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(54) **SHOCK ABSORBING SUPPORT**

UNTERSTÜTZUNG ZUR STOSSDÄMPFUNG

SUPPORT AMORTISSEUR

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(73) Proprietor: **Latchways plc**
Calne, Wiltshire SN11 9PL (GB)

(72) Inventors:
• **FLUX, Peter, Robert**
Roy Bridge Inverness-shire PH31 4AS (GB)

- **BISSETT, Timothy, George**
Devizes Wiltshire SN10 1RZ (GB)
- **HEARSON, David, Norman**
Marlborough Wiltshire SN8 1JU (GB)

(74) Representative: **Rees, Alexander Ellison et al**
Urquhart-Dykes & Lord,
30 Welbeck Street
London W1G 8ER (GB)

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Description

[0001] The present invention relates to a shock absorbing support and, in particular, to a shock absorbing support for use in a personnel fall arrest system.

[0002] Personnel fall arrest systems generally comprise a cable or cable network linking a personnel harness to a rigid structure such as a building. If a fall occurs, it is desirable to reduce the shock loading produced when the fall is arrested in order to reduce the chance of injury to the falling person and to minimise the forces applied to the elements of the fall arrest system and the rigid building structure.

[0003] WO-A-95/29738 describes a unidirectional shock absorbing device which comprises a coiled strip. US-A-4 272 114 describes a shock absorbing support for use in vehicles. This device comprises a hollow polyhedral body in the form of a frustum of a hollow quadrangular pyramid.

[0004] Further, personnel fall arrest systems generally include elements which should be replaced or inspected after a fall arrest incident has occurred. Accordingly, it is desirable to provide a clear, permanent, visual indication that a fall arrest has occurred.

[0005] The present invention is intended to provide an omnidirectional shock absorbing support providing a clear visual indication that it has been subject to a high load.

[0006] The invention is a shock absorbing support comprising a base, an anchor element and at least three deformable arms each having first and second ends, the first ends of the arms being linked together and to the anchor element and the second end of each arm being attached to the base, the arms being arranged symmetrically about the anchor element.

[0007] An embodiment of the invention will now be described, by way of example only, with reference to the accompanying diagrammatic figures, in which:

- Figure 1 shows a shock absorbing support according to the invention;
- Figure 2 shows an arm element of the shock absorbing support of Figure 1, and
- Figure 3 shows a base element of the shock absorbing support of Figure 1.

[0008] Referring to the Figures, a shock absorbing support (1) is shown. The support is formed by a pair of base members (2) and a pair of arm elements (3).

[0009] The base members (2) are substantially planar strips of type 316 stainless steel, each 60mm wide, 3mm thick and 300mm long. The two base members (2) are secured together at their mid points in a cruciform configuration by a bolt (4).

[0010] Each arm element (3) is formed as an "A" frame type arrangement by bending a strip of type 316 stainless steel 50mm wide and 3mm thick to define a symmetrical truncated triangle shape having two planar

arm elements (3A), each 300mm in length, a planar attachment region (3B) linking the arms (3A) at first ends thereof and a pair of feet (3C), with one foot (3C) being formed at a second end of each arm (3A). The arm elements (3A), attachment region (3B) and feet (3C) are linked by curved sections. A bolt hole (3D) is provided in the attachment region (3B) and a bolt hole (3E) is provided in each of the feet (3C).

[0011] Each of the arm elements (3) is secured to a respective one of the base members (2) by a pair of bolts (5) passing through the bolt holes (3E) in the feet (3C) and through cooperating bolt holes (not shown) in the base member (2). The two arm elements (3) are secured together by a bolt (6) which passes through each of the bolt holes (3D) in their respective attachment regions (3B). The bolt (5) also secures an anchor element (7) to the two arm elements (3).

[0012] In the illustrated example, the anchor element (7) is a D-ring suitable for supporting flexible cables. The D-ring could, of course, be replaced by other suitable anchor elements as required.

