US 20100000099A1

(19) **United States**

(12) **Patent Application Publication**

ARNETOLI

(10) **Pub. No.: US 2010/0000099 A1**

(43) **Pub. Date: Jan. 7, 2010**

(54) **MOWING HEAD WITH PERIPHERAL MEMBERS FOR ENGAGEMENT OF THE CUTTING LINE**

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(21) Appl. No.: **12/500,143**

(22) Filed: **Jul. 9, 2009**

Related U.S. Application Data

(63) Continuation of application No. 11/531,131, filed on Sep. 12, 2006.

(30) **Foreign Application Priority Data**

Sep. 13, 2005 (IT) FI2005A000191

Publication Classification

(51) **Int. Cl.**
A01D 34/416 (2006.01)

(52) **U.S. Cl.** **30/347**

(57) **ABSTRACT**

The mowing head (**1**) includes: a body (**3**), which can be engaged to a motor shaft and defines a peripheral edge (**3**C); at least one member for anchorage (**9**) of a cutting line (F), with an elastically loaded eccentric oscillating element, which co-operates with a surface of contrast fixed to the body for anchoring the cutting line. The oscillating element (**11**) projects from the peripheral edge of the body of the mowing head with a knurled edge (**11**Z), which forms a gripping surface for causing oscillation of the oscillating element and release of the cutting line.

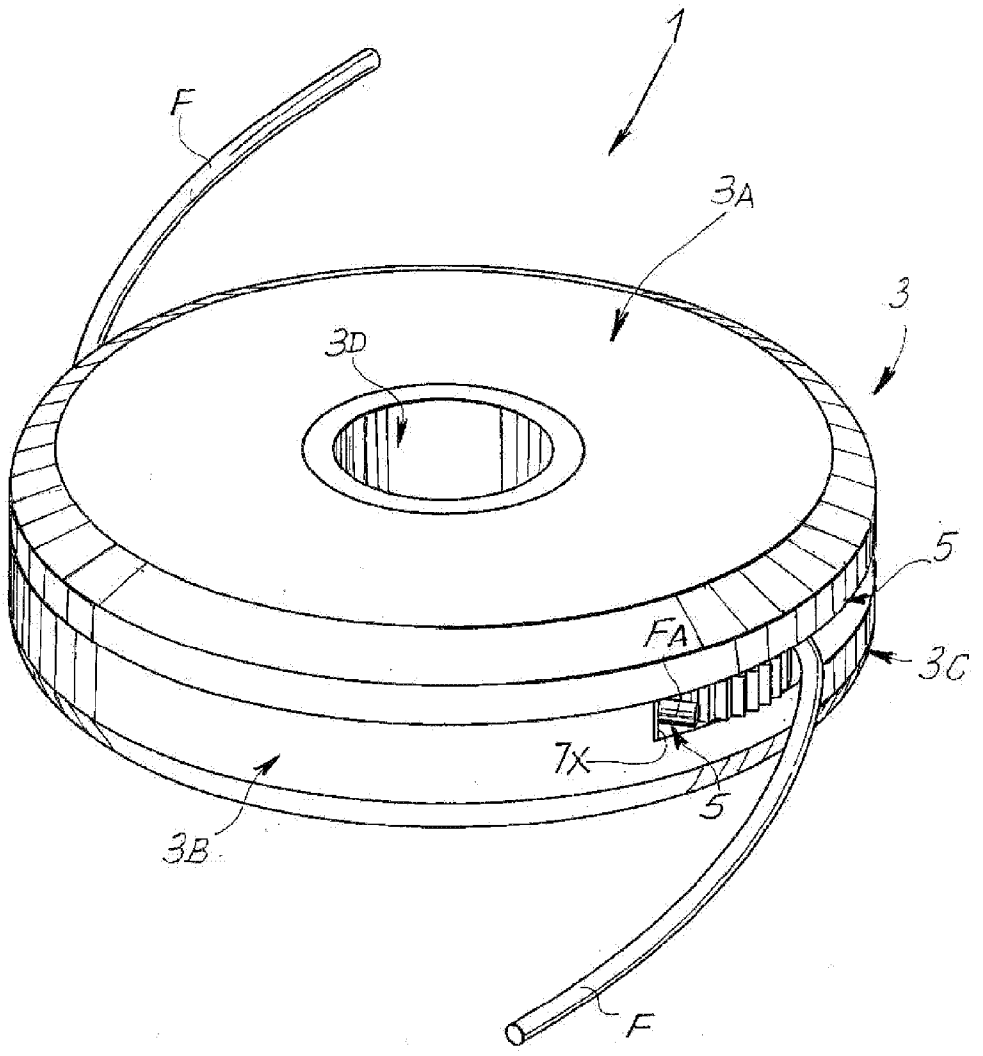
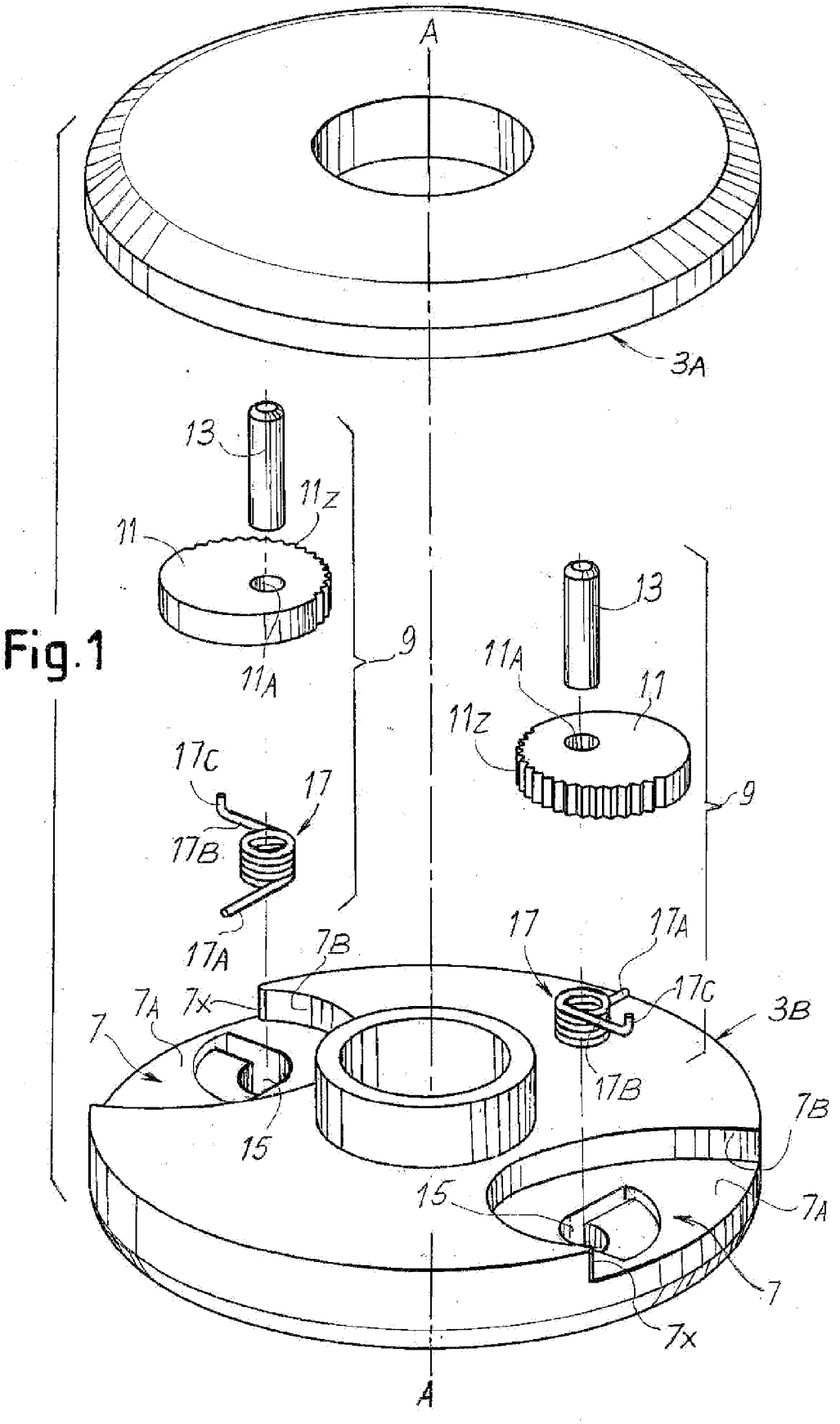


