21
26
24
50
20
22
64
60
100
29
74
66
22
24
26
64
10
82
63
76
62
76
72
70
78
77
77
79

FIG 3

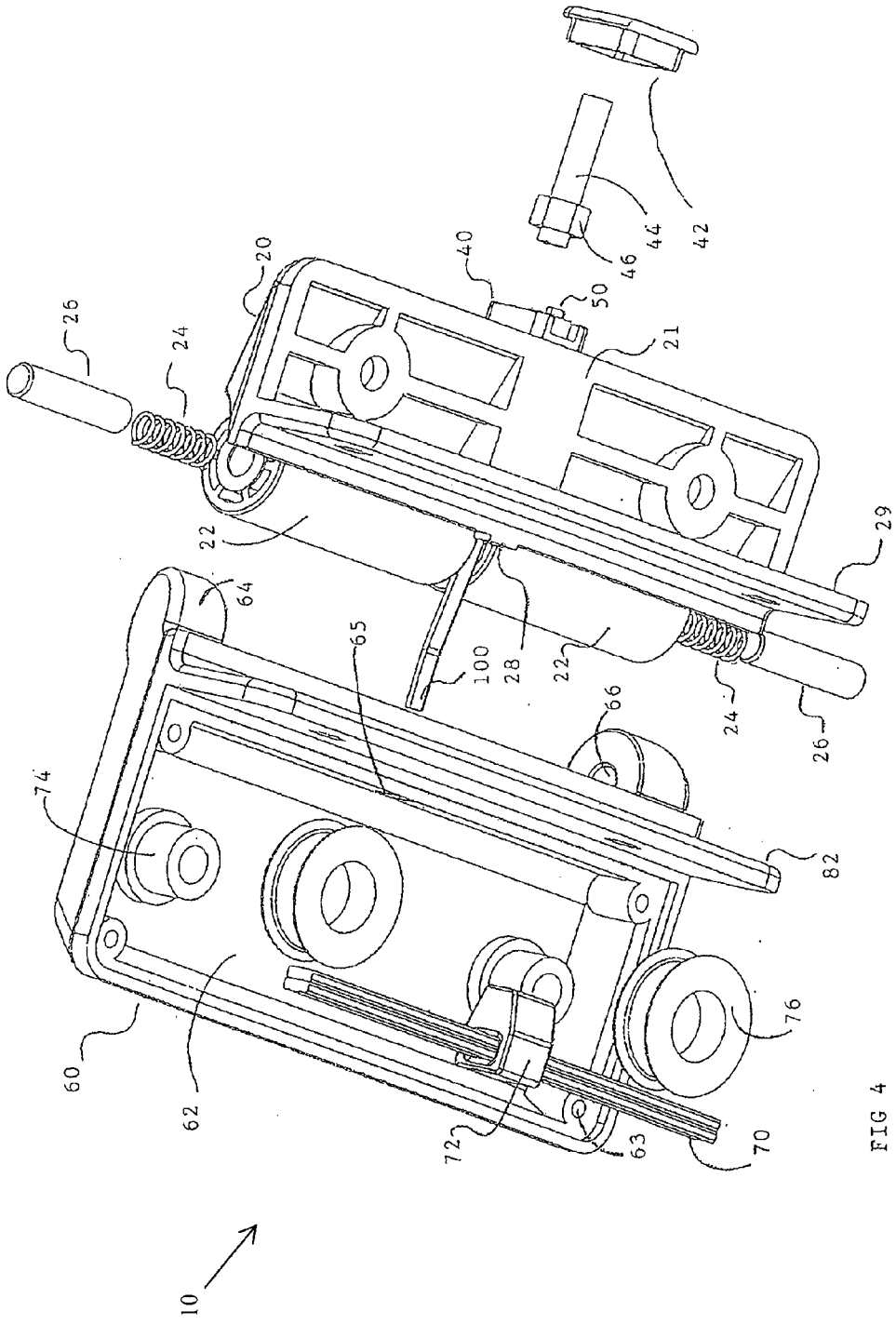

42
44
46
40
50
20
21
26
24
22
29
64
65
100
28
66
74
82
60
62
72
63
70
76
10

FIG 4

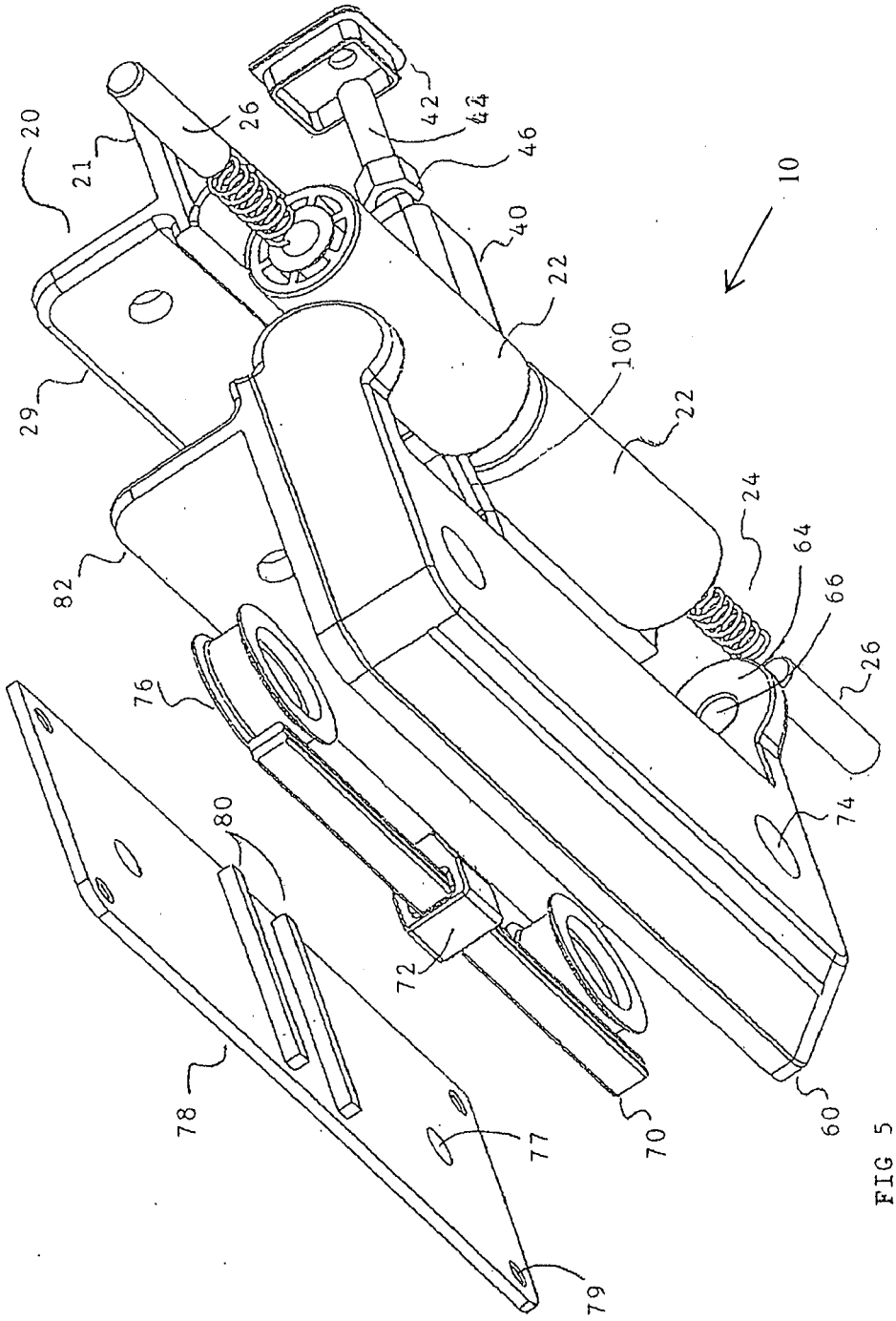

20
21
26
42
44
46
10
40
22
100
22
29
24
64
66
82
26
76
74
80
72
78
77
70
60
79

FIG 5

