

(12) **Patent Application Publication**  
**LINAKER**

(43) **Pub. Date:** **Apr. 7, 2011**

(57) **ABSTRACT**

(22) Filed: **Sep. 3, 2010**

### Related U.S. Application Data

(63) Continuation-in-part of application No. PCT/AU2009/000268, filed on Mar. 5, 2009.

(30) **Foreign Application Priority Data**

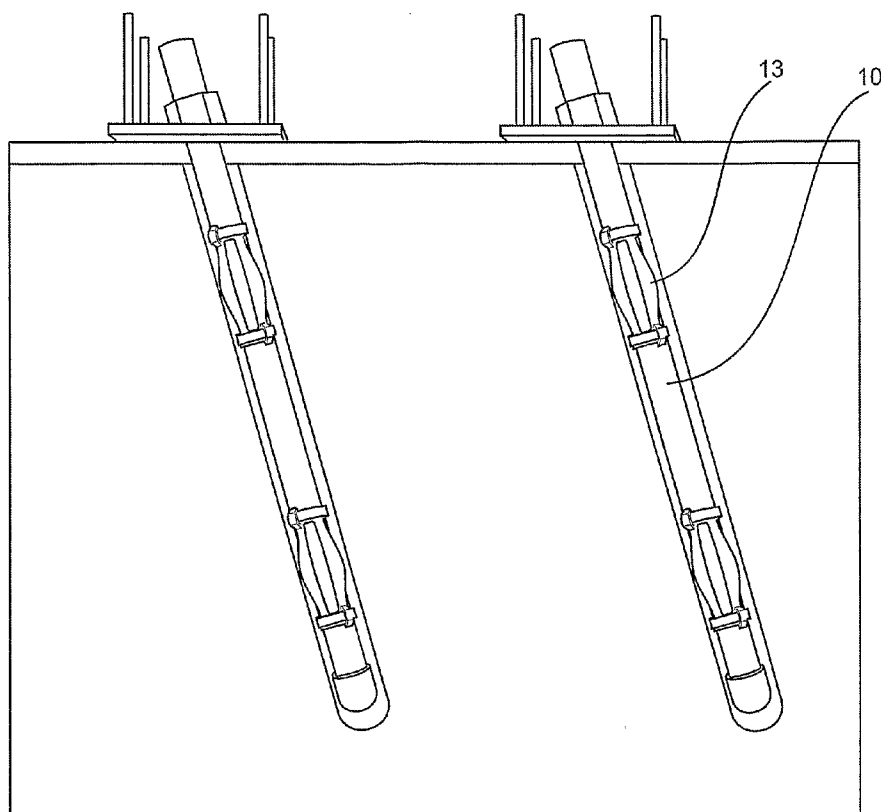
Mar. 5, 2008 (AU) ..... 2008901065

## Publication Classification

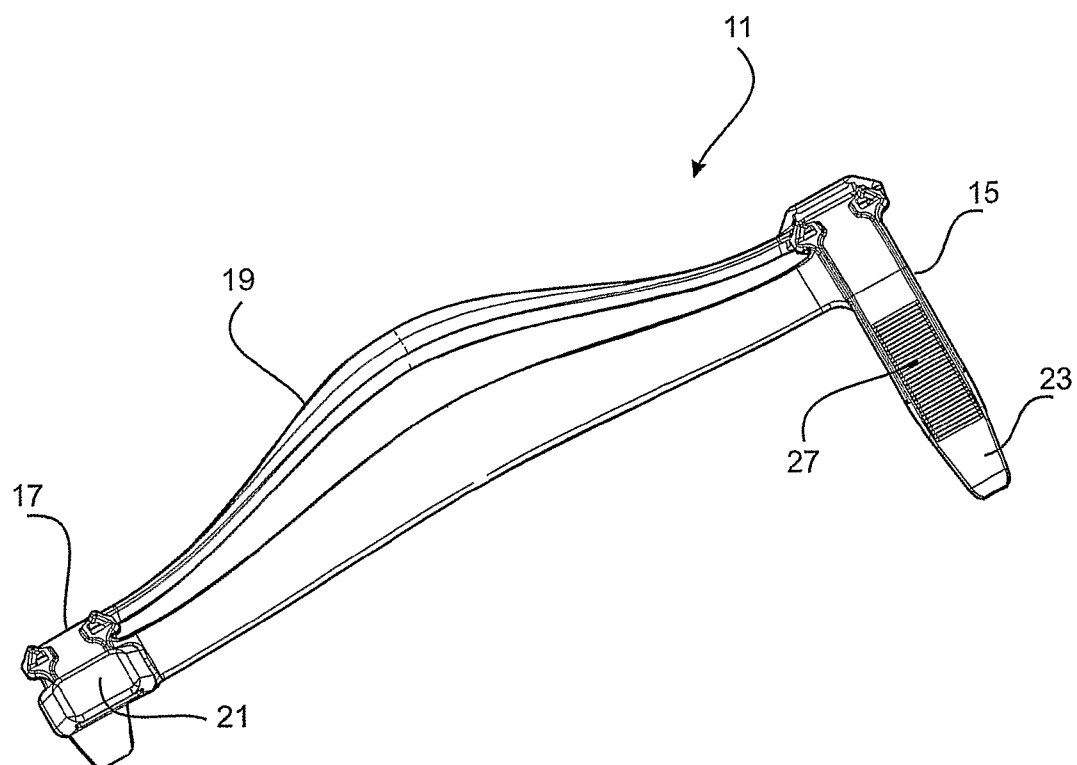
(51) **Int. Cl.**  
**E21B 17/10** (2006.01)

(52) **U.S. Cl.** ..... 166/241.6

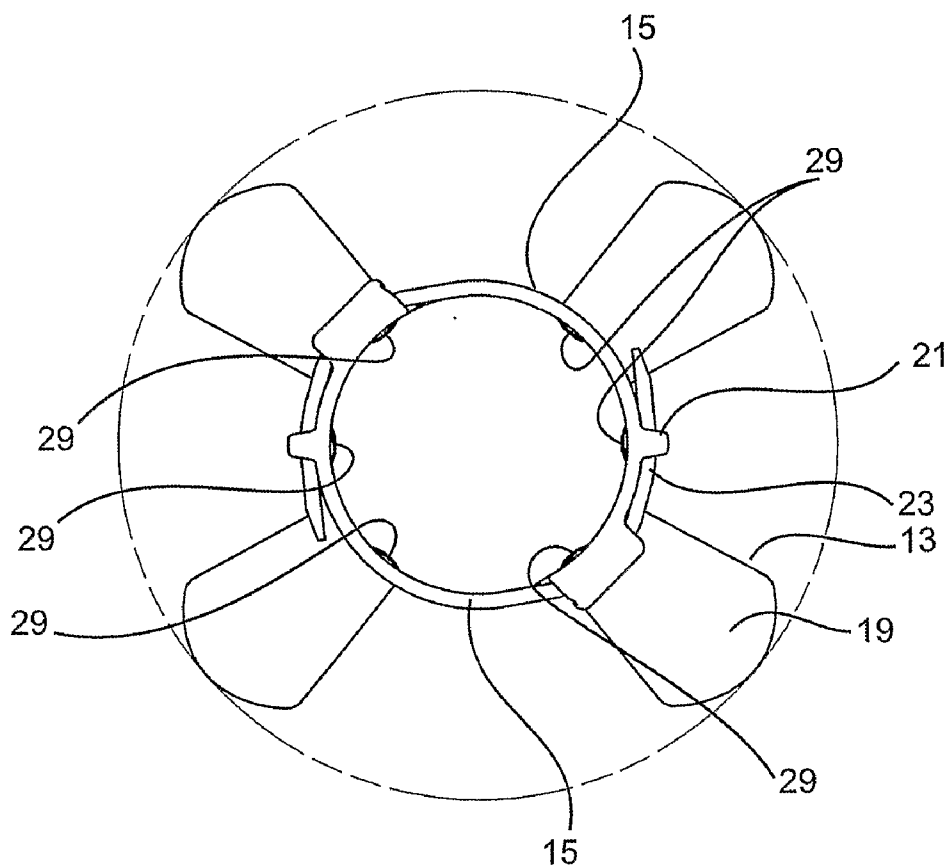
A centraliser segment (11) which can, by itself or in combination with one or more corresponding centraliser segments, be used to form a centraliser (13) which can in use be clampingly engaged around an element (10) which is receivable in a borehole, said centraliser segment comprising a first collar portion (15), a second collar portion (17) and at least one bow element (19) extending between said first collar portion and said second collar portion to maintain the collar portions in spaced relation to each other, wherein the collars have an inner face which in use is to bear against the element and wherein said bow element has a curvature along its length to define an intermediate portion which extends laterally from the centraliser segment away from the inner faces of the collars, at least the intermediate portion of the bow elements having a convex transverse profile, a first connection element (21) provided at one end of the collar portions and second connection element (23) provided at the other end of the collar portions, wherein in use said first connection element are engagable with said second connection element of the same or another centraliser segment such that one or more said centraliser segments are connectable together to form a centraliser which in use is capable of being received around the element whereby the intermediate portions are radially outermost, said first and second connection element having an adjustment means which can cause the diameter of the centraliser to be varied.



