

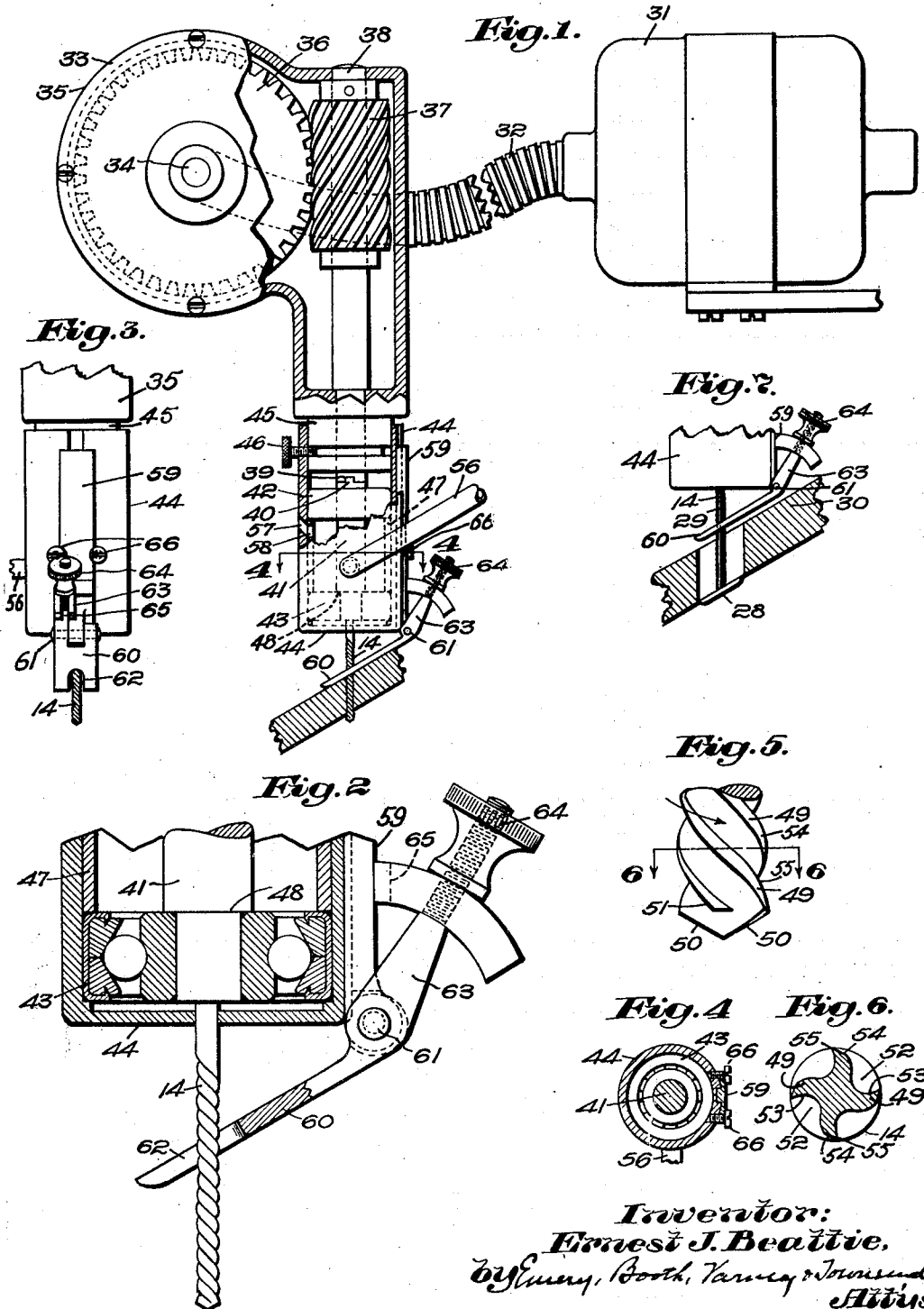
Nov. 11, 1930.