[0013] Each base member (2) comprises a planar central section (2A) and two planar end sections (2B), the end sections (2B) both being in a common plane parallel to the plane of the central section (2A) and the end sections (2B) being linked to the central section (2A) by kinked portions (2C). A pair of bolt holes (8) for securing the shock absorbing support (1) to a building or similar rigid support structure are formed in each of the end sections (2B) of each of the base members (2). The kinked portions (2C) of the base members (2) are arranged to be just outside the positions at which the feet (3C) of the arm elements (3) are bolted to the base sections. The depth of the kinked portions (2C) is set so that the end sections (2B) of each base member (2) are displaced by half the thickness of the base member, in the illustrated example 1.5mm, from the centre section (2A).

[0014] The base members (2) and the arm elements (3) are arranged so that the base member which overlies the other base member is bolted to the arm element which overlies the other arm element and the two base members are arranged opposite ways up so that the base member which overlies the other base member has its end sections lower than its middle sections while the base member which underlies the other base member has its end sections above the middle section.

[0015] This arrangement allows the cruciform shock absorbing support to be formed from two identical arm elements (3) and two identical base members (2) while ensuring that the end portions (2B) of the base members (2) all lie in a single plane for securing to a rigid support structure and that the structure of the shock absorbing support is not pre-stressed or distorted in bolting the members together during assembly.

[0016] In use, the shock absorbing support (1) transmits loads from the anchor element (7) to the rigid structure and for low loads acts as a substantially rigid unit. If a load of greater than 3.5kN is applied to the anchor

element approximately parallel to the base members the shock absorbing support will distort due to plastic deformation of the arm elements (2). This plastic deformation will start with the curved sections linking the arm (3A), support (3B) and foot (3C) sections of each arm element

[0017] In practice, it has been found with a loading of 8kN parallel to the base members (2) the shock absorbing support distorts sufficiently to move the anchor element by 170mm sideways.

[0018] The distortion of the shock absorbing support absorbs some of the energy applied to the shock absorbing support and so reduces the instantaneous shock loads applied to the rigid support structure and the cable, or other arrangements, attached to the anchor element (7). Such instantaneous shock loads could damage or destroy the rigid support structure or the cable or other arrangement. In particular, in a fall arrest system such shock loading can injure the falling person.

[0019] Further, the distortion of the shock absorbing support provides a clear, permanent, visual indication that a high load has been applied to the support. This would not normally occur with a device incorporating resilient means, eg springs as the energy absorbing means.

[0020] In a fall arrest system, a load of 3.5kN or greater will normally only be applied to the system in the event that a fall arrest situation has taken place. The distortion of the support will act as a visual reminder to users to check and replace elements of the system as required.

[0021] The symmetrical arrangement of the arms (3A) ensures that the shock absorbing support has an approximately omnidirectionally constant response to loads. This approximately omnidirectional constant response to loads includes both the threshold level at which distortion and plastic deformation of the shock absorbing support begins and the profile of load against time or load against distortion exhibited by the shock absorbing support if a load above this level is applied.

[0022] Instead of an A-frame like arrangement, the arms (3A) could be formed individually or all of the arms could be formed integrally. For example, by cutting or pressing from a sheet. Bolting is of course only one method of assembly and the elements could be secured together by any other convenient means such as welding. Similarly, the inclusion of bolt holes to allow attachment of the shock absorbing support to a rigid support structure is not essential but is convenient.

[0023] In order to provide the necessary symmetry of the arms it is necessary that at least three arms are provided.

[0024] In the described example, the arms are formed by bent strips having a uniform width and thickness. In order to provide a desired threshold value for deformation to begin and the desired profile of deformation against time, the arms could be given a variable width or thickness or provided with ribs or cutaways or any

other strength varying feature.

[0025] The arms (3) could also have forms other than planar strips, such as rods.

[0026] A threshold for distortion of 3.5kn is often desirable in fall arrest systems but the shock absorbing support can be arranged to have any desired threshold value by suitable dimensioning and shaping and choice of materials.

[0027] The materials and dimensions described herein should be regarded as merely illustrative. The shock absorbing support of the invention can be made from a wide range of materials in any desired size suitable for the intended use.

