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SPRING-PRESSED SURGICAL INSTRUMENT

Filed June 27, 1956

2 Sheets-Sheet 1

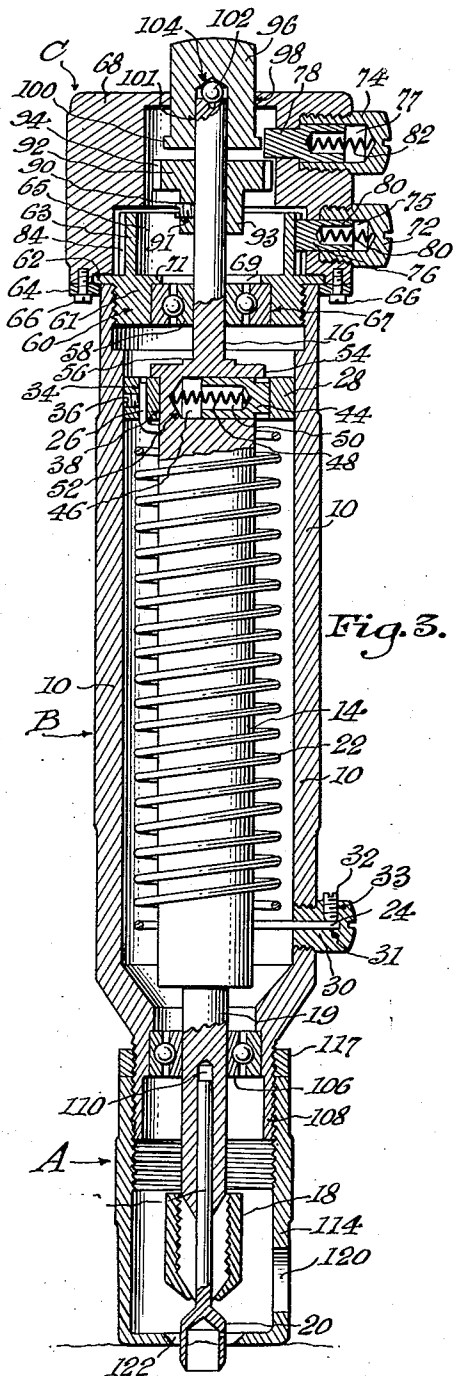


Fig. 3.

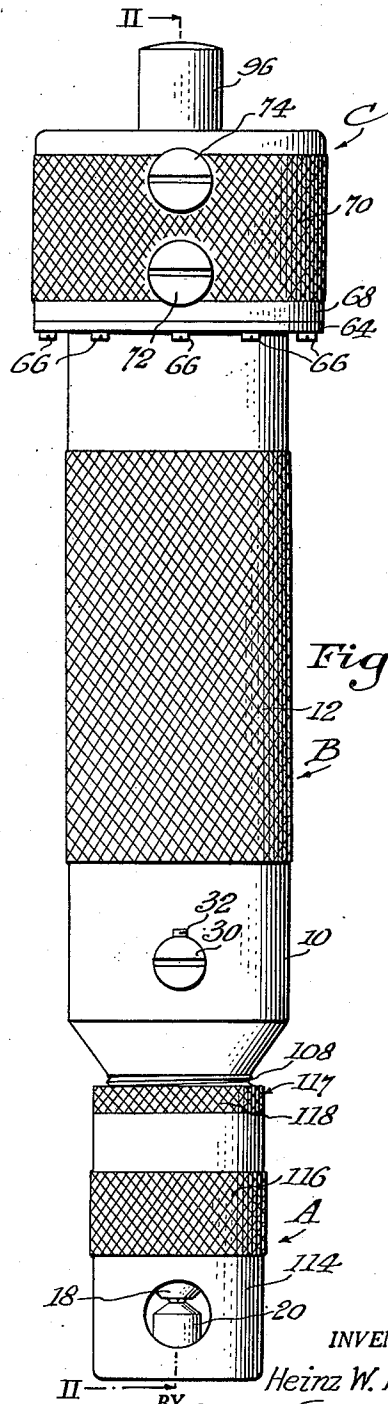


Fig. 1.