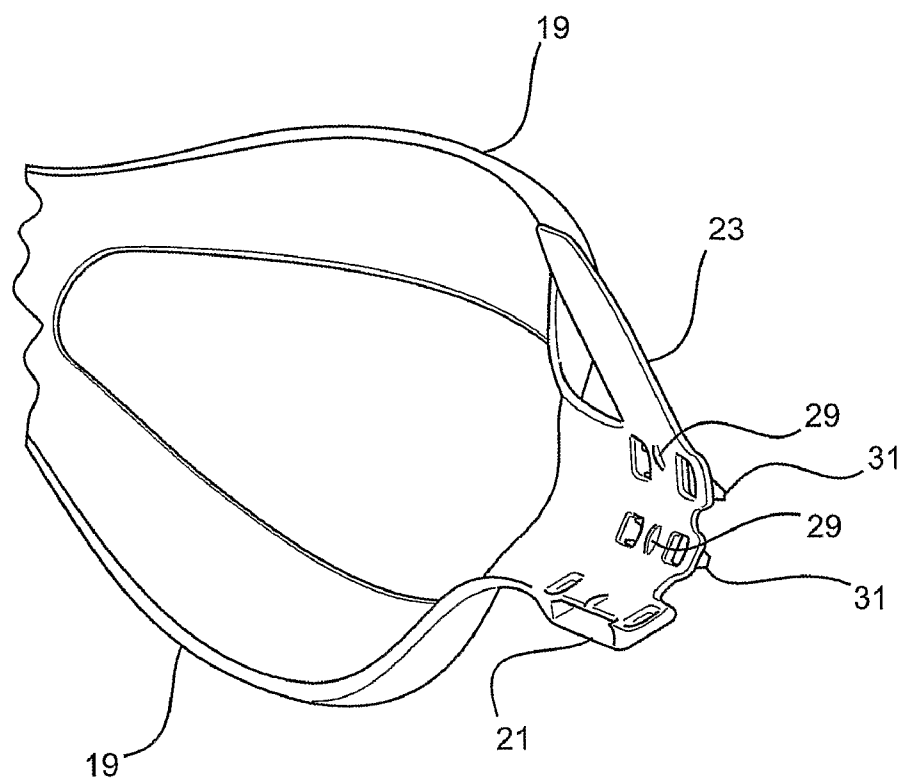




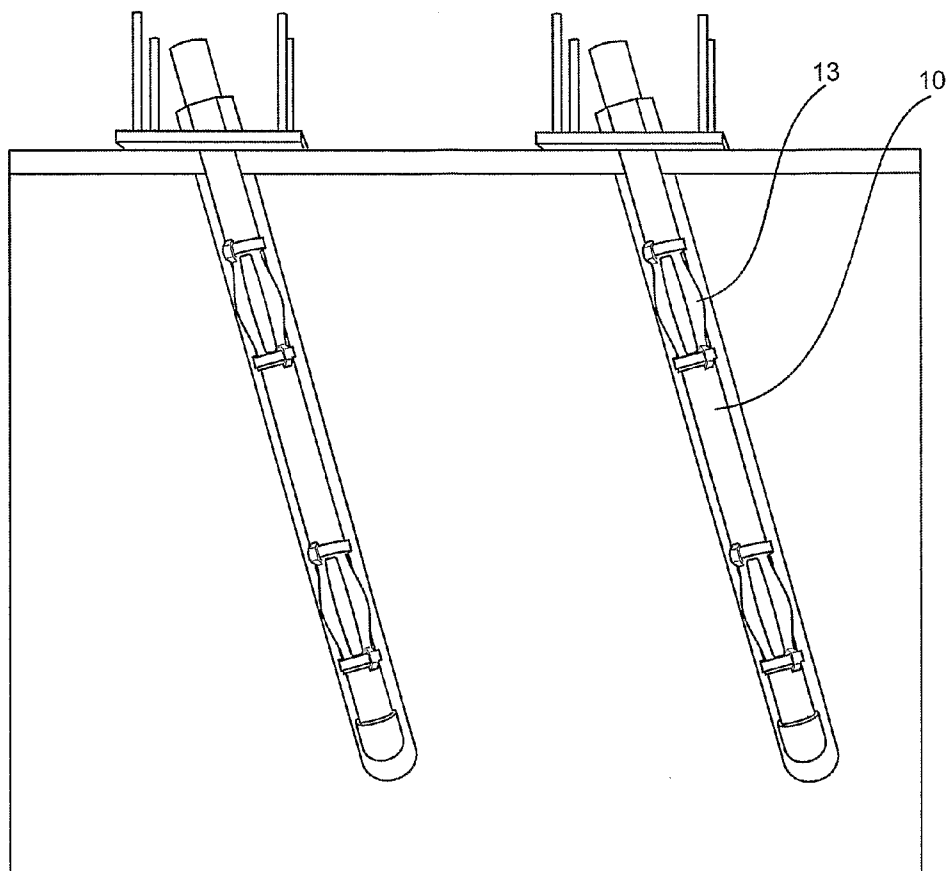
**Fig. 2**



**Fig. 3**



**Fig. 4**



**Fig. 5.**

## CENTRALISER SEGMENT AND CENTRALISER

### RELATED APPLICATIONS

[0001] This application is a continuation-in-part of PCT/AU2009/000268 filed on Mar. 5, 2009, which claims priority to Australian patent application number 2008901065 filed on Mar. 5, 2008. The contents of each of these applications is incorporated herein by reference in their entirety.

### FIELD OF THE INVENTION

[0002] The present invention relates to a centraliser segment and a centraliser formed of one or more of such centraliser segments. The centraliser can be used with items to be located within a borehole such as rock bolts and soil nails.

### BACKGROUND

[0003] One application of the centraliser is to centralise a rock bolt. A centraliser which has been previously proposed by the inventor and which could be used to centralise borehole casings and rock bolts is disclosed in AU200143778. The centraliser elements of the above patent specification incorporated a connection element which required the use of a specialised tool in causing the movement between the connection element when closing the interconnected ends of the centraliser to cause it to clamp around the casing or borehole. In addition the connection elements were generally planar and were bent to be received about the casing or rock bolt and as result their natural resilience tended to resist any tightening of the centraliser especially when being applied around elements of small diameter. While the centraliser elements of the form referred to above can be very advantageous when used with pipes or casings they present problems when applied to elements of smaller diameter such as rock bolts and soil nails.