Claims

1. A shock absorbing support (1) **characterised in that** it comprises a base (2), an anchor element (7) and at least three deformable arms (3) each having first and second ends, the first ends of the arms (3) being linked together and to the anchor element (7) and the second end of each arm being attached to the base (2), the arms (3) being arranged symmetrically about the anchor element (7).
2. A support (1) as claimed in claim 1, in which the arms (3) are symmetrically arranged about an axis perpendicular to the plane of the base (2) and passing through the anchor element (7).
3. A support (1) as claimed in claim 1 or claim 2 and having at least four arms (3), the arms (3) being arranged in diametrically opposed integrally formed pairs.
4. A support (1) as claimed in claim 3 in which the base (2) comprises a plurality of substantially planar elongate base members (2) joined together at their centres and each attached to both of the second ends of the arms (3) of a respective integral pair.
5. A support (1) as claimed in claim 4, in which each base member (2) has two ends and is provided with securing means (8) for securing the support (1) to a further structure adjacent each of said ends.
6. A support (1) as claimed in claim 5, in which each base member (2) has a central section (2A) at which it is joined to the other base members (2) lying in a first plane and two end portions (2B) provided with the support (1) means lying in a second plane parallel to and offset from the first so that all of the end portions (2B) of the base members (2) lie in a single plane.
7. A support (1) as claimed in claim 6, and comprising four arms (3) and two base members (2), in which

the base members (2) have the same thickness and the offset between the first and second planes of each base member (2) is half the thickness of the base member (2).

8. A support (1) as claimed in claim 7, and comprising two identical integral pairs of arms (3) and two identical base members (2).
9. A support (1) as claimed in any preceding claim, in which each integral pair of arms (3) is formed from a single strip of material by folding.
10. A support (1) as claimed in any preceding claim, in which each base member (2) is formed from a single strip of material.

Patentansprüche

1. Stoßdämpfende Stütze (1), **dadurch gekennzeichnet, dass** sie eine Grundplatte (2), ein Anker-element (7) und mindestens drei verformbare Arme (3) umfasst, von denen jeder erste und zweite Enden aufweist, wobei die ersten Enden der Arme (3) miteinander und mit dem Anker-element (7) verkoppelt sind und das zweite Ende jedes Arms an der Grundplatte (2) befestigt ist, wobei die Arme (3) symmetrisch um das Anker-element (7) herum angeordnet sind.
2. Stütze (1) nach Anspruch 1, wobei die Arme (3) symmetrisch um eine Achse angeordnet sind, die senkrecht zur Ebene der Grundplatte (2) verläuft und durch das Anker-element (7) hindurchgeht.
3. Stütze (1) nach Anspruch 1 oder Anspruch 2 mit mindestens vier Armen (3), wobei die Arme (3) in sich genau gegenüberliegenden, integral ausgebildeten Paaren angeordnet sind.
4. Stütze (1) nach Anspruch 3, wobei die Grundplatte (2) mehrere im Wesentlichen planare längliche Grundteile (2) umfasst, die in ihrem Mittelpunkt miteinander verbunden sind und die alle an den beiden zweiten Enden der Arme (3) des jeweiligen integralen Paares befestigt sind.
5. Stütze (1) nach Anspruch 4, wobei jeder Grundteil (2) zwei Enden aufweist und mit einer Befestigungsmöglichkeit (8) für das Befestigen der Stütze (1) an einer weiteren, an jedem der Enden anliegenden Struktur ausgestattet ist.
6. Stütze (1) nach Anspruch 5, wobei jeder Grundteil (2) einen mittleren Abschnitt (2A) aufweist, an dem er mit den anderen, in einer ersten Ebene liegenden Grundteilen (2) und den beiden bereitgestellten

Endabschnitten (2B) verkoppelt ist, wobei die Stütz-vorrichtung (1) in einer zweiten Ebene planparallel zu ersterer und von dieser versetzt liegt, so dass alle Endabschnitte (2B) auf dem Grundteil (2) in einer einzigen Ebene liegen.

