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(54) **ACCUMULATION YARN FEEDER WITH WEFT BRAKING DEVICE CONTROLLED BY FEEDBACK**

(57) A drum (12) supporting a yarn (Y) wound upon itself, which is adapted to be unwound upon request from a downstream textile machine. A passive weft braking device (18) and an active weft braking device (36) brake the yarn (Y). A tension sensor (66) downstream of the active weft braking device (36) measures the tension of the yarn (Y) and sends a corresponding signal to a control unit (CU), which drives by feedback the active weft brak-

ing device (36). The latter comprises at least one first weft braking lamina (44a, 44b), which is pushed against an abutment (46a, 46b) by motor means (48) connected to the control unit (CU), with the interposition of transmission means (40a, 40b, 42a, 42b, 52). The yarn (Y) slides between the weft braking lamina (44a, 44b) and the abutment (46a, 46b).

EP 3 521 493 A1

Description

[0001] The present invention relates to an accumulation yarn feeder provided with a weft braking device controlled by feedback.

[0002] As is known, a generic yarn feeder can comprise a drum which supports a yarn which is wound onto it and is adapted to unwind it when requested by a generic textile machine, such as a knitting machine or a weaving machine. Before entering the textile machine, the yarn that unwinds from the drum passes through at least one weft braking device, which controls its mechanical tension.

[0003] In EP 0707102, the weft braking device is constituted by a hollow frustum-shaped body which is pushed elastically against the output end of the drum by a radial arrangement of springs. The inner ends of the springs are anchored to the smaller end face of the frustum-shaped body and their outer ends are anchored to an annular support. The latter can move axially under the actuation of a screw-and-nut mechanism actuated by a motor.

[0004] The yarn in output from the feeder slides while pressed between the drum and the hollow frustum-shaped element, thus receiving a braking action by friction.

[0005] The motor that controls the screw-and-nut mechanism is controlled by feedback by a loop which modulates the braking action applied by the weft braking device on the basis of the signal received by a tension sensor. The main aim is to keep the tension of the yarn fed to the machine downstream substantially constant on a preset value.

[0006] Known weft braking devices controlled by feedback, such as the one described in EP 0707102, are capable of applying relatively low braking forces, for example on the order of 20 cN in knitting processes, whereas some applications require higher yarn feed tensions, up to 100-200 cN.

[0007] For these applications, it is known to use so-called "positive" yarn feeders, in which the yarn is wound on a drum which rotates at a speed that is synchronized with the downstream machine; however, as is well known in the art, these systems are not suitable for some kinds of process, for example jacquard processes.

[0008] In order to overcome the above cited limitations of known systems, EP 2829647 in the name of this same Applicant teaches to provide the yarn feeder with a second braking device.

[0009] The first braking device is of the frustum-shaped type described above but is passive, i.e., it is not controlled. In practice, a preset braking force is set by acting on a knob.

[0010] The second braking device is of the comb type and is controlled by a step motor. A tension sensor measures the tension of the yarn that unwinds from the drum and sends a corresponding tension signal to the control unit, which drives by feedback the comb-type brake so

as to stabilize the tension of the yarn on a desired value.

[0011] The system described above achieves the intended aim of applying to the yarn controlled braking forces that are much more intense than known systems.

[0012] However, this system is rather complex and therefore expensive to provide.

[0013] Furthermore, it has the additional drawback of not being manually adjustable to a fixed value, as required in some circumstances.

[0014] The aim of the present invention is to provide an accumulation yarn feeder provided with a weft braking device controlled by feedback that is capable of applying considerably higher braking forces than traditional systems provided with a single braking device controlled by feedback, for example of the frustum-shaped type, but at the same time is simpler to provide with respect to systems provided with a comb-type brake such as the one described in EP 2829647.

[0015] Within this aim, an object of the invention is to provide a controlled weft braking device which, when needed, can also be adjusted manually, acting in practice as an auxiliary passive break.

[0016] This aim and this and other objects and other advantages that will become better apparent hereinafter are achieved by an accumulation yarn feeder having the characteristics described in claim 1, while the dependent claims define other advantageous characteristics of the invention, albeit secondary ones.