[0004] The discussion throughout this specification, of the background and prior art to the invention is intended only to facilitate an understanding of the present invention. It should be appreciated that the discussion is not an acknowledgement or admission that any of the material referred to was part of the common general knowledge in Australia and the world as at the priority date of the application.

### DISCLOSURE OF THE INVENTION

[0005] Throughout the specification and claim, 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 integer or group of integers but not the exclusion of any other integer or group of integers.

[0006] In accordance with one aspect of the present invention, there is provided a centraliser segment which can, by itself or in combination with one or more corresponding centraliser segments, be used to form a centraliser which can in use be clampingly engaged around an element which is receivable in a borehole, said centraliser segment comprising a first collar portion, a second collar portion and at least one strap like resiliently flexible bow element extending between said first collar portion and said second collar portion to maintain the collar portions in spaced relation to each other, wherein the collars have an inner face which in use is to bear against the element and wherein said at least one bow element has a curvature along its length to define an intermediate portion which extends laterally from the centraliser segment away from the inner faces of the collars, said bow elements

being resiliently flexible and each bow element having a convex transverse profile and having a varied width along their length which is greatest at the central intermediate portion, a first connection element provided at one end of the collar portions and second connection element provided at the other end of the collar portions, wherein in use said first connection element are engagable with said second connection element of the same or another centraliser segment such that one or more said centraliser segments are connectable together to form a centraliser which in use is capable of being received around the element whereby the intermediate portions are radially outermost, said first and second connection element having an adjustment means which can cause the diameter of the centraliser to be varied.

[0007] According to a preferred feature of the invention each bow element is configured to have a curvature along its length

[0008] According to a preferred feature of the invention wherein the collar portions are curved along their longitudinal axis to have a curvature which at most approaches the curvature of the element to which the centraliser is to be applied.

[0009] According to a preferred feature of the invention the first connection element comprises a passage formed along the respective collar portion to extend inwardly from the respective end and the second connection element comprises an elongate element which in use is able to be received in the passage, the elongate element formed with a set of serrations spaced along at least a portion of its length, the passage formed with a pawl element which is positioned to resiliently engage the serrations to control the longitudinal movement of the elongate portion when received in the passage. According to a preferred feature of the invention the engagement of the pawl member with the serrations is such as to permit the reduction in diameter of the centraliser but to resist an increase in the diameter of the centraliser. According to a preferred feature of the invention the outer face of the collar is provided with a pair of transversely spaced retention lugs located in spaced relationship from the passage, the retention lugs configured and arranged to receive the portion of the elongate element passing from the passage on application of the centraliser to the element to hold the portion in close abutting relationship with the outer face of the collar. According to a preferred feature of the invention a plurality of pairs of retention lugs are provided.

[0010] According to a preferred feature of the invention at least two bow elements extend between said first and second collar portions.

[0011] According to a preferred feature of the invention, said first and second collar portions are substantially parallel.

[0012] According to a preferred feature of the invention said first and second collar portions are provided as strap-like members.

[0013] According to a preferred feature of the invention said centraliser segment is made of a corrosion resistant material.

[0014] According to a preferred feature of the invention the inner face of the collars between the connection element is provided with a protrusion at spaced intervals along the length of the collars. According to a preferred feature of the invention the protrusions comprise a rib-like formation extending transversely across the inner face of the collars.

[0015] In accordance with a second aspect of the present invention, there is provided a centraliser for an element com-

prising a centraliser segment, as hereinbefore described, wherein the ends of one or more centraliser segments are connected together via said first and second connection element around the element to provide a centraliser for the element.

[0016] The invention will be more fully understood in the light of the following description of one specific embodiment.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The description is made with reference to the accompanying drawings, in which:

[0018] FIG. 1 is an isometric view of a centraliser segment according to the first embodiment;

[0019] FIG. 2 is a side elevation of a centraliser segment according to the first embodiment.

