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## (54) Title: BONE FRACTURE FIXATION MEANS

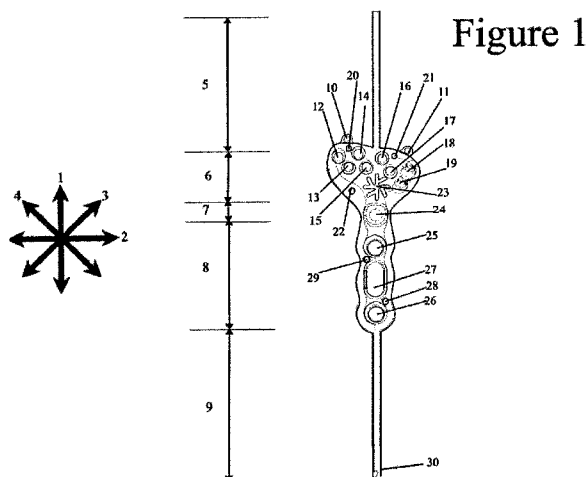


Figure 1

(57) Abstract: A bone fracture fixation plate juxta-articular stabilisation means comprises a plate with integral pin and tail parts, a plate specific jig, a plate and jig specific drill sleeve, a slotted head top loading screw, a plate positioner and a pin bender. This system can be used for fixation of most types of fractures involving the juxta-articular radius. The plate has a most juxta-articular row of screw holes in individually bendable and detachable extensions especially designed for very juxta-articular or the volar lip fractures. The plate also has bendable and detachable pin part and tail parts on either ends that allows the plate to be used with a chuck as a wire or drill bit and also have longer purchase into the bone with minimal soft tissue exposure. The plate and targeting assembly have plate positioning slots for wires in its juxta-articular part to allow adjustment in position of plate in longitudinal, transverse and oblique directions after initial fixation with wires without committing to a screw hole. This allows a very precise placement of the plate in the most ideal position. The targeting assembly can be mounted onto the plate prior to surgery thus reducing surgical step and time. The specific orientation of the screw holes in the shaft part of the plate orientates the screws such that when tendons apply forces across the fracture, the plate is wedged between screw and the bone rather than pushed away from the bone. Therefore, more aggressive physical therapy can be commenced earlier or plates with fewer screws in the proximal part can be used without compromising the strength of the fixation.

## Description

### Title of Invention: BONE FRACTURE FIXATION MEANS

[1] **Field of the Invention**

[2] The invention relates to bone fracture fixation means.

[3] **Background**

[4] Some or all of the following in this Background section may not yet be public knowledge.

[5] The invention relates to fixation of metaphyseal, juxta-articular or intra-articular fractures of juxta-articular radius but many of its features can be used in any fracture fixation with a plate. Displaced juxta-articular or intra-articular fractures and many displaced metaphyseal fractures are now commonly treated by operative method (open reduction and internal or external fixation).

[6] Relatively less complex fractures are treated by closed manipulation and stabilisation with K-wires. For more complex fractures especially displaced intra-articular fractures, open reduction and internal fixation with plate and screws has become choice of most surgeons because it allows direct, accurate reduction and early mobilisation of joint. For very few fractures where anatomical reduction is not necessary, intra-medullary implants such as nails are used but they have not gained popularity because such fractures can be successfully treated with less expensive and simpler procedures using k-wires. Moreover, nails are not suitable for the commonly encountered juxta- or intra-articular fractures.

[7] K-wiring, although simpler to use, has several disadvantages. Commonly, it is left exposed out of skin and therefore subjects to the risk of infection. It also requires plaster immobilisation following the procedure as it provides a weak stabilisation on its own.

[8] There are various plating systems available today for fixation of juxta-articular radius fractures. The plates applied on volar aspect with locking screws are very popular.

[9] After a good surgical exposure, precise placement of the plate in the correct position is the most important first step. The best quality of bone is in the subchondral region where screws can have good purchase in the bone. This region is very close to the joint, therefore many surgeons trying not to enter into the joint with their screws end up too far proximal in not so good bone and hence, less stable fixation. Most plates have an oblong hole in the part that is applied onto the opposite side to the juxta-articular fragment of the bone to allow adjustment in plate position along the longitudinal axis of the bone after initial fixation with one screw through this hole. Only one is known to the author that has additional oblong hole to allow adjustment in transverse direction. If more adjustment than the length of oblong hole is required, one

cannot do it without making another drill hole for another screw. This can certainly cause unnecessary additional weakness in the bone. The adjustment along the longitudinal axis is only possible if fixation to the opposite side to the juxta-articular fragment is done first with one screw in the above said oblong hole. Many surgeons like to do the fixation of the juxta-articular side first. This allows them to reduce the displaced juxta-articular fragment better as they now have better hold onto the displaced short fragment. In the juxta-articular fixation first technique surgeons do not have any means of adjustment in plate positioning with most plates currently available. The one plate known to author that allows adjustment over the juxta-articular part can do so only in transverse direction. Once committed to a screw in the oblong hole that allows adjustment in transverse direction, no further adjustment along the longitudinal axis is possible. If the position in longitudinal axis is found to be less than satisfactory after insertion of screw in the said transverse oblong hole, the procedure has to be started all over again.

- [10] One plating system has pre-fixed drill sleeves. The disadvantage of this plate is that all these drill sleeves (8 or 9 of them) need to be removed individually and it is not unheard that some have been left in by error. Moreover, there is no guide to direct the screws in right direction and therefore, it is not unusual to have cross threading of the locking screws with the plate.

[11] **Statement of invention**

- [12] According to one aspect of the invention, there is provided a means as claimed in claim 1.

- [13] According to another aspect of the invention, there is provided a bone fracture fixation plate positioning means for facilitating controlled adjustment of the position of the plate on a long bone on the juxta-articular side of a fracture during fixation on that side and before fixation or positioning to the bone on the other side of the fracture, such positioning means being adapted to facilitate controlled adjustment of position of the plate on the bone from an initial position both towards and away from the fracture (herein called a longitudinal direction) and also transversely of such longitudinal direction, preferably in at least two directions transversely of said longitudinal direction, and/or preferably in at least one direction oblique to said longitudinal direction.

- [14] According to another aspect of the invention, there is provided a bone fracture fixation plate comprising a plate and a pin integral with the plate and extending from one end of the plate, the plate being provided with means to facilitate insertion of the pin into the cortex of the bone.

- [15] According to another aspect of the invention, there is provided a method of positioning a bone fracture fixation plate, e.g. as described above according to the

invention, by use of means to facilitate controlled adjustment of the position of the plate on a long bone on the juxta-articular side of a fracture during fixation on that side and before fixation or positioning to the bone on the other side of the fracture, in which such means are used to control adjustment of position of the plate on the bone from an initial position in one or more of the following directions, namely towards or away from the fracture (herein called a longitudinal direction) and transversely and obliquely of such adjustment, and preferably at least obliquely of said longitudinal direction.

- [16] According to another aspect of the invention, there is provided a method of attaching to a bone a plate, e.g. as described above according to the invention, in which insertion facilitating means is used to facilitate insertion of a pin of the plate into the cortex of the bone.
- [17] Any of the other features recited in the accompanying claims may be provided in embodiments of the invention.
- [18] According to further aspects of the invention, there are provided any of the features of any examples herein described with or without reference to the accompanying drawings.
- [19] Embodiments may comprise a bone fracture fixation plate positioning means for facilitating controlled adjustment of the position of the plate on a long bone on the juxta-articular side of a fracture during fixation on that side and before fixation or positioning to the bone on the other side of the fracture, such means being adapted to facilitate controlled adjustment of position of the plate on the bone from an initial position both towards and away from the fracture (Longitudinal) and transversely and obliquely of such adjustment and a bone fracture fixation plate comprising a plate and a pin integral with the plate and extending from one end of the plate, the plate being provided with means to facilitate insertion of the pin into the cortex of the bone without prior drilling.
- [20] The means may comprise a plate with its plate-specific companion targeting jig, a jig and plate-specific drill sleeve, an eccentric hole plate-positioner and a two-piece pin bender.
- [21] Embodiments may have any of the following features:
- [22] a) The plate has a *juxta-articular* part with more than one row of threaded holes, a *neck*, a *shaft*, a *pin* and a *tail*. The juxta-articular part of the plate is twisted in relation to the shaft part. The plate can be further contoured to the anatomy of the surface of the juxta-articular bone during the procedure. The plate has either a group of linked slots or an arrangement of aperture in the plate comprising of at least three holes surrounding an initial-position hole in the middle of juxta-articular part for temporary fixation of the plate to the bone with one wire and subsequent adjustment in position of the plate in longitudinal, transverse and oblique directions. Once the plate is positioned

precisely to the correct place it can be further secured by inserting wires in the wire holes in the juxta-articular part of the plate before insertion of the definitive screws. There are threaded holes in the extensions to the juxta-articular end of the plate and these extensions can be individually bent and readily detached from the plate if required. The neck part has a threaded hole with a recessed collar for the targeting jig. The shaft part of the plate has threaded oblique holes directed from juxta-articular side and superficial surface (surface away from bone) to opposite side and deep surface (close to bone) for screws. The pin part is integral to and extends from the shaft and has sharpening at the end remote from the plate to facilitate insertion into the cortex of the bone. The tail part is integral to and extends from the juxta-articular end of the plate. This can be held in a chuck and the pin part penetrates the cortex of the bone like a drill bit. The pin part is bent where it comes out of the bone after said insertion of the pin into the cortex. The said tail is suitable to be inserted in a slot in the region of the outer end of a bone-fixing screw and is suitable for the tail beyond the screw to be cut off before the tail is fixed in place in such slot. The pin part and tail part can be cut off and the rest of the plate can be used for fracture fixation.

[23]     b) The targeting jig is plate-specific and is configured to sit on a juxta-articular part of the plate. It is attached to the plate with a screw-through a hole, which has a proud collar on the undersurface to fit into the recessed collar on the plate. The targeting jig has either the group of linked slots or the arrangement of aperture with at least three holes surrounding an initial-position hole corresponding to those into the plate. The jig also has other holes corresponding to the holes in the plate except for those in the bendable and detachable extensions to the juxta-articular end of the plate.

