US 20070170299A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2007/0170299 A1**

Ritter (43) **Pub. Date: Jul. 26, 2007**

(54) **DRIVES PERTAINING TO A REEL CHANGER**

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(21) Appl. No.: **10/587,373**

(22) PCT Filed: **Jan. 25, 2005**

(86) PCT No.: **PCT/EP05/50308**

§ 371(c)(1),
(2), (4) Date: **Jul. 26, 2006**

(30) **Foreign Application Priority Data**

Jan. 30, 2004 (DE)..... 10 2004 004 759.6
Jun. 24, 2004 (DE)..... 10 2004 030 490.4

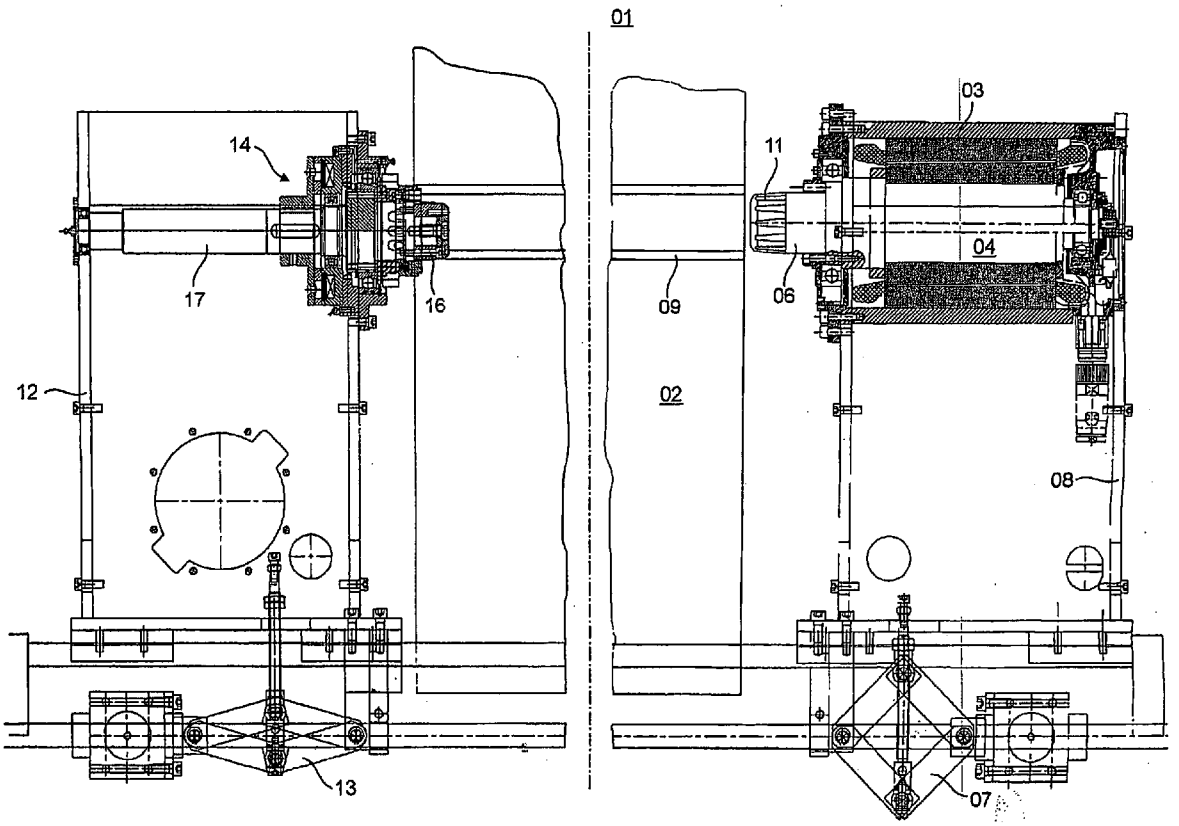
Publication Classification

(51) **Int. Cl.**
B65H 19/22 (2006.01)

(52) **U.S. Cl.** **242/533.6**

(57) **ABSTRACT**

A drive for a reel changer includes at least one electric motor. This drive is used to rotatably drive a web supply roll that is held in the reel changer. A web of material is wound on the supply roll. The electric motor is embodied as a synchronous motor.