Fig.1


A
3A
13
11Z
11
11A
9
13
11A
11
11Z
9
17C
17
17B
17A
7B
17
17A
17C
3B
7A
7x
7
15
17B
7B
15
7A
7
7x
A

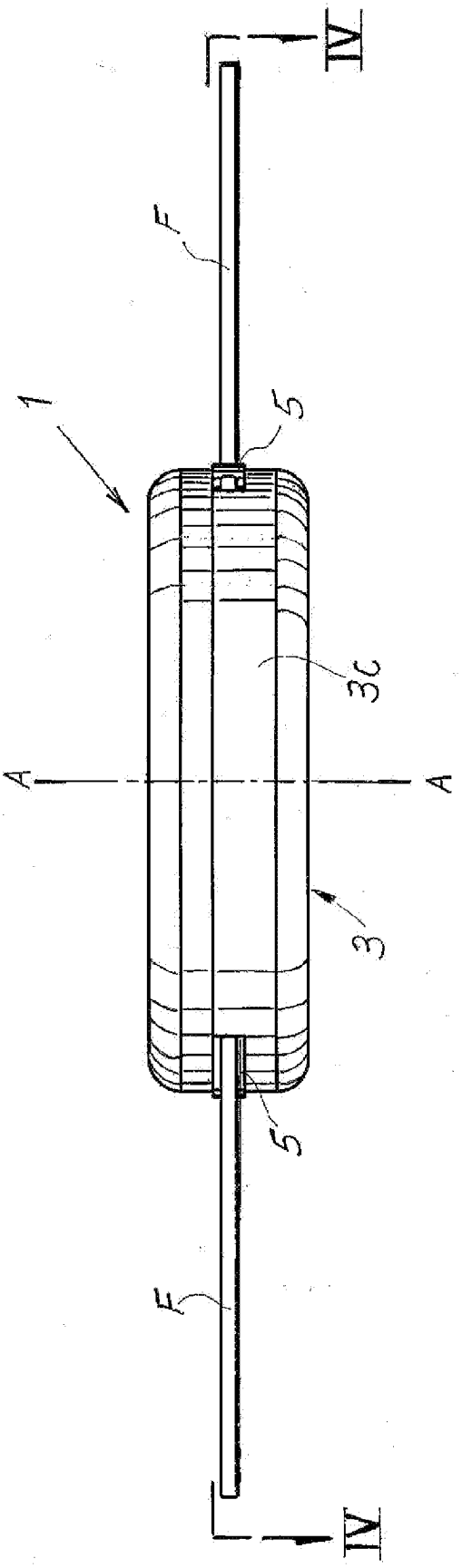


Fig. 2

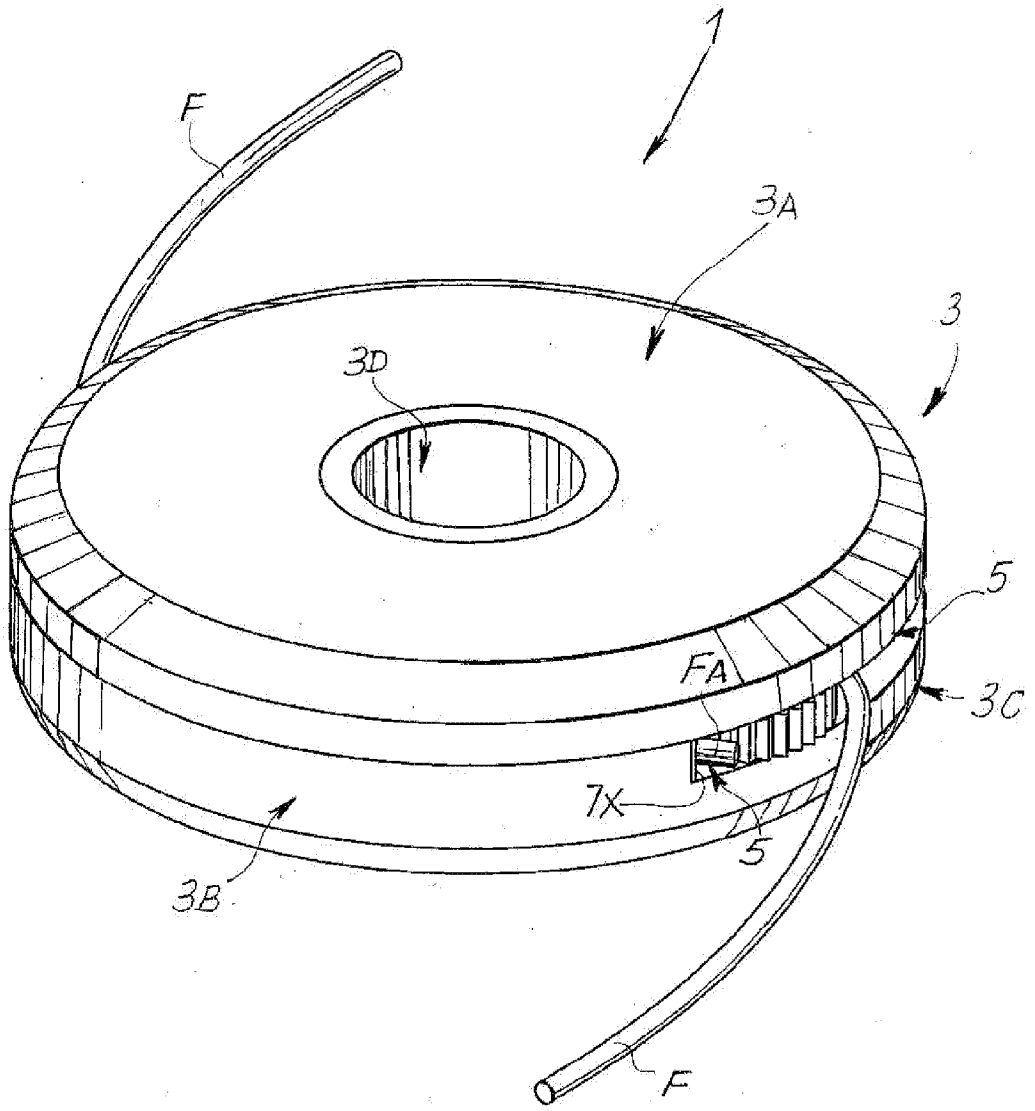
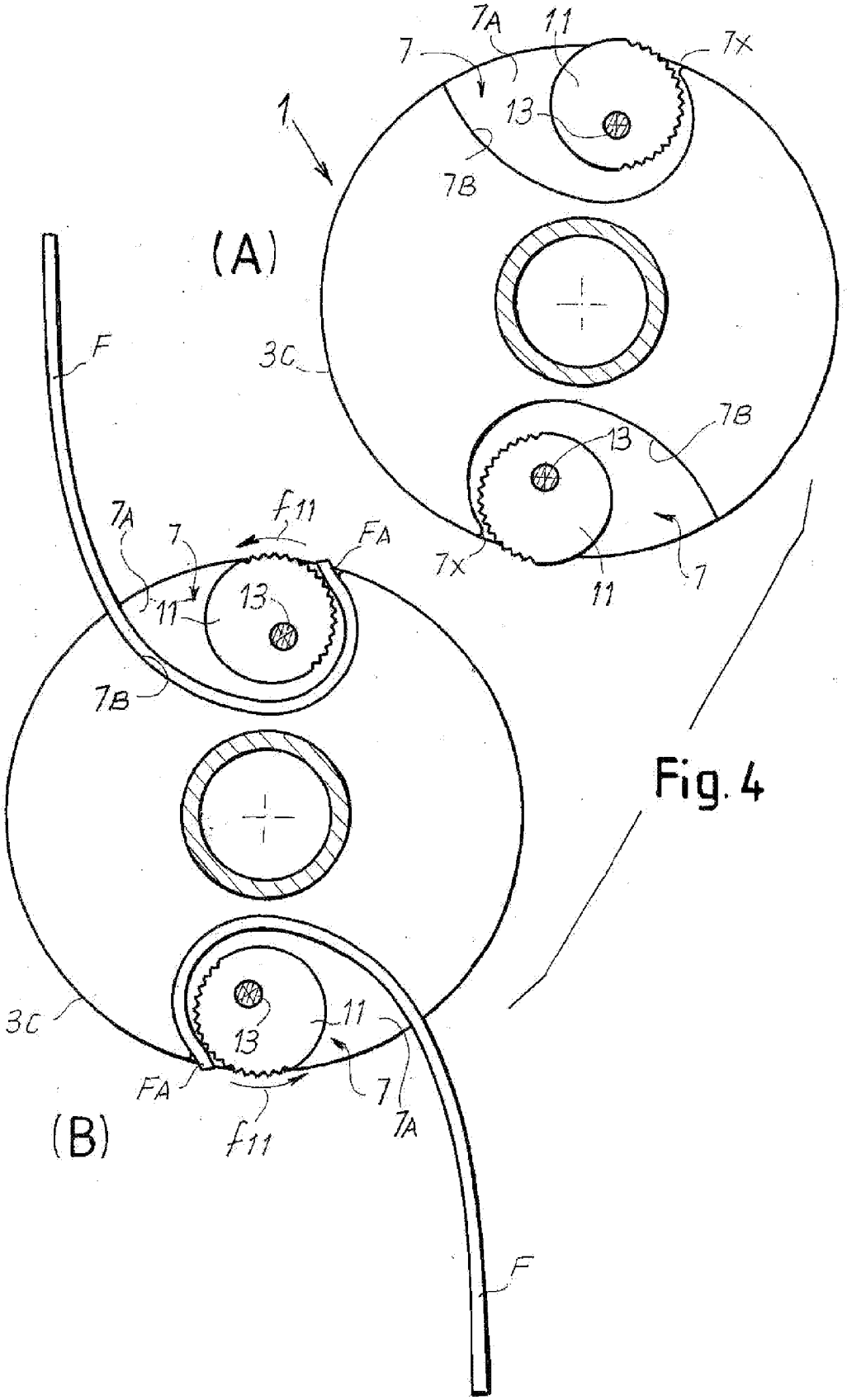


