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Torque transistor and E-Bike with torque transistor

The present invention relates to a torque transmission assembly for the drive train of a muscle power operated vehicle with an auxiliary motor in accordance with the preamble of the independent claim 1. In the context of the present application, the term “muscle power operated vehicle” in principle means any type of muscle power operated vehicle, in particular aquatic craft such as pedalos or the like. However, the present is of particular application to e-bikes or pedelecs with a mid-mounted motor or bottom bracket motor.

A torque transmission assembly of this type in accordance with the preamble of the independent claim 1 comprises an output shaft, a first input shaft for transmitting a torque produced by muscle power to the output shaft, a second input shaft for transmitting a torque produced by the auxiliary motor to the output shaft, and a freewheeling function by means of which a user of the muscle power operated vehicle does not have to pedal along with the auxiliary motor when the auxiliary motor is deactivated or not switched on.

Torque transmission assemblies are known from the prior art and are used, for example, with e-bikes with a mid-mounted motor. In the solutions known from the prior art, electric sensors detect whether the rider of the bicycle is exerting pressure on the pedals in order to move the bicycle forwards. If pressure has been applied to the pedals, the auxiliary motor is switched on in order to support the rider. When the rider no longer exerts pressure on the pedals, or turns the pedals in the opposite direction, this is also detected by electric sensors and the support of the auxiliary motor is reduced or deactivated. Electric systems are prone to failure and defects and must therefore be designed with redundancy, particularly with regards to safety so that, for example, braking of the bicycle is guaranteed even in the event of the malfunction of a sensor. Furthermore, the output shaft which carries the chainring is usually securely connected to the first input shaft or it is formed by the first input shaft. As a rule, the second input shaft is securely connected to the output shaft. The freewheeling function is usually produced by a freewheel which is disposed in the auxiliary motor itself or is installed in a transmission disposed between the auxiliary motor and the output shaft. In order to prevent the auxiliary motor from having to turn along with or turn backwards when back-pedalling, in the known solutions of the prior art, it is necessary to install a further freewheel in addition to the first freewheel.

EP 3 254 945 A1 discloses a drive unit for a bicycle with an auxiliary motor having a foot pedal, an output shaft and a drive element which is connected to the output shaft and driven by an electric motor, a torque detecting unit as well as a control. EP 700 826 A1 describes a further method for controlling the electric motor of a bicycle with an auxiliary motor, wherein the auxiliary motor is controlled in accordance with the increase in the torque produced by means of muscle power and detected by a torque sensor.

The objective of the present invention is to further develop the torque transmission assembly of the aforementioned type so as to provide a particularly compact and inexpensive construction and at the same time to be able to ensure both of the aforementioned freewheeling functions. Furthermore, reliable deactivation of the supportive power of the auxiliary motor should be guaranteed.

The objective is achieved by the features of the independent claim 1. In accordance with these features, in a torque transmission assembly in accordance with the preamble of the independent claim 1, then, the solution of the invention to the problem is provided when the torque transmission assembly has a mechanical clutch which is configured to transmit a torque from the second input shaft to the output shaft when, at the first input shaft, a torque which acts in a driven direction of rotation is applied to the output shaft, and not to transmit a torque from the second input shaft to the output shaft when, at the first input shaft, a torque which acts against the driven direction of rotation is applied to the output shaft.

Advantageous embodiments of the present invention are defined in the dependent claims.

In the embodiment of the present invention, the clutch is a mechanical clutch which can be operated without supplying electrical energy. Preferably, the mechanical clutch is a clutch of the ratchet brake type. Compared with electrical systems, a mechanical clutch has greater reliability. In electrical systems there is a risk that, for example, a battery or accumulator could be flat and thus the system would malfunction. Furthermore, sensor or power cables could break and result in system malfunctions. Particularly in the case of vehicles which are usually used outdoors, this is a huge problem because they have to be able to function reliably for years at various temperatures and, for example, in snow and rain. In the safety and vehicle fields, then, electrical systems have to be constructed with double or even triple redundancy.

According to a further particularly preferred embodiment of the present invention, the output shaft, the first input shaft and the second input shaft are disposed coaxially with respect to each other and in principle are rotatably mounted against each other, wherein between the first input shaft and the output shaft there is an entraining engagement with a clearance which permits relative rotation between the first input shaft and the output shaft within a specific circumference clearance, wherein at least one ratchet element of the ratchet brake type is disposed between the second input shaft and the output shaft in a manner such that in all cases, the ratchet element is in a disengaged position or is brought into the disengaged position when the output shaft is turned by the first input shaft in the driven direction of rotation and the second input shaft either does not turn or turns more slowly in the driven direction of rotation than the output shaft and first input shaft, wherein the ratchet element is moved out of the disengaged position into a locked position by a relative rotation between the output shaft and the second input shaft when the second input shaft briefly turns faster in the driven direction of rotation than the output shaft, so that an entraining engagement is established between the second input shaft and the output shaft, wherein in all cases, the ratchet element remains in the locked position as long as a torque acting in the driven direction of rotation is transmitted to the output shaft via both the first input shaft and via the second input shaft, and wherein the first input shaft has an unlocking element which in all cases then actively moves the ratchet element from the locked position into the disengaged position when the first input shaft turns against the driven direction of rotation relative to the output shaft within the circumference clearance between the first input shaft and the output shaft. The clutch provided in accordance with the invention is thus engaged when the ratchet element is in the locked position. As soon as the locking element is in the disengaged position, the clutch provided in accordance with the invention is disengaged.

The advantage with this embodiment is that both of the aforementioned freewheeling functions are integrated into a single functional unit. A further advantage is that the torque to be transmitted via the ratchet element is limited to the maximum torque of the auxiliary motor. In contrast, when two separate freewheels are used, one of the two freewheels has to be configured to the maximum torque which the user of the muscle power operated vehicle exerts on the output shaft. The particularly preferred embodiment therefore enables the construction to be very compact and easy.

In accordance with the aforementioned particularly preferred embodiment, the output shaft, the first input shaft and the second input shaft are disposed coaxially with respect to each other. Unless stated otherwise, information such as “in the circumferential direction” etc will refer to the common geometrical axis of the output shaft, first input shaft and second input shaft.

In accordance with a further particularly preferred embodiment of the present invention, the ratchet element is a roller element which is disposed between a first clamping surface of the output shaft and a second clamping surface of the second input shaft, wherein the distance between the first clamping surface and the second clamping surface is reduced when considered in the driven direction of rotation in a manner such that in the locked position of the ratchet element, self-locking occurs between the ratchet element and the first clamping surface as well as the second clamping surface. The ratchet element which is configured as a roller element can turn freely in the disengaged position, but a relative rotation between the output shaft and the second input shaft in which the second input shaft rotates faster in the driven direction of rotation than the output shaft is detected by the second clamping surface of the second input shaft and entrained and therefore rolls in the circumferential direction along the first clamping surface into the locked position in which the aforementioned self-locking occurs. In the event of a relative rotation in the opposite direction, the self-locking is readily disengaged.