[0017] The invention is now described in greater detail with reference to a preferred but not exclusive embodiment thereof, illustrated by way of nonlimiting example in the accompanying drawings, wherein:

Figure 1 is a perspective view of an accumulation yarn feeder according to the invention;

Figure 2 is a perspective view of a detail of the yarn feeder of Figure 1 in enlarged scale and from a different angle;

Figure 3 is a partially sectional plan view of the detail of Figure 2;

Figure 4 is an exploded perspective view of a component of the yarn feeder according to the invention.

[0018] With reference to the figures, an accumulation yarn feeder 10 comprises a drum 12 on which a yarn Y is wound. When requested by a generic textile machine, such as a weaving machine (not shown), the yarn unwinds from the drum 12, passes through a braking assembly supported by an arm 16 that is integral with the drum 12, and finally is fed to the textile machine.

[0019] As the drum 12 gradually empties, a flywheel 17 driven by a motor M winds new turns, drawing yarn from an upstream spool (not shown).

[0020] The braking assembly comprises a passive weft braking device 18 of the conventional type, which is adapted to apply a preset uncontrolled braking action to the yarn that unwinds from the drum 12.

[0021] In a per se known manner, the passive weft

braking device 18 comprises a hollow frustum-shaped body 26, which is pushed elastically with its internal surface against the output end 12a (Figure 3) of the drum 12. The hollow frustum-shaped body 26 is supported coaxially to the drum 12 by a radial arrangement of springs such as 27. The springs 27 have their inner ends anchored to a ring 28 which is fixed to the smaller end face of the hollow frustum-shaped body 26 and their outer ends anchored to an annular support 29. The latter is connected to the arm 16 so that it can move axially under the actuation of a screw-and-nut mechanism (not shown) which is incorporated in the arm 16 and can be actuated manually by means of a knob 34.

[0022] In practice, by rotating the knob 34 the pressure applied by the hollow frustum-shaped body 26 against the output end 12a of the drum 12 is adjusted and accordingly so is the braking force applied to the unwinding yarn Y that slides between them.

[0023] Downstream of the passive weft braking device 18, the arm 16 supports a first thread guiding bush 35.

[0024] The braking assembly furthermore comprises an active weft braking device 36, which is supported directly downstream of the first thread guiding bush 35 by a longitudinal bar 37 which is fixed to the arm 16.

[0025] With particular reference to Figure 5, the controlled weft braking device 36 according to the invention comprises a box-shaped receptacle 38, which is closed by a lid 38a which is fixed by means of a screw 39.

[0026] The receptacle 38 is provided with an annular engagement tab 38b, by means of which it is fixed to the longitudinal bar 37. In detail, the annular engagement tab 38b is fitted on the longitudinal bar 37 and is locked thereon by means of a threaded grub 38c.

[0027] The receptacle 38 rotatably supports two parallel pivots 40a, 40b which are substantially perpendicular to the axis of the drum. The pivots 40a, 40b integrally support at one end respective gear sectors 42a, 42b which mutually mesh and are received inside the receptacle 38.

[0028] The opposite ends of the pivots 40a, 40b exit from the receptacle 38 and have respective pairs of weft braking laminas coupled thereto.

[0029] In particular, each pair of weft braking laminas comprises an internal weft braking lamina 44a, 44b and an external weft braking lamina 46a, 46b, which are extended in a flag-like configuration in the same direction, are screwed on respective opposite flattened faces of the respective pivot 40a, 40b and, in the example illustrated herein, are substantially mutually parallel.

[0030] The pivots 40a, 40b are rotated so as to move the free ends of the internal weft braking laminas 44a, 44b and of the external weft braking laminas 46a, 46b into mutual abutment under the actuation of an electric motor, advantageously a step motor 48.

[0031] In particular, the step motor 48 is provided with a driving shaft 50 which integrally supports a worm screw 52 which meshes with one of the two gear sectors, the gear sector 42a in the example of embodiment described

and illustrated herein.

[0032] A wheel 56 for the optional manual adjustment of the angular position of the pivots 40a, 40b and accordingly of the contact pressure between the free ends of the weft braking laminas is also connected to the end of the driving shaft 50.

[0033] The yarn in output from the first thread guiding bush 35 slides between the two internal weft braking laminas 44a, 44b and the two external weft braking laminas 46a, 46b of the controlled weft braking device 36, receive a braking action by friction which is variable as a function of the pressure between the free ends of the weft braking laminas.