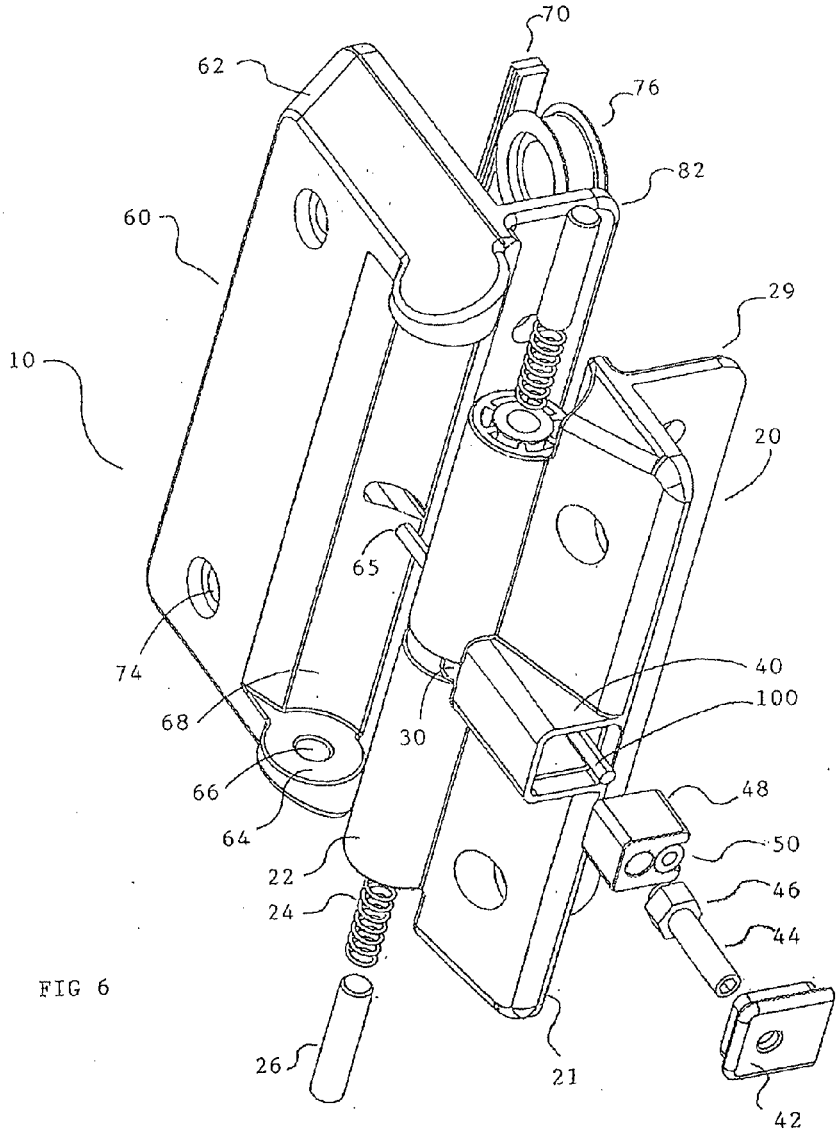

70
62
76
82
60
29
10
20
65
74
40
100
68
30
66
48
64
50
22
46
24
44
26
21
42

FIG 6

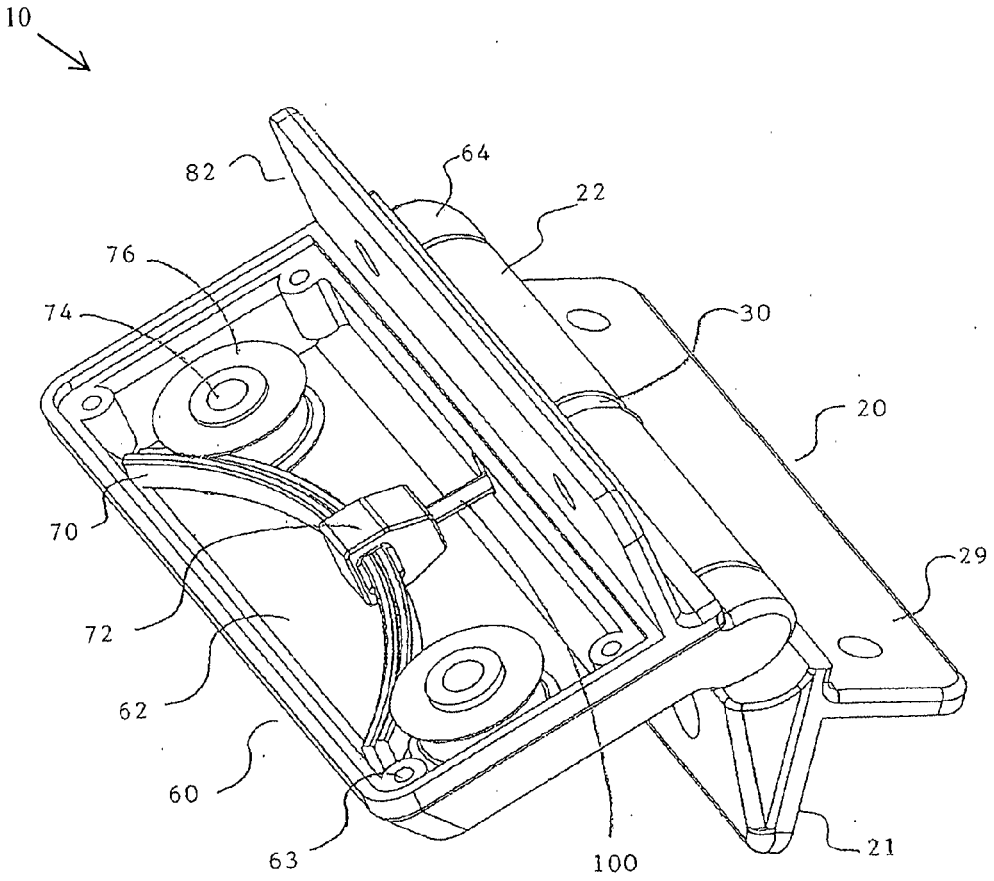


FIG 7

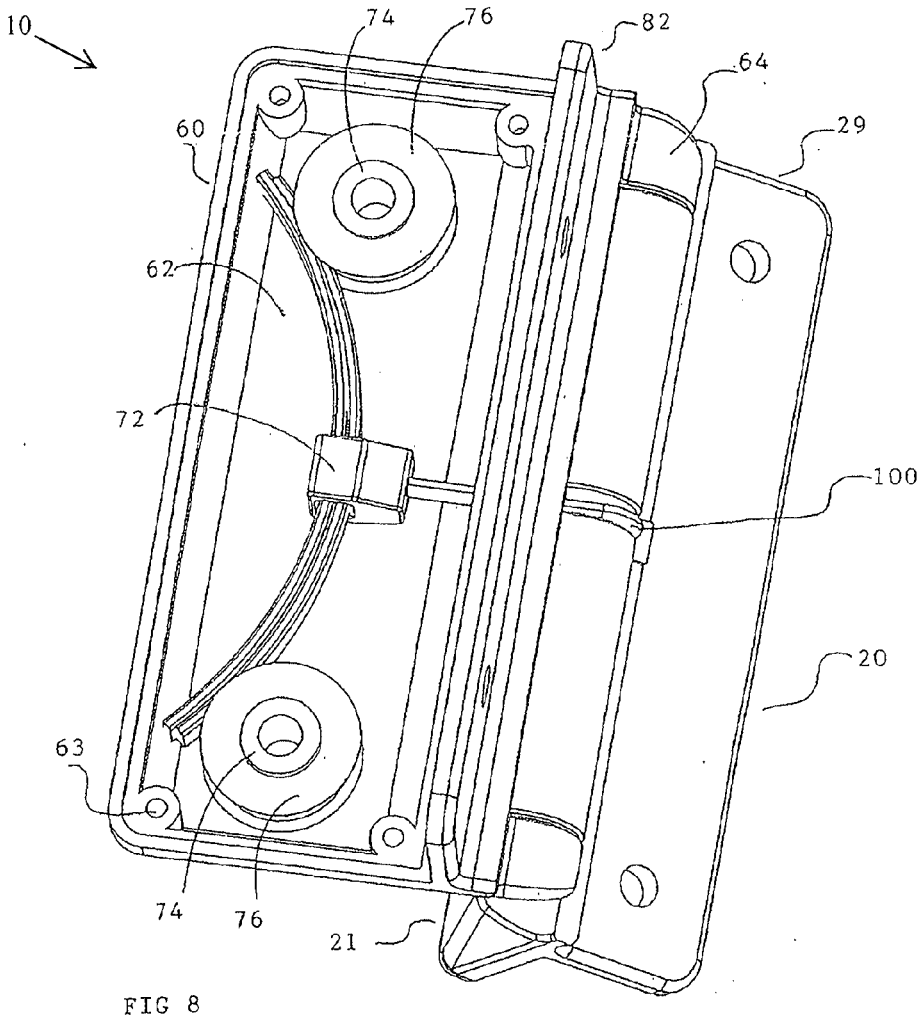


FIG 8

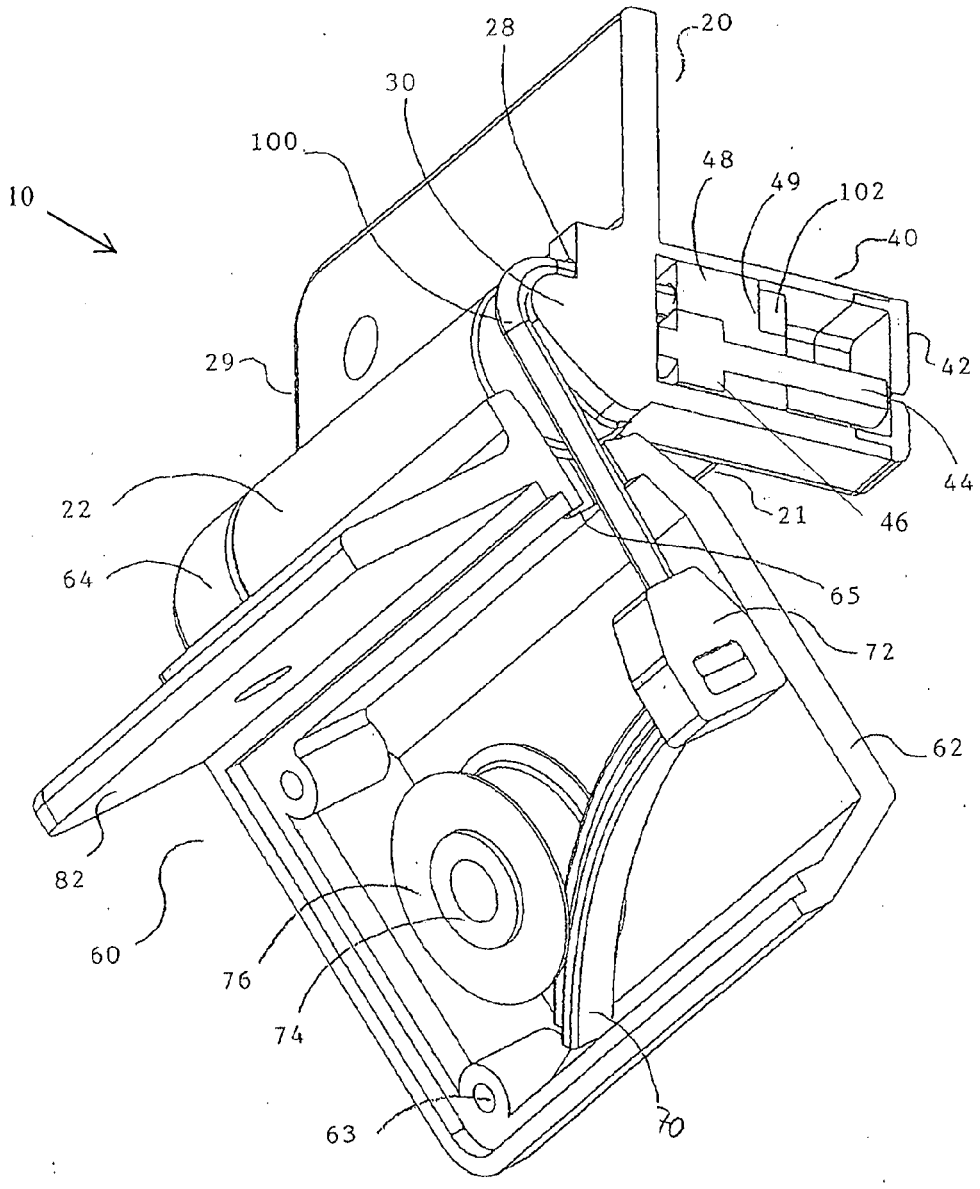

10
28
20
30
100
48
49
102
40
29
42
44
22
21
46
64
65
72
62
82
60
76
74
63
70

FIG 9