[24]     c) The drill sleeve that is specific to the above two, line the apertures in the jig to protect the jig from the drill bit that is guided by these apertures, can lock into the threaded holes of the plate, has scales over its body to indicate how far into the bone a drill bit passing through the sleeve has penetrated and this can be seen from four sides and has means to lock the jig to a positioning and/or fixing member in an aperture or a slot in the jig during adjustment in position of the plate.

[25]     d) Eccentric hole plate-positioner allows further fine adjustment in plate position by rotating over a positioning and/or fixing member in an aperture in the plate. The eccentric hole of the plate-positioner allows the surgeon to move the plate in a controlled manner in the desired direction when rotated and has means to temporarily fix the plate to the bone.

[26]     e) Two-piece pin bender allows the shaft part to be accommodated into the bender while it bends the pin part to allow rest of the plate to sit well onto the bone.

[27]     **Advantages of Embodiments of the Invention**

[28]     The plate of these embodiments has the following advantages over other plates

currently available or known to the inventor.

- [29] 1. The group of linked slots or the group of holes in the juxta-articular part allows adjustment in the initial position of the plate after temporary fixation with a wire in longitudinal, transverse or oblique directions. This facilitates precise placement of the plate in the desired position. There is an opportunity to improve the position even further with the help of eccentric hole plate positioner.
- [30] 2. The part with the most juxta-articular row of screw holes can be individually bent and detached without having any effect on the rest of the plate. This feature allows fixation of fractures very close to the joint.
- [31] 3. The pin part can penetrate bone with minimal soft tissue exposure and allows for longer hold into the bone.
- [32] 4. The pin part and the tail part can be cut off and the rest can be used as a plate.
- [33] 5. The obliquely placed screw holes in the shaft part of the plate allow screws to be inserted only in a predetermined direction from juxta-articular side and superficial surface (surface away from bone) to opposite side and deep surface (close to bone). With the screws in this configuration, the plate is wedged between screws and bone rather than pushed away from the bone by the forces of the tendons across the fracture.
- [34] 6. The group of linked slots in the targeting jig corresponding to those in the plate allows for the jig to be pre-mounted, thus reducing an intra-operative step.
- [35] 7. The drill sleeve allows for measurement of depth of drill bit into the bone that can be seen from four directions.

[36] **Introduction to drawings**

[37] The invention now will be described by way of example, referring to the accompanying Figures, in which:

- [38] Figure 1 shows an embodiment of the plate in front profile with adjustment slots
- [39] Figure 2 shows the plate in front profile with adjustment holes
- [40] Figure 3 shows the plate in side profile
- [41] Figure 4 shows the plate in an end profile from the juxta-articular end
- [42] Figure 5 shows the targeting jig in front profile
- [43] Figure 6 shows the targeting jig in side profile
- [44] Figure 7 shows the drill sleeve in front, side and top end profiles
- [45] Figure 8 shows the slotted head top loading screw in front, side and top end profiles
- [46] Figure 9 shows the eccentric hole plate positioner in front (A), top (B) and bottom (C) end profiles
- [47] Figure 10 shows both members of the two piece pin bender. A, is front profile of inner member, B is front profile of outer member, C is top end profile when both members are together in an open position and D is top end profile when both members are together in a closed position

[48] Figure 11 shows the front view of juxta-articular radius fracture stabilised with a plate

[49] Figure 12 shows the side view of juxta-articular radius fracture stabilised with a plate.

[50] **Detailed description**

[51] Figure 6 b: shows the lateral view of the fixation as described above

[52] Means 5-9, Figures 1, 2 & 3 for facilitating the use of a bone fracture fixation plate 5-9, comprising means 23, 31, Figures 1 & 2, to facilitate positioning of the plate 5-9 and/or insertion of part 9 of the plate 5-9 into the cortex of the bone 67 are described below with reference to the above mentioned drawings.

[53] The means 5-9, comprising a bone fracture fixation plate positioning means 23, 31 for facilitating controlled adjustment of the position of the plate 5-9 on a long bone 67, Figures 11 & 12, on the juxta-articular side 68, 69 of a fracture 70, during fixation on that side and before fixation or positioning to the bone 67 on the other side of the fracture 70, such positioning means 23, 31 being adapted to facilitate controlled adjustment of position of the plate 5-9 on the bone from an initial position both towards and away from the fracture 70 (herein called a longitudinal direction 1, Figure 5) and also transversely 2, 3, 4 of such longitudinal direction 1 is shown in Figures 1 to 7 and 9.

[54] Means 5-9 which comprise the plate 5-9 is shown in Figures 1 to 4.

[55] The means 6 has a slot means 23 comprising a cruciform slot arrangement 23 as shown in Figure 1.

[56] Alternatively, the means 6 has an aperture means 31 comprising an arrangement of holes 31 that comprises at least three holes surrounding an initial-position hole (the central hole, not numbered) as shown in Figure 2.

[57] The means 5-9 comprising a bone fracture fixation plate 5-9 has a juxta-articular epiphyseal part 6 and a diaphyseal elongate shaft part 8 connected together and twisted relative to one another as shown in Figure 4.

[58] The means 6 has extensions 10, 11, Figures 1, 2 & 3 on its juxta-articular end (junction of parts 5 and 6) and these extensions 10, 11 comprise means (holes, possibly slanting) adapted to guide and/or hold positioning and/or fixing member/s 80 inserted through the extensions 10, 11 into parts of the bone 68, 69 as shown in Figures 11 & 12.

[59] Means 25, 26 Figures 1 and 2, comprise guide means 25, 26 that are directed obliquely towards the bone 67 in a direction 1 away from the fracture 70 (see Figure 12), for example 'from juxta-articular side and superficial surface (away from bone) to opposite side and deep surface (close to bone)' and fixing members 76, 77, when inserted into the bone 67 through these guide means 25, 26 follow the above said

direction as shown in Figure 12.

- [60] The jig means 43 has a slot means 40 comprising of a cruciform slot arrangement 40 corresponding to the slot arrangement 23 on means 6 of the plate 5-9.
- [61] Alternatively, the jig means 43 can have an aperture means comprising an arrangement of holes (not shown) similar to 31 that comprises of at least three holes surrounding an initial-position hole (the central hole, not shown, not numbered).
- [62] The jig means 43 has a prominent means 44 on its undersurface configured to sit into a recession around means 24, Figures 1 & 2 of the juxta-articular part 6 of the plate 5-9 as shown in Figure 6.
- [63] The nozzle part 45 of the sleeve means 48, that lines aperture means 32-39, Figure 5, in the jig means 43 to protect the jig means 43 from a drill bit guided by such aperture means 32-39 in the jig 43, is shown in Figure 7.
- [64] The sleeve means 48, comprises means 46 (a side screw hole) and 47 (threads for a side screw), Figure 7, to lock to the jig means 43 a positioning and/or fixing member (a wire, not shown) in aperture means 32-39 in the jig means 43.
- [65] The sleeve means 48 comprises scale means 49 adapted to indicate through the windows 50 how far into the bone 68, 69 a drill bit (not shown) passing through the hole 51 in the sleeve means 48 has penetrated is shown in Figure 7. This distance is measured by looking at a laser mark on the drill bit (a circle engraved around the bit) through the four windows 50 in the sleeve means 48 against the said scale means 49.
- [66] Means 48 in which the scale means 49 are adapted to be viewed from four sides is shown in the 'top plan' part of Figure 7.
- [67] The targeting jig 43 is adapted to be fixed in relation to the plate 5-9 on its neck part 7, Figures 1 and 2. This is done by a non-integral fixing member (a screw, not shown) passing through an aperture means 41, Figure 5, in the jig 43 and engaging in a corresponding aperture 24 in the neck part 7 of the plate 5-9, Figures 1 and 2.
- [68] The means 5-9 with the help of an eccentric plate positioner means 62-66, Figure 9, allows further controlled fine adjustment in the positioning of the plate 5-9 in all directions in the same plane as 1, 2, 3 & 4 but not limited to 1, 2, 3 & 4. The positioner means 62-66 is used as follows. The plate 5-9 is placed as accurately as possible in position on the bone 67, a wire (not shown) is passed through positioning hole 24, 25, 26 or 27 in plate 5-9 and its lower end embedded into the cortex of the bone 67. Positioner means 62-66 is then placed on the wire (so that the wire passes through its eccentric whole 66) and slid down to plate 5-9 until the bottom end (as seen in Figure 9) enters the hole e.g. 24 until the stop 65 reaches plate 5-9. The wire is eccentrically located in positioner means 62-66 by means of whole 66. The plate 5-9 is then finely adjusted to the desired position relative to the bone 67 by rotating the positioner means 62-66 about the positioning wire, at which desired position a screw (not shown) is



inserted into threaded hole 64 and tightened to the wire to hold positioner means 62-66 (and hence plate 5-9) precisely in the desired position. Then fixing screws 76-80 are then put in place in other holes 25, 26 and 12-19 in plate 5-9, first using a drill (not shown) to make the necessary guide holes (not shown separately in the drawings) in the bone 67 for these fixing screws 76-80. Finally, the positioner means 62-66 is removed together with the guide wire, leaving the plate 5-9 precisely positioned on the bone 67. By the end of this procedure, the surgeon will have succeeded in achieving accurate reduction and satisfactory fixation of the fracture 70, 71, 74.

[69] In another use of the plate 5-9, the pin 9 is cut off completely before the plate 5-9 is attached to the bone 67.

[70] The means 5-9 comprises a bone fracture fixation plate 5-9 comprising a plate 6-8 and a pin 9 integral with the plate 5-9 and extending from the end adjacent to shaft part 8 of the plate 6-8, the plate 5-9 being provided with means 30 to facilitate insertion of the pin 9 into the cortex of the bone 67 as shown in Figures 1, 2, 3, 11 and 12.