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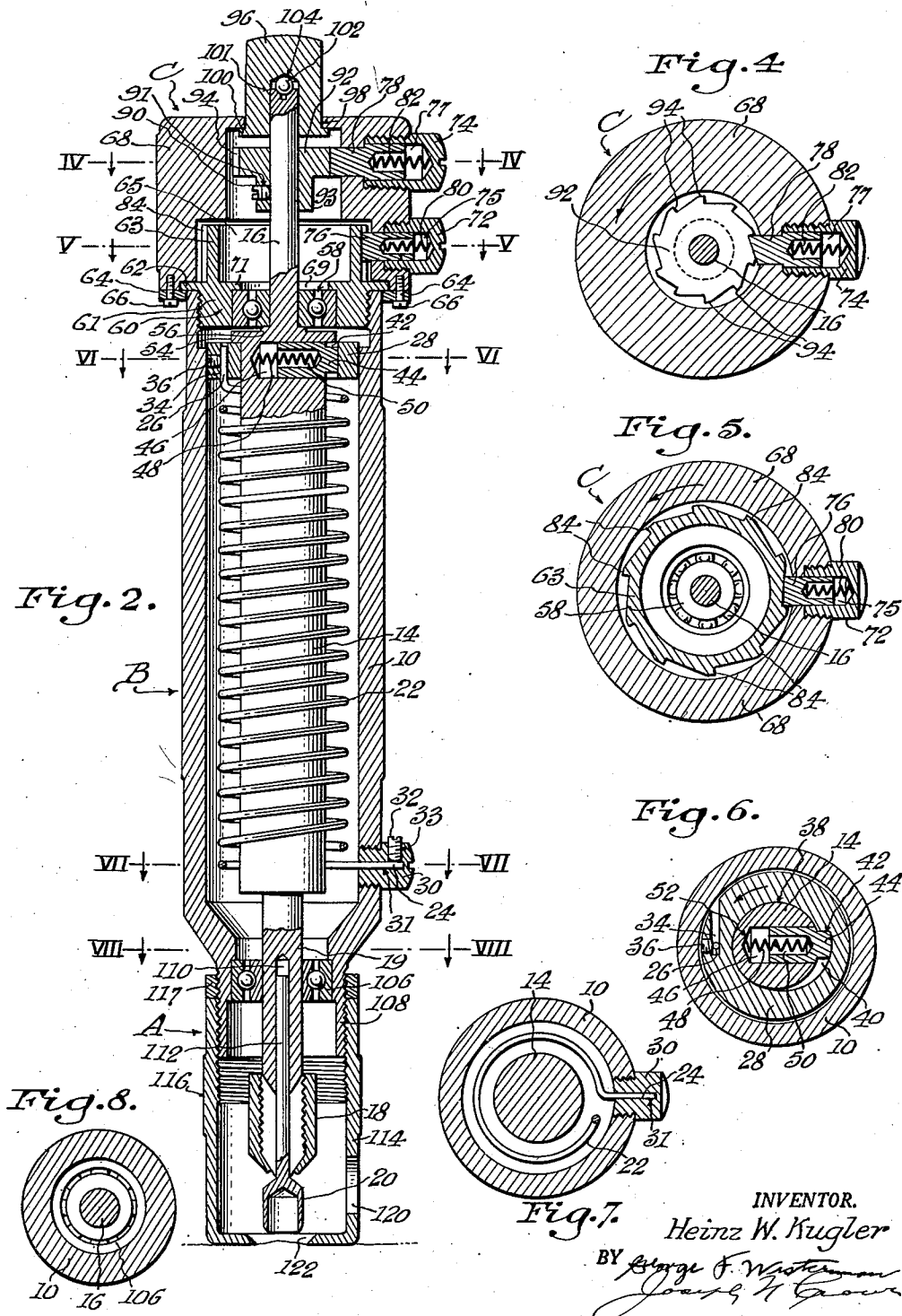
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SPRING-PRESSED SURGICAL INSTRUMENT

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6 Claims. (Cl. 128—2)

(Granted under Title 35, U. S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment of any royalty thereon.

The present invention provides improvements in surgical instruments employed for obtaining specimens of live skin or tissue for biopsy examination, or other physiological specimens for microscopic and/or histologic examination for diagnostic purposes or for other studies; or for obtaining samples of other soft materials such as paper, cloth, felt or the like.