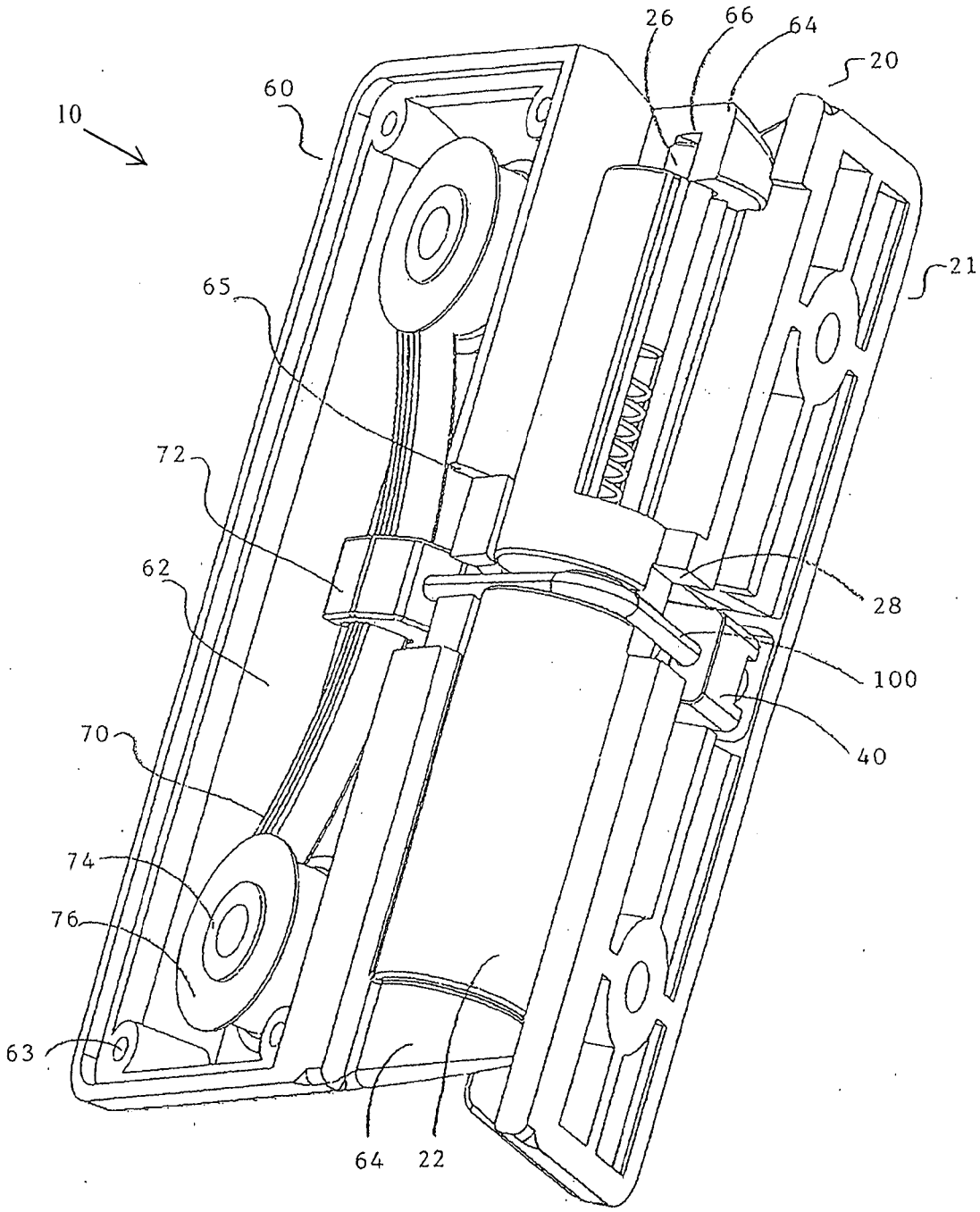


FIG 10

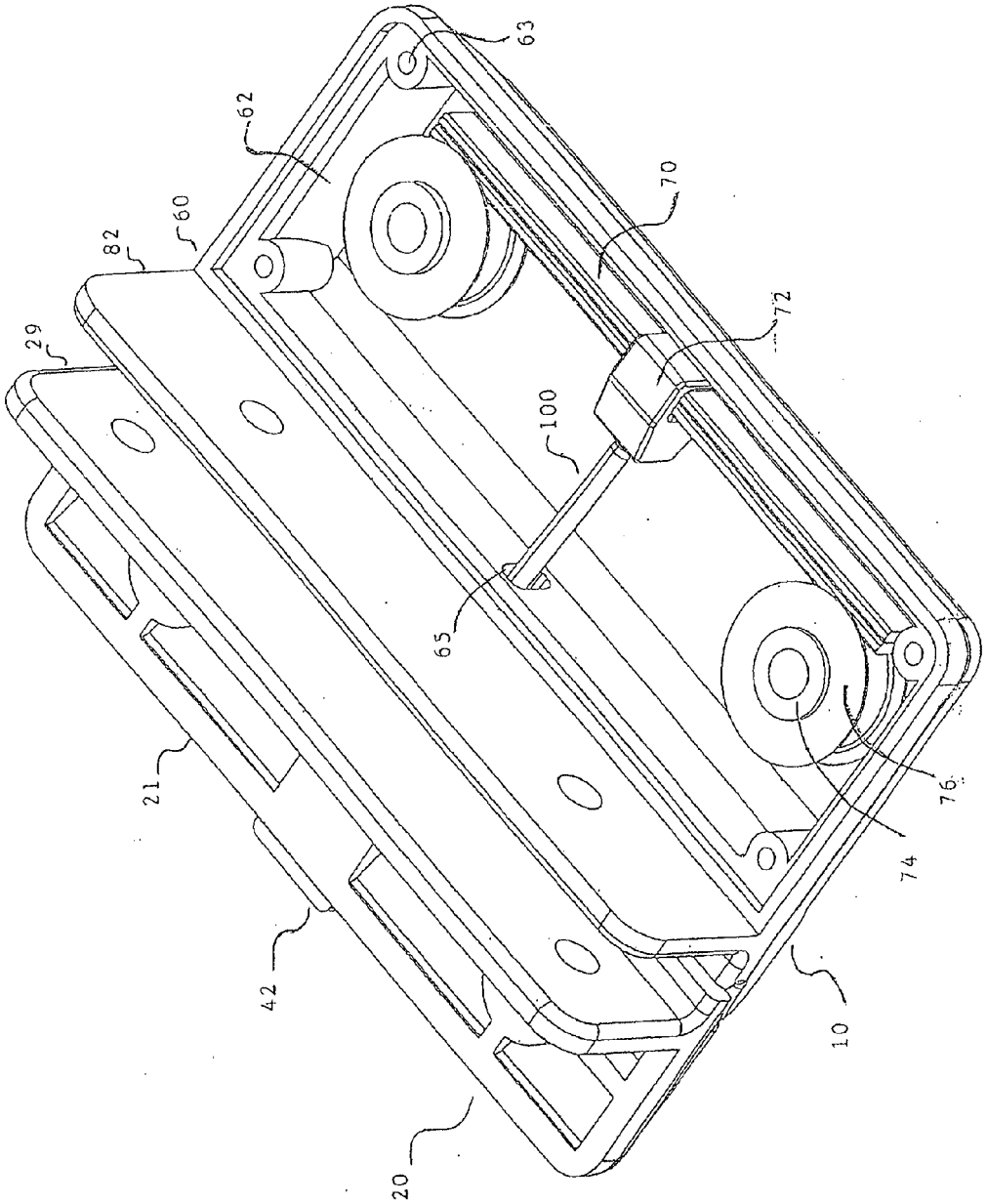


FIG 11

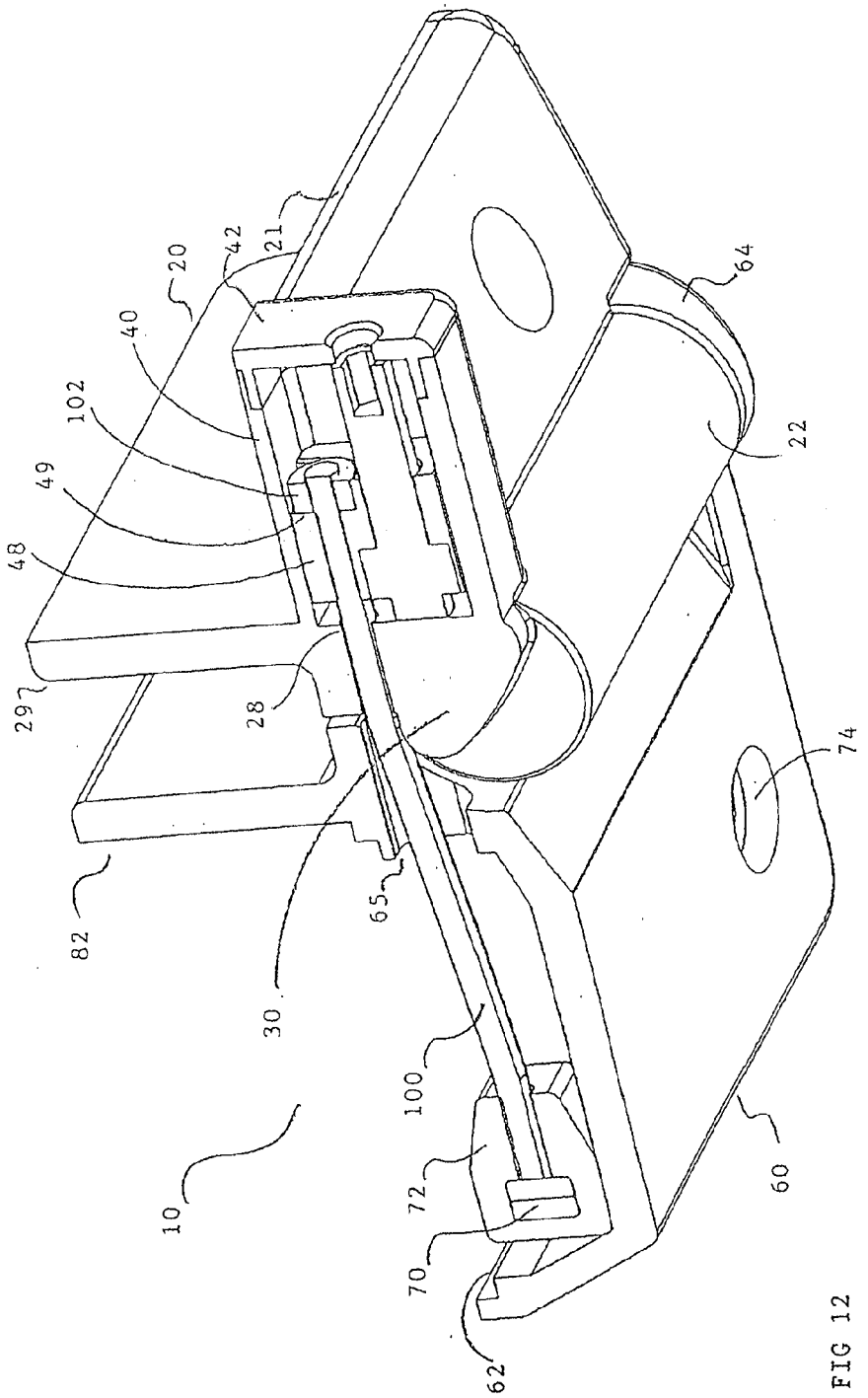


FIG 12

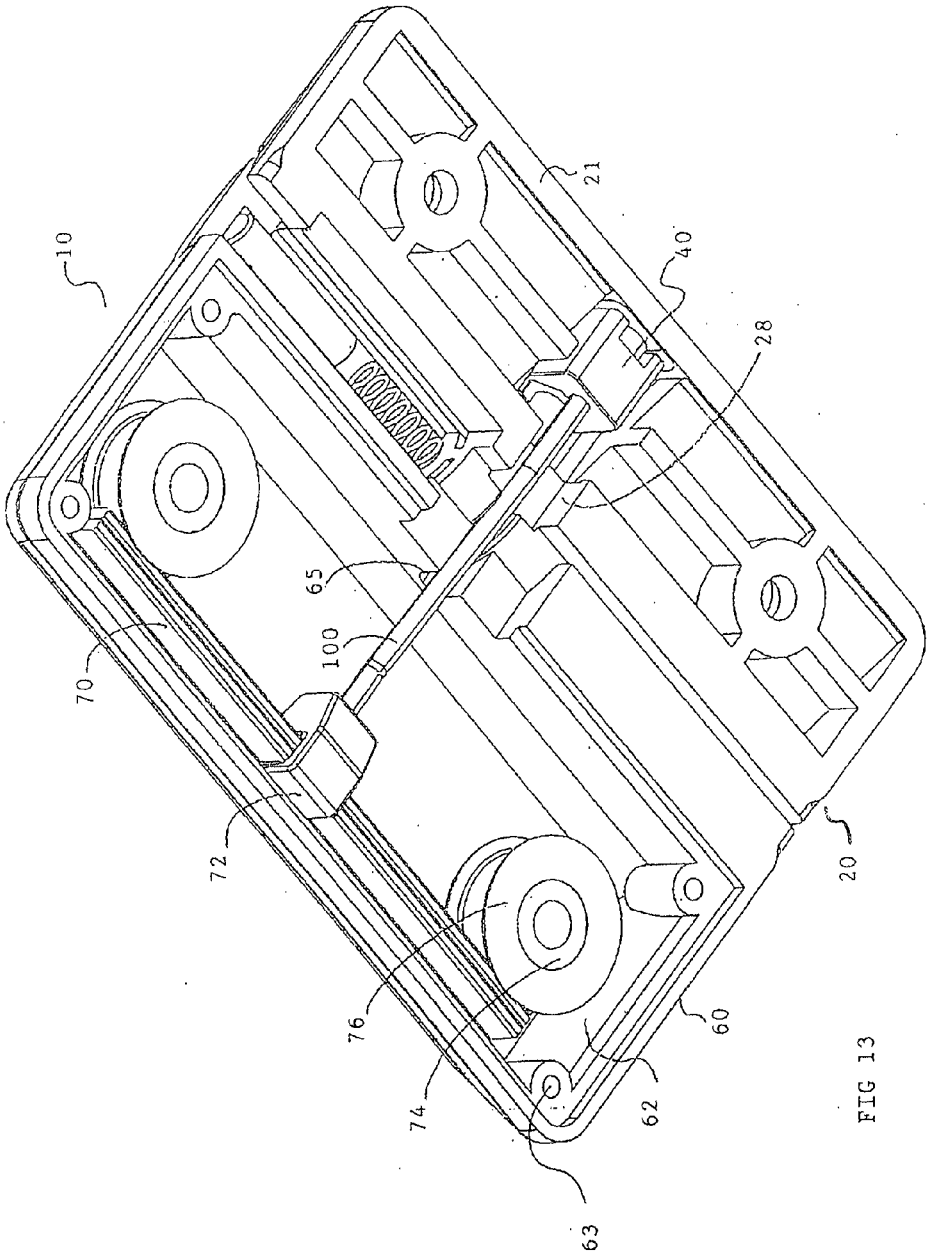


FIG 13

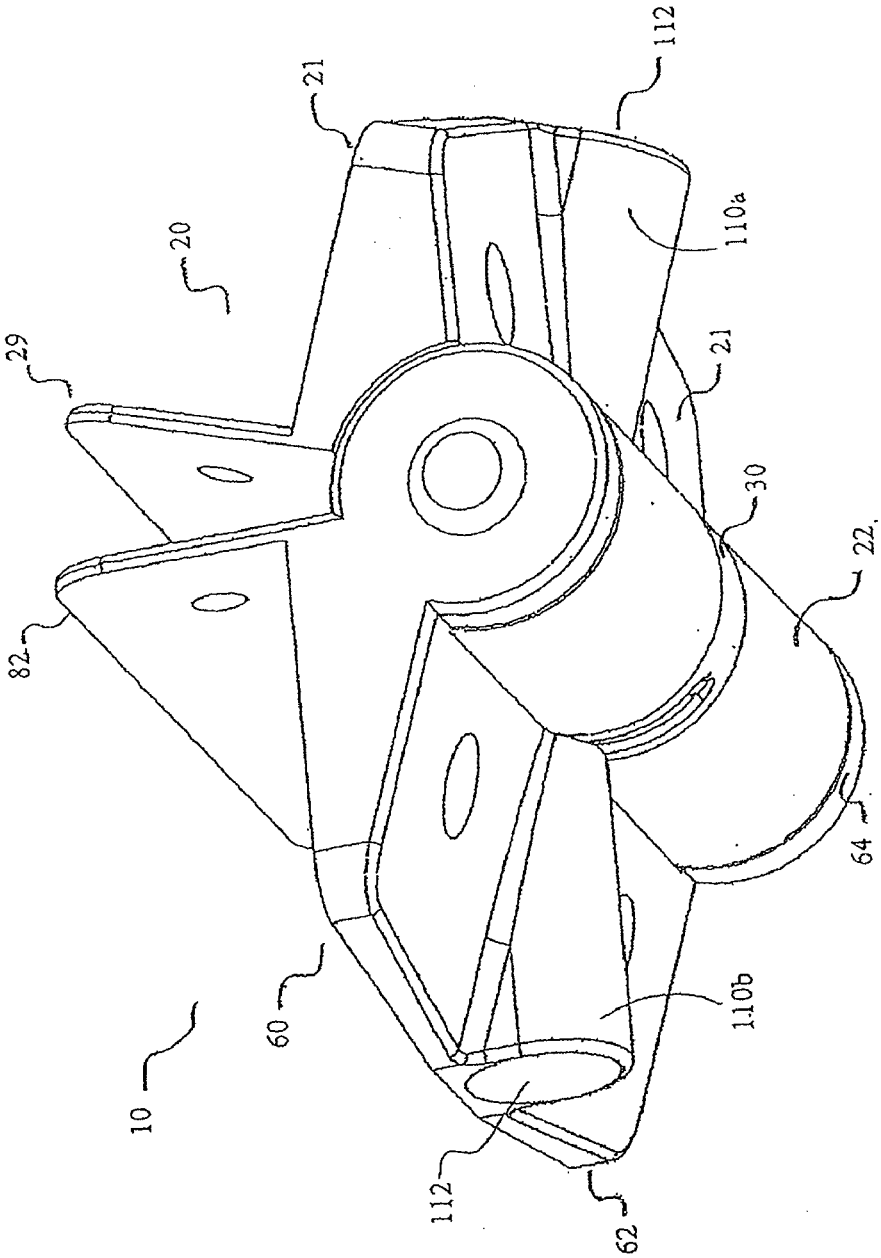


FIG 14

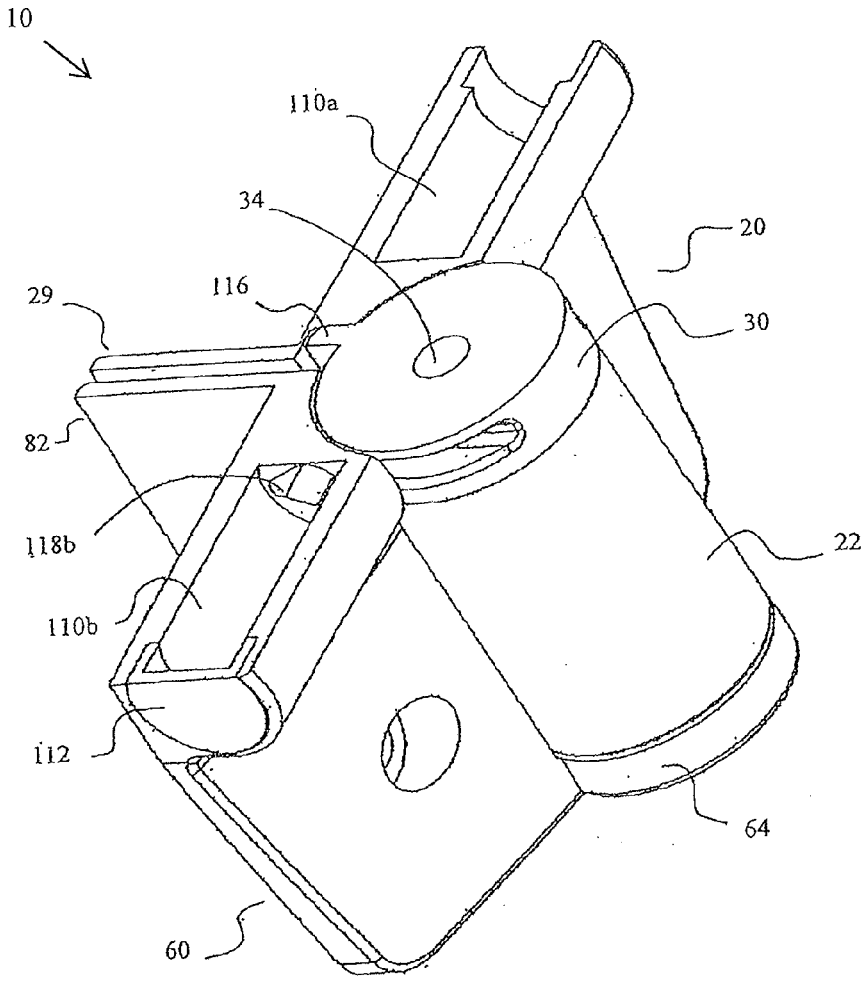


FIG 15

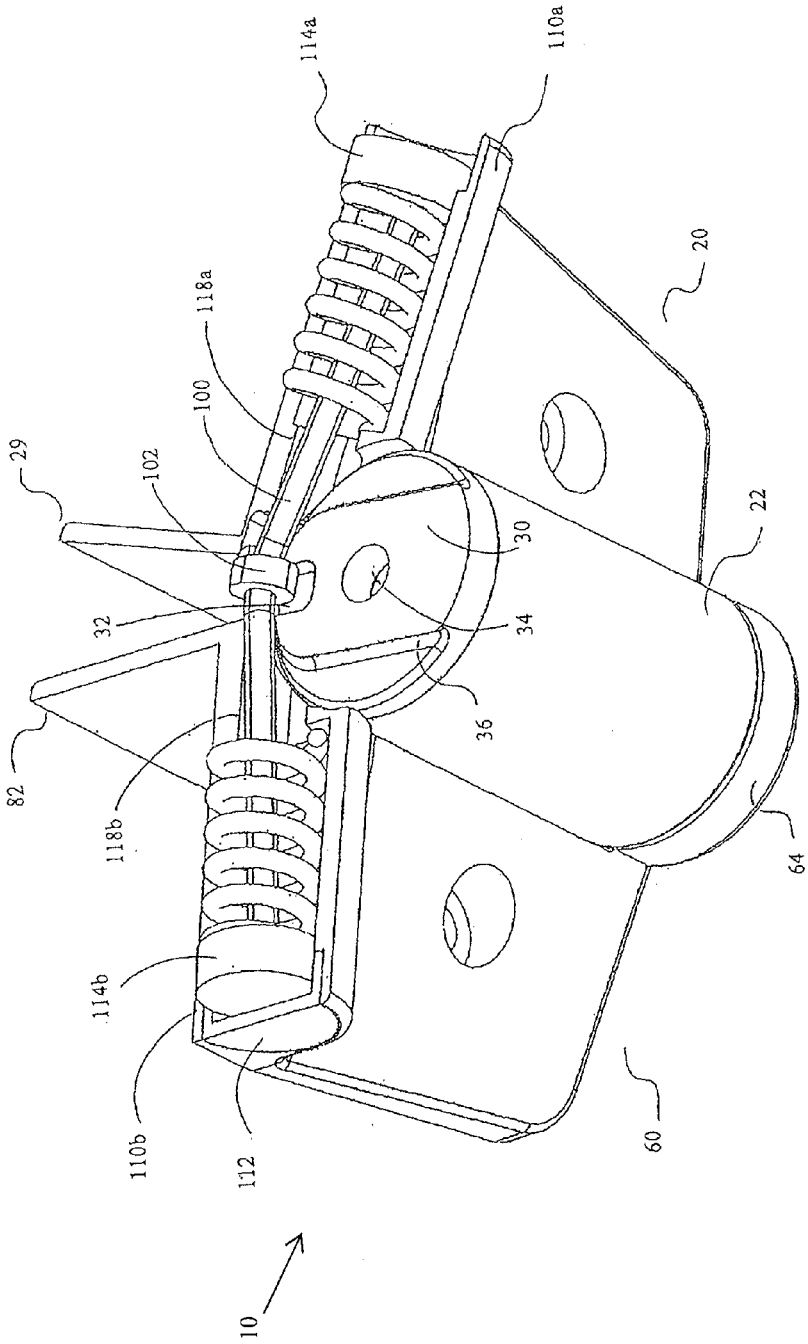

114a
