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Lifting anchors

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ABSTRACT

An anchor for use in lifting a concrete component, the anchor comprising a head engagable with a clutch of a lifting system, and the anchor having a body portion for embedment with the concrete component, wherein the body portion includes a pair of opposed legs extending in a substantially longitudinal direction of the anchor, each of the legs having a foot portion which is formed to extend in a direction transverse to the longitudinal direction of the anchor so as to provide anchorage against longitudinal displacement within the concrete component.

A shear bar for use in conjunction with an edge-lift anchor for use in lifting a concrete component wherein the shear bar has a bent intermediate portion for coupling to the anchor, and each end of the bent intermediate portion extends into an elongated arm. When coupled to the anchor the shear bar extends from one end thereof around one side of a head of the anchor, through an aperture of a head of the anchor, and back around the other side of the head such that the two arms of the shear bar extend from the anchor in generally opposite directions and generally perpendicular to a longitudinal direction of the anchor.

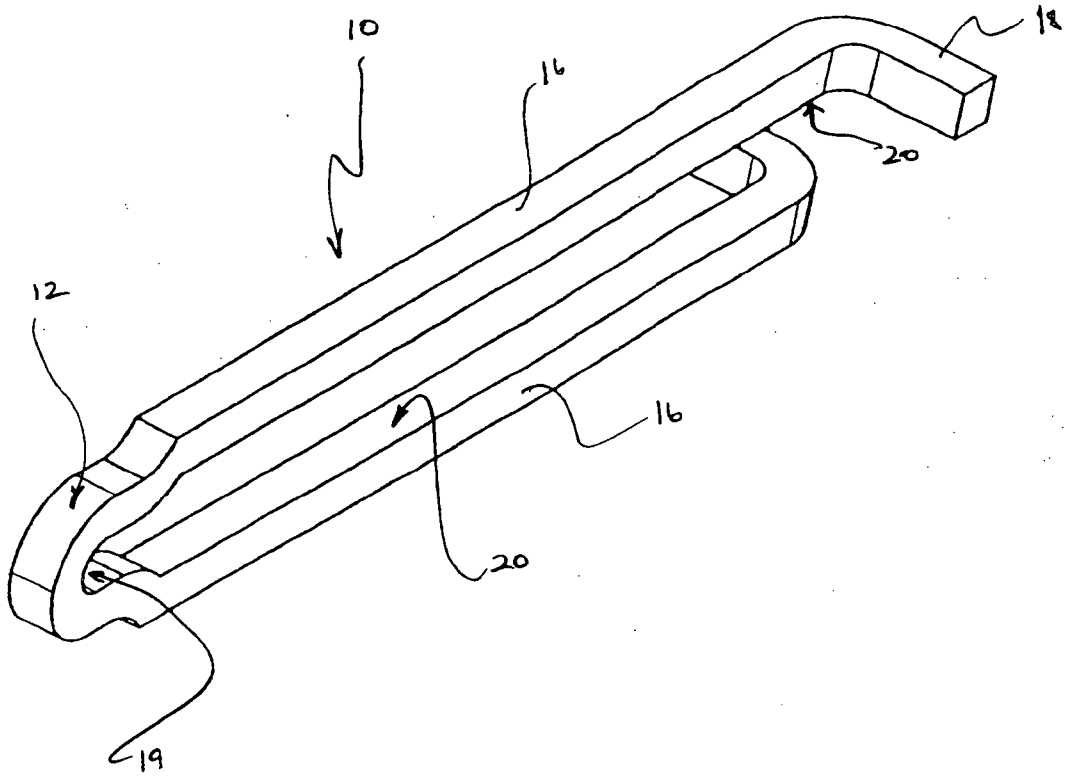

FIGURE 1

Regulation 3.2

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Patents Act 1990

COMPLETE SPECIFICATION

FOR A STANDARD PATENT

(ORIGINAL)

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Invention Title: **"Lifting anchors"**

Details of Associated Provisional Application No: 2003901865

The following statement is a full description of this invention, including the best method of performing it known to us.

LIFTING ANCHORS

The present invention relates to lifting anchors for incorporation into formwork for concrete panels and other components prior to casting the concrete in order to define lifting points by which the panel can be lifted.

Lifting anchors for incorporation into precast concrete panels and other components generally fall into two categories. One category consists of a so-called "face-lift" anchor which is incorporated into the thickness of a panel so as to provide a lifting point at the face of a panel. Face-lift anchors are often, but not always, used in a tilt-up lifting situation in which a panel lying substantially horizontally on the ground is raised into a substantially vertical orientation and then lifted into position. The second category is a so-called "edge-lift" anchor in which the anchor is incorporated into an edge of the panel; this is used in situations where the panel, lying substantially horizontally on the ground is raised into a substantially vertical orientation, then standing on one edge in a generally upright configuration is lifted from another edge in which one or more lifting anchors are incorporated. In each case, a head of the anchor incorporating a lifting eye for engagement with the bolt of a lifting clutch is located within a recess formed in the surface of the panel by application of a so-called void former to the head of the anchor prior to casting, the void former being removed to expose the recess after the concrete has set.

One commonly used form of edge-lift anchor consists of a pair of parallel legs of wave-like shape extending downwardly from the head of the anchor. These legs lie at either side of the typically centrally placed reinforcement and thus between the reinforcement and the adjacent face of the panel. The wave-like form of each leg provides the substantive anchorage of each leg within the concrete. The head of the anchor is also apertured to receive one or more reinforcing bars which act as shear bars to assist in carrying the shear load during lifting. Conventionally, this type of anchor is cut from metal plate material, for example by plasma arc cutting.

Although edge-lift anchors of the form described above are generally satisfactory in

use and have been widely adopted, when the anchor is under lifting load the applied forces between the two legs and the surrounding concrete cause, as a result of the profile of the legs, the legs to move slightly apart and as each leg is quite close to the surface of the panel some surface cracking can arise. This needs to be filled after erection of the panel.

Preferred embodiments of the present invention seek to provide a lifting anchor which overcomes or alleviates this disadvantage associated with previously proposed lifting anchors. Preferred embodiments of the present invention also seek to provide a lifting anchor which is cheaper to manufacture than previously proposed lifting anchors.

In accordance with the present invention, there is provided an anchor for use in lifting a concrete component, said anchor comprising a head engagable with a clutch of a lifting system, and said anchor having a body portion for embedment with the concrete component, wherein the body portion includes a pair of opposed legs extending in a substantially longitudinal direction of the anchor, each of said legs having a foot portion which is formed to extend in a direction transverse to the longitudinal direction of the anchor so as to provide anchorage against longitudinal displacement within the concrete component.

Preferably, the anchor is formed by drawing metal into a bar and by bending the bar into the head and body portions. The metal material may be supplied in a coil from which it is then drawn (for example, through rollers) into straight bar, cut to size and bent to form the anchor. Alternatively, the metal material may be supplied in a length of straight bar in which case the drawing operation is unnecessary. The cutting operation may take place either before or after the bending operation.

In accordance with another aspect of the invention, there is provided an edge-lift anchor for use in lifting a concrete component, said anchor comprising a head engagable with a clutch of a lifting system, and said anchor having a body portion for embedment with the concrete component, wherein the body portion includes a pair of opposed legs extending in a substantially longitudinal direction of the anchor, each of said legs having a foot portion which is formed to extend in a direction transverse to the longitudinal direction of the anchor

so as to provide anchorage against longitudinal displacement within the concrete component.

