(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 875 905 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
27.05.2015 Bulletin 2015/22

(51) Int Cl.:
B25F 5/00 *(2006.01)*

(21) Application number: **13193815.1**

(22) Date of filing: **21.11.2013**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(71) Applicant: **ROBERT BOSCH GMBH**
70442 Stuttgart (DE)

(72) Inventors:
- **Thornton, Darren**
  Co11 1UD Mistley, Essex (GB)
- **Koepf, Christian**
  IP92BA Wherstead (GB)
- **Kelly, Aaron**
  IP145QW Stowmarket (GB)
- **Kleemann, Andreas**
  98597 Breitungen (DE)

(54) Switching device for garden tools

(57) The invention relates to a switching device for electrically driveable garden tools, which comprises at least one operating unit to control at least one motor and at least one conversion unit (18) to convert a mechanical movement into a proportional electrical signal; wherein said operating unit (14) comprises at least one switch operating element (54) to actuate at least one electrical switch (66) to open and/or close an electrical circuit, and comprises at least one speed operating element (20) for adjusting a rotation speed of said motor (16).

The conversion unit (18) according to the invention comprises at least one conversion element (22) which is mechanically coupled to said speed operating element (20) for converting a mechanical movement of said speed operating element (20) into an electrical signal to adjust a rotation speed of said motor (16).

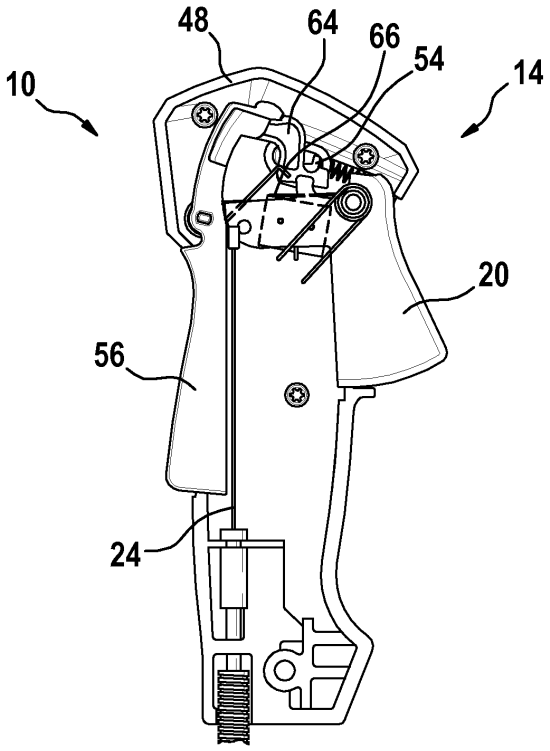

Fig. 2

EP 2 875 905 A1

Description

Prior Art

[0001] EP 2 223 778 A2 describes a switching device for garden tools, in particular for electrically driveable garden tools, which comprises an operating unit to control a motor and a conversion unit to convert a mechanical movement into a proportional electrical signal. The operating unit comprises at least one switch operating element to actuate at least one electrical switch to open and/or close an electrical circuit, and comprises a speed operating element for adjusting a rotation speed of the motor. The conversion unit comprises a conversion element which is arranged at a distance to the speed operating element.

[0002] To convert a mechanical movement of the speed operating element into an electrical signal to adjust a rotation speed of the motor, the speed operating element has to be brought into contact with the conversion element via a movement of the speed operating element relative to the conversion element for converting a mechanical movement into a proportional electrical signal.

Summary of the Invention

[0003] The invention relates to a switching device for garden tools, in particular for electrically driveable garden tools, which comprises at least one operating unit to control at least one motor, and at least one conversion unit to convert a mechanical movement into a proportional electrical signal, wherein the operating unit comprises at least one switch operating element to actuate at least one electrical switch to open and/or close an electrical circuit, and comprises at least one speed operating element for adjusting a rotation speed of the motor.

[0004] The conversion unit according to the invention comprises at least one conversion element, which is mechanically coupled to the speed operating element for converting a mechanical movement of the speed operating element into an electrical signal to adjust a rotation speed of the motor. Hence, a movement of the speed operating element is directly transferred to the conversion element. Preferably, the speed operating element is mechanically coupled to the conversion element in such a manner that every movement of the speed operating element is directly transmitted to the conversion element. The term "operating unit" shall define a unit comprising at least one element, in particular an operating element, which can be directly actuated by an operator and which is provided to change and/or to influence a process and/or a state by an actuation and/or by an input of at least one parameter. An "operating element" shall define an element provided to receive an input from the operator in an operation process, wherein the element is directly contacted by the operator and a force exerted on the operating element can be sensed and/or mechanically transferred to actuate a device. The speed operating element is provided to be actuated directly by the operator, in particular by fingers of the operator's hand, so as to control a rotation speed of the motor. Preferably, the speed operating element is moveably supported, in particular pivotally moveably supported. However, it is also possible that the speed operating element is translationally moveably supported. An operating force to move the speed operating element is preferably less than 25 N. Preferably, the operating force to move the speed operating element is in a range between 20 N and 5 N.