110a
20
118a
100
29
102
30
22
32
34
36
82
118b
64
114b
110b
112
60
10

FIG 16

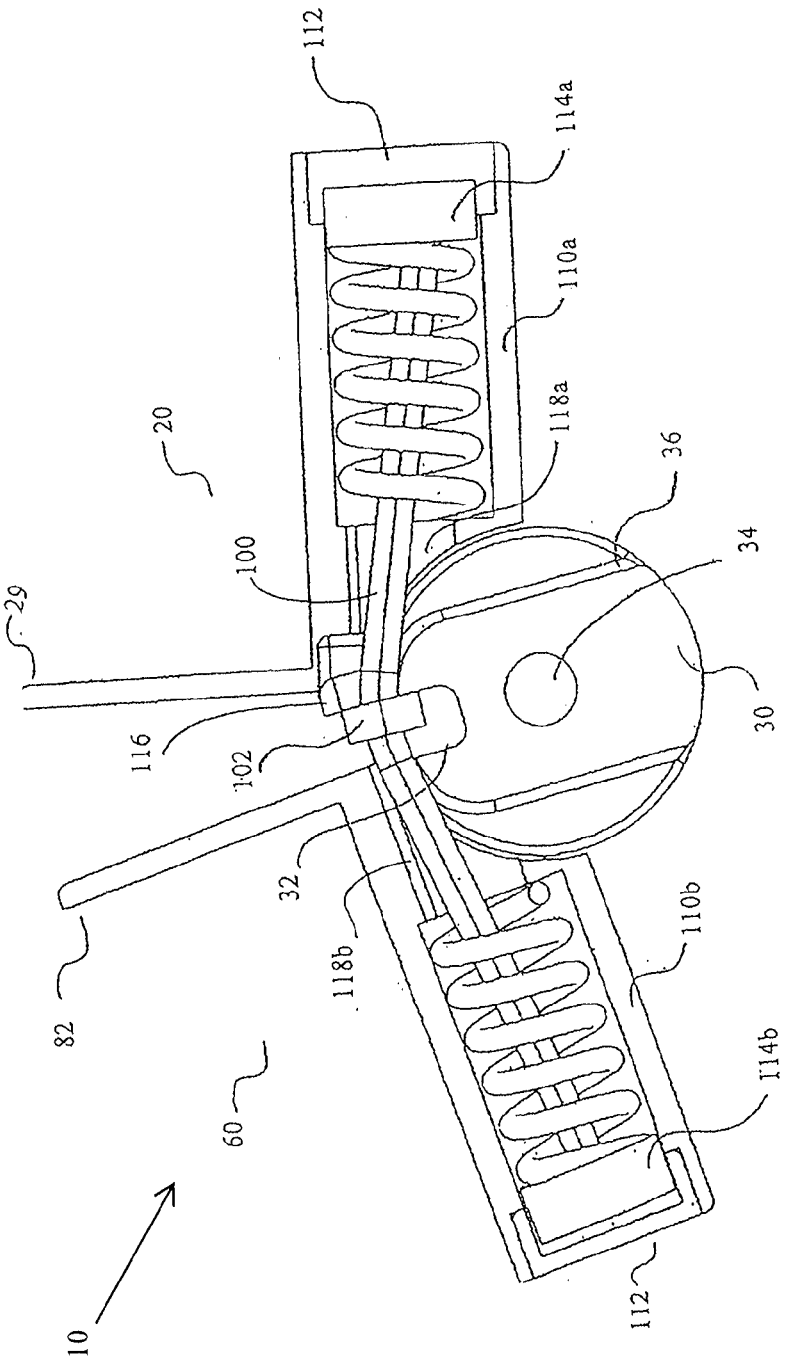

112
114a
110a
118a
20
36
34
100
29
30
116
102
32
110b
118b
82
114b
60
112
10

FIG 17

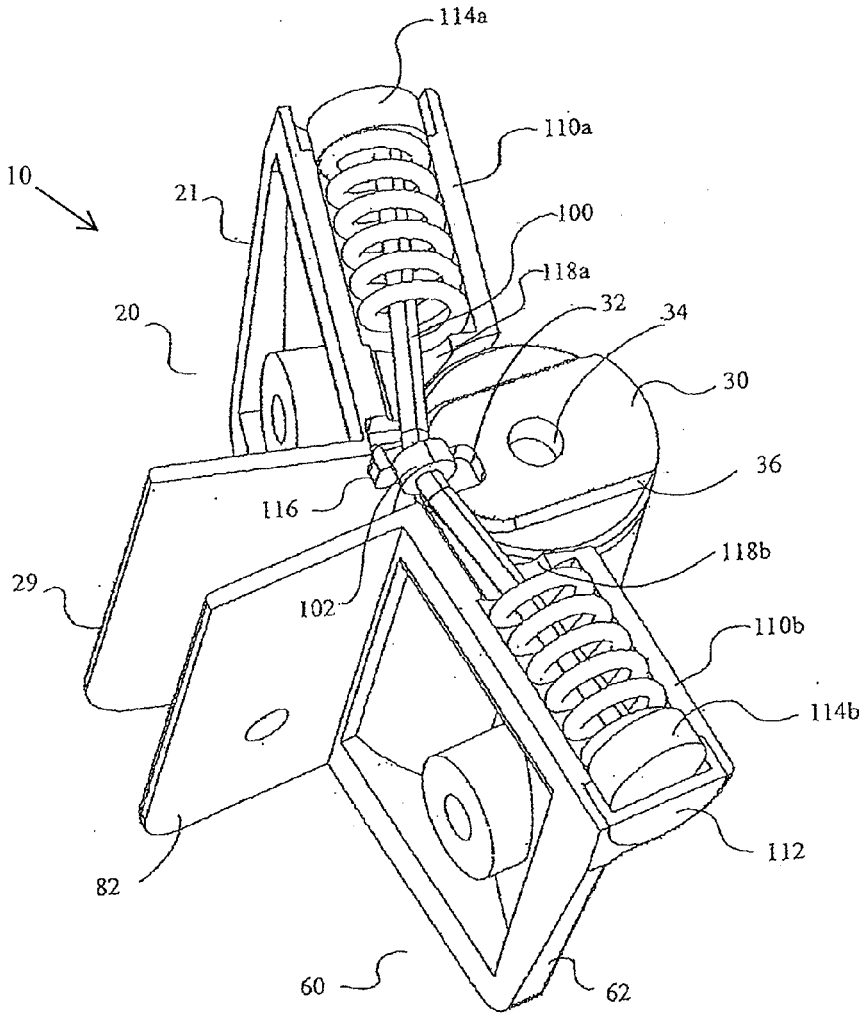
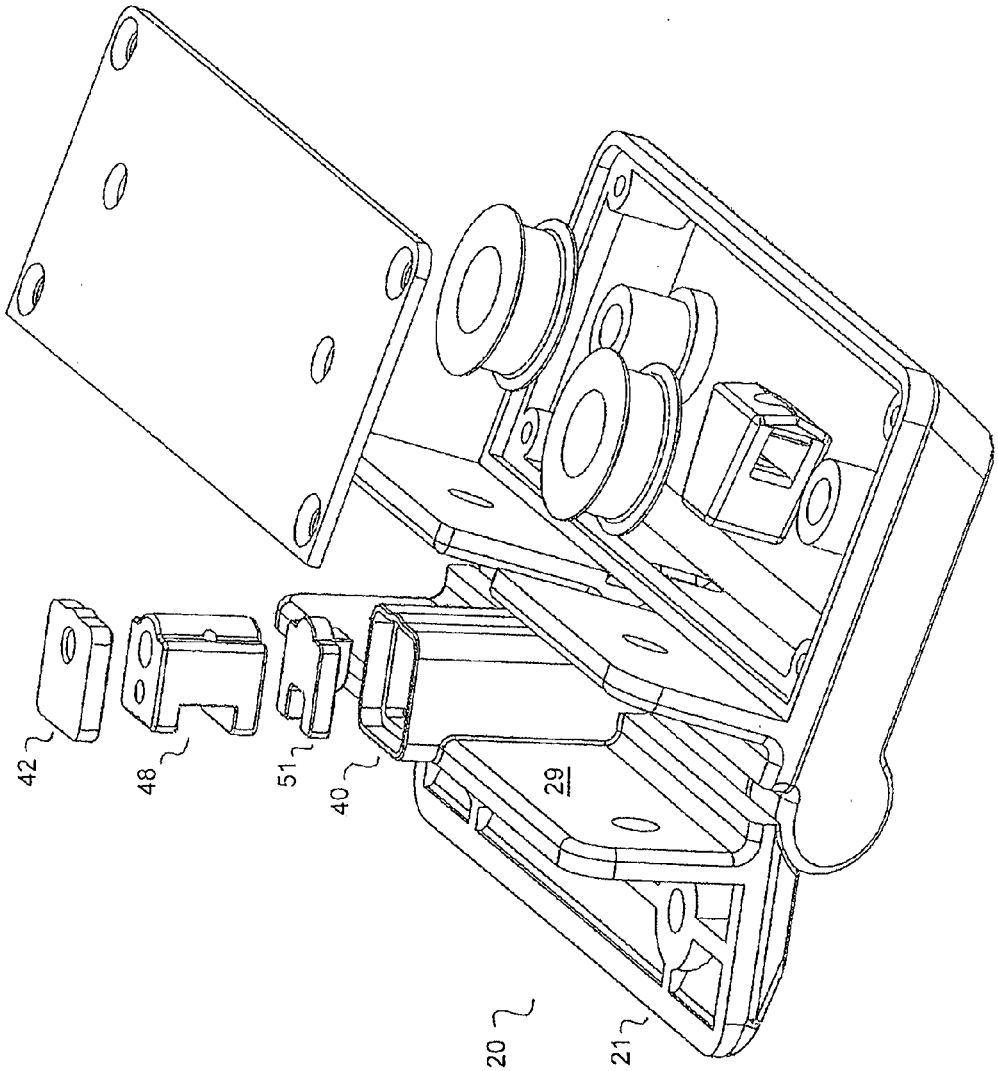

114a
110a
10
21
100
118a
20
32
34
30
36
116
118b
29
102