Particularly preferably, the ratchet element is a clamping roller. Clamping rollers with a cylindrical shape are easy to manufacture and enable high torques to be transmitted while at the same time being compact in construction. The ratchet element may alternatively also be conical in configuration. In a section perpendicular to the longitudinal axis of the ratchet element, the ratchet element may have a circular cross section. In accordance with a preferred embodiment, however, the ratchet element has a circular cross section with at least one prominence. Particularly preferably, the ratchet element has a circular cross section with 2 prominences. The prominence has a cam surface which optimizes the transmission of power between the second input shaft and the output shaft. In particular, when two prominences are provided, a surface is formed in the region between the prominences which optimizes the transmission of power between the second input shaft and the output shaft. Furthermore, positioning of the ratchet element is improved by means of the prominence.

More preferably, an axis of rotation of the ratchet element is parallel to a common axis of the output shaft, first input shaft and second input shaft.

In accordance with a further preferred embodiment of the present invention, the first clamping surface and the second clamping surface are formed by conical surfaces, wherein a median radius of the second clamping surface is constant over the entire circumference of the second input shaft, and wherein a median radius of the first clamping surface varies when considered in the circumferential direction. This embodiment also contributes to a compact construction as well as to safe operation of the clutch mechanism.

In accordance with a further preferred embodiment of the present invention, the ratchet element is received in a first recess of the output shaft, wherein the first clamping surface is formed by a subarea of the first recess. This embodiment contributes to simple construction of the torque transmission assembly in accordance with the invention and allows for easy positioning of the ratchet element.

In this regard, particularly advantageously, considered in the circumferential direction, a second recess is formed in the output shaft which is contiguous with the first recess, wherein the unlocking element of the first input shaft is a peg which engages with the second recess, wherein the entraining engagement between the first input shaft and the output shaft is established in the driven direction of rotation by means of the engagement between the peg and the second recess, and wherein the circumference clearance between the first input shaft and the output shaft is generated by the fact that a combined extent of the first recess and the second recess considered in the circumferential direction is larger than a combined extent of the ratchet element and the peg considered in the circumferential direction. This embodiment contributes to a particularly compact and simple construction. In addition, in this embodiment, particularly few components are required. The circumference clearance can produce a specific relative movement between the first input shaft and the output shaft. By means of the relative movement, the ratchet element can move into the locked position in which a torque is transmitted from the second drive shaft to the output shaft, and into the disengaged position in which no torque is transmitted from the second input shaft to the output shaft.

In accordance with a further particularly preferred embodiment of the present invention, the second input shaft coaxially surrounds the output shaft. This embodiment also contributes to a compact construction. In this regard, particularly advantageously, the second input shaft is configured as a crown wheel. The crown wheel can be driven in a simple manner, whereby a pinion of the motor shaft engages in corresponding gear teeth of the crown wheel.

In accordance with a further preferred embodiment of the present invention, the first input shaft extends through the output shaft. This embodiment also contributes to a compact construction.

In a further particularly preferred embodiment of the present invention, the torque transmission assembly has a plurality of ratchet elements which are distributed in the circumferential direction. Particularly high torques can be transmitted via the ratchet elements because of the plurality of ratchet elements. Advantageously, exactly as many unlocking elements or pegs are provided as there are ratchet elements. More particularly preferably, both the ratchet elements and the unlocking elements are distributed in a regular manner in the circumferential direction. This results in particularly advantageous power transmission. This also results in a long service life.

In a preferred embodiment of the present invention, the ratchet brake has an annular tensioning element which is configured in a manner such as to support the ratchet elements when moving into the locked position. The tensioning element may, for example, consist of an elastic material such as elastic or rubber. However, the tensioning element may also be a radial spring which consists of tightly wound wire, wherein the wire is made resilient by means of the winding. The tensioning element supports the ratchet elements when transferring into the locked position in which a torque is transmitted from the second input shaft onto the output shaft. By means of the tensioning element, which serves as the resilient element or spring, a force or a torque is exerted on the ratchet elements. The torque supports the clutch elements during their movement into the locked position. Because in this embodiment the ratchet elements are biased into the locked position by the tensioning element, the slightest of relative movements between the second input shaft and the output shaft is sufficient to produce a friction fit between the second input shaft and the output shaft. The tensioning element ensures that all of the ratchet elements are moved into the locked position. This is of particular advantage because the grease required for lubrication can lead to the fact that despite relative movement between the second input shaft and the output shaft, the ratchet elements get stuck in the disengaged position and are not transferred into the locked position or do not roll or slide into the locked position. Preferably, the tensioning element sits with its inner circumference biased onto the ratchet elements. However, it is also possible for the tensioning element to be seated with its outer circumference biased onto the ratchet elements. In both cases, more preferably, the ratchet elements have a seating surface which, relative to an axis of the respective ratchet element, is not a straight cylinder but forms a cam surface on which the tensioning element is seated in a manner such that a torque is exerted on the ratchet element due to interaction of the tensioning element and the cam surface. More preferably, the seating surface is formed on a protrusion which is at an axial distance from a main body of the ratchet element. More preferably, the seating surface passes through the axis of the ratchet element.

The present invention also provides a bicycle with an auxiliary motor and a torque transmission assembly in accordance with the invention, wherein the auxiliary motor is configured as a mid-mounted motor and is coupled to the second input shaft.

Exemplary embodiments of the present invention will now be described in more detail with the aid of the accompanying drawings, in which:

Figure 1: shows a partial sectional view of the bottom bracket region of an e-bike with a torque transmission device in accordance with a first exemplary embodiment,

Figure 2: shows a cross section through the torque transmission device of Figure 1 in the axial position of the ratchet elements and unlocking elements,

Figure 3: shows the cross section of Figure 2 with the auxiliary motor deactivated and the pedals being moved in a forwards direction by the user of the e-bike,

Figure 4: shows the cross section of Figure 2 when support of the auxiliary motor is being employed,

Figure 5: shows the cross section of Figure 2 with continuous support for the user of the e-bike by the auxiliary motor,

Figure 6: shows the cross section of Figure 2 at the moment that the movement of the pedals is stopped,

Figure 7: shows the cross section of Figure 2 when the pedals are moved backwards by the user of the e-bike and with the auxiliary drive deactivated,

Figure 8: shows the cross section of Figure 2 with the pedals being moved backwards by the user of the e-bike and with a forward rotation of the second input shaft due to activation of the auxiliary drive,

Figure 9: shows the cross section of Figure 2 when the e-bike is being pushed backwards,

Figure 10: shows a cross section through a further exemplary embodiment of the torque transmission device in accordance with the invention with a tensioning element,

Figure 11: shows a ratchet element of the torque transmission device in accordance with the invention from Figure 10, in a detailed view onto the front end of the ratchet element, and

Figure 12: shows a perspective view of the ratchet element of Figure 11.

Hereinbelow, identical parts will be provided with identical reference numerals. When reference numerals are contained in a figure and are not described in the associated description of the figure, reference should be made to the description in respect of the preceding or following figures.

