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Peterson

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[54] **SPREADER INSTRUMENT FOR USE IN PERFORMING A SPINAL FUSION**

[76] Inventor: **Wendell C. Peterson,** 7107 Prospect Place, NE., Albuquerque, N. Mex. 87110

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[51] **Int. Cl.²** **A61M 24/00**

[58] **Field of Search**..... 128/20, 345, 303 R, 354, 128/341; 81/302; 29/223, 239

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Primary Examiner—Richard A. Gaudet
Assistant Examiner—Henry S. Layton
Attorney, Agent, or Firm—Richard A. Bachand

[57] **ABSTRACT**

A spreader instrument for use in spinal fusion surgery for separating adjacent vertebral bodies having a common bone assembly receiving hole pre-formed therein includes two elongated members pivotally attached intermediate their ends. A pair of partial-circularly shaped plates are attached to the pivoted members, extending outwardly from adjacent opposite free ends of the respective members. The plates are oriented with their concave faces toward each other to be adapted to be inserted into the pre-formed holes within the vertebral bodies. The plates engage the walls of the pre-formed hole in the bodies and spreads or separates the bodies as the members are pivoted, permitting a cylindrically shaped bone assembly to be axially inserted between the semi-circular plates into the hole in the vertebral bodies.

9 Claims, 5 Drawing Figures

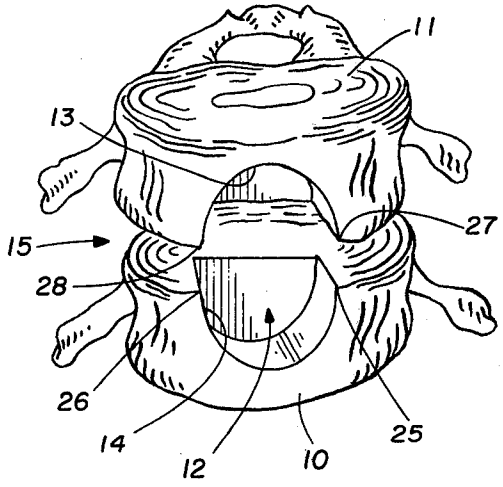

FIG. 1

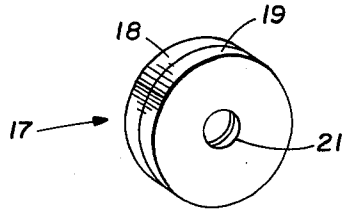

FIG. 2

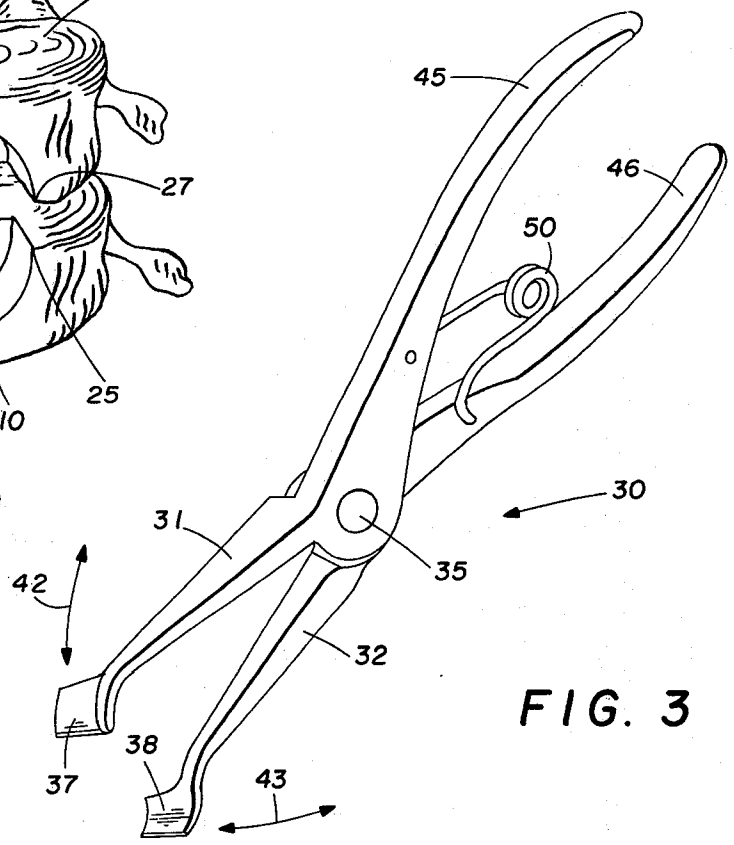

FIG. 3

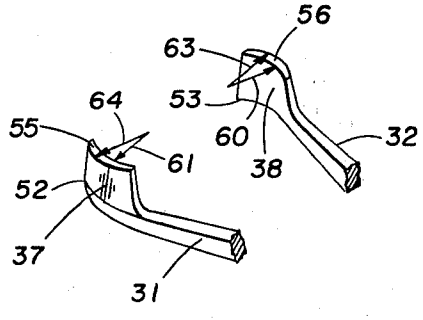

FIG. 4

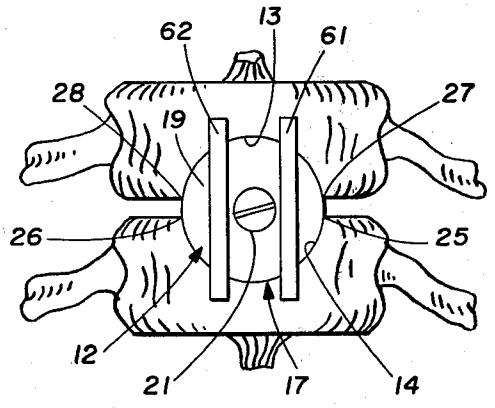

FIG. 5

SPREADER INSTRUMENT FOR USE IN PERFORMING A SPINAL FUSION

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to surgical instruments, and more particularly to a spreader instrument for use in performing a surgical fusion between adjacent vertebral bodies.

2. Description of the Prior Art

In performing the surgical procedure widely known as a spinal fusion, two or more vertebral bodies are fused together by grafting a bone section or a bone assembly made of a plurality of bone sections between each pair of vertebrae to be fused. Although such fusions may be performed either anteriorily or posteriorily, the invention has particular application to the anteriorily performed procedure.

Ordinarily, in performing the operation, when the two vertebral bodies to be fused are reached and exposed, and the area between them is cleaned of the disc and other materials, such as those which may have been extruded from the disc, a hole is drilled along a centerline between the two vertebrae. The hole defines a cylindrical cavity within the vertebrae extending almost to the nerve bundles within the spinal column with each half of the cylindrically shaped hole being located in a respective one of the vertebrae. (The particular drilling methods are well known, and therefore are not described herein in detail.) A bone section is then obtained and inserted into the hole to ultimately form a unitary structure with the two vertebrae.

