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(54) **Ball chain connector and method of releasably connecting together ball chain ends**

Kugelkettenverbinder und Verfahren zur lösbaren Verbindung von Kugelkettenenden

Connecteur de chaîne à billes et procédé permettant d'assembler de façon amovible des extrémités de chaîne à billes

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Description

[0001] The present invention relates to a ball chain connector and a method of releasably connecting together ball chain ends, in particular allowing the ball chain ends to break apart from one another.

[0002] Ball chains are well known in the prior art for operating architectural coverings, for example raising or lowering the cover. Such a ball chain comprises a series of beads/ balls connected together by flexible member sections such that the chain as a whole is flexible and the balls can engage with a pulley wheel to operate the architectural covering.

[0003] A known problem and danger with such ball chains is that a child or infant can become entangled in the hanging loop of the ball chain. Various proposals have been made to allow the two opposite ends of a ball chain to break away from each other under load. For example, JP 2011-027174 proposes the use of a connector having one part that is fixed to one ball chain end and another part that is fixed to another ball chain end. The two connector parts are attached to one another in a releasable manner. GB 2,479,523 and KR 101252028 propose a similar arrangement in which the connector parts of GB 2,479,523 are held together with magnets and the connector parts of KR 101252028 are held together via a ball-shaped connector on one of the parts that resiliently fits in a cavity of the other part. CA 2708468 proposes a connector fixed to the flexible member section at one end of the ball chain and provided with a resilient receiving cavity for receiving a ball at the other end of the ball chain. Under load, the resilient cavity is able to deflect outwardly to release the ball held within the cavity.

[0004] The previous arrangements using multi-part connectors are undesirably complex and expensive. They may be undesirably bulky. Also, special steps may be required to attach the parts to the end of the ball chain, making construction and installation more complex and making it more difficult to adjust the length of the ball chain as required. Furthermore, resiliently gripping an end ball of the ball chain itself can result in unreliable breakaway forces. For normal ball chains, the tolerance for the size of balls need not be particularly accurate. The ball diameter may differ to some extent within a single chain due to production inaccuracies or, indeed, ball chains may be provided with different ball sizes.

[0005] The present invention aims to overcome or at least reduce some of these problems.

[0006] According to the present invention, there is provided a method of releasably connecting together ball chain ends. The method includes securing the ball chain ends to respective first and second part of a ball chain connector and releasably connecting together the first and second parts. The method provides for releasably connecting together the first and second parts by using a ball-shaped connector on the first part that can fit into a side opening in the second part. The method provides for the second part to resiliently hold the first part within

resiliently deflectable walls.

[0007] According to the present invention, there is also provided a ball chain connector for use with ball chains having a series of balls connected together by flexible member sections. The ball chain connector is for connecting together two ball chain ends. The ball chain connector includes a first part and a second part. The first part defines a cavity receiving an end ball at the end of a ball chain and a first through hole for passing a flexible member section of the ball chain and the second part defines a second cavity receiving an end ball at the end of a ball chain and a second through hole for passing a flexible member section of the ball chain. The first part includes a ball-shaped connector at the distal end of a stem extending opposite to said first through hole and the second part includes a resilient wall opposite said second through hole and configured to receive and resiliently hold said ball-shaped connector. The resilient wall also defines a connection aperture from which at least the stem extends and possibly a smaller part of the ball-shaped connector. The resilient wall further defines a side opening, between the second through hole and the connection aperture, into which the ball-shaped connector can be inserted. The resilient wall is configured to be resiliently deflected so as to release the ball-shaped connector and allow the first and second parts to separate.

[0008] There may also be provided a ball chain together with a ball chain connector and also an architectural covering including such a ball chain and ball chain connector.

[0009] In this way, a relatively simple and inexpensive means is provided for connecting together the first and second parts. Because the first and second parts of the connector can be produced specially for this purpose, production tolerances can be provided that ensure accurate and consistent breakaway forces. The first and second parts can easily be arranged to accept end balls within a wide range of varying sizes without affecting the functionality of the ball chain connector. Use of a ball-shaped connector is advantageous by its effectiveness as a releasable connection together with ease and low cost of manufacture.

[0010] The first part may be considered to extend in an elongate direction between the first through hole and the ball-shaped connector. With respect to this elongate direction, the ball chain connector may include a first side wall extending between the first through hole and the ball-shaped connector. The first side wall may define a first opening into which an end ball of a ball chain can be inserted.

[0011] The first side wall of the first part may further define a first slot joining the first opening to the first through hole. This first slot allows a flexible member section of a ball chain extending from the end ball to be moved/guided from the first opening to the first through hole.

[0012] In this way, the ball chain connector provides a

simple means of fitting the first part to an end ball of a ball chain. The end ball may be inserted through the first opening into the first cavity and then rotated such that the flexible member section extending from that end ball passes through the first slot so as to extend out through the first through hole. Under load, the end ball is held securely within the first cavity with the flexible member section extending out of the first through hole.

[0013] It is possible also for the side wall portion defining the first opening to have some resilience and the first opening to be provided with a size slightly smaller than an end ball. In this way, a user may push the end ball into the first opening against some resilient resistance with the end ball then being held securely within the first cavity.

[0014] In an equivalent manner, the second part may be considered to extend in an elongate direction between the second through hole and the connection aperture. With respect to this elongate direction, the second part may include a second side wall between the second through hole and the connection aperture. The second side wall may define a second opening into which an end ball of a ball chain can be inserted.

[0015] The second side wall of the second part may further define a second slot joining the second opening to the second through hole so as to allow a flexible member section of a ball chain to be moved/guided from the second opening to the second through hole.

[0016] As described with respect to the first part, an end ball may be inserted through the second opening into the second cavity and rotated so that the flexible member section passes from the second opening to the second through hole. The end ball is thus securely held within the second cavity.

[0017] Similarly to the first part, the side wall portion defining the second opening may be resilient and may define a second opening slightly smaller than the end ball so as to securely hold the end ball within the second cavity.

[0018] Noting that the second part is configured to hold within it both an end ball of a ball chain and the ball-shaped connector of the first part, its outer elongate extent may be greater than the outer elongate extent of the first part between the first through hole and the stem of the ball-shaped connector.

[0019] In order to fit the ball-shaped connector into the resilient wall of the second part, it is possible merely to push the ball-shaped connector through the connection aperture against the resilient resistance of the resilient wall until the ball-shaped connector moves within that resilient wall and reaches a position at which it is held within the second part by that resilient wall.

[0020] The resilient wall may further define a side slot extending from the side opening to the connection aperture. The side slot allows the stem of the ball-shaped connector to be moved/guided from the side opening to the connection aperture when the ball-shaped connector is rotated within the hold of the resilient walls.

[0021] This provides an alternative and optionally easier means for inserting the ball-shaped connector into the second part.

[0022] The side opening defined by the resilient wall may be smaller than the ball-shaped connector. Also, the resilient wall may be configured to resiliently deform so as to allow the ball-shaped connector to pass within and be received by the resilient wall.

[0023] In this way, even before the ball-shaped connector is rotated to its in-use position with the stem protruding away from the connection aperture, the ball-shaped connector may be held resiliently within the resilient wall.