Figure 1 shows a partial sectional perspective view of the bottom bracket region of an e-bike with a torque transmission assembly in accordance with the invention in accordance with a first exemplary embodiment. The bottom bracket shaft 1, onto which the pedals of the e-bike (not shown) are fastened, forms a first input shaft of the torque transmission assembly in accordance with the invention. The first input shaft 1 extends through the hollow cylindrical output shaft 3 of the torque transmission assembly. The hollow cylindrical output shaft 3 in turn carries the chainring support 7 to which the chainring 6 is attached. The drive torque applied to the output shaft 3 is transmitted to the rear wheel of the e-bike by means of the chain (not shown). The torque transmission assembly in accordance with the invention furthermore comprises a second input shaft 2 which is also hollow in configuration and radially surrounds the output shaft 3. The second input shaft 2 is configured as a crown wheel. It therefore has a conical toothed surface into which the pinion 13 of the output shaft of the electric auxiliary motor of the e-bike engages. The second input shaft 2 is thus exclusively driven via the auxiliary drive, which is not shown in any further detail. All three shafts, namely the output shaft 3, the first input shaft 1 and the second input shaft 2, are disposed coaxially with respect to each other and in principle are rotatably mounted with respect to each other. They share the common geometric axis 8 shown in Figure 1.

The torque assembly in accordance with the invention is configured in a manner such that a torque can be transmitted to the output shaft 3 via both input shafts 1 and 2. In this regard, the torque transmission assembly in accordance with the invention has two freewheeling functions which are integrated into a single functional unit. The first freewheeling function prevents a user of the e-bike from having to turn the auxiliary motor as well when pedalling forwards when the auxiliary motor is deactivated or not connected. The second freewheeling functions ensures that the auxiliary motor does not have to be turned in the direction opposite to the normal direction of rotation when the user pushes the pedals of the e-bike backwards without transmitting a torque to the rear wheel. The rear wheel hub is therefore also equipped with an appropriate freewheel.

The function of the torque transmission assembly will now be described. Between the output shaft 3 and the second input shaft 2 are a plurality of cylindrical ratchet rollers 4 which in normal operation ensure the transmission of a torque from the second input shaft 2 onto the output shaft 3 in the manner of a ratchet brake. The ratchet rollers 4 are evenly distributed around the circumference of the output shaft 3 and are received in corresponding recesses 9 at the outer circumference of the output shaft 3. As can clearly be seen in Figure 1, the axes of the ratchet rollers 4 are not orientated parallel to the axis 8 of the torque transmission assembly in accordance with the invention. Rather, they are at an oblique angle with respect to the common axis 8 of the output shaft 3, first input shaft 1 and second input shaft 2. The ratchet rollers 4 therefore act between the clamping surfaces of the output shaft 3 and the second input shaft 2 which are substantially conical.

Figure 2 shows a cross section through the torque transmission assembly in accordance with the invention orthogonally to the axis 8 in the axial position of the ratchet rollers 4. The clamping surface 12 on the side of the second input shaft 2 is formed by a rotationally symmetrical conical surface. The clamping surface 11 on the side of the output shaft is formed by the base surface of the recess 9 at the outer circumference of the output shaft 3. Figure 2 clearly shows that when considered in the circumferential direction, the clamping surface 11 rises in the clockwise direction or in the drive direction 15, so that the distance between the clamping surface 11 and the clamping surface 12 reduces in the clockwise direction. Again considered in the circumferential direction, next to each recess 9 is a second recess 10 in the outer contour of the output shaft 3. As can be seen in Figure 5, peg-shaped extensions 5 of the first input shaft 1 engage in the second recesses 10. The peg-shaped extensions 5 are not shown in Figure 1 for the sake of clarity.

Because of the engagement of the peg-shaped extensions 5 in the recesses 10 in the outer contour of the output shaft 3, an entraining engagement exists between the first input shaft 1 and the output shaft 3. This means that in principle, the output shaft 3 rotates with it when the first input shaft 1 is rotated in the drive direction of rotation 15 or against the drive direction of rotation. The entraining engagement has a clearance, however. As can be seen in Figure 2, the combined extent of the first recess 9 and the second recess 10 when considered in the circumferential direction is larger than the combined extent of the ratchet roller 4 and the adjacent peg 5, also considered in the circumferential direction. In this manner, a clearance 14 is formed which acts in the circumferential direction, as can be seen in Figure 2.

If the user of the e-bike pushes forwards on the pedals, and therefore in the drive direction of rotation 15, then the first input shaft 1 turns in the clockwise direction shown in Figure 3. In this regard, after overcoming the clearance 14, the peg-shaped extensions 5 of the first input shaft come to be seated with the flanks of the second recess 10 shown on the right hand side in the figure so that the output shaft 3 is rotated along with the first input shaft 1. In this regard, the ratchet rollers 4 remain in the left hand corner of the associated first recess 9 and can rotate freely, as illustrated by the arrow in the ratchet roller 4 in Figure 3.

If the auxiliary motor is now activated, then the second input shaft 2 also rotates in the clockwise direction, as can be seen in Figure 4. In order to be able to transmit a torque from the auxiliary motor to the output shaft, the second input shaft 2 has to briefly rotate faster than the output shaft 3. The ratchet roller 4 is entrained by this relative movement and rolls to the right along the rising clamping surface 11 until it is clamped between the clamping surface 11 of the output shaft 3 and the clamping surface 12 of the second input shaft 2, and therefore self-locking occurs. This situation is shown in Figure 5. A torque is now transmitted to the output shaft 3 via both the first input shaft 1 as well as via the second input shaft 2.

If the user of the e-bike holds the pedals against the torque of the second input shaft 2, then by means of the peg-shaped extensions 5, a force is exerted on the ratchet rollers 4 which is in the anti-clockwise direction. This situation is shown in Figure 6. If the static friction of the ratchet rollers is overcome, then they start to rotate or slip. The friction fit between the second input shaft and the output shaft is then interrupted. The second input shaft rotates freely. This may be the case, for example, when the auxiliary motor accelerates faster than the rider wants. Clearly, the e-bike may have an appropriate torque sensor which in this case would measure a negative torque, which would result in deactivation of the auxiliary motor.

Figure 7 shows how the torque transmission assembly in accordance with the invention behaves when the rider of the e-bike pedals backwards. In this case, the peg-shaped protrusion 5 pushes the ratchet roller 4 in the anti-clockwise direction until the ratchet roller is clamped between the peg-shaped protrusion 5 and the left flank of the first recess 9. Now, the torque is transmitted in the anti-clockwise direction from the first input shaft or the peg-shaped protrusion 5 via the ratchet roller 4 onto the output shaft 3. The output shaft 3 rotates with the first input shaft in the anti-clockwise direction. In contrast, the friction fit between the output shaft and the second input shaft is lifted, so that the auxiliary motor does not have to rotate along with this backwards movement of the pedals. As can be seen in Figure 8, activation of the auxiliary motor in the drive direction, which acts to rotate the second input shaft 2 in the clockwise direction, has no influence on the ratchet roller 4 and on the backwards movement of the first input shaft 1 and the output shaft 3.

Finally, Figure 9 shows the behaviour when the e-bike is pushed backwards. In this case, the output shaft 3 rotates in the anti-clockwise direction and in this regard entrains the peg-shaped extensions 5 of the first input shaft by its movement. By means of a relative rotation between the output shaft 3 and the second input shaft 2, the ratchet roller 4 rolls along the first clamping surface 11 to the right into the locked position in which self-locking occurs between the ratchet roller 4 and the output shaft 3 as well as the second input shaft 2. Thus, the auxiliary motor turns along with it when the e-bike is pushed backwards.

