AU9470337

(12) PATENT ABRIDGMENT (11) Document No. AU-B-70337/94
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 669999

(54) Title
**MEDULLARY DRILL HEAD**

(51)[5] International Patent Classification(s)
**A61B 017/16** **A61B 017/58**

(21) Application No. : **70337/94** (22) Application Date : **19.08.94**

(30) Priority Data

| (31) Number | (32) Date | (33) Country |
|---|---|---|
| **2774/93** | **15.09.93** | **CH SWITZERLAND** |

(43) Publication Date : **13.04.95**

(44) Publication Date of Accepted Application : **27.06.96**

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(56) Prior Art Documents
**US 4021920**
**AU 70225/91 A61B 17/16**
**AU 26539/77 A61B 17/16**

(57) Claim

1. A drill head for drilling out the medulla of a tubular bone including a hollow body of revolution having a front part, a middle part and a rear part, each of the front and rear parts having an opening, the rear part having coupling means for attachment to a drill and the front and rear parts having spiral slots wherein the spiral slots are provided with a cutting edge.

AUSTRALIA

Patents Act

**COMPLETE SPECIFICATION**
(ORIGINAL)

Class Int. Class

Application Number:
Lodged:

Complete Specification Lodged:
Accepted:
Published:

Priority

Related Art:

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Invention Title:

**MEDULLARY DRILL HEAD**

Our Ref : 380680
POF Code: 44501/171481

**The following statement is a full description of this invention, including the best method of performing it known to applicant(s):**

11316.A65

# MEDULLARY DRILL HEAD

## Field Of The Invention

The invention relates to a drill or reamer head for bone surgery and in particular to a drill or reamer head for use in drilling the medullae of long bones.

## Background Of The Invention

In osteosynthetic treatment of fractured tubular bones, prior to the implantation of a medullary nail, the medullary space must be drilled or reamed out. To this end first a reamer guide or mandrel is fitted through the medullary segments of the individual bone fragments, over which a hollow, flexible drilling shaft with a solid drilling head is then fitted. A pneumatic drill is normally used to drive the drill shaft. After that a flexible shaft with replaceable heads having exterior diameters of differing sizes is inserted to do the final reaming out of the medullary space. Medullary drill heads can be attached securely onto the flexible shaft, and released from it by means of a simple coupling.

Since according to the state of the art the medullary drill heads (apart from the hollow shaft for the reamer guide which is fully occupied by the guide) are solid, during the drilling procedure a considerable metaphyseal and radial pressure is generated within the medulla of the distal fracture fragment. Peak values for pressure of up to 1500 mm Hg can be produced.

The enormous increase in pressure causes a squeezing of the medullary fat into the transcortical vessels, which is disadvantageous to fracture healing, because the transcortical vessels are impaired in their function not only be the drilling procedure but also by the shifting of the medullary fat. Also, a pressure-induced infiltration of fat into the draining vein system may lead to fat embolisms.

In addition, the temperature rise that accompanies the drilling procedure (with peak values up to 50°C) is undesirable.

Finally, the drill head frequently becomes jammed in the medullary space; it must then be extracted with special instruments.

Summary of the Invention

According to the invention there is provided a drill head for drilling out the medulla of a tubular bone including a hollow body of revolution having a front part, a middle part and a rear part, each of the front and rear parts having an opening, the rear part having coupling means for attachment to a drill and the front and rear parts having spiral slots wherein the spiral slots are provided with a cutting edge.

An advantage of the invention, is provided by a hollow drill head which permits dispersal of hydraulic pressure in the distal fracture fragment during drilling of the medulla, thus avoiding the difficulties experienced with prior drilling devices.

Preferably, the front and rear parts have the shape of truncated cones.

By using a drill head according to the invention, the pressure that is engendered in front of the drill head during the drilling procedure can be dispersed backward through the openings provided for this purpose in the hollow drill head.