Fig. 3


7A
11
7
7x
1
13
7B
(A)
F
3C
7B
13
7A
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f11
FA
7x
11
7
11
13
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3C
13
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(B)
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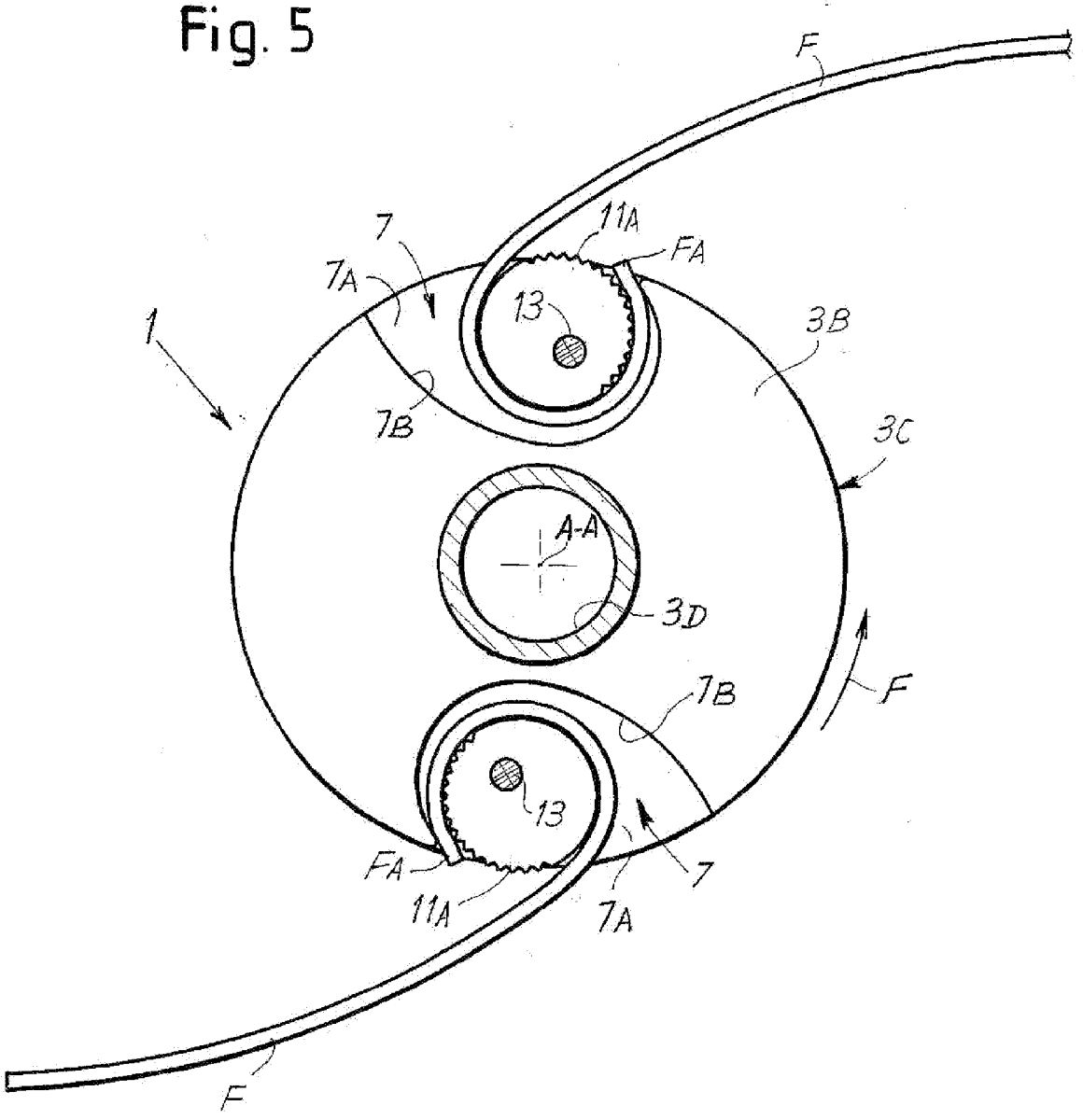
F