Figure 10 shows a cross section through a further exemplary embodiment of the torque transmission device in accordance with the invention. The torque transmission device is in principle constructed in exactly the same manner as the torque transmission device in accordance with the exemplary embodiment from Figures 1 to 9. In the exemplary embodiment shown in Figure 10, the torque transmission device additionally has a tensioning element 16 which is configured in a manner such that when moving into the locked position, it supports the ratchet elements 4. The tensioning element 16 is annular in configuration and is seated on appropriate seating surfaces 18 of the ratchet element 4. As can be seen in Figures 11 and 12, the seating surface 18 is formed on a protrusion 20 which is axially separated from a main body 19 of the ratchet element 4. The tensioning element is elastic in configuration so that a bias is produced through the tensioning element. By seating the tensioning element 16 at a point on the seating surface 18, this means that a force or a torque can be produced on the ratchet element 4. By means of the torque, the ratchet elements 4 are supported when moving or shifting into the locked position. As an example, the tensioning element 16 may be produced from an elastic material such as elastic or rubber, by means of which the tension is produced. Alternatively, the tensioning element 16 may be produced from a resilient spring. Winding a wire produces a radial spring which can also produce the tension. The ratchet elements 4 of the ratchet brake have to be well greased. In this manner, in the exemplary embodiment of Figures 1 to 9, it may occur that in the disengaged position the ratchet elements 4 stick and cannot roll or slide or shift into the locked position by means of the relative movement between the second input shaft 2 and the output shaft 3 as well as the centrifugal force and/or gravitational force. By means of the tensioning element 16 of the torque transmission device in accordance with the second exemplary embodiment shown in Figure 10, however, the ratchet elements 4 are supported during transfer from the disengaged position into the locked position, so that all of the ratchet elements are reliably and quickly brought into the locked position.

The protrusion 20 with the seating surface 18 protrudes approximately 1 mm to 10 mm, preferably 2 mm to 5 mm from the main body 18 of the ratchet element 4, so that the tensioning element 16 can be seated properly and the protrusion 20 does not take up too much space in the ratchet brake. The seating surface 18 extends radially approximately straight from the side of the circumference of the ratchet element 4 to the other side of the circumference. Preferably, in this regard the seating surface 18 runs approximately through the mid-point with a cross section that runs perpendicular to the longitudinal axis of the ratchet element 4. In this manner, by means of the seating surface 18, a torque which is as large as possible can be produced at the ratchet element 4. The seating surface 18 has a curvature 21 close to the outer circumference of the ratchet element 4. By means of the curvature 21, when the tensioning element 16 is seated on the seating surface 18, it is less strongly loaded than if the tensioning element were seated on a sharp edge.

The tensioning element 16 shown in Figure 10 produces a bias directed inwardly to the common axis 8. In this disposition, the tensioning element 16 should lie against a region of the ratchet element 4 which is close to the axis. The region which is close to the axis is that region of the ratchet element 4 which, when viewed in Figure 1, is closer to the common axis of the three shafts 1, 2 and 3. Thus, the protrusion 20 forms the region which is close to the axis.

It is also possible for the tensioning element to produce a bias which is directed outwards from the common axis 8. In such a disposition (not shown), the tensioning element would be seated against the region of the ratchet element which is further from the axis.

As can be seen in Figure 12, the ratchet element 4 has a main body with a circular cross section and two prominences 17. The prominences 17 enlarge the circumference of the ratchet element 4 by effectively forming two cams, whereupon both the transmission of power as well as the positioning or orientation of the ratchet element 4 between the second input shaft 2 and the output shaft 3 is improved.

List of reference numerals

1 first input shaft
2 second input shaft
3 output shaft
4 ratchet element
5 unlocking element
6 chainring
7 chainring support
8 axis
9 first recess
10 second recess
11 first clamping surface
12 second clamping surface
13 pinion
14 circumference clearance
15 driven direction of rotation
16 tensioning element
17 prominence
18 seating surface
19 main body
20 protrusion
21 curvature

PATENTKRAV

1. Drejningsmomentoverføringsarrangement til drivstrengen i et muskelkraftdrevet køretøj med hjælpemotor,
med en udgangsaksel (3),
en første indgangsaksel (1) til overføring af et ved hjælp af muskelkraft frembragt drejningsmoment til udgangsakslen (3),
en anden indgangsaksel (2) til overføring af et ved hjælp af hjælpemotoren frembragt drejningsmoment til udgangsakslen (3),
og med en friløbsfunktion, hvormed det forhindres, at en bruger af det muskelkraftdrevne køretøj skal dreje hjælpemotoren med, når hjælpemotoren er frakoblet,
kendetegnet ved, at drejningsmomentarrangementet omfatter en mekanisk kobling, som er udformet til at overføre et drejningsmoment fra den anden indgangsaksel (2) til udgangsakslen (3), når der ved den første indgangsaksel (1) forekommer et på udgangsakslen (3) i en drivende drejeretning (15) virkende drejningsmoment, og ikke at overføre noget drejningsmoment fra den anden indgangsaksel (2) til udgangsakslen (3), når der ved den første indgangsaksel (1) forekommer et på udgangsakslen (3) mod den drivende drejeretning (15) virkende drejningsmoment.

2. Drejningsmomentoverføringsarrangement ifølge krav 1, **kendetegnet ved, at** den mekaniske kobling er en kobling som en slags klemlåsemekanisme, som kan drives uden elektrisk energiforsyning.

3. Drejningsmomentoverføringsarrangement ifølge krav 1 eller 2, **kendetegnet ved, at** udgangsakslen (3), den første indgangsaksel (1) og den anden indgangsaksel (2) er anbragt koaksialt i forhold til hinanden og er lejret principielt drejeligt mod hinanden, hvor der mellem den første indgangsaksel (1) og udgangsakslen (3) består et spillerumsbehæftet medbringerindgreb, som i forbindelse med et vist

omkredsspillerum (14) tillader en relativ drejning mellem første indgangsaksel (1) og udgangsaksel (3),

hvor mindst et klemelement (4) som en slags klemlåsemekanisme er anbragt mellem den anden indgangsaksel (2) og udgangsakslen (3) på en sådan måde, at klemelementet (4) i hvert tilfælde befinder sig i en løsnet stilling eller bringes til den løsnede stilling, når udgangsakslen (3) ved hjælp af den første indgangsaksel (1) drejes i drivende drejeretning (15), og den anden indgangsaksel (2) enten ikke drejer eller drejer langsommere i drivende drejeretning end udgangsaksel (3) og første indgangsaksel (1),

hvor klemelementet (4) ved hjælp af en relativdrejning mellem udgangsaksel (3) og anden indgangsaksel (2) overføres fra den løsnede stilling til en låsestilling, når den anden indgangsaksel (2) kortvarigt drejer hurtigere i drivende drejeretning (15) end udgangsakslen (3), således at der etableres et medbringerindgreb mellem anden indgangsaksel (2) og udgangsaksel (3), hvor klemelementet (4) i hvert tilfælde forbliver i låsestillingen, så længe der både via den første indgangsaksel (1) og via den anden indgangsaksel (2) overføres et i drivende drejeretning (15) virkende drejningsmoment til udgangsakslen (3),

og hvor den første indgangsaksel (1) omfatter et oplåseelement (5), som i hvert tilfælde bevæger klemelementet (4) aktivt ud af låsestillingen til den løsnede stilling, når den første indgangsaksel (1) ved hjælp af det i forbindelse med det mellem første indgangsaksel (1) og udgangsaksel (3) bestående omkredsspillerum (14) drejer mod den drivende drejeretning (15) set i forhold til udgangsakslen (3).

