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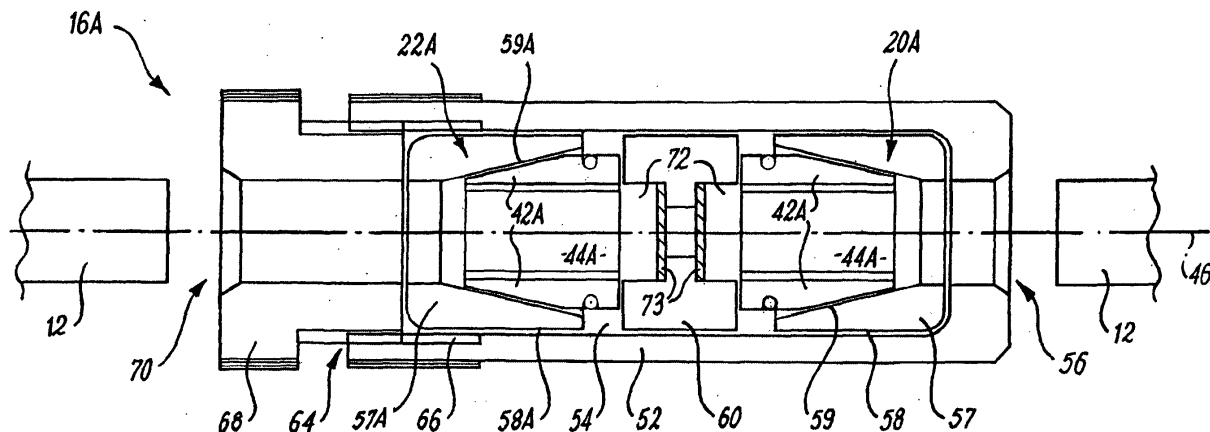
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(54) **Reinforced concrete bodies**

(57) An attachment arrangement 16A has two collet arrangements 20A, 22A. A main body 52 has a passage 54 containing taper inserts 57, 57A. Collar parts 42A are housed within the inserts 57, 57A. The collar parts 42A also abut a spacer 60 which is free to move axially within the passage 54. The length of the passage is governed

by a member 68, threaded in the main body 52. As the member 68 is tightened, the collar parts 42A are squeezed between the spacer 60 and the respective tapering walls 59, 59A of the inserts 57, 57A. This presses the collar parts 42A inwardly to grip a rebar 12 which has been inserted within the body 52.



**Fig. 2**

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## Description

**[0001]** The present invention relates to apparatus for use in forming reinforced concrete bodies.

**[0002]** A reinforced concrete body may consist of a reinforcing bar or frame of interconnected reinforcing bars embedded within the concrete, to provide reinforcement. Reinforcing bars are often connected together, such as by welding, within the body or for connection between bodies.

**[0003]** The present invention provides an attachment arrangement for use in forming a mechanical connection between elongate reinforcing members for concrete, the arrangement having the form of two collet arrangements for receiving and gripping the ends of respective elongate members, each collet arrangement comprising a plurality of collar parts which together define between them a space for receiving the respective reinforcing member to form a collar therearound, the collar parts together defining a tapering outer surface for the collar and being located within a tapering passage, the arrangement further comprising an abutment member movably located within the passage and between the collar parts of the respective collet arrangements, and an adjustment arrangement operable, in use, to reduce the length of the passage, whereby to simultaneously tighten both collet arrangements around their respective elongate members.

**[0004]** Preferably, the adjustment arrangement includes a threaded member which is threadably movable to change the length of the passage. The passage preferably houses at least one taper insert which defines the tapering passage and receives the collet parts of one of the collet arrangements, so that movement of the taper insert causes the grip of the collet parts to change. The taper insert may have a face against which the threaded member bears when moved, to move the taper insert. The bearing face is preferably generally transverse to the tapering passage, the threaded member being rotatable about the axis of the tapering passage to move axially by virtue of the thread, and thereby to cause the taper insert to move.

**[0005]** The tapering outer surfaces of the collar parts are preferably substantially frusto-conical. The tapering passage may be substantially complementary to the outer surfaces of the collar parts, in the region by which the collar parts are engaged.

