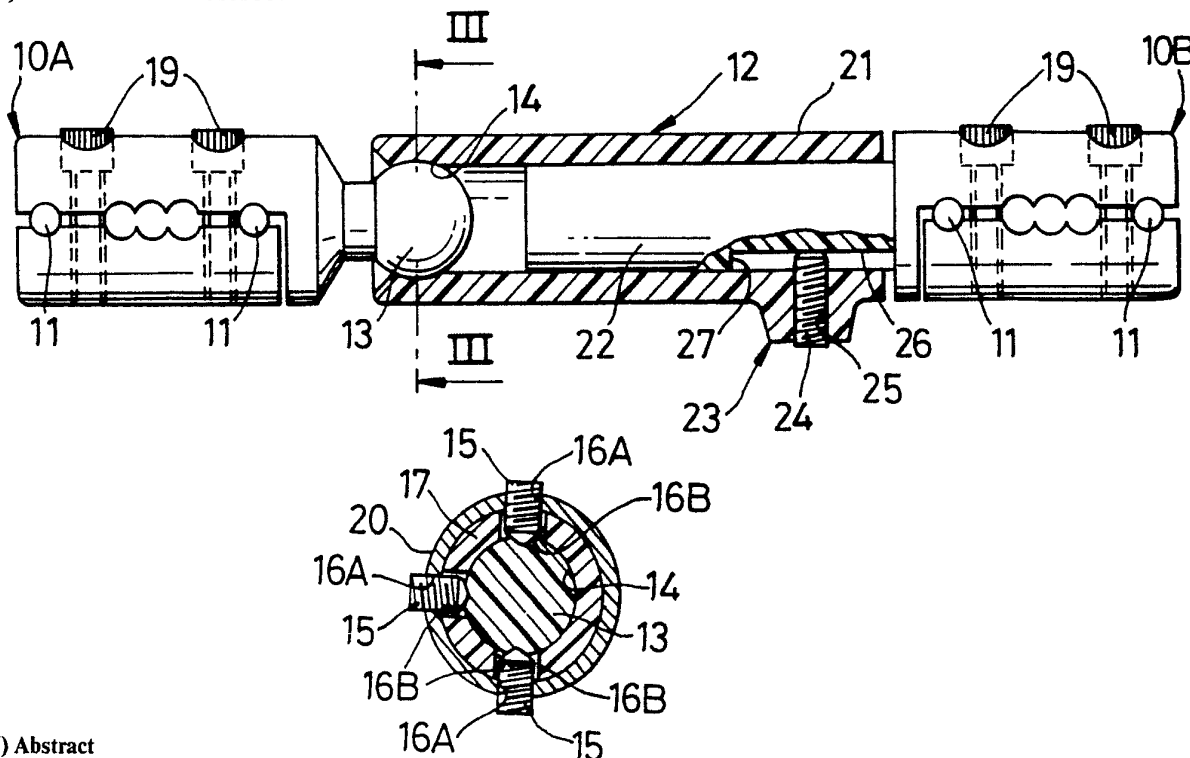




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<p>(21) International Application Number: PCT/GB91/00276</p> <p>(22) International Filing Date: 30 January 1991 (30.01.91)</p> <p>(30) Priority data: 9002065.2 30 January 1990 (30.01.90) GB</p> <p>(71) Applicant (for all designated States except US): SHEFFIELD CITY COUNCIL [GB/GB]; Town Hall, Sheffield S1 1UL (GB).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): OLIVER, Albert, Edward [GB/GB]; 10 Bellbrook Avenue, Darfield, Nr. Barnsley S73 9BP (GB).</p> <p>(74) Agent: HULSE & CO.; Cavendish Buildings, West Street, Sheffield S1 1ZZ (GB).</p>		<p>(81) Designated States: AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US.</p> <p>Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>

(54) Title: BONE FIXATION



(57) Abstract

Figures (1 and 2) show a bone fixator having clamps (10A, 10B) for bone pins (11) connected by means (12) including a ball-and-socket joint (13, 14) having at least one setscrew (15) in the socket wall (17) to dig into the ball (13) for setting up a fracture, but with the intention of being releasable for re-setting of the clamps at a later stage; also having the advantage of being more convenient for use in high ambient temperatures or in poor lighting conditions that previously disclosed fixators using hardenable resin filler to secure the ball joint. Three setscrews (15) in the socket wall (17) are preferred.

