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

(11) EP 3 403 785 A1

# (12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
**21.11.2018 Bulletin 2018/47**

(51) Int Cl.:
***B27D 5/00*** *(2006.01)* ***H02J 9/06*** *(2006.01)*

(21) Application number: **18171135.9**

(22) Date of filing: **08.05.2018**

(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**
Designated Validation States:
**KH MA MD TN**

(30) Priority: **19.05.2017 IT 201700054667**

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## (54) MOTOR UNIT FOR AN EDGING MACHINE AND EDGING MACHINE

(57) Described is a motor unit (10) for an edging machine (100), comprising:
- a stepper motor (11);
- an encoder (12) connected to a rotor (13) of the motor (11) and configured to detect the angular position of the rotor (13) with respect to a stator (14) of the motor (11);
- a control device (15) connected to the encoder (12) to receive from the latter electronic signals indicating the angular position and connected to the motor (11) to actuate it according to the electronic signal so as to position the rotor (13) in a predetermined angular position of the stator (14) in which the motor (11) is in a predefined configuration;
- an accumulator (16) electrically connected to the encoder (12) and to the control device (15) for electrically powering them.

The motor (11), the encoder (12) and the accumulator (16) are integrally interconnected to form a unit artefact (17) installable in an edging machine (100) and connectable to an electrical power source.

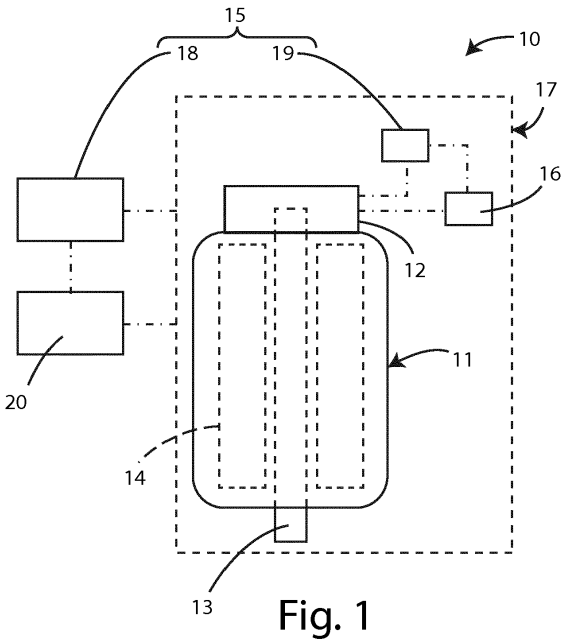


Fig. 1

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## Description

**[0001]** This invention relates to a motor unit for an edging machine and edging machine that comprises it.

**[0002]** More specifically, the invention relates to a motor unit for an edging machine and in particular to a motor unit which does not require zero-setting operations to recover the position after dismantling operations, even partial, of the machine, for example to carry out maintenance operations or for transferring the machine itself.

**[0003]** The currently known prior art edging machines have, in general, a transport device designed to pull a panel through plurality of processing stations which have tools designed to interact with an edge of the panel.

**[0004]** Examples of these stations are the milling station, the glue spreading station, the edge application station, stations for trimming the edge and scraping the glue or the station for tempering the edge applied.

**[0005]** Currently, the need is felt in the field of edging machines of guaranteeing the repeatability of the processing carried out on the products and, in particular, the need is felt of being able to carry out milling which enables a high degree of uniformity of the processing carried out on a series of products, with a tolerance in the order of micrometres.

**[0006]** Similarly, the uniform reproduction may be requested of an operation for distribution of the layer of glue which is necessary, for example, for applying an edge on the panel.

**[0007]** In order to achieve this uniformity of processing, the prior art machines comprise stepper motors connected with an encoder which has the function of indicating to a control device of the motor the position of the unit moved by the motor, so that it can be recovered following accidental or undesired movements of the unit.

**[0008]** The prior art edging machines are also equipped with a buffer battery which has the function of keeping powered the encoder and the control device to allow the recording of any movements of the motor and therefore allow the recovery of the position of the unit prior to the movements.