[0005] The term "mechanically coupled" shall define a connection between at least two elements, wherein the two elements directly abut on each other in every position of the two elements or wherein the two elements are directly fixed to each other or connected to each other via at least one further element directly connected to the two elements so as to transfer a movement of the one element to the other element. Preferably, the speed operating element rotates the conversion element to convert a mechanical movement of the speed operating element into a proportional electrical signal. The switching device according to the invention can advantageously achieve a highly fail-safe electronics to control a motor. If an error occurs within the mechanical connection between the speed operating element and the conversion element, a starting of the motor can advantageously be stopped to prevent a possible injury of the operator by a driven insert tool driveable by the motor.

[0006] Moreover, the conversion unit comprises at least one tapping element mechanically coupled to the speed operating element and to the conversion element. The tapping element is provided to transfer a movement of the speed operating element to the conversion element. Preferably, the tapping element is fixed to the speed operating element and/or to the conversion element by a positive and/or a non-positive connection. It is also possible that the tapping element is fixed to the speed operating element and/or to the conversion element by a different connection which is considered expedient by a person skilled in the art. The speed operating element can advantageously be located at a distance to the conversion element without losing an opportunity of directly transmitting a movement of the speed operating element to the conversion element, because of the connection via the tapping element. Moreover, it is advantageously possible to protect the conversion unit against wet conditions, in a manner independent of a protection against wet conditions of the operating unit.

[0007] In a preferred embodiment of the switching device according to the invention, the tapping element is flexible. Preferably, the tapping element is flexible concerning a resistance against a bending load. The tapping element is primarily provided to transmit tensile and/or compressive forces. The tapping element can advantageously be adapted in a constructively simple manner to different constructive solutions of an arrangement of the speed operating element relative to the conversion ele-

ment. Furthermore, large distances between the speed operating element and the conversion unit can advantageously be bridged.

[0008] In addition, the conversion unit comprises at least one spring element to exert a spring load on the conversion element in at least one direction. Preferably, the spring element is embodied as a leg spring. It is also possible that the spring element is embodied in a different shape which is considered expedient by a person skilled in the art. The conversion element can advantageously be moved into a start position by the spring element if a mechanical damage, in particular a mechanical damage of the tapping element, occurs. Therefore, a highly failsafe switching device can advantageously be achieved.

[0009] Moreover, the conversion unit comprises at least one adjusting unit to adjust at least one tapping element of the conversion unit. Preferably, the adjusting unit is embodied as a mechanical adjusting unit to adjust a position of a supporting element of the tapping element relative to the speed operating element and/or relative to a motor housing of the garden tool. It is also possible that the adjusting unit is embodied as an electronic adjusting unit to adjust an electrical parameter which depends on a position of the tapping element of the conversion unit relative to the speed operating element and/or relative to the motor housing. By means of the adjusting unit according to the invention, a comfortable adjustment of the tapping element can advantageously be achieved in the case of a geometrical and/or dimension deviation. Therefore, a precisely working switching device can advantageously be achieved. Furthermore, a long life expectancy can advantageously be achieved.

[0010] In a preferred embodiment of the switching device according to the invention, the tapping element is translationally moveably supported. Therefore, a precise transmitting of a movement of the speed operating element can advantageously be achieved. Furthermore, a compact and simple embodiment of the tapping element can advantageously be achieved.

[0011] Preferably, the tapping element is embodied as a Bowden cable. In a preferred embodiment of the switching device according to the invention, the tapping element is embodied as a push/pull Bowden cable. A safe and weatherproof construction to transmit a movement of the speed operating element to the conversion element can advantageously be achieved.

[0012] In a preferred embodiment of the switching device according to the invention, the conversion unit is embodied as a potentiometer. Therefore, a constructively simple and cost-efficient embodiment of the conversion unit can advantageously be achieved to convert a mechanical movement into a proportional electrical signal. Moreover, a garden tool, in particular an electrically driveable garden tool, is proposed, which comprises at least one switching device according to the invention. The electrically driveable garden tool can be energized by a portable accumulator or by a cable which can be connected with an electrical socket e.g. of a local power network. Preferably, the electrically driveable garden tool is embodied as an electrically driveable brushcutter. It is also possible that the switching device is used in another garden tool, like a hedge trimmer, a leaf blower, a chain saw etc. The garden tool according to the invention has the advantage that a comfortable and safe usage can be realized. Thus a garden tool with a high ease of use can advantageously be achieved.

[0013] In addition, a method to control an electric motor of an electrically driveable garden tool with a switching device according to the invention is proposed. A comfortable switching method with a high security level can advantageously be achieved.

[0014] The switching device according to the invention, the garden tool according to the invention and/or the method to control a motor of a garden tool with a switching device according to the invention is/are not to be limited to the utilization and the embodiment described above. In particular, the switching device according to the invention, the garden tool according to the invention and/or the method to control a motor of a garden tool with a switching device according to the invention can have a differing number of elements, components and units for a satisfying function as specified herein.

Brief Description of the Drawings

[0015] Further objects, features and advantages of the present invention will become apparent from reading the following detailed description, taking in conjunction the accompanying drawing wherein a particular embodiment of the invention is disclosed as an illustrative example.

Fig. 1 shows an electrically driveable garden tool according to the invention comprising a switching device according to the invention in a schematic representation,

Fig. 2 shows a detail view of the switching device according to the invention in a schematic representation,

Fig. 3 shows a detail view of a conversion unit of the switching device according to the invention in a schematic representation,

Fig. 4 shows a detail view of an adjusting unit of the conversion unit in a schematic representation and

Fig. 5 shows an exploded view of the conversion unit and a portion of a motor housing of the garden tool according to the invention in a schematic representation.