**[0006]** The collet arrangements are preferably generally oppositely directed.

**[0007]** The invention also provides an attachment arrangement for use in forming a mechanical connection to an elongate reinforcing member for concrete, the arrangement including a collet arrangement for receiving and gripping the end of the elongate member, the collet arrangement comprising a plurality of collar parts which together define between them a space for receiving the reinforcing member to form a collar therearound, the collar parts together defining a tapering outer surface for

the collar and being located within a tapering passage, the tapering passage being defined by a taper insert, so that movement of the taper insert causes the grip of the collar parts to change, and the taper insert having a face against which a threaded member bears as it turns, to move the taper insert and adjust the collet arrangement.

**[0008]** Preferably the bearing face is generally transverse to the tapering passage, the threaded member being rotatable about the axis of the tapering passage to move axially by virtue of the thread, and thereby cause the taper insert to move.

**[0009]** The tapering outer surfaces of the collar parts are preferably substantially frusto-conical. The tapering passage is preferably substantially complementary to the outer surfaces of the collar parts, in the region by which the collar parts are engaged.

**[0010]** The arrangement may further comprise a second collet arrangement for receiving a second elongate member, there being an abutment member movably located within the passage and between the collar parts of the respective collet arrangements, whereby the threaded member is movable, in use, to reduce the length of the passage, whereby to simultaneously tighten both collet arrangements around their respective elongate members.

**[0011]** Preferably, the two collet arrangements are generally oppositely directed.

**[0012]** Examples of the present invention will now be described in more detail, by way of example only, and with reference to the accompanying drawings, in which:

Fig. 1 is a schematic perspective diagram of a reinforced concrete body incorporating attachment arrangements in accordance with the present invention;

Fig. 2 is an enlarged, part-sectional view of an attachment arrangement used within the body of Fig. 1;

Fig. 3 illustrates an alternative form of attachment arrangement; and

Fig. 4 illustrates a further alternative form of attachment arrangement.

**[0013]** Fig. 1 indicates at 10 the outline of a reinforced concrete body. Within the body, a frame of elongate reinforcing members (or "rebars") are provided, prior to the concrete material 14 being cast around the frame of members 12. In the final form of the body 10, the frame of members 12 are therefore embedded within the material 14 to provide reinforcement.

**[0014]** The rebars 12 are mechanically connected at their ends by attachment arrangements 16. The arrangements 16 connect the rebars 12 end-to-end. Other joints may be formed e.g. by welding, such as at 18. The rebars 12 may be of various different lengths and orien-

tations, allowing a frame of appropriate shape to be formed for reinforcing the body of concrete, which may be of simple or complex shape.

**[0015]** It is envisaged that the body 10 will be cast by providing shuttering once the frame of rebars 12 has been formed, and pouring concrete into the void within the shuttering, around the rebars 12, thereby embedding them within the body 10. The body may, for example, be a component of a structure such as a building or bridge, in which case, the body may be cast in its final location.

**[0016]** Fig. 2 illustrates an attachment arrangement 16A. The attachment arrangement 16A has two collet arrangements 20A, 22A, facing in generally opposite directions, for receiving the ends of respective rebars 12.

**[0017]** The arrangement 16A has a main body 52 through which a passage 54 extends. The passage 54 is of generally constant cross-section. At one end of the passage 54, a relatively narrow mouth 56 provides an entry aperture for a rebar 12. Within the passage 54, adjacent the mouth 56, a taper insert 57 is located. This has a cylindrical outer surface 58, complementary to the passage 54, and tapering frusto-conical inner walls 59, within which collar parts 42A are received. The collar parts 42A abut a spacer 60 which is free to move axially within the passage 54. The insert 57 is also free to move axially along the passage 54.

**[0018]** There may be three or more parts 42A arranged around the axis 46 of the passage 54. The collar parts 42A define between them a space 44A which has parallel sides, aligned with the axis 46 of the tube 24. The outer surfaces of the parts 42A are substantially frusto-conical and complementary with the frusto-conical inner walls 59. Accordingly, movement of a collar part toward or away from the mouth 56 will cause the part 42A to move closer to or away from the central axis 46. Moving the collar parts in this way will thus cause the space 44A to contract or expand according to the axial position of the parts 42A relative to the taper insert 57. Circumferential gaps (not shown) between adjacent collar parts 42A will also increase or reduce as the collar expands and contracts.