**[0009]** The encoder is clearly integrated in the motor and, therefore, when the latter is disconnected from the electricity supply, for example for maintenance purposes or for moving the machine, the encoder is also disconnected from the power supply, and therefore does not detect accidental movements of the motor when the buffer battery is disconnected.

**[0010]** In this case, the control device cannot return the unit, moved accidentally, to the position which it had before the accidental movement.

**[0011]** In order to prevent any positioning errors due to these accidental movements of the units which can have occurred whilst the machine has been switched OFF, a widespread practice is currently to set to zero the positions of the working units, returning the latter to an end stroke position which corresponds to a predetermined reference position and, subsequently, to reposition the units with respect to the predetermined position.

**[0012]** However, this practice requires time and therefore reduces the productivity of the processing system.

**[0013]** Moreover, due to the natural soiling of the machine and, in particular, that of the blocks used to define the end stroke position, a positioning error can occur which compromises an efficient operation of the machine.

**[0014]** A known alternative to this operation is that of using absolute encoders which, however, are more complex and therefore imply higher costs of the system.

**[0015]** The problem at the basis of this invention is to simplify the operation of the traditional edging machines, in particular allowing automatic recovery of accidental movements of operational units actuated by a motor, also following disconnection of the motors from the buffer battery.

**[0016]** The main aim of the invention is to make a motor unit and an edging machine that comprises it which resolves this problem overcoming the drawbacks of the edging machines described above.

**[0017]** Within the scope of such a task, it is the aim of this invention to provide a motor unit, and an edging machine that comprises it, which allows the automatic recovery of an accidental movement of a tool even when the motor unit which actuates it has been disconnected from the electricity supply and/or from the buffer battery, if present.

**[0018]** Another aim of the invention is to make a motor unit and an edging machine that comprises it which is equally reliable but structurally simpler than motor units with traditional absolute encoders and traditional edging machines which comprise motor units with absolute encoders.

**[0019]** This task, as well as these and other aims which will emerge more fully below, are attained by a motor unit and an edging machine that comprises it according to the accompanying independent claims.

**[0020]** Detailed features of a motor unit and an edging machine that comprises it according to the invention are indicated in the dependent claims.

**[0021]** Further features and advantages of the invention will emerge more fully from the description of a preferred but not exclusive embodiment of a motor unit and an edging machine that comprises it according to the invention, illustrated by way of non-limiting example in the accompanying drawings, in which:

- Figure 1 is a schematic view of a motor unit for an edging machine according to the invention;
- Figure 2 is a simplified schematic block diagram of a motor unit for an edging machine according to the invention.

**[0022]** With particular reference to the above-mentioned drawings, the numeral 10 denotes in its entirety a motor unit for an edging machine 100, comprising:

- a stepper motor 11;
- an encoder 12 connected to a rotor 13 of the motor 11 and configured to detect the angular position of the rotor 13 with respect to a stator 14 of the motor 11;
- a control device 15 connected to the encoder 12 to receive from the latter an electronic signal indicating the angular position and connected to the motor 11 to actuate it according to the electronic signal so as to position the rotor 13 in a predetermined angular position of the stator 14 in which the motor 11 is in a predefined configuration, which can also be identified as position zero.

**[0023]** According to the invention, a motor unit 10 has a particular peculiarity in that it comprises an accumulator 16 electrically connected to the encoder 12 and to the control device 15 for electrically powering them.

**[0024]** Moreover, according to the invention, the motor 11, the encoder 12 and the accumulator 16 are integrally interconnected to form a unit artefact 17, advantageously enclosed in a casing, not illustrated, to facilitate the handling.

**[0025]** Operationally, even when the motor unit 10 is disconnected from an electrical power supply, the accumulator 16 is connected to the encoder 12 and to the control device 15 so that they are electrically powered, until the charge of the accumulator runs out.

**[0026]** In this way, when the motor unit 10 is installed in an edging machine and connected to a tool to position it and move it in a controlled manner in the machine, even when the motor unit 10 is not connected to an electrical power supply and there is an accidental movement of the tool, the control device 15 detects the accidental movement by means of the encoder 12 thanks to the power supply provided by the accumulator 16 and, when the machine is reactivated, it allows the tool to be placed in its original position, that is, before the accidental movement occurred.