In one form of the invention, the legs are generally parallel, and the foot portions extend substantially perpendicularly to the longitudinal direction of the anchor.

The foot portions provide the substantive anchorage within the concrete and therefore the legs can principally be substantially straight rather than of wave-like form as in previously proposed anchors.

Preferably, the head has an eye for engagement with a locking bolt of a clutch of the lifting system, the locking bolt extending through said eye.

In one embodiment, metal is drawn into a length of bar which is bent to form the head and the body portion. More particularly, the metal material may be supplied in a coil from which it is then drawn (for example, through rollers) into straight bar, cut to size and bent to form the anchor. Alternatively, the metal material may be supplied in a length of straight bar in which case the drawing operation is unnecessary. The cutting operation may take place either before or after the bending operation.

In another embodiment, the head and legs are cut from metal plate material, for example by plasma arc cutting, with the end portions being subsequently bent to form the foot portions.

Anchors of this general form can either be used as edge-lift or face-lift anchors. When used as edge-lift anchors, provision will be made for use in conjunction with one or more shear bars. When the anchor is formed from bent bar, the shear bar or bars are preferably permanently attached to the anchor, such as by welding, to ensure that the shear bar(s) will always be present when the anchor is used. It is particularly preferred that the shear bar(s) will be adjacent the lower end of the eye so as to lie within the void formed after casting so that the presence of the shear bar(s) will be visible by inspection of the void into which the anchor is set, after casting of the concrete component. In this form, the shear

bar(s) can also advantageously be used to form abutment shoulders for cooperation with the clutch body to limit clutch rotation. Preferably, the anchor is coupled to a first shear bar, the first shear bar having a bent intermediate portion which extends through an aperture of the head for coupling the first shear bar to the anchor, and each end of the bent intermediate portion extending into an elongated arm. In particular, the first shear bar extends from one end thereof around one side of the head, through an aperture of the head, and back around the other side of the head such that the two arms of the first shear bar extend from the anchor in generally opposite directions and generally perpendicular to the longitudinal direction of the anchor. In one embodiment, the anchor is coupled to a second, like, shear bar, the second shear bar extending from one end thereof around the other side of the head, through the aperture of the head, and back around the one side of the head such that the second shear bar is a mirror image, in a central transverse axis of the anchor through the aperture, of the first shear bar.

In one form of the invention, the bent intermediate portion is generally S-shaped.

When cut from metal plate material, the head portion can be apertured (for example, by cutting one or more holes in the head) for cooperation with shear bars.

Preferably, each of the foot portions is bent such that the foot portions extend in mutually opposite directions. More preferably, each of the foot portions extends in a direction substantially perpendicular to a plane in which both legs lie.

In accordance with another aspect of the present invention, there is provided a shear bar for use in conjunction with an edge-lift anchor for use in lifting a concrete component wherein the shear bar has a bent intermediate portion for extending through an aperture of a head of the anchor for coupling the shear bar to the anchor, and each end of the bent intermediate portion extends into an elongated arm. In particular, when used in combination with an edge-lift anchor as described above, the shear bar extends from one end thereof around one side of the head of the anchor, through the aperture of the head of the anchor, and back around the other side of the head such that the two arms of the shear bar extend

from the anchor in generally opposite directions and generally perpendicular to a longitudinal direction of the anchor.

Preferably, the bent intermediate portion of the shear bar is generally S-shaped.

Preferably, the shear bar is formed by bending a drawn metal bar. More particularly, the metal material may be supplied in a coil from which it is then drawn (for example, through rollers) into straight bar, cut to size and bent to form the shear bar. Alternatively, the metal material may be supplied in a length of straight bar in which case the drawing operation is unnecessary. The cutting operation may take place either before or after the bending operation.

Preferred embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of an edge-lift anchor, in accordance with a preferred embodiment of the present invention;

Figure 2 is a front view of the anchor shown in Figure 1;

Figure 3 is a side view of the anchor shown in Figure 1;

Figure 4 is a top view of the anchor shown in Figure 1;

Figure 5 is a perspective view of the anchor of Figure 1, shown coupled to an S-shaped shear bar;

Figure 6 is a front view of the anchor and shear bar arrangement of Figure 5;

Figure 7 is an end view of the anchor and shear bar arrangement of Figure 5;

Figure 8 is a top view of the anchor and shear bar arrangement of Figure 5; and

Figures 9a to 9e show in diagrammatic form the general shapes of exemplary alternative embodiments of shear bar in accordance with the present invention.

An edge-lift anchor 10 for use in lifting a concrete component is shown in Figures 1 to 8, and comprises a head 12 and a body portion 14. The body portion 14 comprises a pair of opposed and generally parallel legs 16 extending in a substantially longitudinal direction of the anchor 10. Each leg 16 ends in a foot portion 18 which is bent to extend in a direction substantially perpendicular to the longitudinal direction of the anchor 10.

The head 12 is provided with an eye 19 for releasable engagement with a locking bolt of a ring clutch of a lifting system, the locking bolt passing through the eye 19. A clutch of this kind is disclosed in Australian Patent No. 639908 which is incorporated herein by reference. In embodiments of the invention, the eye may be in the form of, for example, an end portion of a longitudinal gap/slot between the parallel legs of the anchor (as shown in Figures 1, 2 and 6) or, alternatively, the eye may be a separate aperture formed in the head of the anchor. In particular, in the case where the anchor is cut from metal plate material, the eye may be a separate hole cut in the head.

The anchor 10 depicted is made from a single piece of bent metal bar, by normal bending techniques.

The anchor 10 has legs 16 with substantially straight opposed inner surfaces 20 which alleviate the problem of cracking caused by use of the anchors having legs with wave-like opposed inner surfaces. Whereas the wave-like form of the opposed surfaces of the legs of prior anchors served to provide anchorage within the concrete, the bent foot portions 18 of the present anchor serve this purpose. Further, the simplicity of the straight opposed inner surfaces of the legs of the anchor enable it to be manufactured by bending metal bar which is simpler than plasma arc cutting metal plate, although this technique can still be employed to manufacture the anchor as will subsequently be described.

For edge-lifting, it is a requirement that the anchor 10 is used with one or more shear bars which assist in carrying the shear loading during lifting of the component. As shown in Figures 5 to 8, the anchor is provided with a shear bar 22 which is permanently attached to it. The shear bar is made from a single piece of bent metal bar and two arms 24, 26 of the shear bar 22 extend from the head 12 of the anchor 10 in generally opposite directions, the arms 24, 26 extending substantially perpendicularly to the longitudinal axis 28 of the anchor 10. The shear bar 22 has a bent intermediate portion in the form of a generally S-shaped central portion 30 for coupling to the anchor 10, and each end of the generally S-shaped central portion 30 extends into one of the arms 24, 26. As seen best in Figures 5 and 8, the shear bar 22 is coupled to the anchor 10 by extending around one side 31 of the head 12, through an aperture 32 of the head 12, and back around the other side 33 of the head 12. The aperture 32 may be incorporated into a longitudinal gap/slot between the parallel legs 16 of the anchor 10 (as shown in Figure 6) or, alternatively, may be formed as a separate aperture. In the embodiment shown, the aperture 32 is positioned along a central longitudinal axis of the anchor 10 such that, with the exception of the foot portions 18 which extend in mutually opposite directions, the anchor 10 is generally symmetrical. In one particular embodiment where the anchor is cut from metal plate material, the head of the anchor may be apertured (for example by cutting a hole in the head which is separate to both the eye 19 and the longitudinal gap/slot between the legs) for cooperation with one or more shear bars. Preferably, permanent attachment of the shear bar 22 to the anchor 10 is achieved by spot welding or similar means. In the prior anchors previously discussed, the head of the anchor is provided with notches for co-operation with shear bars at both sides of the head and which are installed when installing the anchor prior to casting the concrete. However, sometimes the shear bars may be omitted by the installer or only a single shear bar may be used, both of which may lead to non-compliance. However, by supplying the anchor with the shear bar of appropriate form permanently attached, this can be avoided.