110b
114b
112
82
60
62

FIG 18

FIG 19



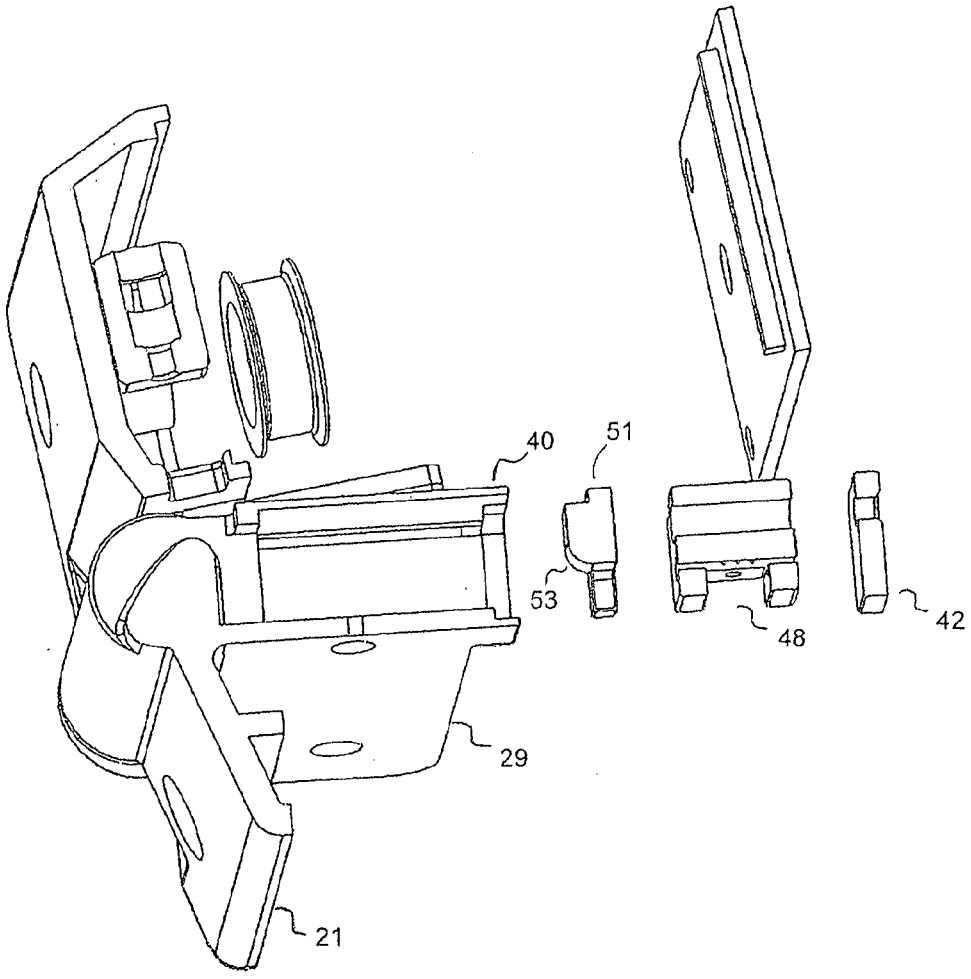


FIG 20

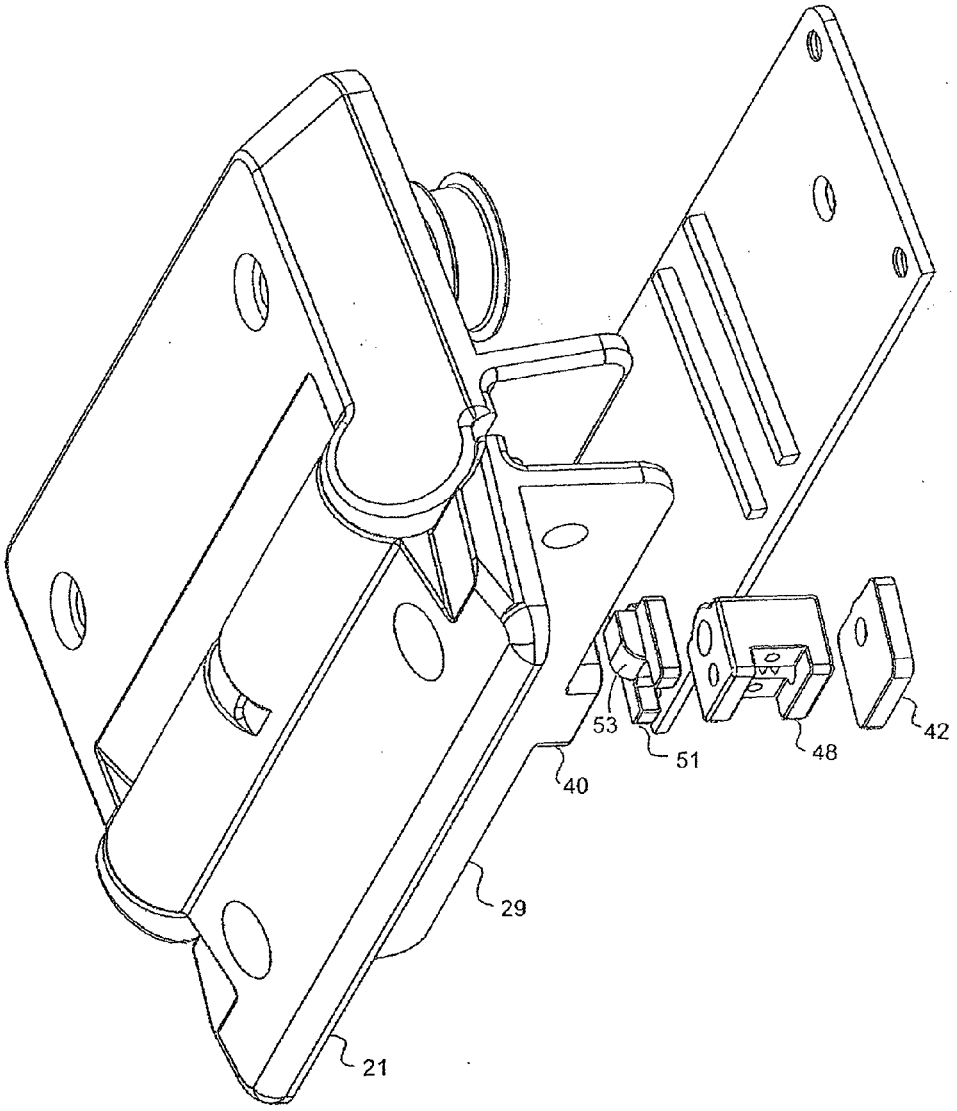


FIG 21

SPRING-BIASED HINGED ASSEMBLY

[0001] This International Application claims priority from Australian Provisional Patent Application 2010900570 which is hereby incorporated in its entirety by cross-reference.