More particularly, the invention provides improvements in the construction of a mechanically operated punch for obtaining specimens or samples of the above-indicated character.

The present improved instrument is designed to be light in weight and freely portable, and to be operable wholly mechanically instead of utilizing electrical power as is required by existing equipment employed for similar purpose, thus widely increasing the field or scope of utility of the present equipment.

The usual instruments employed for taking specimens of the herein-indicated character are electrically powered. Such type of electrically powered punch is an ordinary high-speed motor-driven hand tool with the cutter head held by a chuck. For regulating the depth of the cut, there are used transparent "Lucite" plastic blocks of various thickness provided with a hole slightly larger than the cutter. The "Lucite" block is placed on the skin, and the cutter is brought down into the hole until the chuck rests on the block when the cutter becomes operative for taking a desired specimen. Where skin or tissue is to be sampled, for biopsy tests or other examination, this customary operation not only is crude and cumbersome, but a very large amount of heat is generated, which causes discomfort to the patient from whom the sample of skin or tissue is being taken.

The objections which have been noted above are obviated by the mechanically-actuated portable instrument provided by the present invention, the improved construction producing a requisite number of revolutions of a cutting tool sufficient to cut the skin and tissues cleanly without generating uncomfortable heat, or without causing other untoward discomfort to a patient whose skin or tissues are being sampled.

Objects and advantages of the subject invention will become apparent as the description proceeds, and the features of novelty will be pointed out in particularity in the appended claims.

Briefly stated, the subject invention embodies a cutting element mounted in a chuck carried by the lower end of a driving spindle rotatably housed within an elongated cylindrical barrel casing or handle member. The spindle is encircled by a helical spring attached at its lower end to the barrel and at its upper end to a slip-ring or free-wheeling coupling device keyed to the spindle, but incorporating means for allowing independent rotation of the latter after an initial turning movement has been imparted to the free-wheeling coupling by the energy stored

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in the spring. A rotatable cap is mounted on the upper end of the casing and connected to the driving spindle through the instrumentality of a pawl and ratchet mechanism to effect winding of the spring upon rotation of the cap. Energy stored by the spring is released by a manually-controlled depressible member in the cap, which separates the pawl and ratchet mechanism to permit the spring to impart a turning movement and sufficient inertia to the spindle to give it a spinning movement of about 30 to 50 rotations more than the free-wheeling coupling.

This improved construction of the subject invention will be understood more clearly from reference to the accompanying drawings, in which:

Fig. 1 is an elevation of an illustrative embodiment of the improved construction;

Fig. 2 is a vertical section of the instrument of Fig. 1, the view being taken on the longitudinal or vertical axis of the instrument along the line II—II of Fig. 1;

Fig. 3 is a view similar to Fig. 2, but showing the cutter in operative or specimen-cutting position; and

Figs. 4, 5, 6, 7 and 8 are transverse sectional views taken on the section lines IV—IV, V—V, VI—VI, VII—VII, and VIII—VIII of Fig. 2, respectively, looking in the direction of the arrows in each view.

Referring more particularly to the drawings, the respective views show details of an illustrative embodiment of a suitable instrument for obtaining skin or tissue specimens for biopsies, histological examinations, or for other studies, from which views it will be seen that the instrument comprises three principal sections, namely, a bottom or chuck section A, an intermediate or stationary barrel or handle section B, and an operating cap section C. Structural details of each section will be referred to hereinafter.

The stationary barrel or handle section B comprises a tubular cylindrical casing 10, having a knurled outer surface 12, containing a rotatable driving spindle 14. The spindle 14 terminates in opposite end sections then being shown and a top stem portion 16 and a bottom end stem portion 19 having a locking chuck 18 mounted on this lower stem portion 19. The chuck 18 releasably receives a specimen cutting tool 20 of a suitable shape and size for cutting out skin and tissue specimens for microscopic or other testing or examination procedures.

The spindle 14 is enclosed in a helical spring 22, one end of which, such as the lower end 24, is secured to the casing 10, while an opposite end of the spring, that is, its upper end 26, is secured in a slip ring or free-wheeling coupling device 28, which is connected to the spindle 14 by a key or other connection. The free-wheeling coupling 28 will be referred to further hereinafter; and it incorporates means for allowing independent rotation of the latter after an initial turning movement which has been imparted to the free-wheeling coupling 28 by energy stored in spring 22.