[0024] The size of the side opening and the resilience of the resilient wall may be arranged to allow the ball-shaped connector to be more easily pushed into the second part through the side opening than through the connection aperture.

[0025] It will be appreciated that it is advantageous for the resilient wall and the ball-shaped connector to have a predetermined size relationship resulting in a predefined breakaway force required to pull the ball-shaped connector from the resilient wall.

[0026] Preferably, the first and second part of the chain connector become separated when the ball chain is loaded with a weight of about 5 to 6 kg. So the predetermined size relationship between the ball-shaped connector and the resilient wall is preferably configured to result in a breakaway force of around 25 to 30N.

[0027] The resilient wall may be configured to permit angular movement of the ball-shaped connector so that the first and second parts are articulated.

[0028] In this way, use of the ball chain connector with the ball chain minimises the impact on the overall flexibility of the ball chain.

[0029] It will be appreciated that the first part need only be slightly larger in size than a ball of the ball chain so as to encapsulate an end ball. The ball-shaped connector of the first part extends into the second part. The second part need only be large enough to encapsulate the ball-shaped connector at one end and an end ball at an opposite end.

[0030] In one embodiment, the second part narrows at a mid portion along the elongate extent so as to mimic the overall shape of two adjacent balls of the ball chain. Indeed, in a further embodiment, the end having a resilient wall for holding the ball-shaped connector may articulate with respect to the end having the second cavity for an end ball of the ball chain. For example, a flexible/resilient connecting portion may be provided between the two ends.

[0031] The ball-shaped connector, the first cavity and the second cavity may be provided as substantially the same size. In other words, the ball-shaped connector may be provided as substantially the same size as the balls of a ball chain with which the connector is to be used.

[0032] The invention will be more clearly understood from the following description, given by way of example

only, with reference to the accompanying drawings, in which:

Figure 1 illustrates an architectural covering including a ball chain connector embodying the present invention;

Figure 2 illustrates a ball chain connector embodying the present invention;

Figures 3(a) and (b) illustrate a first part of a ball chain connector embodying the present invention;

Figures 4(a) and (b) illustrate a second part of a ball chain connector embodying the present invention; and

Figures 5(a) and (b) illustrate a further embodiment according to the present invention.

[0033] A variety of architectural coverings are known which use ball chains as part of their operation. The present invention may be applied to any such ball chain. An example of an architectural covering using a ball chain with a ball chain connector embodying the present invention is shown in Figure 1.

[0034] This example of an architectural covering 10 includes a head rail 12 supporting a roller 14 from which a sheet fabric 16 may be extended or retracted. A bottom rail 18 is provided at a lower edge of the sheet fabric 16. A mechanism is provided in a housing 14a at one end for rotating the roller 14 so as to extend or retract the sheet fabric 16. In the illustrated embodiment, this mechanism is operated by a ball chain.

[0035] As illustrated, the ball chain 20 includes a plurality of balls 22 arranged in a known manner as an array along a flexible member 24. A single flexible member 24 may be provided or a plurality of individual respective flexible members. Irrespective, each pair of adjacent balls 22 may be considered as being connected together by a flexible member section 26.

[0036] An embodiment of the present invention is illustrated in Figure 1 as ball chain connector 30 having a first part 32 releasably connected to a second part 34. The first part 32 holds within a respective cavity an end ball 22a of the ball chain 20. Similarly, the second part 34 holds within a respective cavity an end ball 22b of the ball chain 20. As illustrated, the ball chain connector 30 thus connects together the two ends of the ball chain 20. As will be described below, when the ball chain 20 is subjected to a sufficient load such that the first 32 and second 34 parts of the ball chain connector 30 are pulled apart with a sufficient force, the two parts 32, 34 separate from one another.

[0037] Figure 2 illustrates an embodiment of a ball chain connector in greater detail.

[0038] As illustrated, the first part 32 of the ball chain connector takes the form of a housing having a side wall defining a cavity 36 for receiving an end ball 22a of the ball chain. Similarly, the second part 34 of the ball chain connector takes the form of a housing having a side wall defining a cavity 38 for receiving an end ball 22b of a ball

chain.

[0039] The housings formed by the first and second parts 32, 34 have respective elongate lengths. At one end of the elongate length of the first part 32, there is a through hole 40. As illustrated, the flexible member section 26 joining the end ball 22a to the adjacent ball 22 extends through the through hole 40. Similarly, the second part 34 defines a through hole 42. The flexible member section 26 adjoining the end ball 22b to the adjacent ball 22 extends through the through hole 42.

[0040] In this way, the first part 32 is secured to an end of the ball chain 20 and the second part 34 is secured to the opposite end of the ball chain 20. The end balls 22a, 22b are held within the respective cavities 36, 38 and cannot pass through the through holes 40, 42 which allow passage of the flexible member sections 26, but are too small to allow passage of the end balls 22a, 22b.

[0041] Features of the first part 32 are shown in greater detail in the end view of Figure 3(a) and side view of Figure 3(b). Similarly, the features of the second part are shown in greater detail in the end view of Figure 4(a) and the side view of Figure 4(b).

[0042] Various embodiments are possible where the end balls 22a, 22b are secured within the respective first and second part 32, 34. For example, it would be possible to mould the first and second parts 32, 34 directly around the end balls 22a, 22b, for example with insert moulding. However, in the illustrated embodiment, the side wall of the first part 32 extending along its length defines an opening 44 through which the end ball 22a can be inserted during fitting. Similarly, the side wall of the second part 34 defines an opening 46 through which the end ball 22b can be inserted during fitting. With the walls having some resilience and the openings 44, 46 being slightly smaller than the balls 22a, 22b, it becomes possible to push the balls 22a, 22b through the respective openings 44, 46 in a resilient manner such that the balls "snap" fit into the respective cavities 36, 38 and are held securely in place.

[0043] Slots 48, 50 shown best in Figures 3(a) and 4(a) are provided between the respective openings 44, 46 and through holes 40, 42. In this way, when the first and second parts 32, 34 are fitted to the ends of the ball chain 20, an end ball 22a, 22b is pushed past the side walls through the respective openings 44, 46 and into the respective cavities 36, 38. The end balls 22a, 22b can then be rotated with their respective flexible member sections 26 passing through the respective slots 48, 50 until they are positioned such that the respective flexible member sections 26 extend through and from the respective through holes 40, 42.

[0044] This provides a convenient and straightforward means for fitting the first and second parts 32, 34 to the ends of the ball chain whilst ensuring that the end balls 22a, 22b are securely held within the respective first and second parts 32, 34.

[0045] In order for the first part 32 to be connected with the second part 34, the first part 32 is additionally pro-

vided with a ball-shaped connector 60. As illustrated, from an end, opposite the through hole 40, of the elongate extent of the housing formed by the first part 32, a stem 62 extends. The ball-shaped connector 60 is provided at a distal end of this stem 62. The ball-shaped connector may be substantially spherical and may be of a size similar to the balls 22 of the ball chain if not of a size substantially the same as those balls 22.

[0046] At an end, opposite the through hole 42, of the housing formed by the second part 34, resilient wall 64 defines a connection aperture 66 and a cavity 68 within the second part 34.