The bone section used for such grafts is commonly obtained either from a leg bone, whereby a single piece may be obtained which is often large enough to suffice as the intervertebral connection, or more frequently, from the patient's illium bone. Usually, however, when the illium bone is used for the graft, it is necessary to utilize two or more bone sections to obtain a bone assembly of sufficient largeness to complete the graft. The bone sections are fastened together, generally by a stainless wire passed in a figure 8 pattern through a hole in the bone sections.

Once the donor bone assembly is prepared, it is inserted into the hole previously formed in the vertebral bodies by manually manipulating the two bodies and forcing them apart a distance sufficient to easily receive the donor bone assembly, then inserting the assembly and releasing the vertebral bodies to return to their usual position, thereby clamping the bone assembly between them. It can be seen that, at best, separating the vertebral bodies in this manner is difficult and inconvenient, considering especially that the operation is being performed several inches below an anterior incision into the patient's stomach area.

To further illustrate the difficulties encountered, in one of the methods for separating the vertebral bodies, the head and feet of the patient are physically pulled in opposite directions, thereby separating, among other things, the vertebrae to be fused. This is inconvenient, and requires the assistance of at least two persons in addition to the surgeon. Special apparatus is also required for fastening to the patient to aid in applying the traction necessary to separate the vertebrae.

Surgical instruments have also been proposed to selectively separate the desired vertebrae, but, in general, such instruments heretofore advanced are unsatisfactory. For example, one apparatus proposed includes a pair of claw sets, one set being required for each vertebral body. The claws are operated to engage the outside walls of the vertebral bodies, with the claws digging into the vertebral bodies. They are then manipulated to pull the bodies apart to allow the bone section to be inserted.

The fusion portion of the operation is then completed by fixing clamps or staples across the intervertebral space between the two fused vertebrae to keep the vertebrae fixed with respect to each other and to constrain the bone assembly within the hole in which it is disposed. The three bodies, i.e., the two vertebrae and the donor bone assembly are then allowed to heal together to unite into a single bone structure.

SUMMARY OF THE INVENTION

In light of the above, it is an object of the invention to provide an instrument for separating or spreading a pair of vertebral bodies to be fused and to permit a donor bone assembly to be inserted into a hole preformed in the vertebrae.