7. Stütze (1) nach Anspruch 6, die vier Arme (3) und zwei Grundteile (2) umfasst, wobei die Grundteile (2) die gleiche Dicke aufweisen und die Versetzung zwischen der ersten und der zweiten Ebene eines jeden Grundteils (2) die Hälfte der Dicke des Grund-teils (2) aufweist.
8. Stütze (1) nach Anspruch 7, die zwei identische in-tegrale Paare von Armen (3) und zwei identische Grundteile (2) umfasst.
9. Stütze (1) nach einem der vorhergehenden Ansprü-che, bei der jedes integrale Paar von Armen (3) durch Falzen aus einem einzigen Streifen Material gebildet ist.
10. Stütze (1) nach einem der vorhergehenden Ansprü-che, bei der jeder Grundteil (2) aus einem einzigen Streifen Material gebildet ist.

Revendications

1. Support amortisseur de chocs (1) **caractérisé en ce qu'il** comprend une base (2), un élément d'an-crage (7) et au moins trois bras déformables (3) ayant chacun des première et deuxième extrémités, les premières extrémités des bras (3) étant liées en-semble et à l'élément d'ancrage (7) et la deuxième extrémité de chaque bras étant fixée à la base (2), les bras (3) étant disposés symétriquement autour de l'élément d'ancrage (7).
2. Support (1) selon la revendication 1, dans lequel les bras (3) sont disposés symétriquement autour d'un axe perpendiculaire au plan de la base (2) et pas-sant à travers l'élément d'ancrage (7).
3. Support (1) selon la revendication 1 ou la revendi-cation 2, et ayant au moins quatre bras (3), les bras (3) étant disposés en paires formées intégralement diamétralement opposées.
4. Support (1) selon la revendication 3, dans lequel la base (2) comprend une pluralité d'éléments de base allongés sensiblement plans (2) joints ensemble en leurs centres et fixés chacun aux deux deuxièmes extrémités des bras (3) d'une paire intégrale res-pective.
5. Support (1) selon la revendication 4, dans lequel chaque élément de base (2) a deux extrémités et

est muni d'un moyen de fixation (8) pour fixer le support (1) à une autre structure adjacente à chacune desdites extrémités.

6. Support (1) selon la revendication 5, dans lequel chaque élément de base (2) a une section centrale (2A) au niveau de laquelle il est joint aux autres éléments de base (2) reposant dans un premier plan et deux parties d'extrémité (2B) fournies avec le moyen de support (1) reposant dans un deuxième plan parallèle à et décalé du premier de telle sorte que toutes les parties d'extrémité (2B) des éléments de base (2) reposent dans un même plan. 5 10
7. Support (1) selon la revendication 6, et comprenant quatre bras (3) et deux éléments de base (2), dans lequel les éléments de base (2) ont la même épaisseur et le décalage entre les premier et deuxième plans de chaque élément de base (2) est la moitié de l'épaisseur de l'élément de base (2). 15 20
8. Support (1) selon la revendication 7, et comprenant deux paires intégrales identiques de bras (3) et deux éléments de base identiques (2). 25
9. Support (1) selon l'une quelconque des revendications précédentes, dans lequel chaque paire intégrale de bras (3) est formée à partir d'une bande unique de matière par pliage. 30
10. Support (1) selon l'une quelconque des revendications précédentes, dans lequel chaque élément de base (2) est formé à partir d'une bande unique de matière. 35