Fig. 4

Fig. 5



MOWING HEAD WITH PERIPHERAL MEMBERS FOR ENGAGEMENT OF THE CUTTING LINE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This is a continuation under 37 CFR 1.53(b) of pending prior application Ser. No. 11/531,131 filed Sep. 12, 2006, and claims the benefit of priority under 35 U.S.C. § 119 of Italian Patent Application FT 2005A000191 filed Sep. 13, 2005, the entire contents of each of the applications are incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to improvements to mowing or trimming heads for brush cutters or the like, and more in particular to mowing heads that use cutting line elements for cutting vegetation.

BACKGROUND OF THE INVENTION

[0003] In gardening, frequently tools are used for cutting vegetation, and in particular for cutting grass, which are based upon the use of cutting lines. The latter are made to project radially from mowing heads, which, fitted to the end of a rotating shaft, are made to rotate at a high speed. The centrifugal force radially extends the lines projecting from the mowing head, so that by rotating they cut the vegetation.

[0004] In some mowing heads of this type, the cutting line is applied in the form of single lengths, one end of which is anchored to the mowing head whilst the opposite end projects radially from the mowing head itself. The length of the individual lengths or portions of cutting line is sufficient to carry out cutting of a certain amount of vegetation. Once the lengths of cutting line are worn out, they are simply replaced with new lengths. Examples of mowing heads of this type are described in the U.S. Pat. Nos. 5,896,666, 5,758,424, 5,887,348.

[0005] The mowing heads described in the above U.S. patents have a rotating body, which can be engaged to a motor shaft and defines a peripheral, i.e., perimetral edge, along which members for anchorage of lengths of cutting line are arranged. Each anchorage member has an eccentric oscillating element elastically loaded against a surface of contrast fixed to the body of the mowing head. The length of cutting line is blocked against the mowing head as a result of the elastic loading exerted by the eccentric oscillating element against the contrast surface. The centrifugal force that is generated during rotation, which is applied on the cutting line projecting from the mowing head and tends to slide the cutting line out of the seat defined between the fixed surface and the eccentric element, increases the force with which the eccentric element presses against the fixed surface, pinching the cutting line. This guarantees effective grip of the cutting line during operation.

[0006] These devices do not enable a convenient removal of possible residue of the cutting line, which can remain blocked in the anchorage member and that must be replaced with new lengths of cutting line. Furthermore, the operations of production and assembly of the anchorage members are complex and far from reliable.

[0007] In some practical embodiments of the above known devices, manufactured by the company Kwik Products, Inc., USA, to enable release of the cutting line and replacement of a worn-out cutting line with a new one, the eccentric elements have a dorsal tab, which projects in the direction of the axis of the mowing head, and on which the user can act to release the residue of cutting line. This solution, albeit solving some problems of the devices described in the U.S. patents cited above, calls for a particular configuration of the mowing head, which cannot be produced closed, and is thus liable to accumulate debris inside it. Furthermore, the operations of release of the cutting line are far from convenient.

[0008] Described in U.S. Pat. No. 4,062,115 is a grass-cutting device with a mowing head to which lengths of cutting line are engaged via insertion, in pairs of adjacent holes, of two stretches of one and the same length of line, which is then blocked via a body that is screwed within the mowing head. The replacement of the worn-out lines is a complex and long operation.

