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(54) Lifting chair and method of lifting

(57) A lifting chair link for lifting steel reinforcing structures includes a frame structure (10) for attaching by clamping to a reinforcing structure (2), the frame structure (10) including at least two substantially parallel elongate members (14,16) for attaching to members (6) on opposite sides of the reinforcing structure (2) and a plurality of connecting members (12,18) that extend between and connect said elongate members (14,16) to one another.

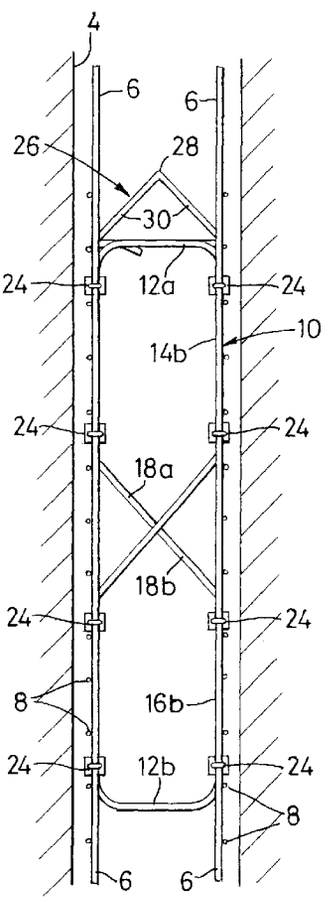

Fig. 3

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Description

The present invention relates to a lifting chair link for lifting and manoeuvring steel reinforcing cages for reinforced concrete structures, and to a method of lifting a reinforcing cage.

The steel structures or "cages" used for reinforcing concrete are generally lifted and manoeuvred into position by attaching the lifting cables of a crane to steel components known as cathedral bars that are welded to the steel cages. Other strengthening components known as Z bars may also be welded to the cages. A disadvantage of this method is that the structure of the cage can be weakened at the locations of the welds. Also, because little support is provided for the cage, the structure may be deformed as it is lifted.

It is an object of the present invention to provide a lifting chair link that mitigates at least some of the aforementioned disadvantages.

According to the present invention there is provided a lifting chair link that may be clamped without welding to the steel reinforcing structure. Because the lifting chair link is not welded to the reinforcing cage, the structure of the cage is not weakened. The need for on-site welding is also avoided. This is desirable since welds made on site can be unreliable, owing to poor weather conditions or the presence of dust.

According to a further aspect of the invention there is provided a lifting chair link having substantially the form of a figure eight. The link may comprise two or more parts that are connected together for use, for example by welding or clamping, to create the figure-of-eight form. The lifting chair link strengthens the structure of the reinforcing cage and spreads the load during lifting, thereby reducing the risk of the cage being deformed.

According to a further aspect of the invention there is provided a lifting chair having substantially the form of a letter S.

According to a further aspect of the invention, there is provided a method of lifting a reinforcing cage for reinforced concrete structures, in which lifting chair links as described above are attached by bolting to the cage and the cage is lifted into position by lifting means attached to the lifting chair links.

By using lifting chair links according to the present invention, the cost and time taken to erect a reinforcing cage is significantly reduced. Safety is also improved, as unreliable welded joints are avoided.

Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, of which:

Fig. 1 is a cross-sectional front view of a reinforcing structure for a diaphragm wall that is to be constructed in an excavated trench, showing the positions of the lifting chair links;

Fig. 2 is a cross-sectional side view of the diaphragm wall on line A-A of Fig. 1;

Fig. 3 is side view showing the lifting chair link in greater detail;

Fig. 4 is an isometric view the lifting chair link and a cathedral bar,

Fig. 5 is a side view of a second type of lifting chair link, and

Fig. 6 shows a detail of the lifting chair link on an enlarged scale.

Fig. 7 is a side view of a third type of lifting chair link,

Fig. 8 is a side view of fourth type of lifting chair link,

Fig. 9 is a side view of a fifth type of lifting chair link,

Fig. 10 is a side view of a sixth type of lifting chair link, and

Fig. 11 is a side view of a seventh type of lifting chair link.