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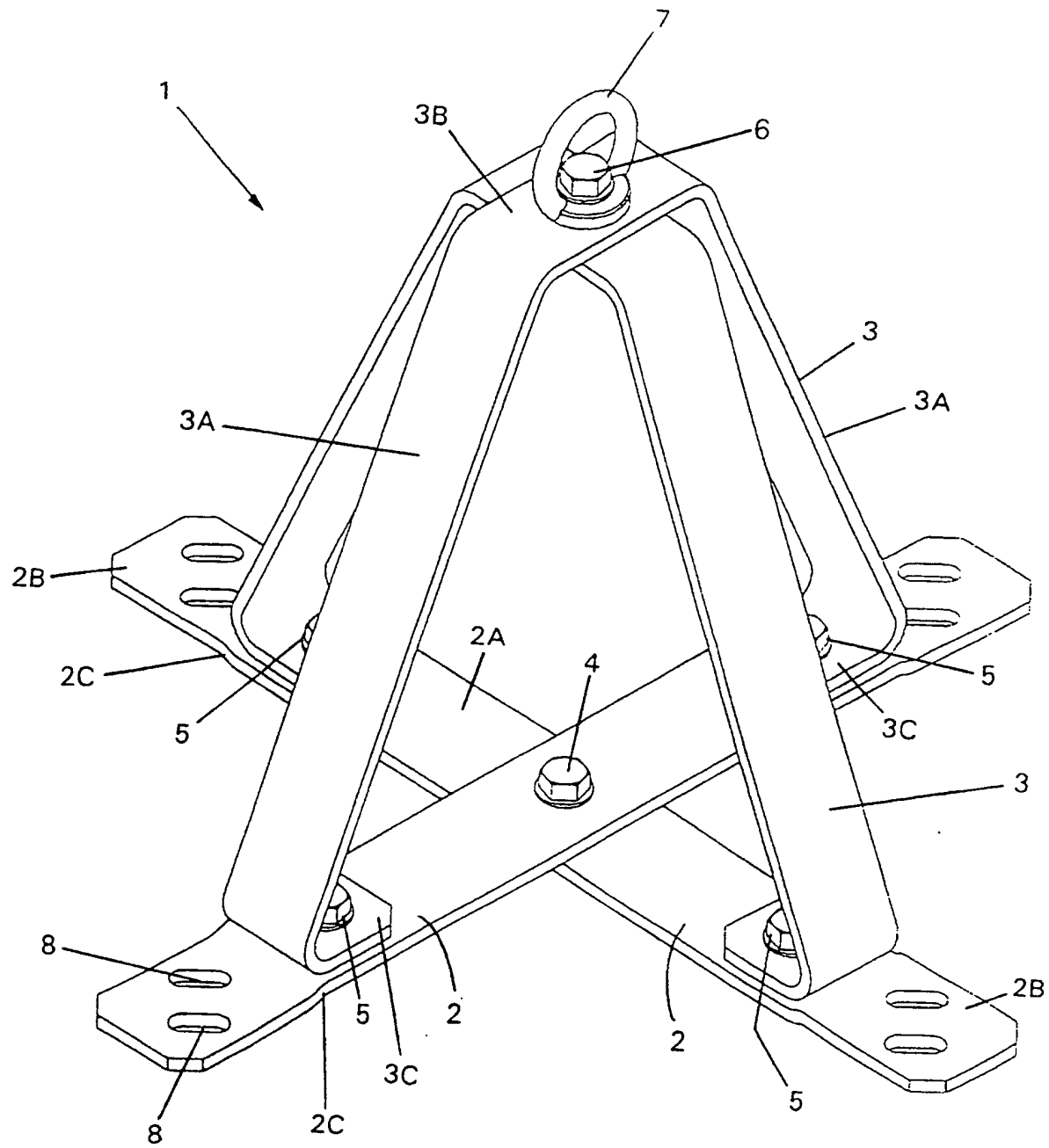