In the drawings:

Fig. 1 is a perspective view of a medullary drill or reamer head according to the invention;

Fig. 2 is a schematic top plan view of the reamer head of Fig. 1 indicating the angular positioning and size of the openings which are shown symbolically;

Fig. 3 is a schematic top plan view of a variant of the drill head of Fig. 2; and

Fig. 4 is a schematic simplified side elevational view of the drill head of Figs. 1 and 2 indicating the inclination of an opening to the axis of the head.

Description Of A Preferred Embodiment

Referring to Fig. 1 of the drawings, a medullary drill head essentially consists of a hollow body of revolution with a truncated conically shaped front part 1, a middle part 2, a truncated conically shaped rear part 3 and a coupling piece 4 attached to the rear part, for releasable attachment to a flexible, drivable drill shaft (not shown). The wall thickness of the hollow body of revolution is most advantageously about 1 mm.

The front part 1, rear part 3 and coupling part 4 are equipped with openings such as 7 and 8, through which a drill or reamer guide or mandrel (not shown) with the same diameter can be inserted.

In front part 1 as well as the section of middle part 2 which adjoins part 1, in the shell 6 of the hollow body of revolution, three openings 5 in the form of spirally shaped slots, are placed 120° apart; that is, as shown in Fig. 2, the angular distance $\alpha$, from the same point on one slot, for example the upper tip or the center, to the same point on adjacent slots, is 120°. In rear part 3, as well as in the adjoining section of middle part 2, approximately symmetrical with the slots in the front part, three openings 5′ in the form of spiral slots, are arranged 120° apart. As shown in Fig. 2, the slots 5, 5′ extend over a sector $\beta$ of about 60°-100°, preferably about 80°-100°, and most preferably about 90°. At their lower ends the slots in the rear part are preferably enlarged as at 11 to prevent clogging of the drill head.

As indicated in Fig. 4, the pitch angle, i.e. the angle of inclination of the helically shaped slots to the longitudinal axis of the head is from about 20° to about 40°, preferably about 25° to about 35°, most preferably about 30°.

Instead of the three slots displaced by 120°, as shown in Fig. 3, two slots displaced by 180° may be used.

The slots 5, 5′ are configured so as to have cutting edges 10, similar to a grater. Preferably the edges 10 which are

oriented toward coupling piece 4 are raised up, for example, by bending them back.

Coupling piece 4 is shaped according to the state of the art, and can be equipped with any suitable coupling system for the drill shaft to be affixed to it.

The two halves of the hollow body of revolution can be made separately and then joined to each other along weld seam 9. The walls of the body may be about 0.5 to about 2 mm thick, preferably about 0.8 to about 1.2 mm. At least 50%, and preferably at least 70%, of the head is hollow.

The claims defining the invention are as follows:

1. A drill head for drilling out the medulla of a tubular bone including a hollow body of revolution having a front part, a middle part and a rear part, each of the front and rear parts having an opening, the rear part having coupling means for attachment to a drill and the front and rear parts having spiral slots wherein the spiral slots are provided with a cutting edge.

2. A drill head according to claim 1 wherein the cutting edges of the spiral slots are facing away from the coupling means.

3. A drill head according to any one of the preceding claims wherein the front part has the shape of a truncated cone.

4. A drill head according to any one of the preceding claims wherein the rear part has the shape of a truncated cone.

5. A drill head according to any one of the preceding claims wherein the front part includes two spiral slots extending into the middle part, about 180° apart.

6. A drill head according to any one of the preceding claims wherein the rear part includes two spiral slots extending into the middle part, about 180° apart.

7. A drill head according to any one of claims 1 to 4 wherein the front part has three slots about 120° apart extending into the middle part.

8. A drill head according to any one of the claims 1 to 4 or 7 wherein the rear part has three slots, about 120° apart extending into the middle part.

9. A drill head according to any one of claims 4 to 6 wherein the spiral slots are inclined to the axis of the drill head at an angle of about 20° to about 40°.