**[0027]** This avoids the use of complex and costly absolute encoders or the need to carry out a zero-setting of the position of the tools or movable units when the machine is started, as is necessary for traditional machines.

**[0028]** The above-mentioned unit artefact 17 can be installed in an edging machine 100 in such a way as to move one or more movable units or tools of the machine and it can be connected to an electricity supply source, for example to the electricity mains, for being powered.

**[0029]** Preferably, the control device 15 comprises a primary element 18, which preferably comprises a CPU, and a secondary element 19, which also preferably comprises a CPU, connected to the encoder 12 and to the accumulator 16 and configured to process the electrical signals received, in use, from the encoder 12.

**[0030]** The primary element 18 is advantageously connected to the motor 11 to actuate it and to the secondary element 19 to receive from the latter operational signals for actuating the motor 11 in such a way as to bring it to the predetermined configuration.

**[0031]** From a structural point of view, the secondary element 19 is advantageously integrated with the motor 11, with the encoder 12 and with the accumulator 16 so as to form a unit identified here as the unit artefact 17.

**[0032]** The motor unit 10 advantageously comprises a buffer battery 20 which can be connected to the unit artefact 17 and to the control device 15 for electrically powering them in the case of a mains electrical power failure.

**[0033]** The presence of the buffer battery 20, in a traditional manner, avoids, in the case of a mains power supply failure and in the case of simultaneous movement of the unit controlled by the motor, and therefore of the motor itself, that the control device records the movement so that it can be recovered before continuing with the processing or starting the next one.

**[0034]** In this text, the expression "to recover a movement" means returning the unit to the position or configuration which it had before the movement, by the action of the motor which is designed to move the unit.

**[0035]** The accumulator 16 advantageously comprises at least one electrical capacitor.

**[0036]** The accumulator 16 is advantageously configured for storing a quantity of electrical charge sufficient to electrical power the encoder 12 and the control device 15 for at least 12 hours.

**[0037]** The accumulator 16 advantageously comprises a supercapacitor.

**[0038]** Figure 2 illustrates in particular a block diagram of a possible configuration of a motor unit for an edging machine.

**[0039]** The motor unit 10 comprises an accumulator 16 electrically connected to the encoder 12 and to the control device 15 for electrically powering them.

**[0040]** Moreover, the motor 11, the encoder 12 and the accumulator 16 are integrally interconnected to form a unit artefact 17.

**[0041]** In accordance with the embodiment shown in Figure 2, the control device 15 advantageously comprises:

- the primary element 18 which, in turn, can comprise a plurality of components 18a, 18c, 18d, of traditional type, and which is connected to the motor 11 to actuate it;
- a secondary element 19 as described above.

**[0042]** The motor unit 10 advantageously also comprises:

- an input/output port 21 connected to the primary element 18;
- a terminal strip 22 for controlling mains and battery for the electrical power supply, connected downstream of the buffer battery 20 and the mains power supply 23;
- a power supply unit 24 connected downstream of the terminal strip 22 and the primary 18 and second-

ary 19 elements for powering them;

- a diverter 25 which connects the secondary element 19 to the terminal strip 22 and to the power supply unit 24 and convertible to electrically connect the secondary element 19 selectively to the terminal strip 22 or to the power supply unit 24 respectively when the motor unit is powered by the mains power supply 23 or by the buffer battery 20.

**[0043]** Another object of this invention is an edging machine, not illustrated, which, in a traditional fashion, comprises at least one milling station equipped with at least one milling cutter designed for milling the edge of a panel.

**[0044]** The edging machine, according to the invention, has a has a peculiarity in that it comprises a least one motor unit 10 made as described above and mechanically connected to the milling cutter for positioning it in the edging machine.

**[0045]** Advantageously, the edging machine further comprises:

- at least one edging station equipped with a device for spreading glue on the edge of the panel;
- at least one motor unit 10 mechanically connected to the device for spreading glue, to position it in the edging machine.

**[0046]** The invention as it is conceived is susceptible to numerous modifications and variants, all falling within the scope of protection of the appended claims.

