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Invention Title: A Surgical Trephine

The following statement is a full description of this invention, including the best method of performing it known to me/us:-

A Surgical Trephine

Abstract

A surgical trephine adapted for boring an opening in tamped bone chippings which include a hollow elongated body portion having an internal bore (11) and the distal
5 end (12) of which has an annular cutting rim (13), a piston (14) located in said bore (11) with a piston surface facing toward said cutting rim (13), means for moving the piston (14) in the bore (11).



A SURGICAL TREPHINE

This invention relates to a surgical trephine adapted for boring an opening in tamped bone chippings.

Modern surgical techniques, especially as applied to hip
5 prostheses, sometimes require a prosthetic device with an elongated stem. These devices are used when not only are there problems with the hip joint but there is also the possibility of fracturing in the length of the femur. The addition of a standard length prosthesis stem into such a femur can sometimes create further problems and for this reason
10 a stem of much longer length is employed. The distal portion of such stems is usually parallel because of the extended length and the narrowing of the femur and its intramedullary canal.

In modern techniques bone chippings can be employed to line the intramedullary canal and these chippings are first tamped into
15 position, for example as described and shown in the Applicants pending European Patent Application No. 95306990.3 (EP 0 705 579). This Application shows a method and apparatus for implanting a prosthesis in which a bone cavity is filled with bone chips which are compressed.

When such a technique is used for long prosthesis stems there
20 are difficulties in shaping the distal end of the cavity due, not only to the long length, but also to the possibilities of causing further compression of the bone chippings and thus tending to expand the filling and create fractures in the bone structure.

The present invention is intended to provide an instrument
25 which can be used for cutting the required cavity into bone chippings in operations of the kind described above, although it can be used for any cavity in which bone chippings are used and a substantially parallel cavity is required.

According to the present invention a surgical trephine adapted for boring an opening in tamped bone chippings includes a hollow elongate body portion having an internal bore and the distal end of which has an annular cutting rim, a piston located in said bore with a piston surface facing towards said cutting rim and means for moving the piston in the bore, and means for limiting the movement up the bore and away from the distal end thereof.

With this device an elongate cavity can be cut in the bone chippings, the debris from the cutting entering the distal end of the internal bore and slowly pushing the piston up the bore away from the distal end. When the body portion is withdrawn from the cavity, the chippings can then be easily dislodged from the bore by displacing the piston.

The body portion may include an aperture in the wall passing into the bore at a point spaced away from the distal end to facilitate cleaning after operation.

The action of the surgeon can be back and forth or with a continuous rotation or with an up and down motion in the form of a pile driver.

Preferably an extension or extended portion of the piston projects beyond the proximal end of the body portion and means can be provided for limiting the movement of the piston up said bore and away from the distal end thereof to limit the upward movement to a position adjacent the proximal end of the aperture.

Preferably the annular cutting rim is provided with cutting teeth although, in certain circumstances, merely a sharpened edge may be required.

The proximal end of the extended portion of the piston or an extension thereof can be provided with removable means to limit the movement of the piston in a distal direction. These means can be removed so that the device can be completely dismantled for cleaning but when it is in position it locates the piston in the bore and prevents the piston dropping through the main body.



Preferably the hollow elongate body portion is provided with an operating handle which can be in the form of a T-piece.

The hollow elongate body portion can also be provided with a depth gauge and means can be provided on the extended portion of the piston, or extension thereof, to provide a position indicator.

If desired the proximal end of the extended portion of the piston, or an extension thereof, can be provided with means for attaching a power source so that the device can be operated by a power device.

The piston can be provided with means to accept a guide wire so that the trephine can be used as one of a series of operations when carrying out the preparation of the bone for implantation.

The invention can be performed in various ways but one embodiment will now be described by way of example and with reference to the accompanying drawings, in which :

Figure 1 is a diagrammatic illustration of a typical phantom for a prosthesis with a long stem impacted into bone chippings in a femur;

Figure 2 is a side elevation of a surgical trephine according to the present invention;

Figure 3 is a cross-sectional front elevation of the device shown in Figure 2 on the lines III-III;

Figure 4 is an isometric view of the trephine according to the invention;

Figure 5 is an enlarged view of the teeth used on the annular cutting rim of the device according to the invention; and

Figure 6 is an enlarged portion of part of the cross-sectional front elevation shown in Figure 3.