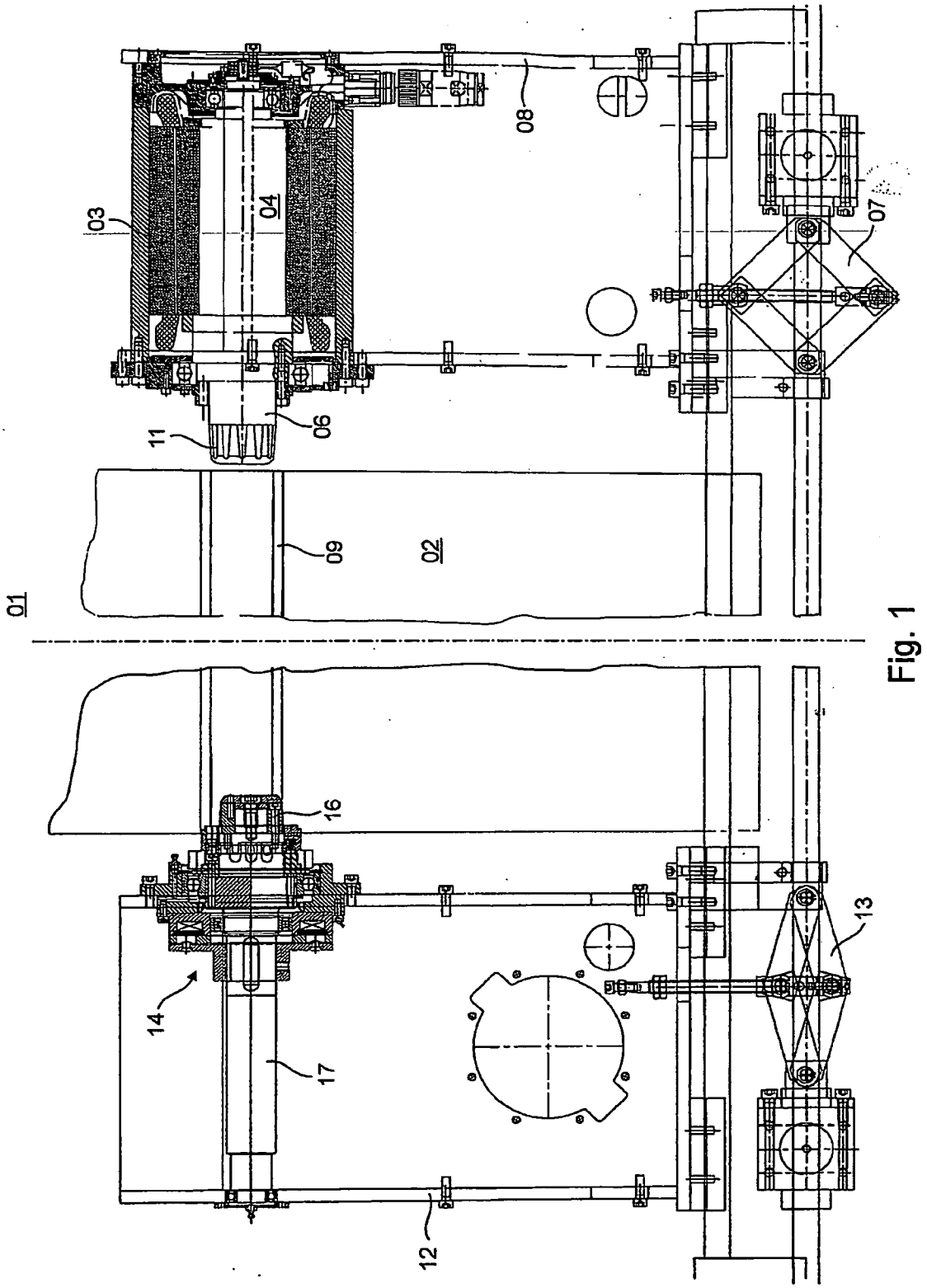


Fig. 1

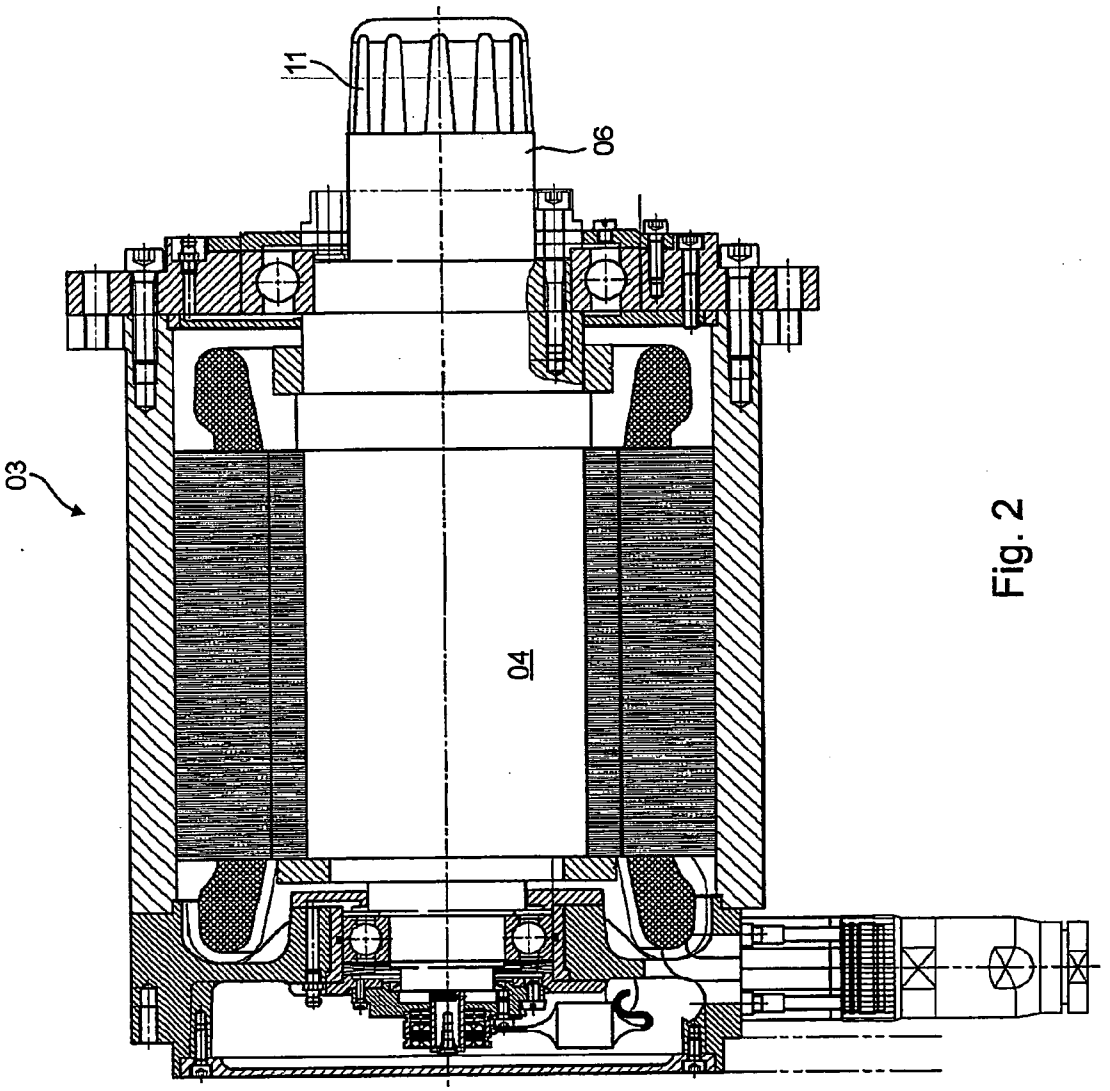


Fig. 2

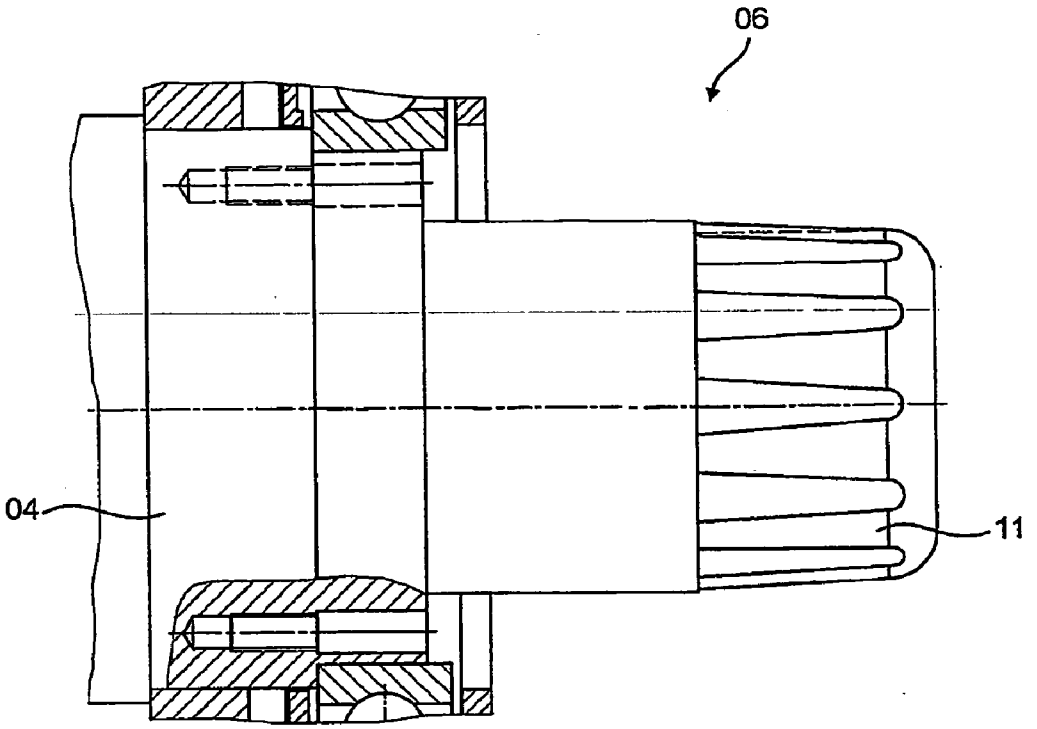


Fig. 3

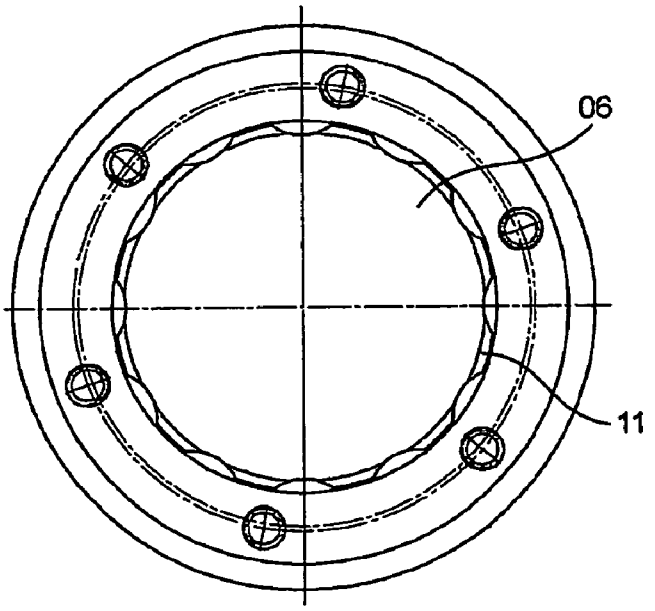


Fig. 4

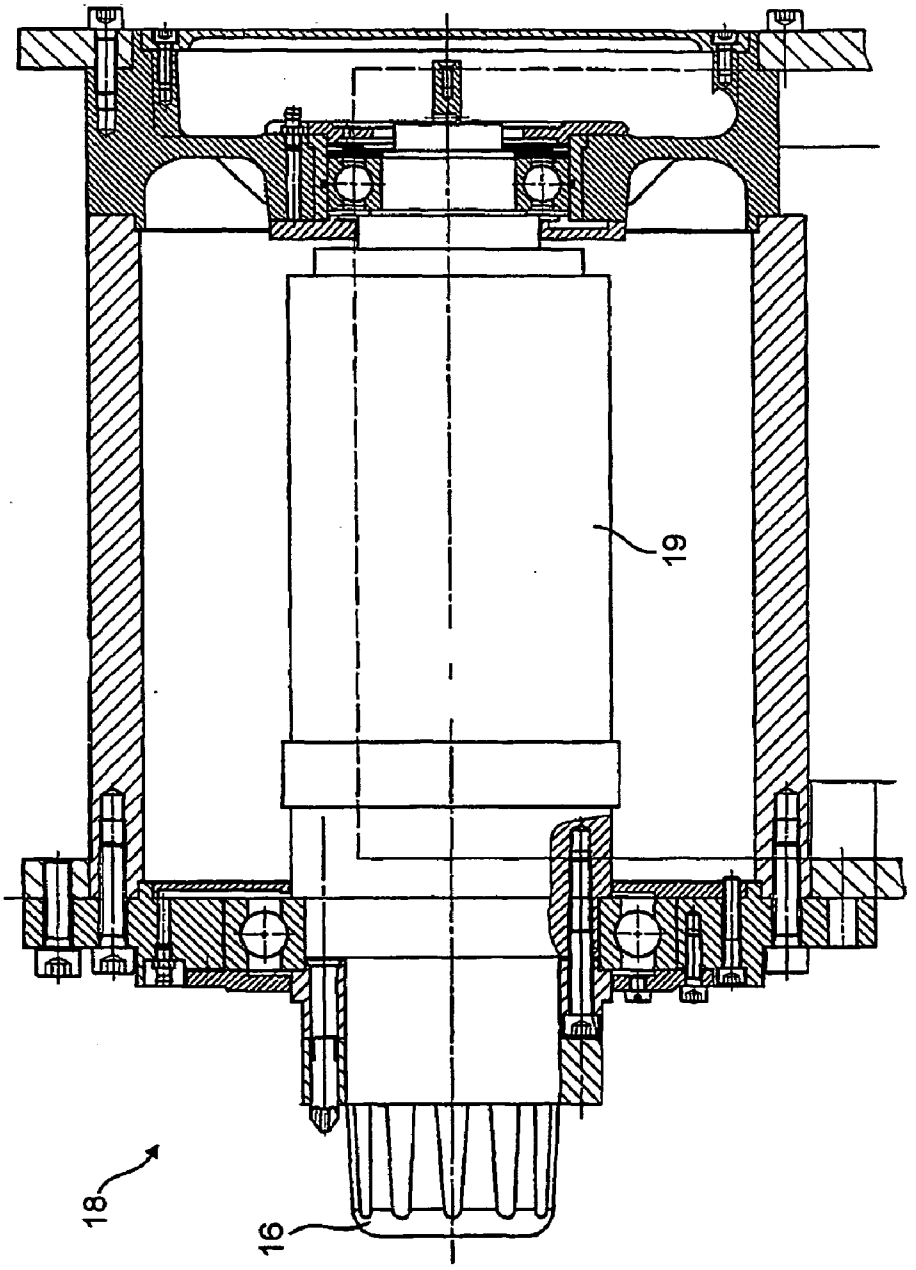


Fig. 5

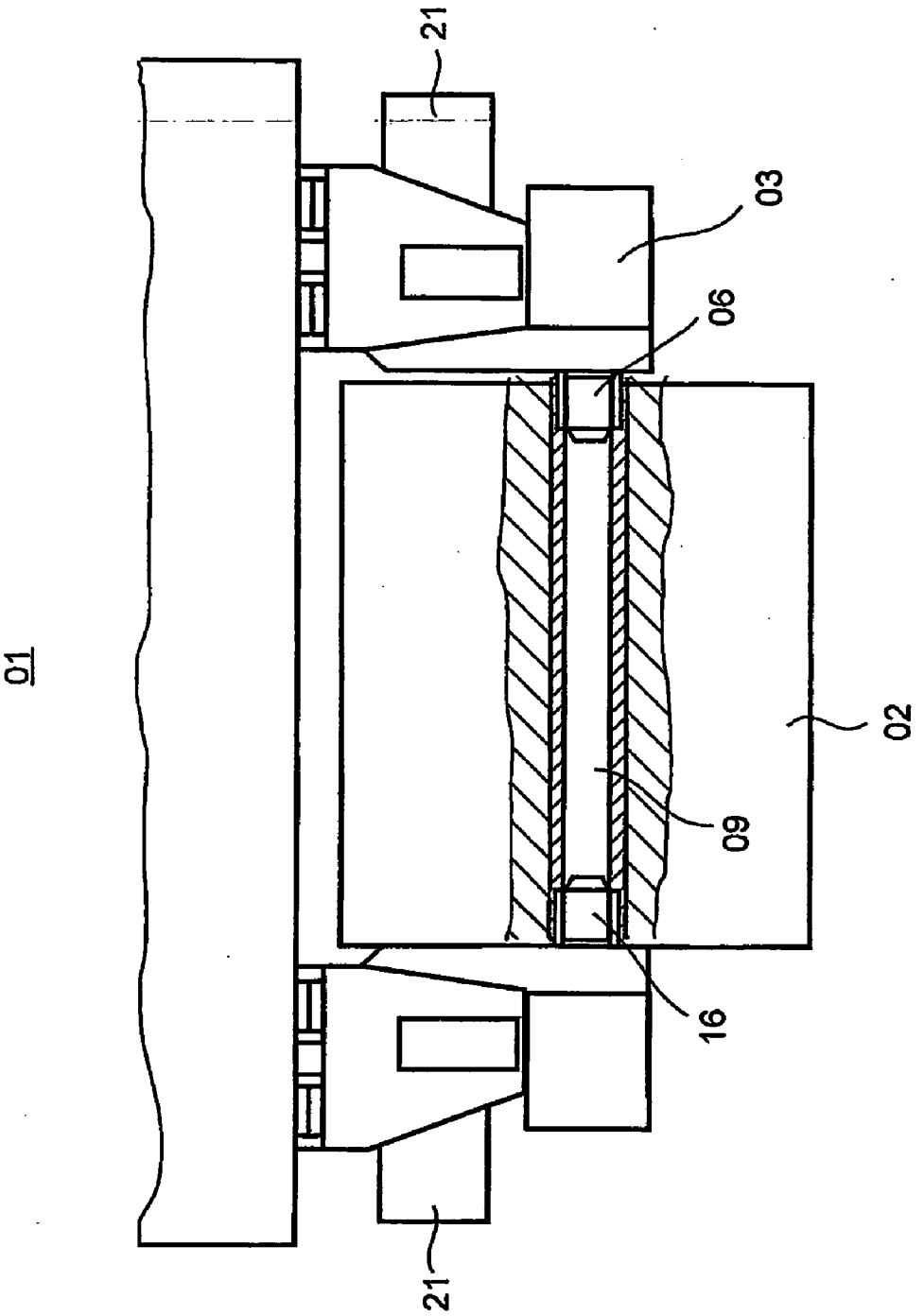


Fig. 6

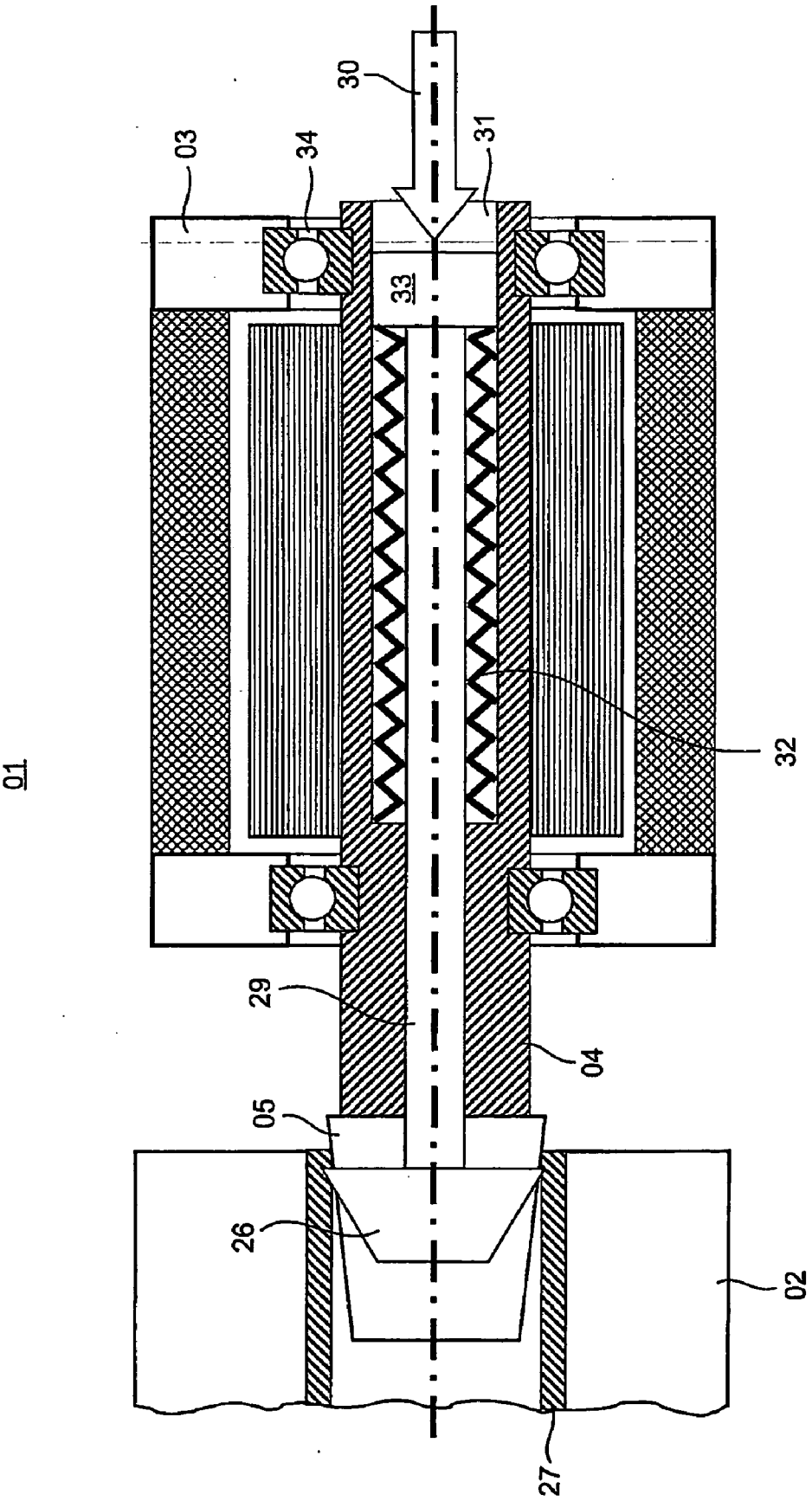


Fig. 7

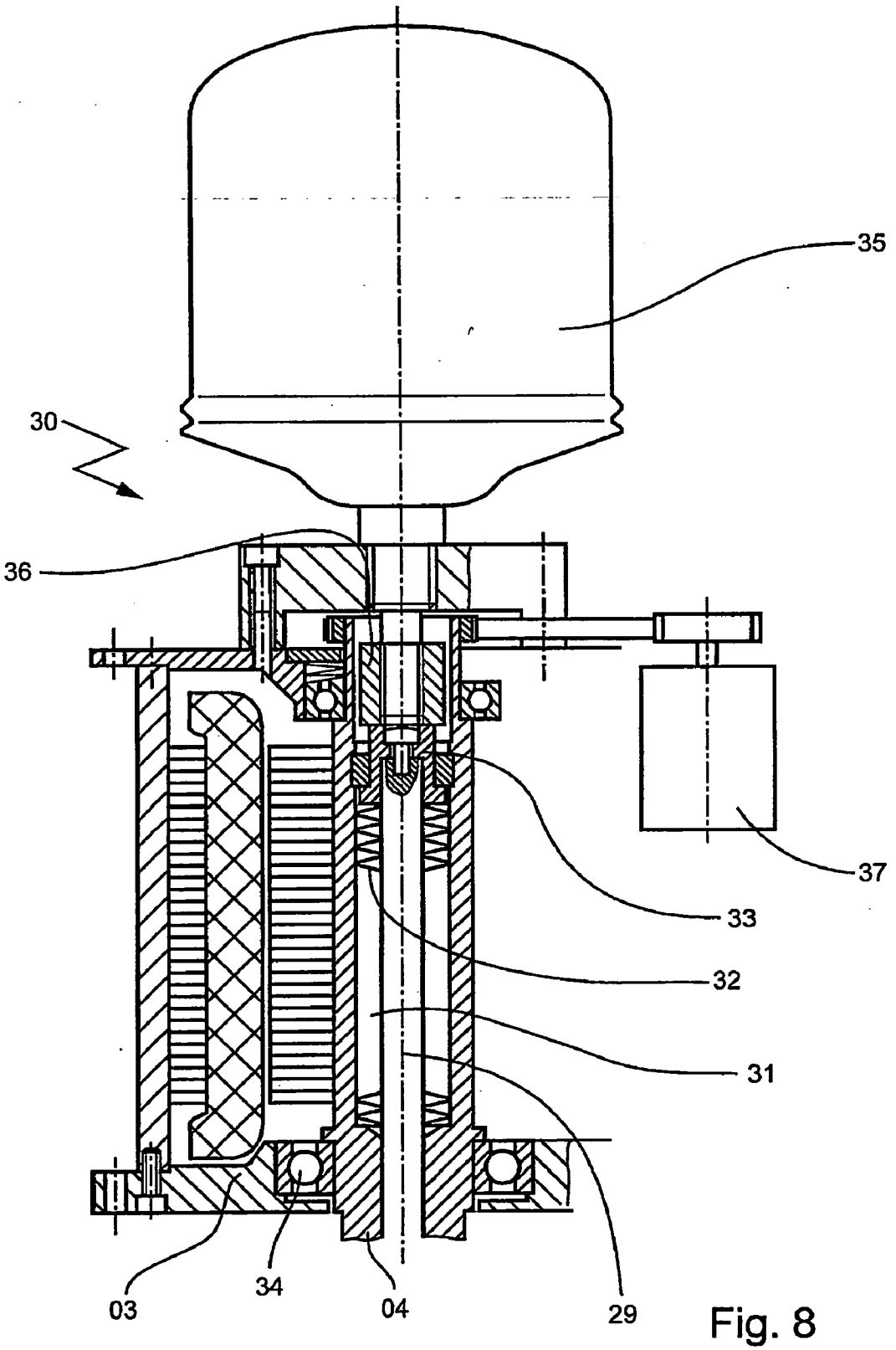


Fig. 8

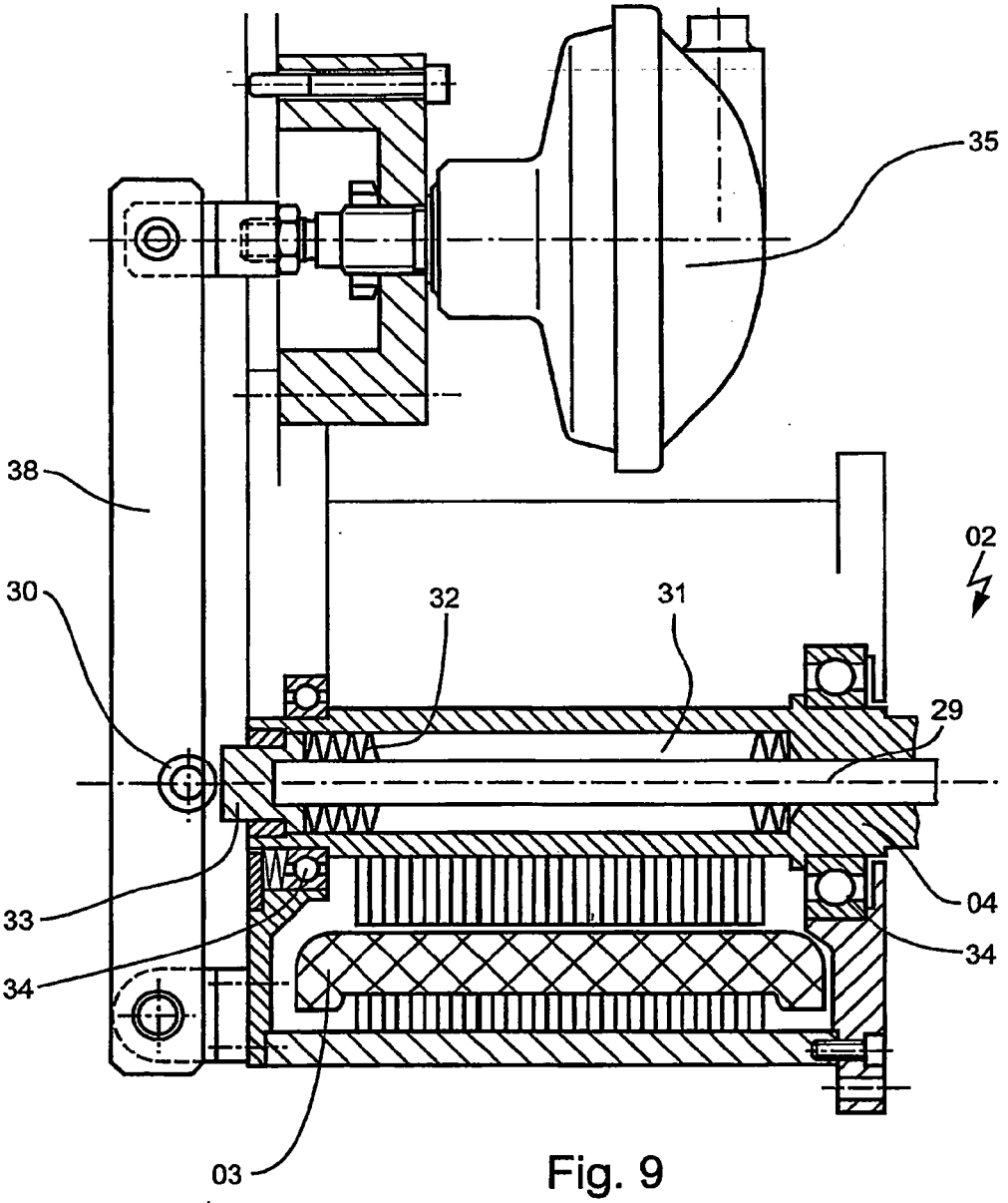


Fig. 9

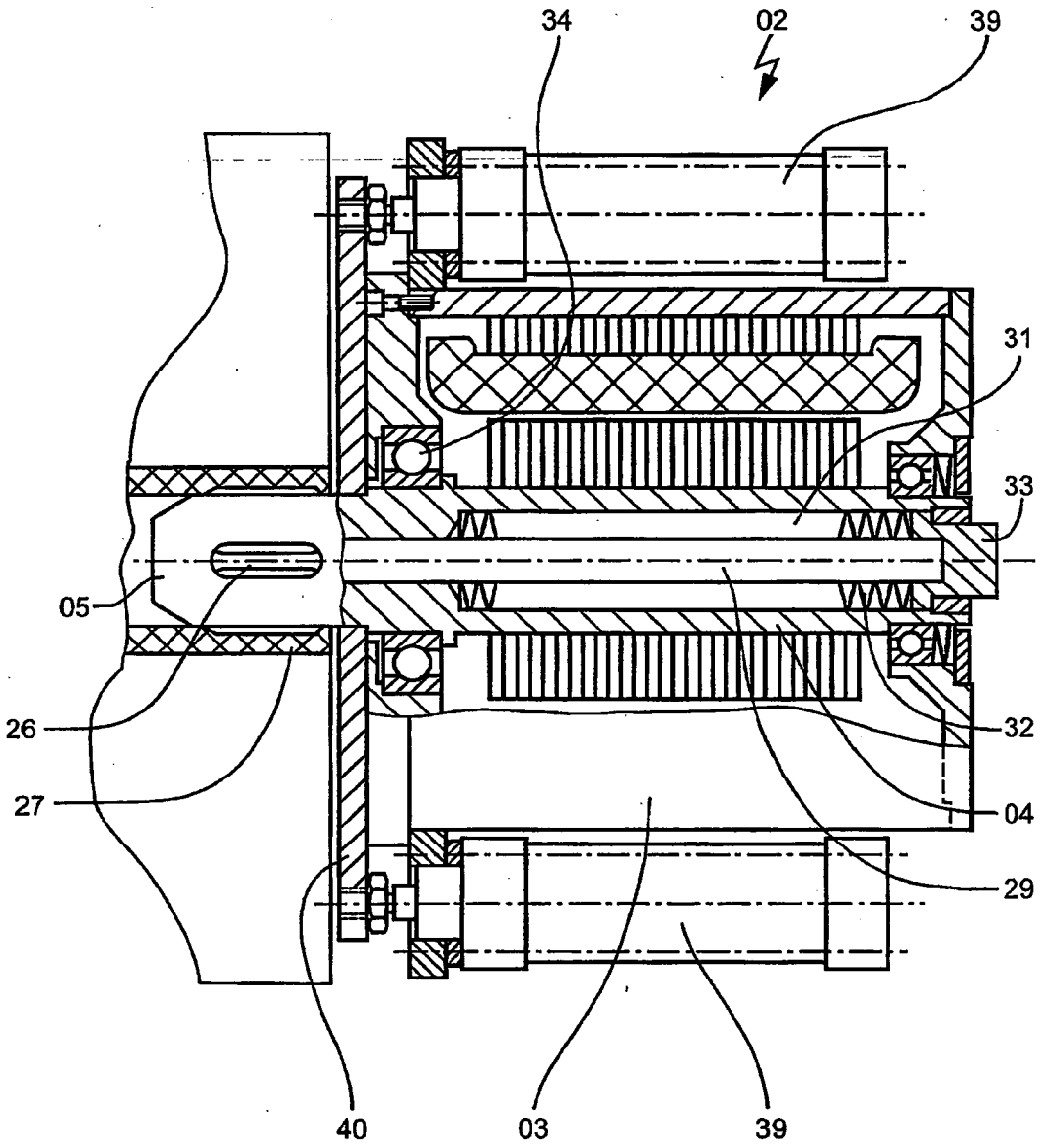


Fig. 10

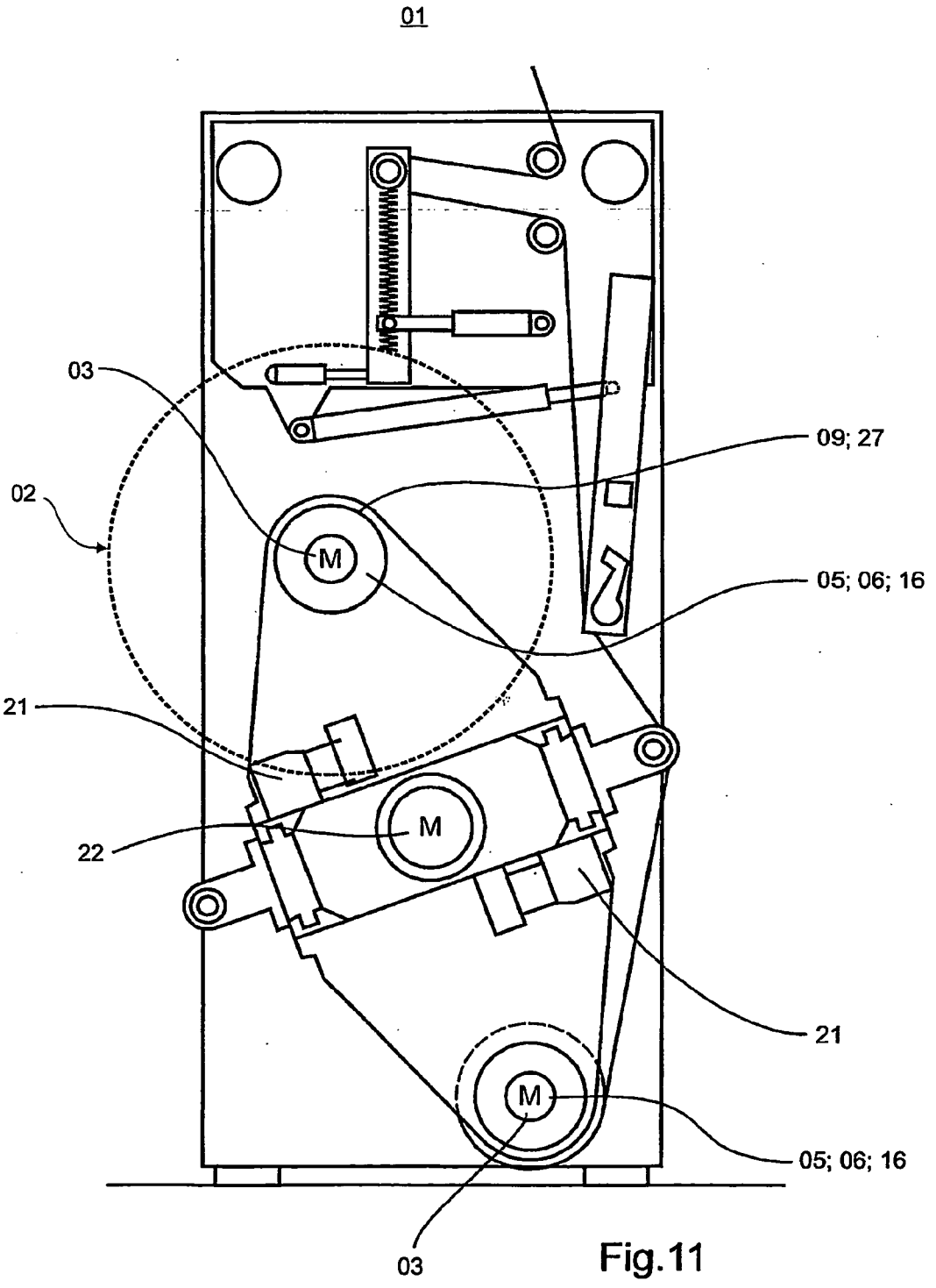


Fig.11

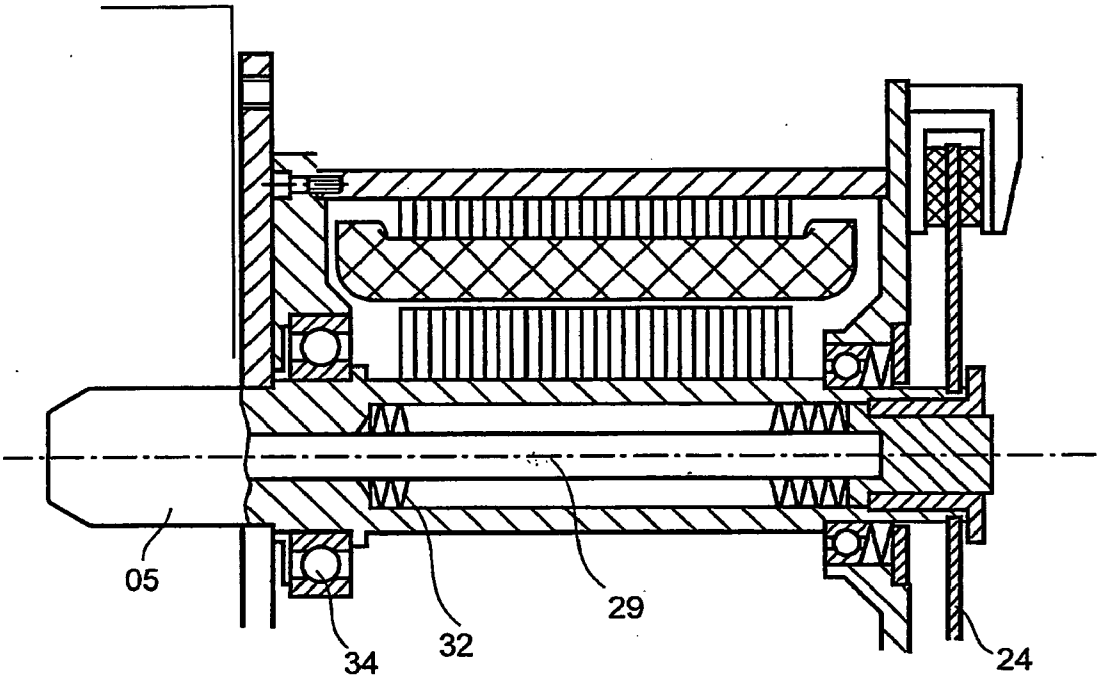


Fig. 12

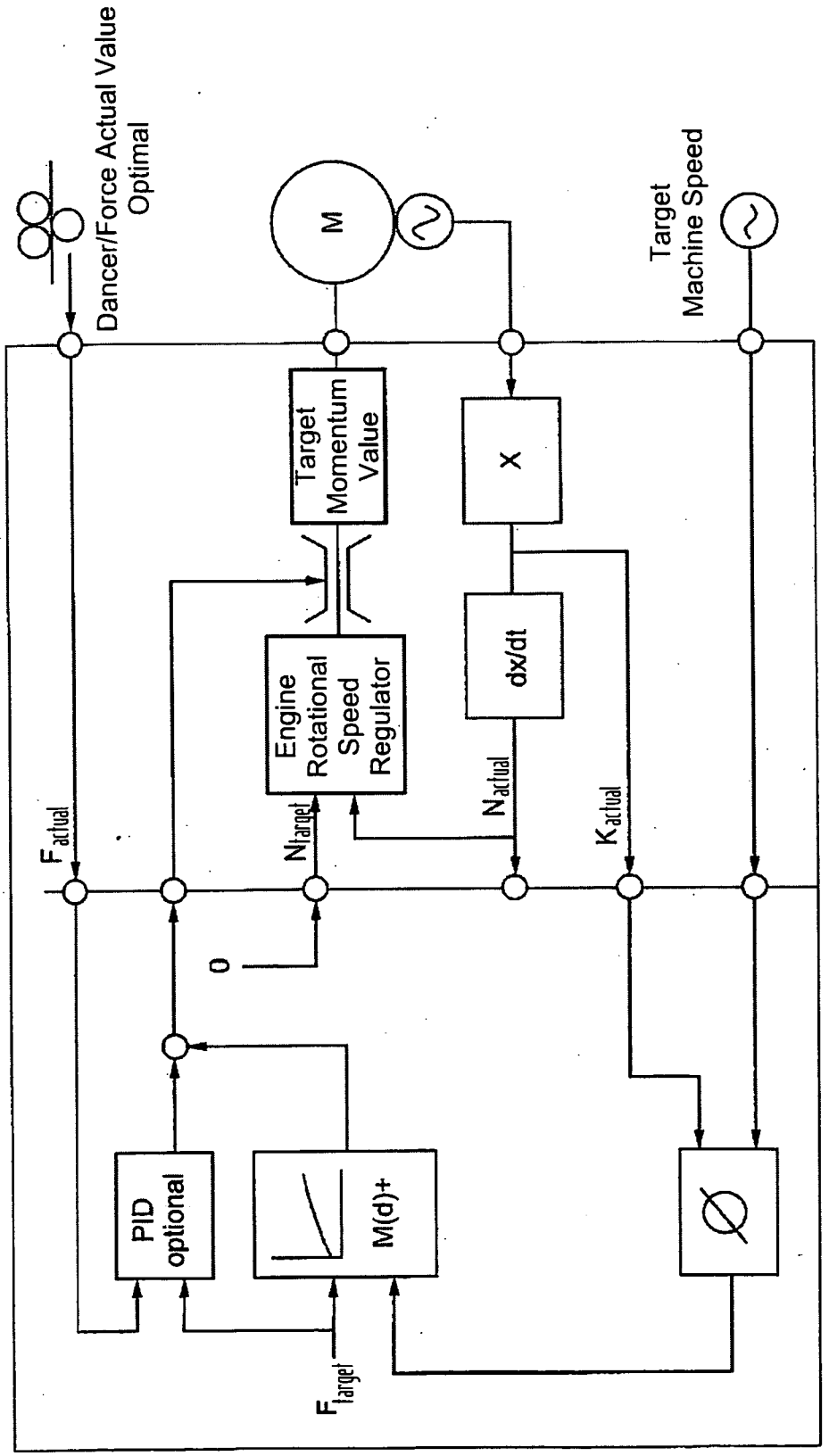

Dancer/Force Actual Value
Optimal
M
Target
Machine Speed
Target
Momentum
Value
X
dx/dt
Engine
Rotational
Speed
Regulator
F_{actual}
N_{target}
N_{actual}
K_{actual}
0
PID
optional
M(d)+
F_{target}

Fig. 13

DRIVES PERTAINING TO A REEL CHANGER

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is the U.S. national phase, under 35 USC 371, of PCT/EP2005/050308, filed Jan. 25, 2005, published as WO 2005/073114 A2 on Aug. 