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**Description**

The invention relates to an apparatus for supplying lubricant, in particular to at least one component of a transmission, according to the preamble of Claim 1. Such an apparatus is  
5 suitable in particular as an emergency lubricating apparatus for a transmission of a wind turbine.

Transmissions of wind turbines usually have a lubricant pump for  
10 supplying lubrication points with lubricant by means of circulatory lubrication. The transmissions are highly loaded. Disruption of the lubricant supply can therefore cause a large amount of damage in a short time, which ultimately leads to failure of the wind turbine.

15 In order to avoid this, emergency lubricating apparatuses are used in wind turbines. Such apparatuses serve to safeguard the supply of lubricant to the transmission in emergency operation, that is to say in the event of failure of a lubricant pump  
20 provided for normal operation.

An emergency lubricating apparatus comprising two pumps is known from publication DE 10 2008 013 728 A1. A first, electrically  
25 operated pump supplies the transmission with lubricant in normal operation. In emergency operation, a second pump is connected. The function thereof must also be ensured in the event of a power failure. Therefore, the second pump is not electrically driven. Instead, a clutch is provided which establishes a force  
30 flow between the transmission and the second pump in emergency operation.

An actuator is provided for actuating the clutch. In normal operation, that is to say when a voltage is applied, the actuator is activated. The activated actuator opens the clutch. A spring  
35 is so mounted that the spring is tensioned when the clutch is opened.

When, in emergency operation, a voltage is no longer applied and

the first pump thus fails, the actuator is also no longer active. Consequently, the spring relaxes and closes the clutch. The second pump is thus located in the force flow of the transmission. The lubricant supply is consequently ensured until the wind  
5 turbine has been stopped.

The use of a second pump to construct an emergency lubricating apparatus brings with it a number of disadvantages. Thus, the second pump increases the production costs of the transmission.  
10 Moreover, additional lines and connections are required for integrating the second pump into the lubricant circuit of the transmission. Moreover, all the additionally installed components increase the weight of the transmission and require additional installation space.

15 A further disadvantage arises from the control of the actuator. The lubricant supply can be maintained only in the case of disruptions of the power supply but not in the case of defects of the first pump. Since the actuator is deactivated only when  
20 a voltage is no longer applied, that is to say when the power supply of the wind turbine has failed, a defect of the first pump - which can also occur when the power supply is not disrupted and a voltage is applied - leads to failure of the lubricant supply.

25 There is further known from JP S64 479 39 U an apparatus having a lubricant pump which supplies an internal combustion engine with oil.

30 The object of the invention is to safeguard the supply of lubricant to a transmission in emergency operation while avoiding the disadvantages inherent in the solutions known from the prior art.

35 An apparatus according to the invention for supplying lubricant, for supplying lubricant to at least one component of a transmission, in particular of a transmission of a wind turbine, comprises a lubricant pump and a motor. A drive shaft serves to

drive the lubricant pump. The motor is designed to drive the drive shaft in normal operation. To that end, a motor shaft is preferably connected in a rotationally fixed manner to the drive shaft.

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The apparatus additionally comprises according to the invention a first clutch. The first clutch is located in a force flow between a shaft which is located in the force flow of the transmission and the drive shaft. The first clutch is designed  
10 to close and/or to interrupt this force flow.

Clutch is used here as a designation for a means which is designed to establish and/or to interrupt a force flow between two shafts. The first clutch is thus a means which is designed  
15 to establish and/or to interrupt a force flow between the shaft which is located in the force flow of the transmission and the drive shaft.

The shaft which is located in the force flow of the transmission  
20 is a shaft which is driven or rotated by the transmission. A rotation of the transmission, in particular of the drive shaft and/or output shaft of the transmission, is thus accompanied by a rotation of the shaft which is located in the force flow of the transmission. The shaft which is located in the force flow  
25 of the transmission can especially be identical with the drive shaft or output shaft. The shaft which is located in the force flow of the transmission can, however, also be an intermediate shaft of the transmission.