In Figure 1 a femur 1 is shown in which the intramedullary canal has been treated to provide a cavity 2 into which a prosthesis with a long stem is intended to be inserted. In Figure 1 a phantom prosthesis 3 with a long stem 4 is shown which will eventually be
5 removed and replaced by the surgical prosthesis. This technique is described and shown in the Applicants pending European Patent Application No. 95306990.3 (EP 0 705 579). When the cavity 2 has been prepared it is filled with bone chippings 5 and these are tamped and compressed. When a long stem is to be used however there are
10 difficulties in tamping the bone chippings against the sides of the cavity 2 by the usual techniques but the present invention allows the distal end of the cavity to be completely filled with bone chippings up to a level indicated by reference numeral 6.

When the bone cavity is being prepared a guide wire 7 is placed
15 in position, usually held by a retaining plug 8, and this guide wire is used, in well known manner, to guide an accurately locate the various components which are used during the operation. The guide wire is, of course, placed in position before the bone chippings are inserted. When a phantom technique is employed the phantom 3 is withdrawn, the
20 cavity within the bone chippings is lined with cement and the surgical prosthesis subsequently inserted with or without the use of a guide wire.

The present invention provides a trephine which can be used to cut out the tamped and compressed bone fragments beneath the level 6
25 and comprises a hollow elongate body portion which has an internal bore 11 and the distal end 12 of which has an annular cutting rim 13. The cutting rim can be provided with teeth 14, as shown in Figure 5.

Located in the bore 11 is an elongate piston 14 which has an extension 15 which projects from the proximal end 16 of the main body
30 10. In the construction shown in the drawings the main body 10 is extended by a cross-piece 17 which acts an operating handle.

The proximal end of the extension 15 is provided with a knurled nut 18 which is shaped to allow easy removal and is adapted to receive an appropriate operating attachment from a power tool. As the nut 18 is screw threaded onto the end of the extension 15 it can be readily removed by hand but it acts as a stop to prevent the piston 14 passing completely through the main body portion 10.

The distal end of the piston 14 is enlarged at 19 and the diameter of the bore 11 is also enlarged at its distal end to accommodate the enlarged portion 19 of the piston. An aperture 20 is provided in the wall of the bore 11 and the enlarged portion of the bore ends at the proximal end of this aperture. Thus, the piston 14 can move towards the distal end of the bore 11 until it emerges from the distal end thereof. Further movement is however restricted by the stop 18. In the other proximal direction the piston can move up the bore 11 until it reaches the position shown in the drawings and where the enlarged part of the piston 19 meets the thicker wall of the upper part of the bore 11. At all times the piston is guided by its wall 21 operating in the narrower part 22 of the bore 11 and the enlarged portion of the piston 19 therefore limits the movement of the piston up the bore and away from the annular cutting rim 13 to a position adjacent the proximal end of the aperture.

The outer surface of the elongate body portion is provided with a depth gauge in the form of appropriate markings indicated by reference numeral 25 and the piston extension 15 carries a position indicator 26 which indicates when the piston 19 has reached the upper end of the aperture 20.

The piston 14 and extension 15 are provided with means to accept a guide wire in the form of a guide bore 27.

In operation the trephine is fed down a guide wire, for example similar to that shown in Figure 1 and indicated by reference numeral 7, and a backwards and forwards or rotary movement is applied by the operating handle 17 to cause the cutting rim 13 to cut into the bone chippings, the chippings which have been cut away passing up the bore

11 and pushing the face 28 of the piston in front of them. The precise depth of the trephine within the bone can be seen from the depth gauge 25. Frequent removal of the device will enable the surgeon to see how far the bone chippings have passed up the bore 11 but the position 5 indicator 27 will immediately make him aware if the lower end of the bore 11 has become completely filled. The device is now removed from the cavity and the bone chippings can be easily expelled by pushing the piston downwardly so that the chippings are expelled through the opening 20 or through the open distal end. Cutting can now be resumed 10 until the required depth, as indicated on the depth gauge 25, is achieved to thus provide an opening which is suitable to receive the prosthesis, or phantom prosthesis, which is to be inserted.

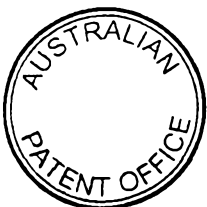
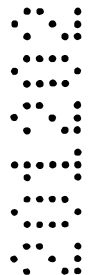
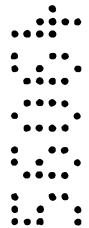
It will be appreciated that the outer diameter of the elongate body portion will be appropriate for the prosthesis with which it is to 15 be used.

The construction is such that the trephine can be easily dismantled for cleaning. Thus, it is merely necessary to remove the stop 18 so that the piston can slide out of the bore 11. Similarly the operating handle 17 is screw threaded onto the proximal end of the body 20 portion 10 so that it can also be easily removed. The construction can be such that a number of body portions of different external diameters can be provided but with a bore of a single diameter so that the piston can be used with other body portions, as can the handle. Alternatively, a series of devices can be provided for different 25 diameters.