[0047] As illustrated, in a fitted/connected condition, the ball-shaped connector 60 is located within the cavity 68 defined by the resilient wall 64 and behind (i.e. on the inner side of) the connection aperture 66. That is to say at least the greater part of the ball-shaped connector, i.e. its greatest diameter, is behind the connection aperture 66. In this way, the ball-shaped connector 60 is connected to the second part 34 and, as a result first and second parts 32, 34 are connected together.

[0048] The wall 64 holding the ball-shaped connector 60 is resilient and can be deflected outwardly. As a result, if a sufficient force is provided pulling the first and second parts 32, 34 away from each other, the ball-shaped connector 60 moves outwardly from the cavity 68 and second part 34, deflecting the resilient wall 64 until it becomes separated from the second part 34.

[0049] By providing the ball-shaped connector 60 as a ball or spherical shape, the first part 32 is able to articulate relative to the second part 34 and retain the overall flexibility of the ball chain 20. Also, by providing a tapered nature to the ball-shaped connector 60, it is able to separate progressively the wall 64 when the first and second parts 32, 34 are pulled apart from one another.

[0050] Embodiments are possible where the ball-shaped connector 60 is fitted to the second part 34 merely by pushing the ball-shaped connector 60 through the connection aperture 66 into the cavity 68. The wall 64 may be provided with one or more divisions allowing it to separate when being deflected apart. Alternatively, if the wall 64 is appropriately flexible, it may merely elastically deform to allow the ball-shaped connector 60 to be inserted or withdrawn.

[0051] In the illustrated embodiment, the wall 64, as part of the side wall of the housing formed by the second part 34 also defines a side opening 70 allowing the ball-shaped connector 60 to be inserted into the cavity 68 through the side of the second part 34. As with the openings 44 and 46, the side opening 70 may be formed with resilient wall portions and have a size slightly smaller than the ball-shaped connector 60 so that the ball-shaped connector 60 may be pushed or snapped fitted into the cavity 68. In the illustrated embodiment, the size of the side opening 70 is greater than the size of the connection aperture 66 such that it is easier for a user to fit the ball connector 60 into the second part 34 using the side opening 70 than to pull the ball-shaped connector 60 out of

the cavity 68 through the connection aperture 66.

[0052] A side slot 72 is defined extending from the side opening 70 to the connection aperture 66. In this way, the first part 32 may be fitted to the second part 34 by inserting the ball-shaped connector 60 through the side opening 70 with the stem 62 already extending in the longitudinal direction of the second part 34, or by inserting the ball-shaped connector 60 through the side opening 70 and then rotating the ball-shaped connector 60 within the cavity 68 such that the stem 62 or at least a reduced diameter portion of the ball-shaped connector 60 passes through the side slot 72 until the stem 62 and first part 32 extend in the longitudinal direction of the second part 34.

[0053] In a further embodiment, illustrated in figures 5(a) and 5(b), the ball-shaped connector 60 may be provided with a protrusion 74. This protrusion 74 may extend into the side opening 70, in assembled condition, as shown in Figure 5(b). Preferably, the protrusion 74 is designed to cooperate with the side opening 70 to limit or prevent rotation of the ball-shaped connector 60 around the longitudinal axis of the ball chain connector 30. The protrusion 74 may further be designed to limit or prevent rotation of the ball-shaped connector 60 around one or both of the other two axes, extending orthogonally to the longitudinal axis. Alternatively, the protrusion 74 may be designed to allow at least some rotation around said other two axes, so that the first and second parts 32, 34 remain articulated in those directions to at least some extent. By limiting the rotational freedom of the first part 32 with respect to the second part 34, in one or more of the aforementioned directions, release of the parts 32, 34 may occur in an even more reproducible, reliable manner, at an accurately predetermined release force.

[0054] The first part 32 may be connected to the second part 34 in a similar way as described before, that is, the ball shaped connector 60 may be fitted into the second part 34 merely by pushing the ball-shaped connector 60 through the connection aperture 66 into the cavity 68. The wall 64 may be provided with one or more divisions allowing it to separate when being deflected apart. Alternatively, if the wall 64 is appropriately flexible, it may merely elastically deform to allow the ball-shaped connector 60 to be inserted or withdrawn. Alternatively, the ball-shaped connector 60 may be fitted into the second part 34 by pushing the ball-shaped connector 60 through the side opening 70 with the stem 62 already extending in the longitudinal direction of the second part 34. Alternatively, if the design of the protrusion 74 so permits, the ball-shaped connector 60 may be inserted through the side opening 70 and subsequently be rotated within the cavity 68 so that the stem 62 passes through the side slot 72 until the stem 62 and first part 32 extend in the longitudinal direction of the second part 34.

[0055] So as to allow the ball chain to break apart under the load of a small child or infant, the ball-shaped connector 60 and wall 64 should be sized appropriately so as to allow separation at a well defined predetermined

force, such as 25N. Because the ball chain connector is being manufactured specifically for this purpose, appropriate tolerances of manufacture can be used to achieve a well defined break apart force.

[0056] From the illustrated embodiment, it will be appreciated that the housing formed by the first part 32 need not be significantly larger than a ball of the ball chain. The second part must include a housing for a ball of the ball chain as well as a housing for the ball-shaped connector 60.

[0057] Alternative embodiments could provide a narrowing of the outer size and shape of the second part 34 between the cavities 38 and 68 such that the overall shape and form of the second part 34 mimics two adjacent balls 22. In addition, embodiments are possible where the join between those two housings is articulated, for example using a flexible interconnecting member, allowing the second part 34 to behave like two adjacent balls of the ball chain.

Claims

1. A ball chain connector (30) for use with ball chains (20) having a series of balls (22) connected together by flexible member sections (26) and for connecting together two ball chain ends, the ball chain connector including:

a first part (32) and a second part (34); wherein:

the first part (32) defines a first cavity (36) for receiving an end ball (22a) at the end of a ball chain and a first through hole (40) for passing a flexible member section (26) of the ball chain;

the second part (34) defines a second cavity (38) for receiving an end ball (22b) at the end of a ball chain and a second through hole (42) for passing a flexible member section (26) of the ball chain;

the first part (32) includes a ball-shaped connector (60) at the distal end of a stem (62) extending opposite to said first through hole (40);

the second part (34) includes at least one resilient wall (64) opposite said second through hole (42) configured to receive and resiliently hold said ball-shaped connector (60) and configured to define a connection aperture (66) from which, when fitted, said stem (62) extends; and

said resilient wall (64) is configured to be resiliently deflected so as to release the ball-shaped connector (60) and allow the first and second parts (32, 34) to separate, **characterized in that**

said resilient wall (64) defines a side open-

ing (70), between the second through hole (42) and the connection aperture (66), into which said ball-shaped connector (60) can be inserted.