In accordance with the present invention, a surgical instrument is presented to separate a pair of adjacent vertebral bodies to be fused, to allow a bone assembly to be inserted into a pre-formed hole therein. The spreader instrument includes two elongated members intermediately pivotally attached to be rotateable each upon the other. At one end of each of the elongated members is a thin, arcuate plate adapted to be inserted into a pre-formed hole in the vertebral bodies to be fused. The plates are mounted about a common axis with their concave sides facing each other. Each plate has a first radius on its inside wall of approximately that of bone assembly to be inserted and a second smaller radius on its outside wall of approximately that of the pre-formed hole in the vertebrae. The plates can then be located within the pre-formed hole to engage its walls, and to enable a bone assembly of slightly larger diameter than the diameter of the pre-formed hole to be inserted into the pre-formed hole without interference.

BRIEF DESCRIPTION OF THE DRAWING

A preferred embodiment of the invention is illustrated in the accompanying drawing wherein:

FIG. 1 is a perspective view of the two vertebral bodies which have been prepared for insertion of a bone assembly therebetween.

FIG. 2 is a perspective view of a typical unitary bone section for insertion between the vertebral bodies of FIG. 1.

FIG. 3 is a perspective view of a spreader instrument in accordance with a preferred embodiment of the invention, for use in spreading the vertebrae of FIG. 1 to enable the bone section of FIG. 2 to be inserted therebetween.

FIG. 4 is a perspective view, partially cut away, showing the arcuately shaped plates of the spreader of FIG. 3.

FIG. 5 is a frontal view of the vertebral bodies of FIG. 1 after completion of the surgical fusion procedure employing the spreader instrument of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Typically, in the performance of a spinal fusion oper-

ation, an incision is made into the patient to expose the vertebral bodies to be fused. An anterior view of a pair of such vertebral bodies **10** and **11** is shown in FIG. **1.** During the operation, a common hole **12** having a top portion **13** and bottom portion **14,** is formed by well-known techniques into the vertebrae **10** and **11,** after the space **15** between the bodies **10** and **11** has been cleaned and the disc and other matters therebetween removed.

Thereafter, a bone plug or assembly **17,** as shown in FIG. **2,** is inserted into the previously formed hole **12** defined by the recesses **13** and **14.** The cylindrically shaped bone assembly **17** includes two bone sections **18** and **19,** obtained, for example, from the illium bone, in a well-known manner. The bone sections **18** and **19** are fastened together by a stainless steel screw **21** or other fastening means, such as a wire or the like (not shown), and are typically made in circular shape, as shown, with a diameter slightly larger than the diameter of the hole **12** of the vertebral bodies **10** and **11.** For instance, the diameter of the bone plug **17** can conveniently be ⅝ of an inch, and the diameter of the hole **12** can be ½ of an inch. Thus, when the bone section **17** is inserted into the hole **12,** the corners **25, 26, 27,** and **28** of the vertebral bodies **10** and **11** tend to cut or bear upon the bone assembly **17,** thereby promoting the fusion thereto as well as immobilizing the vertebral bodies and increasing their stability.

To insert the bone assembly **17** into the hole within the vertebral bodies **10** and **11,** the spreader instrument **30,** in accordance with a preferred embodiment of the invention, as shown in FIG. **3,** is employed. The spreader **30** includes two elongated members **31** and **32,** which are pivoted with respect to each other about a point **35** intermediate the ends of the members. The members **31** and **32** are arranged so that the extremities do not crisscross at the pivot point **35.** That is, the ends upon which the plates **37** and **38** are carried are caused to separate when the opposite, or handle ends **45** and **46** are moved together. At one end of the respective members **31** and **32,** arcuate shaped plates **37** and **38** are attached or formed. The plates **37** and **38** may, as shown, be mounted at an angle of perhaps **30** degrees with respect to the members **31** and **32** to ease operation from above the incision.

The rotational position of the plates **37** and **38,** as shown by the arrows **42** and **43,** is controlled by the handle portion **45** and **46** of the elongated members **31** and **32.** A biasing spring **50** is included between the members to urge them toward a normal closed position of the spreader **30.** Also, a locking clip or other such device (not shown) may be easily included between the members **45** and **46** to allow the position of the spreader to be maintained at a desired opening angle.

Because the spreader is used in areas having small access thereto, the handle portion, including the elongated members **45** and **46,** may be bent slightly along its axis (bend not shown) to ease operation in such areas, for example, to an angle about **30** degrees.

The construction of the arcuate plates **37** and **38** is shown in more detail in FIG. **4.** The plates **37** and **38** are of generally frusto-conical sections having bases **52** and **53** extending over a larger arc distance than the tips **55** and **56.** Additionally, the inner radius, indicated by the arrows **60** and **61** are made to conform to the radius of the bone plug assembly **17** of FIG. **2.** Thus, for example, if the radius of the bone assembly **17** in FIG. **2** is ⅝ of an inch, the inner radii, indicated by the arrows **60** and **61,** are also made of radius equal to ⅝ of an inch.