**[0019]** At the other end of the arrangement 16A, the passage 54 has a second mouth 64 of the same width as the passage 54. The mouth 64 leads into an internally-threaded passage section 66 within which an externally threaded member 68 is engaged. The member 68 defines a further mouth 70 through which a rebar 12 may be introduced into the passage 54. A second taper insert 57A is provided in the passage 54, between the member 68 and the spacer 60, so that the member 68 bears on the transverse face of the insert 57A. The taper insert 57A is identical to the insert 57, but is reversed so that the inner walls 59A again open toward the spacer 60. A second set of collar parts 42A are received between the walls 59A and the spacer 60, so that axial movement of the collar parts relative to the insert 57 causes the collar to expand or contract, as described above.

**[0020]** Each transverse face of the spacer 60 is provided with a well 72 for receiving the end of a rebar. A cushion 73 of resilient material is provided at the bottom of each well 72.

**[0021]** Relative rotation of the member 68 in the main body 52 changes the length of the passage 54 between the mouths 56, 64. In particular, the member 68 can be tightened against the taper insert 57A to force the taper insert 57A toward the insert 57, thereby squeezing the sets of collar parts 42A between the spacer 60 and the respective taper walls 59, 59A. This causes the collar parts 42A to press inwardly into the passage. Consequently, the arrangement 16A can be used to provide a mechanical connection between the ends of two rebars, as follows. The member 68 is first turned to lengthen the passage and thus loosen the collar parts 42A by allowing them freedom to move away from the inserts 57, 57A. Two rebar ends are then introduced into respective mouths 56, 64, passing between the loose collar parts 42A and into the wells 72. At this stage, the collar parts 42A will fit loosely around the rebar ends, and will not be able to grip the ends. The member 68 is then turned relative to the body 52 to shorten the passage length, pressing the taper inserts 57, 57A toward each other so that they force the collar parts 42A against the spacer 60. Further tightening of the member 68 thus causes the collar parts 42A to be pressed inwardly to grip the respective rebar ends. Thereafter, any attempt to remove the rebar 12 from the mouths 56, 64 will tend to cause the collar parts 42A to be pulled towards the respective mouth 56, 64 and thus to engage the tapering walls 59, 59A of the respective insert 57, 57A. This further presses them inwardly toward the axis 46, to grip the rebar 12. As the withdrawing force is increased, so that gripping force is also increased, thus resulting in a secure joint which cannot be disconnected without deliberately damaging the arrangement. The joint thus formed is therefore capable of conveying tension forces between the members 12, as will arise within reinforcing bars of reinforced concrete bodies.

**[0022]** Adequately tightening the member 68 in this manner allows any looseness or "play" within the arrangement to be substantially overcome or reduced. Provision of the cushions 73 has been found to allow slight axial movement of the device 16A, relative to the rebar, during tightening. This assists in tightening the arrangement to take up "play".

**[0023]** Tightening of the arrangement is further assisted by the freedom for the spacer 60 to move axially along the passage 58. Thus, the forces on the spacer 60 will cause it to adopt a position at which both collet arrangements are equally tight, even if the degree of movement required by each arrangement is different.

**[0024]** It has been found that the arrangement of the member 68 and the insert 57A is advantageous in achieving a tightened joint. In particular, it can be seen that the insert 57A is not required to turn as the arrangement is tightened. This avoids complex interactions be-

tween the insert 57A and the collar parts 42A, which have been found to arise if the insert 57A turns as it is tightened, and have been found to inhibit full tightening. The provision of a transverse face on the insert 57A, against which the member 68 presses, allows axial movement of the insert 57A to be created without the rotation of the member 68 being conveyed to the insert 57A. Friction results between the member 68 and the transverse face of the insert 57A, but in the manner normally experienced in a conventional nut-and-bolt arrangement.

**[0025]** Furthermore, isolating the rotation of the member 68 from the axial movement of the insert 57A has been found to reduce or eliminate any torque on the rebar 12 as a result of tightening.