11, 2005 and claiming priority to DE 10 2004 004 759.6, filed Jan. 30, 2004 and to DE 10 2004 030 490.4, filed Jun. 24, 2004, the disclosures of which are expressly incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention is directed to drives of a reel changer. The drive includes at least one electric motor which drives a material reel, held in the reel changer, in a rotational manner.

BACKGROUND OF THE INVENTION

[0003] EP 1 155 987 A2 discloses a reel changer for a printing press. To drive the supply reels in this reel changer, three-phase asynchronous motors, general rotary current motors or alternating current motors, universal motors, or direct current motors are provided. In accordance with one embodiment, the supply reels may be driven only on one side of the supply reel. The supply reel is mounted on the opposite side, without a drive, in a rotational support.

[0004] DE 102 24 839 A1 also discloses a drive for a reel changer for a printing press.

[0005] DE 94 09 754 U1 discloses a winding machine for bandages and bindings. A winding axis of the winding machine is driven by a synchronous motor.

[0006] DE 41 26 392 C1 and DE 31 11 990 C2 both disclose that the use of synchronous motors is known in the field of winding machines.

[0007] The subsequently published document EP 1 460 010 A2 discloses a machine having an electric motor, which is preferably embodied as a synchronous motor and which is used to directly drive a winding core of a wound reel.

[0008] DE 1 599 036 discloses a winding device having a spreader head comprised of segments. The segments are arranged in the shape of a ring around a rotatable roll shaft which is provided with cam surfaces. In the case of axial displacement relative to the roll shaft, the segments may be moved in a radial direction towards or away from the axis of the shaft. The segments are held in their spread position by a spring which is working in the axial direction. These segments may be released from their spread position by the use of a pressurized piston that acts against the force of the spring in the opposite direction.

[0009] EP 0 981 443 B1 discloses a hollow shaft motor of a rotating cylinder or of a roll in a rotary printing press.

[0010] EP 1 155 987 A2 discusses a drive for a reel changer and having at least one motor as the central drive of a paper reel. The rotational momentum or the drive force of the motor is transferred to the core of a paper reel by tension pins.

[0011] WO 02/24564 A1 describes an adjusting element for a tension shaft in a reel changer. A core may be fixed on the tension shaft. To fix the core onto the tension shaft, pressure springs are used to push knee levers outwardly in the direction of clamping jaws that have been provided. An adjusting element may be displaced, in an axial direction, in a hollow shaft by a fluid-driven piston to activate the clamping jaws, such that the clamping jaws are pressed outwards and thereby fix the core into place. To strip off a used core, an ejector device is arranged on the tension shaft. The ejector device is mounted on the hollow shaft in an axially displaceable fashion and rotates, along with the hollow shaft, around a central axis in a housing.