**[0047]** Further, all the details can be replaced by other technically-equivalent elements.

**[0048]** In practice, the materials used, as well as the contingent forms and dimensions, can be varied according to the contingent requirements and the state of the art.

**[0049]** Where the constructional characteristics and the technical characteristics mentioned in the following claims are followed by signs or reference numbers, the signs or reference numbers have been used only with the aim of increasing the intelligibility of the claims themselves and, consequently, they do not constitute in any way a limitation to the interpretation of each element identified, purely by way of example, by the signs or reference numerals.

## Claims

1. A motor unit (10) for an edging machine (100), comprising:

   - a stepper motor (11);
   - an encoder (12) connected to a rotor (13) of said motor (11) and configured to detect the angular position of said rotor (13) with respect to a stator (14) of said motor (11);
   - a control device (15) connected to said encoder (12) to receive from the latter indicative electronic signal of said angular position and connected to said motor (11) to actuate it according to said electronic signal so as to position said rotor (13) in a predetermined angular position of said stator (14) in which said motor (11) is in a predefined configuration;

   **characterized in that** it

   - comprise an accumulator (16) electrically connected to said encoder (12) and to said control device (15) for electrically feeding them, and from the fact that
   - said motor (11), said encoder (12), and said accumulator (16) are integrally interconnected to form a unit artifact (17) installable in an edging machine (100) and connectable to an electrical power source .

2. A motor unit (11) (10) according to claim 1, **characterized in that** said control device (15) comprises a primary element (18) and a secondary element (19) connected to said encoder (12) and to said accumulator (16) and configured to process said electrical signals received, in use, by said encoder (12); said primary element (18) being connected to said motor (11) to actuate it and to said secondary element (19) to receive from the latter operational signals operative to actuate said motor (11) so as to bring it to said predetermined configuration.

3. A motor unit (10) according to claim 2, **characterized in that** said secondary element (19) is integrated with said motor (11), said encoder (12), and said accumulator (16) to form said unit artifact (17).

4. A motor unit (10) according to any one of the preceding claims, **characterized in that** it comprises a buffer battery (20) connectable to said unit artifact (17) and to said control device (15) for electrically feeding them.

5. A motor unit (10) according to any one of the preceding claims, **characterized in that** said accumulator (16) comprises at least one electric capacitor.

6. A motor unit (10) according to any one of the previous claims, **characterized in that** said accumulator (16) is configured to store a sufficient amount of electric charge to electrically feed said encoder (12) and said control device (15) for at least 12 hours.

7. Edging machine (100) comprising at least one milling station having at least one milling cutter for milling a board of a panel, **characterized in that** it comprises at least one motor unit (10), made in accordance with one of the preceding claims, mechanically connected to said cutter to position it in said edging machine

(100).

**8.** Edging machine (100) according to claim 7, **characterized in that** it comprises:

- at least one edging station provided with a device for spreading glue on the edge of said panel;
- at least one motor unit (10), made in accordance with one of claims 1 to 6, mechanically connected to said device for spreading glue to position it in said edging machine (100).

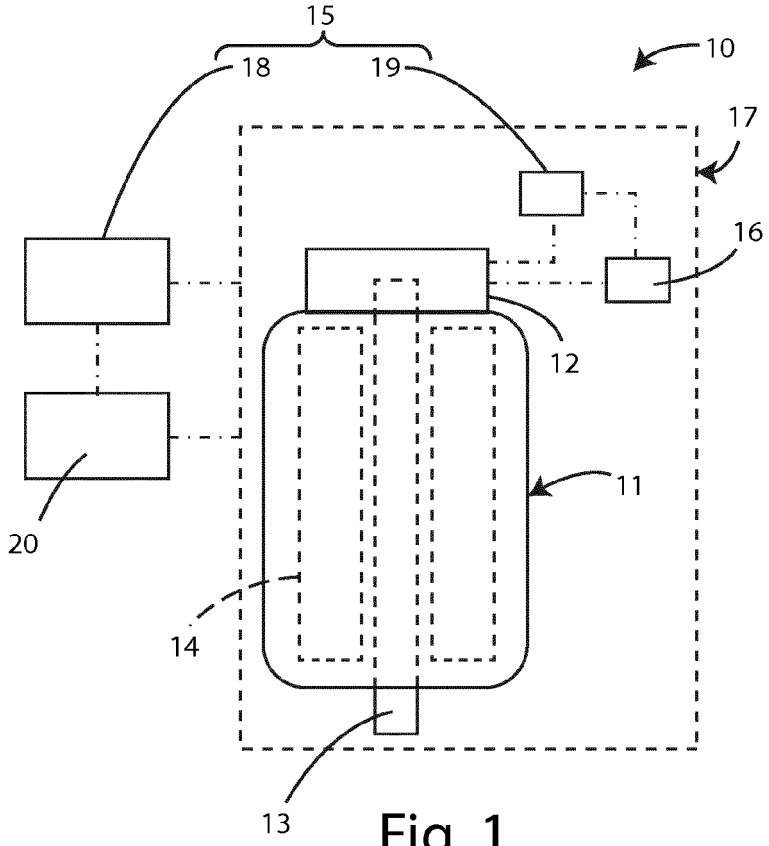
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Fig. 1