E. J. BEATTIE

1,781,564

CUTTING DEVICE AND TOOL THEREFOR

Filed April 8, 1929



Inventor:
Ernest J. Beattie.
by *Cunning, Booth, Yarnall & Townsend*
Attys

UNITED STATES PATENT OFFICE

ERNEST J. BEATTIE, OF FALL RIVER, MASSACHUSETTS

CUTTING DEVICE AND TOOL THEREFOR

Application filed April 8, 1929. Serial No. 353,322.

This invention aims to provide an improved cutting device, more specially designed for cutting plaster casts employed in surgery and the like, to convenience the removal of the same, and a device also well adapted for trepanning and for removing sections of bone or bony structure. My invention will best be understood from a description of an illustrative embodiment thereof shown in the accompanying drawing, together with certain modifications in respect to details.

Referring to the drawing:—

Fig. 1, partially broken away and partially in section, illustrates one embodiment of my invention;

Fig. 2 is an enlarged detail, partially in section, showing the lower portion of Fig. 1;

Fig. 3 is a right hand elevation of the lower portion of Fig. 1;

Fig. 4 is a horizontal section on the line 4—4, Fig. 1, looking downward;

Fig. 5 is an enlarged detail showing the lower end of the preferred form of cutting tool;

Fig. 6 is a cross section on the line 6—6, Fig. 5, looking downward; and

Fig. 7 is a detail, partially in section, to be referred to.

In a co-pending application, Serial No. 320,376, I have shown a device adapted for somewhat similar uses with the present, wherein the cutting tool is carried by a portable motor, which latter is mounted in or provided with a suitable handle, by which the motor and cutting tool may be moved about to permit the tool to be employed in desired manner, the device being connected by a flexible conductor with a suitable source of electric current.

In many instances, however, a device employing a portable electric motor with the cutting device or tool directly connected with it is found to be undesirably heavy, and I have therefore in my present invention shown a stationary motor 31, mounted upon a convenient stand or upon the wall, the shaft of the motor being connected by a flexible shaft 32 of desired construction and length, with a relatively small and light portable tool

carrying head 33. This head, as shown, contains a drive shaft 34 to which the free end of the flexible shaft 32 is suitably connected, and upon this drive shaft, within the casing 35, is mounted a spirally toothed wheel 36, Fig. 1. This wheel meshes with a spirally toothed driving pinion 37 mounted upon a short upright shaft 38, journaled at its ends in suitable bearings therefor in the casing 35, the ratio of the gear and pinion being such that the pinion shaft 38 may be driven at very high speed. I have found from 8,000 to 10,000 revolutions per minute to produce excellent results. The casing 35 and its enclosed parts may conveniently be made so light as to be easily and delicately handled by the surgeon for any desired purpose.

The depending extended end of the pinion shaft 38 is transversely grooved at 39, Fig. 1, to constitute one member of a conventional clutch, the other member of which is provided with a corresponding transverse rib or fin 40 on the end of the tool carrying shaft 41. This shaft is mounted in two combined radial and thrust ball bearings 42, 43, shown in dotted lines, Fig. 1. The bottom bearing 43 is shown in enlarged section in Fig. 2. These bearings are closely fitted within a housing cap 44 mounted to turn upon a depending boss 45 on the portable casing 35. The boss 45 has a circumferential groove into which projects the inner end of a retaining and clamping screw 46, see Fig. 1, which latter, by traveling freely around in the groove permits free rotation of the housing cap upon and with respect to the portable casing 35, yet retains the cap in its position upon said boss. The clamping screw also furnishes convenient means for clamping the cap against rotation in any desired position upon said boss.

The ball bearings 42 and 43 are retained in suitable spaced relation in the cap by a spacing sleeve 47, Fig. 2.

The tool carrying shaft 41, see Fig. 2, near its lower end is provided with a shoulder 48, to seat upon the inner cone of the lowermost ball bearing 43, to prevent the draft of the tool from tending to draw the carrying shaft outward from its bearings.

The tool itself, marked 14 in Figs. 1 to 6 in-

clusive, may be held in position by a suitable conical and threaded end, or it may be made integral with the short drive shaft 41, as here shown.