FIGURE 1

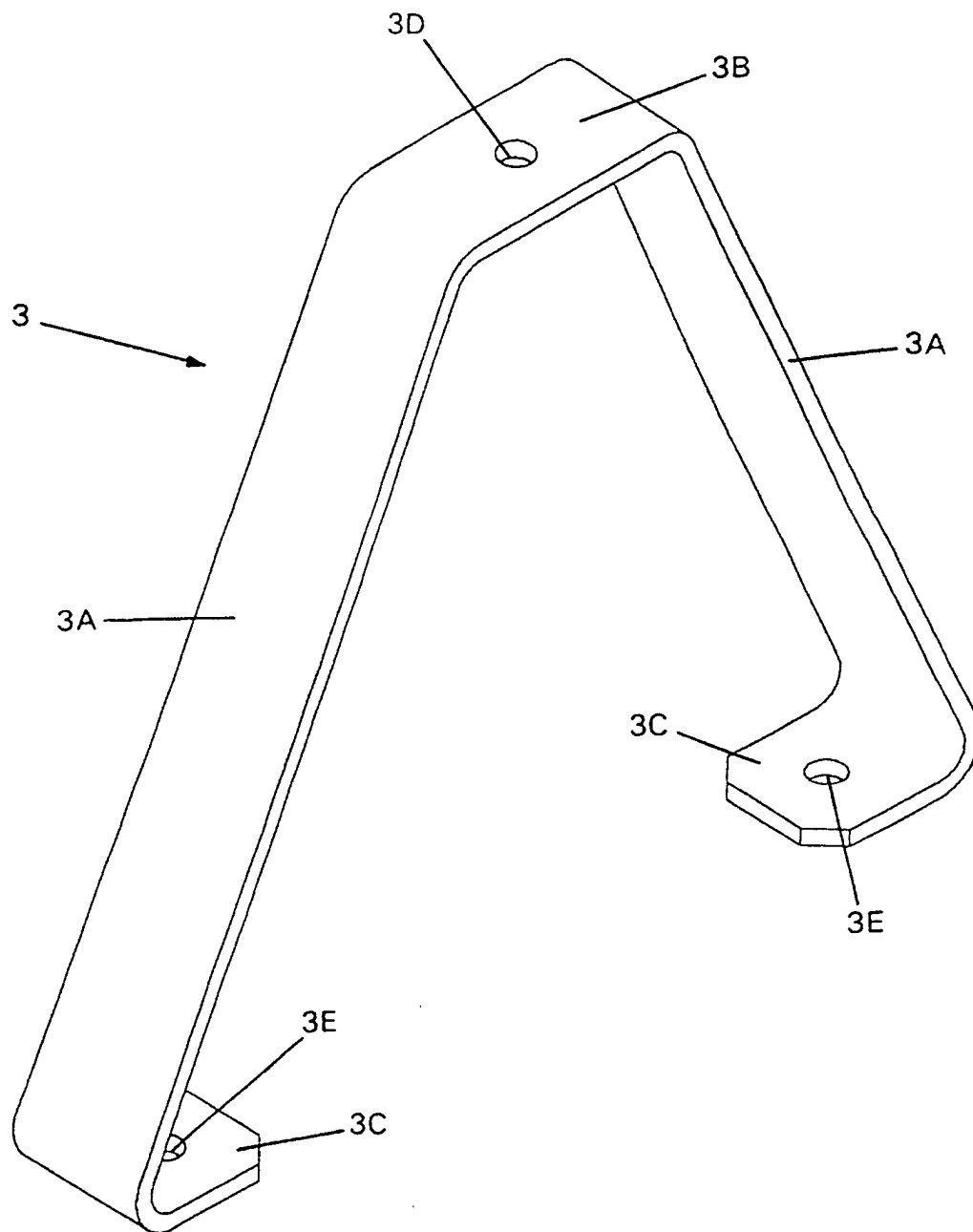


FIGURE 2

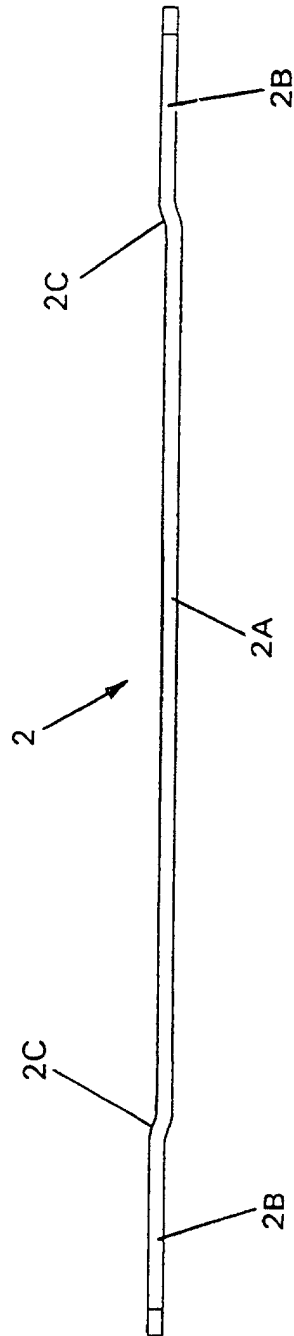


FIGURE 3