**[0026]** Consequently, it is envisaged that a frame of rebars 12 would be formed by loosely connecting the ends of the rebars by means of arrangements as shown in Fig. 2, and then tightening each arrangement 16A by turning the member 68, such as by means of a spanner or other tool. It is to be understood that only one tightening operation is necessary in order to tighten both collet arrangements of each connection. This arises because the various components are free to move axially within the body 52.

**[0027]** Fig. 3 illustrates a further arrangement 16B used to form a mechanical connection with a rebar 12 within a reinforced concrete body 10. In this example, the end of the rebar 12 is close to the outer surface 74 of the body 10 and it is desired to fix the body 10 to an external item illustrated as a plate 76. Only a short length of rebar is shown in Fig. 3, outside the arrangement 16B, in the interests of clarity.

**[0028]** One end of the arrangement 16B is formed in the manner described in relation to Fig. 2, and the same reference numerals are thus used again. In particular, the collet arrangement 22A can be tightened by means of a member 68 to grip the end of the rebar 12, once it has been inserted through the mouth 70. Again, a movable spacer 60 is illustrated, but could be replaced by an appropriate surface of the body 52 (or other fixed surface) for abutment with the collar parts 42A.

**[0029]** The other end of the arrangement 16B is not provided with collet arrangements, but with an internally threaded passage 78 into which a bolt 80 may be introduced after passing through the plate 76. The bolt 80 can then be tightened within the passage 78 to tighten the plate 76 against the outer surface 74, thus securing together the body 10 and plate 76.

**[0030]** Provision of an attachment arrangement of the type illustrated in Fig. 3 readily allows the reinforced concrete body to be secured to other components, such as stanchions or other structural members in the event that the body 10 is an element of a building, bridge or other construction. It can readily be understood that forces are then transferred directly from the other member 76 to the rebars 12 within the body 10, by means of the arrangement 16B. This improves the mechanical in-

tegrity of the overall arrangement.

**[0031]** Fig. 4 illustrates a further alternative attachment arrangement 16C, which is similar to the arrangement of Fig. 2, in that two collet arrangements 20B, 22B are provided, facing in generally opposite directions.

**[0032]** The principal difference, in comparison with the arrangement of Fig. 2, is that the inserts 57, 57A are not present, and the tapering walls for receiving the collar parts 42B are provided at 59C, 59D by tapering walls of the passage 54A, and by tapering walls of the member 68A. The spacer 60A is free to move along the passage 54A, and again allows both collet arrangements to be tightened together.

**[0033]** Thus, as the member 68A is turned to tighten both collet arrangements, the walls 59D will move axially relative to the collar parts 42B, causing the collet arrangements to tighten, but will also turn around the axis 46. This will cause torque between the walls 59D and the collar parts 42B, and/or between the collar parts 42B and the rebar being gripped (not shown). Neither torque is desirable and has been found to inhibit tightening, as compared to the arrangement of Fig. 2, in which torque is isolated from the inserts 42B.

**[0034]** It will be apparent that many variations and modifications can be made to the apparatus described above, without departing from the scope of the present invention. In particular, the various collet arrangements and arrangements for tensioning can be used in various combinations, with attachment arrangements which have collet arrangements at one or both ends and which are embedded or exposed. It is generally expected that the collet arrangements would be oppositely directed, but they could be disposed at other angles.

**[0035]** Whilst endeavouring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the Applicant claims protection in respect of any patentable feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