5 The cutting tool, in whichever type of device employed, is preferably of novel construction, shown more in detail in Figs. 5 and 6. Referring to these figures, it will be observed that the lands 49 are of relatively high
10 pitch and preferably such as to extend spirally at an angle of forty-five degrees or thereabout with the axis of the tool. As shown in Fig. 5, four spiral lands are employed, two of which merge at their lower ends into the
15 drill-like end cutting edges 50, the intervening lands terminating at 51 short of and having no connection with any drill-like cutting edges. The drill-like cutting edges 50 are diametrically opposite each other and of common bevel and formation, the construction of
20 the tool being such that when forced endwise into the body which is to be cut, the tool will, by its cutting edges 50, drill its way into or through the same like an ordinary drill, the
25 intervening short lands then performing no effective action, unless possibly to assist in freeing the hole of chips produced by the drilling operation. The endwise or drilling movement having been completed, the tool
30 may thereafter be operated sidewise through the body to be cut, whereupon all four of the lands, those merging into the drill-like end cutting edges, as well as the intervening ones, become effective to promote rapid lateral cutting and self-clearing action.

Referring to Fig. 6 which, as stated, is a cross-section of the tool shown in Fig. 5, it will be noticed that the flutes 52 are deep and that the rear bounding walls 53 thereof are
40 and preferably will be slightly concave, to facilitate the lateral cutting action of the tool which, so far as known to me, is availed of for the first time in the tool disclosed in my invention. The extreme outer ends of the
45 lands are beveled off, as at 54, to assist in providing satisfactory lateral cutting edges 55, and to provide proper clearance to reduce friction during the cutting operation.

In my novel side-cutting spirally-toothed tool, as illustrated in Figs. 5 and 6, a left hand spiral is employed and the cutting edges 55
50 face to the left. In other words, if the spiral is left-hand, the cutting edges are also left-hand and, conversely, if a right-hand spiral were used, the cutting edges would be formed at the right-hand edges of the lands. In either case, whether right-hand or left-hand, the cutting edge and spiral are the same
55 hand, so that the spiral lands or flutes act to lift the chips out from and at the top of the kerf being produced. A drill is commonly provided with a right-hand cutting edge for a right-hand spiral, but the cutting edge is at the end of the drill and not at the sides thereof; and a reamer or mill cutter is ordinarily

provided with spiral cutting edges that are of the opposite hand to the spirals, that is to say, if the cutting edges are right-hand, they are ordinarily upon left-hand spirals, and vice versa. So far as I know, my invention
70 provides for the first time in the art spiral side-cutting edges that are of the same hand as the spirals, that is to say, left-hand cutting edges for left-hand spirals, or right-hand cutting edges for right-hand spirals.

Referring again to Fig. 1, I have provided means for introducing a cooling fluid to the interior of the housing cap 41, for the purpose of preventing, to a sufficient degree, overheating of the tool when employed in trepanning
75 or other heavy operations. In the present instance, I have provided a flexible tube 56, which is attached to the housing at one end and to a suitable supply of cooling fluid, such, for example, as methyl chloride, conveniently at hand, and which, while not interfering appreciably with the free movement or portability of the tool carrying head, will at all times conduct thereto a sufficient
80 supply of the fluid to prevent over-heating of the tool or the parts in which it is mounted. To permit circulation of this fluid, the housing cap is provided with an exit opening 57, and the spacing sleeve within the cap is provided with one or more openings 58 to register
85 with the outlet opening 57, to permit escape of so much of the cooling fluid as it may be necessary to provide an exit for. For convenience in handling, the cooling fluid above referred to is introduced as a liquid and flows in comparatively small quantities, but expands and gassifies within the cap and escapes as a gas.