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BONE FIXATION

This invention relates to bone fixation and has as its object the provision of a bone fixator having simple effective means for positively securing a pair of spaced bone-pin clamps at an angle to each other, upon setting of a fracture, yet allowing releasing and/or re-setting of the clamps relative to each other at an appropriate stage in the healing process.

According to the present invention, a bone fixator comprises a pair of clamps each having means for clamping at least two bone pins, and connecting means between the clamps incorporating a ball-and-socket joint having at least one setscrew (but preferably three) in a screwthreaded hole in the socket wall and adapted to dig into the ball.

Thus the ball-and-socket joint allows the clamps to be set at an angle to each other and then to be secured by the setscrew (or each setscrew) being screwed into the screwthreaded hole in the socket wall until the tip of the setscrew digs into the ball. The (or each) setscrew can be unscrewed when release and/or re-setting of the clamps relative to each other is desirable. However, a major advantage of the present invention is that it provides a more convenient way of securing the clamps relative to each other than using resin as described in WO 89/09031 in high ambient temperatures or in poor lighting conditions where it would be difficult to see the holes for introduction and emergence of the resin.

The connecting means may also incorporate telescoping

means and releasable securing means for locking the telescoping means in at least a partially extended condition for initial setting of a fracture, the securing means being adapted to be released at the appropriate later stage in the healing process for the telescoping means to allow of dynamic distraction of the fracture.

The releasable securing means may conveniently be a setscrew (or "grubscrew") in a screwthreaded lateral hole in an outer tubular member of the telescoping means and adapted to bear against an inner member of the telescoping means, which inner member may be tubular but is preferably a solid shaft and which inner member preferably has a longitudinal groove in which the setscrew engages and the inner end of which forms a stop for the setscrew preventing complete withdrawal of the inner telescoping member from the outer.

It will be appreciated that the telescoping means can be used to effect adjustment of the nominal length of the fixator to suit different lengths of fractured bones and/or different locations of fractures.

The components of the fixator may be formed of aluminium or aluminium alloy, but preferably of rigid plastics, with the setscrew or setscrews and clamping screws for the bone pins made of metal, whereby the fixator can be disposable.

The socket wall may be encircled by a metal ring having a screwthreaded hole or holes for a setscrew or setscrews in register with a plain hole or holes in the socket wall through which the or each setscrew passes. The metal

ring may be incorporated in the moulding of the socket wall, but is preferably force-fitted on the socket wall or secured thereon with adhesive after the ball has been snapped into the socket.

An embodiment of the invention and some modification thereof will now be described, by way of example only with reference to the accompanying drawings, in which:-

Figure 1 is a part-sectional side elevation of a bone fixator in accordance with the invention;

Figure 2 is an end elevation as seen from the right hand end of Figure 1;

Figure 3 is a section on the line III-III of Figure 1;

Figure 4 corresponds to Figure 3 but shows a preferred feature of the invention; and

Figure 5 corresponds to Figure 4 but shows a modification thereof.

In the embodiment of Figures 1 to 3, a bone fixator comprises a pair of clamps 10A, 10B each having means for clamping at least two bone pins 11, and connecting means 12 between the clamps incorporating a ball-and-socket joint 13, 14 having a setscrew 15 in a screwthreaded hole 16 in the socket wall 17 and adapted to dig into the ball 13.

Thus the ball-and-socket joints 13, 14 allows the clamps 10A, 10B to be set at an angle to each other and then to be secured by the setscrew 15 being screwed into the screwthreaded hole 16 in the socket wall 17 until the tip 18 of the setscrew digs into the ball 13, as shown in Figure 3.

The fixator is indicated as being made of rigid

plastics, with the setscrew 15 and clamping screws 19 for the bone pins 11 being made of metal. Therefore, it is preferable to provide three setscrews 15, as shown in Figure 4, to afford a better grip on the ball and ensure that the clamps 10A, 10B are securely held at the required angle to each other.