Although it is preferred for the anchor to be supplied with the shear bar permanently attached in the manner described, the anchor could be provided with a mounting for attachment of one or more shear bars during installation. In Figure 5 of Australian Patent

No. 639908 there is shown an anchor head formed with abutment surfaces provided by shoulders which co-operate with the body of the ring clutch to restrict pivotal movement of the ring clutch body about the eye during lifting, for the reasons explained in that patent. When the anchor is cut from metal plate, these shoulders can readily be formed during cutting. Conveniently, in the anchor 10, shaping of the shear bar 22 in the manner illustrated also forms abutments for limiting pivotal movement of the ring clutch body. This is provided by portions 34, 36 of the shear bar immediately adjacent the sides of the head 12. Although this is particularly provided, the anchor could be provided with other forms of abutment, for example by appropriately shaping or cutting the head.

Figures 9a to 9e show diagrammatically the general shapes of several alternative embodiments of shear bars according to the present invention. In each case, the shear bar comprises a bent intermediate portion 30 for coupling to a head of an edge-lift anchor, with each end of the bent intermediate portion 30 leading into arms 24,26 which extend in generally opposite directions away from the anchor. Shear bars manufactured according to any one of the shapes depicted are coupled to the head of an edge-lift anchor in a manner similar to that shown in Figure 8, in that a central length 38 of the bent intermediate portion 30 extends through an eye of the head, with the ends of the central length 38 leading into portions 40,42 which are bent back around the sides of the head such that the arms 24,26 at either end of the shear bar extend in generally opposite directions away from the anchor. The alternative shapes of shear bar shown in Figures 9a to 9e are shown merely by way of example, and other alternative shapes of shear bar may be used within the scope of the invention.

In an embodiment wherein the edge-lift anchor is used in combination with two shear bars, a first shear bar 22 is fitted to the anchor as shown in Figures 5 to 8, and a second shear bar 22a is fitted to the anchor as shown in broken lines in Figure 8 such that from a top view the second shear bar 22a is a mirror image (in a central transverse axis through the aperture 32) of the first shear bar 22. Conveniently, in such an embodiment, the two shear bars 22, 22a are alike, except of course for their orientation when fitted to the anchor as depicted.

Although the anchor 10 described above is an edge-lift anchor, in accordance with an alternative embodiment of the present invention (not shown), the anchor can be formed as a face-lift anchor. The face-lift anchor in accordance with the invention is similar to the edge-lift anchor shown in Figures 1 to 4, except in that the face-lift anchor has a proportionally shorter body portion owing to the difference in the nature of location of the face-lift anchor wherein the body portion of the face-lift anchor is incorporated into the thickness of the panel rather than in the length or width of the panel as is done the edge-lift anchor. A further difference between the edge-lift and face-lift anchors of the present invention lies in that the face-lift anchor is not used in conjunction with a shear bar.

Although it is particularly advantageous for the anchor (whether edge-lift or face-lift) to be formed by bending metal bar as it is a relatively quick and inexpensive method of manufacture, nevertheless the anchor could also be manufactured by other techniques such as cutting from metal plate by plasma arc cutting to provide opposed legs of substantially straight form which are subsequently bent at their ends to form the foot portions. This still avoids the problems previously discussed in connection with the legs of wave-like form and also provides a quicker cutting action than occurs when cutting the wave shape. In this form the head of the anchor is of conventional shape, for example with shoulders for co-operation with the ring clutch body and with notches or other openings for receiving shear bars.

The preferred embodiment of the edge-lift anchor as shown in Figures 5 to 8 is also advantageous as the shear bar which also provides the abutments 34, 36 will be visible at the bottom of the void formed during casting by the removable void former, so that inspection will reveal that the correct type of anchor has been installed and that the correct shear bar arrangement is in place, and which is not possible by routine inspection when conventional anchors are used.

The above preferred embodiments have been described by way of example only and modifications are possible within the scope of the invention.

Throughout this specification, unless the context requires otherwise, the word

"comprise", or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated step or integer or group of steps or integers but not the exclusion of any other step or integer or group of steps or integers.

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

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. An anchor for use in lifting a concrete component, said anchor comprising a head engagable with a clutch of a lifting system, and said anchor having a body portion for embedment with the concrete component, wherein the body portion includes a pair of opposed legs extending in a substantially longitudinal direction of the anchor, each of said legs having a foot portion which is formed to extend in a direction transverse to the longitudinal direction of the anchor so as to provide anchorage against longitudinal displacement within the concrete component.

2. An anchor as claimed in claim 1, wherein the anchor is formed by bending a length of metal bar.

3. An anchor as claimed in claim 2, wherein the length of metal bar is drawn from a coil.

4. An edge-lift anchor for use in lifting a concrete component, said anchor comprising a head engagable with a clutch of a lifting system, and said anchor having a body portion for embedment with the concrete component, wherein the body portion includes a pair of opposed legs extending in a substantially longitudinal direction of the anchor, each of said legs having a foot portion which is formed to extend in a direction transverse to the longitudinal direction of the anchor so as to provide anchorage against longitudinal displacement within the concrete component.

5. An edge-lift anchor as claimed in claim 4, wherein the legs are generally parallel, and the foot portions extend substantially perpendicularly to the longitudinal direction of the anchor.

6. An edge-lift anchor as claimed in claim 4 or claim 5, wherein the legs are principally straight and the foot portions provide substantive anchorage of the anchor within the concrete.

7. An edge-lift anchor as claimed in any one of claims 4 to 6, wherein the head has an eye for engagement with a locking bolt of a clutch of the lifting system, the locking bolt extending through said eye.

8. An edge-lift anchor as claimed in any one of claims 4 to 7, wherein the anchor is formed by bending a length of metal bar.

9. An edge-lift anchor as claimed in claim 8, wherein the length of metal bar is drawn from a coil.

10. An edge-lift anchor as claimed in any one of claims 4 to 7, wherein the head and legs are cut from metal plate material, with the end portions being subsequently bent to form the foot portions.

11. An edge-lift anchor as claimed in claim 10, wherein the head and legs are cut from metal plate material by plasma arc cutting.

12. An edge-lift anchor as claimed in any one of claims 4 to 11, in combination with one or more shear bar(s).

13. An edge-lift anchor as claimed in claim 12, wherein the one or more shear bar(s) is/are permanently attached to the anchor.

14. An edge-lift anchor as claimed in claim 13, wherein the one or more shear bar(s) is/are permanently attached to the anchor by welding.

15. An edge-lift anchor as claimed in any one of claims 12 to 14, wherein the one or more shear bar(s) are adjacent a lower end of the eye so as to lie within a void

formed in the concrete component after casting so that the presence of the shear bar(s) is visible by inspection of the void into which the anchor is set, after casting of the concrete component.

16. An edge-lift anchor as claimed in any one of claims 12 to 15, wherein the shear bar(s) form(s) abutment shoulders for cooperation with the clutch body to limit clutch rotation.