[71] The means 30 comprises a sharpening at the end of the pin 9 remote from the plate 6-8 as shown in Figures 1, 2 and 3. The sharpening is combined with a flute (shown but not numbered) and/or threads (not shown) for ease of penetration into the cortex of bone 67 and / or better hold of pin 9 into the bone 67.

[72] The means 9 of the plate 5-9 is adapted to be bent where it comes out of the bone 67 after said insertion of the pin 9 into the cortex of the bone 67 with the help of a two-piece pin bender A & B as shown in Figure 10. The bender part A is placed inside bender part B and rotated until their slots coincide so that the whole bender can be slid sideways on to parts 8 and 9. The projecting top of part A can be grasped in one hand and rotated against the outer part B by about 180° to shift the two slots so that the bender cannot come off the plate 5-9, the two parts A and B locking together or otherwise being held tight together by friction. The part A has a height (as seen in Figure 10) somewhat shorter than the height of part 8 of the plate 5-9 and is slid down to overlap that part of part 9 that projects from the bone. This enables the bottom part of the bender (as seen in Figure 10) to be located precisely at the point where pin 9 emerges from the bone so as to be able to bend in 9 precisely at that point. The parts A and B can then be mutually rotated until their slots coincide in order to allow the bender to be withdrawn from the plate 5-9.

[73] The plate 5-9 has a tail means 5 that is suitable to be held in a chuck (not shown) to facilitate means 5-9 to be used as a drill bit (e.g. rotating several times per second) to facilitate the pin means 9 to penetrate the bone cortex 67, Figure 1, 2 & 3.

[74] The tail means 5 is suitable to be inserted in a slot means 57, 58, Figure 8 in the region of the outer end 72, Figure 11 of a bone-fixing screw 55 with the help of a top loading screw 73, Figure 11 and is suitable for the tail 5 beyond the outer end 72 of the

bone fixing screw 55 to be cut off before the tail 5 is fixed in place in such slot 57, 58 as shown in Figure 11.

[75] The juxta-articular part 6 of the plate 5-9 has apertures 12-19, Figure 1 & 2, defined in mutually relatively twisted parts of said plate 5-9 so as to facilitate positioning or fixing members 78, 79, non-integral with the plate 5-9, being inserted through such apertures 12-19 and into the bone 68, 69 in mutually non-parallel directions as shown in Figure 12.

[76] As noted in connection with Figures 4 and 12, part 6 is twisted relative to part 8 and the left and right hand parts of part 6 are twisted relative to one another.

[77] It will be seen that three particular features of the embodiments are:

[78] - the pin that penetrates into the cortex and extends integrally from the main plate;

[79] - the means to facilitate precise positioning of the plate by adjustments from an initial position;

[80] - the guide means (holes) in the plate which have a specific direction and can be fitted closely by suitable pins so as to guide them into the specific directions described above (towards the bone, away from the fracture).

[81] It will be apparent to one skilled in the art, that features of the different embodiments disclosed herein may be omitted, selected, combined or exchanged and the invention is considered to extend to any new and inventive combination thus formed. Where a preference or particularisation is stated, there is implied the possibility of its negative, i.e. a case in which that preference or particularisation is absent.

[82] Many variations of the invention and embodiments hereinbefore described will be apparent to people skilled in the art and all such variations are to be considered as falling within the scope of the invention.

## Claims

[Claim 1]

1. Means for facilitating the use of a bone fracture fixation plate, comprising means to facilitate positioning of the plate and/or insertion of part of the plate into the cortex of the bone.
2. Means as claimed in claim 1, comprising a bone fracture fixation plate positioning means for facilitating controlled adjustment of the position of the plate on a long bone on the juxta-articular side of a fracture during fixation on that side and before fixation or positioning to the bone on the other side of the fracture, such positioning means being adapted to facilitate controlled adjustment of position of the plate on the bone from an initial position both towards and away from the fracture (herein called a longitudinal direction) and also transversely of such longitudinal direction.
3. Means as claimed in claim 2, in which said positioning means are adapted to facilitate said adjustment in at least two directions transversely of said longitudinal direction.
4. Means as claimed in claim 2 or 3, in which said positioning means are adapted to facilitate said adjustment in at least one direction oblique to said longitudinal direction.
5. Means as claimed in claim 2, 3 or 4 which comprise the plate and a plate positioner.
6. Means as claimed in claim 5, which comprise an arrangement of aperture means in the plate.
7. Means as claimed in claim 6, in which said aperture arrangement comprises at least three holes surrounding an initial-position hole.
8. Means as claimed in claim 7, in which there are holes, which are threaded.
9. Means as claimed in claim 5 or 6, in which said aperture arrangement comprises slot means.
10. Means as claimed in claim 9, in which said slot means comprise a cruciform slot arrangement.
11. Means as claimed in any one of claims 3 to 10, in which the plate has a juxta-articular epiphyseal part and a diaphyseal elongate shaft part connected together and twisted relative to one another.
12. Means as claimed in any one of claims 3 to 11, comprising extensions to the juxta-articular end of the plate that can be bent and readily detached from the plate.

13. Means as claimed in claim 12, in which said extensions comprise means adapted to guide and/or hold positioning and/or fixing member/s inserted through the extensions into parts of the bone.
14. Means as claimed in any one of claims 3 to 13, comprising means adapted to guide and/or hold positioning and/or fixing member/s inserted through the plate obliquely into the bone on said other side of the fracture.
15. Means as claimed in claim 14, in which said guide means comprise aperture means directed obliquely through the plate.
16. Means as claimed in claim 14 or 15, in which said guide means are directed obliquely towards the bone in a direction away from the fracture.
17. Means as claimed in any one of claims 2 to 16, which comprise a targeting jig adapted to be fixed in relation to the plate.
18. Means as claimed in claim 17, which comprise an arrangement of aperture means in the jig.
19. Means as claimed in claim 18, in which said jig arrangement comprises at least three holes surrounding an initial-position hole.
20. Means as claimed in claim 18 or 19, in which said jig arrangement comprises slot means.
21. Means as claimed in claim 20, in which said jig slot means comprise a cruciform slot arrangement.
22. Means as claimed in any one of claims 18 to 21, in which the jig comprises means to lock to the jig a positioning and/or fixing member in the said aperture means in the jig.
23. Means as claimed in any one of claims 17 to 22, in which the jig is configured to sit on a juxta-articular part of the plate.
24. Means as claimed in any one of claims 2 to 23, which comprises sleeve means.
25. Means as claimed in claim 24, comprising a targeting jig and in which the sleeve means serve to line aperture means in the jig to protect the jig from a drill bit guided by such aperture means.
26. Means as claimed in claim 24 or 25, comprising a targeting jig that comprises means to operate the sleeve means to lock to the jig a positioning and/or fixing member in aperture means in the jig.
27. Means as claimed in any one of claims 24 to 26, in which the sleeve means comprise scale means adapted to indicate how far into the bone a drill bit passing through the sleeve means has penetrated.

28. Means as claimed in claim 27, in which the scale means are adapted to be viewed from four sides.

29. A method of positioning a bone fracture fixation plate by use of means, as claimed in any one of claims 2 to 28, to facilitate controlled adjustment of the position of the plate on a long bone on the juxta-articular side of a fracture during fixation on that side and before fixation or positioning to the bone on the other side of the fracture, in which such means are used to control adjustment of position of the plate on the bone from an initial position in one or more of the following directions, namely towards or away from the fracture (herein called a longitudinal direction) and also transversely of such longitudinal direction.

30. A method as claimed in claim 29, in which said positioning means are used to facilitate said adjustment in at least two directions transversely of said longitudinal direction.

31. A method as claimed in claim 29 or 30, in which said positioning means are used to facilitate said adjustment in at least one direction oblique to said longitudinal direction.

32. A method as claimed in claim 29, 30 or 31, in which one or more extensions to the juxta-articular end of the plate are bent and/or detached from the plate.

33. A method as claimed in claim 32, in which one or more positioning and/or fixing members are guided and/or held by guide means of said extension/s when inserted through the plate obliquely into the bone on said other side of the fracture.

34. A method as claimed in claim 33, in which said guide means are used to direct said members obliquely towards the bone in a direction away from the fracture.

35. A method as claimed in any one of claims 29 to 34, in which a targeting jig is fixed in relation to the plate.

36. A method as claimed in claim 35, in which a plate positioning and/or fixing member is locked to the jig in aperture means in the jig.

37. A method as claimed in claim 35 or 36, in which sleeve means are used to line aperture means in the jig to protect the jig from a drill bit guided by such aperture means.

38. A method as claimed in claim 37, in which the sleeve means are operated to lock to the jig a positioning and/or fixing member in aperture means in the jig.

39. A method as claimed in claims 37 or 38, in which scale means of the sleeve means are used to indicate how far a distance into the bone a drill bit passing through the sleeve means has penetrated.
40. A method as claimed in claim 39, in which the scale means are used to indicate on four sides the said distance.
41. Means as claimed in claim 1, comprising a bone fracture fixation plate comprising a plate and a pin integral with the plate and extending from one end of the plate, the plate being provided with means to facilitate insertion of the pin into the cortex of the bone.
42. A plate as claimed in claim 41, in which said facilitating means comprise a sharpening at the end of the pin remote from the plate.
43. A plate as claimed in claim 42, in which said sharpening comprises cutting edge means.
44. A plate as claimed in claim 42 or 43, in which said sharpening comprises shaping said pin to a point at its said remote end.
45. A plate as claimed in any one of claims 41 to 44, in which said facilitating means comprise threading and/or flute means provided to said pin adjacent its said end.
46. A plate as claimed in any one of claims 41 to 45, adapted to be bent where it comes out of the bone after said insertion of the pin into the cortex, which may be done with a two piece pin bender.
47. A plate as claimed in any one of claims 41 to 46, comprising a tail extending from the opposite end of said plate.
48. A plate as claimed in the claim 47, in which said tail and said pin are in line with said plate, and the plate is such that said tail can be inserted in a chuck and the plate can be used as a drill bit.
49. A plate as claimed in claim 47 or 48, in which said tail is suitable to be inserted in a slot in the region of the outer end of a bone-fixing screw and is suitable for the tail beyond the screw to be cut off before the tail is fixed in place in such slot.
50. A plate as claimed in claim 49 in combination with said bone-fixing screw, the combination being provided with means to fix said tail in said slot.
51. A plate as claimed in claim 50, in which said means to fix said tail in said slot comprise screw means suitable to screw to said outer end of the bone-fixing screw to fix said tail in said slot.
52. A plate as claimed in any one of claims 47 to 51, in which the tail is adapted to be bent, after said insertion of the pin into the cortex.