[0009] Described in the U.S. Pat. No. 4,199,926 is a mowing head in which the main body is formed by a disk-like member with a hole for anchorage to the motor shaft. Approximately radial seats made in the disk-like body receive the ends of lengths of cutting line that project radially from the body itself. The lengths are fixed in the corresponding seats by means of screw members that squeeze the cutting line within its own seat. The clamping is not particularly reliable and moreover the operations of replacement of the lengths of worn-out cutting line are long and complex and call for purposely designed tools.

[0010] Described in the U.S. Pat. Nos. 4,756,146 and 5,433,006 are mowing heads in which the lengths of cutting line are anchored by being inserted within a tortuous path made in the disk-like body of the mowing head. Also in this case, the insertion of the lengths of cutting line and their replacement following upon wear is a complex and long operation.

[0011] Described in the U.S. Pat. No. 4,905A65 is a mowing head in which individual lengths of cutting line are inserted in pairs of adjacent holes to assume a U-shaped conformation. Particular solutions are not envisaged for secure anchorage of the lines to the mowing head.

[0012] Described in the U.S. Pat. No. 5,303,476 is a mowing head in which a single length of cutting line is anchored in a diametral position to project with its own ends in diametrally opposite points of the mowing head. An elastic lever is provided for engaging the length of cutting line.

[0013] U.S. Pat. No. 5,023,998 describes a mowing head in which lengths of cutting line are applied in a diametral position to project with both of its ends from the mowing head itself. Anchorage is obtained by causing the cutting lines to describe a tortuous path within the body that forms the mowing head. The insertion of the cutting lines in this path is a highly complex and troublesome operation.

SUMMARY OF THE INVENTION

[0014] An object of the present invention is to provide a mowing head of the type initially mentioned, and in particular of the type using lengths of cutting line anchored to a body of the mowing head, which is of simpler and more reliable construction and of more practical use as compared to known mowing heads.

[0015] Basically, provided according to the invention is a mowing head comprising: a body which can be engaged to a motor shaft and defines a peripheral edge; and at least one member for anchorage of a cutting line, with an elastically loaded eccentric oscillating element, which co-operates with

a contrast surface fixed to the body of the mowing head for anchoring the cutting line. According to one embodiment of the invention, the oscillating element projects from the peripheral edge of the body of the mowing head with a knurled edge, which forms a gripping surface for causing oscillation of the oscillating element and release of the cutting line.

[0016] In an advantageous embodiment of the invention, the oscillating element is partially surrounded by the contrast surface, which gradually approaches the oscillating element, defining an area of insertion and engagement of the cutting line of variable width, from a mouth of larger dimensions up to a point for anchorage of the cutting line between the contrast surface and the oscillating element.

[0017] In a practical embodiment of the invention, the contrast surface will define a seat for said oscillating element, which is open along an elongated slit on the perimetral surface of the body of the mowing head, the oscillating element projecting from said elongated slit in an off-center position. The cutting line is fed between one end of the slit and the oscillating element and is blocked approximately at the opposite end of said elongated slit.

[0018] In a practical embodiment, the knurled edge forms an engagement surface for engaging the cutting line, the oscillating element being set so that said knurled edge pinches the cutting line against the contrast surface fixed to the body of the mowing head. The centrifugal force acting on the cutting line when the mowing head is in rotation tends to increase the pressure exerted by the oscillating element against said contrast surface.

[0019] According to an advantageous embodiment of the invention, the conformation of the members for anchorage of the cutting line is such that, in a position where the cutting line is mounted and anchored to the mowing head, during rotation said cutting line is wound around the oscillating element for an angle greater than 180°. Advantageously, the oscillating element can form a rest for the cutting line during rotation of the mowing head.

[0020] Preferably, the eccentric oscillating element has a circular cross section and is supported about an axis of oscillation that is eccentric with respect to the center of the circular cross section.

[0021] In a practical embodiment, the contrast surface with which the oscillating element co-operates for clamping the cutting line has a concave curvilinear development, for example approximately in the shape of a spiral, and delimits a seat for housing said oscillating element, said seat being open on the peripheral edge of the body of the mowing head.

[0022] In a practical embodiment, the concave curvilinear surface defines, along with the perimetral edge of the oscillating element, a channel for inserting and guiding the cutting line, said channel having a decreasing cross section, with a mouth of larger dimensions on the peripheral edge and an area with a smaller cross section, in which the cutting line is elastically gripped between the oscillating element and said concave curvilinear surface.

[0023] The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its uses, reference is made to the accompanying drawings and descriptive matter in which preferred embodiments of the invention are illustrated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] In the drawings:

[0025] FIG. **1** is an exploded perspective view of a mowing head according to the invention;

[0026] FIG. **2** is a side view of the mowing head assembled, with the lengths of cutting line anchored to the body of the mowing head;

[0027] FIG. **3** is a perspective view of the mowing head of FIG. **2**;

[0028] FIG. **4**A is a cross sectional view according to the plane of trace IV-IV of FIG. **2** of the mowing head without the cutting lines;

[0029] FIG. **4**B is a cross sectional view according to the plane of trace IV-IV of FIG. **2** of the mowing head with the cutting lines inserted; and

[0030] FIG. **5** is a cross-sectional view similar to the cross section of FIG. **4**, illustrated in which is the configuration that the cutting lines assume when the mowing head is in rotation about its own axis.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0031] In a possible embodiment, the mowing head, as a whole designated by **1**, comprises a body **3**, which is formed by two disk-like portions designated by **3**A and **3**B, respectively. The two disk-like portions **3**A, **3**B are coupled together along a plane of coupling of trace IV-IV (FIG. **2**), orthogonal to the axis A-A of rotation of the mowing head.