17. An edge-lift anchor as claimed in any one of claims 12 to 16, wherein the or each shear bar has a bent intermediate portion which extends through an aperture of the head for coupling the shear bar to the anchor, and each end of the bent intermediate portion extends into an elongated arm.

18. An edge-lift anchor as claimed in claim 17, wherein the shear bar(s) is a single shear bar coupled to the anchor, said single shear bar extending from one end thereof around one side of the head, through the aperture of the head, and back around the other side of the head such that the two arms of the single shear bar extend from the anchor in generally opposite directions and generally perpendicular to the longitudinal direction of the anchor.

19. An edge-lift anchor as claimed in claim 17, wherein the shear bar(s) comprise a first shear bar and a second, like, shear bar both coupled to the anchor, the first shear bar extending from one end thereof around one side of the head, through the aperture of the head, and back around the other side of the head such that the two arms of the first shear bar extend from the anchor in generally opposite directions and generally perpendicular to the longitudinal direction of the anchor, and the second shear bar extending from one end thereof around the other side of the head, through the aperture of the head, and back around the one side of the head such that the second shear bar is substantially a mirror image of the first shear bar when viewed from above a top end of the anchor.

20. An edge-lift anchor as claimed in any one of claims 17 to 19, wherein the bent intermediate portion is generally S-shaped.

21. An edge-lift anchor as claimed in any one of claims 12 to 20 when dependent on claim 10, wherein the head is apertured for cooperation with the one or more shear bar(s).

22. An edge-lift anchor as claimed in any one of claims 4 to 21, wherein each of the foot portions is bent such that the foot portions extend in mutually opposite directions.

23. An edge-lift anchor as claimed in claim 22, wherein each of the foot portions extends in a direction substantially perpendicular to a plane in which both legs lie.

24. A shear bar for use in conjunction with an edge-lift anchor for use in lifting a concrete component wherein the shear bar has a bent intermediate portion for extending through an aperture of a head of the anchor for coupling the shear bar to the anchor, and each end of the bent intermediate portion extends into an elongated arm.

25. A shear bar for use in conjunction with an edge-lift anchor as claimed in any one of claims 4 to 11, wherein when coupled to the anchor the shear bar extends from one end thereof around one side of the head of the anchor, through an aperture of the head of the anchor, and back around the other side of the head such that the two arms of the shear bar extend from the anchor in generally opposite directions and generally perpendicular to a longitudinal direction of the anchor.

26. A shear bar as claimed in claim 24 or claim 25, wherein the bent intermediate portion of the shear bar is generally S-shaped.

27. A shear bar as claimed in any one of claims 24 to 26, wherein the shear bar is formed by bending a length of metal bar.

28. A shear bar as claimed in any one of claims 24 to 27, wherein the length of metal bar is drawn from a coil.

29. An anchor for use in lifting a concrete component substantially as hereinbefore described with reference to the accompanying drawings.

30. An edge-lift anchor for use in lifting a concrete component substantially as hereinbefore described with reference to the accompanying drawings.