[0012] The published document WO 2005/056195 A1 discloses an electric motor with permanent magnets for a reel changer of a printing press.

[0013] WO 99/55533 discloses a roller or cylinder of a printing press that is driven by an electric motor with permanent magnets.

[0014] In generally known drives, which directly drive the supply reel in a core drive, without the intermediate connection of a drive or a device for transferring rotational momentum, such as a belt, the rotational momentum is transferred to the core of a supply reel by the use of cones, in a positive and/or frictional connection. It is not possible to tense the cones. Tensible cones are known in reel changers with belt drives.

SUMMARY OF THE INVENTION

[0015] The object of the present invention is to provide drives for a reel changer of a printing press.

[0016] This object is attained according to the invention by the provision of a drive for a reel changer that includes at least one electric motor. A material reel that is held in the reel changer on a receiving unit, and upon which a material web may be wound, may be driven in a rotational manner by the electric motor which is embodied as a synchronous motor. The motor may have a drive shaft which is in a coaxial central position relative to the receiving unit. This drive shaft may be a hollow shaft. The receiving unit may have radially movable clamping jaws.

[0017] One advantage of the drive, in accordance with the present invention, lies especially in the fact that a field-suppressible synchronous motor is provided. Such synchronous motors have an extraordinarily broad output spectrum and may be produced in a cost-effective fashion. Due to their motor characteristics, such synchronous motors are particularly suitable for use in driving reel changers of a printing press.

[0018] In generally known drive devices for reel changers, driving cones are normally provided. These driving cones engage the interior of the core of a supply reel such that rotational momentum may be transmitted to the supply reel. These cones are driven by the drive shaft of the electric motor which is provided for driving purposes. In order to simplify the device and to thereby achieve a cost savings, one preferred embodiment of the present invention provides for the drive shaft of the synchronous motor to be able to engage in the supply reel, and in particular in the core of the supply reel, such that rotational momentum may be transferred from the motor. The drive cone is disposed directly on the armature of the synchronous motor, and in particular is disposed on the armature in a rigid manner.

[0019] Carrier elements on the drive shaft, which are provided for the transfer of rotational momentum, should preferably be connected to the drive shaft in a rigid manner, and most preferably as one piece. In this manner, it is possible to omit additional, extremely expensive adjustment mechanisms that would otherwise be necessary for adjusting the carrier elements.

[0020] One particular advantage of the reel changer in accordance with the present invention, which is driven only on one side by the use of an electric motor, lies in the fact that the opposite side, drive-free rotational support is also able to accept axial forces along the central axis of the supply reel, in particular while placing the reel on the axis. As a result, it is thus possible, in particular, for the axial support on the side of the electric motor to have a correspondingly weaker construction.

[0021] The receptacles, which are adapted for storing the supply reel, should preferably have the same construction on both sides of the supply reel so that costs may be saved by using identical parts. Both receptacles should be rotationally mounted, with only one receptacle being driven by the synchronous motor.

[0022] In a further advantageous embodiment of the present invention, it is possible for a free tail of the material web wound on the supply reel to be wound back onto the supply reel with the aid of the synchronous motor.

[0023] A further advantage of the present invention particularly lies in combining the generally already known virtues of a tensile receiving shaft with the advantages of a direct central drive of a supply reel. In this manner, the component cost, as well as the complexity of the machine are reduced. The device of the present invention overall is more compact and simpler than prior devices, while maintaining at least an equally high level of functionality. On the receiving shaft, there is a fixing device that may be set to either a work position or an idle position in order to either fix the core of a supply reel in the receiving position or to release it again. The rotational drive momentum is transferred to the supply reel through a hollow shaft which is provided as a motor drive shaft, and which is preferably embodied as one piece with the receiving unit.

[0024] The process of fixing the reel onto the receiving unit may be activated by the use of an adjustment element that is axially mounted in the hollow shaft. The hollow shaft has recesses in which a spring element is disposed. The spring element ensures that a core tension acts on the adjustment element so that the adjustment element guides the fixing device back into an idle position that fixes the supply reel in place. An activation device is arranged on the adjustment element, on a side that is opposite to the receiving unit in an axial position. This activation device switches the adjustment element into a working position, which releases the supply reel. In addition, a decoupled arrangement is provided, in the idle position, between the fixed activation device and the adjustment element that rotates with the hollow shaft and which is due to a distance that arises between these two components. The purpose of this arrangement is to prevent friction between the fixed activation device and the rotating adjustment element.

[0025] It is practical for the activation device to be diaphragm or a membrane cylinder that is disposed in an extended axial direction of the adjustment element. In order to be able to construct the diaphragm cylinder in a smaller fashion and to make the device more compact, the activation device is a lever mechanism with a lever arm that may be activated by a diaphragm cylinder which is disposed in a parallel axis orientation with respect to the electric motor.

[0026] Two receiving shafts, for use in guiding a supply reel, may each have an electric motor as a drive. In this manner, the rotational momentum output, which would otherwise be required from one electric motor, is divided between two electric motors, which two electric motors can therefore each have smaller dimensions.

[0027] An ejector unit, for use in removing the material reel from the receiving unit, may be disposed in the axial direction and concentric to the receiving unit. In order to activate the ejector unit, the adjustment element may be used. More preferably, pneumatic cylinders may be provided and which are embodied parallel to the central axis.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] Preferred embodiments of the present invention are shown in the drawings and are described in greater detail below.

[0029] Shown are in:

[0030] FIG. **1**, a reel changer in accordance with the present invention and in a partially shown cross-sectional view; in

[0031] FIG. **2**, an electric motor for use in driving the reel changer in accordance with FIG. **1**, in cross-section; in

[0032] FIG. **3**, a side elevation view of a receiving unit of the electric motor provided for storing a supply reel in accordance with FIG. **2**; in

[0033] FIG. **4**, a front or end view of the receiving unit of FIG. **3**; in

[0034] FIG. **5**, a second preferred embodiment of a drive-free rotational support in cross section; in

[0035] FIG. **6**, a schematic view of a reel changer in accordance with the present invention; in

[0036] FIG. **7**, a schematic, cross-sectional view of a hollow shaft motor; in

[0037] FIG. **8**, a cross-sectional view of a central drive with an activation device which is extended in the axial direction; in

[0038] FIG. **9**, a cross-sectional view of a central drive with a lever mechanism; in

[0039] FIG. **10**, a cross-sectional view of a central drive with an ejector unit; in

[0040] FIG. **11**, a schematic side elevation view of a reel changer; in

[0041] FIG. **12**, a schematic cross-sectional depiction of a central drive having a brake; and in

[0042] FIG. **13**, a graphic depiction of a drive regulator in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0043] Referring initially to FIG. **1**, there is shown a partial cross-sectional view of a reel changer **01**, and in particular a reel changer for a rotary, web-fed printing press, for use in supporting a supply reel **02** having a width, of for example, from 300 mm to 1000 mm, and upon which a material web, such as, in particular, a web of printable material, has been wound. For the purpose of driving the supply reel **02**, a motor **03**, and in particular a synchronous motor **03**, has been provided on one side of the supply reel **02**. The synchronous motor **03** has a drive shaft **04** that protrudes past the housing of the synchronous motor **03** on a side of the motor which is facing the supply reel **02**. This protruding side of the drive shaft **04** serves as a receiving unit **06**, upon which the supply reel **02** may be rotationally supported.

[0044] An axial adjustor **07**, which, as may also be seen in FIG. **1**, is embodied in the manner of a scissor lever mechanism, supports a bracket **08** that is mounted in a shiftable fashion on the reel changer **01**. The bracket may be moved in the direction of the longitudinal axis of the supply reel **02** in such a way that the receiving unit **06** of the synchronous motor **03** is movable axially into and out of engagement with an interior of a core **09** which is provided in the supply reel **02**. To transfer rotational momentum from the drive shaft **04** to the core **09**, radially protruding carrier elements **11** are provided on the receiving unit. These carrier elements **11** are formed integrally with the material of the drive shaft **04** as one piece, and are able to transfer rotational momentum to the supply reel **02** in a positive or frictional fashion, and are provided on the receiving unit **06**.

[0045] On an opposite side of the reel changer **01**, another bracket **12** is provided and which second bracket **12** may also be moved in the direction of the longitudinal axis of the supply reel **02** by the use of an axial adjuster **13**. A drive-free rotational support **14** is provided on the second bracket **12** and absorbs the weight forces of the supply reel **02**, on the side of the supply reel **02** that is opposite to the synchronous motor **03**. A receiving unit **16** extends axially from the side of the rotational support **14** and facing the supply reel **02**. This second receiving unit is essentially structurally identical to the first receiving unit **06** and also comes into engagement with the interior of the core **09**. On the side of the rotational support **14**, which is opposite from the second receiving unit **16**, a drive-free shaft **17** is provided, with which the rotational support **14** is supported, extending in the direction of the longitudinal axis of the supply reel **02**, on the bracket **12**, such that larger axial forces may also be absorbed by the rotational support **14**.

[0046] At a minimum, distances between bearing points and the two receiving units **06**; **16** are equal. One bearing point of each receiving unit **06**; **16** is disposed on each of the opposite sides of the brackets **08**; **12**. A distance between the two bearing points of each of the first and second receiving units **06**; **16** corresponds approximately to a width of each of the bracket **08**; **12**.

[0047] In FIG. **2**, the structure of the synchronous motor **03** is enlarged and is shown in cross section. The receiving unit **06** with its carrier elements **11** is formed from the drive shaft **04** using appropriate processing techniques. An additional clamping cone, which would be interposed between the core **09** of the supply reel, and the drive shaft **04** can thus be omitted.

[0048] The synchronous motor **03** is embodied as a field-suppressible, synchronous motor **03**. Motor **03** may be operated with a field suppression of a ratio of up to 1:10. The motor **03** has six poles and one electrical exciter. In particular, the armature of the synchronous motor **03** has poles comprising permanent magnets and the stator of the synchronous motor **03** has an electrical exciter. The permanent magnets preferably utilize rare-earth materials.