As shown in Figs. 1 and 2, a conventional concrete diaphragm wall, which may be intended for example as a foundation for a bridge or a building, normally includes a steel reinforcing structure or cage 2 that is positioned in an excavated trench 4, which is then filled with concrete. The reinforcing cage 2 is typically box shaped and includes a set of vertical bars 6 and a set of horizontal bars 8 adjacent each face of the wall. The vertical and horizontal bars 6,8 are welded to one another wherever they meet to form a grid. The two sets of vertical and horizontal bars 6,8 are bent around the edges of the structure to meet one another.

The lifting chair link 10, which is shown most clearly in Figs. 3 and 4, is fabricated from steel bars and has the form substantially of a figure-of-eight. More specifically, the lifting chair link 10 comprises horizontal upper and lower bars 12a,12b, two upper vertical members 14a,14b that depend from the upper bar 12a, two lower vertical members 16a,16b that extend upwards from the lower bar 12b, and two diagonal members 18a,18b that connect each upper vertical member 14a,14b to the opposite lower vertical member 16a,16b.

The lifting chair link 10 may be formed from a single piece of steel that is bent to the shape shown in the drawings or, alternatively, it may be constructed from two or more separate components that are connected together on site. For example, it may consist of two components, each consisting, as shown in Fig. 5, of two vertical members 14a,14b, a horizontal bar 12a, a first full length diagonal member 20a and a second half-length diagonal member 20b. Two such components may be connected together by joining the longer diagonal mem-

ber 20a of one of the components to the shorter diagonal member 20b of the other component, for example by welding or clamping. Alternative forms are also possible. For example, the link may consist of two substantially S-shaped components that are connected together for use to produce the figure-of-eight form.

As shown in Figs. 1 and 2, twelve lifting chair links 10 may typically be used to lift a reinforcing cage for a diaphragm wall, these being arranged in three rows of four links (those being an upper row 22a, a middle row 22b and a lower row 22c). Each link 10 extends across the cage 2 perpendicular to the plane of the diaphragm wall and its vertical members 14,16 are attached to the vertical bars 6 on opposite sides of the cage 2 by means of eight U-shaped bolts 24. In the drawings, the U-bolts 24 are shown arranged substantially horizontally around the vertical members 14,16 of the lifting chair link 10 and the vertical bars 6 of the cage 2. In practice, it may be preferable to set the U-bolts 24 at an angle so that they capture the horizontal cage bars 8 as well the vertical cage bars 6.

In the top row 22a, each lifting chair link 10 is attached to a structure known as a cathedral bar 26, which consists of an upright triangular frame 28 consisting of two slanting bars 30 and a cross bar 32, and two vertical legs 34 that depend from the lower corners of the triangular frame 28. The cathedral bar 26, which is constructed from mild steel, is attached to the lifting chair link 10 and the reinforcing cage 2 by means of the U bolts 24, which clamp the vertical legs 34 to the upper vertical members 14a,b of the links 2 and the vertical bars 6 of the cage 2.

The four lifting chair links 10 in the middle row 22b are connected to a lifting bar 36 that extends horizontally through the links 10 and is attached by welding to the upper vertical member 14a and one of the diagonal bars 18a on one side of each chair, as shown in detail in Fig. 6. A second lifting bar 36 is attached in a similar manner to the four lifting chair links 10 in the bottom row 22c.

The reinforcing cage 2 is erected using lifting gear as follows: four lifting cables (not shown) are attached to the slanting elements 30 of the cathedral bars 26, which are attached to the lifting chairs 10 in the top row 22a. Further lifting cables are attached via snatch blocks to the lifting bars 36 that are connected to the lifting chair links 10 in the middle and bottom rows 22b,c. The reinforcing cage 2 is lifted into the vertical position and then lowered into an excavated trench 4. The figure-of-eight shaped lifting chair links 10 strengthen the cage 2 and thereby reduce the risk of deformation. They also spread the stress evenly over the whole of the structure, thereby reducing strain and the risk of structural failure.

The cage 2 is hung from the walls of the trench by means of U-shaped hanging bars (not shown). One leg of each hanging bar is welded to the cathedral bars 26 and the other leg is clamped using a U-bolt to one of the vertical bars of the cage. Once the reinforcing cage 2 has been located in the trench 4, at least some of the U-bolts 24 may be removed prior to filling the trench with concrete, so that they can be reused.