4. Drejningsmomentoverføringsarrangement ifølge krav 3, **kendetegnet ved, at** klemelementet (4) er et rullelegeme, som er anbragt mellem en første klemflade (11) på udgangsakslen (3) og en anden klemflade (12) på den anden indgangsaksel (2), hvor afstanden mellem første klemflade (11) og anden klemflade (12) set i drivende drejeretning (15) formindskes på en sådan måde, at der i klemelementets (4) låsestilling består en selvspærring mellem klemelementet (4) og den første klemflade (11) samt den anden klemflade (12).

5. Drejningsmomentoverføringsarrangement ifølge krav 4, **kendetegnet ved, at** klemelementet (4) er en klemrulle.

6. Drejningsmomentoverføringsarrangement ifølge krav 4 eller 5, **kendetegnet ved, at** klemelementet (4) er udformet cylindrisk eller kegleformet.

7. Drejningsmomentoverføringsarrangement ifølge krav 6, **kendetegnet ved, at** klemelementet (4) ved et snit vinkelret på klemelementets (4) længdeakse har et cirkulært tværsnit eller et cirkulært tværsnit med mindst en udbuling (17).

8. Drejningsmomentoverføringsarrangement ifølge et af kravene 4 til 7, **kendetegnet ved, at** en rotationsakse af klemelementet ligger parallelt med en fælles akse (8) af udgangsaksel (3), første indgangsaksel (1) og anden indgangsaksel (2).

9. Drejningsmomentoverføringsarrangement ifølge et af kravene 4 til 8, **kendetegnet ved, at** den første klemflade (11) og den anden klemflade (12) er dannet af kegleflader, hvor en middelradius af den anden klemflade (12) er konstant over hele omkredsen af den anden indgangsaksel (2), og hvor en middelradius af den første klemflade (11) varierer set i omkredsretning.

10. Drejningsmomentoverføringsarrangement ifølge et af kravene 4 til 9, **kendetegnet ved, at** klemelementet (4) er optaget i en første reces (9) i udgangsakslen (3), hvor den første klemflade (11) er dannet af en delflade af den første reces (9).

11. Drejningsmomentoverføringsarrangement ifølge krav 10, **kendetegnet ved, at** der set i drivende drejeretning (15) i tilslutning til den første reces (9) er udformet en anden reces (10) i udgangsakslen (3), hvor oplåseelementet (5) i den første indgangsaksel (1) er en tap, som griber ind i den anden reces (10), hvor medbringerindgrebet mellem første indgangsaksel (1) og udgangsaksel (3) i drivende

drejeretning (15) etableres ved hjælp af indgrebet mellem tap og anden reces (10), og hvor omkredsspillerummet (14) mellem den første indgangsaksel (1) og udgangsakslen (3) er givet ved, at en set i omkredsretning kombineret udstrækning af første reces (9) og anden reces (10) er større end en set i omkredsretning kombineret udstrækning af klemelementet (4) og tappen.

12. Drejningsmomentoverføringsarrangement ifølge et af kravene 1 til 11, **kendetegnet ved, at** den anden indgangsaksel (2) koaksialt omslutter udgangsakslen (3).

13. Drejningsmomentoverføringsarrangement ifølge krav 12, **kendetegnet ved, at** den anden indgangsaksel (2) er udført som kronhjul.

14. Drejningsmomentoverføringsarrangement ifølge et af kravene 1 til 13, **kendetegnet ved, at** den første indgangsaksel (1) strækker sig gennem udgangsakslen (3).

15. Drejningsmomentoverføringsarrangement ifølge et af kravene 1 til 14, **kendetegnet ved, at** drejningsmomentoverføringsarrangementet omfatter flere klemelementer (4), som er anbragt fordelt i omkredsretning.

16. Drejningsmomentoverføringsarrangement ifølge et af kravene 1 til 15, **kendetegnet ved, at** klemlåsemekanismen omfatter et ringformet spændeelement (16), som er udformet til at understøtte klemelementerne (4) ved overgangen til låsestillingen.

17. Cykel med en hjælpemotor og et drejningsmomentoverføringsarrangement ifølge et af kravene 1 til 16, hvor hjælpemotoren er udført som midtermotor og er koblet med den anden indgangsaksel (2).