FIELD OF THE INVENTION

[0002] The present invention relates to a spring-biased hinged assembly. The spring-biased hinged assembly is particularly suitable for use in mounting a gate that is biased towards the closed position via a closing torque. Such self-closing gates may be associated with, for example, swimming pools and child care centers. Such gates are typically automatically latched when they reach the closed position such that the default configuration is for the gate to be both closed and securely latched. The invention will herein be described in a non-limiting manner with reference to this specific field of use.

BACKGROUND OF THE INVENTION

[0003] The use of spring-biased hinged assemblies for self-closing gates is known. A problem with these hinged assemblies is that the gate tends to slam shut when it is released from the fully open position ("long range closing") and then allowed to accelerate under the influence of the closing torque produced by the spring. This can be dangerous to users of the gate and it can also damage the gate or latching components.

[0004] It is not a viable solution to use a weak spring, because it is important that the spring produce enough closing torque to close the gate when the gate is released from adjacent to the closed position ("close-range closing"). Indeed, known spring-biased hinged assemblies usually have some means for increasing the pre-load on the spring as the spring weakens or relaxes over time to ensure that there remains an adequate closing torque for close-range closing.

[0005] The present invention aims to provide a novel spring-biased hinged assembly. In the preferred embodiment, which is designed for use with self-closing gates, the invention provides sufficient torque to ensure reliable close-range closing whilst at the same time addressing the slamming problem associated with long-range closing.

SUMMARY OF THE INVENTION

[0006] The present invention provides a spring-biased hinged assembly and a method of converting spring force into torque in a spring-biased hinged assembly as defined in the claims.

[0007] Other preferred features of the various aspects of the invention will be apparent from the dependant claims and from the following description of the preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The various aspects of the invention will now be described in a non-limiting manner with respect to a preferred embodiment of the invention in which:—

[0009] FIG. **1** is a front perspective view of a spring-biased hinged assembly in situ on a gate and fence structure;

[0010] FIG. **2** is a rear perspective view of the spring-biased hinged assembly in situ on the gate and fence structure of FIG. **1**.

[0011] FIG. **3** is an exploded view of the rear of the spring-biased hinged assembly;

[0012] FIG. **4** is another exploded view of the rear of the spring-biased hinged assembly;

[0013] FIG. **5** is an exploded side view of the spring-biased hinged assembly;

[0014] FIG. **6** is a front perspective view of the spring-biased hinged assembly;

[0015] FIG. **7** is a perspective view of the spring biased hinged assembly when partially opened;

[0016] FIG. **8** is another perspective view of the spring biased hinged assembly when partially opened;

[0017] FIG. **9** is a perspective view of a transverse cross section of a partially opened spring-biased hinged assembly of the present invention;

[0018] FIG. **10** is a further rear perspective view of the partially opened spring-biased hinged assembly, without mounting flanges;

[0019] FIG. **11** is a rear perspective view of the spring-biased hinged assembly in the closed position;

[0020] FIG. **12** is a perspective view of a transverse cross-section of the spring-biased hinged assembly in the closed position;

[0021] FIG. **13** is a rear perspective view of the spring-biased hinged assembly in the closed position, without mounting flanges;

[0022] FIG. **14** is a top perspective view of an alternative embodiment of the present invention;

[0023] FIG. **15** is a perspective view of a transverse cross-section of an alternative embodiment of the present invention with the spring-biased hinged assembly in the closed position;

[0024] FIG. **16** is a perspective view of a transverse cross-section of an alternative embodiment of the present invention with the spring-biased hinged assembly in a partially open position;

[0025] FIG. **17** is a top view of a transverse cross-section of an alternative embodiment of the present invention with the spring-biased hinged assembly in a partially open position;

[0026] FIG. **18** is a rear perspective view transverse cross-section of an alternative embodiment of the present invention with the spring-biased hinged assembly in a partially open position.

[0027] FIG. **19** is a perspective view of another alternative embodiment of the spring-biased hinged assembly in a partially open position;

[0028] FIG. **20** is a perspective view of a transverse cross-section of the alternative embodiment of the spring-biased hinged assembly of FIG. **19**; and

[0029] FIG. **21** is a front perspective view of the alternative embodiment of the spring-biased hinged assembly of FIG. **19**.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0030] With reference to FIG. **1**, the spring-biased hinged assembly **10** of a first embodiment of the present invention is shown with a first hinged member **20** mounted to a fence F, and a second hinged member **60** mounted to a gate G to allow articulation between the two hinged members, and to cause the gate G to be self closing relative to the fence F. It will be readily understood that the spring-biased hinged assembly **10** may equally be applied to any two structures requiring self closing or self opening functionality, such as for example cool room doors, or animal entry flaps mounted to residential doors, or the like.

[0031] As shown in FIG. **1**, the spring-biased hinged assembly **10**, protrudes minimally and presents smooth surfaces in order to minimize the ability for a child to get a foothold and climb onto the hinged assembly and potentially unlock the gate G.

[0032] The first hinged member **20** and second hinged member **60** each include apertures, which are preferably recessed into the respective hinged members. The apertures allow the first hinged member **20** to be mounted to the fence F and the second hinged member **60** to be mounted to the gate G such that the front of the spring-biased hinged assembly **10** is presented outwardly, as illustrated in FIG. **1**.

[0033] FIG. **2** illustrates a rear perspective view of the spring-biased hinged assembly **10** when the gate G is open to be approximately perpendicular to the fence F. First hinged member **20** is additionally mounted to the fence F via a first apertured mounting flange **29**, whilst second hinged member **60** is additionally mounted to the gate G via a second apertured mounting flange **82**. The respective flanges may be screwed, bolted or otherwise fastened to the fence or gate structures in a manner known in the art. First hinged member **20** includes a pair of cylindrical chambers **22** which contain a spring and pin arrangement (not shown in FIG. **2**) to allow articulated movement between the first hinged member **20** and second hinged member **60**.

[0034] FIGS. **3** and **4** show exploded views of the rear of the spring-biased hinged assembly **10** according to the first embodiment of the invention. As can be seen, first hinged member **20** comprises an apertured base plate **21** having integrally formed therewith a first apertured mounting flange **29** which extends approximately perpendicular the apertured base plate **21**. First hinged member **20** also comprises a pair of cylindrical chambers **22**. Each cylindrical chamber **22** is sufficiently large enough to accommodate a compression spring **24** and a locating pin **26** which abuts the compression spring. This allows each locating pin **26** to be biased such that, when assembled, a portion of the locating pin **26** is exposed from the open end of each cylindrical chamber **22** and engages with a recess **66** for the locating pins **26**.

[0035] In the present embodiment, first hinged member **20** also comprises a spool **30** (not visible in FIGS. **3** and **4**) intermediate the cylindrical chambers **22**. The axial space created by the spool allows tensile member **100** to fit between the cylindrical chambers and wrap over the spool on its path to a pre-tensioning chamber **40** integrally formed with the first hinged member **20**.

[0036] Pre-tensioning chamber **40** allows the tension in tensile member **100** to be adjusted. The pre-tensioning chamber **40** includes an anchor block **48** (not shown in FIGS. **3** and **4**) which receives tensile member **100**. The anchor block may be moved within pre-tensioning chamber **40** via rotation of tensioning bolt **44** relative to captive nut **46** in order to adjust the tension in tensile member **100**. In the embodiment shown in FIG. **3**, a clamping screw **50** is used to fasten the tensile member to the anchor block within the pre-tensioning chamber **40**. However, as will be described in more detail later, alternative fastening means may also be used. End cap **42** seals the pre-tensioning chamber **40** in order to prevent unwanted debris entering the chamber.

[0037] Second hinged member **60** includes a housing **62** having fastening apertures **63** formed thereon for mounting cover plate **78**. Second hinged member **60** also includes a second apertured mounting flange **82** as an additional mounting point for the second hinged member **60**. Extending from housing **62** is a pair of hinge plates **64**, with each hinge plate having a recess **66** for receiving the locating pins **26** of first hinged member **20**. In this manner, first hinged member **20** is able to articulate with second hinged member **60**.

[0038] Housing **62** of the second hinged member **60** also contains a pair of mounting apertures **74**. Each mounting aperture **74** is a hollow cylindrical shape to allow well known fastening means such as screws or bolts to pass there-through in order to secure the second hinged member **60** to a gate post as shown in FIG. **1**, or other similar structures. Each mounting aperture **74** also locates a bearing **76** such that the bearing may rotate about the central axis of each mounting aperture **74**.

[0039] In the embodiment shown, a pair of leaf springs **70** is held together by a leaf spring retaining sleeve **72**. The leaf springs **70** are preferably constructed from a synthetic composite material which is not prone to corrosion or fatigue. Whilst a further embodiment of the present invention allows for a single leaf spring to be used, it is preferable to include multiple leaf springs **70**. This avoids the possibility of a complete failure of the spring-biased hinged assembly **10** to shut, should the single leaf spring break.

[0040] Tensile member **100** passes through an opening **65** in the housing **62** of the second hinged member **60** so that one end of the tensile member **100** is fastened to leaf spring retaining sleeve **72**, as will be described later.

[0041] In the embodiment of the present invention shown in FIGS. **3** and **4**, each bearing **76** includes a pair of annular rims which prevent leaf springs **70** from moving axially off the surface of the bearing **76** as the bearing rotates about mounting aperture **74**.

[0042] In order for the spring-biased hinged assembly **10** to present a flat surface to a gate post or panel onto which the second hinged member **60** is to be mounted, a cover plate **78** is provided. The cover plate **78** also prevents debris and the like from entering into the housing **62** of the second hinged member **60**. Cover plate **78** also contains plate fastening holes **79** which are aligned with fastening apertures **63** of the housing **62** in order to fix cover plate **78** to the housing self tapping screws or the like. Additionally, cover plate **78** includes a pair of cover plate mounting apertures **77**. When cover plate **78** is fastened to the housing **62**, each mounting aperture **74** axially aligns with a respective cover plate mounting aperture **77**. This provides a pair of fastening points to facilitate fastening of the second hinged member **60** to a gate post, fence or other structure.

[0043] In the preferred embodiment of the present invention, first and second hinged members **20**, **60** and cover plate **78** are constructed from injection-moulded glass-reinforced nylon, or a similar type of polymer. Alternatively, the hinged members may be constructed from synthetic or composite material, metal, alloy or a combination thereof. Preferably, bearing **76** is also manufactured from glass-reinforced nylon.

[0044] As shown in FIG. **4**, tensile member **100** passes through bore hole **28** formed in first hinged member **20**. An opening **65** is formed in housing **62** of the second hinged member **60** so that the opposite end of tensile member **100** may be threaded therethrough.