[0049] A constant idle momentum of the synchronous motor **03** lies in the range of 100 Nm to 200 Nm. A maximum rotational momentum lies in the range of 600 Nm to 800 Nm, and in particular at approximately 700 Nm. Moreover, the synchronous motor **03** has a theoretical no-load rotational speed in the range of 500 rpm to 600 rpm.

[0050] A frequency transformer is connected upstream of the synchronous motor **03** for the purpose of regulating the rotational speed of motor **03**.

[0051] A rotational angle sensor is also provided on the motor **03**. A rotational axis of this rotational angle sensor is disposed coaxially to the rotational axis of the armature of the synchronous motor **03**. Furthermore, a rotational axis of the supply reel **02** and a rotational axis of the armature of the synchronous motor **03** are disposed coaxially of one another.

[0052] A cooling device, which is preferably embodied in the manner of a fan, is provided on the synchronous motor **03**. In generator operation, the synchronous motor **03** itself may be used as a braking device.

[0053] In a particular embodiment, the synchronous motor **03** is embodied as a shell-type motor.

[0054] In a preferred embodiment, a braking device **24**, and in particular a friction brake, is disposed on the synchronous motor **03**, as is depicted schematically in FIG. **12**.

[0055] The braking device **24** shown in FIG. **12** is preferably embodied as a disc brake. The brake **24** accomplishes, on the one hand, the braking function of the motor **03**, such as, for example, when braking the material reel **02** in the case of a normal stop, and in particular, in the case of a fast stop or in control processes. On the other hand, the brake **24** also serves as a locking brake, which locking of the supply reel **02** may be necessary in order to execute the preparation of the adhesive slice on the end of the material web wound on reel **02**, for example. The brake may be regulated, and in particular, its braking force may be altered, activated, or, in another embodiment, it may be synchronized and can be switched on or off.

[0056] The braking device **24**, which, in particular, is a disc or disc brake device, is preferably disposed concentrically to the armature of the electric motor **03** is and connected to the motor, and preferably to the hollow motor drive shaft **04**, in a rotationally secure manner.

[0057] In FIG. **3** and FIG. **4**, the reel core receiving unit **06** is shown in an enlarged view with the carrier elements **11**.

[0058] FIG. **5** shows a second preferred embodiment of a drive-free rotational support **18**, in accordance with the present invention, that may be used on a reel changer **01**. Again, a drive-free shaft **19** is provided for intercepting axial

forces, and with which shaft **19** the drive-free rotational support **18** is supported on the side of the reel changer **01** opposite the first receiving unit **06**.

[**0059**] FIG. **6** shows a schematic view of a reel changer **01** and partially in cross section. The motor drive shaft **04**, which is not specifically shown, protrudes axially past the housing of the synchronous motor **03**, as shown at the right in FIG. **6** and, on the side facing the supply reel **02**. Drive shaft **04** and serves as a receiving unit **06**; **16** for the supply reel **02**. Each of the two reel cone end receiving units **06**; **16** of the reel changer **01** has its own actuator **21**, each of which actuator **21** is usable for adjusting its respective one of the receiving units **06**; **16** in the axial direction of the supply reel **02**. It is advantageous for the actuators **21** to be movable together with the respective reel cone end receiving units **06**; **16**. For this purpose, for example, a gear rod is disposed on the bracket of the reel changer **01** into which toothed wheels driven by each of the actuators **21** engage.

[**0060**] FIG. **7** shows a second preferred embodiment, in a partial cross-sectional view, of a reel changer **01** in accordance with the present invention and having a motor **03**, preferably a synchronous motor **03**, as has already been described.

[**0061**] The electric motor **03** has a hollow shaft **04** as its drive shaft **04**. The drive shaft **04** is connected to a reel core receiving unit **05**, and preferably is formed in one piece. Drive shaft **04** is, at the same time, the rotor of the electric motor **03**. The reel core receiving shaft **05** is a tensioning spindle **05** and has adjustable clamping jaws **26** as its fixing element **26**, which adjustable clamping jaws **26** are shown abstractly and symbolically as a cone in FIG. **7**. By use of the clamping jaws **26**, a reel core **27** of a supply reel **02** may be fixed into place on the reel core receiving shaft **05**. An adjustment element **29** is located in the hollow shaft **04**. The adjustment element **29** preferably is an actuating shaft **29** that is disposed axially to the central axis of the electric motor **03** and that is connected, on its end proximate to the receiving shaft **05**, with the clamping jaws **26** by a mechanism which is generally known in the prior art, as is disclosed, for example, in WO 02/24564 A1.

[**0062**] By axially displacing the actuating shaft **29**, the clamping jaws **26** are either pushed outwards against the reel core **27** or are pulled inwards towards the central axis. The clamping jaws **26** are pulled in when a new supply reel **02** is to be received on the reel core receiving shaft, or when the reel core **27** of the supply reel **02** is to be released from the reel core receiving shaft **05**.

[**0063**] The actuating shaft **29** is displaced axially within the hollow drive shaft **04** by an actuation device **30** which is located on the end of shaft **29** facing away from the reel core receiving unit **05**. The actuation device **30** may be any device, which is generally known from the prior art, and that is able to move a body under pressure and/or tension into at least two positions. The actuation device **30** may be a generally known fluid-driven piston that exerts its pressure forces on the actuating shaft **29** in the axial direction and is therefore shown symbolically as an arrow in FIG. **7**.

[**0064**] In its side which is facing away from the receiving shaft **05**, the hollow shaft **04** has a recess **31** generally in the shape of an axial cylinder in which recess **31** disc springs **32** are disposed, and which function as a spring device **32**. The disc springs **32** are constrained by a piston **33** that is connected, in a fixed manner, to the actuating shaft **29**. The disc springs **32** are therefore located in a core-shaped intermediate chamber **31** that is defined, on the side facing the reel core receiving unit or tensioning spindle **05**, by a stop that is fixed in place in the hollow shaft **04** and on the opposite side by the movable piston **33**. If the disc springs **32** are in a relaxed, rest position, the adjustable clamping jaws **26** in the receiving shaft **05** are pushed outwards to the maximum extent. If the piston **33** is pushed into a working position, by the actuation device **30**, and is moved toward the receiving shaft **05**, then the clamping jaws **26** move inwards towards the center axis. The core **27** of a supply reel **02** may then be released by the receiving shaft **05** and a new core **27** may be received. The hollow shaft **04** is rotatably supported in the electric motor **03** by the use of the roller bearing **34** which are depicted schematically in FIG. **7**.

[**0065**] FIG. **8** shows a further preferred embodiment of a central drive, which is provided at least on one of two receiving shafts **05**, which are provided for receiving a material reel **02** in a generally known reel changer **01**. FIG. **8** shows a partial cross-sectional view of the electric motor **03** with the hollow shaft **04**. The hollow shaft **04** is mounted in a rotatable fashion, by suitable roller bearings **34** and, at the same time, forms the drive shaft **04** of the electric motor **03**. For reasons of simplicity, the previously described tensioning spindle or reel core receiving unit **05** is not shown in FIG. **8**. The previously described piston **33** is screwed onto the adjustment element **29**. Together with the actuating shaft **29** and the piston **33**, the hollow shaft **04** forms a shell-shaped cavity **31** in which the disc springs **32** are disposed. It has been determined to preferably use 45 to 57 disc springs **32**. The piston **33** is pressed into a work setting by an actuation device **30**, in the direction of the receiving shaft **05**, which is not specifically shown in FIG. **8**, in order to pivot the clamping jaws **26** shown in FIG. **7** inwards. In this depicted preferred embodiment, the actuation device **30** is disposed axially in the extended direction of the actuating shaft **29**. The actuation device **30** includes a diaphragm or membrane cylinder **35** that is pneumatically activated. This is advantageous because compressed air is usually available in a production environment. In its rest position, when the disc springs **32** are in their relaxed state, the piston **33** and a stop plunger **36** of the diaphragm cylinder **35** do not touch. Thus, friction between the stationary stop plunger **36** and the rotating piston **33** is prevented.

[**0066**] To control the synchronous motor **03**, a transmitter **37** is connected, by the use of a belt or a toothed chain, to the drive shaft **04**. The transmitter **37** detects the exact position and speed of the electric motor **03** and the electric motor **03** is actuated accordingly. Otherwise, explicit reference is hereby made to the special arrangement shown and to its depiction in the drawings as being essential.

[**0067**] FIG. **9** shows the central drive, which is somewhat different, in part, from the arrangement which is shown in FIG. **8**. The fundamental difference here is that the actuation device, generally at **30**, is embodied as a lever mechanism. A lever arm **38** is activated by a diaphragm or membrane cylinder **35**. The diaphragm cylinder **35** is disposed with an axis which is parallel to the central axis of the electric motor **03**. The lever arm **38** extends transversely over the radius of the electric motor **03** with one extended end.

[0068] On the outermost radius of the electric motor **03**, and on the shortest end of the lever arm **38**, a fixed pivot point is arranged. On its opposite end, the lever arm **38** is movable in the axial direction of the electric motor **03** and is displaced by the diaphragm cylinder **35**. At the level of the movable piston **33**, a ring or a ball is located on the lever arm and that presses on the piston **33** in order to activate the actuating element **29**, when the lever arm **38** is pivoted by the diaphragm cylinder **35** in the axial direction towards the tensioning spindle **05**. Here, the level or translation ratio of the lever arm **38** is preferably i=3.4, i.e., the lever arm **38** which is activated by the diaphragm cylinder **35** preferably corresponds to 440 length units, with the lever arm **38** pressing on the piston **33** preferably corresponding to 130 length units. Thus, the diaphragm cylinder **35** can have a correspondingly smaller construction than was required in the embodiment in accordance with FIG. **8**. This reduces the production costs and the required fluid pressure for the diaphragm cylinder **35**. Such an arrangement allows for a more compact structure of the central drive than in the embodiment of the present invention in accordance with FIG. **8**.

[0069] FIG. **10** shows a third preferred embodiment of the central drive in accordance with the present invention. In this third preferred embodiment, two pneumatic cylinders **39**, each with a lift or a displacement of preferably 125 mm, are disposed parallel to the central axis of the electric motor **03** in order to form an ejector unit **40**. The ejector unit **40** pushes the core **27** of the supply reel **02** off of the tensioning spindle or reel core receiving unit **05**, when the supply reel **02** must be changed. The ejector unit **40** is positioned on the central drive in a fixed manner concentrically to the reel core receiving unit **05** and thus does not move together with the supply reel **02**. FIG. **10** clearly shows, in cross section, the clamping jaws **26** of the receiving shaft **05** that press radially apart into the core **27** of the supply reel **02** in the radial direction in order to better hold the core **27** in place. Holding the core **27** firmly in place is important because a supply reel **02** may weigh over 1000 kg and thus high rotational momentum can occur. The mechanism pertaining to this sort of clamping jaws **26** is known from prior art and is therefore not shown. Otherwise, the central drive is structured as is depicted in FIGS. **7** to **9**.