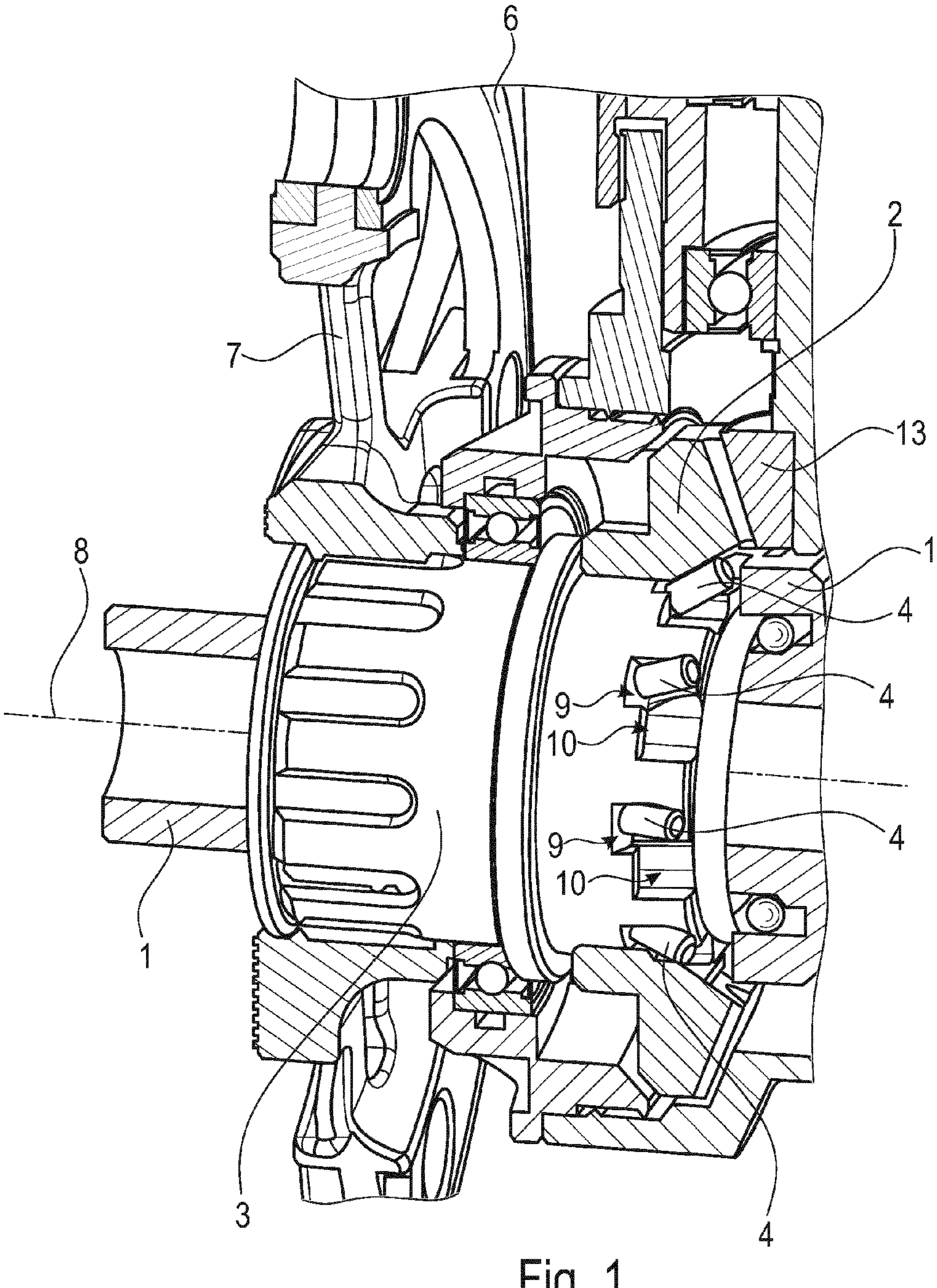

Fig. 1

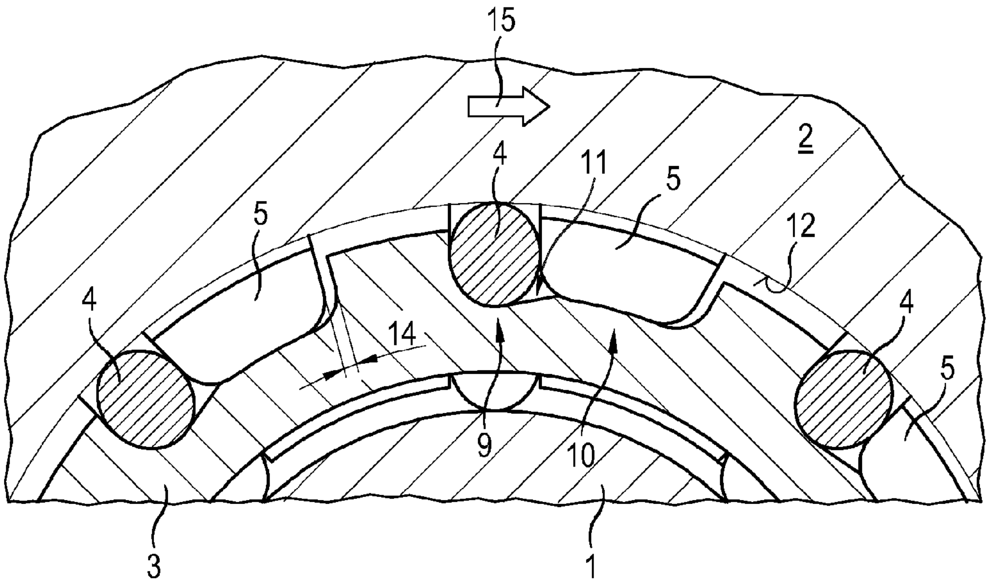

Fig. 2

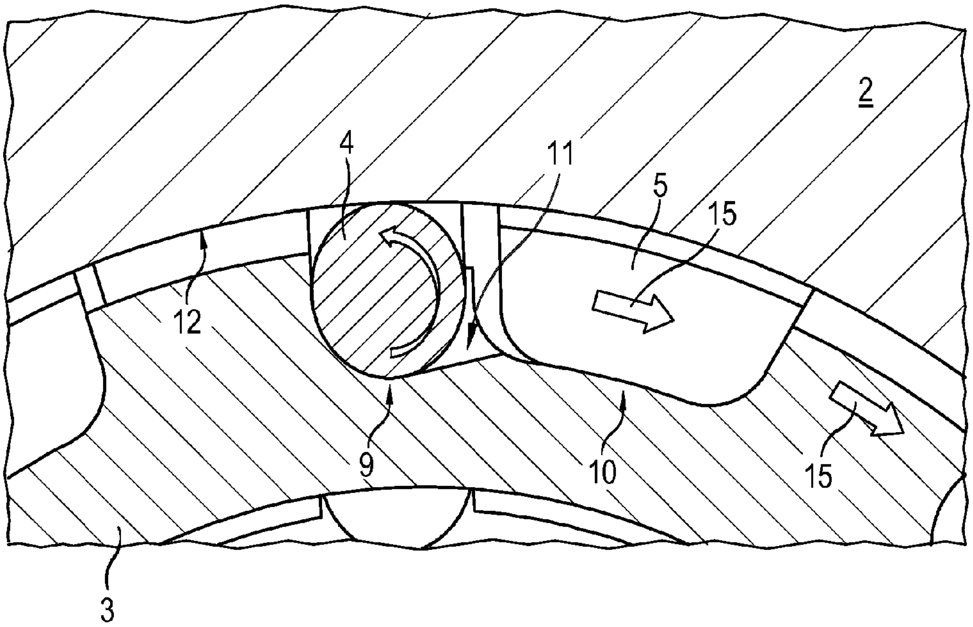

Fig. 3

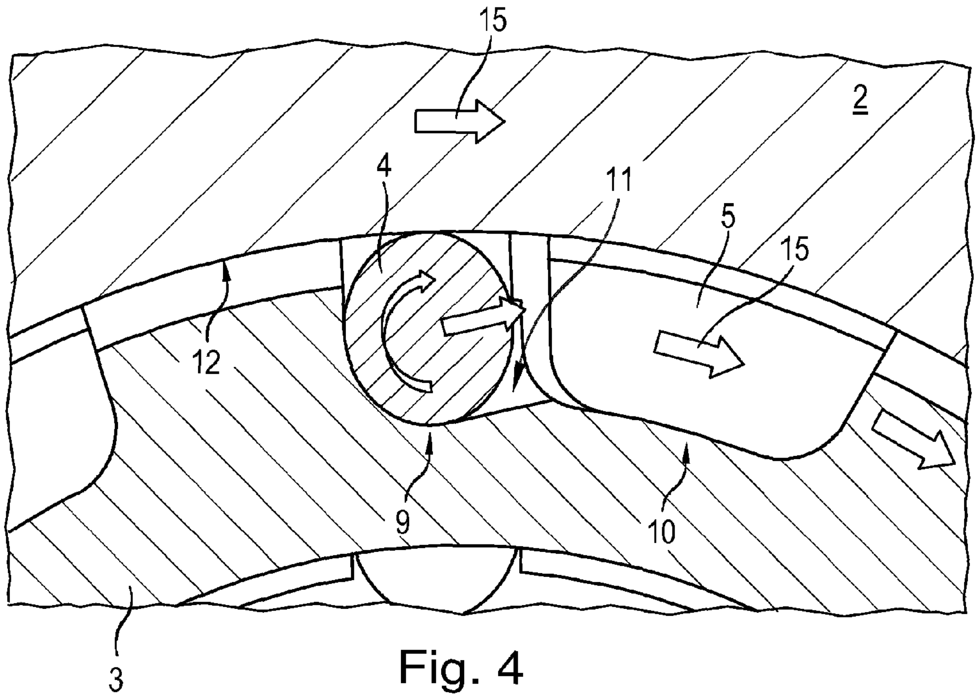

Fig. 4