Detailed Description of the Illustrative Embodiment

[0016] Figure 1 shows a garden tool 12 which compris-

es at least one switching device 10. The garden tool 12 is embodied as an electrically driveable brushcutter. Therefore, the garden tool 12 comprises a motor housing 30 to support a motor 16, in particular an electric motor 16, of the garden tool 12. Moreover, the garden tool 12 comprises a tool holder 32 which a cutting tool 34 can be mounted to. The cutting tool 34 can be embodied as a trimmer line cutting tool, as a blade-like cutting tool, as a saw-like cutting tool etc. The tool holder 32 is rotatably driveable by the motor 16. Hence, the garden tool 12 comprises a gear 36 which the motor 16 and the tool holder 32 are connected to. It is also possible that the tool holder 32 is directly driven by the motor 16. Then, the motor 16 is located in a motor housing 30 to which the tool holder 32 is directly attached. The gear 36 is supported in a gear casing 38 of the garden tool 12. The tool holder 32 is mounted to the gear casing 38. The gear casing 38 and the motor housing 30 are connected with each other via a shaft 40 of the garden tool 12. The shaft 40 is embodied as a guidance rod for the garden tool 12. In case the motor 16 directly drives the tool holder 32, the motor housing 30 (in the alternative embodiment the gear casing 38 in figure 1 is the motor housing 30) is arranged on one end of the shaft 40 and a housing for electrical components (in the alternative embodiment the motor housing 30 in figure 1 is the housing for electrical components) is arranged at another end of the shaft 40. The garden tool 12 further comprises an energy supply connection unit 42 to which an energy supply unit 44 can be connected. The energy supply unit 44 is embodied as an accumulator unit. The energy supply connection unit 42 is arranged at the motor housing 30. In case the motor 16 directly drives the tool holder 32, the energy supply connection unit 42 is arranged at the housing for electrical components which is connected to the motor housing 30/gear casing 38 via the shaft 40. Thus a general construction of the garden tool 12 is well known to a person skilled in the art.

[0017] The switching device 10 for the garden tool 12 comprises at least one operating unit 14 to control the motor 16 and at least one conversion unit 18 for converting a mechanical movement into a proportional electrical signal, wherein the operating unit 14 comprises at least one switch operating element 54 to actuate at least one electrical switch 66 (figure 2) to open and/or close an electrical circuit, and comprises at least one speed operating element 20 for adjusting a rotation speed of the motor 16, and wherein the conversion unit 18 comprises at least one conversion element 22 which is mechanically coupled to the speed operating element 20 for converting a mechanical movement of the speed operating element 20 into an electrical signal to adjust a rotation speed of the motor 16. The conversion unit 18 comprises at least one tapping element 24 mechanically coupled to the speed operating element 20 and to the conversion element 22, for mechanically coupling the speed operating element 20 and the conversion element 22 with each other.

[0018] The operating unit 14 further comprises a lock operating element 56 to hold the switch operating element 54 in an actuated state via a positive and/or a non-positive connection. Moreover, the switching device 10 comprises a bike handle unit 46. The bike handle unit 46 is mounted to the shaft 40. Furthermore, the bike handle unit 46 comprises a handle 48 at which the operating unit 14 is located. The handle 48 can be gripped by an operator's hand for guiding the garden tool 12 during work with the garden tool 12. Moreover, the bike handle unit 46 comprises a further handle 50 which can be gripped by the operator. The handle 48 and the further handle 50 are connected with each other via a handlebar 52 of the bike handle unit 46. The handlebar 52 is u-shaped. Herein, the handle 48 is arranged at one end of the handlebar 52 which is at a far side of the handlebar 52 with respect to the end at which the further handle 50 is arranged.

[0019] The speed operating element 20, the switch operating element 54 and the lock operating element 56 are each arranged at different sides of the handle 48. The speed operating element 20 is provided to be actuated by at least one finger of the operator's hand when the operator grips the handle 48, wherein the at least one finger is different from a thumb of the operator's hand. In addition, the speed operating element 20 is pivotally moveably supported at the handle 48. The switch operating element 54 is provided to be actuated by a thumb of the operator's hand when the operator grips the handle 48. Moreover, the switch operating element 54 is translationally moveably supported at the handle 48. The lock operating element 56 is provided to be actuated by a palm of the operator's hand when the operator grips the handle 48. Furthermore, the lock operating element 56 is pivotally moveably supported at the handle 48.

[0020] The tapping element 24 is connected to the speed operating element 20 via a positive and/or a non-positive connection (figure 2). The speed operating element 20 comprises a connection portion to which the tapping element 24 is connected. In its connection portion the speed operating element 20 comprises a connection recess in which an end of the tapping element 24 is located. Furthermore, the tapping element 24 is connected to the conversion element 22 via a positive and/or a non-positive connection (figure 3). The conversion element 22 comprises a connection portion to which the tapping element 24 is connected. In its connection portion the conversion element 22 comprises a connection recess in which an end of the tapping element 24 is located. The conversion element 22 is arranged in the motor housing 30. Therefore, the tapping element 24 mechanically connects the speed operating element 20 arranged in the handle 48 to the conversion element 22 arranged in the motor housing 30. The tapping element 24 is flexible. Herein, the tapping element 24 is embodied as a Bowden cable. Therefore, the tapping element 24 is translationally moveably supported.