2. A ball chain connector (30) according to claim 1, wherein the first part (32) extends in an elongate direction between the first through hole (40) and the ball-shaped connector (60) and includes a first side wall therebetween which defines a first opening (44) into which an end ball (22a) of a ball chain can be inserted.
3. A ball chain connector (30) according to claim 2, wherein the first side wall of the first part (32) further defines a first slot (48) joining the first opening (44) to the first through hole (40) so as to allow a flexible member section (26) of a ball chain to pass from the first opening to the first through hole.
4. A ball chain connector (30) according to any preceding claim, wherein the second part (34) extends in an elongate direction between the second through hole (42) and the connection aperture (66) and includes a second side wall therebetween which defines a second opening (46) into which an end ball (22b) of a ball chain can be inserted.
5. A ball chain connector (30) according to claim 4, wherein the second side wall of the second part (34) further defines a second slot (50) joining the second opening (46) to the second through hole (42) so as to allow a flexible member section (26) of a ball chain to pass from the second opening to the second through hole.
6. A ball chain connector (30) according to any preceding claim, wherein the side opening (70) defined by the resilient wall (64) is smaller than the ball-shaped connector (60) and the resilient wall is configured to resiliently deform so as to allow the ball-shaped connector to pass within and be received by the resilient wall.
7. A ball chain connector (30) according to any preceding claim, wherein the resilient wall (64) defines a side slot (72) extending from the side opening (70) to the connection aperture (66) so as to allow the stem (62) of the ball-shaped connector (60) to pass from the side opening to the connection aperture.
8. A ball chain connector (30) according to any preceding claim, wherein the resilient wall (64) and the ball-shaped connector (60) have a predetermined size relationship resulting in a predefined breakaway force required to pull the ball-shaped connector from the resilient wall.

9. A ball chain connector (30) according to claim 8, wherein the breakaway force is between 25N and 60N, preferably between 25N and 30N.
10. A ball chain connector according to any preceding claim, wherein the resilient wall (64) is configured to permit angular movement of the ball-shaped connector (60) so that the first and second parts (32, 34) are articulated. 5
11. A ball chain connector (30) according to any preceding claim, wherein the ball-shaped connector (60), first cavity (36) and second cavity (38) are substantially the same size. 10
12. A ball chain connector (30) according to any preceding claim, wherein the ball-shaped connector (60) comprises a protrusion (74) that in assembled condition extends in the side opening (70). 15
13. A ball chain connector (30) according to claim 12, wherein the protrusion (74) is designed to cooperate in assembled condition with the side opening (70) to prevent rotation of the ball-shaped connector (60) in at least one rotation direction, preferably around a longitudinal axis of the ball chain connector. 20 25
14. A ball chain (20) having a series of balls (22) connected together by respective flexible member sections (26) and a ball chain connector (30) according to any preceding claim for connecting together opposite ends of the ball chain wherein the first cavity (36) is configured to receive an end ball (22a) at either respective end of the ball chain and the second cavity (38) is configured to receive an end ball (22b) at the other respective end of the ball chain. 30 35
15. A method of releasably connecting together ball chain ends including securing the ball chain ends to respective first and second parts (32, 34) of a ball chain connector (30) according to anyone of claims 1 to 13 and releasably connecting together the first and second parts by using a ball-shaped connector (60) on the first part held resiliently within one or more resiliently deflectable walls (64) on the second part. 40 45

Patentansprüche

1. Kugelskettenverbinder (30) zur Verwendung mit Kugelsketten (20), die eine Reihe von Kugeln (22) aufweisen, die durch flexible Elementabschnitte (26) miteinander verbunden sind, und zum Verbinden von zwei Kugelskettenenden, wobei der Kugelskettenverbinder Folgendes umfasst: 50
- einen ersten Teil (32) und einen zweiten Teil (34); wobei:

der erste Teil (32) einen ersten Hohlraum (36) zur Aufnahme einer Endkugel (22a) am Ende einer Kugelskette und ein erstes Durchgangsloch (40) zum Durchführen eines flexiblen Elementabschnitts (26) der Kugelskette definiert;
 der zweite Teil (34) einen zweiten Hohlraum (38) zur Aufnahme einer Endkugel (22b) am Ende einer Kugelskette und ein zweites Durchgangsloch (42) zum Durchführen eines flexiblen Elementabschnitts (26) der Kugelskette definiert;
 der erste Teil (32) einen kugelförmigen Verbinder (60) am distalen Ende eines Schafts (62) umfasst, der sich gegenüber dem ersten Durchgangsloch (40) erstreckt;
 der zweite Teil (34) mindestens eine elastische Wand (64) umfasst, die dem zweiten Durchgangsloch (42) gegenüberliegt und dafür konfiguriert ist, den kugelförmigen Verbinder (60) aufzunehmen und elastisch zu halten, und und dafür konfiguriert ist, eine Verbindungsöffnung (66) zu definieren, von der, wenn sie angebracht ist, sich der Schaft (62) erstreckt; und
 die elastische Wand (64) elastisch abgelenkt gebildet ist, um den kugelförmigen Verbinder (60) freizugeben und zu ermöglichen, dass sich der erste und der zweite Teil (32, 34) voneinander trennt, **dadurch gekennzeichnet, dass**
 die elastische Wand (64) eine Seitenöffnung (70) zwischen dem zweiten Durchgangsloch (42) und der Verbindungsöffnung (66) definiert, in die der kugelförmige Verbinder (60) eingesetzt werden kann.

2. Kugelskettenverbinder (30) nach Anspruch 1, wobei sich der erste Teil (32) in einer länglichen Richtung zwischen dem ersten Durchgangsloch (40) und dem kugelförmigen Verbinder (60) erstreckt und eine dazwischenliegende erste Seitenwand umfasst, die eine erste Öffnung (44) definiert, in die eine Endkugel (22a) einer Kugelskette eingesetzt werden kann.
3. Kugelskettenverbinder (30) nach Anspruch 2, wobei die erste Seitenwand des ersten Teils (32) ferner einen ersten Schlitz (48) definiert, der die erste Öffnung (44) mit dem ersten Durchgangsloch (40) verbindet, um einem flexiblen Elementabschnitt (26) einer Kugelskette zu ermöglichen, von der ersten Öffnung zu dem ersten Durchgangsloch hindurchgeführt zu werden.
4. Kugelskettenverbinder (30) nach einem der vorhergehenden Ansprüche, wobei sich der zweite Teil (34) in einer länglichen Richtung zwischen dem zweiten Durchgangsloch (42) und der Verbindungsöffnung

(66) erstreckt und eine dazwischenliegende zweite Seitenwand umfasst, die eine zweite Öffnung (46) definiert, in die eine Endkugel (22b) einer Kugelskette eingesetzt werden kann.