Referring now to Figs. 1 and 4, I have provided upon the side of the housing cap 44 a vertical groove to receive a corresponding
90 rib upon the inner face of the vertically adjustable support 59, carrying at its lower end the swinging guide 60 pivoted to the support at 61. This guide may be of desired outline and area, and is provided with a reentrant slot 62, see Fig. 2, through which the cutting tool 14 extends. Beyond the pivot 61 the guide is provided with an angularly extended clamping arm 63 screw-threaded at its free
95 end and provided with a clamping nut 64. The threaded end of the clamping arm extends through a slot in the clamping segment 65, which projects outwardly from the lower end of the adjustable support 59 to furnish
100 means in cooperation with the clamping nut for clamping the arm 63 and its attached guide plate 60 in desired angular position to facilitate use of the cutting tool 14 at the desired angle in its action upon the body that is to be cut.

The support 59 is vertically adjustable in the groove provided therefor in the housing cap, and is clamped in its groove by suitable means, conveniently clamping screws 66,
105

Fig. 3. Vertical adjustment of this support upon the housing cap provides for varying the possible depth of drilling and cutting action of the drill in connection with the provision of desired angular cut by swinging the guide plate 60 as described.

The device, fitted as in Fig. 6, may conveniently be used for removing sections or strips of bone in surgery.

In trepanning it is important that the end of the cutting tool be not pushed inward too far to rupture the dura mater, commonly called the dura, which overlies the brain and lies between the latter and the inner surface of the skull.

Trepanning is ordinarily done by cutting obliquely through the skull rather than perpendicularly through the mass to be cut. To provide for this, in Fig. 7 a guide foot, which is there marked 28, is shown, mounted obliquely upon and at the bottom of the strut 29, so that when the guide foot with its associated strut and cutter are inserted through the hole in the skull 30, drilled therefor in customary manner by suitable instruments well known in the surgical art and drilled obliquely as indicated, the guide foot may be inserted obliquely through this oblique hole until said foot presses, as it may, slightly upon the dura, whereupon the tool is then advanced sidewise, that is to say, in a direction away from the point of view in Fig. 7, to cause the cutter 14 to cut an oblique kerf in and along the skull bone, the strut 29 following it. As the motor is advanced, the surgeon holds the guide foot 28 closely against the under side of the skull, so that the said guide foot will pass between the skull and the dura and, by lifting the device in this position, instead of in a sense pressing downward upon it, functions by a pulling up operation, against the under side of the body that is being cut, rather than pressing down upon the underlying support which is beneath the body being cut, as would be the case where the guide 60 were used. Both the guide foot and guide may be used at the same time, if desired, as shown in Fig. 7.

The broad area and the rounded and beveled edges of the guide foot 28, Fig. 7, are such that if the surgeon in manipulating it should momentarily fail to lift it into contact with the under side of the skull, it might be pressed lightly upon the dura without harm to the patient. This device, Fig. 7, may be used to remove any given section of a skull for trepanning and do it with the removal of less bony structure, and therefore with a more accurate subsequent fit, than by the instruments commonly used, which remove a wider kerf or larger amount of the skull in the process.

The cutting tool used, as in Fig. 7, will, of course, be very much smaller than that

ordinarily used for removal of bone, plaster or the like. I would not for this purpose, Fig. 7, ordinarily employ a cutting tool larger than one-sixteenth of an inch in diameter, although, of course, this diameter might be varied in any given instance.

For the removal of plaster casts, the guide foot would usually stand square with reference to the axis of the cutting tool, instead of oblique, as shown in Fig. 7, and if a rest at the upper side of the article being cut were to be employed, that also would ordinarily stand square with the tool, rather than oblique as shown in Fig. 1.

The cutting tool shown is highly efficient, whatever form of carrying device and drive may be provided, whether the motor be made portable, carrying the tool directly engaged with it, or whether the motor be stationary, as here shown, and the tool carried by a portable head flexibly or otherwise portably driven from the motor.

My invention is not limited to the particular embodiments shown.