31. A shear bar substantially as hereinbefore described with reference to the accompanying drawings.

DATED this 27th day of February, 2004

CETRAM PTY LIMITED

By DAVIES COLLISON CAVE

Patent Attorneys for the Applicant

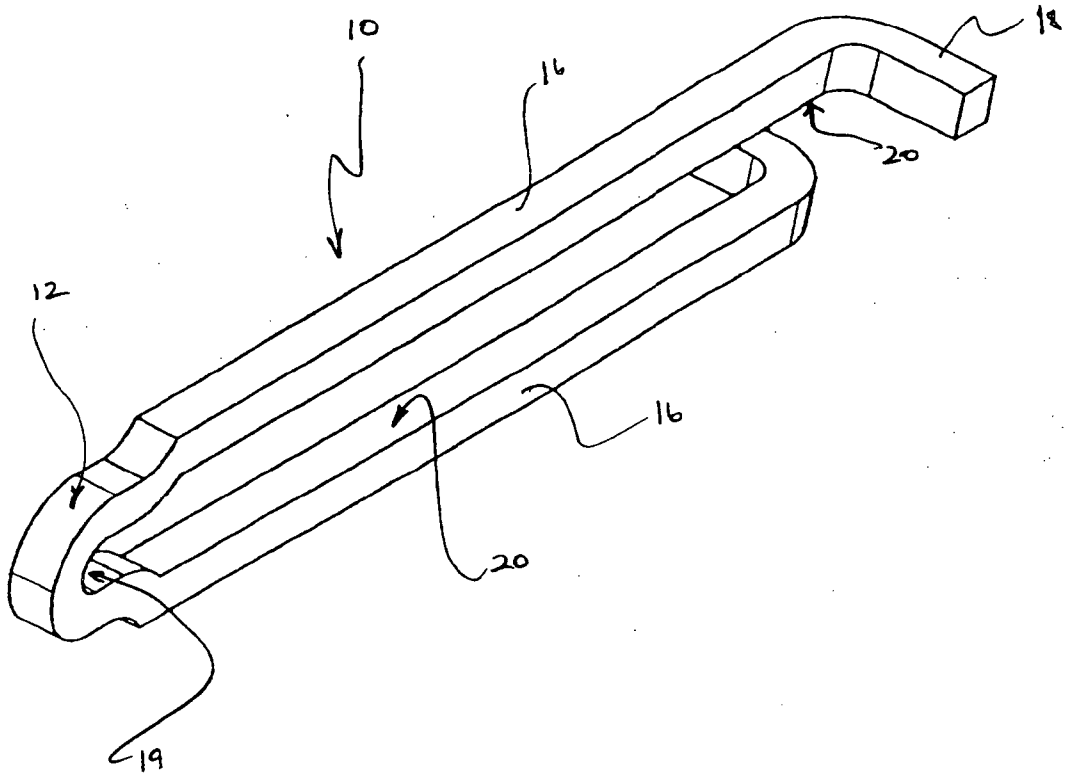

FIGURE 1

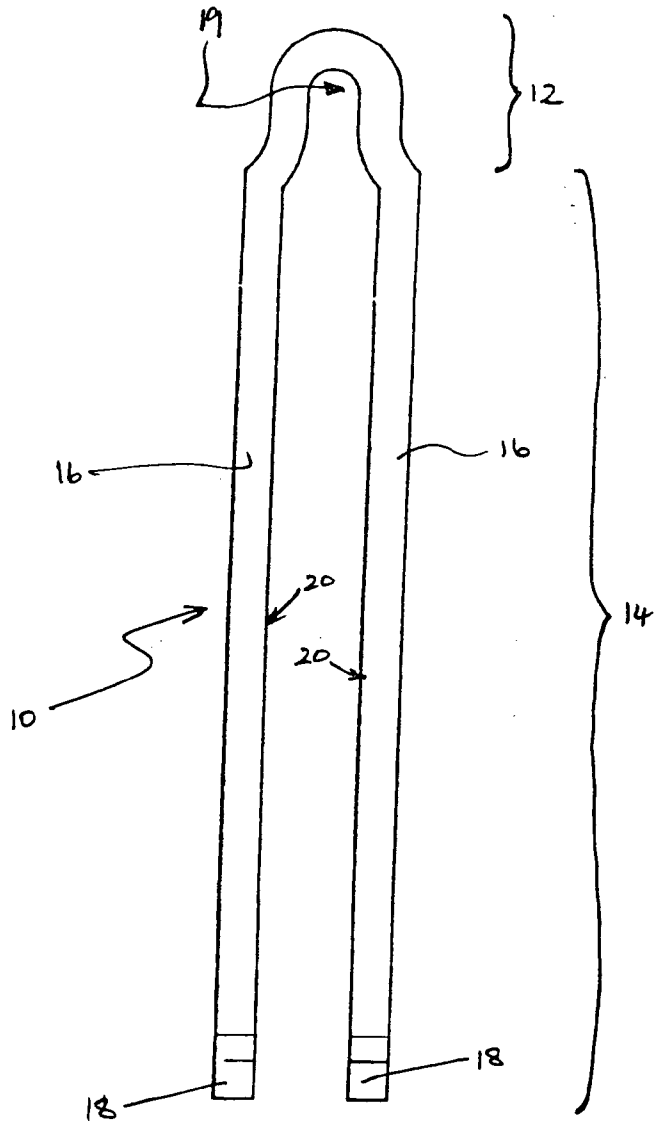

FIGURE 2

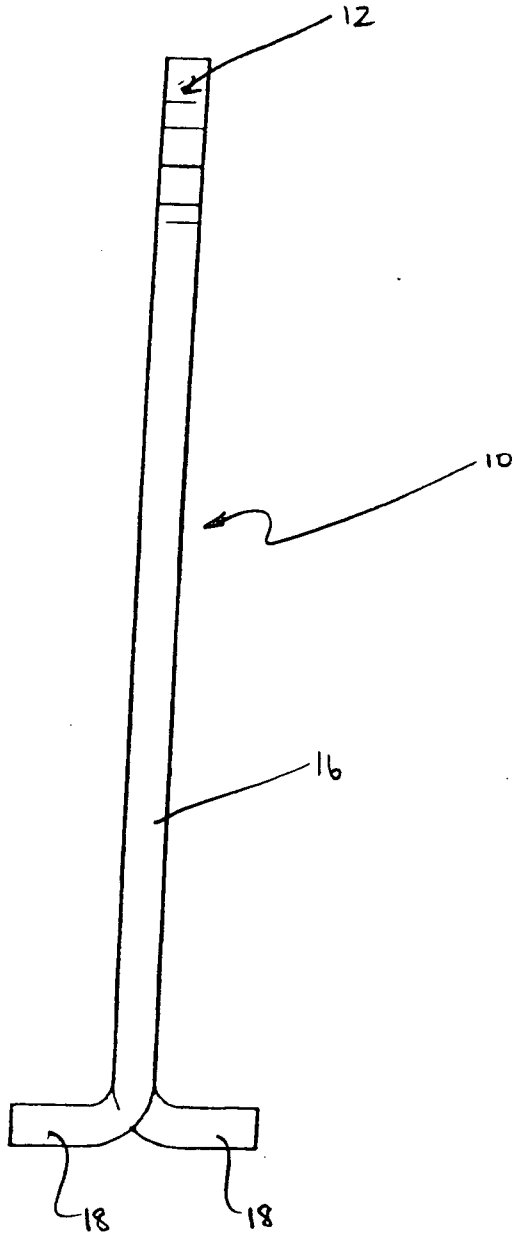

FIGURE 3

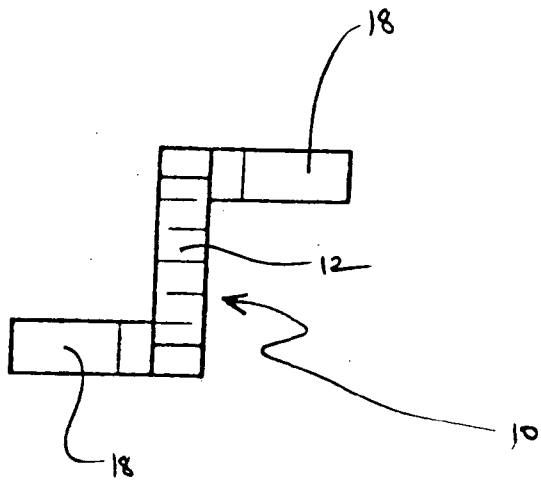

FIGURE 4