5. Kugelskettenverbinder (30) nach Anspruch 4, wobei die zweite Seitenwand des zweiten Teils (34) ferner einen zweiten Schlitz (50) definiert, der die zweite Öffnung (46) mit dem zweiten Durchgangsloch (42) verbindet, um einem flexiblen Elementabschnitt (26) einer Kugelskette zu ermöglichen, von der zweiten Öffnung zu dem zweiten Durchgangsloch hindurchgeführt zu werden. 5 10
6. Kugelskettenverbinder (30) nach einem der vorhergehenden Ansprüche, wobei die Seitenöffnung (70), die von der elastischen Wand (64) definiert wird, kleiner ist als der kugelförmige Verbinder (60), und die elastische Wand so konstruiert ist, dass sie sich elastisch verformt, so dass der kugelförmige Verbinder darin hindurchgeführt und von der elastischen Wand aufgenommen werden kann. 15 20
7. Kugelskettenverbinder (30) nach einem der vorhergehenden Ansprüche, wobei die elastische Wand (64) einen seitlichen Schlitz (72) definiert, der sich von der Seitenöffnung (70) zur Verbindungsöffnung (66) erstreckt, so dass der Schaft (62) des kugelförmigen Verbinders (60) von der Seitenöffnung zu der Verbindungsöffnung hindurchgeführt werden kann. 25 30
8. Kugelskettenverbinder (30) nach einem der vorhergehenden Ansprüche, wobei die elastische Wand (64) und der kugelförmige Verbinder (60) eine vorbestimmte Größenbeziehung aufweisen, die zu einer vorbestimmten Abreißkraft führt, die erforderlich ist, um den kugelförmigen Verbinder von der elastischen Wand zu ziehen. 35
9. Kugelskettenverbinder (30) nach Anspruch 8, wobei die Abreißkraft zwischen 25N und 60N, vorzugsweise zwischen 25N und 30N liegt. 40
10. Kugelskettenverbinder nach einem der vorhergehenden Ansprüche, wobei die elastische Wand (64) so konfiguriert ist, dass sie eine Winkelbewegung des kugelförmigen Verbinders (60) ermöglicht, so dass die ersten und zweiten Teile (32, 34) gelenkig sind. 45
11. Kugelskettenverbinder (30) nach einem der vorhergehenden Ansprüche, wobei der kugelförmige Verbinder (60), der erste Hohlraum (36) und der zweite Hohlraum (38) im Wesentlichen die gleiche Größe haben. 50
12. Kugelskettenverbinder (30) nach einem der vorhergehenden Ansprüche, wobei der kugelförmige Verbinder (60) einen Vorsprung (74) aufweist, der sich

im zusammengebauten Zustand in der Seitenöffnung (70) erstreckt.

13. Kugelskettenverbinder (30) nach Anspruch 12, wobei der Vorsprung (74) so ausgelegt ist, dass er im zusammengebauten Zustand mit der Seitenöffnung (70) zusammenwirkt, um eine Drehung des kugelförmigen Verbinders (60) in mindestens einer Drehrichtung, vorzugsweise um eine Längsachse des Kugelskettenverbinders, zu verhindern. 5 10
14. Kugelskette (20), die Folgendes aufweist: eine Reihe von Kugeln (22), die durch jeweilige flexible Elementabschnitte (26) miteinander verbunden sind, und einen Kugelskettenverbinder (30) nach einem der vorhergehenden Ansprüche zum Verbinden von gegenüberliegenden Enden der Kugelskette, wobei der erste Hohlraum (36) so konfiguriert ist, dass er eine Endkugel (22a) an jedem jeweiligen Ende der Kugelskette aufnimmt, und der zweite Hohlraum (38) so konfiguriert ist, dass er eine Endkugel (22b) an dem anderen jeweiligen Ende der Kugelskette aufnimmt. 15 20
15. Verfahren zum lösaren Verbinden von Kugelskettenenden, das Folgendes umfasst: Befestigen der Kugelskettenenden an jeweiligen ersten und zweiten Teilen (32, 34) eines Kugelskettenverbinders (30) nach einem der Ansprüche 1 bis 13 und lösbares Verbinden der ersten und zweiten Teile unter Verwendung eines kugelförmigen Verbinders (60) an dem ersten Teil, der in einer oder mehreren elastisch ablenkbaren Wänden (64) an dem zweiten Teil elastisch gehalten wird. 25 30

Revendications

1. Connecteur de chaîne à billes (30) à utiliser avec des chaînes à billes (20) ayant une série de billes (22) assemblées par des sections d'élément flexible (26), et permettant d'assembler deux extrémités de chaîne à billes, le connecteur de chaîne à billes comprenant :

une première partie (32) et une deuxième partie (34) ; dans lequel :

la première partie (32) définit une première cavité (36) pouvant recevoir une bille d'extrémité (22a) à l'extrémité d'une chaîne à billes, et un premier trou traversant (40) permettant de faire passer une section d'élément flexible (26) de la chaîne à billes ;
la deuxième partie (34) définit une deuxième cavité (38) pouvant recevoir une bille d'extrémité (22b) à l'extrémité d'une chaîne à billes, et un deuxième trou traversant (42) permettant de faire passer une section

- d'élément flexible (26) de la chaîne à billes ; la première partie (32) comprend un connecteur en forme de bille (60) au niveau de l'extrémité distale d'une tige (62) s'étendant dans la direction opposée audit premier trou traversant (40) ; la deuxième partie (34) comprend au moins une paroi élastique (64) opposée audit deuxième trou traversant (42), pouvant recevoir et maintenir de manière élastique ledit connecteur en forme de bille (60), et pouvant définir une ouverture d'assemblage (66) à partir de laquelle ladite tige (62) s'étend, lorsqu'elle est installée ; et ladite paroi élastique (64) peut fléchir élastiquement de façon à libérer le connecteur en forme de bille (60) et à permettre la séparation des première et deuxième parties (32, 34), **caractérisé en ce que** ladite paroi élastique (64) définit une ouverture latérale (70) entre le deuxième trou traversant (42) et l'ouverture d'assemblage (66), dans laquelle ledit connecteur en forme de bille (60) peut être introduit.
2. Connecteur de chaîne à billes (30) selon la revendication 1, dans lequel la première partie (32) s'étend dans une direction allongée entre le premier trou traversant (40) et le connecteur en forme de bille (60), et comprend une première paroi latérale entre eux, qui définit une première ouverture (44) dans laquelle une bille d'extrémité (22a) d'une chaîne à billes peut être introduite.
 3. Connecteur de chaîne à billes (30) selon la revendication 2, dans lequel la première paroi latérale de la première partie (32) définit en outre une première fente (48) reliant la première ouverture (44) au premier trou traversant (40) de façon à permettre le passage d'une section d'élément flexible (26) d'une chaîne à billes de la première ouverture au premier trou traversant.
 4. Connecteur de chaîne à billes (30) selon l'une quelconque des revendications précédentes, dans lequel la deuxième partie (34) s'étend dans une direction allongée entre le deuxième trou traversant (42) et l'ouverture d'assemblage (66), et comprend une deuxième paroi latérale entre eux, qui définit une deuxième ouverture (46) dans laquelle une bille d'extrémité (22b) d'une chaîne à billes peut être introduite.
 5. Connecteur de chaîne à billes (30) selon la revendication 4, dans lequel la deuxième paroi latérale de la deuxième partie (34) définit en outre une deuxième fente (50) reliant la deuxième ouverture (46) au deuxième trou traversant (42) de façon à permettre le passage d'une section d'élément flexible (26) d'une chaîne à billes de la deuxième ouverture au deuxième trou traversant.
 6. Connecteur de chaîne à billes (30) selon l'une quelconque des revendications précédentes, dans lequel l'ouverture latérale (70) définie par la paroi élastique (64) est plus petite que le connecteur en forme de bille (60), et la paroi élastique peut se déformer élastiquement afin de permettre le passage du connecteur en forme de bille à l'intérieur et sa réception par la paroi élastique.
 7. Connecteur de chaîne à billes (30) selon l'une quelconque des revendications précédentes, dans lequel la paroi élastique (64) définit une fente latérale (72) s'étendant de l'ouverture latérale (70) à l'ouverture d'assemblage (66) de façon à permettre le passage de la tige (62) du connecteur en forme de bille (60) de l'ouverture latérale à l'ouverture d'assemblage.
 8. Connecteur de chaîne à billes (30) selon l'une quelconque des revendications précédentes, dans lequel la paroi élastique (64) et le connecteur en forme de bille (60) ont un rapport dimensionnel prédéterminé résultant en une force de rupture prédéfinie nécessaire pour écarter le connecteur en forme de bille de la paroi élastique.
 9. Connecteur de chaîne à billes (30) selon la revendication 8, dans lequel la force de rupture est comprise entre 25 N et 60 N, de préférence, entre 25 N et 30 N.
 10. Connecteur de chaîne à billes selon l'une quelconque des revendications précédentes, dans lequel la paroi élastique (64) peut permettre un mouvement angulaire du connecteur en forme de bille (60) de telle sorte que les première et deuxième parties (32, 34) sont articulées.
 11. Connecteur de chaîne à billes (30) selon l'une quelconque des revendications précédentes, dans lequel le connecteur en forme de bille (60), la première cavité (36) et la deuxième cavité (38) sont essentiellement de taille identique.
 12. Connecteur de chaîne à billes (30) selon l'une quelconque des revendications précédentes, dans lequel le connecteur en forme de bille (60) comprend une saillie (74) qui s'étend dans l'ouverture latérale (70), à l'état assemblé.
 13. Connecteur de chaîne à billes (30) selon la revendication 12, dans lequel la saillie (74) est conçue pour coopérer, à l'état assemblé, avec l'ouverture latérale (70), afin d'empêcher la rotation du connecteur en forme de bille (60) dans au moins une direction de