The spring 22 obviously is the operating means or source of power for the instrument. With further reference to this spring and its connection to the casing 10, it will be seen that such connection includes a screw plug 30 threadedly mounted in the casing 10 adjacent to the lower end thereof, this plug 30 having an opening 31 which receives the lower end 24 of the spring, the plug 30 also including a threaded hole 33 which receives a locking screw 32 which lockingly engages the end 24 of the spring 22 and secures the spring in place in opening 31.

In a similar manner, the opposite, or upper, end of the spring, which is indicated at 26, is received in slip ring or free-wheeling coupling device 28, which is provided with opening 34 into which the end portion 26 of

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the spring 22 is fitted and locked by locking screw 36. The free-wheeling coupling 28 is an annulus which is mounted on the upper end of the spindle 14, the opening 38 in the said coupling 28 receiving the spindle 14 in eccentric relation with the latter, as is indicated at 40, Fig. 6, there being an abutment shoulder 42 against which engages an outwardly directed locking pawl 44, which is mounted in a recess 46 in the spindle 14, the pawl 44 being urged outwardly with respect to the spindle 14 and against the inner periphery of the free-wheeling coupling 28 by action of a compression spring 48 which is mounted in an axial recess 50 in locking pawl 44, the spring 48 being compressed between the locking pawl 44 and the inner end 52 of the recess 46 in spindle 14.

The foregoing mounting of the spring 14 permits an interlocked engagement between the pawl 44 with abutment shoulder 42 during counterclockwise rotation of spindle 14, as indicated by the directional arrow on Fig. 6, for tensioning spring 22 as the spring is wound up, while enabling the free-wheeling coupling 28 and spindle 14 to be released for clockwise rotation to release the tension in the spring for outward propulsion of the cutting tool 20 from the chuck section A of the instrument.

Referring further to the structure of the spindle 14 and to the structural details of cap section C, it will be noted that the spindle 14 is provided with an upper flange collar 54 for retaining the free-wheeling coupling 28 on the spindle 14, the top restricted stem 16 extending upwardly from the flange collar 54, there being a stop 56 on the flange collar 54, which stop 56 engages the underside of an anti-friction bearing 58 which is mounted in a top closure plug 60 that is threadedly mounted in the top end of casing 10. The closure plug 60 is provided with a retaining flange or collar 62, against the underside of which an annular locking collar or ring 64 is maintained in assembled relation by spaced screws 66 which extend through the ring 64 into the underside of operating cap 68 of the cap section C of the instrument, thereby clamping the annular flange 62 between the ring 64 and cap 68.

The flange 62 divides the outside of the plug 60 into two sections, that is, a lower externally threaded section 61, the threads of which register with complementary threads in the top of cylindrical casing 10, and an upper section 63. The lower section 61 houses the anti-friction bearing 58, the inner race of which is in engagement with the lower portions of stem 16 of the spindle 14. The upper section 63 of the plug 60 is provided with a large recess 65 which communicates with lower recess 67 containing the anti-friction bearing 58 through opening 69 which forms flange 71 against which the top of anti-friction bearing 58 abuts.

The operating cap 68 is provided with a knurled outer surface 70 which is provided with interiorly threaded openings for receiving threaded internally recessed plugs 72 and 74, having internal recesses 75 and 77 in which pawl elements 76 and 78 are slidably mounted and in which compression coil springs 80 and 82 are received and held between the respective pawl elements 76 and 78 and the closed ends of recesses 75 and 77, the pressure of the springs against the pawl elements continuously urging the latter outwardly with respect to the plugs 72 and 74.

The upper section 63 of the plug 60 has its outer surface formed with peripheral locking teeth 84 which extend the height of the upper section 63 of the plug and which are engaged by pawl element 76 for lockingly interconnecting the top section 63 of the plug 60 with the cap 68 when the latter is urged in counterclockwise direction as will be seen in Fig. 5, and which will be referred to again hereinafter.