53. A plate as claimed in any one of claims 41 to 52, suitable for the pin to be inserted into a long bone obliquely in a direction away from the juxta-articular side of a fracture, on the opposite side of the fracture.
54. A plate as claimed in any one of claims 41 to 53, adapted for one or more positioning or fixing members, non-integral with the plate, to be inserted obliquely through the plate.
55. A plate as claimed in any one of claims 41 to 54, in which said plate is twisted.
56. A plate as claimed in claim 55, which has apertures defined in mutually relatively twisted parts of said plate so as to facilitate positioning or fixing members, non-integral with the plate, being inserted through such apertures and into the bone in mutually non-parallel directions.
57. A method of attaching to a bone a plate as claimed in any one of claims 41 to 56, in which said insertion facilitating means is used to facilitate insertion of the pin into the cortex of the bone.
58. A method as claimed in claim 57, in which said insertion facilitating means comprises a sharpening at the end of the pin remote from the plate and this sharpening is used to facilitate insertion of this end into said cortex.
59. A method as claimed in claim 57 or 58, in which said insertion facilitating means comprises threading and/or flute means adjacent said remote end and this means is used to facilitate insertion of this end into said cortex.
60. A method as claimed in any one of claims 57 to 59, in which, after insertion of the pin into the cortex, the plate is bent where it comes out of the bone.
61. A method as claimed in any one of claims 57 to 60, in which a tail extending from the opposite end of said plate from said pin is in line with said plate and said pin and is inserted in a chuck and the plate is used as a drill bit to facilitate insertion of the pin into the cortex.
62. A method as claimed in any one of claims 57 to 61, in which a tail extending from the opposite end of said plate from said pin is inserted in a slot in the region of the outer end of a bone-fixing screw and the tail beyond of the screw is cut off before the tail has been fixed in place in such slot.
63. A method as claimed in claim 62, in which screw means are used to screw to said outer end of the bone-fixing screw to fix said tail in said

slot.

64. A method as claimed in any one of claims 57 to 63, in which a tail extending from the opposite end of said plate from said pin is bent after said insertion of the pin into the cortex.

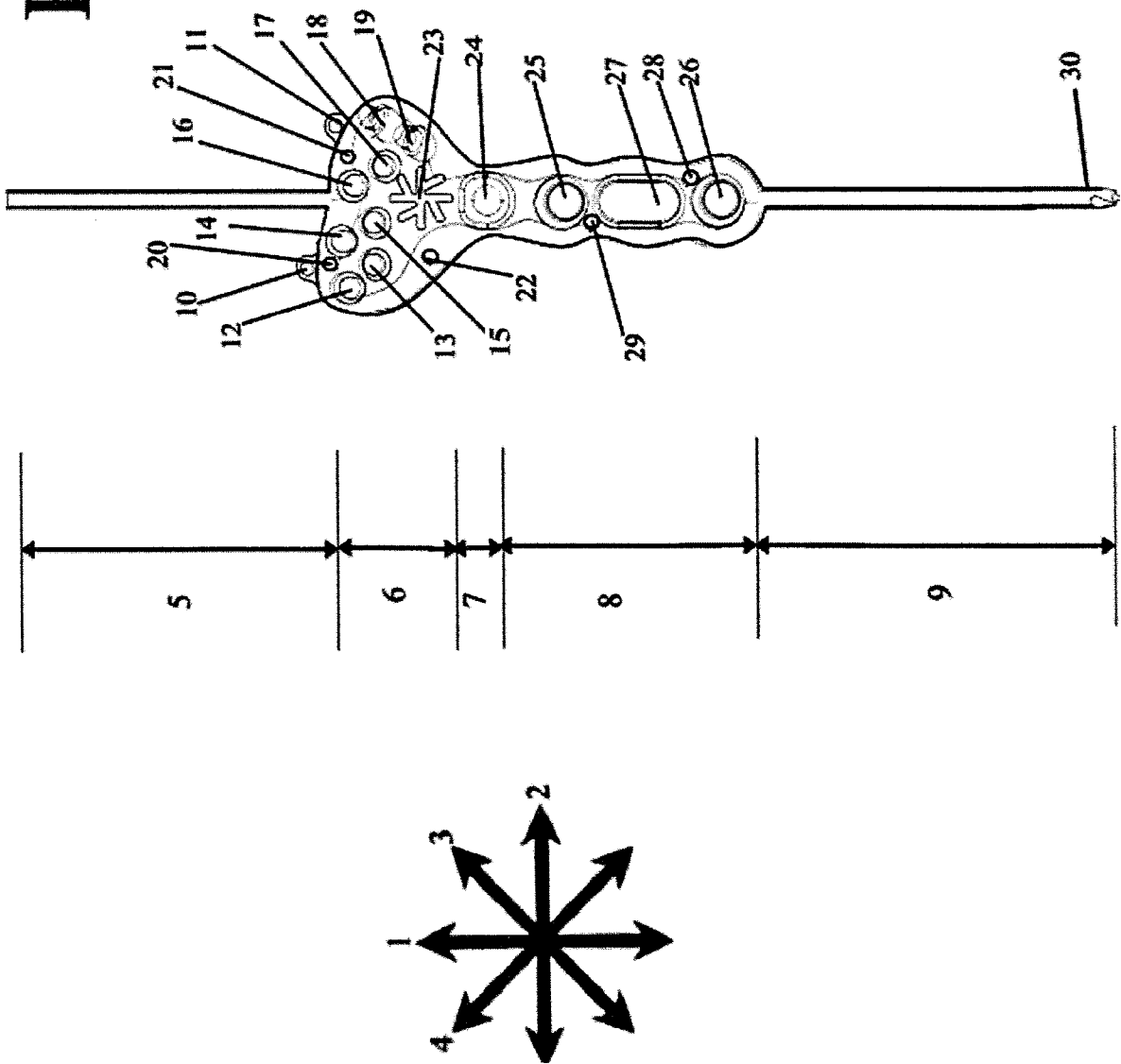
65. A method as claimed in any one of claims 57 to 64, in which the pin is inserted into a long bone obliquely in a direction away from the juxta-articular side of a fracture on the opposite side of the fracture.

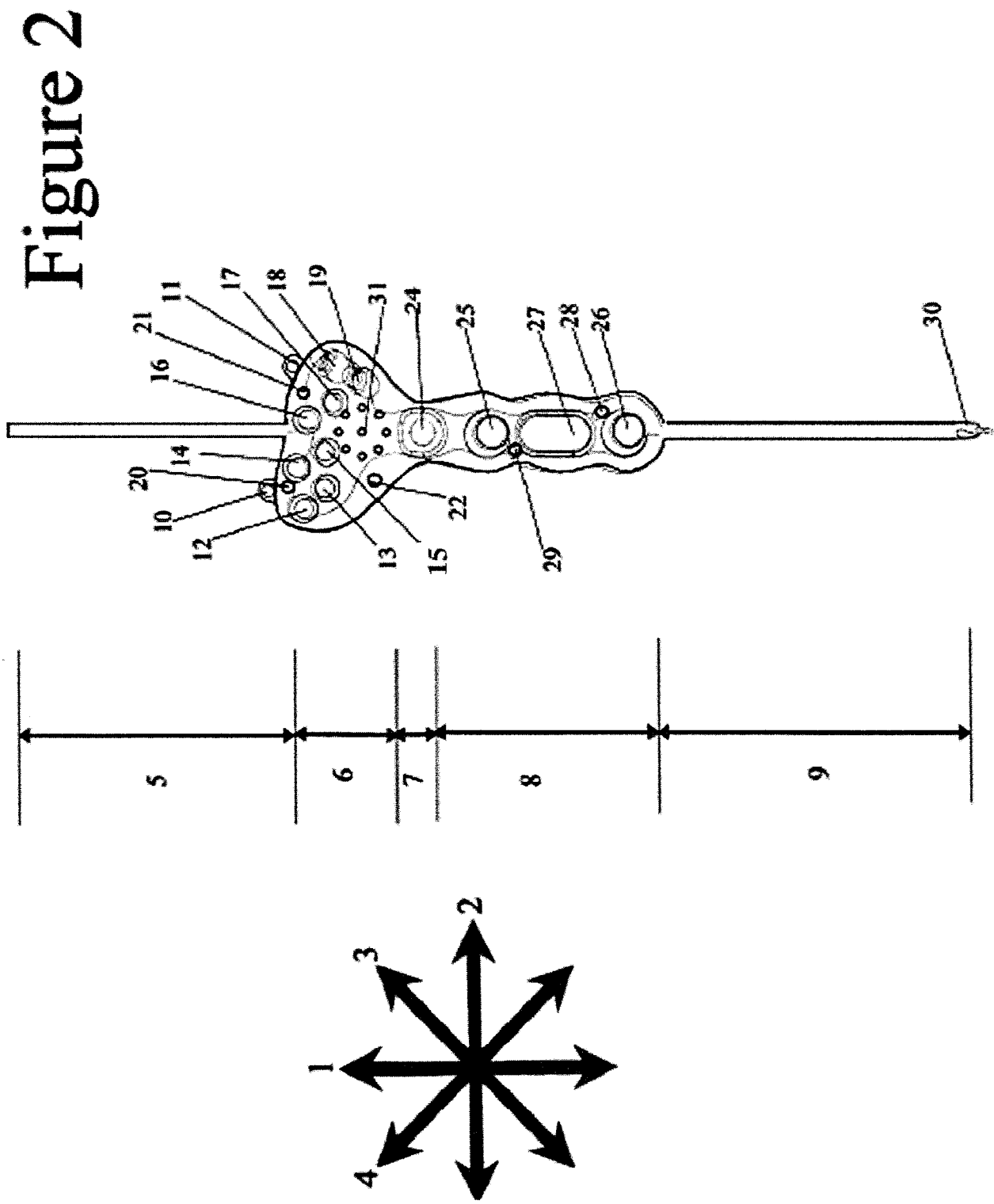
66. A method as claimed in any one of claims 57 to 65, in which one or more positioning or fixing members, non-integral with the plate, are inserted obliquely through the plate.