## Claims

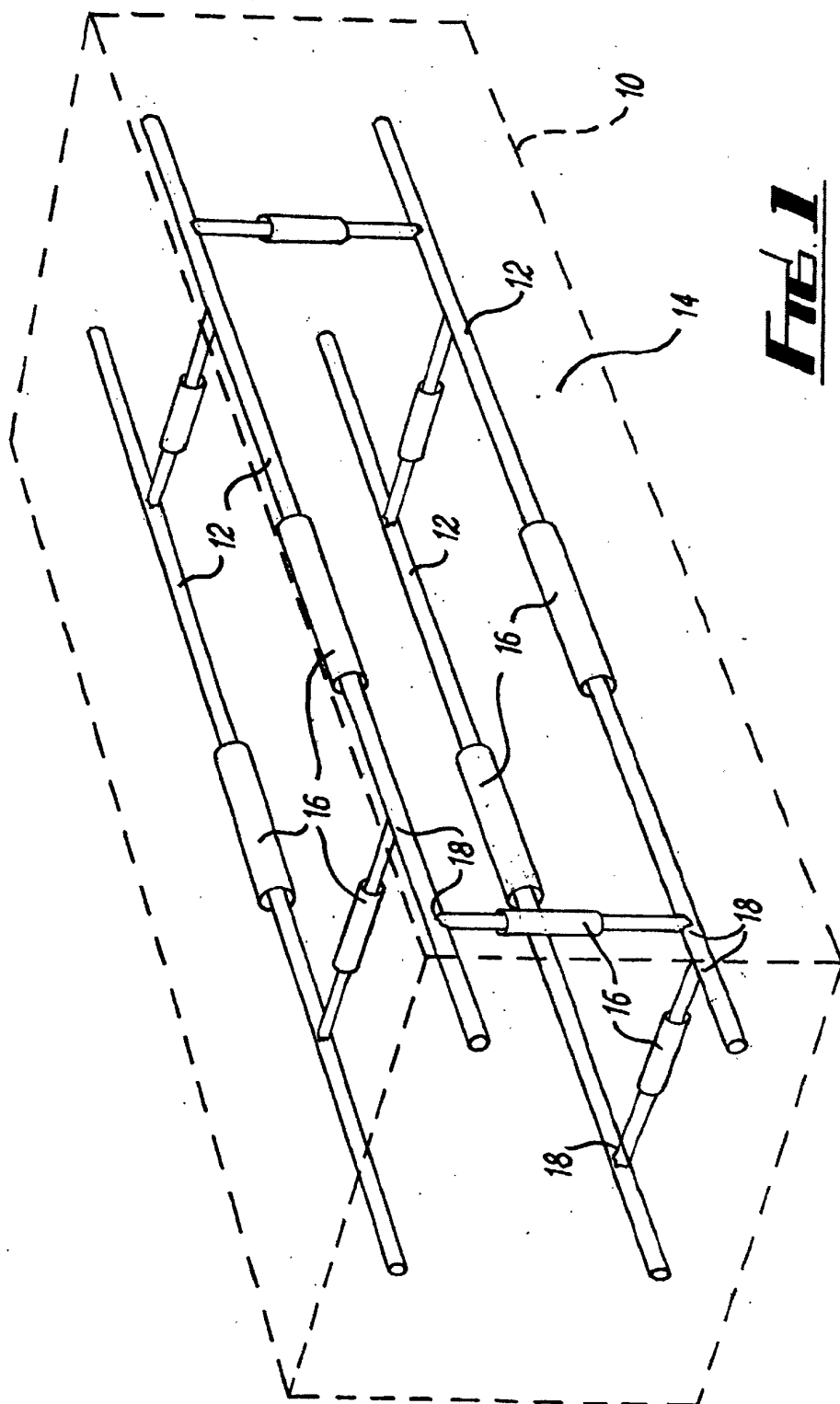
1. An attachment arrangement for use in forming a mechanical connection between elongate reinforcing members for concrete, the arrangement having the form of two collet arrangements for receiving and gripping the ends of respective elongate members, each collet arrangement comprising a plurality of collar parts which together define between them a space for receiving the respective reinforcing member to form a collar therearound, the collar parts together defining a tapering outer surface for the collar and being located within a tapering passage, the arrangement further comprising an abutment member movably located within the passage