rotation, de préférence, autour d'un axe longitudinal du connecteur en forme de bille.

14. Chaîne à billes (20) ayant une série de billes (22) 5
assemblées par des sections d'élément flexible (26),
et connecteur de chaîne à billes (30) selon l'une quel-
conque des revendications précédentes, permettant
d'assembler deux extrémités de la chaîne à billes,
dans lesquels la première cavité (36) peut recevoir 10
une bille d'extrémité (22a) à l'une des extrémités res-
pectives de la chaîne à billes, et la deuxième cavité
(38) peut recevoir une bille d'extrémité (22b) à l'autre
extrémité respective de la chaîne à billes.
15. Procédé permettant d'assembler de façon amovible 15
des extrémités de chaîne à billes, comprenant les
étapes consistant à fixer les extrémités de chaîne à
billes aux première et deuxième parties respectives
(32, 34) d'un connecteur de chaîne à billes (30) selon 20
l'une quelconque des revendications 1 à 13, et à
assembler de façon amovible les première et deuxiè-
me parties à l'aide d'un connecteur en forme de bille
(60) sur la première partie, maintenu de manière
élastique dans une ou plusieurs parois pouvant flé-
chir élastiquement (64) sur la deuxième partie. 25

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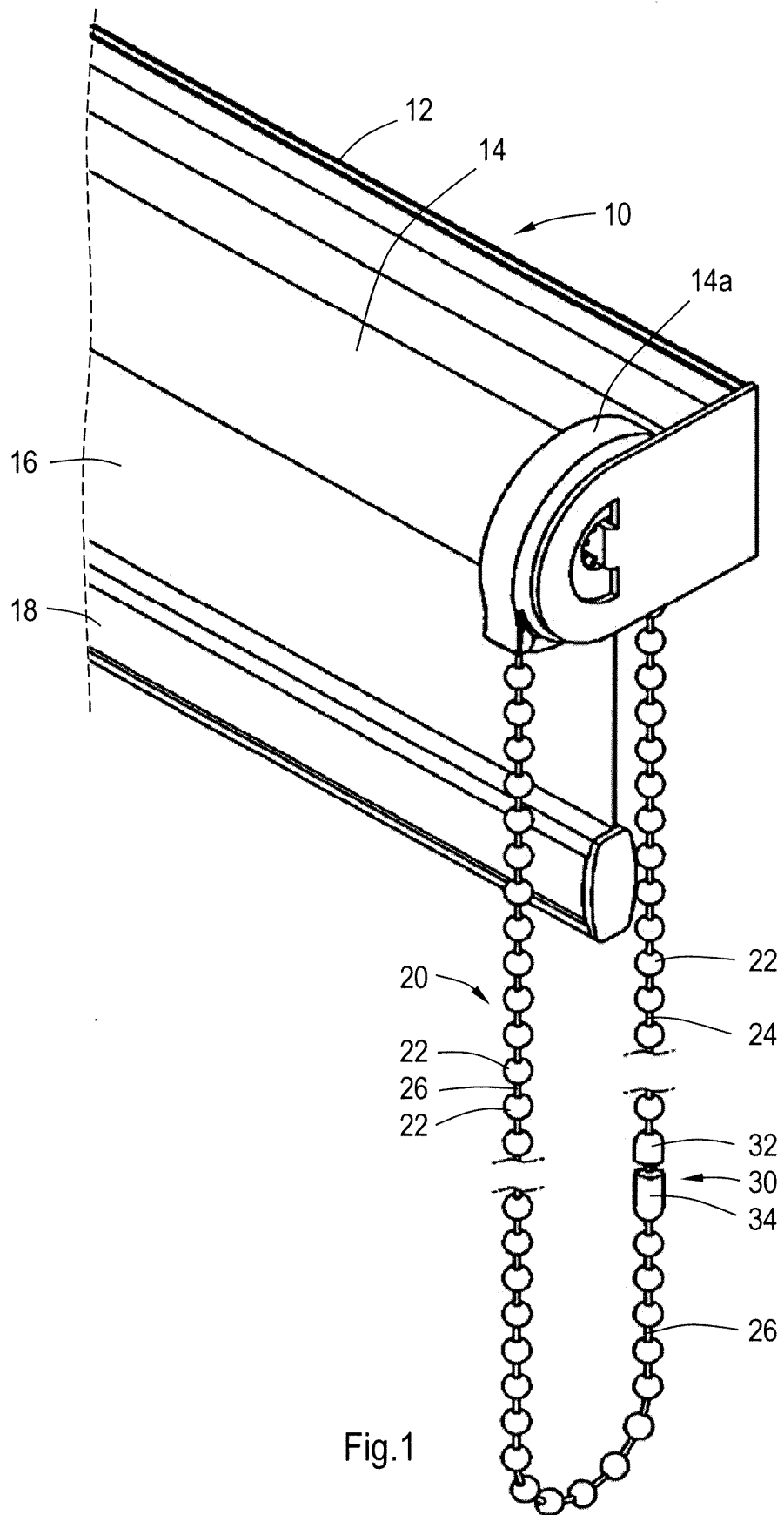