67. A method as claimed in any one of claims 57 to 66, in which and said plate has apertures defined in mutually relatively twisted parts of said plate and positioning or fixing members, non-integral with the plate, are inserted through such apertures and into the bone in mutually non-parallel directions.



Figure 1





# Figure 3

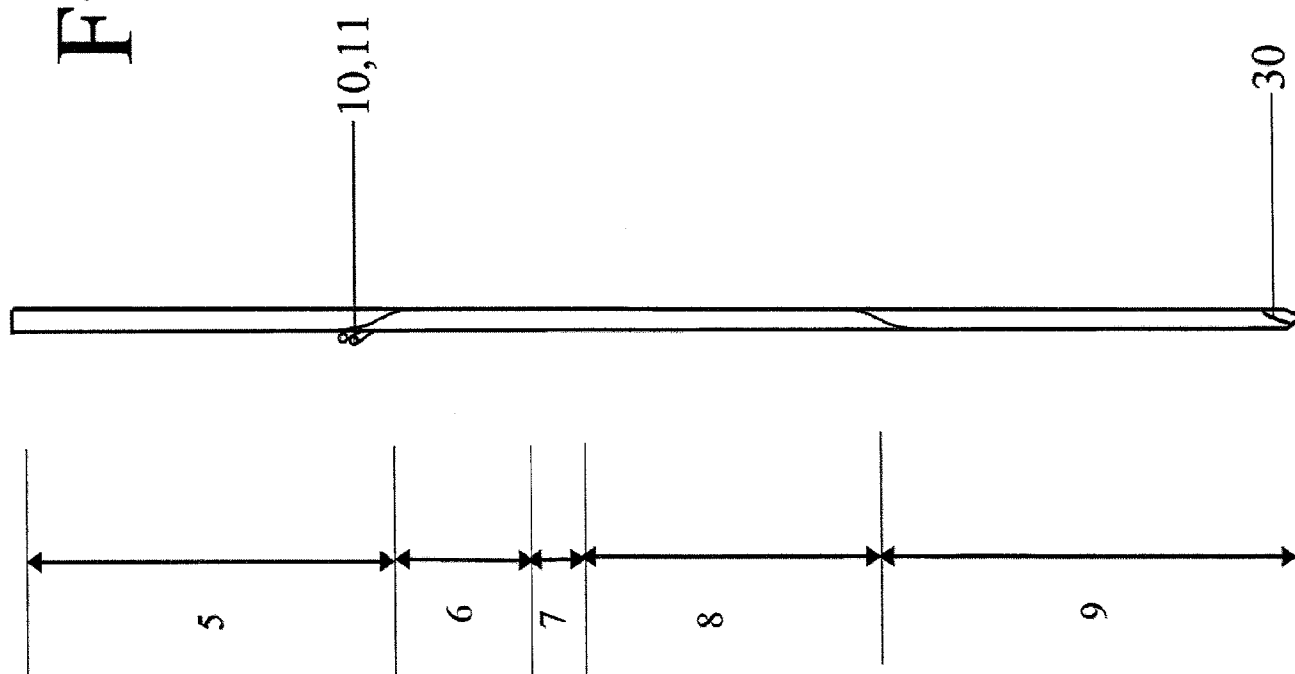


Figure 4

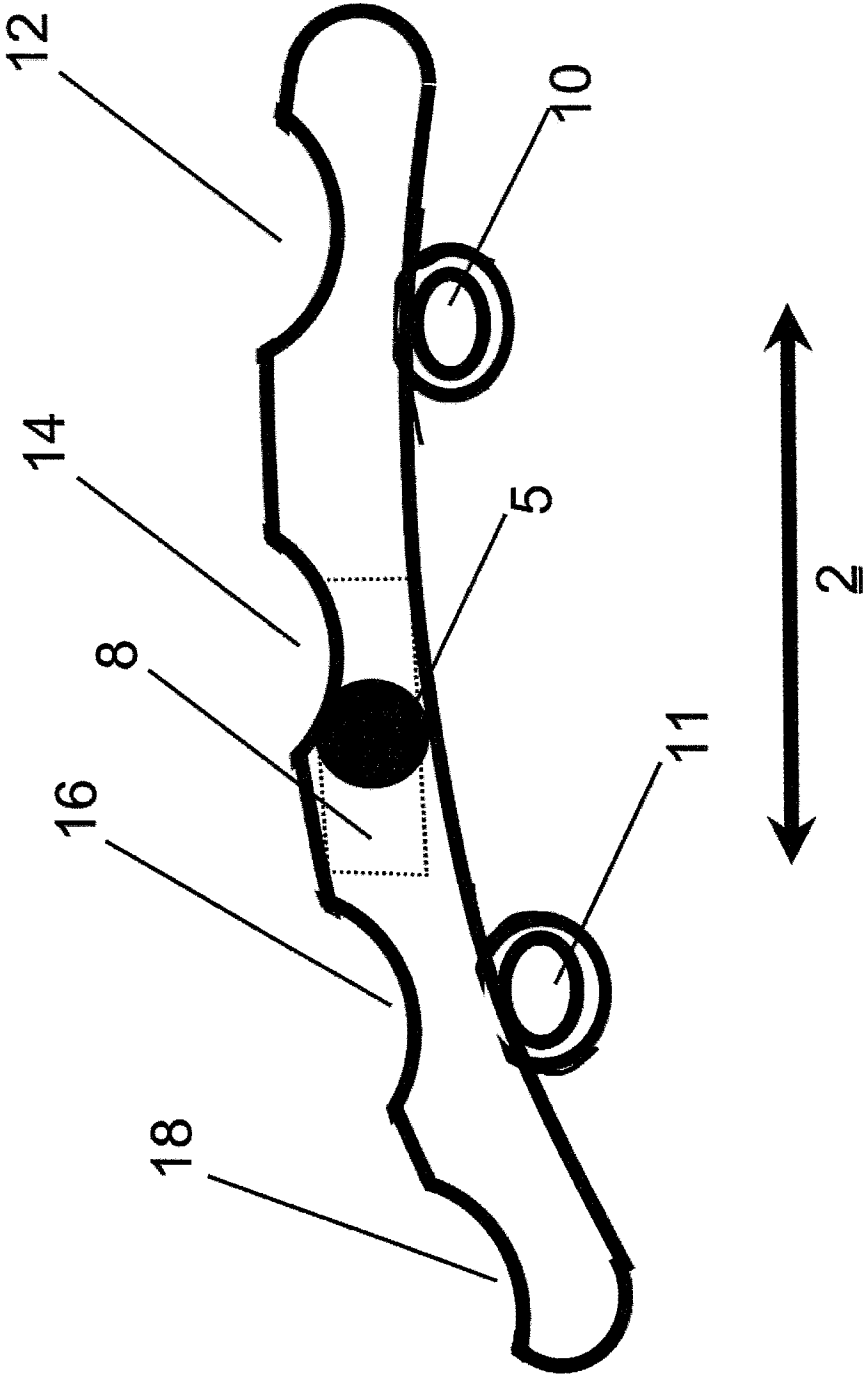


Figure 5

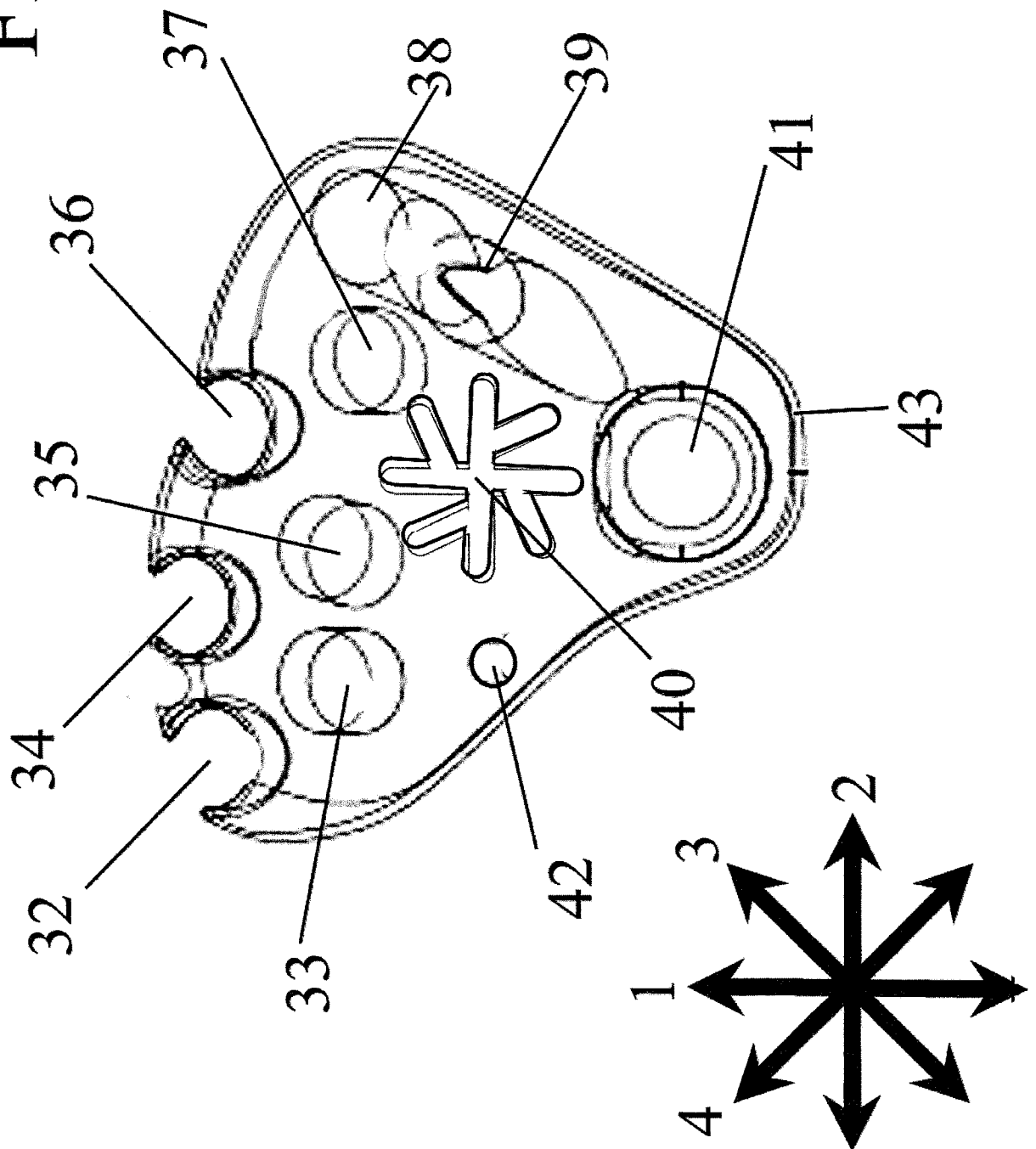


Figure 6