[0020] FIG. 3 is an end elevation of two centraliser segments according to the first embodiment joined together to form a centraliser;

[0021] FIG. 4 is an isometric view of the centraliser showing the inner face of the centraliser segment; and

[0022] FIG. 5 is an illustrative view of a centraliser according to the first embodiment in position around a rock bolt which is in position within a bore hole.

#### DETAILED DESCRIPTION OF SPECIFIC EMBODIMENT

[0023] The embodiment comprises a centraliser segment 11 which is intended in use to be used by itself or in combination with other corresponding centraliser segments to form a centraliser 13 which can be applied to a rock bolt 10 as shown at FIG. 4 whereby the ends of a single segment or a set of interconnected segments are connected together to form an annular centraliser 13 which in use is to be located around the rock bolt 10 to centralise the rock bolt 10 within a borehole. The use of a set of interconnected segments to form a centraliser 13 is required with rock bolts 10 having medium to large diameters, whilst the use of a single segment to form the centraliser 13 is appropriate with rock bolts 10 having small diameters. The centralisers 13 are formed of a suitable plastics material which is resistant to corrosion and has sufficient rigidity and resilience to perform its function as a centraliser.

[0024] The centraliser segment 11 according to the embodiment comprises a first collar portion 15 and a second collar portion 17 which are held in spaced parallel relationship by a set of substantially parallel bow elements 19, which extend between the first and second collar portions 15 and 17. The first and second collar portions 15 and 17 are curved along their length.

[0025] The bow elements 19 are strap-like members which are curved along their length such that the central intermediate portion of the bow elements 19 extends laterally to one side of the centraliser segment. When the centraliser 13 is mounted to the rock bolt 10 (as shown at FIG. 4) the collar portions 15 and 17 snugly engage the rock bolt 10 while the bow elements 19 extend outwardly from the side of the rock bolt 10 to locate the rock bolt 10 centrally within the bore hole. In addition the bow elements have a varied width along their length which is greatest at the central intermediate portion. In addition each bow element has a convex transverse external profile.

[0026] Each end of each collar portion is provided with connector element 21 and 23 where the connector elements

on each collar are the same and the connector elements on each collar are complementary to each other and enable the ends of a centraliser element or of another corresponding centraliser element to be lockingly interconnected as shown at FIG. 3 to define a centraliser 13. In addition once the connector elements are inter-engaged to form a centraliser 13 the diameter of the resultant centraliser 13 is able to be varied.

[0027] The first connector elements 21 which are provided at one end of both collar portions comprises a longitudinally directed passage 25 which is formed on the outer face of the collar. The interior of the passage is provided with a pawl (not shown). The second connector elements 23 are formed as tongue-like extensions of the collar and are dimensioned and configured to be slidably receivable in the passage 25 of the first connector elements. The passage is of similar cross section to the tongue-like extensions. The outer face of the extensions are formed with a set of serrations 27. When the extension of the second connector is received in the passage 25 of the respective first connector the pawl within the respective passageway will engage with the serrations 27 to retain the extension within the passage. The nature of the engagement is such that the extensions can move within the respective passage to reduce the diameter of the centraliser but cannot move such as to increase the diameter of the centraliser. Each passage 25 is associated with pairs of retention lugs 31 which are located at spaced intervals from the inner axial end of the respective passage. Each of the retention lugs are formed at their outer ends with a flange like extension where the portions of each pair of lugs are in opposed relation to each other. The spacing between each pair of lugs and the spacing of their flange-like extensions is such that the lugs will receive and retain the portion of the ends of the second connector elements after they have passed through the passage.

[0028] The free ends of the single centraliser segment or of a set of interconnected centraliser segments are interconnected to form a centraliser 13. In the case of small diameter rock bolt 10, a single centraliser segment can be used and in the case of larger diameter rock bolt 10 two or more centraliser segments 11 are able to be connected together end to end via the first and second connectors 21 and 23. The interconnection between the ends is effected by inserting the extensions of the second connectors into the passage 25 of the respective first connectors until the serrations 27 on the second connectors are engaged by the pawl and as a result the further movement of the extension within the passage is controlled by the pawl. The diameter of the centraliser 13 is able to be adjusted through a range which is determined by the length of the serrated portion 27 of the extensions.