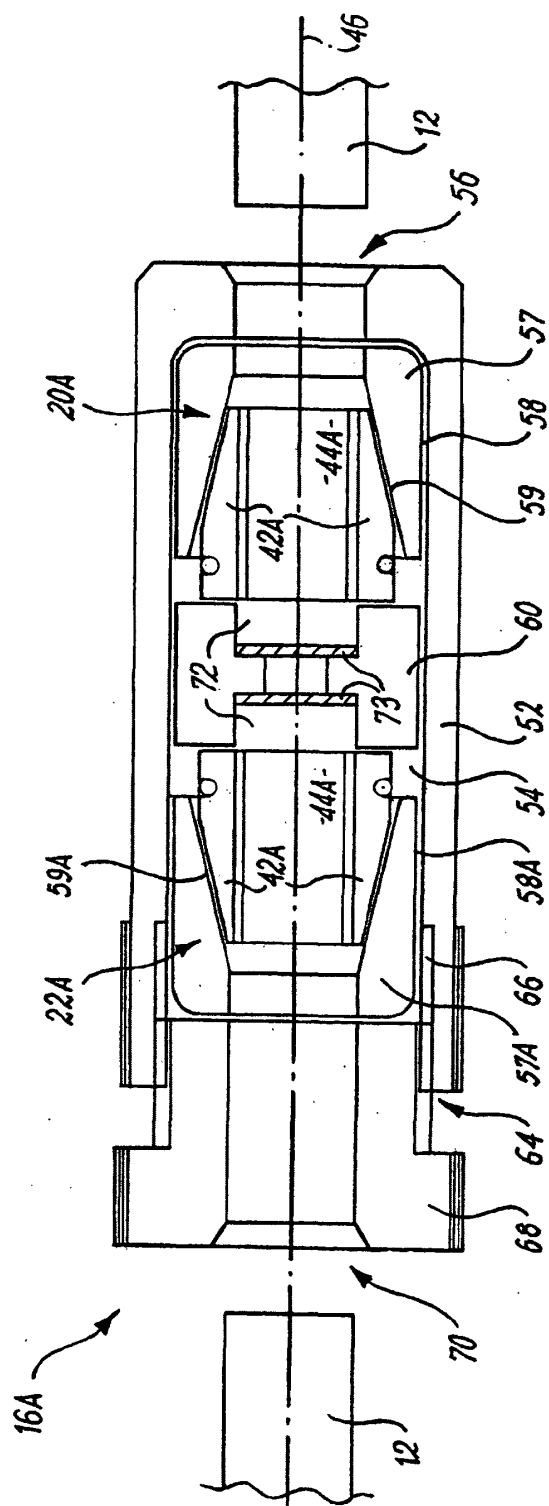
and between the collar parts of the respective collet arrangements, and an adjustment arrangement operable, in use, to reduce the length of the passage, whereby to simultaneously tighten both collet arrangements around their respective elongate members.

2. An arrangement according to claim 1, further including a threaded member which is threadably movable to change the length of the passage. 5
3. An arrangement according to claim 1 or 2, wherein the passage houses at least one taper insert which defines the tapering passage and receives the collet parts of one of the collet arrangements, so that movement of the taper insert causes the grip of the collet parts to change. 10
4. An arrangement according to claim 3, wherein the taper insert has a face against which the threaded member bears when moved, to move the taper insert. 15
5. An arrangement according to claim 4, wherein the bearing face is generally transverse to the tapering passage, the threaded member being rotatable about the axis of the tapering passage to move axially by virtue of the thread, and thereby to cause the taper insert to move. 20
6. An arrangement according to any preceding claim, wherein the tapering outer surfaces of the collar parts are substantially frusto-conical. 25
7. An arrangement according to any preceding claim, wherein the tapering passage is substantially complementary to the outer surfaces of the collar parts, in the region by which the collar parts are engaged. 30
8. An arrangement according to any preceding claim, wherein the collet arrangements are generally oppositely directed. 35
9. An attachment arrangement for use in forming a mechanical connection to an elongate reinforcing member for concrete, the arrangement including a collet arrangement for receiving and gripping the end of the elongate member, the collet arrangement comprising a plurality of collar parts which together define between them a space for receiving the reinforcing member to form a collar therearound, the collar parts together defining a tapering outer surface for the collar and being located within a tapering passage, the tapering passage being defined by a taper insert, so that movement of the taper insert causes the grip of the collar parts to change, and the taper insert having a face against which a threaded member bears as it turns, to move the ta- 40 45 50 55