[0070] FIG. **11** is a somewhat schematic depiction of a reel changer with two synchronous motors **03**. The reel changer **01** has two separate pairs of receiving units **05**; **06**; **16**, each of which is adapted for receiving one supply reel **02**. In this reel changer, it is advantageous for the drive of the supply reel **02** to be accomplished by synchronous motors **03**.

[0071] Both of the depicted pairs of receiving units **05**; **06**; **16** may be pivoted around a common pivot axis with two axially coordinated supply reels **02** or scrap reels. This pivot motion is made possible by an actuator **22**. In this reel changer **01**, each pair of receiving units **05**; **06**; **16** is driven on only one side by the use of one drive motor **03**. It is also possible for both pairs of receiving units **05**; **06**; **16** to be disposed on the same side of the reel changer **01**. The adjustment of each of the receiving units **05**; **06**; **16** in the axial direction of the supply reel **02** is made by a dedicated actuator **21**, generally as depicted in FIG. **6**.

[0072] The constantly changing diameter of the reel dRoll and the fixed web tension FWeb are governed by the equation MRoll=FWeb*dRoll/2, where MRoll is the braking momentum of the reel. This necessitates a broad adjustment range of the braking momentum of the reel, which braking momentum must be controlled according to the diameter of the reel or must be regulated by a tensile force regulator.

[0073] In order to keep the tension of the web at a desired target value, with a high degree of precision, it is necessary to determine the precise diameter of the reel. Because reels are used that each have different initial diameters, it is expedient for the specific reel diameter to be determined automatically with the aid of the machine conductivity. If the diameter is known, the desired target value of force on the web is controlled using the equation MRoll=FWeb*dRoll/2. In so doing, speed-dependent, non-linear values, such as the friction of the reel, are also compensated for. In addition, an optional, superimposed PID regulator adjusts for unknown disturbance variables as well as for changes to system values with the aid of the target web tension value.

[0074] The momentum control of the motors is realized by a digital rotational speed regulator with a limiter. In the case of a web tear, this rotational speed regulator, with a target value of 0, prevents the reel from accelerating in an uncontrolled fashion. The speed regulator brakes, and electrically holds the reel, in this case until it is stationary.

[0075] In addition, the web tension can be reduced to a predefined value when the machine is idle.

[0076] FIG. **13** shows a drive regulation diagram, in accordance with the present invention, by way of example.

[0077] While preferred embodiments of drives pertaining to a reel changer, in accordance with the present invention, have been set forth fully and completely hereinabove, it will be apparent to one of skill in the art that various changes in, for example, the overall sizes of the reels, the source of the compressed air for the diaphragm cylinders and the like could be made without departure from the true spirit and scope of the present invention which is accordingly to be limited only by the appended claims.

What is claimed is:

1-64. (canceled)

65. A drive for a reel changer comprising:

at least one receiving unit in said reel changer and adapted to support a material reel on which a web of material is wound;

an electric motor usable to drive said at least one receiving unit about an axis of rotation, said electric motor being a synchronous motor; and

an armature in said synchronous motor, said armature having permanent magnet poles.

66. The drive of claim 65 wherein said synchronous motor includes a drive shaft, said drive shaft being adapted to directly engage said material reel.

67. The drive of claim 66 further including radially protruding carrier elements on said drive shaft and adapted to engage said material reel.

68. The drive of claim 67 wherein said carrier elements are rigidly connected to said drive shaft.

69. The drive of claim 65 wherein said synchronous motor includes a drive shaft, said drive shaft being a hollow shaft.

70. A drive for a reel changer comprising:

at least one receiving unit in said reel changer and adapted to support a material reel on which a web of material is wound;

an electric motor usable to drive said at least one receiving unit for rotation about an axis of rotation; and

a hollow drive shaft in said electric motor, said hollow drive shaft being coaxial with said receiving unit and usable to drive said receiving unit.

71. The drive of claim 70 further including a movable adjustment element in said hollow drive shaft.

72. The drive of claim 71 wherein said movable adjustment element is an actuating shaft.

73. The drive of claim 71 further including recesses in said hollow drive shaft, and spring means in said recesses, said spring means being usable to shift each adjustment element in said hollow drive shaft into a reel engaging position.

74. The drive of claim 73 wherein said spring means includes disc springs.

75. The drive of claim 73 further including an activation device usable to shift said adjustment element into a reel release position, said receiving unit being located on a first side of said electric motor, said activation device being located on a second, opposite side of said electric motor.

76. The drive of claim 75 wherein said activation device includes a diaphragm cylinder.

77. The drive of claim 75 wherein said activation device includes a lever mechanism.

78. The drive of claim 77 further including a diaphragm cylinder adapted to move said lever mechanism in a direction parallel to said axis of rotation.

79. The drive of claim 71 further including a fixing device engageable with said material reel in response to movement of said adjustment element.

80. The drive of claim 65 further including an ejector unit concentric with said at least one receiving unit and usable to remove said material reel from said receiving unit.

81. The drive of claim 80 further including an actuating element usable to activate said ejector unit.

82. The drive of claim 81 wherein said actuating element includes pneumatic cylinders disposed axially with respect to said at least one receiving unit.

83. The drive of claim 70 wherein said hollow shaft is part of said receiving unit.

84. The drive of claim 70 wherein said electric motor is a synchronous motor.

85. The drive of claim 84 wherein said synchronous motor is a field-suppressible synchronous motor.

86. The drive of claim 85 wherein a field-suppression of said synchronous motor has a ratio of up to 1 to 10.

87. The drive of claim 65 wherein said synchronous motor has six poles.

88. The drive of claim 65 wherein said synchronous motor has an electrical exciter.

89. The drive of claim 65 wherein said synchronous motor has a permanent exciter.

90. The drive of claim 84 further including an armature of said synchronous motor having permanent magnet poles.

91. The drive of claim 65 wherein said synchronous motor has a constant idle momentum in the range of 100 Nm to 100 Nm.

92. The drive of claim 65 wherein said synchronous motor has a maximum rotational momentum in the range of 600 Nm to 800 Nm.

93. The drive of claim 65 wherein said synchronous motor has a theoretical no-load rotational speed in the range of 500 rpm to 600 rpm.

94. The drive of claim 65 further including frequency control means usable to regulate a rotational speed of said synchronous motor.

95. The drive of claim 65 further including a rotational angle sensor on said synchronous motor.

96. The drive of claim 65 further including a cooling fan on said synchronous motor.

97. The drive of claim 70 further including a braking device on said electric motor.

98. The drive of claim 70 wherein said electric motor is usable as a brake during generator operation.

99. The drive of claim 65 further including a rotational angle sensor having a rotational axis which is coaxial to a rotational axis of said armature.

100. The drive of claim 65 wherein a rotational axis of said material reel and a rotational axis of said armature are coaxial.

101. The drive of claim 65 wherein a rotational axis of said material reel and a rotational axis of said armature have the same rotational momentum.

102. The drive of claim 65 further including a core of said material reel.

103. The drive of claim 65 further including a second receiving unit, said first and said second receiving units engaging first and second ends of said material reel.

104. The drive of claim 103 wherein both of said first and second receiving units are supported for rotation and further wherein said electric motor drives only one of said first and second receiving units.

105. The drive of claim 103 wherein each of said first and second receiving units include radially immovable carrier elements adapted to be press-fit into a core of said material reel.

106. The drive of claim 104 wherein axial forces are absorbable by said receiving unit and driven by said electric motor.

107. The drive of claim 104 wherein said first and second receiving units are structurally the same and each is a cone.

108. The drive of claim 106 wherein each said receiving unit is movable axially with respect to said reel changer along a central axis of said material reel.

109. The drive of claim 108 wherein each said receiving unit is movable axially by a scissor lever mechanism.

110. The drive of claim 103 wherein each of said first and second receiving units are supported by supports, distances each said support to each said receiving unit being equal for said first and second receiving units.

111. The drive of claim 110 wherein each of said supports includes a bracket having first and second sides, each said support including first and second support points on said first and second sides of said bracket.

112. The drive of claim 111 wherein a distance between said first and second support points for each of said supports corresponds to a width of said brackets.

113. The drive of claim 110 wherein said first and second supports are structurally identical.

114. The drive of claim 103 wherein said first and second receiving units form a first pair of receiving units and further including a second pair of receiving units.

115. The drive of claim 114 wherein said first and second pairs of receiving units are supported for pivotal movement about a common pivot axis.

116. The drive of claim 115 further including a pivot actuator usable to accomplish said pivotal movement of said first and second pairs of receiving units.

117. The drive of claim 115 wherein each of said first and second pairs of receiving units has one said electric motor adapted to drive a first of said receiving units.

118. The drive of claim 117 wherein said electric motors for each said first receiving unit are located on the same side of the reel changer.

119. The drive of claim 114 wherein each said receiving unit has an electric motor.

120. The drive of claim 114 wherein each said receiving unit includes an actuator usable to displace said receiving unit in an axial direction of said material reel.

121. The drive of claim 120 wherein each said actuator is movable with its one of said receiving units.

122. The drive of claim 121 further including a control element for each said actuator and movable with each said actuator.

123. The drive of claim 65 wherein said electric motor is usable to wind a material onto said material reel.

124. The drive of claim 65 wherein said reel changer is disposed on a web-fed rotary printing press.

125. The drive of claim 69 wherein said drive shaft is the rotor of said synchronous motor.

126. A drive for a reel changer comprising:

at least one receiving unit in said reel changer and adapted to support a material reel on which a web of material is wound;

an electric motor usable to drive said at least one receiving unit about an axis of rotation;

a plurality of material reel engageable clamping jaws in said at least one receiving unit; and

a diaphragm cylinder usable to move said clamping jaws radially with respect to said material reel.

127. The drive of claim 126 further including a lever arm having a first end in engagement with said diaphragm cylinder and a second end secured to a pivot.

128. The drive of claim 127 further including a clamping jaw actuating element engageable with said lever arm intermediate said first and second ends.

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