[0034] In greater detail, the active weft braking device 36 is controlled by feedback by a control unit CU (shown only schematically in Figure 3) in order to keep the tension of the yarn transferred to the machine downstream substantially stable on a desired value.

[0035] For this purpose, the control unit CU is programmed so as to drive by feedback the step motor 48 on the basis of the tension signal T received from a tension sensor 66, which is supported by the bar 37 downstream of the active weft braking device 36, directly after a second thread guiding bush 64.

[0036] As anticipated earlier, if necessary the braking force can also be adjusted manually on a preset value by means of the wheel 56, by virtue of the non-reversibility of the transmission means that connect the weft braking laminas to the step motor, i.e., the gear sectors and the worm screw.

[0037] The programming of the control unit CU falls within the normal knowledge of the person skilled in the art and therefore is not further described.

[0038] A manually adjustable stabilizer brake 68 is supported downstream of the tension sensor 66.

[0039] In operation, first of all the minimum desired tension level is set by adjusting manually the passive weft braking device 18.

[0040] The active weft braking device 36 amplifies the braking action applied by the passive weft braking device 18 so as to stabilize the supply tension on a preset value.

[0041] As the person skilled in the art may appreciate, the maximum braking level that can be applied by the active weft braking device 36 is much higher than the maximum tension values that can be reached by traditional weft braking devices.

[0042] In particular, the applied braking level can be compared with that of the system described in EP 2829647, already cited earlier.

[0043] However, according to the intended aim and objects, the system described herein is simpler to provide and therefore more economical to manufacture.

[0044] As a further advantage, the system according to the invention allows, if necessary, to adjust the braking force even manually by means of the knob 56. In this mode, the active weft braking device 36 acts in practice like an auxiliary passive brake.

[0045] A preferred embodiment of the invention has

been described, but of course the person skilled in the art may apply different modifications and variations within the scope of the claims.

[0046] In particular, although in the embodiment described herein both weft braking laminas are movable, as an alternative only one of them might move with respect to a fixed abutment, which might be another lamina, a rigid wall, or other similar element.

[0047] Furthermore, the transmission means interposed between the step motor and the weft braking lamina might be modified. For example, instead of rotating, one of the weft braking laminas might translate under the control of a set of teeth in a meshing relationship with the worm screw connected to the step motor. It should be noted that in this case also, the transmission means would be of the non-reversible type, allowing auxiliary manual adjustment in a manner similar to the embodiment shown.

[0048] In this regard it is understood that although the adoption of non-reversible transmission means is preferable, both for the reasons described above and because it allows to apply very high braking forces, it should not be considered strictly necessary.

[0049] Moreover, although reference to a step motor has always been made in the embodiment described herein, it is of course possible to use other types of electric motor, in particular brushless motors.

[0050] The disclosures in Italian Patent Application No. 102018000002247 from which this application claims priority are incorporated herein by reference.

[0051] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A yarn feeder (10), comprising

- a drum (12) supporting a yarn (Y) wound upon itself, which is adapted to be unwound upon request from a downstream textile machine, and
- a passive weft braking device (18), which is arranged so as to apply a predetermined uncontrolled braking action on the yarn (Y) unwinding from the drum (12),
- an active yarn braking device (36), which is arranged downstream of said passive weft braking device (18),
- a tension sensor (66), which is arranged downstream of said active weft braking device (36) in order to measure the tension of the yarn (Y) that unwinds from the drum (12) and to generate a corresponding tension signal (T),

- a control unit (CU), programmed to drive by feedback said active weft braking device (36) on the basis of said tension signal (T),

characterized in that said active weft braking device (36) comprises at least one first weft braking lamina (44a, 44b), which is pushed against an abutment (46a, 46b) by motor means (48) which are functionally connected to said control unit (CU), with the interposition of transmission means (40a, 40b, 42a, 42b, 52), the yarn (Y) being adapted to slide between said first weft braking lamina (44a, 44b) and said abutment (46a, 46b).

2. The yarn feeder (10) according to claim 1, **characterized in that** said transmission means (40a, 40b, 42a, 42b, 52) are irreversible and are provided with auxiliary manual adjustment means (56).