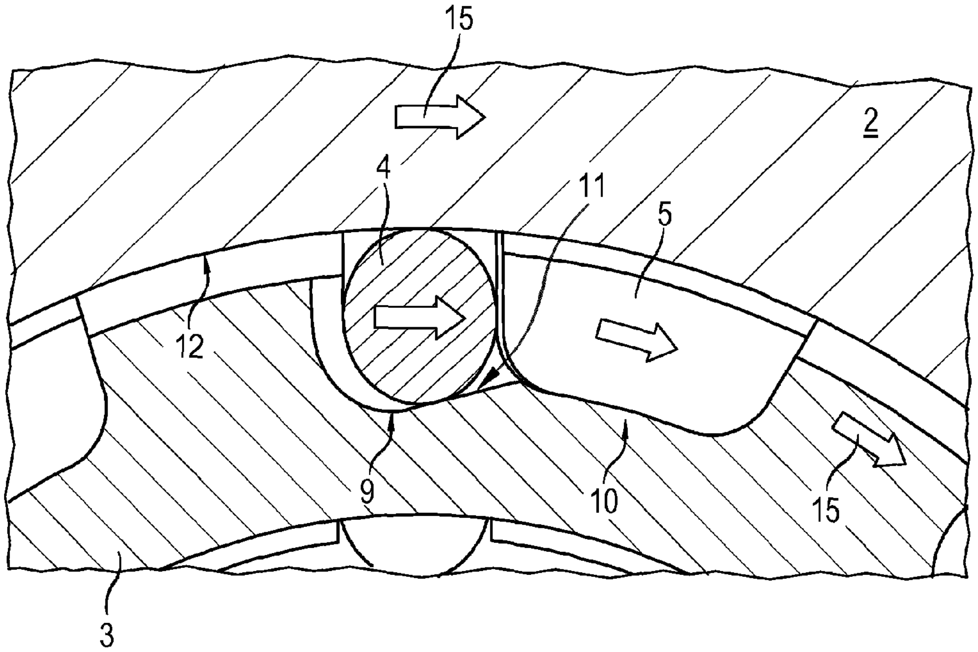

Fig. 5

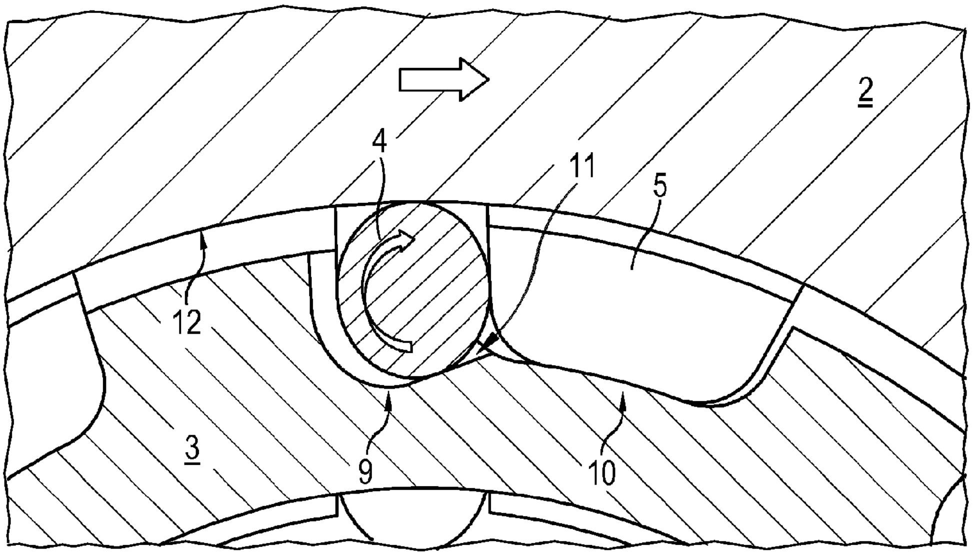

Fig. 6

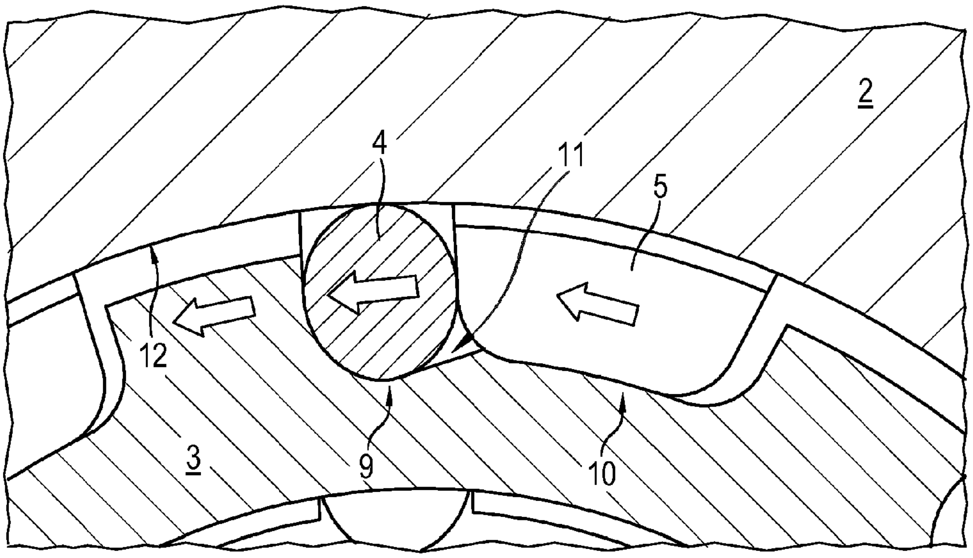

Fig. 7

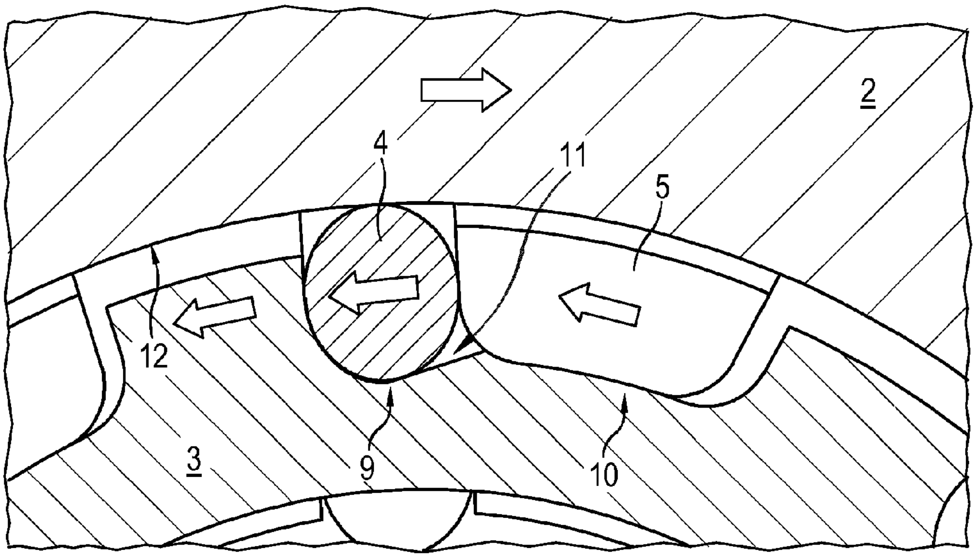

Fig. 8