30 Accordingly, there are two alternative possibilities for driving the lubricant pump. In normal operation, the first clutch interrupts the force flow between the shaft which is located in the force flow of the transmission and the drive shaft of the lubricant pump. The lubricant pump is then driven by the motor.  
35 In the event of a failure of the motor, that is to say in emergency operation, the first clutch closes the force flow between the shaft which is located in the force flow of the transmission and the drive shaft. This has the result that the

lubricant pump is driven by the transmission. The first clutch thus establishes a force flow between the transmission, or the shaft which is located in the force flow of the transmission, and the lubricant pump, or the drive shaft of the lubricant pump.

5 By closing the first clutch, a rotationally fixed connection between the shaft which is located in the force flow of the transmission and the drive shaft of the first clutch is formed.

In order that the motor is not also driven together with the  
10 lubricant pump and consequently acts as a generator, the transmission can be equipped with a second clutch, which is designed to close and/or to interrupt a force flow between the drive shaft of the lubricant pump and the motor. In normal operation, that is to say when an electrical voltage is applied  
15 and the motor drives the lubricant pump, this clutch is closed. The second clutch then establishes a rotationally fixed connection between the driven shaft of the motor and the drive shaft of the lubricant pump, and thus a force flow between the motor and the lubricant pump. In emergency operation, the second  
20 clutch interrupts this force flow and thus prevents the motor from turning further. Alternatively, it is possible to separate the motor from the power supply system in emergency operation by means of a switch provided for that purpose.

25 The motor can in particular be an electric motor. This is functional only as long as an electrical voltage is applied in normal operation. In order to ensure the supply of lubricant in the case of a disruption of the power supply, that is to say if the electrical voltage is no longer applied, the apparatus in a  
30 preferred further development comprises a spring. The spring is so arranged that it is tensioned when the first clutch is opened.

Spring here denotes an element with a spring function, that is to say a store for potential energy. The spring thus stores  
35 potential energy when it is tensioned. By relaxing the spring, the potential energy is released again. Preferably, the spring is a coil spring.

When the electrical voltage is applied, the first clutch is opened in accordance with a further development. According to the invention, the clutch remains open while the electrical voltage is applied.

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Preferably, a first operating element for opening the first clutch is provided, which first operating element is coupled with the power supply of the wind turbine. When the electrical voltage is applied, the electrical voltage is thus applied in particular to the first operating element.

10

When the voltage is applied to the first operating element, the first operating element becomes active and opens the first clutch. The first operating element remains active and holds the first clutch open as long as the electrical voltage is applied to the first operating element. When the first clutch is open and the force flow between the shaft which is located in the force flow of the transmission and the drive shaft of the lubricant pump is thus interrupted, the lubricant pump is driven by the motor.

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When no electrical voltage is applied to the first operating element - in particular when the power supply of the wind turbine has failed - the first operating element becomes inactive and loses its effect. The spring force of the spring, which is tensioned when the first clutch is opened, then acts in such a way that the clutch closes, whereby the spring relaxes, and thus the force flow between the shaft which is located in the force flow of the transmission and the drive shaft of the lubricant pump is established. The spring thus closes the first clutch when no electrical voltage is applied to the first operating element and holds the first clutch closed as long as no electrical voltage is applied to the first operating element. The lubricant pump is then driven via the transmission.

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The above-described measures serve to maintain the supply of lubricant in the case of disruptions of the power supply. Without further precautions, however, the operating element would remain

active when the motor is defective and fails while the power supply is intact. In order to be able to operate the lubricant pump in this case too, a further preferred further development comprises a switching element for switching on and switching off  
5 the electrical voltage, in particular applied to the first operating element.

When the power supply is intact, switching on causes an electrical voltage to be applied, in particular to the first  
10 operating element. Correspondingly, after switching off, an electrical voltage is no longer applied, in particular to the first operating element.

In normal operation, the switching element switches on the  
15 electrical voltage, in particular applied to the first operating element. This leads to activation of the first operating element, which opens the first clutch and tensions the spring. The force flow between the shaft which is located in the force flow of the transmission and the drive shaft of the lubricant pump is thus  
20 interrupted, so that the motor can drive the lubricant pump.