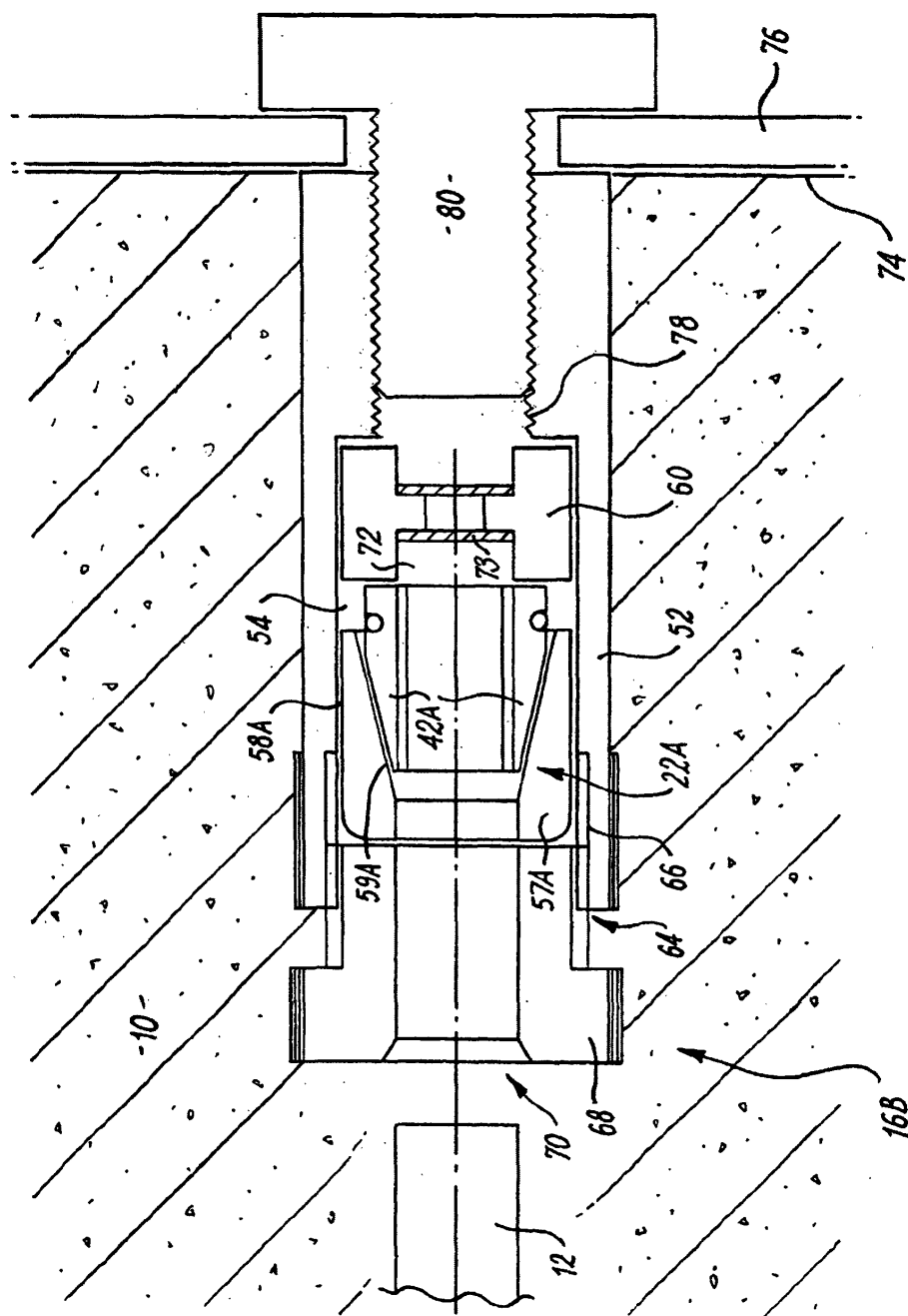
per insert and adjust the collet arrangement.