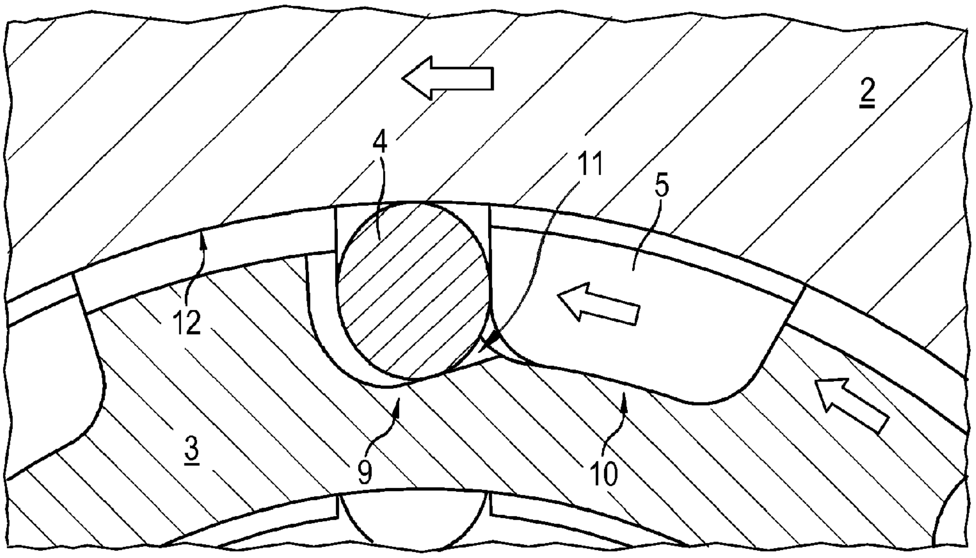

Fig. 9

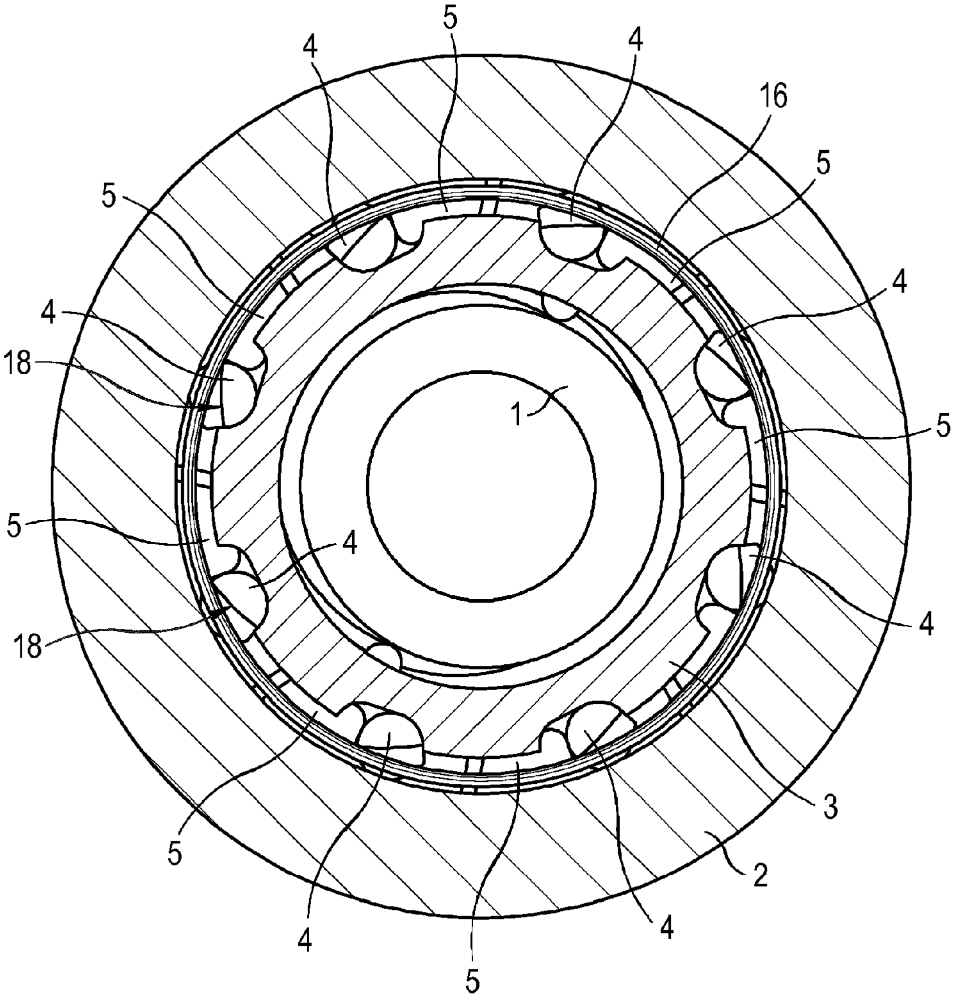

Fig. 10

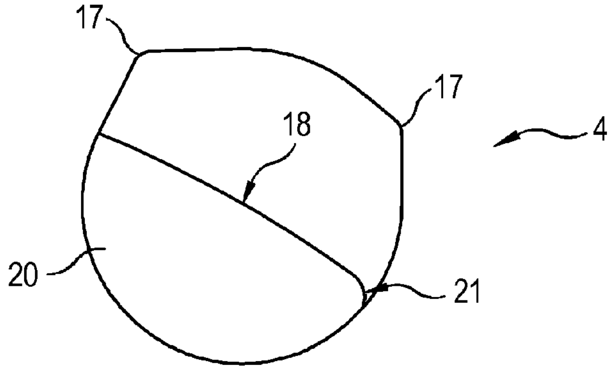

Fig. 11

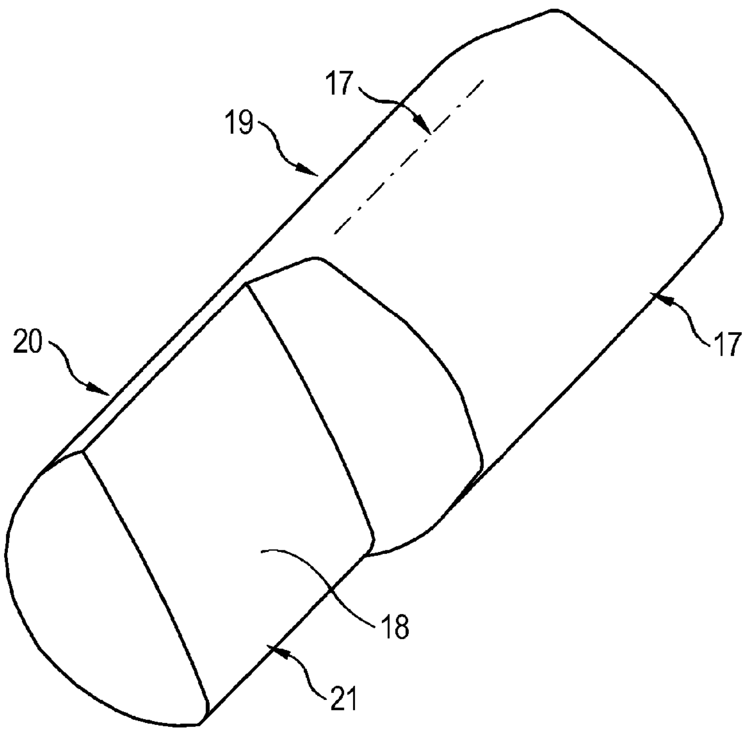

Fig. 12