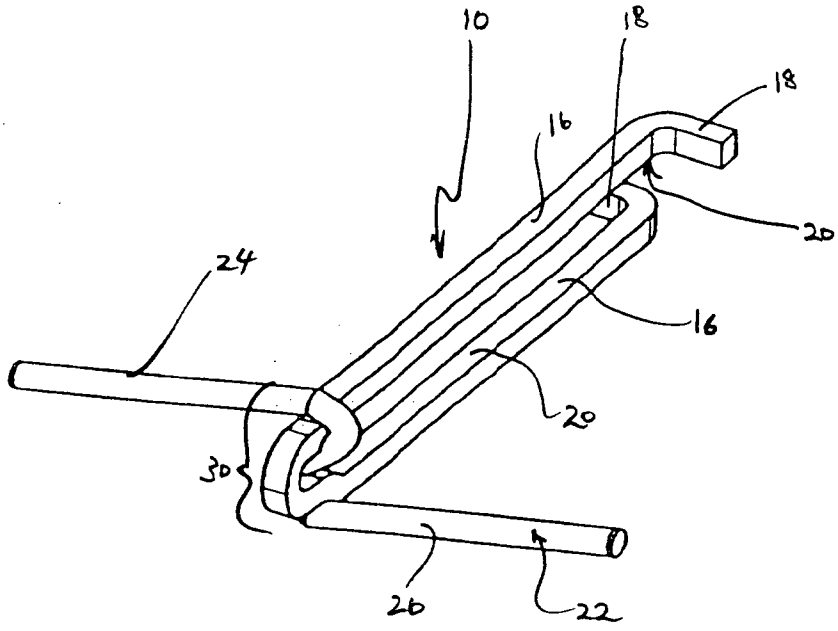

FIGURE 5

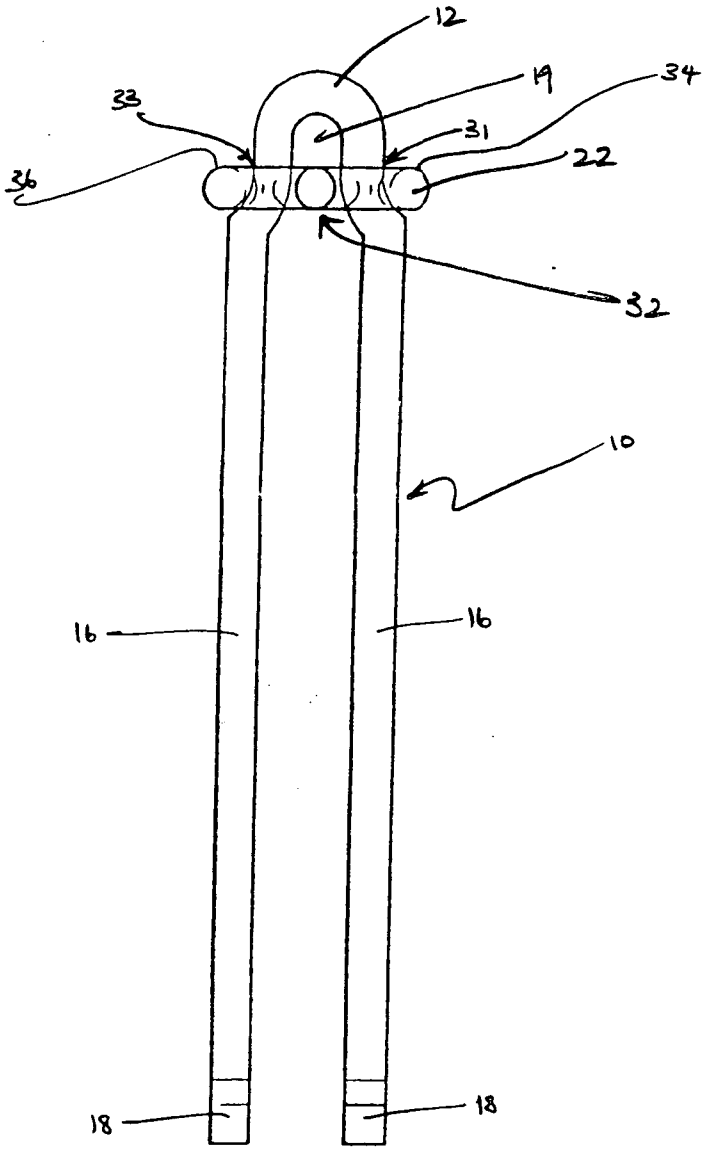

FIGURE 6

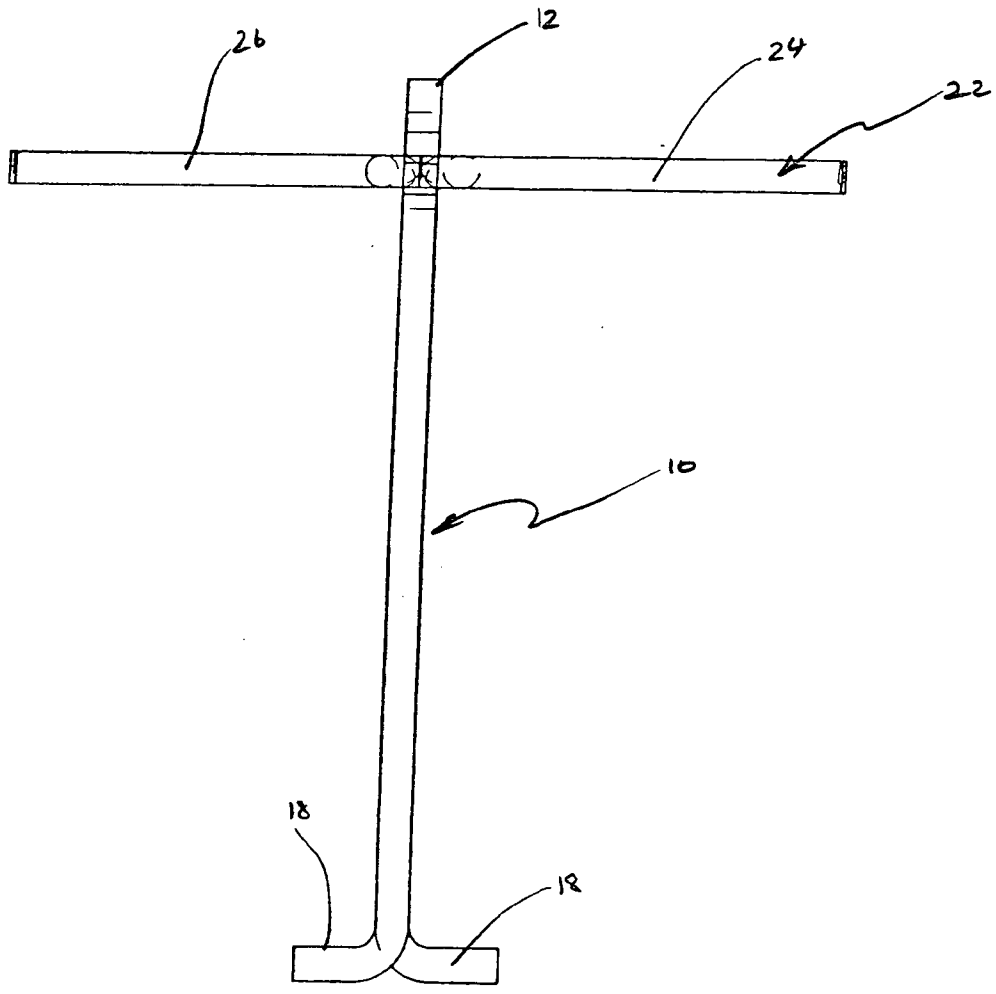

FIGURE 7

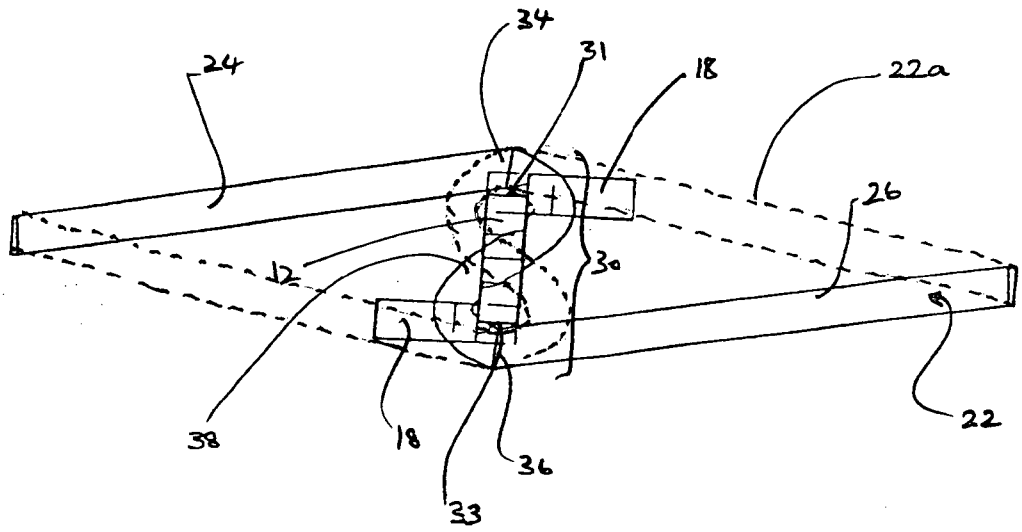

FIGURE 8

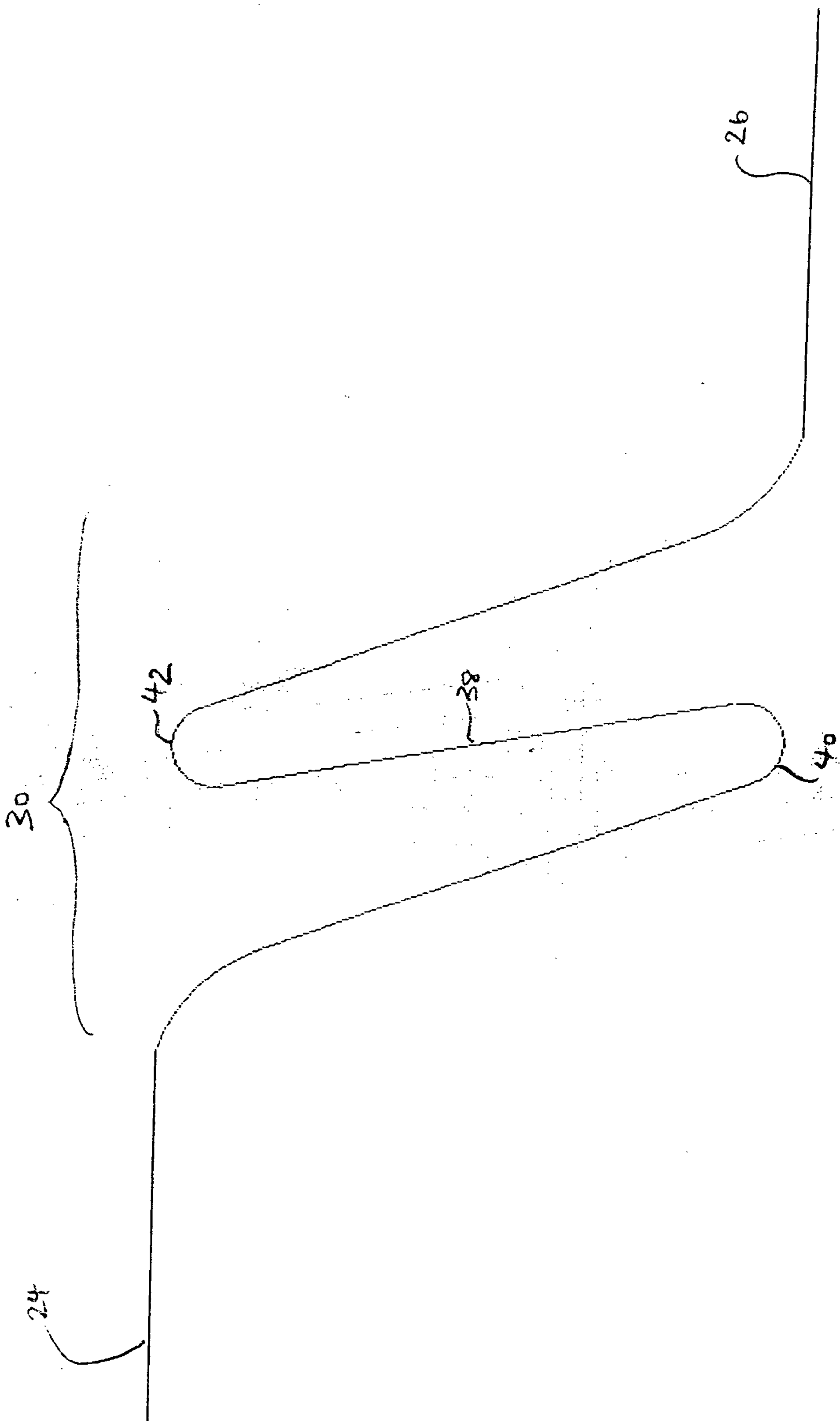