Cap 68 is recessed appropriately interiorly to receive the top section 63 of plug 60, and also to house ratchet member 92, the teeth 94 of which interlockingly engage with pawl 78 for interlocking the stem 16 of spindle 14

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to the cap 68 when the latter is being urged in clockwise direction, but releases the stem 16 for rotation relative to the cap 68 when the latter is being urged in counterclockwise direction as shown in Fig. 4, so that the teeth 94 of ratchet 92 are pitched in opposite direction to teeth 84 on the upper, or locking, section of plug 60. The ratchet 92 has a lower hub portion 93 having an opening 91 therethrough for receiving locking screw 90 which locks ratchet 92 to the stem 16 of spindle 14. The teeth 94 of ratchet 92 are engaged by pawl 78 which continuously is urged against the teeth 94 by pressure of spring 82, the outer end of the pawl 78 being beveled to conform to the slope of teeth 94.

The upper end of stem portion 16 of spindle 14 is received in a release push cap 96 which is mounted in a top opening 98 in the cap 68. The release push cap 96 has a retaining flange 100 which is larger in diameter than the top opening 98, and it also has an axially extending recess 101 which tightly receives the upper end of stem 16, an anti-friction bearing 102 being provided between the upper end of the stem and the closed end 104 of the recess 101.

As has been noted above, the lower end of spindle 14 is extended into lower stem section 19, which is encircled by a bottom anti-friction bearing 106 which is retained between threaded restricted end 108 of the barrel 10 and the lower stem section 19 of the spindle. The stem 19 is provided with a longitudinally-extending axial recess 110 into which is fitted shank 112 of cutting device or tool 20 which is releasably locked in place by a chuck 18. Adjustable gage sleeve 114, having knurled surface portion 116 and lock nut 117 having a knurled surface 118 are threadedly mounted on restricted end 108 of the casing 10, the sleeve 114 being provided with a lateral sight opening 120 and end opening 122 for passage of specimen cutting tool 20. The adjustable gage sleeve 114 is locked in adjusted position by the knurled lock nut 117, which is threadedly mounted on restricted end 108 of casing 10, above the gage sleeve 114.

In operation, a cutting tool 20 of desired size, is inserted in chuck 18 and the depth of cut is set by pushing the thumb release cap 96 down and turning the depth gage sleeve 114 up or down until the cutting tool 20 is protruding for the desired distance, and locking the sleeve 114 into position with the lock nut 117. The punch is wound in a vertical position with the cutter 20 upwards to permit the spindle 14 to be in loaded position. The barrel 10 of the tool is held in the left hand and the cap C is rotated counterclockwise approximately three revolutions. When winding, ratchet 92 turns top stem portion 16, and therefore spindle 14, which turns slip ring 28, which winds the spring 22. The ratchet 92 prevents the spindle 14 from unwinding. As has been noted above, the spring 22 is secured to the casing 10, shown in Fig. 7, and to the slip ring 28 as shown in Fig. 6. This slip ring 28 permits the spring 22 to be wound. When the punch is released, the spring 22 unwinds its three revolutions but permits the spindle 14 to travel approximately 30 to 50 revolutions. In Fig. 4, pawl 78 slides through a square hole 77, which prevents the pawl 78 from turning.

To release the punch, the thumb release cap 96 is pushed downwardly. In so doing, the punch does not operate until the ratchet wheel 92 slides off the ratchet stop pawl 78. At this moment, the cutting tool 20 is in close contact with the live skin, and as the spindle 14 is released, the cutting tool 20 while revolving is brought down to the full predetermined depth of the cut, thus completing the operation. The ball 102 in the thumb release cap 96 is provided to reduce friction, as are the two ball bearings 58 and 106. Ratchet 92, having a lefthand thread, will tighten as the spring pressure in winding is increased. The cap section C is set into position and the retaining ring 64 is fastened to the bottom of section C with eight (more or less) small screws 66. The ratchet wheel 92 in Fig. 4 is held in position by set screw 90 which prevents slipping,

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although other means may be used to obtain the same result. Opening 120 in the depth-gauge 114 is provided for viewing and centering the cutting tool 20 over the area to be sampled.

After cutting, the tool is removed from the skin surface and the plug of skin is removed from the subject by means of suitable surgical instruments at the base of the plug. Plugs of other materials may remain in the cutter and are subsequently removed.