[0021] The conversion unit 18 is embodied as a potentiometer. The conversion element 22 is pivotally move-

ably supported in the motor housing 30. Herein, the conversion element 22 interacts with a resistance element 58 (figure 5) of the conversion unit 18, whereby an electrical resistance of the resistance element 58 depends on an angle of rotation of the conversion element 22 relative to the resistance element 58. A rotation speed of the motor 16 is controllable via a rotational movement of the conversion element 22. This changes the electrical resistance of the resistance element 58 in a well-known manner. A rotation of the conversion element 22 depends on a movement of the speed operating element 22 which is mechanically coupled to the conversion element 22 via the tapping element 24. When the speed operating element 20 is moved, the conversion element 22 is also moved because of the mechanically coupling via the tapping element 24. The change in the electrical resistance of the resistance element 58 is detected by a PCBA 62 (printed circuit board assembly) of the switching device 10 to trigger a speed adjustment of the motor 16.

[0022] Furthermore, the conversion unit 18 comprises at least one spring element 26 to exert a spring load on the conversion element 22 in at least one direction, in particular towards a start position of the conversion element 22. In the start position of the conversion element 22, an electrical energy supply to the motor 16 is disconnected so that the motor 16, in particular a rotor of the motor 16 does not rotate. The spring element 26 is embodied as a leg spring. One leg of the spring element 26 is braced at an inner surface of the handle 48 and another leg of the spring element 26 is braced at the conversion element 22 (figure 3). When an operating force on the speed operating element 20 is discontinued, the conversion element 22 is moved into a start position via a spring load of the spring element 26. The conversion unit 18 further comprises at least one arrester element 60 provided to limit a maximum angle of movement of the conversion element 22 relative to the motor housing 30. In its start position the conversion element 22 abuts on at least one side of the arrester element 60. The conversion element 22 strikes against another side of the arrester element 60 when the conversion element 22 is rotated by the maximum angle of movement. It is also possible that the conversion unit 18 comprises more than one arrester element 60, which arrester elements 60 are provided to limit a maximum angle of movement of the conversion element 22.

[0023] Moreover, the conversion unit 18 comprises at least one adjusting unit 28 to adjust the tapping element 24 of the conversion unit 18 (figures 3 and 4). The adjusting unit 28 is provided to adjust a position of an outer cable housing 72 of the Bowden cable relative to the speed operating element 20 and/or relative to the motor housing 30. Therefore, the adjusting unit 28 allows a proper assembly in the case of a geometrical or a dimensional deviation at a fixing portion 70 of the motor housing 30, which one end of the outer cable housing 72 of the Bowden cable is fixed to. Herein, the adjusting unit 28 allows an adjustment of a position of the outer cable housing 72 of the Bowden cable of about 0.5 mm to 5 mm. The adjusting unit 28 is embodied as a bulkhead connection adjusting unit. Hence, the adjusting unit 28 comprises at least one adjusting element 68 which interacts with the fixing portion 70 of the motor housing 30 for adjusting a position of the outer cable housing 72 of the Bowden cable (figures 3 and 4).

[0024] A method to control and/or start the motor 16 of the electrically driveable garden tool 12 with the switching device 10 can comprise the following steps:

The switch operating element 54 is pushed into an actuated position of the switch operating element 54 by the operator, whereby the electrical switch 66 is actuated. The electrical switch 66 closes an electrical circuit for energizing the PCBA 62 of the switching device 10. The PCBA 62 is turned on. It is also possible that the PCBA 62 is only turned on when the speed operating element 20, the switch operating element 54 and the lock operating element 56 are actuated. The electrical switch 66 is embodied as a micro switch, in particular as a dual micro switch. It is also possible that the electrical switch 66 is embodied as a different switch which is considered expedient by a person skilled in the art. In the process of the actuation of the switch operating element 54, the lock operating element 56 is also moved into an actuated position of the lock operating element 56. The lock operating element 56 holds the switch operating element 54 in an actuated position of the switch operating element 54 via a blocking element 64 (figure 3).

The lock operating element 56 can be depressed without a movement of the switch operating element 54 but this does not turn on or trigger a signal from the electrical switch 66. A signal from the electrical switch 66 only occurs when the switch operating element 54 is operated. Now that the electrical switch 66 is engaged and the PCBA 62 is in operation, the motor 16 can be started by a movement of the speed operating element 20. A movement of the speed operating element 20 moves the tapping element 24, which moves the conversion element 22. Herein, an electrical signal is triggered to start the motor 16 and to control a rotation speed of the motor 16. Therefore, a rotation speed of the motor 16 depends on a movement distance of the speed operating element 20 and hence on a movement distance of the tapping element 24 and the conversion element 22.

Preferably, the rotation speed of the motor 16 is adjustable form 0 to 15,000 rpm. It is also possible that the rotation speed of the motor 16 is adjustable within a different range which is considered expedient by a person skilled in the art. In case the operator's hand is removed from the handle 24, the lock operating element 22 releases the switch operating element 20 and the electrical switch 66 switches off the PCBA 62 and the electrically driveable garden tool 12. The

PCBA 62 is located in the motor housing 30.