[0045] Tensile member **100** may comprise a high strength synthetic cord such as braided or unbraided ultra-high molecular weight polyethylene fiber such as Dyneema®, or Spectra®. Alternatively, a high tensile stainless steel braided wire or the like may be suitable for use as a tensile member.

[0046] In addition to the features shown in FIGS. **3** and **4**, FIG. **5** shows cover plate **78** including a pair of guide rails **80**. The guide rails **80** prevent leaf spring retainer sleeve **72** from sliding along the length of the leaf springs **70** as tension is put on the tensile member due to articulation of the spring-biased hinged assembly **10**. Linearly guiding the leaf spring retainer sleeve **72** allows tensile member **100** to be kept in alignment with the opening **65** in housing **62**, the spool **30**, and bore **28** of the first hinged member **20**.

[0047] According to a preferred embodiment of the invention shown in FIG. **5**, end cap **42** has an aperture therein to allow access to tensioning bolt **44**. This allows easy access of an Allan key or the like, in order to rotate bolt **44** and tension tensile member **100** as previously described, without having to remove end cap **42** and expose the pre-tensioning chamber to the environment.

[0048] FIG. **6** illustrates a front perspective view of the spring-biased hinged assembly **10** described in FIGS. **3** and **4**. For safety, both first hinged member **20** and second hinged member **60** present a low profile outer face in order to prevent children being able to gain a toe-hold on the spring-biased hinged assembly **10** and climb on the hinged assembly. Additionally, housing **62** preferably includes sloped or beveled sides in order to hinder children climbing on the spring-biased hinged assembly **10**.

[0049] In addition, FIG. **6** shows housing **62** of the second hinged member **60** including a part-cylindrical recess **68** shaped to receive the cylindrical chambers **22** of first hinged member **20**. In the present embodiment, opening **65** is located in the part-cylindrical recess **68** to allow tensile member **100** to pass therethrough. Opening **65** is aligned with spool **30**, and the bore hole (not shown) of the first hinged member **20** so that the tensile member **100** may extend from pre-tensioning chamber **40** though the bore hole **28** of the first hinged member **20**, wrap about spool **30** and pass through opening **65** with minimal deviation.

[0050] In accordance with an embodiment of the present invention, FIGS. **7** and **8** show the spring-biased hinged assembly **10** in a partially open position. As the spring-biased hinged assembly is opened, first hinged member **20** and second hinged member **60** articulate relative to each other, and tensile member **100** wraps onto spool **30** thereby placing tension on the tensile member **100**, resulting in leaf springs **70** becoming loaded or flexed. As the load on leaf springs **70** increases due to the spring-biased hinged assembly **10** opening further apart, bearings **76** also rotate about mounting apertures **74**.

[0051] Flexing of the leaf springs **70** provides the tension on the tensile member **100** and hence a torque to ensure the first hinged member **20** and second hinged member **60** fully articulate back to the closed position once the force opening a gate has ceased.

[0052] The preferred embodiment of the present invention will be described in more detail with reference to FIG. **9** which shows a transverse cross section of a partially opened spring-biased hinged assembly **10**.

[0053] First hinged member **20** includes a pre-tensioning chamber **40** which contains an anchor block **48** having a seat **49**. The seat **49** receives a swage **102** capping one end of tensile member **100**. By turning tensioning bolt **44**, captive nut **46** may move along the length of the tensioning bolt **44**, resulting in anchor block **48** moving along the length of the pre-tensioning chamber **40**. This movement of the anchor block **48** in turn tensions or relaxes the tensile member **100** as the seat **49** of anchor block **48** engages with swage **102** and moves the swage's relative position within the pre-tensioning chamber **40**.

[0054] By adjusting the tension of the tensile member **100** in the manner described above, the leaf springs **70** may also be pre-loaded prior to the spring-biased hinged assembly **10** being opened. That is, the spring-biased hinged assembly may have a torque placed upon it to cause the first hinged member **20** and second hinged member **60** to articulate to a closed position if no other force is applied to the spring-biased hinged assembly **10**.

[0055] Advantageously, pre-loading or flexing the leaf springs **70** as described above whilst the spring-biased hinged assembly is in the closed position provides the closing torque between the first hinged member **20** and second hinged member **60** required to close a gate when close-range closing of the gate is required.

[0056] As would be understood by the skilled person, the amount of load or bias placed on leaf springs **70** may be adjusted by simply rotating the tensioning bolt **44**. Additionally, the torque characteristics of the spring-biased hinged assembly **10** may be altered by altering the size, number and/or type of leaf springs **70** used.

[0057] In another embodiment of the present invention not illustrated, a second spring may be fixed to the first hinged member **20** in place of the tensioning chamber **40**. In this embodiment, one end of tensile member **100** is fastened to the second spring (for example a compression spring, or one or more leaf springs) located in the first hinged member **20**. The other end of tensile member **100** is fastened and tightened to leaf spring retaining sleeve **72** with the desired amount of tension to pre-load the leaf springs **70** and second spring as desired.

[0058] As shown in FIG. **9**, tensile member **100** passes through bore hole **28** and wraps around spool **30** before extending through opening **65** in housing **62** of the second hinged member **60**. In this embodiment, spool **30** is integral with the first hinged member **20** and is shown with a cammed profile. Spool **30** is positioned intermediate the pair of cylindrical chambers **22** and is offset from the central axis of the cylindrical chambers **22**.

[0059] As would be understood by those skilled in the art, alternative spool locations relative to the center of the cylindrical chamber **22** are envisaged. For example, the spool **30** may be in co-axial alignment with the cylindrical chamber. Similarly, the profile of the spool **30** may vary from cylindrical through a variety of different, or even multiple cam profiles on the spool **30**. The amount of torque between the first hinged member **20** and second hinged member **60** as they articulate from an open to a closed position is a function of the load or strain on the tensile member **100**, and the effective radius of the spool at the point the tensile member **100** tangentially wraps about the spool. Therefore, by adjusting the cam profile or location of the spool **30**, or the tension in the tensile member **100** various torque characteristics for the spring-biased hinged assembly **10** can be achieved as the first hinged member **20** and second hinged member **60** articulate relative to each other from an open to a closed position.

[0060] As the first hinged member **20** and second hinged member **60** articulate further apart in order to open the spring-biased hinged assembly **10**, more of the tensile member **100** wraps itself onto the non-cylindrical profile of spool **30** as the spool is axially rotated during articulation.

[0061] The subsequent torque characteristics of the spring-biased hinged assembly **10** are a product of the resistive force provided by the leaf springs **70** and the radius of the spool **30** at the tangential point at which the tensile member **100** contacts the spool **30**.

[0062] By selectively varying the profile of spool **30**, the radius of the spool **30** at which the tensile member **100** tangentially contacts the spool may be varied. Consequently, the torque characteristics of the spring-biased hinged assembly **10** may be controlled by the user.

[0063] Advantageously, the present invention allows the torque characteristics between the first hinged member **20** and second hinged member **60** to be controlled such that unwanted acceleration created by the long range closing of a gate is prevented as the spring-biased hinged assembly **10** articulates towards the closed position.

[0064] In one embodiment of the present invention, the profile of the radius of the spool **30** may be selected to provide a uniform torque as the spring-biased hinged assembly **10** articulates to a closed position. Alternatively, a spool profile may be selected to increase the torque as the spring-biased hinged assembly moves from a long range closing to a close-range closing position of a gate. As would be recognised by the skilled person, further alternative torque characteristics for the spring-biased hinged assembly **10** are available to the user by selectively varying the profile of the spool **30**. For example, a spool profile may be selected which allows the spring-biased hinged assembly to be retained in the open or "over-lock" position.

[0065] As would be appreciated by the skilled person in the art, selecting a spool profile which allows the spring-biased hinged assembly to be retained in the "over-lock" position is particularly advantageous when the spring-biased hinged assembly is applied to doors or gates which are required to remain open in a pre-determined position for a period of time. A typical example of such a use is the application of the spring-biased hinged assembly to a screen door, such as a fly screen door, so that the door may remain open whilst a high traffic of users pass through the doorway.

[0066] In accordance with the preferred embodiment of the present invention, FIG. **10** shows the spring-biased hinge assembly **10** in an open position, with respective first and second aperture mounting flanges removed for clarity.

[0067] As first hinged member **20** and second hinged member **60** articulate further apart, tensile member **100** wraps itself further about the spool (not shown) and the load on leaf spring **70** increases in the manner previously described.

[0068] In an alternative embodiment of the present invention not shown, the spool may be replaced with a lever arm on the first hinged member, intermediate the cylindrical chambers in a manner similar to that of the spool. In this embodiment, one end of the tensile member is fastened to the lever arm by any suitable known means, whilst the other end is passed through the opening in the second hinged member and fastened to the leaf spring retaining sleeve as previously described.

[0069] In this embodiment, the tensile member may be pre-tensioned, or the tension adjusted by tightening/loosening the tension in the tensile member when fastening it to the lever arm, or leaf spring retaining sleeve, rather than using the tensioning bolt and anchor block arrangement previously described.

[0070] The subsequent torque characteristics of the spring-biased hinged assembly **10** are a product of the resistive force provided by the leaf springs **70** and the effective length of the lever arm at the point at which the tensile member **100** contacts the lever arm.

[0071] By selectively varying the effective length of the lever arm, the torque characteristics of the spring-biased hinged assembly **10** may be controlled by the user in a manner similar to that described above.

[0072] FIG. **10** shows the tensile member **100** extending from leaf spring retainer sleeve **72** through opening **65**, over the spool (not visible in FIG. **10**) and through bore hole **28** into pre-tensioning chamber **40**, whereby the tensile member **100** is located approximately in the longitudinal centre of the spring-biased hinge assembly **10**.

[0073] In further embodiment, the tensile member **100** need not be located substantially medially in the spring-biased hinged assembly **10**. That is, spool **30**, whilst remaining intermediate to the cylindrical chambers **22**, may be located closer to one end of the spring-biased hinged assembly. Accordingly, bore hole **28** and pre-tensioning chamber **40** are moved into axial alignment with the spool **30** and the length of cylindrical chambers **22** also adjusted appropriately. Similarly, opening **65** in housing **62** of the second hinged member **60** is also relocated to provide axial alignment, and leaf spring retaining sleeve **72** moved accordingly to provide a substantially linear path for the tensile member **100** between the first hinged member **20** and second hinged member **60**.

[0074] In yet another alternative embodiment not shown, the first hinged member includes a single cylindrical chamber **22** having a spool **30** located at one end thereof. A hole is provided in the spool **30** which extends into the cylindrical chamber **22** in order to retain a compression spring **24** and locating pin **26** such that the location pin **26** protrudes from the spool **30** into recess **66** of the second hinged member **60** as previously described. In a manner similar to that described above, the pre-tensioning chamber **40**, bore hole **28**, opening **65** and leaf spring retaining sleeve **72** are subsequently re-aligned with the spool **30** in order to provide a substantially linear path for the tensile member **100** to extend from the first hinged member **20** to the second hinged member **60**.

[0075] FIG. **11** shows the spring-biased hinge assembly **10** of the preferred embodiment in the closed position. As illustrated, the spring-biased hinge assembly is not pre-tensioned such that leaf springs **70** are pre-loaded or flexed prior to articulation between the first hinged member **20** and second hinged member **60**.

[0076] In an alternative embodiment of the present invention, leaf springs **70** and leaf spring retaining sleeve **72** may be replaced with a compression spring mounted to housing **62** of the second hinged member **60** in any suitable manner. Additionally, bearings **76** may also be removed and the tensile member **100** fixed to the compression spring in any suitable manner. The remaining components of the spring-biased hinge assembly **10** may be used as previously described.

[0077] FIG. **12** shows a transverse cross section of the spring-biased hinge assembly **10** in the closed position. Anchor block **48** is located at the base of pre-tensioning chamber **40**; consequently leaf springs **70** are in a relaxed state. In this embodiment spool **30** has a cammed profile which is offset from the central longitudinal axis of cylindrical chamber **22**.

[0078] The cammed profile of spool **30** varies the radius of the spool at the tangential point at which the tensile member **100** contacts the spool **30** as the spring-biased hinged assembly **10** articulates. The torque characteristics of the spring-

biased hinged assembly **10** are thereby varied such that as the spring-biased hinged assembly articulates from an open position to the closed position exponential torque characteristics are prevented and a substantially uniform torque is present.