The embodiment of the invention illustrated in the accompanying drawings and described specifically in the foregoing description is illustrative of a representative example of the present invention, but it will be apparent that specific structural details may be varied without departing from the inventive concept; and accordingly, it will be understood that it is intended and desired to embrace within the scope of the invention such modifications and changes as may be necessary or desired to adapt it to varying conditions and uses as defined by the appended claims.

Having thus described my invention, what I claim as new and wish to secure by Letters Patent is:

1. A manually operable surgical cutting device for obtaining specimens of skin and tissue for microscopic examinations, which comprises in combination, a tubular barrel-handle member having, when in operative position, an upper end and a lower end, a rotatable spindle housed in the barrel member and having a pair of oppositely directed stem portions, one of which is an upper stem portion projecting beyond the upper end of the barrel, the other of which stem portions is a bottom stem portion projecting beyond the lower end of the barrel, a free-wheeling coupling element in the barrel adjacent to its upper end, a coil spring encircling the spindle and having a lower end secured to the barrel and an upper end secured to the free-wheeling coupling element, locking means releasably connecting the spindle to the free-wheeling coupling element for applying increasing tension to the coil spring responsively to actuation of the free-wheeling coupling in one direction, a tissue-cutting tool carried by the bottom stem portion of the spindle, increasing tension in the coil spring withdrawing the spindle and cutting tool into the barrel-handle member, and a top closure cap assembly for closing the upper end of the barrel member including finger-release mechanism for releasing the resulting tensioned coil spring for reversely actuating the spindle to impact the tissue-cutting tool against an anatomical surface for enabling the tool to cut a specimen of skin and tissue to be examined.

2. The cutting device claimed in claim 1, wherein the top closure cap assembly includes a closure plug threadedly mounted in the upper end of the barrel having the upper stem portion of the spindle extending therethrough, a hollow closure cap secured to the plug, the said plug having external intermediate ratchet teeth on outer portions thereof adapted to interlock releasably with an intermediate pawl member mounted in the closure cap connecting the closure cap and plug, a top ratchet member

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mounted on the said stem portion of the spindle, a second locking pawl in the closure cap for locking with the top ratchet, and a manually depressible operating cap mounted in the closure cap over the upper stem of the spindle for depressing the latter until the ratchets become released from their coacting pawls for causing the spring to rotate the spindle and cutting tool for operating the latter.

3. A manually operable surgical cutting device comprising a tubular handle casing, a rotatable spindle mounted in the casing for oppositely directional rotation with respect to the casing, a cutting tool carried by the spindle, spring driving means connected to the casing and enclosing the spindle, a rotatable cap on the casing, the spring being also secured to the cap for enabling the spring to be wound into tensioned condition, latch means for holding the spring under tension, spring releasing mechanism mounted on the casing, and energy-transmitting coupling means eccentrically connected to the spring and unidirectionally rotatably keyed to the spindle enabling the spring to rotate the spindle for operating the cutting tool and enabling the spindle to decelerate at a slower rate than the spring and coupling means.

4. A manually operable surgical cutting device comprising, in combination, a tubular casing defining a handle for the device, a rotatable spindle mounted in the casing, a releasable chuck on a lower end of the spindle an interchangeable cutting tool held by the chuck, a helical spring encircling the spindle, one end of the spring being affixed to the casing and an opposite end of the spring being operably connected to the spindle, a rotatable cap on the casing, a pair of pawls extending into the cap, a pair of oppositely-directed ratchets adjacent to and engaged by the pawls, one of the ratchets being connected to the spindle and enabling the spring to be increasingly tensioned responsively to rotating the cap in a given direction, the other of the pair of ratchets being connected to the casing for holding the spring in tensioned condition, manually operable mechanism for releasing the tensioned spring, and a free-wheeling slip-ring coupling unidirectionally rotatably keyed to the spindle and eccentrically connected to the spring for rotating the spindle and enabling the spindle to decelerate at a slower rate than the coupling.

5. The structure defined in claim 4 comprising additionally an adjustable shoulder on the cutting tool end of the casing.

6. The device of claim 3 further including releasable latch means between the casing and spindle for securing the spindle between step-wise increases in tension in the spring responsive to continued winding of the spring.

References Cited in the file of this patent

UNITED STATES PATENTS

1,905,851	Green	Apr. 25, 1933
2,249,906	Longoria	July 22, 1941
2,419,045	Whittaker	Apr. 15, 1947