When the lubricant pump is defective, on the other hand, the switching element switches off the voltage, in particular applied to the first operating element. As a result, the first  
25 operating element is deactivated, so that the spring, which is tensioned when the clutch is opened, relaxes and closes the clutch. Consequently, the force flow between the shaft which is located in the force flow of the transmission and the drive shaft of the lubricant pump is closed.

30 In a further preferred further development, the electrical voltage is switched off when the motor is defective. To that end, the switching element can be coupled with an element for detecting a defect of the motor.

35 When the motor is defective, the rotating elements of the motor and of the lubricant pump, in particular the drive shaft, stop. A rotational speed sensor is therefore particularly suitable as

the element for detecting a defect of the lubricant pump. That sensor can measure, for example, the rotational speed of the drive shaft of the pump. If the sensor detects a reduced rotational speed or a stoppage, the switching element is initiated to switch off the voltage, and thus to initiate emergency operation.

Instead of the switching element, the apparatus can in an alternative further development have a second operating element in addition to the first operating element. The first operating element is activated when the electrical voltage is applied, in particular to the first operating element. It is designed to open the first clutch when activated.

The second operating element is arranged between the first operating element and the first clutch, so that it can overlay the first operating element. Thus, while the electrical voltage is applied, in particular to the first operating element, and the first operating element is activated, the second operating element can close the first clutch and thus initiate emergency operation of the lubricant pump.

Analogously to the switching element, the second operating element preferably closes the first clutch when the lubricant pump is defective. To that end, the second operating element can also be coupled with a means for detecting a defect of the motor.

An exemplary embodiment of the invention, which will be described in greater detail hereinbelow, is shown in Fig. 1. Specifically:

Fig. 1 shows a lubricant pump comprising an electric motor and a connectable mechanical drive.

The lubricant pump 101 shown in Fig. 1 serves to supply lubrication points of a transmission with lubricant. The lubricant pump 101 is driven via a drive shaft 103. The drive shaft 103 passes through the housing of the lubricant pump 101

and is accessible at both ends from outside.

At a first end - shown on the right in Fig. 1 - the drive shaft 103 is coupled in a rotationally fixed manner with a driven shaft 105 of an electric motor 107. The drive shaft 103 of the lubricant pump 101 and the shaft 105 of the electric motor 107 rotate about a common axis. In this manner, the electric motor 107 can drive the lubricant pump 101.

10 A second end - shown on the left in Fig. 1 - of the drive shaft 103 is provided with a drive profile 109. The drive profile 109 is formed by an external tooth system extending axially, that is to say parallel to the axis of rotation of the drive shaft 103 and the shaft 105 of the electric motor 107. A pinion 111 has a matching internal tooth system. The internal tooth system of the pinion 111 and the external tooth system of the drive profile 109 engage with one another in such a way that the pinion 111 is connected in a rotationally fixed manner to the drive shaft 103. The pinion 111 can thereby be displaced in the axial direction on the drive shaft 103 or on the drive profile 109.

The pinion 111 additionally has an external tooth system 113. The external tooth system 113 is so designed that it can mesh with a toothed wheel 115. The toothed wheel 115 is located in the force flow of a transmission, that is to say it is driven by the transmission.

A meshing connection between the external tooth system 113 of the pinion 111 and the toothed wheel 115 occurs when the pinion 111 is displaced in a first direction - to the left in Fig. 1. In contrast, if the pinion 111 is displaced in a second direction - to the right in Fig. 1 - the external tooth system 113 disengages from the toothed wheel 115, so that the toothed wheel 115 is able to rotate independently of the external tooth system 113 and thus of the pinion 111, the drive profile 109 and the drive shaft 103 of the lubricant pump 101. The pinion 111 thus constitutes a clutch which can close and/or interrupt a force flow between the toothed wheel 115, in particular a shaft

on which the toothed wheel 115 is fastened, and the drive shaft 103 of the transmission 101.

For displacing the pinion 101 from the first position into the second position and from the second position into the first position, an operating element 117 is provided. The operating element 117 consists of a shift fork 119, a solenoid 121 and a spring 123.