FIGURE 9a

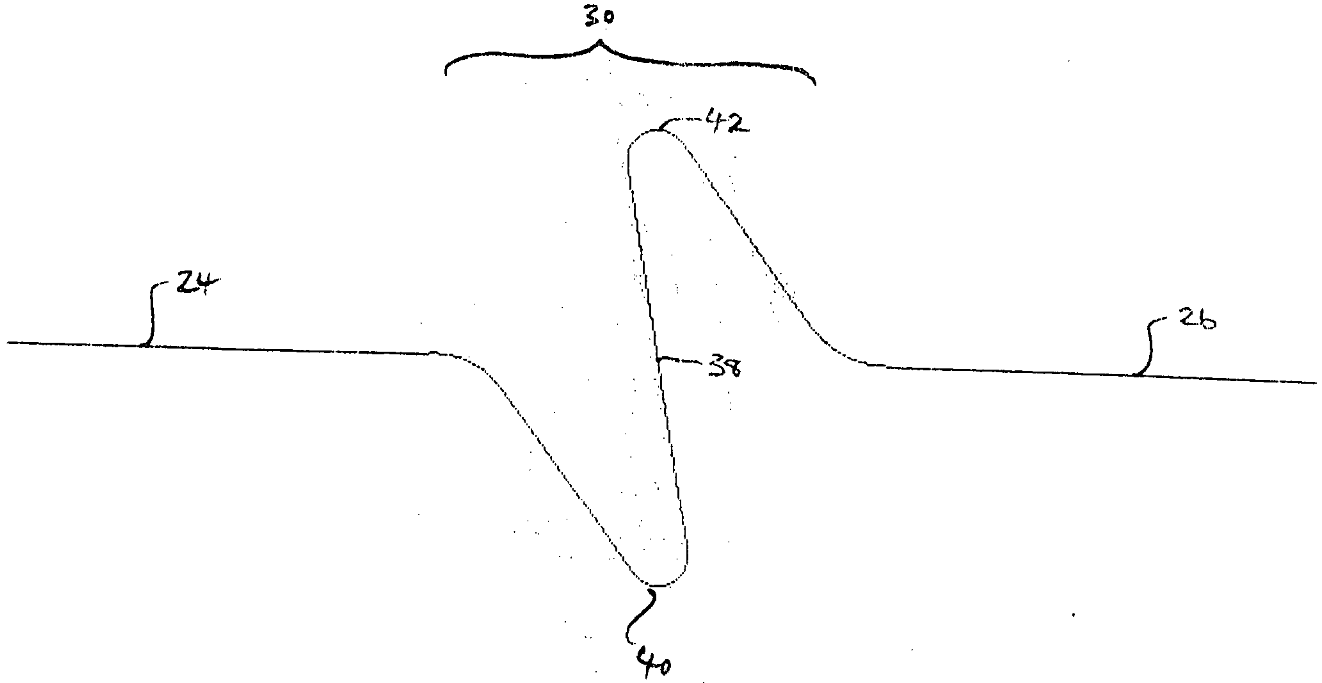

FIGURE 9b

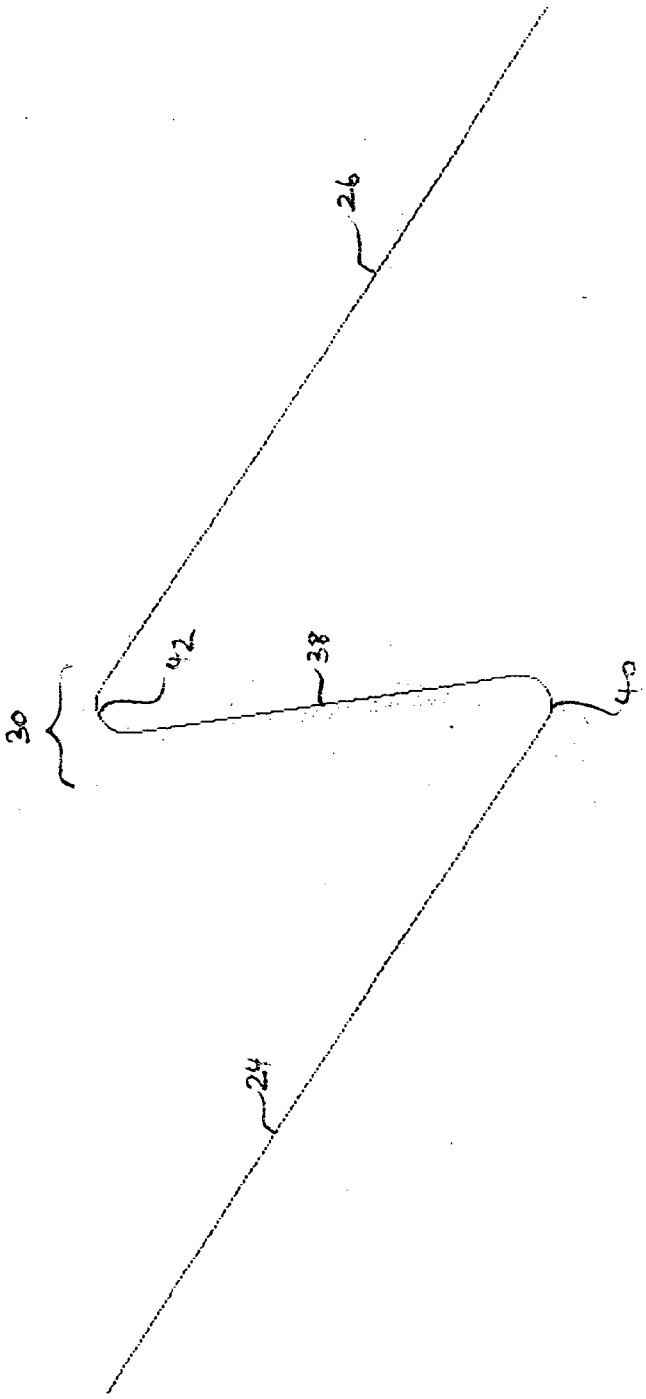

FIGURE 9c

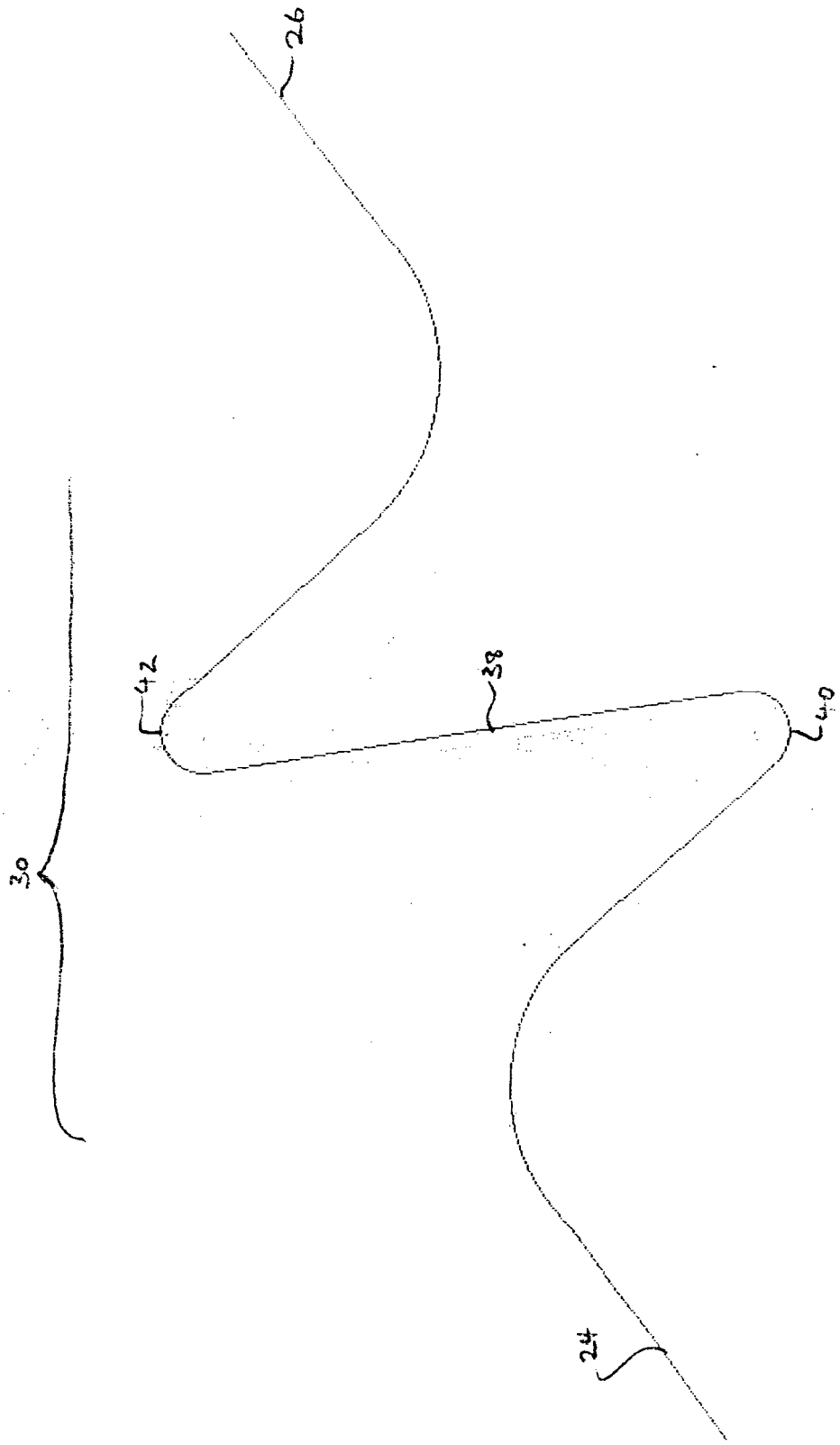

FIGURE 9d

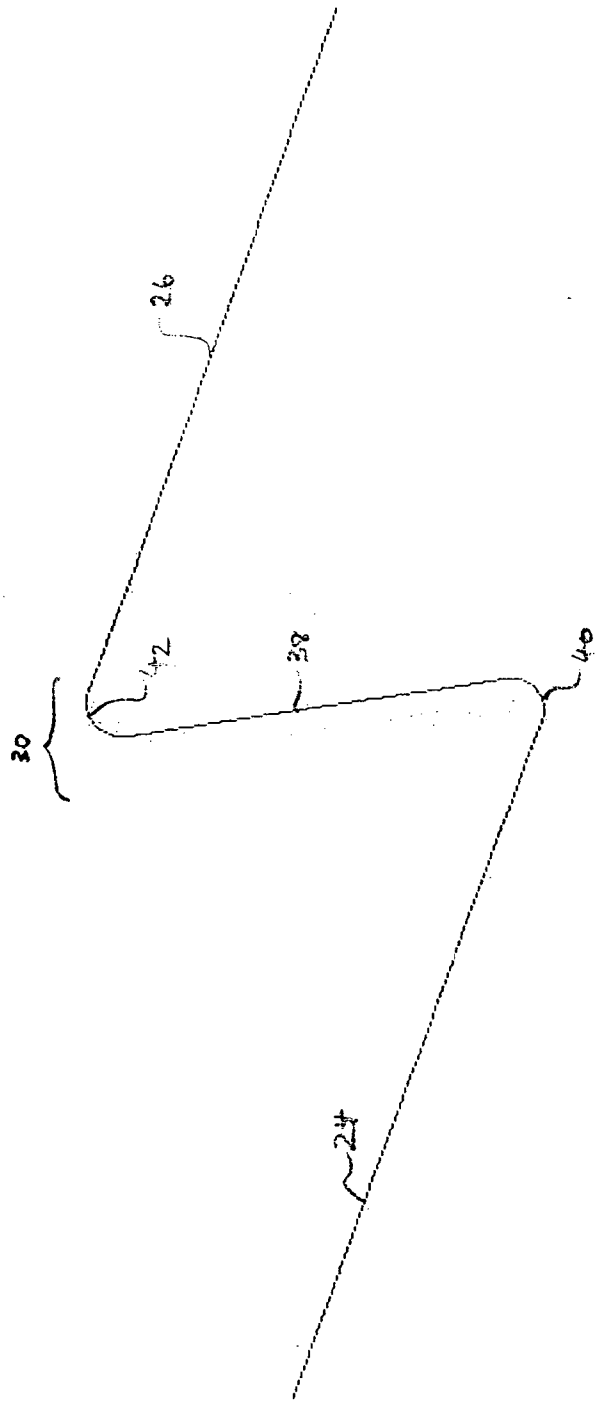

FIGURE 9e