[0025] Before the motor 16 is started, the PCBA 62 interrogates a position of the conversion element 22 relative to the resistance element 58 so as to check a correct angular position value of the conversion element 22. When the detected angular position value of the conversion element 22 is outside a predetermined starting range of the conversion element 22, the PCBA 62 does not allow a start of the motor 16. When the detected angular position value of the conversion element 22 is within the predetermined starting range of the conversion element 22, the PCBA 62 utilizes the maximum rotation speed of the motor 16 and a linear increment of the maximum angle of movement of the conversion element 22. Based on the start position and the maximum angle of movement of the conversion element 22, the PCBA 62 calculates a maximum rotation speed threshold value and defines a linear increment between the maximum rotation speed threshold value and the maximum angle of movement of the conversion element 22. The maximum rotation speed threshold value is not set at the position of the maximum angle of movement of the tapping element 24 but rather before this. Once the conversion element 22 has reached the position which corresponds to the maximum rotation speed of the motor 16, any further rotation of the conversation element 22 does not alter the rotation speed of the motor 16. This solution advantageously provides a possibility to compensate an alteration of a mechanical parameter of the operating unit 14 and/or the conversion unit 18, for example a stretching of the tapping element 24, loss of spring stiffness of the spring element 26, a wear of the support of the speed operating element 20 etc.

[0026] A calculating routine of the PCBA 62 checks after a start of the PCBA 62 the initial position Y1 of the conversion unit 18. For safety reasons this is only allowed to be done after PCBA 62 has performed self-tests. This adds a defined "blind" time together with power supply activation. Once awake the PCBA 62 will then record an initial position Y1. This recorded position is the zero speed position where all speeds are calculated from. The motor 16 only starts rotating when the conversion unit 18 reaches a positionY1 + H1 (with H1 being an additional movement, especially a rotation, of the conversion unit 18 which is greater than Y1). The speed is regulated between the positions Y1 +X1 and Y1 +X2 (with X1 being higher than Y1 and with X2 being higher than X1). H 1, X1 and X2 are defined as increments of Y1 instead of an absolute value due to the mechanical constraints of not having an absolute positioning sensor but only a relative one.

[0027] During operation of the garden tool 12, if the switching device 10 is allowed to return to zero speed and the conversion unit value read back is smaller than the previous Y1, then Y1 will be reset to the new recognized value. A self-adjusting function to consider a bouncing of the spring element 26 can be achieved. In case Y1 is measured outside the normal/permissible start up range, the full speed of the motor 16 may not be achievable until the operator releases and reoperates the electrical switch 66 again. This reset allows the switching device 10 including the conversion unit 18 to return to a lower Y1 value within the working parameter range. In short the auto calibration of the conversion unit value will occur within a value less than 200 Milliseconds, especially within 120 Milliseconds, of the electrical switch 66 being activated, and whenever the motor 16 is stopped.

Claims

1. A switching device for garden tools, in particular for electrically driveable garden tools, comprising:

   at least one operating unit (14) to control at least one motor (16);
   and at least one conversion unit (18) to convert a mechanical movement into a proportional electrical signal;
   wherein said operating unit (14) comprises at least one switch operating element (54) to actuate at least one electrical switch (66) to open and/or close an electrical circuit, and comprises at least one speed operating element (20) for adjusting a rotation speed of said motor (16), and wherein said conversion unit (18) comprises at least one conversion element (22) which is mechanically coupled to said speed operating element (20) for converting a mechanical movement of said speed operating element (20) into an electrical signal to adjust a rotation speed of said motor (16).

2. The switching device as defined in Claim 1, wherein said conversion unit (18) comprises at least one tapping element (24) mechanically coupled to said speed operating element (20) and to said conversion element (22).

3. The switching device as defined in Claim 2, wherein said tapping element (24) is flexible.

4. The switching device as defined in any one of the preceding Claims, wherein said conversion unit (18) comprises at least one spring element (26) to exert a spring load on said conversion element (22) in at least one direction.

5. The switching device as defined in any one of the preceding Claims, wherein said conversion unit (18) comprises at least one adjusting unit (28) to adjust at least one tapping element (24) of said conversion unit (18).

6. The switching device as defined in any one of Claims 2 to 5, wherein said tapping element (24) is translationally moveably supported.

7. The switching device as defined in any one of Claims 2 to 6, wherein said tapping element (24) is embodied as a Bowden cable.

8. The switching device as defined in any one of the preceding Claims, wherein said conversion unit (18) is embodied as a potentiometer.

9. A garden tool, in particular an electrically driveable brushcutter, comprising:

at least one switching device as defined in any one of the preceding Claims.