10 The shift fork 119 is rotatably mounted about an axis of rotation which is arranged between the two ends of the shift fork 119. One end of the shift fork 119 engages into a groove 125 of the pinion 111. A further end of the shift fork 119 is connected to a rod 127 of the solenoid 121.

15  
Activation of the solenoid 121 leads to a movement of the rod 127 in the first direction. The shift fork 119 converts this movement into a movement of the pinion 111 in the second direction. Consequently, the force flow between the toothed wheel 115 and the drive shaft 103 of the lubricant pump 101 is interrupted.

20  
Furthermore, the spring 123 is so arranged that it is tensioned by the movement of the rod 127 in the first direction. The solenoid 121 thus acts against the spring force of the spring 123. As long as the solenoid 121 is activated, the spring 123 remains tensioned. If the solenoid 121 is deactivated, the spring 123 can relax. This leads to a movement of the rod 127 in the second direction. The shift fork 119 converts this movement into a movement of the pinion 111 in the first direction. The external tooth system 113 and the toothed wheel 115 consequently come into engagement. As a result, a load path is established between the toothed wheel 115 and the drive shaft 103 of the lubricant pump 101. The lubricant pump 101 is thus driven via the toothed wheel 115.

35  
By suitably choosing the transmission ratio between the toothed wheel 115 and the pinion 111, the delivery volume of the

lubricant pump 101 can be adapted to the expected requirement.

In order to facilitate the meshing of the external tooth system 113 of the pinion 111 with the toothed wheel 115, the pinion 111 is provided with a sleeve 129 which is displaceable in the axial direction. The sleeve 129 has the groove 125. A spring 131 fixes the sleeve 129 resiliently relative to the pinion 111. If the teeth of the toothed wheel 115 and of the external tooth system 113 are opposite one another when the external tooth system 113 of the pinion 111 meshes with the toothed wheel 115, an axial preload in the first direction is applied to the pinion 111 by the spring 131. This results in the external tooth system 113 of the pinion 111 meshing with the toothed wheel 115 when the toothed wheel 115 rotates further, so that the teeth of the toothed wheel 115 and the external tooth system 113 are suitably positioned relative to one another.

Reference numerals

	101	lubricant pump
	103	drive shaft
5	105	shaft
	107	electric motor
	109	drive profile
	111	pinion
	113	external tooth system
10	115	toothed wheel
	117	operating element
	119	shift fork
	121	solenoid
	123	spring
15	125	groove
	127	rod
	129	sleeve
	131	spring

## Patentkrav

1. Anordning til smøremiddelforsyning, med en smøremiddelpumpe (101), der har en drivaksel (103), med en motor (107), med i det  
5 mindste en kobling (109, 111, 113), en fjeder (123) og et aktiveringselement (121); hvor motoren (107) er udformet til at fremdrive drivakslen (103); hvor koblingen er udformet til at etablere og/eller afbryde en kraftstrøm mellem en aksel, der befinder sig i et drevs kraftstrøm, og drivakselen (103);  
10 kendetegnet ved, at anordningen er udformet til smøremiddelforsyning af i det mindste en komponent i drevet; hvor fjederen (123) spændes ved koblingens (109, 111, 113) åbning; hvor aktiveringselementet (121) er udformet til at åbne  
15 koblingen (109, 111, 113), når der er påtrykt en elektrisk spænding på aktiveringselementet (121); og hvor fjederkraften af den ved koblingens (109, 111, 113) åbning spændte fjeder virker sådan, at koblingen (109, 111, 113) lukker, når der ikke er påtrykt en elektrisk spænding på  
20 aktiveringselementet (121).

2. Anordning ifølge krav 1, kendetegnet ved et omskifteelement til ind- og udkobling af den elektriske spænding.

25

3. Anordning ifølge det foregående krav, kendetegnet ved, at den elektriske spænding udkobles ved en defekt i motoren (107).

30 4. Anordning ifølge krav 1, kendetegnet ved et første aktiveringselement (117) og et andet aktiveringselement, hvor det første aktiveringselement (117) aktiveres, når den elektriske spænding er påtrykt, hvor det første aktiveringselement (117) er udformet til at åbne  
35 koblingen (109, 111, 113), idet det aktiveres, og hvor det andet aktiveringselement er anbragt mellem det første aktiveringselement (117) og koblingen (109, 111, 113), således at

det andet aktiveringselement kan lukke koblingen (109, 111, 113), når det første aktiveringselement er aktiveret.