10. A drill head according to any one of claims 4 to 6 wherein the spiral slots are inclined to the axis of the drill head at an angle of about 25° to 35°.

11. A drill head according to any one of claims 4 to 6 or 8 or 9 wherein the spiral slots occupy a sector of the body of revolution of about 60° to about 100°.

12. A drill head according to claim 11 wherein the sector is about 80° to about 100°.

13. A drill head according to any one of the preceding claims wherein the body of revolution includes a shell from about 0.5 to about 2mm thick.

14. A drill head according to any one of claims 1 to 12 wherein the shell is from about 0.8 to about 1.2 mm thick.

15. A drill head according to any one of the preceding claims including openings in the front part and in the coupling part for receiving a guide wire.

16. A drill head according to any one of the preceding claims wherein at least 50% of the total volume of the body of revolution is hollow.

17. A drill head according to any one of claims 1 to 15 wherein at least 70% of the total volume of the body of revolution is hollow.

18. A drill head substantially as hereinbefore described and illustrated.

Dated: 1 May, 1996
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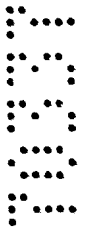
SYNTHES AG, CHUR

## Abstract

A drill head for medullary drilling is formed as a hollow body of revolution having cutting slots in its surface.

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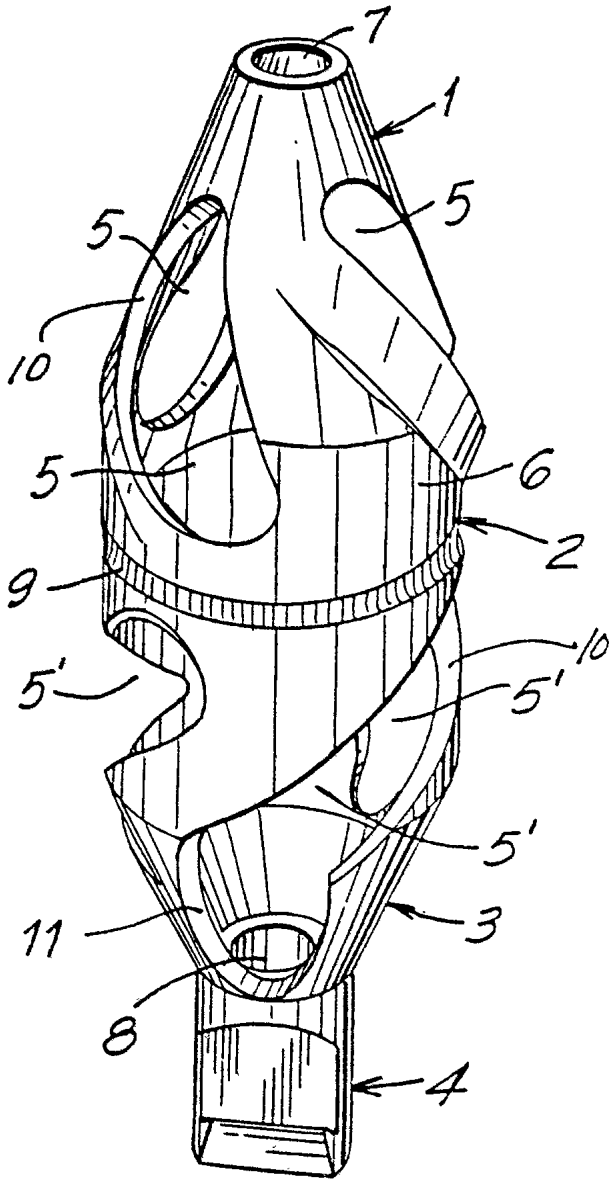