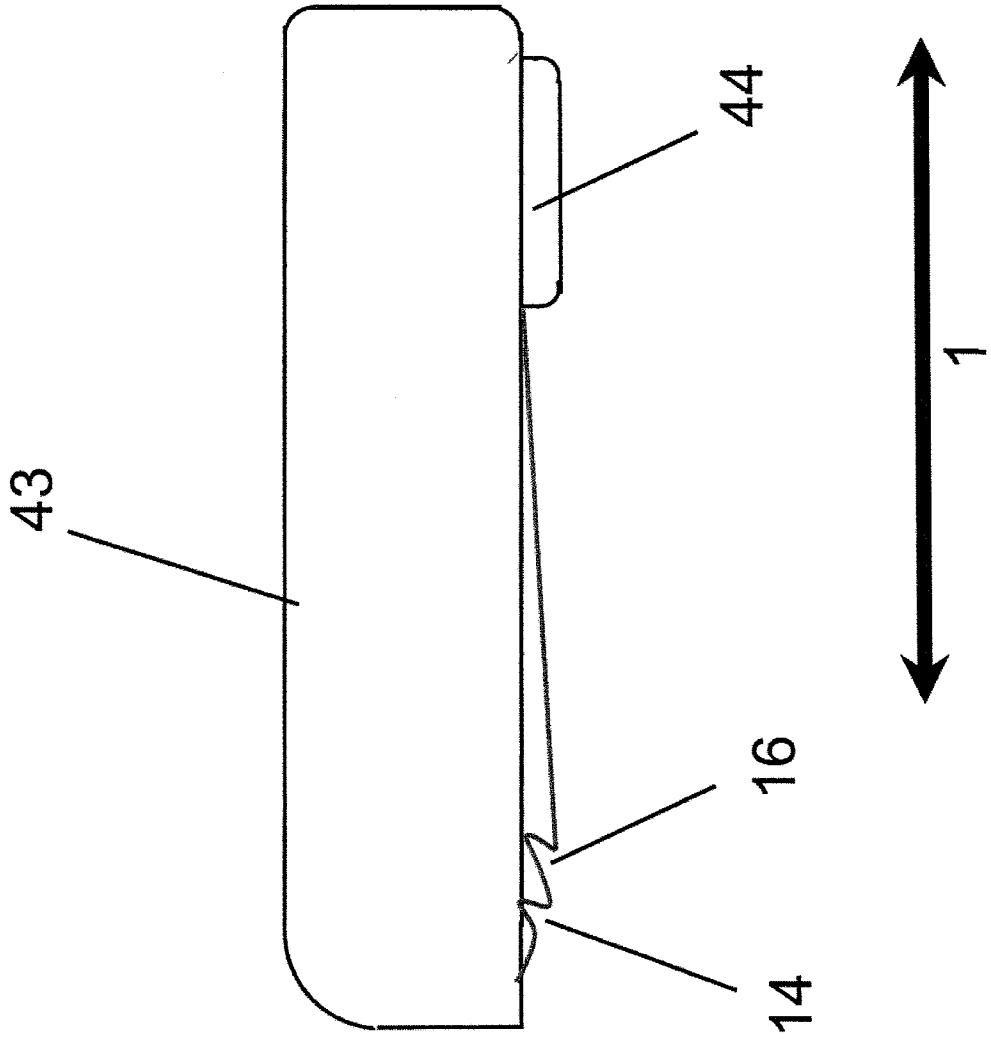


Figure 7

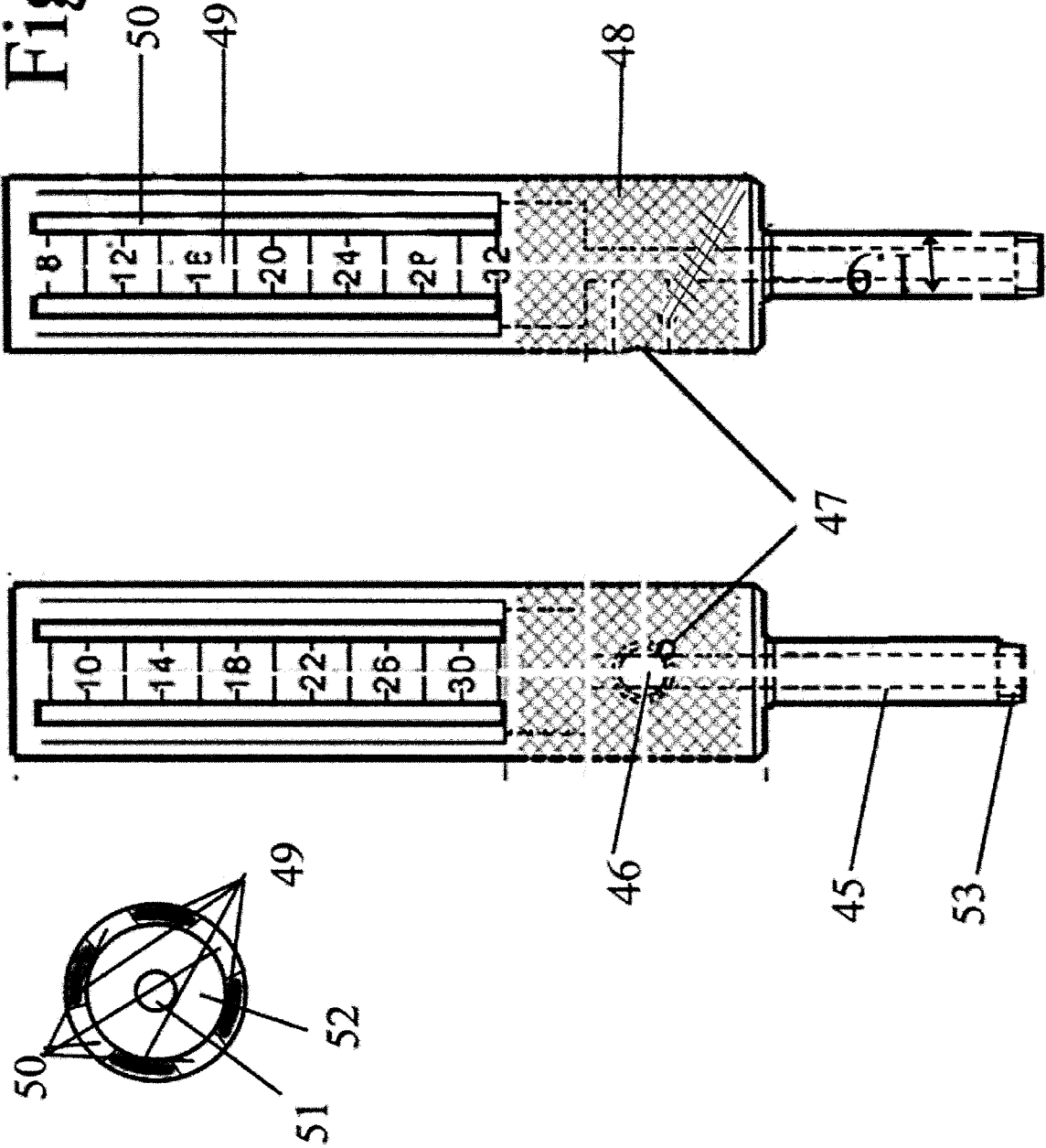


Figure 8

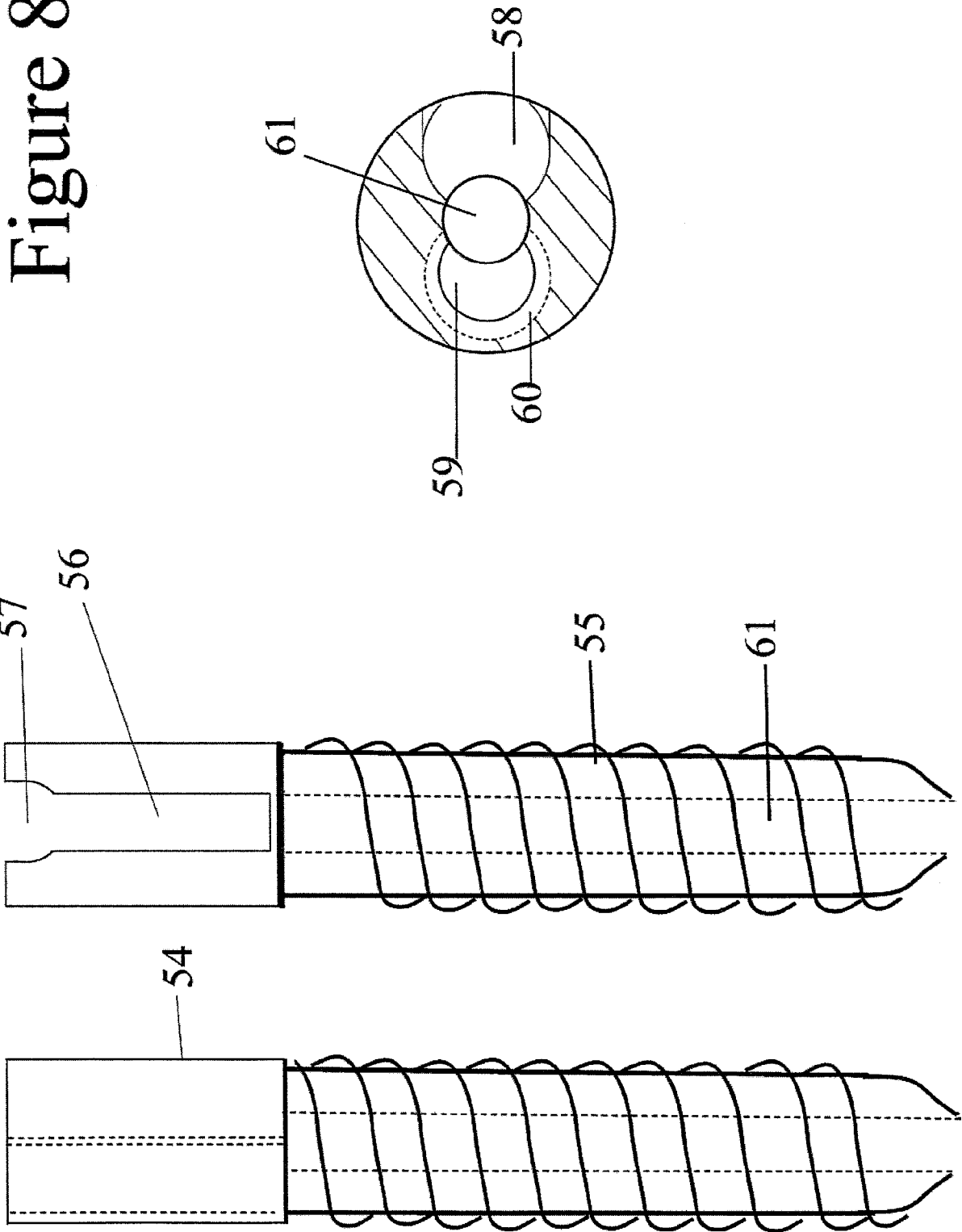




Figure 9

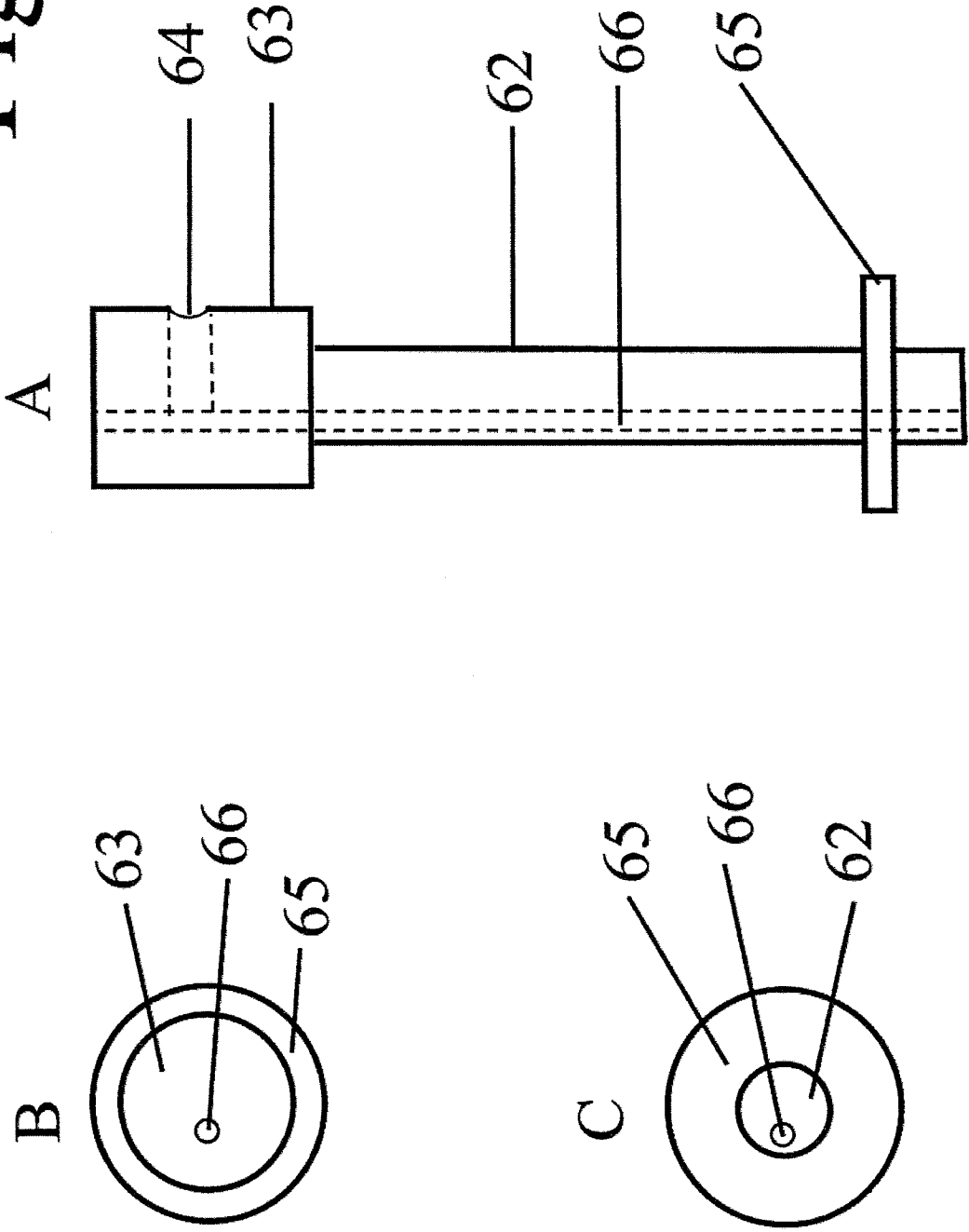
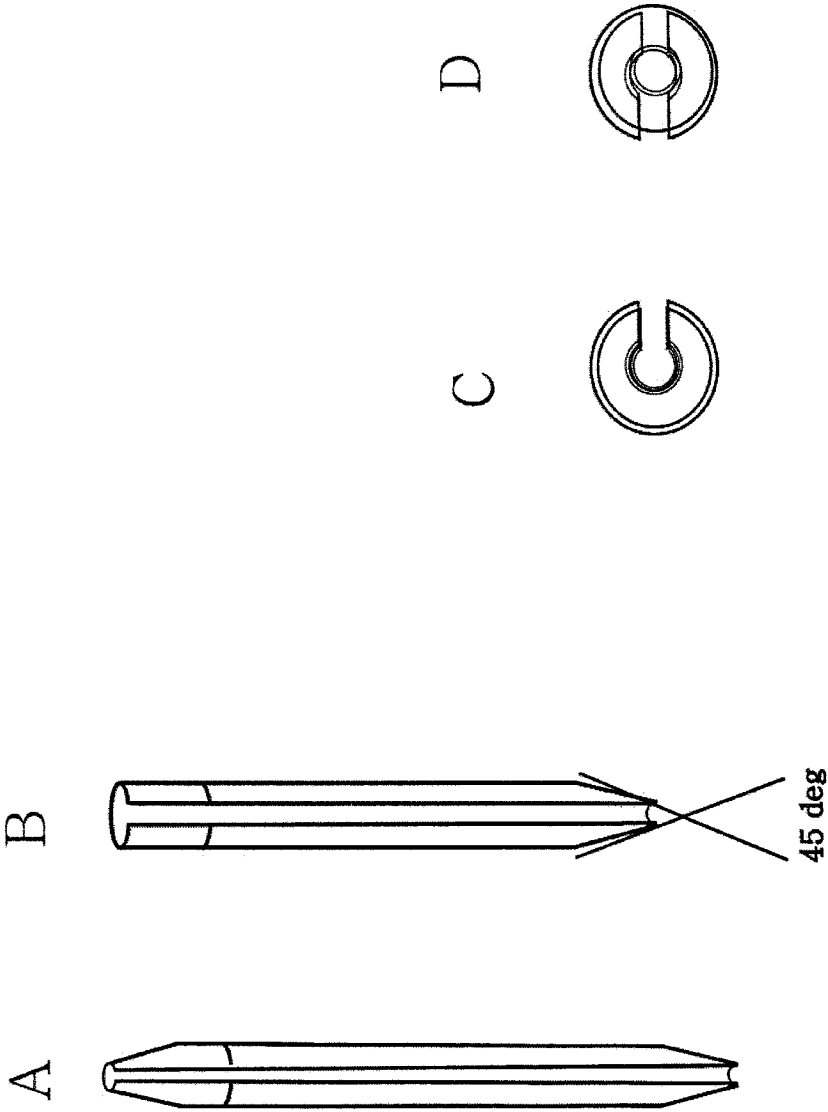