Claims:

1. A portable plaster cast cutting device comprising a carrier; a guide foot carried thereby; a tool holder mounted in said carrier; a remote source of power; a driving connection between the latter and said carrier, constructed to permit free movement of the latter relative to the former; and a side-cutting, spiral-toothed cutting tool mounted on and to be rotated by said tool holder.
2. A portable plaster cast cutting device comprising a carrier; a guide foot carried thereby; a tool holder mounted in said carrier; a remote source of power; a driving connection between the latter and said carrier, constructed to permit free movement of the latter relative to the former; and a side-cutting tool mounted on and to be rotated by said tool holder.
3. A portable plaster cast cutting device comprising a carrier; a tool holder mounted thereon; a flexible driving shaft for said tool holder mounted on said carrier and to rotate said tool holder; and a side-cutting spiral-toothed cutting tool mounted on and to be rotated by said tool holder.
4. A portable plaster cast cutting device comprising a carrier; a tool holder mounted thereon; flexible driving means for said tool holder; a side-cutting spiral-toothed cutting tool mounted on and to be rotated in said tool holder; and means to supply a cooling medium to said tool holder or the tool mounted thereon.
5. A portable plaster cast cutting device comprising a carrier; a tool holder mounted thereon; a side-cutting tool mounted on and to be rotated in said tool holder; and a guide plate angularly positioned upon said carrier and angularly positioned relative to the axis of said tool.

6. A portable plaster cast cutting device comprising a carrier; a tool holder mounted thereon; a side-cutting tool mounted on and to be rotated in said tool holder; a guide
5 plate upon said carrier and angularly adjustable relative to the axis of said tool; and means to hold said guide plate in desired angular position.

7. A portable plaster cast cutting device
10 comprising a carrier; a tool holder mounted thereon; a side-cutting tool mounted on and to be rotated in said tool holder; flexible means for driving said tool holder; a strut depending from said tool holder; and a guide
15 plate mounted on said strut.

8. A portable plaster cast cutting device comprising a carrier; a tool holder mounted thereon; a side-cutting tool mounted on and to be rotated in said tool holder; flexible
20 means for driving said tool holder; a strut depending from said tool holder; and a guide plate mounted on said strut and in angular position relative to the axis of said tool.

9. A portable plaster cast cutting device
25 comprising a carrier; a tool holder mounted in ball bearings thereon; means to operate said tool holder; and a side-cutting spiral-toothed cutting tool mounted in and to be rotated by said tool holder.

30 10. A portable plaster cast cutting device comprising a carrier; a tool holder mounted thereon; means to rotate said tool holder; a side-cutting spiral-toothed cutting tool mounted in and to be rotated by said tool
35 holder; and a guide plate for and adjustable longitudinally in the direction of the axis of said cutting tool and holder.

11. As a new article of manufacture, a small high speed side-cutting spiral-toothed
40 cutting tool for surgery, wherein the spiral cutting edges and spiral grooves are of the same hand or face in the same direction.

12. As a new article of manufacture, a small high speed side-cutting spiral-toothed
45 cutting tool for surgery, said tool provided also with drill-like end cutting edges.

13. As a new article of manufacture, a small high speed side-cutting spiral-toothed cutting tool for surgery, said tool provided
50 with a plurality of spiral side-cutting edges and with drill-like end cutting edges fewer in number than the spiral side-cutting faces.

14. As a new article of manufacture, a surgeon's small high speed side-cutting
55 spiral-toothed cutting tool wherein the spiral cutting edges and spiral grooves are of the same hand or face in the same direction, and wherein the following faces of the spiral grooves are under cut.

60 15. As a new article of manufacture, a small high speed side-cutting spiral-toothed cutting tool for surgery, said tool provided with a plurality of spiral side-cutting edges, and drill-like end cutting edges fewer in num-
65 ber than the spiral side-cutting edges, one

or more of said spiral cutting edges extending to and merging with corresponding drill-like end cutting edges.

16. As a new article of manufacture, a surgeon's small high speed side-cutting
70 spiral-toothed cutting tool wherein the spiral cutting edges and spiral grooves are of the same hand or face in the same direction, said spiral cutting edges bounding externally beveled faces.

In testimony whereof, I have signed my
75 name to this specification.

ERNEST J. BEATTIE.

80

85

90

95

100

105

110

115

120

125

130

CERTIFICATE OF CORRECTION.

Patent No. 1,781,564.

Granted November 11, 1930, to

ERNEST J. BEATTIE.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, line 128, claim 5, strike out the word "angularly"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 9th day of December, A. D. 1930.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.