As will be apparent to those skilled in the art, the invention may readily be adapted for lifting many other types of reinforcing structure, including for example pile cages.

Fig. 7 shows a third type of lifting chair link, which has an S-shaped configuration. A cathedral bar is formed integrally with the S-shaped lifting chair link, by creating an apex bend in the uppermost part of the link.

Fig. 8 shows a fourth type of lifting chair link which, like the link shown in Fig. 7, is S-shaped. A cathedral bar is not, however, formed integrally with the link.

Fig. 9 shows a detail of a fifth type of lifting chair link, which has a figure 8 shape and includes an integral cathedral bar.

Fig. 10 shows a sixth type of lifting chair link, which has substantially a Figure 7 shape and includes two additional horizontal bars.

Fig. 11 shows a seventh type of lifting chair link which has substantially a Figure 8 shape and includes two additional horizontal bars.

Claims

1. A lifting chair link for lifting steel reinforcing structures, the lifting chair link including a frame structure for attaching, for example by clamping, to a reinforcing structure, the frame structure including at least two substantially parallel elongate members for attaching to members on opposite sides of the reinforcing structure and a plurality of connecting members that extend between and connect said elongate members to one another.

2. A lifting chair link according to claim 1, wherein the lifting chair link has a substantially figure-of-eight form.

3. A lifting chair link according to claim 2, wherein the lifting chair link includes at least two parts that are connected together to create the figure-of-eight form.

4. A lifting chair link according to claim 3, wherein the lifting chair link includes two substantially S-shaped parts.

5. A lifting chair link according to claim 3, wherein the lifting chair link includes two loop-shaped parts.

6. A lifting chair link according to claim 5, wherein each loop-shaped part has an outwards-extending leg.

7. A lifting chair link according to any one of the preceding claims, wherein at least one of said connecting members includes two diagonal members of op-

posite slope, for use as a cathedral bar.

8. A lifting chair link according to any one of claims 1 to 6, including a cathedral bar member that is attached to the elongate members.

9. A method of lifting a steel reinforcing structure using a plurality of lifting chair links, each lifting chair link comprising a frame structure including at least two substantially parallel elongate members attaching to members on opposite sides of the reinforcing structure and a plurality of connecting members that extend between and connect said elongate members, wherein the plurality of lifting chair links that are attached to the reinforcing structure, lifting means are attached to the lifting chair links and the cage is lifted into position by said lifting means.

10. A method according to claim 9, wherein the plurality of lifting chair links are attached to the reinforcing structure by clamping.

11. A method according to claim 9 or claim 10, wherein at least some of said lifting chair links include cathedral bar members, said lifting means being attached to said cathedral bar members.

12. A method according to any one of claims 9 to 11, wherein at least some of said lifting chair links are connected to one another by a lifting bar member, the lifting means being attached to said lifting bar member.

13. A lifting chair link for lifting steel reinforcing structures, the lifting chair link being substantially as described herein with reference to one or more of the accompanying drawings.

14. A method of lifting a steel reinforcing structure, the method being substantially as described herein with reference to one or more of the accompanying drawings.