10. A method to control a motor (16) of a garden tool with a switching device as defined in any one of Claims 1 to 8.

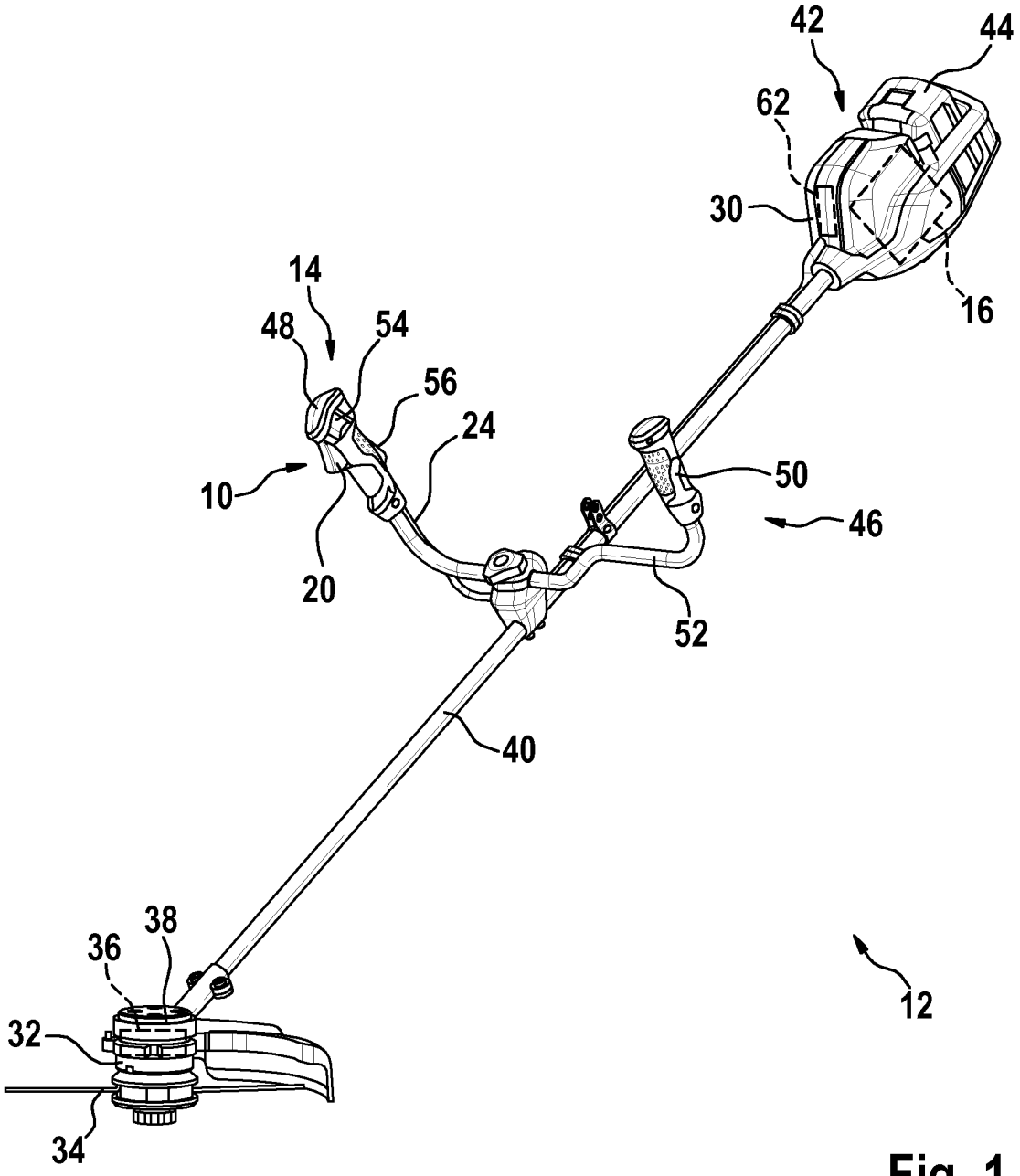

Fig. 1

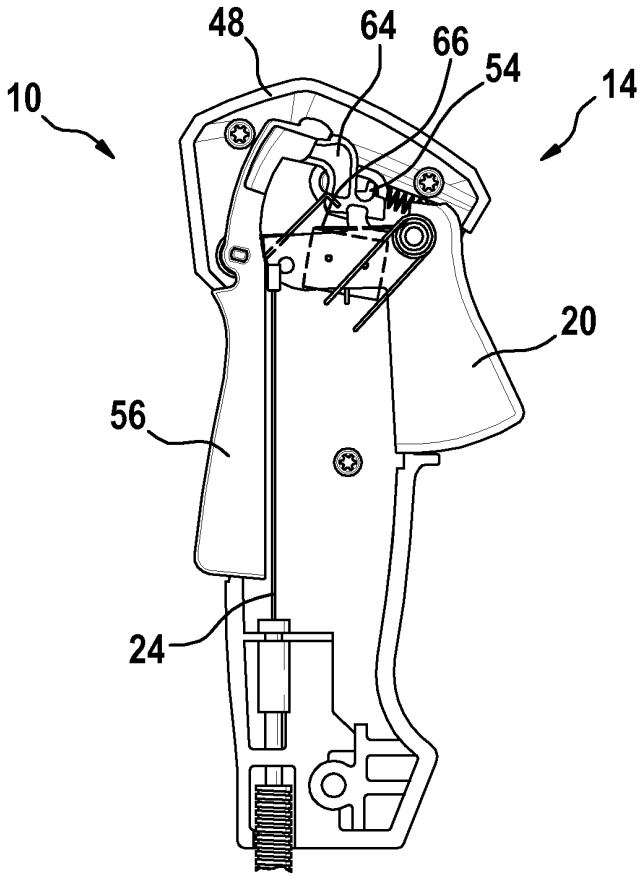

Fig. 2

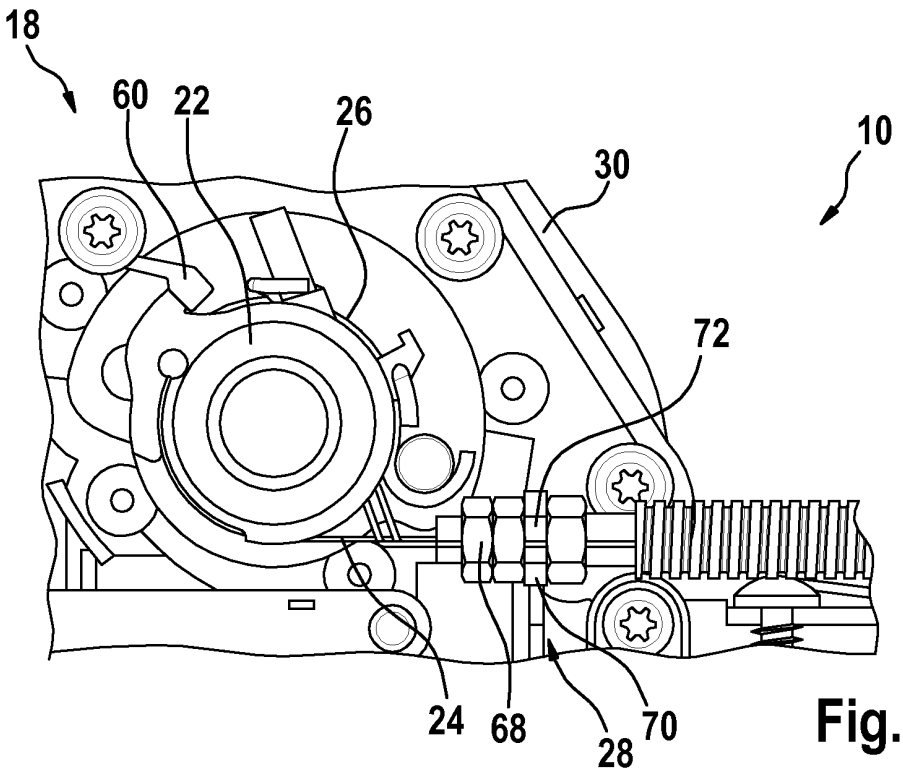

Fig. 3

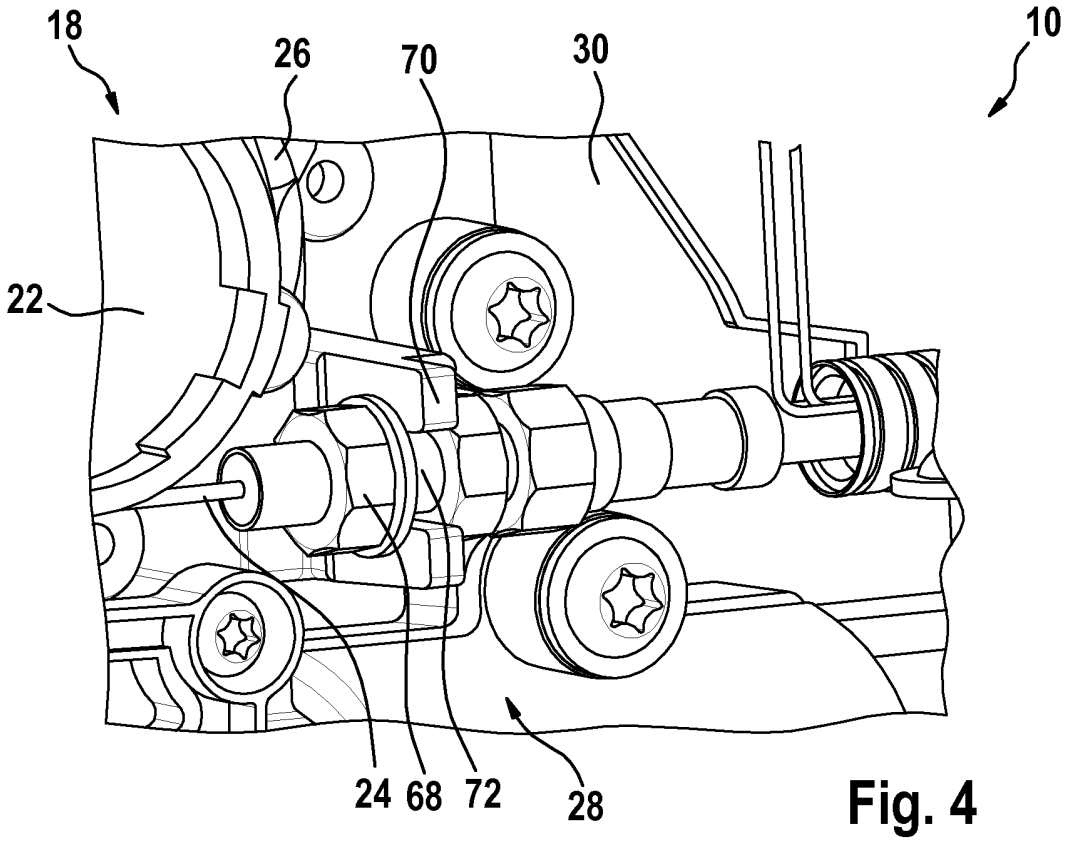

Fig. 4

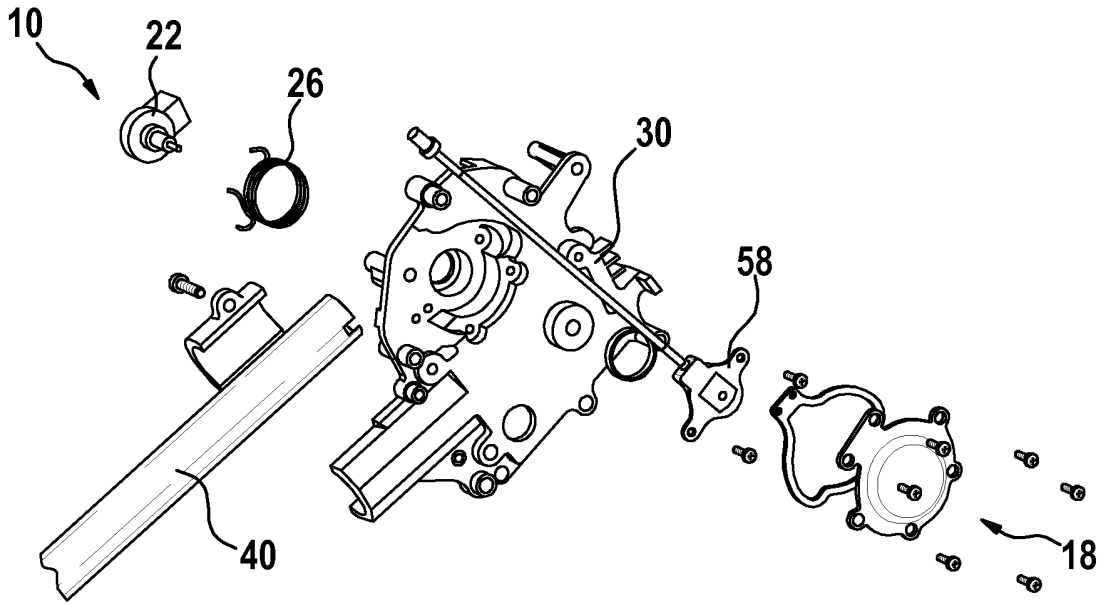

Fig. 5

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 13 19 3815

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	WO 2013/122267 A1 (HITACHI KOKI KK [JP]) 22 August 2013 (2013-08-22) * page 6 - page 9 * * page 11 - page 13 * * page 21 - page 23 * * page 26 * * page 30; figures * -----	1-4,6-10 5	INV. B25F5/00
X	EP 2 474 218 A1 (MAKITA CORP [JP]) 11 July 2012 (2012-07-11) * paragraph [0024] * * paragraph [0028] * * paragraph [0032] * * paragraph [0035] - paragraph [0037] * * paragraph [0048] - paragraph [0050] * * figures * -----	1,2,4,6, 8-10	