On the other hand, the outside radii of the plates **37** and **38** are made to conform to the radius of the hole **12** as defined by the recesses **13** and **14** in the vertebral bodies **10** and **11.** Thus, if the hole **12** in the vertebral bodies **10** and **11** has a radius of approximately ½ of an inch, the radii indicated by the arrows **63** and **64** will also be of ½ of an inch.

This radius variance between the inner and outer surfaces of the plates **37** and **38** greatly facilitates the use of the spreader, since the surfaces precisely conform to the curves of the vertebral bodies and plug used in connection therewith. Furthermore, the different radii facilitates easy withdrawal of the spreader **30** from within the holes of the vertebral body **10** after the bone assembly **17** has been inserted, since all of the surfaces are conforming, with no corners or other areas of particular contact which might tend to bind.

It should be emphasized that the length of the plates **37** and **38** should be selected to be sufficiently long as to enable the vertebral bodies to be spread upon insertion into the holes **12** and **13** therein, but not so long as to present the possibility of cutting into the spinal cord lying directly beneath the hole **12.** It has been found, for example, that a length of approximately ¾ of an inch is generally sufficient.

The plates **37** and **38** are oriented upon the members **31** and **32** in a manner such that they are essentially complementary about a common centerline axis when they are separated a distance just sufficient to receive the bone plug or assembly **17.** Thus, as the plug **17** is inserted, its centerline axis will coincide with the center of the inside radii of each of the plates **37** and **38.** Likewise, in this position, the outside radii of the plates **37** and **38** will each have a radius located at a common endpoint with the other, defining a diameter equal to the desired diameter of the hole **12** to receive the bone plug **17.**

In operation, the elongated members **31** and **32** are manipulated by the handles **45** and **46** to spread the plates **37** and **38** within the holes **13** and **14** of the vertebral bodies **10** and **11.** The vertebral bodies **10** and **11** are thereby spread or separated a distance sufficient to allow the bone assembly **17** to be inserted in the hole area **12.** After the bone assembly **17** has been inserted into place, the spreader **30** is removed from the hole **12,** and the vertebral bodies **10** and **11** are allowed to recede to their original positions to clamp the bone assembly **17** therebetween.

Finally, as shown in FIG. **5,** to complete the surgical fusion, a means to restrain movement between the vertebral bodies **10** and **11** and to constrain the bone assembly **17** within the holes in the vertebral bodies is placed. Such means can conveniently be elongated staples or clamps **61** and **62,** which extend across the hole of the vertebral bodies **10** and **11.** The staples **61** and **62** are fastened at their respective ends into the vertebral bodies **10** and **11.**

The spreader **30,** in accordance with the invention, can be made of any suitable material, such as stainless steel or the like, such materials for surgical instruments of the type hereof being well known in the art.

Although the invention has been described and illustrated with a certain degree of particularity, it is understood that the present disclosure has been made only by

way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention and hereinafter claimed.

What is claimed is:

1. A spreader for separating vertebral bodies having a hole pre-formed therein to receive a cylindrical plug comprising, two pivotally attached elongated members, and two frustro-conically shaped curved plates, each rigidly attached to a respective one of said members, each of said plates having a first outside radius to engage the wall of said hole, and having a second inside radius smaller than said first radius for passing the bone plug, said first and second radii being upon a common center line oriented at an angle of approximately **30°** from an axis along said respective elongated member.

2. The spreader of claim **1** further comprising biasing means between said members to urge said plates in a direction toward each other.

3. The spreader of claim **1** wherein said plates are mounted with their centerline axes oriented at an angle with respect to the axis of said members, and are disposed on said elongated members to be symmetrical about a centerline axis with respect to each other when the interior faces of said plates are separated by a distance approximately equal to the diameter of said plug.

4. The spreader of claim **3** wherein the material of which the spreader is formed is stainless steel.

5. A spreader for separating two vertebral bodies having a pre-formed bone plug receiving hole, comprising:

a pair of elongated members,

pivot means medially interconnecting said pair of elongated members,

a pair of frustro-conically shaped arcuate plates, each rigidly attached to and outstanding from adjacent an end of a respective one of said members, each plate being of inside radius of approximately ⅝ of an inch to pass said bone plug and of outside radius of approximately ½ of an inch to engage one of said vertebral bodies, the center line axis of each of said plates defining an angle of about **30°** with respect to the axis of the elongated member upon which it is mounted.

6. The spreader of claim **5** wherein each of said pair of arcuate plates is of approximately ¾ of an inch in length.

7. The spreader of claim **5** wherein each of said elongated members are bent at an angle of about **30°** upon its axis.

8. The spreader of claim **7** further comprising biasing means between said elongated members normally urging said plates together.

9. The spreader of claim **8** wherein the material of which the spreader is formed is stainless steel.

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