FIG. 1

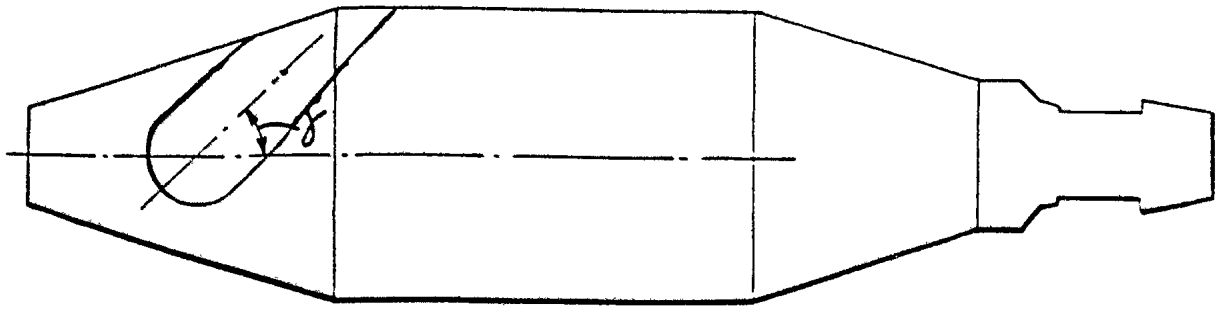


FIG. 4

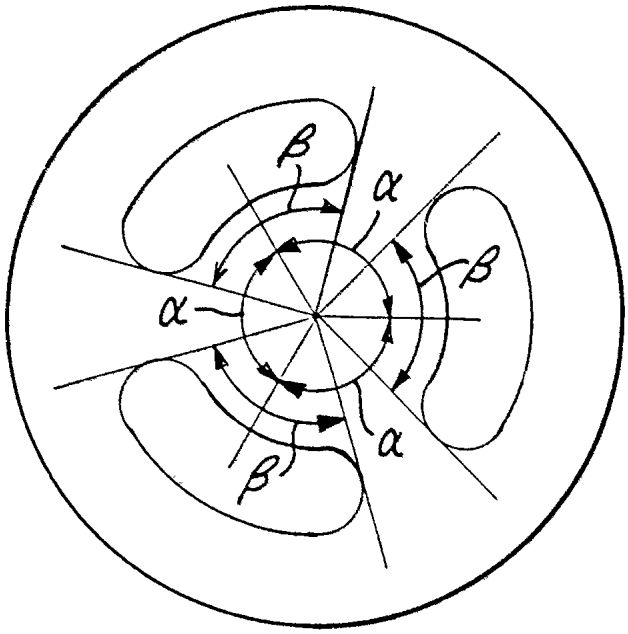


FIG. 2

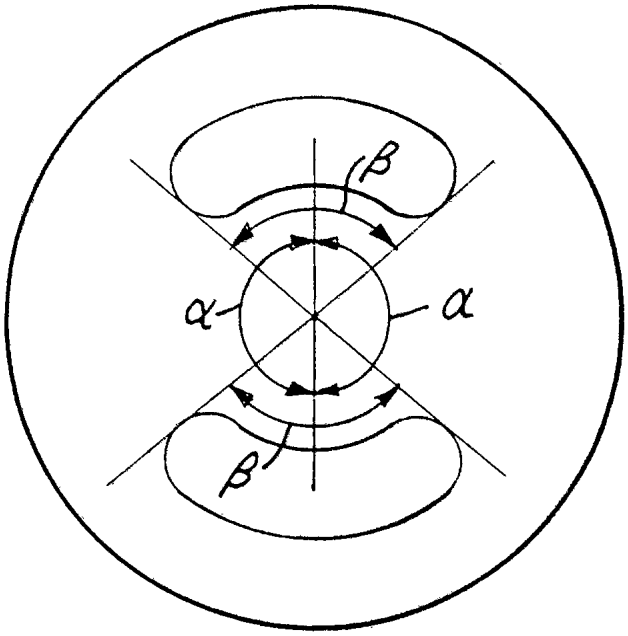


FIG. 3