One of the advantages of the piston is that it can be used to clean the bore 11 during use and because of the stops it reduces the possibility of jamming bone chippings in the bore if a surgeon continues to operate the device with the bore full.

The claims defining the invention are as follows:

1. A surgical trephine adapted for boring an opening in tamped bone chippings which includes a hollow elongate body portion having an internal bore and the distal end of which has an annular cutting rim, a piston located in said bore with a piston surface facing towards said cutting rim, means for moving the piston in the bore, and means for limiting the movement up the bore and away from the distal end thereof.
2. A surgical trephine as claimed in claim 1 in which said body portion includes an aperture in the wall passing into the bore at a point spaced away from the distal end to facilitate cleaning after operation.
3. A surgical trephine as claimed in claim 1 or claim 2 in which an extension or extended portion of the piston projects beyond the proximal end of the body portion.
4. A surgical trephine as claimed in claim 2 or claim 3 in which the means for limiting the movement of the piston up said bore and away from the distal end thereof to limit the upward movement to a position adjacent the proximal end of said aperture.
5. A surgical trephine as claimed in any one of preceding claims 1 to 4 in which said annular cutting rim is provided with cutting teeth.
6. A surgical trephine as claimed in any one of preceding claims 3, 4 or 5 in which the proximal end of the extended portion of the piston or an extension thereof is provided with removable means to limit the movement of the piston in a distal direction.
7. A surgical trephine as claimed in any one of preceding claims 1 to 6 in which the hollow elongate body portion is provided with an operating handle.
8. A surgical trephine as claimed in any one of preceding claims 1 to 7 in which said elongate body portion is provided with a depth gauge.



9. A surgical trephine as claimed in any one of preceding claims 1 to 8 in which means are provided on the extended portion of the piston, or extension thereof, to provide a position indicator.

10. A surgical trephine as claimed in any one of preceding claims 3 to 9 in which the proximal end of the extended portion of the piston or an extension thereof is provided with means for attaching a power source so that the device can be operated by a power device.

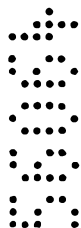
11. A surgical trephine as claimed in any one of preceding claims in which the piston is provided with means to accept a guide wire.

12. A surgical trephine, substantially as hereinbefore described with reference to Figures 2 to 6 of the accompanying drawings.

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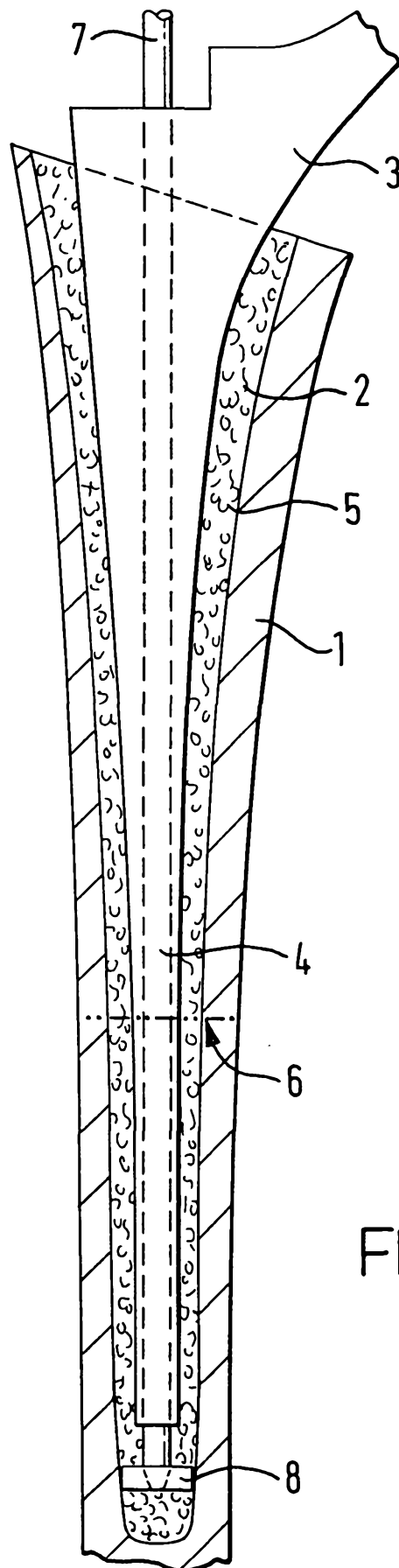


FIG. 1