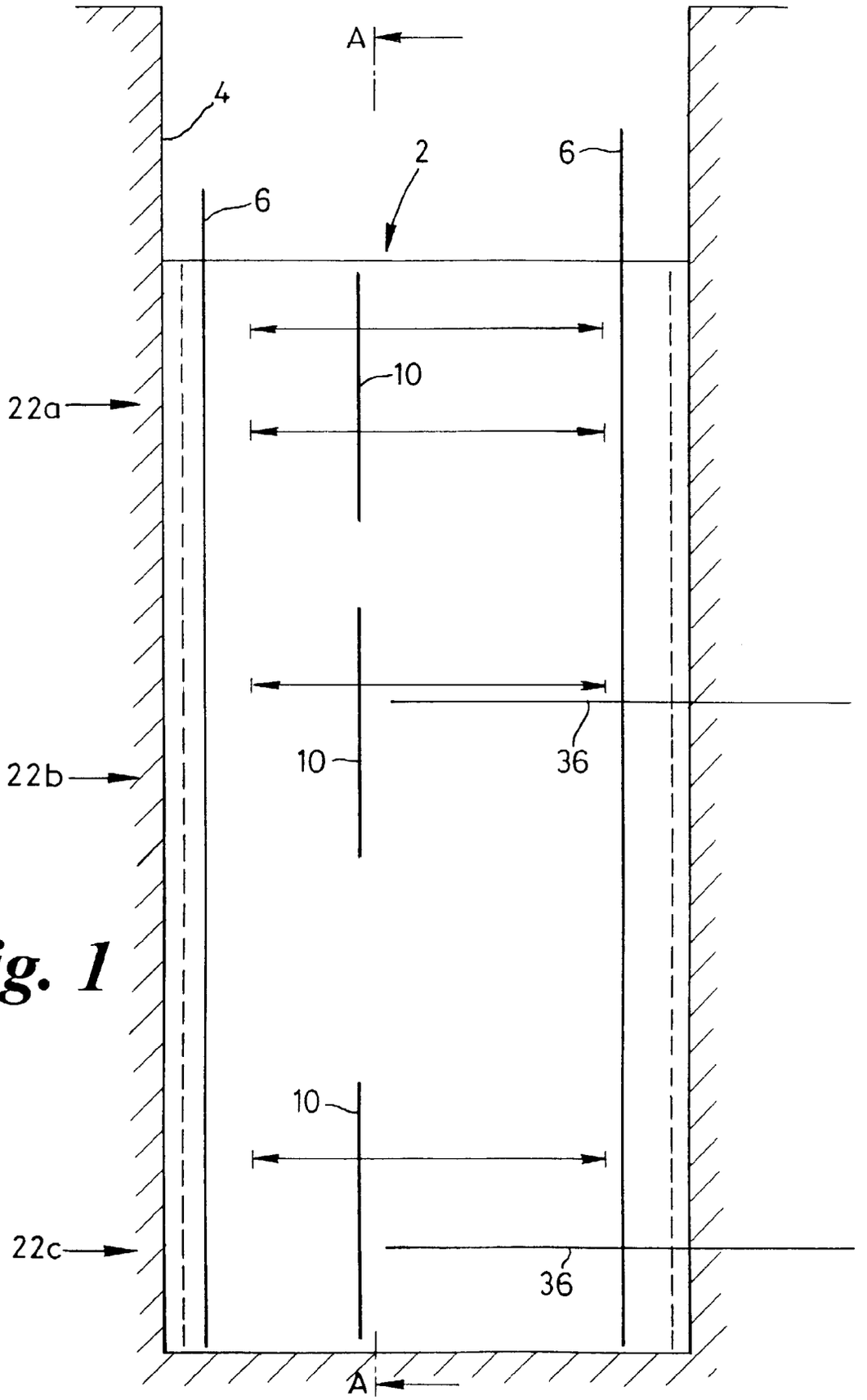

Fig. 1

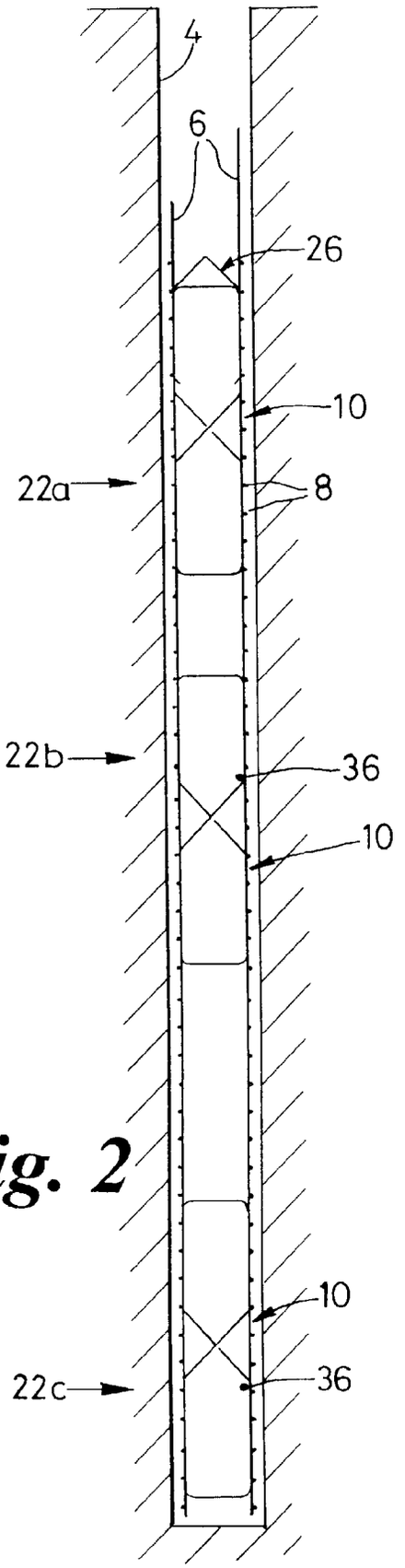
4
6
26
10
22a
8
22b
36
10
10
22c