Fig.1

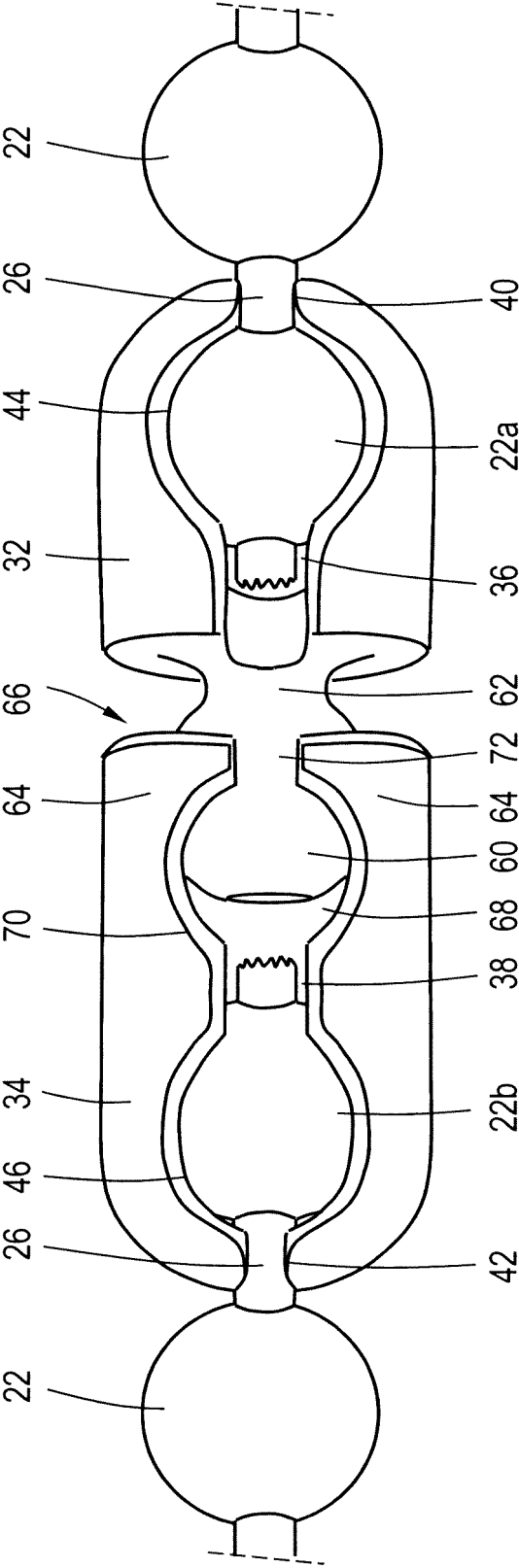


Fig.2

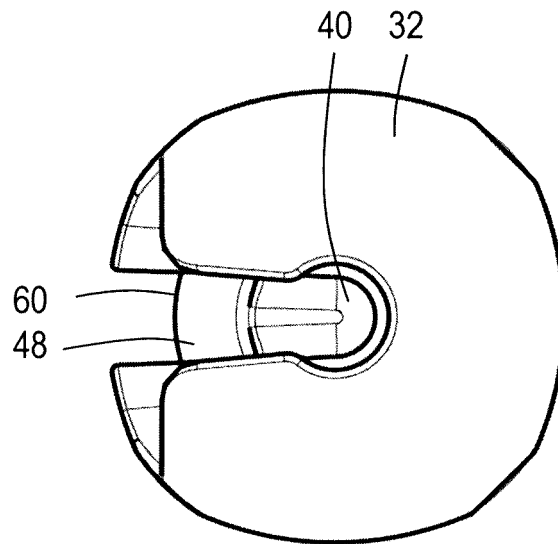


Fig.3a

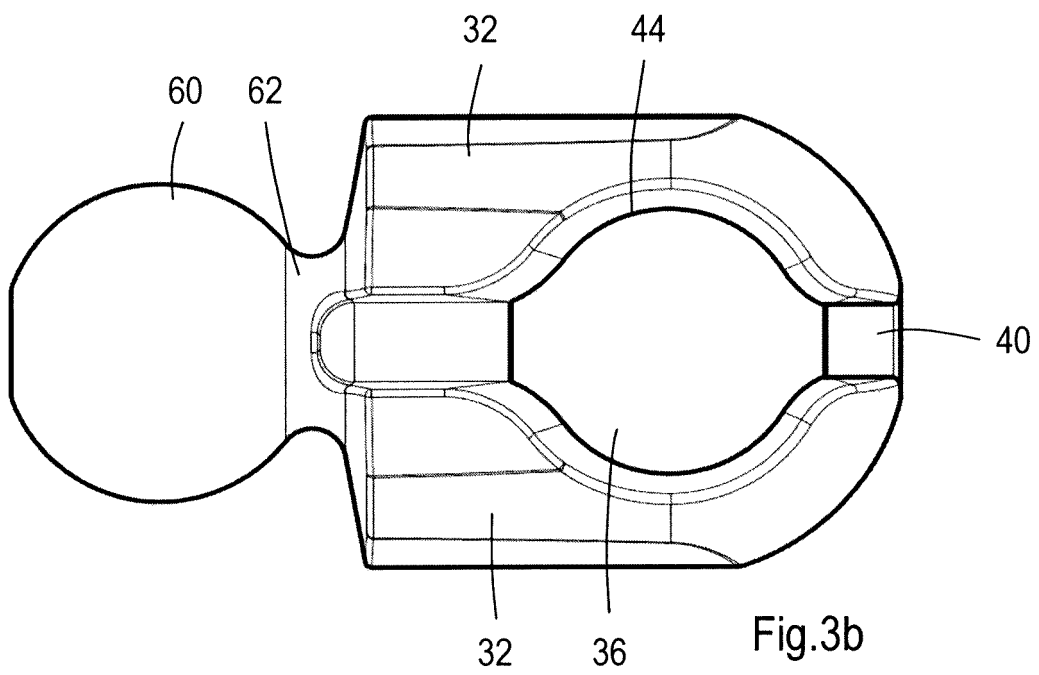


Fig.3b

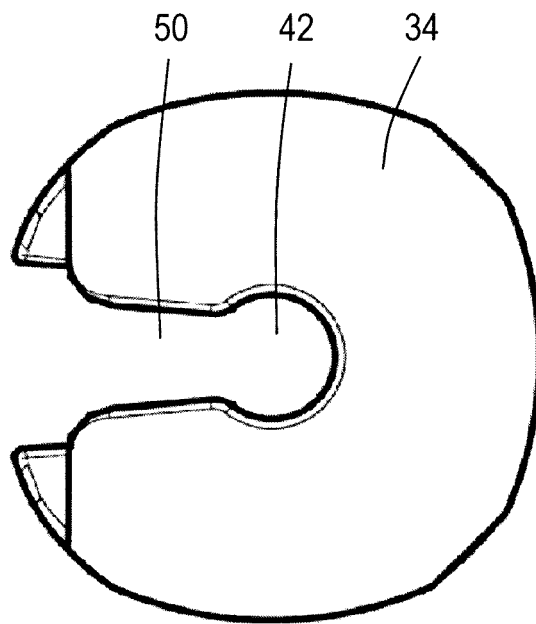


Fig.4a