[0079] FIG. **12** also shows the swage **102** of tensioning member **100** located on seat **49** of the anchor block **48**. In an alternative embodiment, the tensioning member **100** may simply be secured to the anchor block **48** by way of a knot should a non-metallic tensile member be used. The other end of the tensile member **100** may be fastened to leaf spring retaining sleeve **72** by weaving the tensile member **100** through at least 2 holes (not shown) in the leaf spring retaining sleeve **72** and tied off. Alternatively, the tensile member may be fixed to leaf spring retaining sleeve **72** through any suitable means as would be understood in the art such as a grub screw or the like, located in a recess in the leaf spring retaining sleeve **72**.

[0080] FIG. **13** shows a perspective view of the spring-biased hinged assembly **10** whilst in the closed position. First and second aperture mounting flanges have been removed for clarity. In this embodiment of the present invention, housing **62** includes an opening **65** in the form of a centrally located shallow channel on an edge of the housing **62**. A second channel is cut to a depth in the base of the first shallow channel to allow tensile member **100** to be axially aligned so as to tangentially contact the spool (not visible) when the spring-biased hinged assembly **10** is in a closed position.

[0081] FIGS. **14-18** illustrate an alternative embodiment of the present invention. In this embodiment, the spring biased hinge assembly **10** includes a first hinged member **20** having an apertured base plate **21** and first apertured mounting flange **29** for mounting the first hinged member **20** to a structure as previously described.

[0082] First hinged member **20** further comprises a pair of cylindrical chambers **22** and a spool **30** intermediate cylindrical chambers **22**. The first hinged member **20** also includes compression springs and locating pins (both not illustrated) to engage with the recess (not illustrated) of hinged plates **64** of the second hinged member **60** as previously described.

[0083] Second hinged member **60** comprises an apertured housing **62** and second apertured mounting flange **82** for mounting the spring biased hinge assembly **10** to a structure in the manner as previously described.

[0084] Additionally, first hinged member **20** includes a spring housing **110***a* for housing a compression spring **114***a*. The spring housing **110***a* includes a tunnel **118***a* sized to allow tensile member **100** to pass therethrough, yet not allow compression spring **114***a* therein. Similarly, second hinged member **60** includes a spring housing **110***b* to receive compression spring **114***b*. Spring housing **110***b* similarly includes a tunnel **118***b*, axially aligned with tunnel **118***a* of spring house **110***a*. The axial alignment of tunnels **118***a* and **118***b* allows tensile member **100** to pass from spring housing **110***a* in the first hinged member **20** to the spring housing **110***b* in the second hinged member **60**. Each of the spring housings **110***a*, **110***b* are preferably fitted with housing caps **112** to close the respective spring housings and prevent debris from entering.

[0085] As seen from FIG. **15**, spring biased hinge assembly **10** includes a spool **30** which rotates independently of the cylindrical chambers **22** as the first hinged member **20** articulates with respect to second hinged member **60**. Spool **30** includes hole **34** therethrough to receive a pin or axle (not shown) in order to provide axial rotation for the spool **30**.

[0086] In a preferred form, a centre pin (not illustrated) is of sufficient length to pass through hole **34** of the spool **30** and extend into the respective cylindrical chambers **22**. Each cylindrical chamber also retains a locating pin **26**, and compression spring **24** as illustrated in FIG. **3**. The ends of the center pin are respectively fitted to the compression springs **24** at the end of the compression springs opposite to that receiving the locating pin **26** so that spool **30** rotates independently of the rotation applied to cylindrical chamber **22**.

[0087] In another alternative embodiment, each cylindrical chamber **22** includes a bore hole at the end closest to spool **30**. The bore hole contains a compression spring **24** and locator pin **26** similar to those previously described with respect to FIG. **3**. Spool **30** is retained by each of the partially protruding locator pins **26** extending from the bore hole in each cylindrical chamber **22** into hole **34** of the spool **30**. The spool is thereby able to rotate independently of any articulation of the spring-biased hinged assembly **10**.

[0088] As illustrated in FIGS. **16-17**, spool **30** also includes a swage recess **32** for receiving and retaining a swage **102** in place on the spool **30**. The spool also includes a tensile support track **36** to assist tensile member **100** being located upon the spool surface **30** rather than abrading and slipping on the spool's surface as articulation of the spring-biased hinged assembly **10** occurs. The tensile member **100** is further prevented from axially misaligning itself through the use of an eyelet **116** formed on spool **30**, as best illustrated in FIGS. **17-18**.

[0089] As shown in FIGS. **16-18**, each end of tensile member **100** is fixed to the distal ends of the respective compression springs **114***a*, **114***b*, and a swage **102** applied approximately half-way along the length of the tensile member **100**. The swage is then retained in swage recess **32** of the spool **30**. By adjusting the length of the tensile member **100** and/or swaging it at the appropriate length, the compression springs **114***a*, **114***b* may be pre-loaded to provide a closing torque between the first hinged member **20** and the second hinged member **60** whilst the spring biased hinged **10** assembly is in the closed position.

[0090] Pre-loading of the compression springs **114***a*, **114***b* ensures that the spring-biased hinged assembly **10** articulates back to the closed position for close-range closing of the spring biased hinge assembly. The torque characteristics can be selectively chosen by adjusting the length of the tensile member **100** prior to swaging and fitting the swage to swage recess **32**, as well as by selecting different spool profiles as previously discussed.

[0091] In a preferred form of the present embodiment, the profile of spool **30** is such that as the first hinged member **20** and second hinged member **60** articulate open, spool **30** rotates approximately half the angle of rotation of the hinged members **20**, **60** at any given point. That is to say, if first hinged member **20** is articulated to a position approximately 90° to the second hinged member **60**, spool **30** rotates approximately 45° from its original position.

[0092] The independent rotation of spool **30** assists in tensile member **100** remaining in the tensile support track **36** thereby preventing the tensile member **100** slipping from, or abrading about the spool **30** as each of the compression springs **114***a*, **114***b* are loaded during articulation of the spring-biased hinged assembly **10**. Advantageously, independent rotation of spool **30** further ensures that each of the compression springs **114***a*, **114***b* are loaded at the same rate so that the load is evenly distribution between each of the respec-

tive compression springs **114***a*, **114***b* as the spring-biased hinged assembly **10** articulates open.

[0093] As previously described, spool **30** may have multiple cam profiles in order to selectively control the torque characteristics of the spring biased hinge assembly **10** having compression springs **114***a*, **114***b*, as it articulates between the open and closed positions.

[0094] Additionally, the use of a compression spring **114***a*, **114***b* in each of first hinged member **20** and second hinged member **60** respectively allows a compact construction of the spring-biased hinged assembly **10** whilst advantageously maintaining the ability to selectively control the torque characteristics of the spring-biased hinged assembly. This advantageously allows the spring-biased hinged assembly of the present invention to be utilized where the size of a hinge is a critical design factor.

[0095] FIGS. **19-21** illustrate a further alternative embodiment of the present invention wherein the pre-tensioning chamber **40** is formed as part of the first aperture mounting flange **29**, rather than aperture base plate **21** of the first hinged member **20**, as previously illustrated in FIG. **6** for example. In use, the spring-biased hinged assembly **10**, is mounted to a gate and fence such that the end cap **42** of the pre-tensioning chamber **40** faces inwards towards the region to be enclosed by the fence and gate.

[0096] This advantageously ensures that any adjusting of the tension on the tensile member (not shown) may only be undertaken by users within the enclosed gated region. Persons outside of the gated region are prevented from tampering with, or vandalsing the tensioning bolt and nut (not shown) within the pre-tensioning chamber **40** as they will not have access to pre-tensioning chamber **40** from their location outside of the enclosed region.

[0097] FIGS. **19-21** also show an exploded view of the elements within the pre-tensioning chamber **40** of this alternative embodiment. As previously described, the pre-tensioning chamber retains an anchor block **48** which receives a tensile member (not shown). End cap **42** prevents debris from entering the pre-tensioning chamber **40** as well as unwanted access to the anchor block **48**. A transition block **51** having a transition radius **53** is retained in the pre-tensioning chamber **40** such that the tensile member (not shown) tracks over the transition radius **53** prior to advancing to the anchor block **48**. By passing the tensile member over the transitional radius **53**, the tensile member circumferentially tracks along the curve of the transition radius as the tension on the tensioning member is altered in the manner previously described. The transitional block **51** thereby prevents the tensile member from scrapping on an edge of the pre-tensioning chamber **40** and fraying. Running the tensile member along the transitional radius **53** also prevents wear points along the tensile member, thereby eliminating the possibility of the tensile member breaking.

[0098] As best illustrated in FIGS. **20** and **21**, the pre-tensioning chamber **40** can be integrally formed with the first mounting flange **29**.

[0099] It will be readily understood by the skilled person that the remaining components of the spring-biased hinged assembly according to the embodiment shown in FIGS. **19-21** operate in the manner previously described.

[0100] Throughout this specification and the claims, unless the context requires otherwise, the word "comprise" and its variations, such as "comprises" and "comprising," will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

[0101] The reference to any prior art in this specification is not, and should not be taken as an acknowledgement or any form of suggestion that such art forms part of the common general knowledge in Australia.

1. A spring-biased hinged assembly comprising:
a spool associated with a first hinged member;
a spring associated with a second hinged member; and
a tensile member extending from the spool to the spring.

2. A spring-biased hinged assembly as claimed in claim **1**, wherein the spool is non-cylindrical.

3. A spring-biased hinged assembly as claimed in claim **1**, wherein the spool has an effective radius which decreases with increased articulation of the hinged assembly.

4. A spring-biased hinged assembly as claimed in claim **1**, wherein articulation of the hinged assembly wraps the tensile member onto the spool and loads the spring.

5. A spring-biased hinged assembly as claimed in claim **4**, wherein torque in the hinged assembly is a function of load on the spring and the effective radius of the spool at the point that the tensile member tangentially wraps onto the spool.

6. A spring-biased hinged assembly as claimed in claim **1**, wherein the spring comprises a leaf spring.

7. A spring-biased hinged assembly as claimed in claim **6**, wherein the leaf spring is mounted on a pair of spaced bearings.

8. A spring-biased hinged assembly as claimed in claim **7**, wherein the pair of spaced bearings are concentric with a pair of mounting apertures in the second hinged member.

9. A spring-biased hinged assembly as claimed in claim **5**, wherein the spring comprises a compression spring.

10. A spring-biased hinged assembly as claimed in claim **9**, wherein the tensile member is fastened to a second spring associated with the first hinged member.

11. A spring-biased hinged assembly as claimed in claim **10**, wherein the second spring is a compression spring.

12. A spring-biased hinged assembly as claimed in claim **9**, wherein the spool rotates independently of the first hinged member and second hinged member.

13. A spring-biased hinged assembly as claimed in claim **1**, wherein the tensile member is adjustably mounted to the first hinged member such that preload on the spring can be adjusted.

14. A spring-biased hinged assembly as claimed in claim **1**, wherein the spool is integrally formed with the first hinged member.

15. A method of converting spring force into torque in a spring-biased hinged assembly, the method comprising:
providing a spool associated with a first hinged member;
providing a spring associated with a second hinged member;
providing a tensile member extending from the spool to the spring; and
articulating the hinged assembly in order to wrap the tensile member onto the spool.

16. A structure including a spring-biased hinged assembly comprising:
a spool associated with a first hinged member;
a spring associated with a second hinged member; and
a tensile member extending from the spool to the spring.

17-28. (canceled)

29. The method as claimed in claim **15**, wherein an effective radius of the spool decreases at an interface with the tensile member with increasing articulation of the hinged assembly.

30. The method as claimed in claim **29**, wherein articulating the hinged assembly and wrapping the tensile member onto the spool includes loading the spring.

31. The method as claimed in claim **30** comprising generating torque in the hinged assembly as a function of the load on the spring and the effective radius of the spool at the interface with the tensile member.

32. The structure as claimed in claim **16**, wherein torque in the spring-biased hinged assembly applied to one or more of the first or second hinged members is a function of load on the spring applied through rotation of the first hinged member relative to the second hinged member and an effective radius of the spool at the point that the tensile member tangentially wraps onto the spool.

* * * * *