[0029] In addition as shown at FIGS. 3 and 4 the inner face of each collar is provided with a set of protrusions or fillets 29 at spaced intervals along the collar. Each of the protrusions or fillets comprises a rib and which is located centrally across the width of the inner face of the collar to extend transversely across the inner face of the collar.

[0030] In use the centraliser 13 is fixed around the rock bolt 10 prior to the rock bolt 10 being inserted into a borehole. The amount of longitudinal curvature in the bow elements 19 of the centraliser segments forming a centraliser 13 can be varied to accommodate for the clearance between the borehole 10 and the rock bolt 10. This can be done by first affixing one collar of the centraliser 13 around the rock bolt 10 and tightening it around the rock bolt 10. If an increased curvature is required in the bow elements 19 then the other collar is located around the rock bolt 10 and is pushed in the direction

of the one collar and then it is firmly clamped around the rock bolt **10**. Pushing the collar portions together will increase the curvature of the bow elements **19**. Alternatively pulling the collar portions away from each other will lessen the curvature of the bow elements **19**.

**[0031]** Due to the bow elements **19** being flexibly resilient, as the rock bolt **10** is pushed into the borehole, the bow elements **19** will resiliently deform if they encounter any obstruction in the wall of the borehole and once the bow elements **19** pass over the obstruction, they will return to their normal shape to maintain contact with the wall borehole. Maintaining the bow elements **19** in contact with the wall of the borehole ensures that the rock bolt **10** remains centralised as it is inserted into the borehole.

**[0032]** One advantage offered by the embodiment is that the application of the centraliser according to the embodiment does not require the use of a specialised tool which is the case of at least some of the embodiments of AU200143778.

**[0033]** Furthermore the convex transverse external profile of the bow elements provides a further advantage since such curvature ensures that in the event the centraliser is caused to rotate within the borehole as a result of rotation of the rock bolt **10** within the borehole the convex cross section of the bows enables the lateral edges of the bow elements to remain clear of the side walls of the borehole and will not become engaged with the sides of the borehole thus enabling the centraliser to more readily rotate with the rock bolt. In action the curvature of the bows provides a further advantage in that it improves the strength of the bows when compared with the bows of AU200143778.

**[0034]** Furthermore the feature of the bow elements having a variable width and that the bow elements have the greatest width intermediate their length provides the following advantages:

**[0035]** It maximises the flexural strength of the bows, and therefore the centralizing force that is applied to the casing or rockbolt.

**[0036]** It increases the surface area of the portion of the bows that is to come into contact with the borehole wall, thereby reducing the pressure exerted by the bow on the borehole wall at the contact point whilst maintaining the desired centralising force which reduces the potential for the bows to track and or gouge into softer formations.

**[0037]** The reduction in pressure also reduces wear/abrasion on the bows.

**[0038]** Increasing the width of the bows along their entire length would interfere with the flexibility of the collar portions, reducing the range of diameters to which the centralizer segments can be applied.

**[0039]** Furthermore the inherent curvature of the collars enable the centraliser to be applied around the rock bolt and whereby the degree of force required to tighten the centraliser to the rock bolt is reduced. This is of significant advantage where the centraliser is used with small diameter rock bolts. Furthermore in the case of rock bolts having a diameter greater than the curvature of the collar portions the resultant centraliser will be clampingly received around the rock bolt and the tightening of the connectors only serves to supplement such engagement.

**[0040]** A further advantage of the centraliser segment according to the embodiment is the presence of the protrusions **29** which serve to improve the frictional engagement of the centraliser with the rock bolt to prevent longitudinal

movement and angular movement of the centraliser along and around the element respectively.