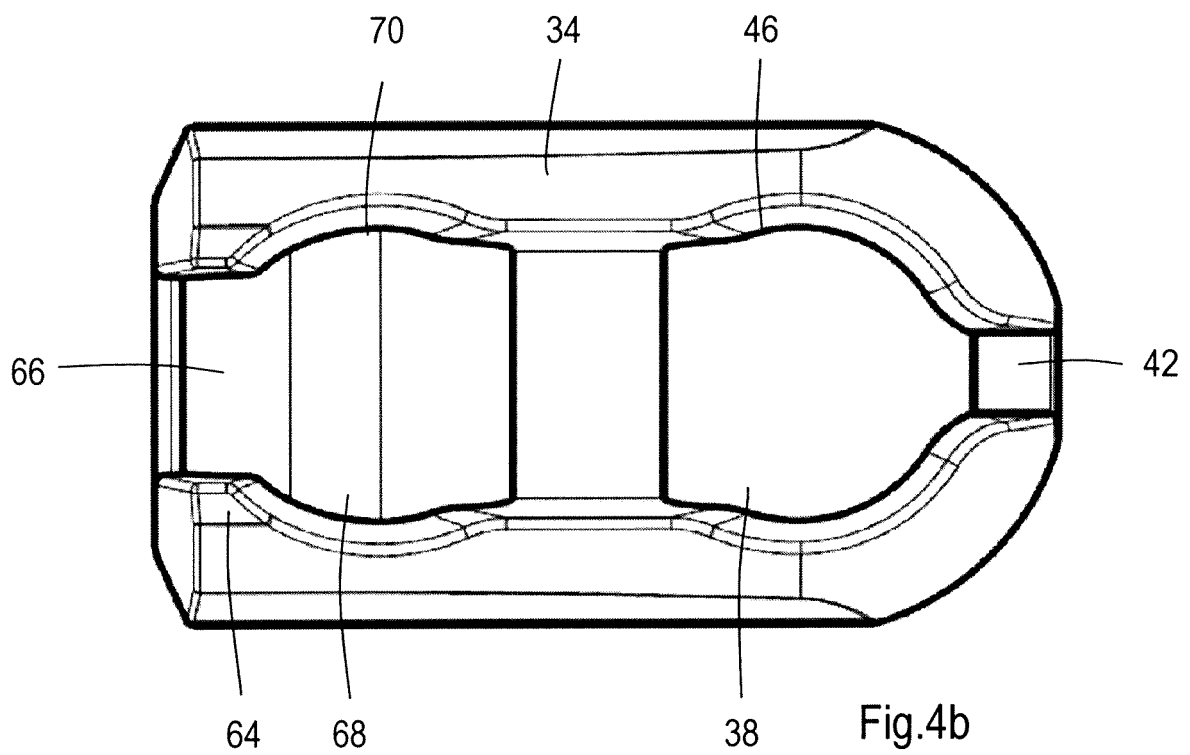
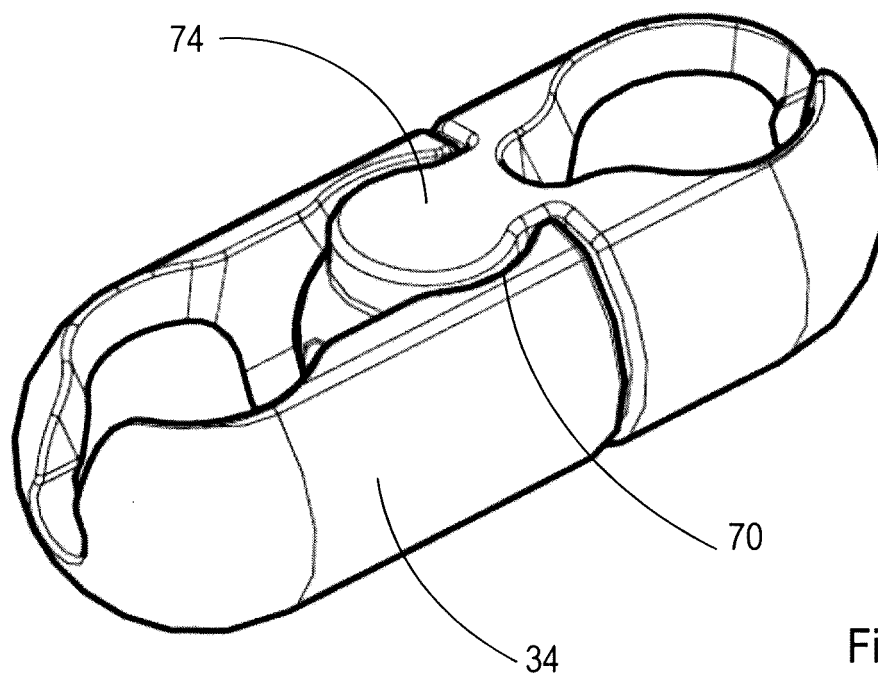
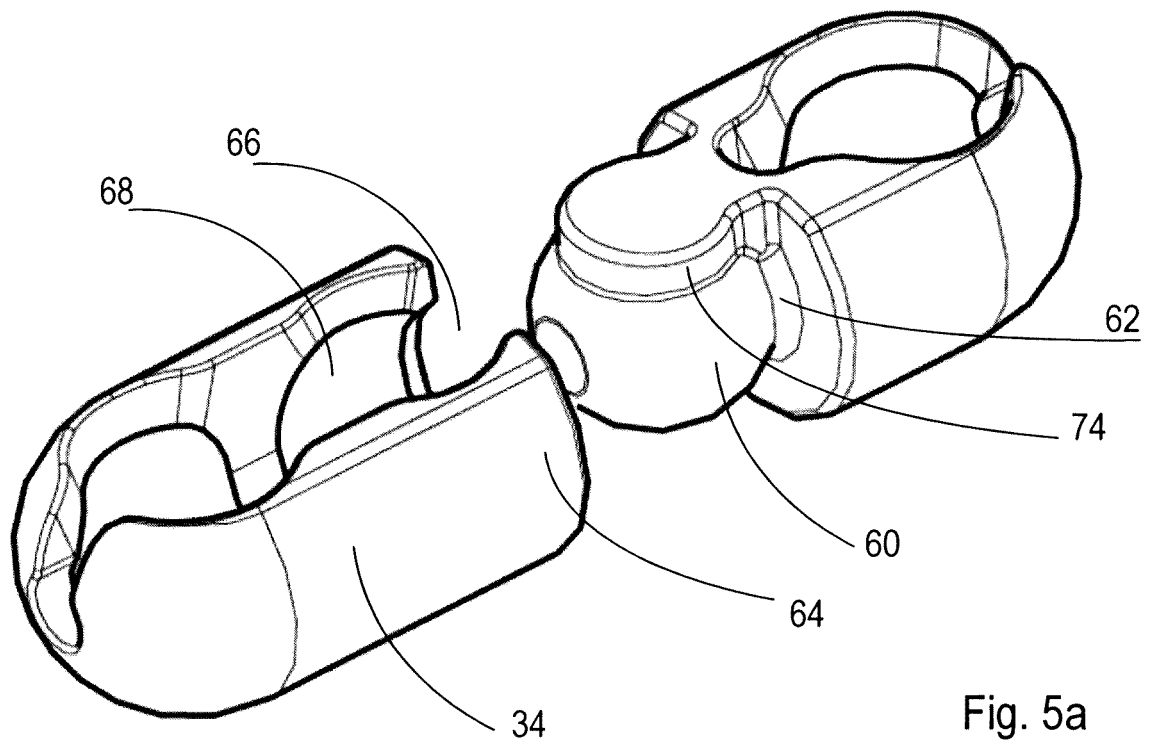


Fig.4b



REFERENCES CITED IN THE DESCRIPTION

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