[0032] Once coupled together, the two disk-like portions **3**A, **3**B define a body that is substantially closed except for two tangential slits **5** made along the peripheral, i.e., perimetral, edge **3**C of the body **3** of the mowing head. Furthermore, the body **3** formed by the coupling of the portions **3**A, **3**B has a central hole **3**D, which is co-axial to the axis of rotation A-A of the mowing head. This through hole enables anchorage of the mowing head **1** to a rotating hub or shaft of a brush cutter or other machinery in two different positions, which are rotated through 180° with respect to one another, about an axis orthogonal to the rotation axis A-A (i.e., with the portion **3**A or the portion **3**B of the body **3** facing the motor shaft alternatively).

[0033] The two disk-like portions **3**A, **3**B can be joined together by bonding, welding **1** with screw means (not illustrated), or in any other suitable way (herein not represented for reasons of simplicity). The mutual coupling of the two disk-like portions **3**A, **3**B can be irreversible, given that (as will be clarified in what follows) normal use of the mowing head does not require uncoupling of the two disk-like portions **3**A, **3**B forming the body **3**.

[0034] In the bottom disk-like portion **3**B (in the drawing) are two seats **7** for housing corresponding anchorage members for anchoring lengths of cutting line. The seats **7** are delimited, not only by the approximately substantially plane surface **7**A made in the disk-like portion **3**B, but also by a curvilinear surface **7**B, which is orthogonal to the surface **7**A and has an approximately spiral development (see FIGS. **4**A, **4**B and **5**). On top, each seat **7** is delimited by the bottom surface of the disk-like portion **3**A, which can be planar.

[0035] Inserted within each of the two seats **7** is a corresponding anchorage member, as a whole designated by **9**, the components of which are illustrated in isolation in the exploded view of FIG. **1**.

[0036] More in particular, each anchorage member **9** comprises an eccentric oscillating element **11**, of substantially circular cross section, mounted in the corresponding seat **7**. Said eccentric element **11** can oscillate about the axis of a pin **13**, inserted in a through hole **11**A of the element **11**. Each pin **13** is inserted in a hole (which may be blind) **15**, made in the surface **7**A of the corresponding seat **7**. A corresponding blind hole is made also in the top disk-like portion **3**A, so that each of the two pins **13** is engaged in two opposed and coaxial blind holes in the portions **3**A and **3**B of the body **3** of the mowing head **1**.

[0037] The hole **15** is sized in such a way as to be able to receive, in addition to the pin **13**, also an elastic member made in the form of a helical spring **17**. The line forming the helical spring **17** has appendages **17**A and **17**B. The appendage **17**A is engaged in the appropriately shaped cavity constituted by the hole **15**, whilst the appendage **17**B has a bent end **17**C that is engaged in a corresponding hole (not illustrated) made on the bottom face of the corresponding eccentric oscillating element **11**. With this arrangement, when the member **9** is assembled, the helical spring **17** loads the eccentric oscillating element **11** in a resting position, from which the element itself can be made to oscillate, torsionally deforming the helical spring **17**.

[0038] As may be noted in FIG. **1**, provided on a part of the perimetral development of each of the elements **11** is a knurling **11**Z for the purposes that will be clarified hereinafter.

[0039] The eccentric oscillating elements **11** are mounted (see in particular FIGS. **4**A, **4**B and **5**) in the respective seats **7** in such a way as to project through the respective slit **5** with at least one portion of the respective knurling **11**Z. It is possible to act on this knurled part of the edge of each eccentric oscillating element **11** to bring about an oscillation of the eccentric oscillating element **11** for the purpose of releasing the cutting line and enabling its replacement in the event of wear.

[0040] As may be noted in particular in FIGS. **4**A, **4**B and **5**, in each of the seats **7** the surface **7**B with approximately spiral-shaped development defines, together with the circular edge of the respective eccentric oscillating element **11**, a channel with a cross section progressively decreasing from a mouth that is located on the perimeter of the body **3** of the mowing head **1** at the slit **5** up to a restriction at a rounded-off edge **7**× with which the curved surface **7**B terminates. The rounded-off edge **7**X is located basically on the circular perimetral edge **3**C of the body **3**. The eccentric oscillating element **11** of each anchorage member **9** is elastically loaded against the respective rounded-off edge **7**C or in any case towards a position in which it is located at a distance from said edge smaller than the diameter of the cutting line F.

[0041] Insertion and anchorage of the cutting line F to the mowing head **1** presented herein is obtained as described here below (see in particular FIGS. **4**A, **4**B). Inserted in each of the two seats **7** is the first end F_A of a length of cutting line F. Insertion is made through the mouth of the channel with variable cross section defined by the surface **7**B and by the perimetral edge of the respective eccentric oscillating element **11**. The cutting line is conveniently guided towards the area with smaller cross section of this channel, sliding on the curved surface **7**B and wedging between the knurled portion **7**Z of the edge of the eccentric oscillating element **11** and the rounded-off terminal edge **7**X of the curved surface **7**B, as may be noted in FIG. **4**B, where the two lengths F of cutting line have been completely inserted and anchored in the mowing head.