**[0041]** A further advantage of the centraliser segment according to the embodiment is that on interconnection of connector elements of the collars to form a centraliser the free ends of the second connector elements which pass from the passages of the first connector elements are retained in snug engagement with the outer face of the collar by the retention lugs **31** and it becomes unnecessary to trim the free ends of the second connector elements before inserting the element into a borehole

**[0042]** The present invention is not to be limited in scope by the specific embodiment described herein. The embodiment is intended for the purpose of exemplification only. Functionally equivalent products, elements and methods are clearly within the scope of the invention as described herein. In addition the invention is not limited to use with rock bolts but can be used with any other similarly dimensioned element which is to be located within a borehole.

The claims defining the invention is as follows:

1. A centraliser segment which can, by itself or in combination with one or more corresponding centraliser segments, be used to form a centraliser which can in use be clampingly engaged around an element which is receivable in a borehole, said centraliser segment comprising a first collar portion, a second collar portion and at least one strap-like resiliently flexible bow element extending between said first collar portion and said second collar portion to maintain the collar portions in spaced relation to each other, wherein the collars have an inner face which in use is to bear against the element and wherein said bow element has a configuration such as to define an intermediate portion which extends laterally from the centraliser segment away from the inner faces of the collars, said bow elements having a convex transverse profile and having a varied width along their length which is greatest at the intermediate portion, a first connection element provided at one end of the collar portions and a second connection element provided at the other end of the collar portions, wherein in use said first connection element are engagable with said second connection element of the same or another centraliser segment such that one or more said centraliser segments are connectable together to form a centraliser which in use is capable of being received around the element at which position the intermediate portions are radially outermost, said first and second connection element having an adjustment means which can cause the diameter of the centraliser to be varied.

2. A centraliser segment as claimed at claim 1 wherein each bow element is configured to have a curvature along its length.

3. A centraliser segment as claimed at claim 1 wherein the collar portions are curved along their longitudinal axis to have a curvature which at most approaches the curvature of the element to which the centraliser is to be applied.

4. A centraliser segment as claimed at claim 1 wherein the first connection element comprises a passage formed along the respective collar portion to extend inwardly from the respective end and the second connection element comprises an elongate element which in use is able to be received in the passage, the elongate element formed with a set of serrations spaced along at least a portion of its length, the passage associated with a pawl element which is positioned to resiliently engage the serrations to control the longitudinal movement of the elongate portion when received in the passage.

5. A centraliser segment as claimed at claim 4 wherein the engagement of the pawl member with the serrations is such as to permit relative movement between the pawl and the passage to cause a reduction in diameter of the centraliser but to resist an increase in the diameter of the centraliser.

6. A centraliser segment as claimed at claim 4 wherein outer face of the collar is provided with a pair of transversely spaced retention lugs located in spaced relationship from the passage, the retention lugs configured and arranged to receive the portion of the elongate element passing from the passage on application of the centraliser to the element to hold the portion in close abutting relationship with the outer face of the collar.

7. A centraliser segment as claimed at claim 6 wherein a plurality of pairs of retention lugs are provided.

8. A centraliser segment as claimed at claim 1 wherein at least two bow elements extend between said first and second collar portions.

9. A centraliser segment as claimed claim 1 wherein said first and second collar portions are substantially parallel.

10. A centraliser segment as claimed at claim 1 wherein said first and second collar portions are provided as strap-like members.

11. A centraliser segment as claimed claim 1 wherein said centraliser segment is made of a corrosion resistant material.

12. A centraliser segment as claimed at claim 1 wherein the inner face of the collars between the connection element is provided with a protrusion at spaced intervals along the length of the collars.

13. A centraliser segment as claimed at claim 12 wherein the protrusions comprise a rib-like formation extending transversely across the inner face of the collars.

14. A centraliser for an element comprising a centraliser segment of the form as claimed at claim 1 wherein the ends of one or more centraliser segments are connected together via said first and second connection element around the element to provide a centraliser for the element.

\* \* \* \* \*