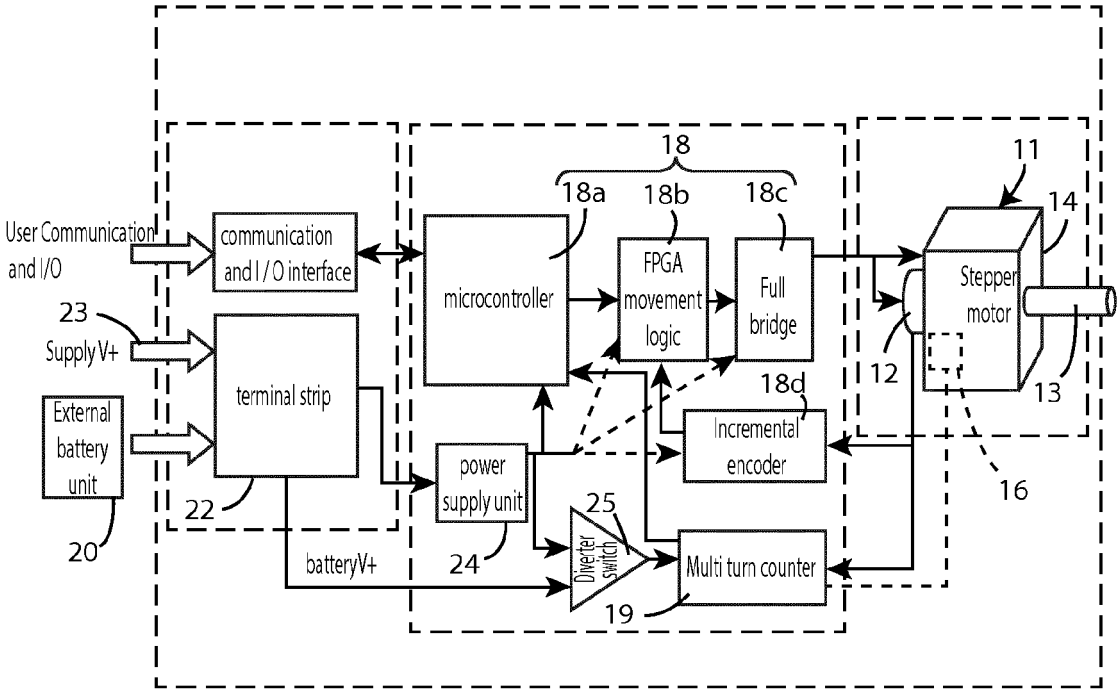
18
18a
18b
18c
11
14
User Communication and I/O
communication and I/O interface
microcontroller
FPGA movement logic
Full bridge
Stepper motor
23
Supply V+
terminal strip
12
18d
13
External battery unit
Incremental encoder
power supply unit
25
16
22
Diverter switch
Multi turn counter
20
batteryV+
24
19

Fig. 2

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# EUROPEAN SEARCH REPORT

Application Number
EP 18 17 1135

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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 9 October 2018 | Lasa Goñi, Andoni |

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## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 17 1135

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