36

Fig. 2

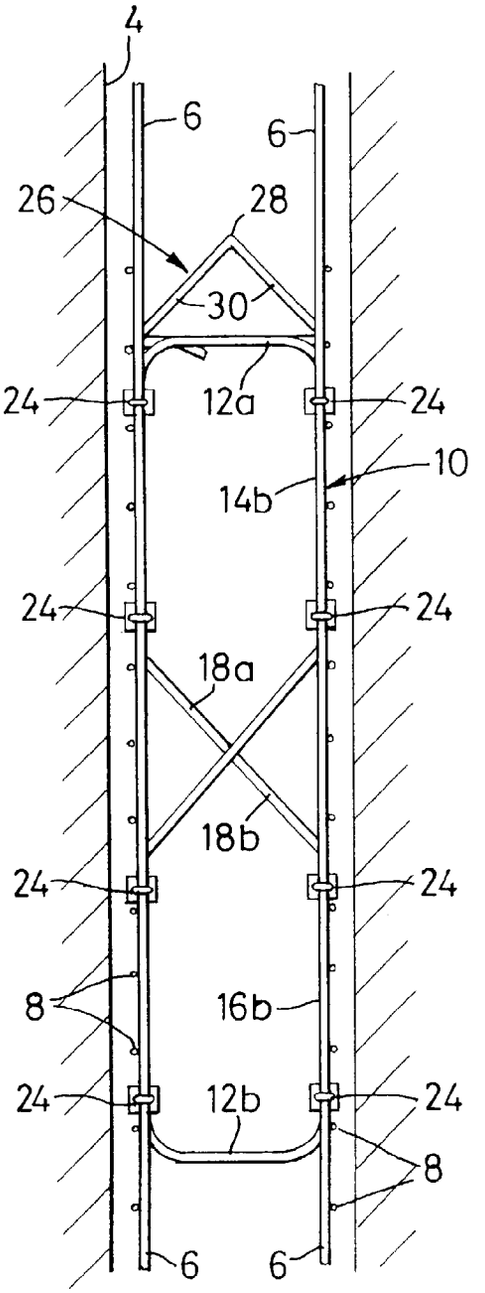
4
6
6
26
28
30
24
12a
24
10
14b
24
24
18a
18b
24
24
8
16b
24
12b
24
8
6
6