10. An arrangement according to claim 9, wherein the bearing face is generally transverse to the tapering passage, the threaded member being rotatable about the axis of the tapering passage to move axially by virtue of the thread, and thereby cause the taper insert to move.
11. An arrangement according to claim 9 or 10, wherein the tapering outer surfaces of the collar parts are substantially frusto-conical.
12. An arrangement according to any of claims 9 to 11, wherein the tapering passage is substantially complementary to the outer surfaces of the collar parts, in the region by which the collar parts are engaged.
13. An arrangement according to any of claims 9 to 12, wherein the arrangement further comprises a second collet arrangement for receiving a second elongate member, there being an abutment member movably located within the passage and between the collar parts of the respective collet arrangements, whereby the threaded member is movable, in use, to reduce the length of the passage, whereby to simultaneously tighten both collet arrangements around their respective elongate members.
14. An arrangement according to claim 13, wherein the two collet arrangements are generally oppositely directed.
15. An attachment arrangement substantially as described above, with reference to Figs. 2, 3 or 4 of the accompanying drawings.
16. Any novel subject matter or combination including novel subject matter disclosed herein, whether or not within the scope of or relating to the same invention as any of the preceding claims.

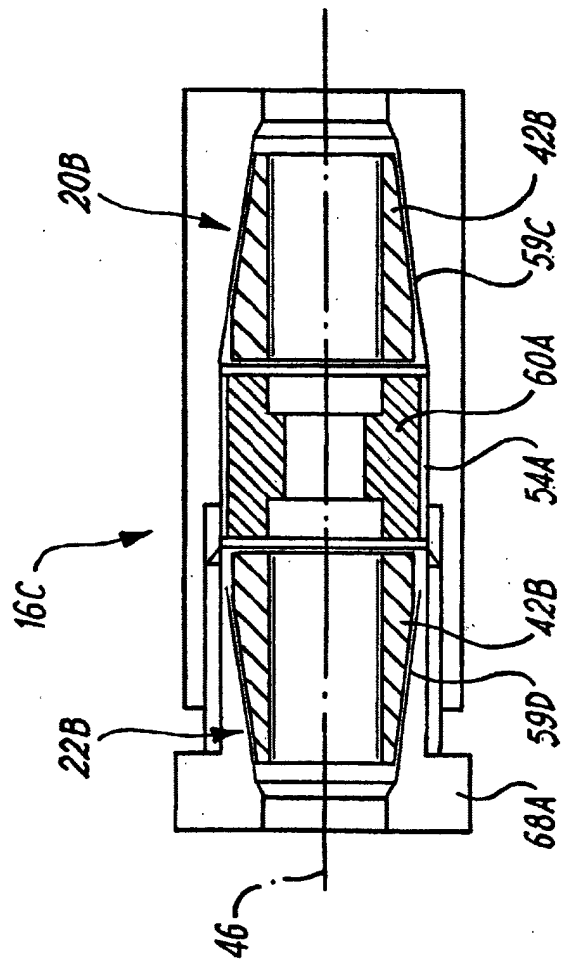




**Fig. 2**



**Fig. 3**



**FIG 4**



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# EUROPEAN SEARCH REPORT

Application Number  
EP 03 25 4150

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                        |                                                                                                                                                     |                                                                                                                                                                                                                                                                                    |                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| Category                                                                                                                                                                                                                   | Citation of document with indication, where appropriate, of relevant passages                                                                       | Relevant to claim                                                                                                                                                                                                                                                                  | CLASSIFICATION OF THE APPLICATION (Int.CI.7) |
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| X                                                                                                                                                                                                                          |                                                                                                                                                     | 9-12                                                                                                                                                                                                                                                                               | TECHNICAL FIELDS<br>SEARCHED (Int.CI.7)      |
| A                                                                                                                                                                                                                          |                                                                                                                                                     | 1                                                                                                                                                                                                                                                                                  | E04C                                         |
| The present search report has been drawn up for all claims                                                                                                                                                                 |                                                                                                                                                     |                                                                                                                                                                                                                                                                                    |                                              |
| Place of search<br>THE HAGUE                                                                                                                                                                                               |                                                                                                                                                     | Date of completion of the search<br>3 October 2003                                                                                                                                                                                                                                 | Examiner<br>Hendrickx, X                     |
| CATEGORY OF CITED DOCUMENTS                                                                                                                                                                                                |                                                                                                                                                     | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or<br>after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding<br>document |                                              |
| X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another<br>document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |                                                                                                                                                     |                                                                                                                                                                                                                                                                                    |                                              |

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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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EP 03 25 4150

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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