Figure 10



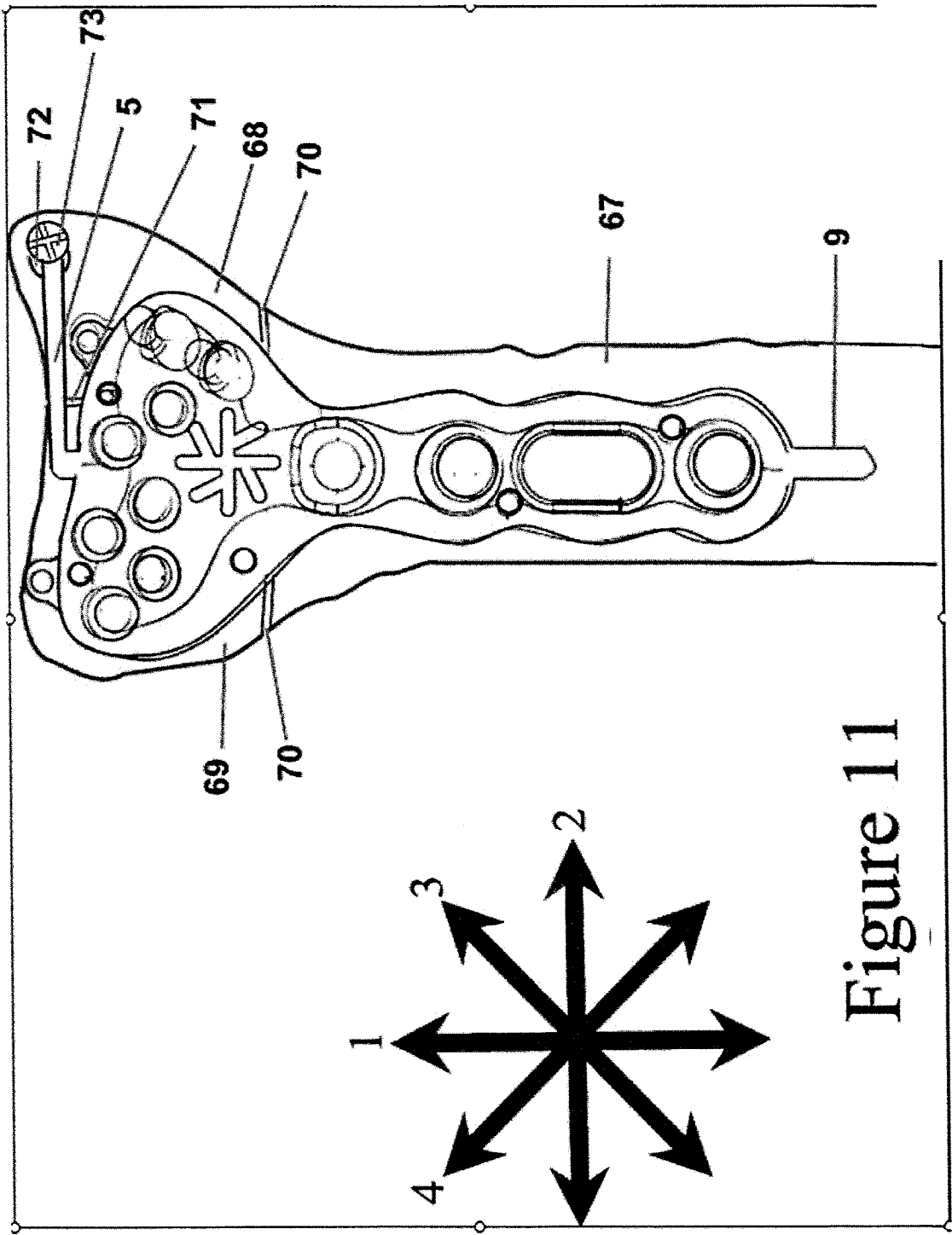
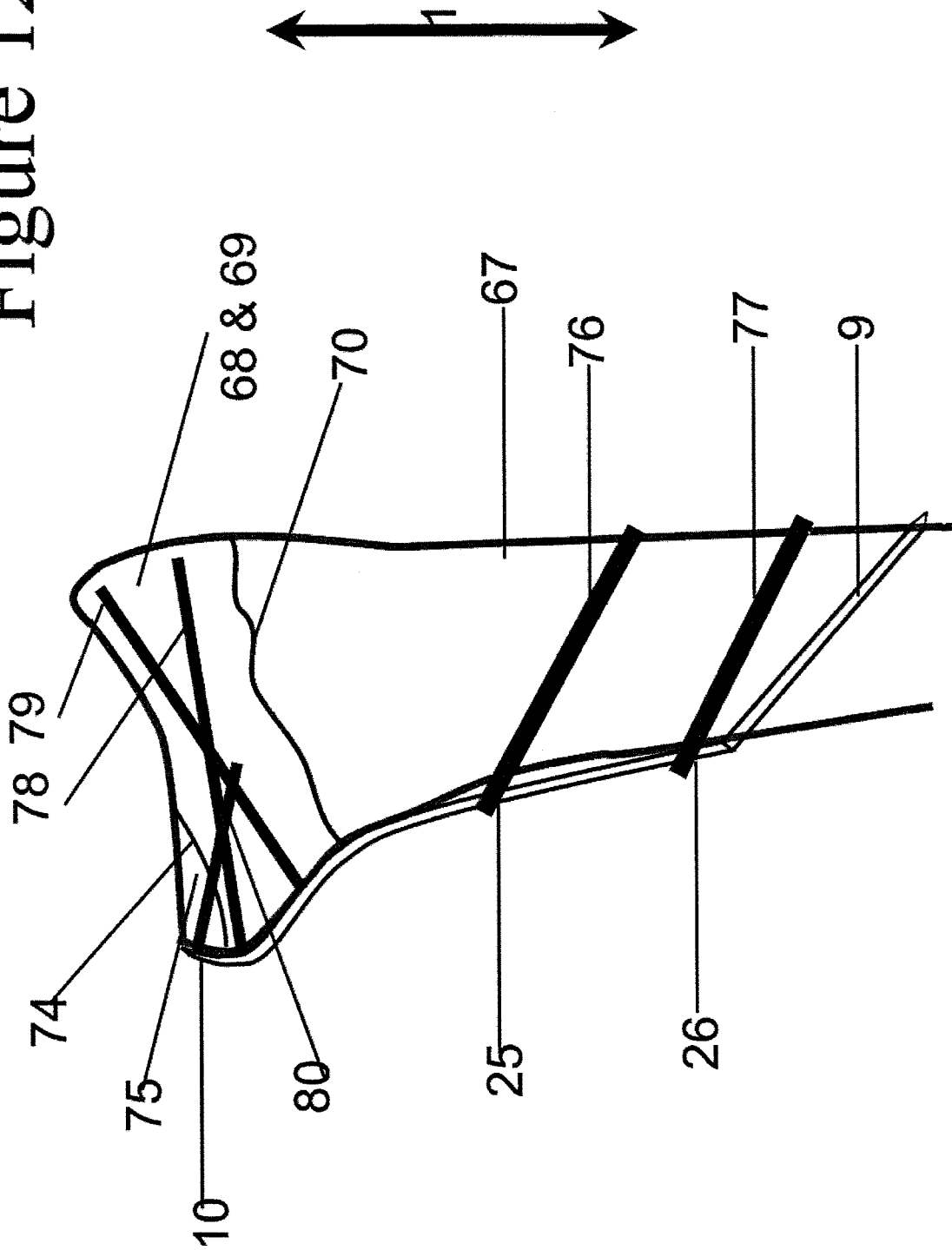


Figure 11

Figure 12



# INTERNATIONAL SEARCH REPORT

International application No  
PCT/IB2011/050262

A. CLASSIFICATION OF SUBJECT MATTER  
INV. A61B17/17 A61B17/80  
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 10 2005 043281 A1 (DIETER MARQUARDT MEDIZINTECHNI [DE]) 15 March 2007 (2007-03-15) paragraph [0037]; figure 1 -----	1
X	US 2009/157086 A1 (DIGESER DENIS [DE] ET AL) 18 June 2009 (2009-06-18) figure 1 -----	1
X	US 2006/173458 A1 (FORSTEIN MICAH [US] ET AL) 3 August 2006 (2006-08-03) figures 12,38 -----	1
X	US 2005/085818 A1 (HUEBNER RANDALL J [US]) 21 April 2005 (2005-04-21) figures 5,12 -----	1
	----- -/--	

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

\* Special categories of cited documents :

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"E" earlier document but published on or after the international filing date

"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)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"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

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"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.

"&" document member of the same patent family

Date of the actual completion of the international search

20 June 2011

Date of mailing of the international search report

29/06/2011

Name and mailing address of the ISA/

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Authorized officer

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# INTERNATIONAL SEARCH REPORT

International application No  
PCT/IB2011/050262

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/124990 A1 (TEAGUE MICHAEL [US] ET AL) 9 June 2005 (2005-06-09) paragraph [0018]; figure 1 -----	1
X	US 2009/228047 A1 (DEROUE ET AL) 10 September 2009 (2009-09-10) figures 1,3,4 -----	1
X	US 2009/177239 A1 (CASTRO MICHAEL [US]) 9 July 2009 (2009-07-09) figures 1,2 -----	1
X	WO 2009/121144 A1 (AUSTOFIX GROUP LTD [AU]; LAIRD EWEN [AU]) 8 October 2009 (2009-10-08) figures 1,3,4,6,7,14 -----	1

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/IB2011/050262

### Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 29-40, 57-67  
because they relate to subject matter not required to be searched by this Authority, namely:  
Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery
2. ☒ Claims Nos.: 2-28, 41-56  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:  
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

### Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

#### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

Continuation of Box II.1

Claims Nos.: 29-40, 57-67

Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery

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Continuation of Box II.2

Claims Nos.: 2-28, 41-56

Due to the plurality of claims dependent on claim 1 it is at present unclear in which direction the application may go. The various definitions of the subject-matter given in claims 2-28 and 41-56 which relate to entirely different aspects of the application, do not allow to correctly identify "the claimed invention" on which an opinion should be based in the sense of Article 33(1) PCT. This makes difficult, if not impossible, to determine the matter for which protection is sought and places an undue burden to others seeking to establish the extend of protection requested. Therefor no detailed written opinion can be established for the claims 2-28 and 41-56.



# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2011/050262

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 102005043281 A1	15-03-2007	NONE	
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WO 2009121144 A1	08-10-2009	AU 2009230888 A1 AU 2010101470 A4 EP 2259734 A1 US 2011106086 A1	08-10-2009 03-02-2011 15-12-2010 05-05-2011