Fig. 3

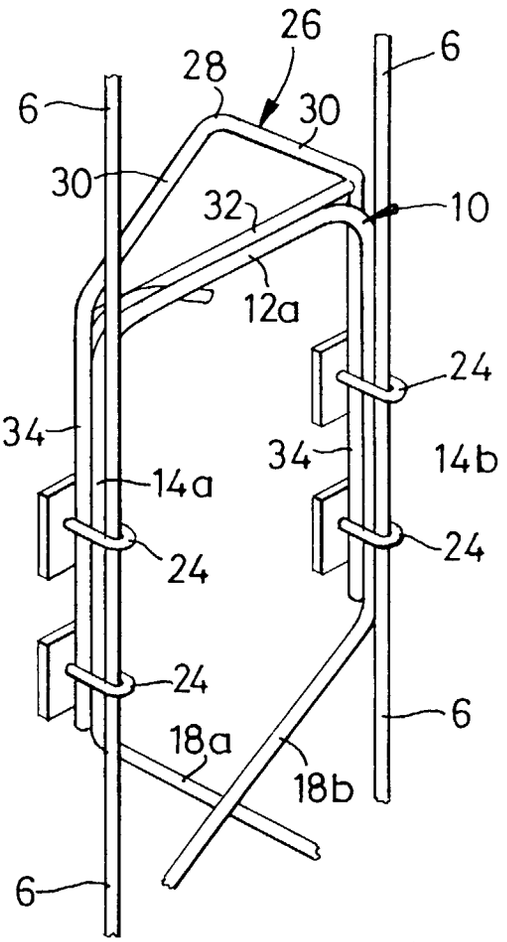

Fig. 4

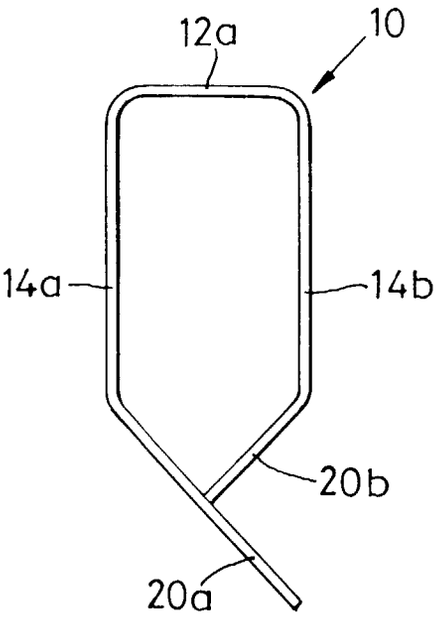

Fig. 5

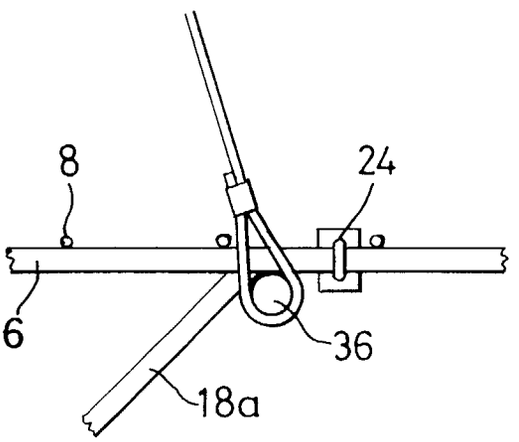

Fig. 6

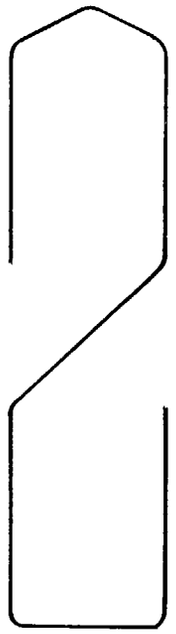

Fig. 7

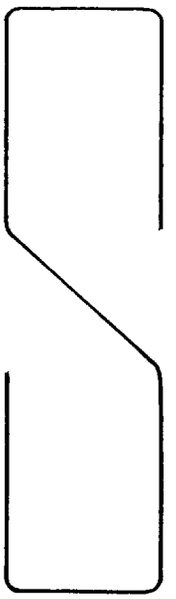

Fig. 8

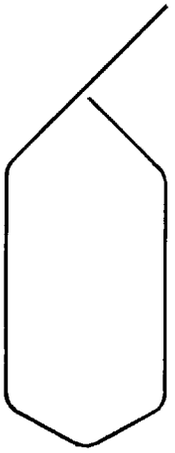

Fig. 9

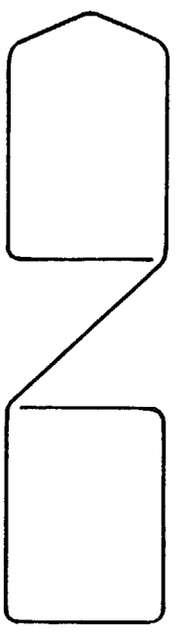

Fig. 10

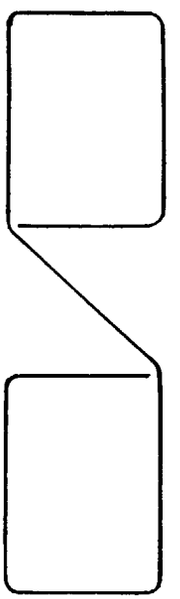

Fig. 11