It has been found desirable to use B.S. Whitworth threads to avoid stripping of the plastic screwthreads, but Figure 5 shows an alternative modification in which the socket wall 17 is encircled by a metal ring 20 having screwthreaded holes 16A for the setscrews 15 in register with plain holes 16B in the socket wall through which the setscrews pass. The metal ring 20 may be incorporated in the moulding of the socket wall, but is preferably force-fitted on the socket wall or secured thereon with adhesive after the ball 13 has been snapped into the socket.

The connecting means also incorporate telescoping means 21, 22 and releasable securing means 23 for locking the telescoping means in at least a partially extended condition for initial setting of a fracture, the securing means being adapted to be released at the appropriate later stage in the healing process for the telescoping means to allow of dynamic distraction of the fracture.

The releasable securing means 23 is shown in Figures 1 and 2 as consisting of a setscrew 24 in a screwthreaded lateral hole 25 in the outer tubular member 21 of the telescoping means and adapted to bear against the inner member 22 of the telescoping means, which inner member is a solid

shaft but has a longitudinal groove 26 in which the setscrew 24 engages and the inner end 27 of which forms a stop for the setscrew preventing complete withdrawal of the inner telescoping member 22 from the outer member 21.

The telescoping means 21, 22 can be used to effect adjustment of the nominal length of the fixator to suit different lengths of fractured bones and/or different locations of fractures.

CLAIMS

1. A bone fixator comprising a pair of clamps each having means for clamping at least two bone pins, and connecting means between the clamps incorporating a ball-and-socket joint having at least one setscrew in a screwthreaded hole in the socket wall and adapted to dig into the ball.
2. A bone fixator as in Claim 1, wherein three setscrews are provided.
3. A bone fixator as in Claim 1 or Claim 2, wherein the connecting means incorporates telescoping means and releasable securing means for locking the telescoping means in at least a partially extended condition for initial setting of a fracture, the securing means being adapted to be released at the appropriate later stage in the healing process for the telescoping means to allow of dynamic distraction of the fracture.
4. A bone fixator as in Claim 3, wherein the releasable securing means is a setscrew in a screwthreaded lateral hole in an outer tubular member of the telescoping means and adapted to bear against an inner member of the telescoping means.
5. A bone fixator as in Claims 3 or 4, wherein the inner member of the telescoping means is tubular.
6. A bone fixator as in Claim 3 or Claim 4, wherein the inner member of the telescoping means is a solid shaft.
7. A bone fixator as in any one of Claims 4 to 6, wherein the inner member has a longitudinal groove in which the setscrew engages and the inner end of which forms a stop

for the setscrew preventing complete withdrawal of the inner telescoping member from the outer.

8. A bone fixator as in any one of Claims 1 to 7, where in the components of the fixator are formed of aluminium or aluminium alloy.

9. A bone fixator as in any one of Claims 1 to 7, wherein the components of the fixator are formed of rigid plastics, with the setscrew or setscrews and clamping screws for the bone pins made of metal, whereby the fixator can be disposable.

10. A bone fixator as in Claim 9, wherein the socket wall is encircled by a metal ring having a screwthreaded hole or holes in register with a plain hole or holes in the socket wall through which the or each setscrew passes.

11. A bone fixator as in Claim 10, wherein the metal ring is incorporated in the moulding of the socket wall.

12. A bone fixator as in Claim 10, wherein the metal ring is force-fitted on the socket wall after the ball has been snapped into the socket.

13. A bone fixator as in Claim 10, wherein the metal ring is secured on the socket wall with adhesive after the ball has been snapped into the socket.