3. The yarn feeder (10) according to claim 2, **characterized in that** said manual adjustment means (56) comprise a wheel (56) which can be gripped and is connected to a driving shaft (50) of said motor means (48).

4. The yarn feeder (10) according to claim 2, **characterized in that** said first weft braking lamina (44a, 46a) is coupled to a respective first pivot (40a) from which it protrudes in a "flag-like" configuration, and said irreversible transmission means comprise a first gear sector (42a) which is integral with said first pivot (40a) and meshes with a worm screw (52) which is functionally connected to said motor means (48).

5. The yarn feeder (10) according to claim 4, **characterized in that** said abutment comprises at least one second weft braking lamina (46a, 46b), which is coupled to a respective second pivot (40b) from which it protrudes in a "flag-like" configuration in the same direction as the first weft braking lamina (44a, 44b), and supports integrally a respective second gear sector (42b) which meshes with said first gear sector (42a).

6. The yarn feeder according to one or more of claims 1-5, **characterized in that** it comprises two pairs of weft braking laminas, each pair comprising an innermost weft braking lamina (44a, 44b) and an outermost weft braking lamina (46a, 46b), which protrude in the same direction.

7. The yarn feeder according to one or more of claims 1-6, **characterized in that** said electric motor is a step motor.

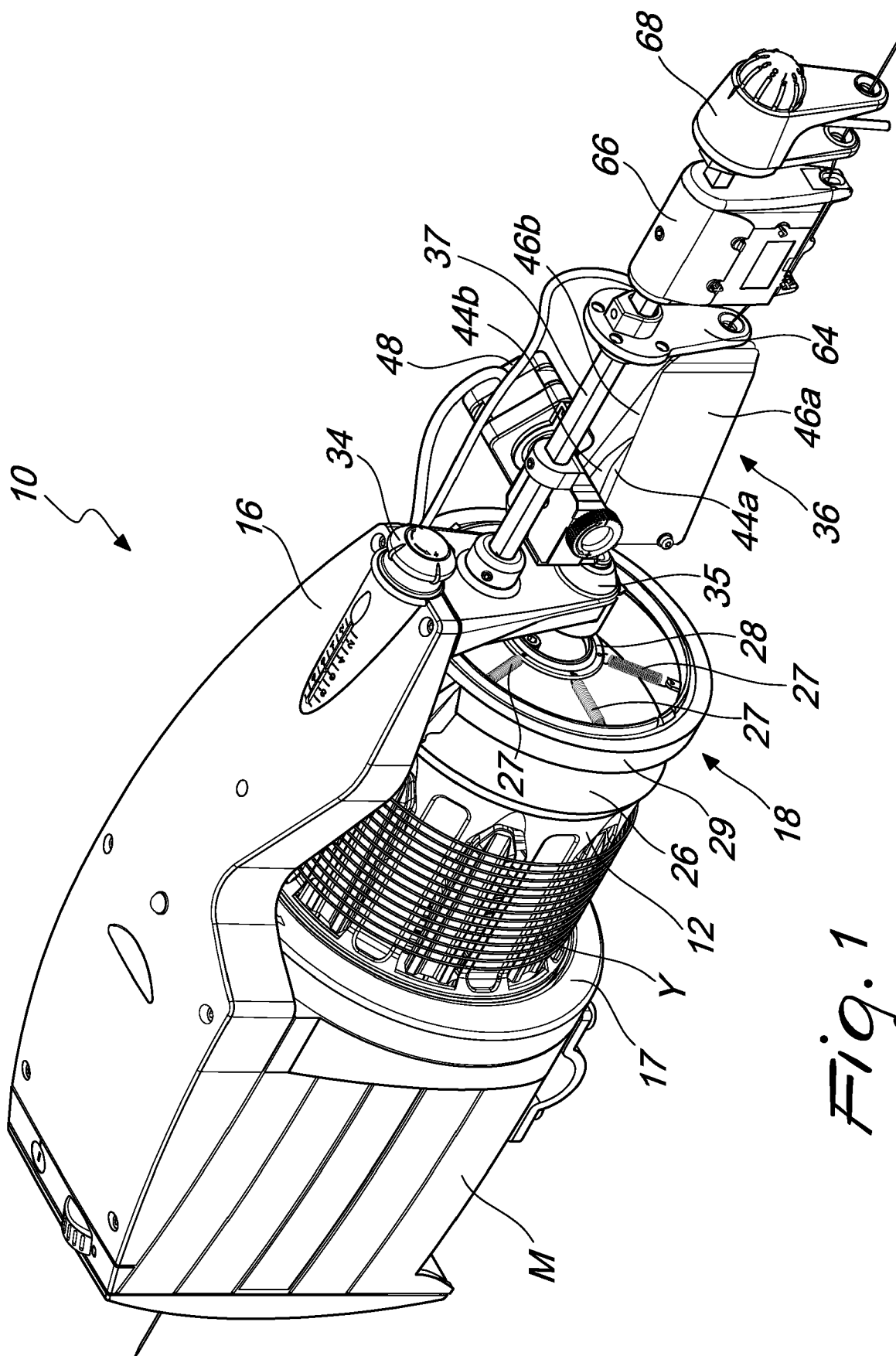
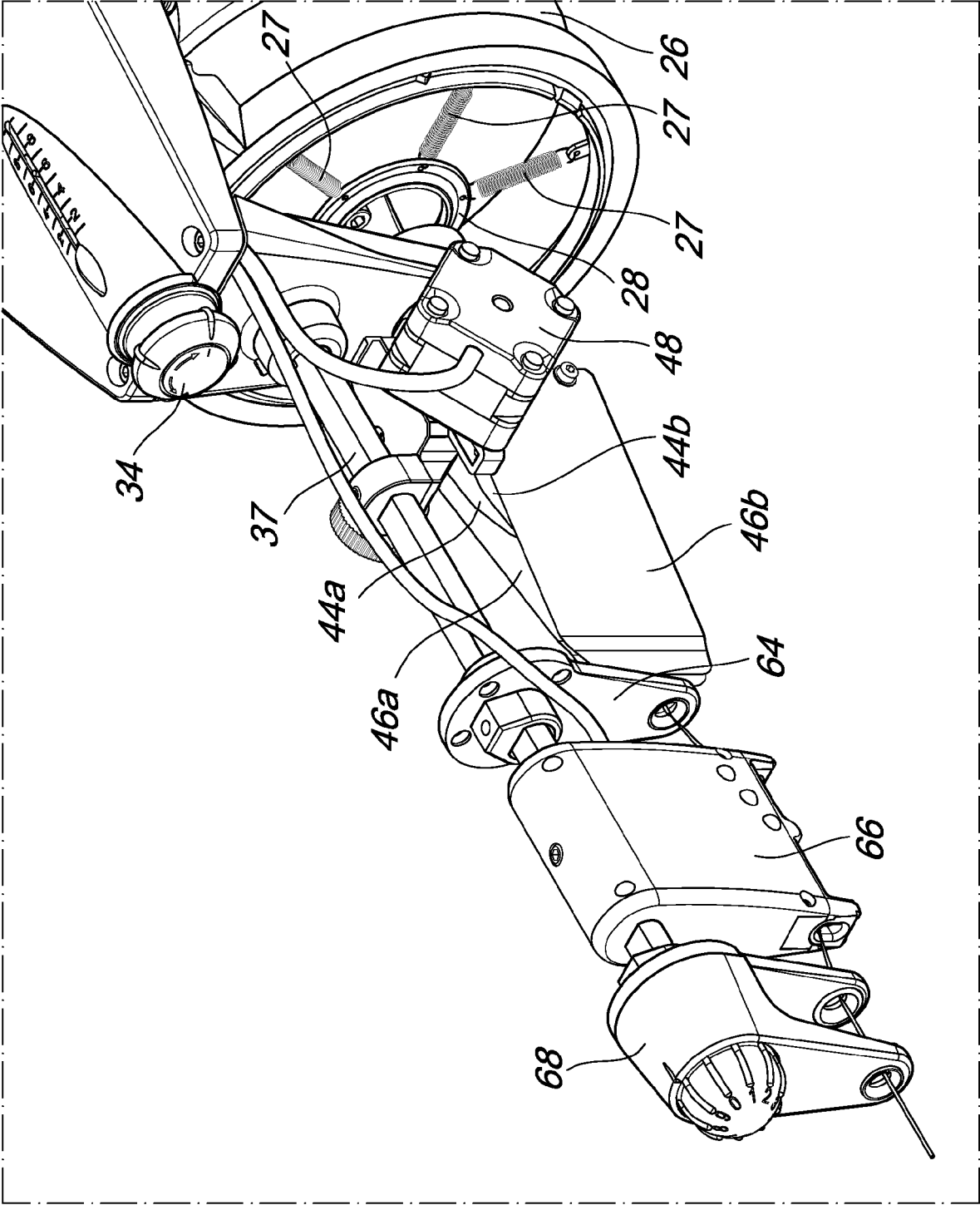