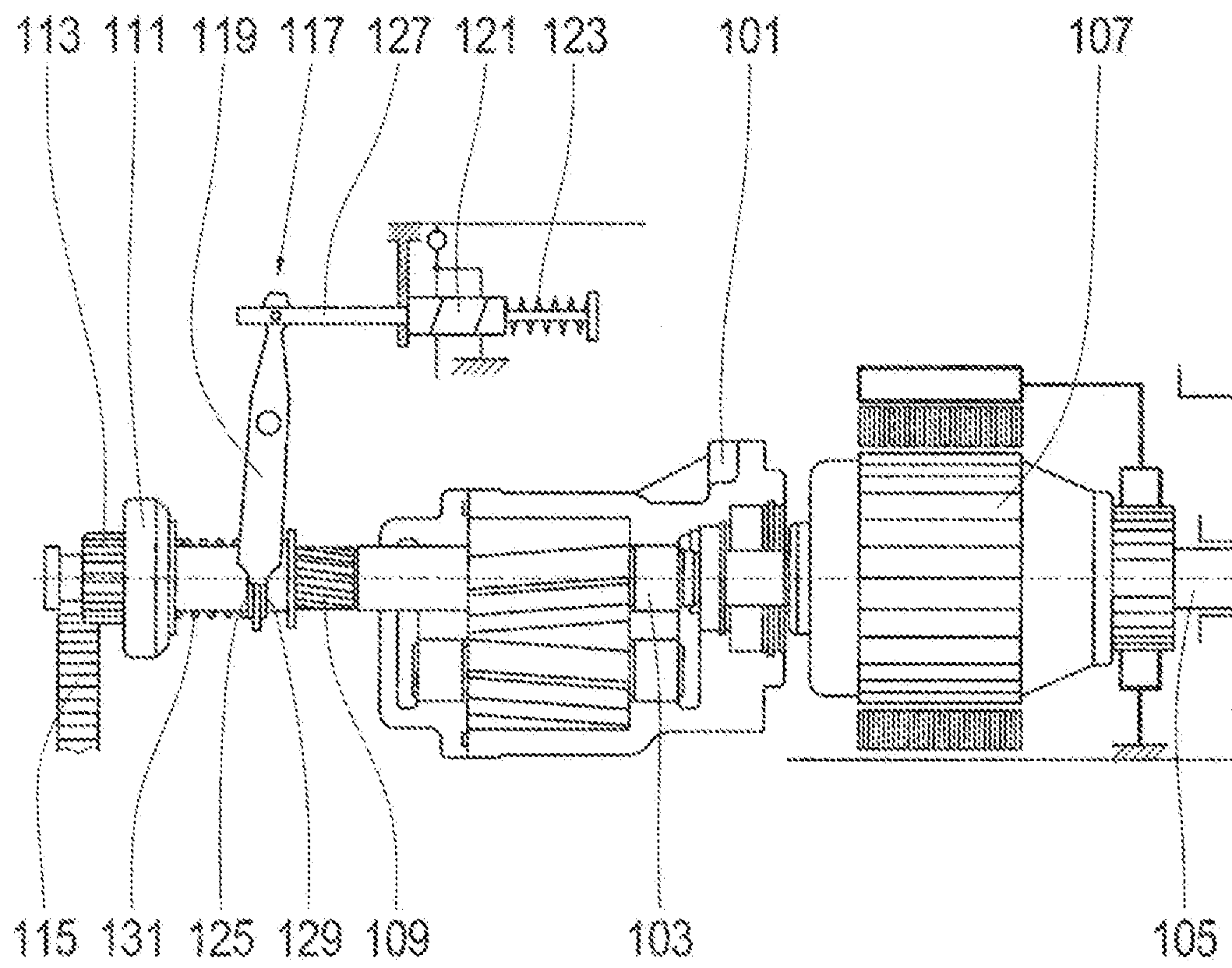


Fig. 1