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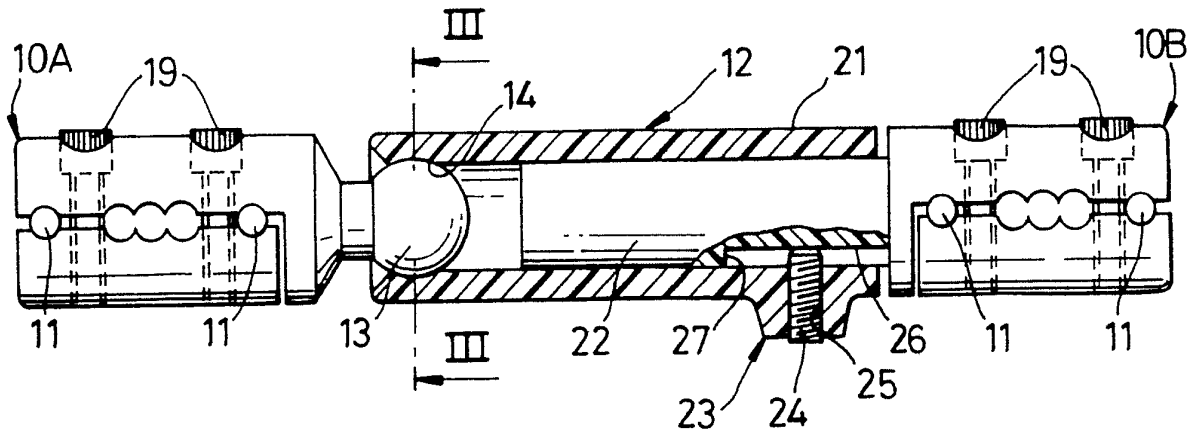


Fig. 1

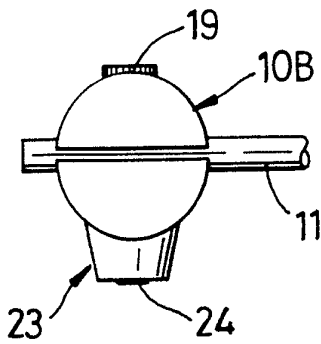


Fig. 2

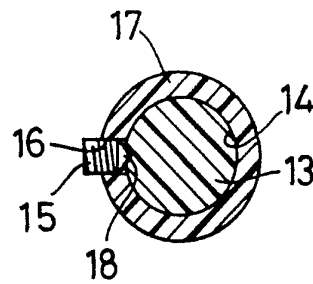


Fig. 3

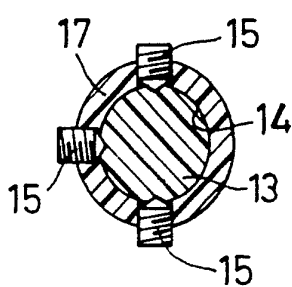


Fig. 4

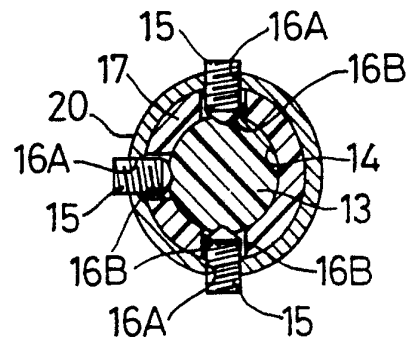
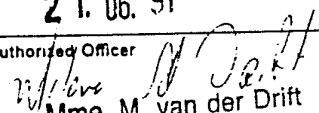


Fig. 5

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 91/00276

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶				
According to International Patent Classification (IPC) or to both National Classification and IPC				
IPC ⁵ :	A 61 B 17/60			
II. FIELDS SEARCHED				
Minimum Documentation Searched ⁷				
Classification System	Classification Symbols			
IPC ⁵	A 61 B			
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸				
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹				
Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³		
X	EP, A, 0011258 (ORTHOFIX) 28 May 1980 see abstract; page 5, lines 16-22; page 8, line 26 - page 9, line 8; figures 2,4	1,3-4,6		
Y		5,7-9		
A	---	2,10-13		
Y	GB, A, 2168255 (ORTHOFIX) 18 June 1986 see abstract; page 1, lines 119-128; page 2, lines 3-11; figures 2,3,3A	5,7		
A	---	3-4		
Y	WO, A, 8909031 (SHEFFIELD CITY COUNCIL) 5 October 1989 see page 1, lines 10-21; page 2, lines 21-27; page 3, line 25 - page 4, line 17; page 4, lines 26-28; figure 8	8-9		
A	cited in the application ---	1,3,5,7		
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>¹⁰ Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </td> <td style="width: 50%; vertical-align: top;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </td> </tr> </table>			<p>¹⁰ Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p>
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IV. CERTIFICATION				
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report			
23rd April 1991	21. 06. 91			
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