[0042] To remove the lengths of cutting line F, for example if these are excessively worn or broken, it is sufficient to act from outside the mowing head on the knurled portion **1**Z projecting from the mowing head itself, through the slit **5** of the body **3** to bring about an oscillation according to the arrow f**11** (FIG. **4**B) about the axis of the pin **13** of the corresponding eccentric oscillating element **11**. This movement of oscillation releases the end F_A of the cutting line F and enables convenient extraction and subsequent replacement thereof with a new length of cutting line.

[0043] When the mowing head **1** is made to rotate in the direction indicated by the arrow f in FIG. **5**, the centrifugal force tends to extend the lengths of cutting line F radially. This pulling action, thanks to the fact that the lengths of line are wound through a wide angle (in a possible embodiment, said angle being wider than 180°) around the respective eccentric oscillating elements **11**, means that said elements are forced into the gripping position; i.e., they are tendentially made to oscillate in a direction opposite to the direction indicated by the arrow fl **1** in FIG. **4**B. This guarantees a secure retention of each of the lengths of cutting line F during rotation of the mowing head **1**. The force exerted by the vegetation that is cut by the lines F during rotation of the mowing head causes, on the other hand, a curving of the cutting lines F, as illustrated in FIG. **5**. By so curving, the cutting lines F rest on the circular edge of the respective oscillating elements **11**, which consequently form a rest with ample curvature for the lines themselves, so reducing the risk of breakage due to the mechanical stresses exerted by the vegetation or by possible obstacles, such as sharp edges of flower beds, stones, clods of earth or the like, on the cutting lines themselves.

[0044] Thanks to the fact that the mowing head can be fitted on the motor shaft in two distinct positions, the direction of rotation f of the mowing head itself will once again be the one indicated in FIG. **5**, irrespective of the direction of rotation of the motor shaft. Purposely provided indications on the two faces of the mowing head can be useful to the user for mounting the mowing head always in the correct way according to the direction of rotation (clockwise or counterclockwise) of the motor shaft of the device on which the mowing head itself is installed.

[0045] While specific embodiments of the invention have been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. A mowing head for accommodating at least one piece of cutting string, the string being fixedly supported in the mowing head, the mowing head comprising:

a base plate;

a continuous side wall extending from said base plate with no apertures, said wall defining one clamping chamber with a contrast surface for each piece of string;

a cam for each piece of string, said cam being partially contained in said clamping chamber, wherein a portion of said cam is located outside of said side wall, said base

plate and said cam defining a peripheral edge, said cam being manually actuatable from said peripheral edge.

2. A mowing head for accommodating at least one piece of cutting string, the string being fixedly supported in the mowing head, the mowing head comprising:

a first base plate;

a second base plate;

a side wall between said first base plate and said second base plate, said wall defining one clamping chamber with a contrast surface for each piece of string;

a cam for each piece of string, said cam being partially contained in said clamping chamber, wherein a portion of said cam is located outside of said side wall, said cam being manually actuatable from a peripheral edge of said side wall.

3. A mowing head in accordance with claim **2**, wherein said first base plate is detachably connected to said second base plate.

4. A mowing head in accordance with claim **3**, wherein said cam is located between said base plate and said second base plate.

5. A mowing head in accordance with claim **2**, wherein said first base plate is non-detachably connected to said second base plate to form an integral mowing head structure.

6. A mowing head in accordance with claim **2**, wherein said cam comprises a knurled surface, said knurled surface defining a user contact means for actuating said cam.

7. A mowing head in accordance with claim **6**, wherein at least a portion of said knurled surface extends in an outward radial direction from said peripheral edge of said side wall.

8. A mowing head for accommodating at least one piece of cutting string, the string being fixedly supported in the mowing head, the mowing head comprising:

an axis of rotation;

a base plate;

a continuous side wall extending from said base plate, said side wall having no apertures, said side wall comprising a contrast surface, said side wall defining one clamping chamber with said contrast surface for each piece of string;

at least one oscillating eccentric cam per piece of string, said at least one oscillating eccentric cam having an oscillating axis, said at least one oscillating eccentric cam being at least partially contained in said clamping chamber, said at least one oscillating eccentric cam being located outside of said side wall, said at least one oscillating eccentric cam being manually actuatable from a peripheral edge of said side wall, said oscillating axis of said at least one oscillating eccentric cam being located in said clamping chamber, said contrast surface and said axis of rotation defining a first radial distance, said oscillating axis and said rotation axis defining a second radial distance, said first radial distance being greater than said second radial distance.

9. A mowing head in accordance with claim **8**, further comprising another plate connected to said base plate.

10. A mowing head in accordance with claim **9**, wherein said at least one oscillating eccentric cam is located between said base plate and said another plate.

11. A mowing head in accordance with claim **9**, wherein said base plate is non-detachably connected to said another plate to form an integral mowing head structure.

12. A mowing head in accordance with claim **8**, wherein said at least one oscillating eccentric cam comprises a knurled surface, said knurled surface defining a user contact means for actuating said cam.

13. A mowing head in accordance with claim **12**, wherein at least a portion of said knurled surface extends in an outward radial direction from said peripheral edge of said side wall.

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