X	US 2009/229131 A1 (TOMIYAMA HIDEKI [JP] ET AL) 17 September 2009 (2009-09-17) * paragraph [0028] - paragraph [0029] * * paragraph [0042] * * paragraph [0045] * * paragraph [0049] - paragraph [0052] * * figures * -----	1,4,8-10	TECHNICAL FIELDS SEARCHED (IPC) B25F
Y	DE 10 2010 038750 A1 (BOSCH GMBH ROBERT [DE]) 2 February 2012 (2012-02-02) * paragraph [0020] * * paragraph [0039] - paragraph [0045] * * paragraph [0052] - paragraph [0055] * * figures * -----	5	
X	US 2011/203118 A1 (SAITO TAKESHI [JP]) 25 August 2011 (2011-08-25) * paragraph [0025] - paragraph [0026] * * paragraph [0028] - paragraph [0032] * * paragraph [0037] - paragraph [0038] * * figures * -----	1,4,8-10	
	-/--		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 March 2014	van Woerden, N

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 13 19 3815

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2008/235957 A1 (YOSHIDA KENICHI [JP]) 2 October 2008 (2008-10-02) * page 1, line 24 - page 2, line 9 * * page 3, line 23 - page 4, line 2 * * claim 1; figures * -----	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 March 2014	van Woerden, N

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 19 3815

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-03-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2013122267 A1	22-08-2013	NONE	
EP 2474218 A1	11-07-2012	CN 102480915 A	30-05-2012
		EP 2474218 A1	11-07-2012
		JP 5256151 B2	07-08-2013
		JP 2011050312 A	17-03-2011
		RU 2012112541 A	10-10-2013
		US 2012167539 A1	05-07-2012
		WO 2011027628 A1	10-03-2011
US 2009229131 A1	17-09-2009	CN 101536633 A	23-09-2009
		JP 4983663 B2	25-07-2012
		JP 2009219427 A	01-10-2009
		US 2009229131 A1	17-09-2009
DE 102010038750 A1	02-02-2012	CN 103052473 A	17-04-2013
		DE 102010038750 A1	02-02-2012
		EP 2601019 A1	12-06-2013
		US 2014027253 A1	30-01-2014
		WO 2012016729 A1	09-02-2012
US 2011203118 A1	25-08-2011	NONE	
US 2008235957 A1	02-10-2008	CN 101273684 A	01-10-2008
		JP 4929009 B2	09-05-2012
		JP 2008237189 A	09-10-2008
		US 2008235957 A1	02-10-2008

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 2223778 A2 **[0001]**