Fig. 1

Fig. 2



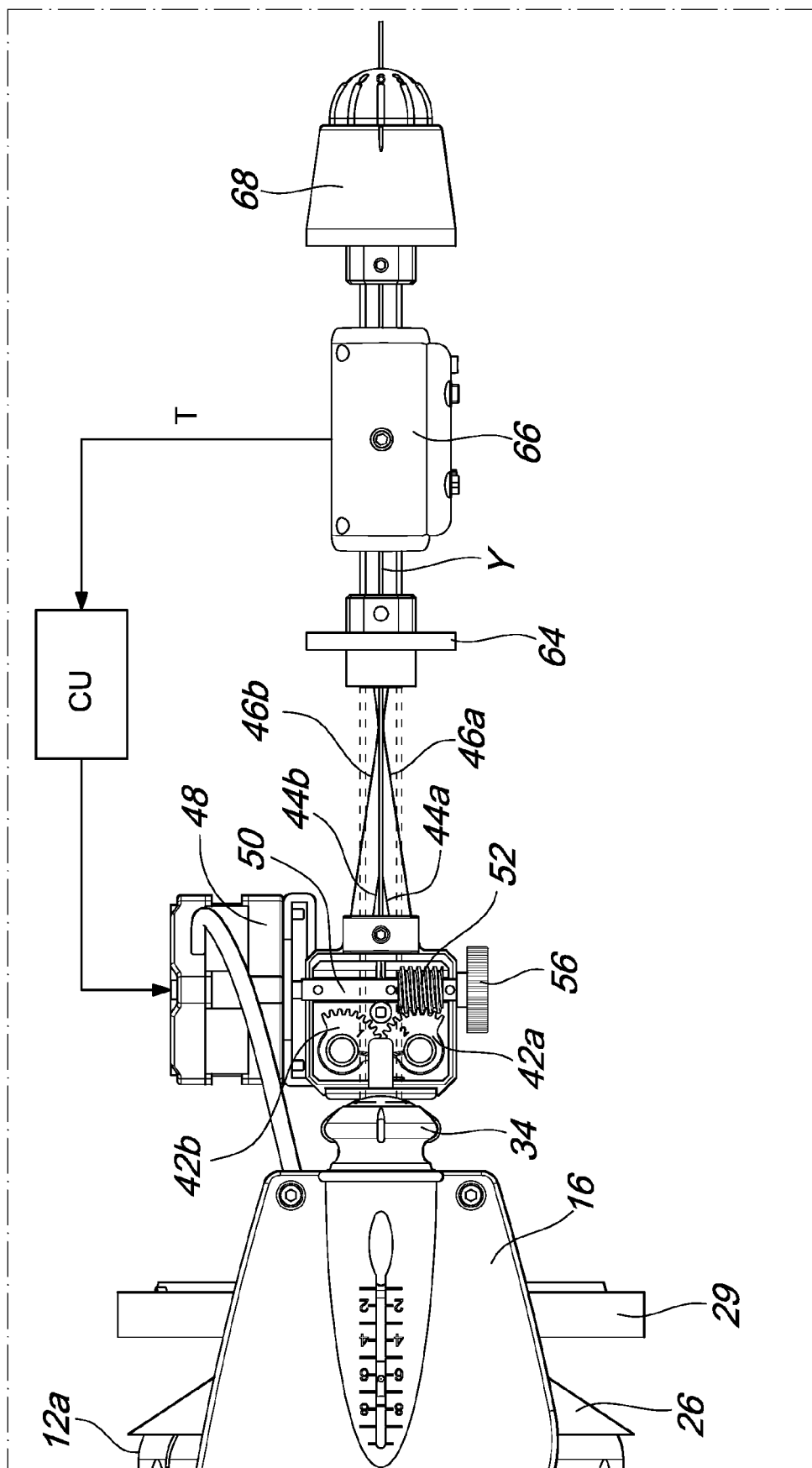


Fig. 3

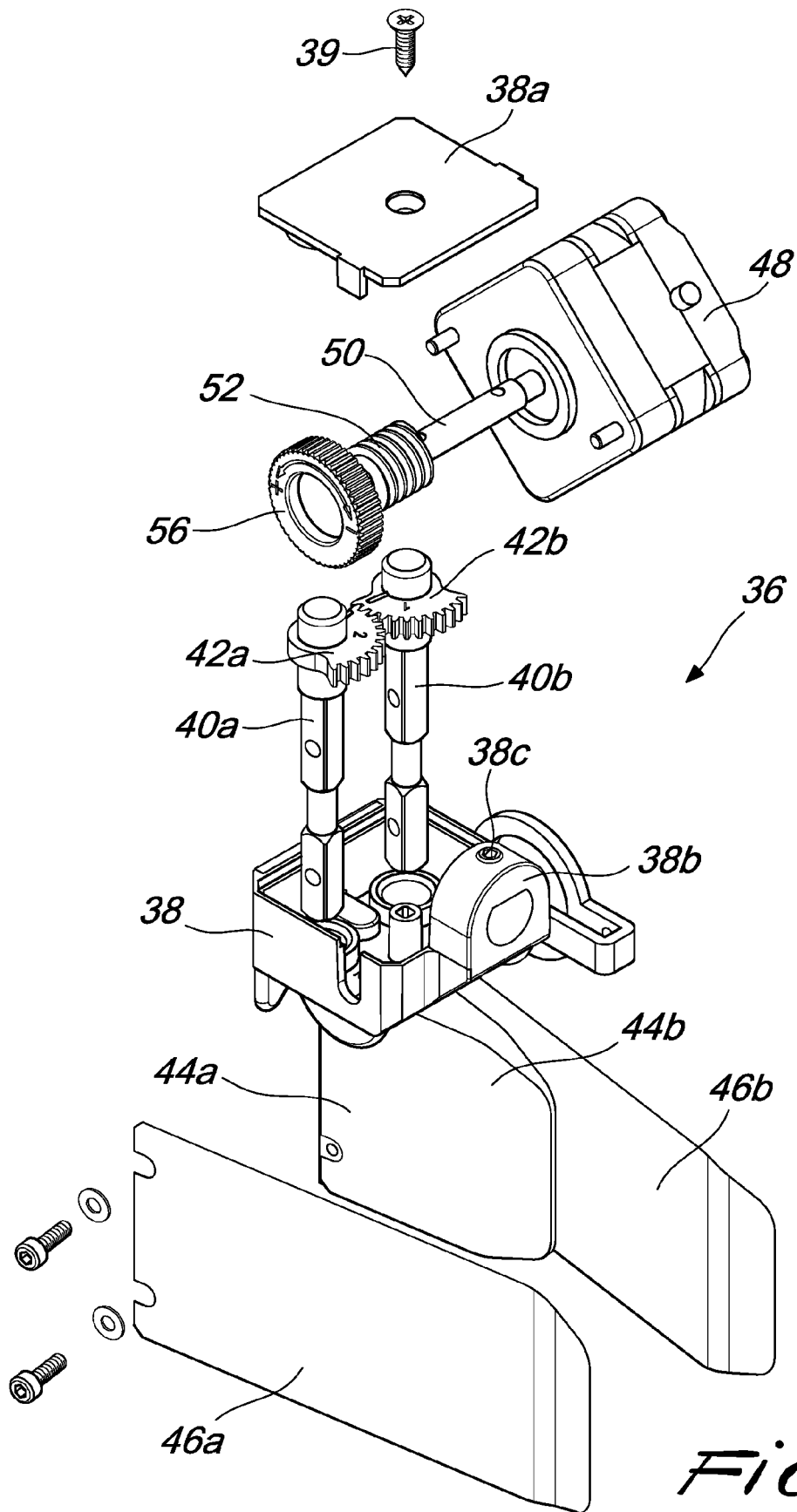


Fig. 4



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Application Number
EP 19 15 4407

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 11 April 2019	Examiner Heinzelmann, Eric
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EPO FORM 1503 03.82 (P04C01)

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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